ESHNR
European Society of
Head and Neck Radiology

22nd Annual Meeting and Refresher Course

Verona (Italy) – Palazzo della Gran Guardia
October 1st –3rd, 2009

Painting by Christiane Bodin

Final Programme & Abstract Book

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ESHNR – European Society of Head and Neck Radiology

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Verona (Italy) – Palazzo della Gran Guardia - October 1st – 3rd, 2009

Local Organizing Committee

Elisa Botturi (Brescia)
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Stefania Montemezzi (Verona)
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Dear Colleagues,

on behalf of the Organizing Committee, it is really my great privilege to welcome you to the 22nd Annual Meeting and Refresher Course of the European Society of Head and Neck Radiology. The Scientific Programme includes a broad spectrum of topics that covers the most recent conceptual and technological advances in challenging areas of Head and Neck Imaging.

A special emphasis is devoted to the new key questions that the development and continous improvement of surgery and chemoradiation pose to Imaging. We shall discuss, with experts in the field of surgery and (chemo) radiotherapy, the ability of MR and CT to address the indications for endoscopic surgery of the sino-nasal tract, for laser excision of early laryngeal cancer and for IMRT planning.

The meeting offers, in addition to the 16 workshops, round tables and lunch symposia, 53 oral communications and posters. Don't forget two long-established appointments of the ESHNR Meeting: the scary film reading panel and the traditional refresher course.

Close to Lake Garda, Verona is a city of rare beauty, set back against the Alps to the north and harmoniously laid out along the smooth curves of the Adige river. One of the most important tourist destinations in Italy, Verona was appointed, in 2000, UNESCO cultural and historical treasure. I am sure you will enjoy this really pleasant place. The Congress venue is located in the city center, very close to the Arena, the world-renowned Roman monument of Verona.

Finally, we have conceived a social programme which will hopefully meet the (high!) expectations of participants and accompanying guests, assuring relaxing and friendly evenings during the meeting.

It is really a great pleasure to welcome you in Verona!

Roberto Maroldi

ESHNR Meeting President

INDEX

INVITED SPEAKERS and CHAIRMEN

Nasreddin D. Abolmaali (Dresden, DE)
Timothy Beale (London, UK)
Minerva Becker (Geneve, CH)
Sotirios Bisdas (Tübingen, DE)
Christiane Bodin (Brescia, IT)
Alexandra Borges (Lisboa, P)
Giuseppe Caruso (Palermo, IT)
Jan Casselman (Brugge, BE)
Jonas A. Castelijns (Amsterdam, NL)
Paolo Castelnuovo (Varese, IT)
Vittorio Colletti (Verona, IT)
Girolamo Crisi (Parma, IT)
Christian Czerny (Wien, A)
Bert De Foer (Wilrijk, BE)
Frederik De Keyzer (Leuven, BE)
Frederique Dubrulle (Lille, F)
Heidi-Beate Eggesbø (Oslo, N)
Fabio Facchetti (Brescia, IT)
Davide Farina (Brescia, IT)
Nicole Freling (Amsterdam, NL)
Julia Frühwald-Pallamar (Wien, A)
Simonetta Gerevini (Milano, IT)
Mirko Giannoni (Ancona, IT)
Stephen Golding (Oxford, UK)
Cesare Grandi (Trento, IT)
Christian R. Habermann (Hamburg, DE)
Herwig Imhof (Wien, A)
Julian Kabala (Bristol, UK)
Romain Kohler (Lille, F)

Sabrina Kösling (Halle, DE)
Tore Arne Larheim (Oslo, N)
Marc Lemmerling (Gent, BE)
Lisa Licitra (Milano, IT)
Antonio Lo Casto (Palermo, IT)
Martin G. Mack (Frankfurt, DE)
Roberto Maroldi (Brescia, IT)
Nadine Martin-Duverneuil (Paris, F)
Stefania Montemezzi (Verona, IT)
Guy Moulin (Marseille, F)
Piero Nicolai (Brescia, IT)
Patrizia Olmi (Milano, IT)
Giorgio Peretti (Brescia, IT)
Lorenzo Pinelli (Brescia, IT)
Roberto Pozzi Mucelli (Verona, IT)
Lorenzo Preda (Milano, IT)
Massimo Pregarz (Peschiera d/G, IT)
Soraya Robinson (Wien, A)
Giuseppe Salvaggio (Palermo, IT)
Ugo Salvolini (Ancona, IT)
Bernhard Schuknecht (Zürich, CH)
Giuseppe Spriano (Roma, IT)
Manigandan Subramanyam Thyagiarajan (Bristol, UK)
Vincent Vandecaveye (Leuven, BE)
Luc Van den Hauwe (Antwerp, BE)
Francis Veillon (Strasbourg, F)
Berit Verbist (Leiden, NL)
Antonello Vidiri (Roma, IT)
Andy Whyte (Perth, AUS)

PROGRAMME OVERVIEW

Thursday – October 1st, 2009

	ROOM A
08.00 – 08.30	*Participants' Registration*
08.30 – 10.05	Lymph node metastases: controversies and update on Imaging techniques
10.05 – 10.30	*Coffee Break*
10.30 – 11.00	*Opening Ceremony and President's address*
11.00 – 12.45	Endoscopic surgery of nose and sinuses: the new questions to Imaging!
12.45 – 01.45	*Lunch*
01.45 – 02.45	GE Lunch Symposium – Hot new possibilities!
02.45 – 04.15	Endoscopic laser surgery in early laryngeal SCC: which role for Imaging techniques?
04.15 – 04.40	*Coffee Break*
04.40 – 05.40	New trends on non-surgical treatment of H&N malignancies. How to assess response on treatment?
06.00 – 07.00	*Get-together Cocktail*

Friday – October 2nd, 2009

	ROOM A	ROOM B
08.00 – 09.40	Inner ear. Imaging update	TMJ and Facial pain
09.40 – 10.30	Inner ear. Imaging update (papers)	CT perfusion, DCE and DWI-MR (papers)
10.30 – 11.00	*Coffee Break*	
11.00 – 12.20	Pediatric Imaging	Bone and around-bone lesions
12.20 – 12.50	Pediatric Imaging (papers)	Miscellaneous (papers)
12.50 – 01.40	*Lunch*	
01.40 – 03.00	Post-treatment changes in the Head and Neck	Trauma in the Head and Neck
03.00 – 04.00	Post-treatment changes in the Head and Neck (papers)	Neck adenopathy (papers)
04.00 – 04.20	*Coffee Break*	
04.20 – 05.20	Salivary glands	Face and paranasal sinuses
05.20 – 05.40	Salivary glands (papers)	Miscellaneous (papers)
05.40 – 06.10	*ESHNR General Assembly*	
08.00 – 11.30	*Gala Dinner at Palazzo Giusti*	

Saturday – October 3rd, 2009

	ROOM A
08.00 – 09.00	Orbital lesions. Imaging update
09.00 – 10.00	How to report on…
10.00 – 10.40	How to perform a DWI exam of the Head and Neck
10.40 – 11.10	*Coffee Break*
11.10 – 12.10	Paragangliomas and neurogenic tumors
12.10 – 01.00	Junior Film Reading Session: "*Italy vs. Rest of the World*"
01.00 – 02.00	*End of the Meeting*
	Lunch
02.00 – 04.00	Refresher Course – 1st part
04.00 – 04.30	*Coffee Break*
04.30 – 06.30	Refresher Course – 2nd part

Invited Lectures
Original Papers
Refresher Course

Thursday – October 1st , 2009

08.00 a.m. *Participants' Registration*

Lymph node metastases: controversies and update on Imaging techniques

Chairmen: J.A. Castelijns – G. Spriano

08.30 a.m. Micrometastasis, necrosis & extra-nodal spread in SCC. The key points of the pathologist
F. Facchetti

08.45 a.m. How nodal metastases influence the treatment planning and prognosis?
G. Spriano

09.05 a.m. The clinical N0 neck. Should we routinely add US to CT (or to MR) when staging Head and Neck cancer?
J.A. Castelijns

09.20 a.m. The US N0 neck. How reliable is DWI?
V. Vandecaveye

09.35 a.m. The US N0 neck. PET-CT to detect occult nodal metastases or not?
B. Schuknecht

09.50 a.m. The US N0 neck. PET-CT and DWI on 3T for nodal metastases
J. Frühwald -Pallamar

10.05 a.m. *Coffee Break*

10.30 a.m. *Opening Ceremony*

10.45 a.m. ***President's address***
Head and Neck subspecialty: where are we now? Where are we going?
M. Becker

Endoscopic surgery of nose and sinuses: the new questions to Imaging!

Chairmen: T. Beale - P. Nicolai

11.00 a.m. Endoscopic surgery of benign tumors of the sino-nasal tract. Key points
P. Nicolai

11.20 a.m. Imaging. Solved and still-to-be solved questions
D. Farina

11.35 a.m. Endoscopic surgery of malignant tumors of the sino-nasal tract. Key points
P. Castelnuovo

11.55 a.m. Imaging. Solved and still-to-be solved questions
T. Beale

12.10 p.m. CSF leakage. Key points
P. Castelnuovo

12.30 p.m. Where Imaging stands
L. Van den Hauwe

12.45 p.m. *Lunch*

GE Lunch Symposium - Hot new possibilities!

Chairman: B. Verbist

01.45 p.m. Super-high res CT of the temporal bone
J. Casselman

02.15 p.m. 3T. Start seeing more into tumor biology!
G. Crisi

Endoscopic laser surgery in early laryngeal SCC: which role for Imaging techniques?

Chairmen: M. Becker – C. Grandi

02.45 p.m. Early glottic & supraglottic SCC. Laser excision. Update of the clinical workup
G. Peretti

03.05 p.m. Pre-treatment assessment of T. Is it the time for MR?
J. Casselman

03.25 p.m. Pre-treatment assessment of T. CT and MR integrated?
M. Becker

03.45 p.m. The follow up post laser excision. When Imaging?
G. Peretti

04.00 p.m. Failures of laser excision. Salvage surgery options. Which role for Imaging?
R. Maroldi

04.15 p.m. *Coffee Break*

New trends on non-surgical treatment of H&N malignancies. How to assess response on treatment?

Chairmen: P. Olmi - V. Vandecaveye

04.40 p.m. Concurrent chemo and radiotherapy. Current results and future trends. What do we need from Imaging?
L. Licitra – P. Olmi

05.10 p.m. The post-CT/RT neck. Morphological and "functional" Imaging?
S. Bisdas

05.25 p.m. The post CT/RT neck: FDG-PET/CT only?
N.D. Abolmaali

06.00 p.m. *Get-together Cocktail*

Friday – October 2nd, 2009

Parallel Sessions

Inner ear. Imaging Update (1st parallel session) – ROOM A

Chairmen: J. Casselman – V. Colletti

08.00 a.m.	Imaging of the acoustic pathways *B. De Foer*
08.20 a.m.	Survey of vestibular schwannoma. Where are we now? *M. Lemmerling*
08.40 a.m.	Imaging of the facial nerve *J. Casselman*
09.00 a.m.	Vascular tinnitus. 3T. Is it really a progress? *C. Czerny*
09.20 a.m.	DWI in cholesteatoma. All you need to know *B. De Foer*

Original papers: Inner ear. Imaging Update – ROOM A

Chairmen: C. Czerny - M. Lemmerling

09.40 a.m.	CT and MRI findings in 121 cochlear implant candidates *B. Kovacsovics*
09.50 a.m.	New insights in insertion trauma during cochlear implant surgery based on 3-dimensional image exploration of the cochlea *B. Verbist; L. Ferrarini; J. Briaire; A. Zarowski; J. Frijns*
10.00 a.m.	CT assessment of cochlear implant electrode position relative to the scala tympani using a round window approach *S. Connor; J. Holland; A. Varghese; D. Jiang; A. Fitzgerald O'Connor*
10.10 a.m.	Radiation dose and quality image comparison between cone beam CT and multi slice CT in the study of bionic ear *M. Barillari; R. Cerini; N. Faccioli; M. Carner; V. Colletti; R. Pozzi Mucelli*
10.20 a.m.	MRI follow up of acoustic neuromas following treatment with SRS *J. Tamangani; J. Freedman; L. Senthil; S. Chavda*

TMJ & Facial pain (2nd parallel session) – ROOM B

Chairmen: N. Martin-Duverneuil - A. Whyte

08.00 a.m.	Essential information for decision making *T.A. Larheim*
08.20 a.m.	New concept! The importance of lateral vectors in TMJ movement *C. Bodin*
08.40 a.m.	MR findings. How to do and report MR of the TMJ *M. Pregarz*
09.00 a.m.	Update on treatment of TMJ disorders *T.A. Larheim*

Original papers: CT perfusion, DCE and DWI-MR – ROOM B

Chairmen: S. Bisdas - L. Preda

09.20 a.m. CT perfusion of Head and Neck malignant neoplasms; differences of blood flow, blood volume, mean transit time, and permeability-surface product parameters
L. Faggioni; E. Neri; P. Vagli; F. Turini; F. Cerri; C. Bartolozzi

09.30 a.m. Perfusion CT for monitoring initial response in advanced squamous cell carcinoma of the Head and Neck treated with concomitant chemoradiotherapy
K. Surlan-Popovic; P. Strojan; Z. Rumboldt; S. Bisdas

09.40 a.m. DCE-MRI estimates of blood flow in patients with Head-and-Neck tumors
S.B. Donaldson; G. Betts; S. Bonington; J. Homer; C.M.L. West; L.E. Kershaw; D.L. Buckley

10.00 a.m. ADC and SUV values in primary Head and Neck squamous cell carcinoma
J. Frühwald-Pallamar; S.F. Nemec; M. Mayerhoefer; A.M. Herneth; G. Karanikas; C. Czerny

10.10 a.m. 18F-fluorodeoxyglucose-PET/CT to evaluate tumor, nodal disease, and gross tumor volume of oropharyngeal and oral cavity cancer: comparison with MR Imaging and validation with surgical specimen
S. Bisdas; O. Seitz; N. Chambron-Pinho; M. Middendorp; T. Vogl; M. Mack

10.30 a.m. Coffee Break

Pediatric Imaging (3rd parallel session) – ROOM A

Chairman: N. Freling

11.00 a.m. The pre-auricular mass in a child
N. Freling

11.20 a.m. Hemangioma & vascular malformations in a child
M.G. Mack

11.40 a.m. The infrahyoid neck mass in a child
M. Subramanyam Thyagiarajan

12.00 p.m. Pediatric cochlear implantation: what we should know about the brain
L. Pinelli

Original papers: Pediatric Imaging – ROOM A

Chairman: N. Freling

12.20 p.m. Preoperative radiological assessment in pediatric patients with cochlear nerve aplasia
M. Barillari; R. Cerini; N. Faccioli; M. Carner; V. Colletti; R. Pozzi Mucelli

Bone & around-bone lesions (4th parallel session) – ROOM B

Chairman: H. Imhof

11.00 a.m. Fibro-osseous lesions in the head & neck
H. Imhof

11.20 a.m. Odontogenic tumors. Imaging strategies
N. Martin-Duverneuil

11.40 a.m. Imaging of skull base meningiomas
F. Dubrulle – R. Kohler

12.00 p.m. Bone infections & necrosis. Key imaging findings
S. Robinson

Original papers: Miscellaneous – ROOM B

Chairman: F. Dubrulle

12.20 p.m. Combined early and late contrast enhancement within one CT scan in the evaluation of deep neck infections
A.E. Berstad; T.M. Aaløkken; J. Kristiansen; H. Stenwig Li

12.30 p.m. Treatment of cranial dural arteriovenous fistulae (DAVF) by endovascular infusion of onyx: our early experience in 9 patients
J. Tamangani; L. Senthil; S. Lamin; S. Chavda

12.40 p.m. Radiological investigation of the Necrotizing External Otitis (NEO)
N. Husain; A. Huber; A. Pangalu; A. Valavanis; S.S. Kollias

12.50 p.m. Lunch

Post-treatment changes in the Head and Neck (5th parallel session) – ROOM A

Chairman: J. Kabala

01.40 p.m. The larynx after open surgery
M. Becker

02.00 p.m. Imaging post endonasal surgery
R. Maroldi

02.20 p.m. Imaging complications after middle ear surgery
F. Veillon

02.40 p.m. Flaps in the neck!!
A. Vidiri

Original papers: Post-treatment changes in the Head and Neck – ROOM A

Chairman: B. Schuknecht

03.00 p.m. Is perfusion computed tomography (CTP) predictive of response to chemoradiotherapy and disease free survival (DFS) at 2 years in patients with locally advanced squamous cell carcinoma of the upper aerodigestive tract treated with chemoradiotherapy?
G. D'Andrea; G. Petralia; G. Giugliano; S. Raimondi; D. Alterio; M. Cossu Rocca; L. Preda

03.10 p.m. Follow up of squamous cell carcinoma of the oral cavity/oropharynx: should we reconsider the role of MRI?
S. Palmieri; D. Farina; R. Maroldi

03.20 p.m. Planned neck dissection after chemioradiotherapy in locally advanced Head and Neck cancer: role of the neck US, MRI and PET-TC in detecting residual neck disease
R. Pellini; V. Manciocco; A. Vidiri; L. Marucci; R. Sciuto; R. Covello; V. Anelli; G. Spriano

Trauma in the Head and Neck (6th parallel session) – ROOM B

Chairman: D. Farina

01.40 p.m. Cone beam CT and maxillo-facial trauma
C.R. Habermann

02.00 p.m. Blunt trauma & perforations of midface. Key information. Strategies
M.G. Mack

02.20 p.m. Temporal bone fractures (& beyond)
B. Verbist

02.40 p.m. Laryngeal trauma. Essential
G. Moulin

Original papers: Neck adenopathy – ROOM B

Chairmen: M.G. Mack – S. Montemezzi

03.00 p.m. Neck adenopathy: a level headed approach to diagnosis
S. La Porte; J. Juttla; A. Winfield; M. Dattani; H. Hirji; D. Remedios

03.10 p.m. Posterior triangle adenopathy: which ultrasound clues to choose
S. La Porte; A. Winfield; J. Juttla; M. Dattani; H. Hirji; D. Remedios

03.20 p.m. Patterns and severity of benign lymphoid hyperplasia on MRI in patients referred for suspected nasopharyngeal carcinoma
K. Bhatia; A. King; A. Vlantis; A. Ahuja; G. Tse; J. Wong; J. Woo; B. Zee; A. Van Hasselt

03.30 p.m. What should be the "Gold Standard" clinician requirements for successful fine needle aspiration under ultrasound guidance?
R. Ngu

03.40 p.m. Occult primary Head and Neck tumors - FDG PET CT
W.L. Wong; M. Dimigen; F. Gollub; A. Gharpurhy

03.50 p.m. Feasibility of real time Head and Neck ultrasound fused with CT and MR 3D volumes. Work in progress.
F. Pittiani; A. Borghesi; L. Sottocornola: R. Maroldi

04.00 p.m. Coffee Break

Salivary glands (7th parallel session) – ROOM A

Chairmen: R. Pozzi Mucelli - S. Robinson

04.20 p.m. US of the salivary glands. When is it exhaustive?
G. Salvaggio – G. Caruso

04.40 p.m. MR Imaging techniques in benign lesions of the parotid gland
C.R. Habermann

05.00 p.m. Beyond perineural spread. Where Imaging fails in ACC?
D. Farina

Original papers: Salivary glands – ROOM A

Chairman: A. Lo Casto

05.20 p.m. Functional Imaging of parotid glands using diffusion-weighted echo-planar MRI: evaluation of different stimulation methods and different B value settings
C.R. Habermann; D. Jurjevic; C. Arndt; T. Ries; J. Graessner; G. Adam

05.30 p.m. Diffusion-weighted echo-planar MRI of primary parotid gland tumors: does a higher B value setting improve the diagnostic potential?
C.R. Habermann; J. Oji; C. Arndt; J. Graessner; Y. v.Kodolitsch; G. Adam

Face and paranasal sinuses (8th parallel session) – ROOM B

Chairman: H.B. Eggesbø

04.20 p.m. Wegener granulomatosis of the face
T. Beale

04.40 p.m. Lymphoma of the face and sinuses
S. Kösling

05.00 p.m. Fungal infections of the sinuses
H.B. Eggesbø

Original papers: Miscellaneous – ROOM B

Chairman: S. Kösling

05.20 p.m. Sinonasal Wegener granulomatosis: spectrum of findings and analysis of the role of MRI in 28 patients
L. Nardo; D. Farina; E. Botturi; R. Maroldi

05.30 p.m. Detection of nasopharyngeal carcinoma: accuracy of MRI of the nasopharynx in high risk patients
A. King; A. Vlantis; K. Bhatia; A. Ahuja; J. Wong; J. Woo; B. Zee; A. van Hasselt

05.40 p.m. ESHNR General Assembly

08.00 p.m. Gala Dinner at Palazzo Giusti

Parallel Sessions

Saturday – October 3rd, 2009

Orbital lesions. Imaging Update

Chairman: C. Czerny

08.00 a.m.	Anatomy of the orbit at ocular pathways *C. Czerny*
08.20 a.m.	Extra-ocular vascular and neoplastic orbital lesions *B. Verbist*
08.40 a.m.	Diplopia due to extra-orbital lesions *M. Lemmerling*

How to report on…

Chairman: S. Golding

09.00 a.m.	Oral cavity carcinoma *J. Kabala*
09.20 a.m.	Post-RT complications *A. Borges*
09.40 a.m.	Chronic rhinosinusitis *A. Whyte*

How to perform a DWI exam of the Head and Neck

Chairman: R. Maroldi

10.00 a.m.	The Integration between the Engineer and the Radiologist experiences *F. De Keyzer – V. Vandecaveye*

10.40 p.m. *Coffee Break*

Paragangliomas and neurogenic tumors

Chairman: A. Borges

11.10 a.m.	Jugular and tympanic bone paragangliomas *F. Veillon*
11.30 a.m.	Skull base neurogenic tumors *U. Salvolini – M. Giannoni*
11.50 a.m.	Neck neurogenic tumors *S. Gerevini*

12.10 p.m. **Junior Film reading Session: "*Italy vs. Rest of the World*"**
M.G. Mack

01.00 p.m. *End of the Meeting*

01.10 p.m. *Lunch*

ESHNR  Refresher Course

Refresher Course – 1st part

Chairman: B. Verbist

02.00 p.m.	Anatomy of the skull base *H. B. Eggesbø*
02.30 p.m.	Pathology of the anterior and central skull base *A. Borges*
03.00 p.m.	Temporal bone pathology *B. Verbist*
03.30 p.m.	The parapharyngeal space *M.G. Mack*

04.00 p.m. *Coffee Break*

Refresher Course – 2nd part

Chairman: F. Veillon

04.30 p.m.	Cranial nerves I-VI *J. Casselman*
05.00 p.m.	Cranial nerves VII-XII *F. Veillon*
05.30 p.m.	The masticator space *H. Imhof*
06.00 p.m.	The oral cavity and oropharynx *S. Golding*

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ABSTRACTS of INVITED LECTURES

(in order of presentation)

How nodal metastases influence the treatment planning and prognosis?

Giuseppe Spriano

It is accepted that the presence of cervical nodal metastases in head and neck squamous cell carcinoma (HNSCC) represents the single most important worsening prognostic factor.
Approximately 50 % of the HNSCC have subclinical or clinical metastases at diagnosis.
The assessment of presence of nodal metastases is therefore crucial in order to establish the correct treatment planning.
The incidence of nodal metastases is related to the characteristics of the primary. Some of them as site, subsite and size are clinically detected; others as tumor thickness and deep tissue invasion, degree of infiltration, cellular differentiation, pattern of invasion within the stroma, positive margins after resection, vascular and neural invasion, inflammatory response, are pathologically detected.
It is well known that even tumors with these similar characteristics may have a different capability of metastatization because of different way of neoplastic progression.
Metastatization is a multistep process which culminates in the acquisition of a more invasive phenotype by some cell clones that can penetrate into vessels and leave them when the lymphatic echelon is reached.
The steps of this process can be summarize in: genetic mutations, cell detachment from the primary, basement membrane invasion, cell migration, extra-cellular matrix degradation and angiogenesis.
These steps are respectively regulated by: chromosomal modifications that allow oncogene activation (and/or suppressor gene inactivation), modification of adhesion molecules (mainly caderins and integrins), mutation in signalling molecules (MET oncogene and EGFR), metalloproteinases activation and Cathepsin D over expression, increasing of microvessel density.
It becomes advisable to early identify this process and this has been the spur to develop the new imaging techniques. On the other hand the improvement of knowledge in molecular biology could lead to prevent or, at least, to treat early and aggressively nodal metastases.
Nowadays the rate of occult neck nodal metastases in N0 (pN+) patients receiving a meticulous work up is low. When occult metastases is present, it produces a disease free survival similar to those found in cN+. For these reasons, the elective treatment of the neck is suggested in the majority of the patients staged up of T2.
As the lymphatic drainage is site-specific and occurs in a predictable manner in N0 cases, the treatment of the levels at risk is considered to be adequate.
An approximately 50% of reduction in 5 years survival rate is seen in patients with nodal metastases at presentation (cN+). A further decline in survival occurs in case of multiple metastases, bilateral or controlateral (cN2b-c), large volume or extracapsular spread (cN2a – N3).
In these clinical presentation a more aggressive treatment is advocated. The surgical removal of the entire lymphatic routes of drainage preserving the uninvolved anatomical neck structures is recommended. Many studies have demonstrate a benefit in reducing regional and distant recurrence when an adjuvant treatment is administrated after surgery using radiotherapy or, in case of massive metastatization and extracapsular spread, concurrent chemo-irradiation.
The treatment of N3 disease is a challenging topic. The selection of the cases that can benefit from aggressive surgery and adjuvant therapy requires a careful radiological study in order to assess the possibility of a radical surgery avoiding to treat patients in which the surgical act is not related with an improved survival.
In the recent decennium many studies have investigated the therapeutic value of "no surgical options" using alterated or intensified radiotherapy or concurrent chemo-radiotherapy in advanced head and neck SCC in order to spare the affected organ, especially the larynx, when the surgery cannot preserve it.
When this strategy is used in patients with advanced neck disease the evaluation of the response to the therapy is mandatory.

As a general role the clinical and radiological residual disease in the neck is resected because the risk of persistent vital neoplastic cell nests is quite high.
When a complete clinical response is obtained, after the so called "planned neck dissection", the examination of the surgical specimen results often negative and the surgical morbidity is very high.
PET scan has been advocated in order to assess biological death of the cancer cells. Based on the data from the recent literature a planned neck dissection can be avoided when clinical, radiological and metabolic examinations are negative for residual disease.
Unfavourable prognostic impact of nodal metastases still represents the most challenging problem in head and neck oncology, even if there was an encouraging improvement in diagnosis and treatment.

The clinical N0 neck. Should we routinely add US to CT (or to MR) when staging Head and Neck cancer?

Jonas A. Castelijns

Because many authors have found that borderline lymph nodes cannot be reliably scored on US, CT, and MRI, and because radiological criteria are not as reliable as cytological, US FNAC is gaining popularity . In the United States this technique has received less acceptance because it is operator dependent. For this it is necessary to have clinical information on the primary tumor and knowledge about the patterns of lymphatic spread from this tumor. It has been shown that US FNAC has a very high specificity, approaching 100%. To obtain a high enough sensitivity, lymph nodes as small as 4-5 mm in the first two echelons should be aspirated. In a previous report, we found that with use of this US-guided aspiration cytology we obtained a sensitivity of 73% with a specificity of 100% in N0 necks. This was significantly better than CT or MRI. Only one other study compared US FNAC to CT and MRI and found it to be superior as well. Recently, however, in a multicenter study using US-guided aspiration, Takes et al. reported a sensitivity of only 42% for the N0 neck. Righi et al. found a sensitivity of 50%, which was worse than 60% for CT; however, in Righi et al.'s study, most false negatives were found in the beginning of the study and some of these were radiated patients or non-squamous cell carcinoma patients. enerally, false-negative results may be the result of aspirating the wrong node or the wrong part of the correct node (=sampling error). Furthermore, the cytopathologist may overlook single tumor cells. A technique which was supposed to increase the accuracy of US-guided aspiration is better selection of the node to aspirate by the sentinel node procedure. Regional metastasis is one of the most important factors in prognosis and treatment of patients with head and neck squamous cell cancer (HNSCC). In addition, since lymphatic metastasis is a frequent event, a decision to treat the lymph nodes in the neck has to be made in almost all patients, even if metastases are not apparent clinically. It is therefore important to assess as reliably as possible whether a patient has regional lymph node metastases. As a consequence of the low sensitivity of palpation, a neck side without palpable metastases is at risk of harboring occult metastasis. This risk is to a large extent dependent on the size and site and other characteristics of the primary tumor. These risk may vary from far below 10% in small glottic carcinomas to 20-50% in T1 or T3 oral, oropharyngeal, and supraglottic tumors. In many head and neck primaries not only the ipsilateral site is at risk but the contralateral site has a significant risk to harbor metastases as well, especially when the primary has grown close to or extends over the midline. In a neck without palpable nodes, imaging can help in detecting occult metastases or in increasing the confidence that the neck is really tumor negative and can be observed. Depiction of suspicious non-palpable lymph nodes can convert selective neck treatment or a wait-and-see policy to more secure comprehensive treatment of all levels of the neck. Negative imaging results, on the other hand, can be used as an argument to refrain from elective treatment of the neck if the risk of radiologically occult metastases is considered to be low enough. n a recent decision-analysis study, a risk of occult neck metastases (i.e., in a palpable negative neck) above 20% was found to be indicative for elective neck treatment, either by radiation therapy or surgery. This risk of occult metastasis, which can occur in both sides of the neck, is determined by characteristics of the primary tumor, such as size, site, and several biological criteria. In practice, most patients with tumors staged as T2 or larger undergo some form of elective neck treatment. So, even when no metastases can be detected the neck will be treated

in the majority of the patients. Disadvantages of this policy are overtreatment and morbidity for the majority of the patients. Modern imaging techniques may be helpful by decreasing the initial risk of occult metastasis. If the risk of occult metastasis is below 20%, the clinician may refrain from a neck dissection and adapt a wait-and-see policy with careful follow-up to detect a neck metastasis as early as possible. As a risk of 20% of occult metastases is considered acceptable to observe the neck, and because most T2 oral carcinomas carry a risk of approximately 30-40% for palpably occult metastases, the sensitivity of any imaging technique should be at least around 50% for non-palpable neck disease so as to detect half of the occult metastases. In selected patients who can be treated with transoral excision or T1 and T2 oral, oropharyngeal, and supraglottic carcinomas, or selected patients who undergo laryngectomy for laryngeal carcinomas, the authors rely on the US-guided FNAC findings and do not routinely treat the neck electively. These patients are followed very meticulously, using US-guided FNAC at 8- to 12-week intervals. Our experience with this wait-and-see policy has been encouraging. Of the 77 patients who underwent a transoral excision without neck treatment in the past 4 years, and have been followed for at least 1 year, 14 have failed in the neck (18%), of whom 10 have been salvaged and are alive without tumor (71% salvage rate). This high salvage rate is certainly related to the short delay of diagnosis of these 14 neck failures due to strict control by US-guided FNAC. Seven neck failures were detected within 4 months after treatment of the primary, four between 4 months and 1 year and three after more than 1 year. Of the 4 patients who died, all had lymph nodes with a minimal axial diameter above 12 mm. The patients who could be salvaged had lymph nodes with a minimal axial diameter less than 12 mm.

The US N0 neck, how reliable is DWI?
Vincent Vandecaveye

In patients with head and neck cancer, nodal metastases are an adverse prognostic factor compromising long term patient survival. Therefore, accurate detection of regional nodal metastases is required for optimization of treatment.
At this time, a direct comparison of ultrasound (US) and the relatively new technique, diffusion-weighted magnetic resonance imaging (DW-MRI) in the evaluation of the clinically negative neck has not been performed, neither in the pre- nor post-radiotherapeutic neck and it would probably be premature to straightforwardly speculate on the relative impact of the separate imaging modalities on the management of the N0 neck. However, recent publications have indicated the value of DW-MRI in the detection of clinically negative nodal metastases, both in the pre- and post-therapeutic neck.
DW-MRI measures differences in tissular microstructure based on the random displacement of water molecules which offers the advantage that the technique does not rely on size-related or anatomical criteria nor lesion vascularization for nodal characterization. As both benign and malignant lymph nodes show increased signal intensity (SI) on high b-value images, differentiation with the apparent diffusion coefficient (ADC) is mandatory. The high contrast-to-noise ratio of native DW-MRI images, however, enables the detection of small lymph nodes and is also likely to facilitate the region of interest (ROI) delineation for ADC-calculation. Moreover, as necrosis is infrequent in subcentimetric nodal metastases, the higher tissue homogeneity may lead to a more straightforward difference between benign and metastatic lymph nodes. These factors may in part explain the reported high accuracy for differentiation of subclinical nodal disease.
In this talk, an overview will be given of the current evidence for use of DW-MRI in the detection of subclinical nodal metastases. The additional value of DW-MRI to other imaging techniques such as ultrasound will be discussed for presurgical staging and radiotherapeutic treatment planning for head and neck squamous cell carcinoma. Also, the potential value of DW-MRI for staging and restaging in other tumor types of the head and neck, such as papillary thyroid cancer, will be discussed. Ultrasound is firmly established in the staging and post-treatment restaging of this tumor type. The additional value of DW-MRI as a complementary presurgical imaging tool and its potential impact on planning the extent of neck dissection will be outlined.

The US N0 neck. PET-CT to detect occult nodal metastases or not?
Berhard Schuknecht

The presence of cervical lymph node metastasis is the most significant independent prognostic factor in patients with head and neck squamous cell carcinoma (HNSCC). The objective for lymph node staging is to assess the extent of concomitant neoplastic lymph node involvement.
The presence of lymph node metastases may imply a 40% to 50% reduction of 5 year survival compared to patients with no lymph node metastases. Staging of the neck by imaging has considerable impact on treatment decision regarding surgical or non-surgical treatment options. The management of patients without neck metastases (clinically negative neck cN0) remains controversial. Patients with negative lymph node status will undergo minimally invasive sentinel node biopsy or risk-level based elective neck dissection; patients with lymph node involvement will undergo modified radical neck dissection (Stoeckli 2007).
The risk of occult nodal metastases is dependent on primary tumor location, size, midline extension and histologic grade. In patients with clinically N0 neck and a >20% probability of occult metastases (Weiss MH 1994), or >44.4% probability in a recent report (Okura M 2009), an elective treatment of the neck for diagnostic and therapeutic purposes is generally recommended.
The objective of lymph node staging is to minimize under- or overstaging and to distinguish the N0 from the N+ neck. This stratifies between observation of the neck on close follow up in most patients and any kind of neck dissection in case of a surgical treatment option.
The clinical staging of the neck lymph nodes is by definition based on physical examination and appropriate imaging. Lymph node staging may rely on ultrasound (US), ultrasound guided fine needle aspiration cytology (USFNAC), contrast enhanced computed tomography (CT), magnetic resonance imaging (MR) or on PET or PET-CT.
Ultrasound criteria for lymph node malignancy comprise a more spherical shape leading to an increased minimal transverse diameter and increased ratio of short to long axis diameter >0.5. A minimum axial diameter of 7 mm for level II and 6 mm for the remainder of the neck lymph nodes revealed an optimal compromise between sensitivity (89% level II, 67% I, 76% III-V) and specificity (62% II, 80% I, 89% III-V) for nodal disease in necks without palpable metastases (van den Brekel 1998). A meta-analysis provided a sensitivity for US in the range of 63% to 97%, and a specificity of 74% to 100% (de Bondt RJB et al. 2007)
Lymph nodes adopt a similar sonomorphology as the primary tumor and thus become more hypoechoic. A pathologic irregular vascularization pattern is depicted by Doppler- or Powerdoppler-sonography. Recent technical advances using sono-elastography have been postulated to achieve higher sensitivity (85%) compared to size criteria (ratio>0.5) with 75% and an increase in specificity from 81% to 98%.
In a prospective study on 76 consecutive patients with HNSCC performed by our group, (Stoeckli unpublished data) US distinguished between the N0 and N+ neck with a sensitivity of 89 % and a specificity of 57%. USFNAC increased specificity to 86%. Negative predictive values for US and USFNAC were 57% and 86% respectively.
The performance of US and USFNAC is dependent on the experience of the investigator and has anatomic limitations regarding retropharyngeal and mediastinal lymph nodes. These locations are exceedingly rare, however, and are not expected to occur without other cervical lymph nodes at initial presentation.
CT and MR provide high anatomic resolution and therefore are routinely performed in many institutions for combined staging of the primary tumor and cervical lymph nodes. Lymph node staging by CT and MR rely on criteria, such as nodal size, structure and contrast-enhancement pattern which may be regarded very similar to those used for US. In a meta-analysis of 8 studies, sensitivity values for CT have been reported between 54% and 95% and specificity to vary considerably from 39% to 100% (de Bondt et al.2007). Corresponding data for MR in 5 studies displayed a slightly higher sensitivity (64% to 92%) and lower specificity (48%-81%).
18 F-FDG PET has been suggested to be more accurate than CT and/or MRI in identifying cervical lymph node metastases in HNSCC because it is considered to be a more sensitive technique. In comparisons for a specific imaging modality the available data are consistent with a small improvement in sensitivity and specificity with PET (in the range of 5% – 10%) over CT and MR. However, statistical significance is not reached as confidence intervals overlap (Kyzas PA et al.

2008). One sizable study that correlated PET with CT/MRI could improve sensitivity only from 50% to 57% in patients with palpably negative neck (Ng SH et al. 2006).
PET/CT is superior to PET in determining the exact anatomic location, in reducing the fraction of equivocal lesions and thus in increasing specificity. PET/CT and PET read together with contrast enhanced CT, however, were observed to provide a comparable diagnostic yield (Goerres et al. 2008). An analysis of PET/CT, CT, US and USFNAC results performed by our group comparing N0 versus N + did not show an increase in sensitivity for PET/CT relative to other techniques. Specificity (77%), however, was superior to CT (54%) and US (57%) but lower than for USFNAC (86%).
PET/CT in comparison to PET and CT has been reported to enhance assessment of cervical lymph node status with highest values for sensitivity (91.8%), specificity (98.9), and accuracy (97.1%) on a level-by-level analysis (Jeong HS et al. 2007).
Limitations of PET/CT consist of high cost and complexity of the examination and reduced availability. The allegedly high sensitivity and specificity in some reports is challenged in fact by false positive findings in inflammatory lymph nodes and false negative results in purely necrotic /cystic lymph nodes.

Suggested reading:
Stoeckli SJ. Sentinel Node Biopsy for Oral and Oropharyngeal Squamous Cell Carcinoma of the Head and Neck. Laryngoscope 2007; 117:1539–1551
Weiss MH, Harrison LB, Isaacs RS. Use of decision analysis in planning a management strategy for the stage N0 neck. Arch Otolaryngol Head Neck Surg 1994;120:699–702.
Okura M et al. Decision analysis and treatment threshold in a management for the N0 neck of the oral cavity carcinoma. Oral Oncol (2009), doi:10.1016/j.oraloncology.2009.03.013
Van den Brekel MWM et al. The Size of Lymph Nodes in the Neck on Sonograms as a Radiologic Criterion for Metastasis: How Reliable Is It? AJNR 1998;19:695-70
De Bondt RBJ et al. Detection of lymph node metastases in head and neck cancer: A meta-analysis comparing US, USgFNAC, CT and MR imaging. EJR 2007;64:266–272
Stoeckli SJ., Schuknecht B., Hany T., Strobel K. Initial staging of the neck in head and neck squamous cell carcinoma: a comparison of CT, PET/CT and USgFNAC unpublished data
Lyshchik A. et al Cervical Lymph Node Metastases: Diagnosis at Sonoelastography—Initial Experience. Radiology 2007;243:258-267
Kyzas PA etal. 18 F-Fluorodeoxyglucose Positron Emission Tomography to Evaluate Cervical Node Metastases in Patients With Head and Neck Squamous Cell Carcinoma: A Meta-analysis J Natl Cancer Inst 2008;100: 712 – 720
Ng SH , Yen TC , Chang JT , et al . Prospective study of [18F]fl uorodeoxyglucose positron emission tomography and computed tomography and magnetic resonance imaging in oral cavity squamous cell carcinoma with palpably negative neck . J Clin Oncol . 2006 ; 24: 4371 – 4376 .
Goerres GW, Schuknecht, Schmid DT, Stoeckli SJ, Hany TF. Positron emission tomography/computed tomography for staging and restaging of head and neck cancer: comparison with positron emission tomography read together with contrast-enhanced computed tomography. Clinical Imaging 2008; 32: 431–437
Jeong HS et al. Use of integrated 18F-FDG PET/CT to improve the accuracy of initial cervical nodal evaluation in patients with head and neck squamous cell carcinoma Head Neck 2007;29:203-10

The US N0 neck: PET-CT and DWI on 3T for nodal metastases.

Julia Frühwald -Pallamar

Application of DWI in the neck area is still challenging mainly due to motion artifacts from swallowing, respiratory motion as well as heterogeneous tissues.
Studies showed the lower the b-values selected for the calculation of the ADC, the higher the obtained ADC at DWI, and the higher the b-values, the lower the ADC. However, increasing the b-value leads to more distortion and susceptibility artifacts which makes the detection of small lymph nodes (under 0.7cm) on the DWI/ADC maps even more difficult.
For DWI of the lymph nodes on 3T we use the DWIBS sequence (diffusion weighted whole body imaging with background body signal suppression) in axial direction with a maximum b-value of 800 mm2/s. The ADC maps are calculated automatically. The lymph nodes are detected on the conventional MRI sequences and linked with the DW image, a ROI is placed in the b 800 image and then copied to the ADC map.
For PET-CT examination, a combined 64 MD PET-CT system is used. It is performed from head to thigh approximately 50min after an intravenous injection of about 300 MBq 18F-FDG and i.v application of contrast material. All lymph nodes with an SUV > 2.5 are tabulated.

Diffusion-weighted MR shows differences among benign and malignant cervical lymph nodes of SCC. Low ADC values indicate restricted diffusion in non necrotic malignant lymph nodes (0.07-0.09 mm2/s). ADC values in necrotic lymph nodes are significantly higher than in non necrotic nodes. The differences in restriction in diffusion may be due to cellularity, perfusion, and necrosis. Thus, the assessment of an ADC threshold for malignant lymph nodes is only reasonable when excluding necrotic zones.
Our findings suggest that different ADC reference values (thresholds) must be established for different diffusion-weighted sequences (b-value,s field-strength).
The SUV appears not to be related to the ADC.

Endoscopic surgery of benign tumors of the sinonasal tract. Key points
Piero Nicolai

During the last decade, endoscopic surgery has emerged as a valid alternative to external approaches in the management of benign tumors of the sinonasal tract (inverted papilloma, osteoma) and nasopharynx (juvenile angiofibroma). This presentation is based on 486 cases of benign tumors treated by endoscopic surgery at two University Hospitals. The presenter will review the diagnostic work-up, treatment selection criteria, surgical technique, complications, follow-up strategy, and outcomes. Many technical details considered of paramount importance to optimize the results, such as the need to perform a subperiosteal dissection of the lesion and to obtain frozen sections at the end of any resection, will be reviewed.
Special emphasis will be placed on the pattern of growth and extension of the different lesions identified by CT and/or MR that may prompt the surgeon to consider an external approach. A careful review of the surgical tricks that might help to minimize the chance of leaving residual disease behind and to reduce complication rate will also be provided. Most benign tumors of the sinonasal tract can be nowadays effectively removed using an endoscopic approach, whereas only patients with early- and intermediate-stage juvenile angiofibromas may be deemed good candidates for endoscopic removal. However, an informed consent to switch intraoperatively to an external approach should always be obtained from the patient.
Endoscopic surgery is currently considered the ideal treatment for many benign tumors of the sinonasal tract and nasopharynx, and the results in terms of complications, hospitalization time, recurrence rate support this concept. However, criteria for selecting an endoscopic versus an external approach still need refinement, particularly in intermediate- and advanced-stage juvenile angiofibromas.

Endoscopic surgery of nose and sinuses: the new questions to Imaging! Solved and still-to-be solved questions
Davide Farina

A great variety of benign neoplasms and tumor-like lesions may involve the sinonasal region. Pretreatment characterization of the lesions and of their deep extension is mandatory, particularly when endonasal approach is the option. The final characterization of sinonasal lesions requires biopsy or histologic assessment of the surgical specimen, yet in a substantial number of cases cross-sectional Imaging may reliably suggest the diagnosis. The accurate demonstration of bony structures makes MSCT superior to MRI in the evaluation of fibro-osseous lesions, such as osteoma, fibrous dysplasia and ossifying fibroma. MRI should be preferred for the evaluation of soft tissue masses among which, inverted papilloma (IP) and juvenile angiofibroma (JA) in most cases exhibit pathognomonic patterns. The typical MRI pattern of IP, already described in literature as "septate striated" or as "convoluted cerebriform", is confidently seen in nearly all cases. Age and sex of the patient, epicentre of the lesion and pattern of deep spread allow to safely recognize on both MSCT and MRI the vast majority of JA. Beyond these, a large spectrum of unusual benign lesions may arise from soft tissues (such as benign fibrous histiocytoma, hemangioma, pyogenic granuloma, inflammatory myofibroblastic tumor, leiomyoma, myxoma, paraganglioma, schwannoma) or minor salivary glands (such as pleomorphic adenoma, monomorphic adenoma). At

Imaging, not only the discrimination between different benign histotypes, but also between benign and malignant tumors is often impossible. The hot topics in the assessment of deep tumor extension are, as for malignant lesions, invasion of the orbit, anterior cranial fossa and pterygopalatine fossa. Besides these, additional information specific for the histotype, may be required. For example, when dealing with osteoma, multiplanar reconstructions obtained from a volumetric MSCT acquisition allow to detail the site of attachment of the lesion and its relationships with sinus drainage pathways. In IP, any bony spur at the site of attachment of the lesion should be emphasized, as this demands surgical drilling to decrease the risk of recurrences. The typical pattern of diploic invasion of bone by JA (peculiarly at greater sphenoid wing) is by far better demonstrated on MRI, and again represent a crucial point to avoid incomplete resection of the lesion.

Endoscopic surgery of malignant tumors of the sino-nasal tract. Key points.
Paolo Castelnuovo

Background
The increasing expertise in the field of transnasal endoscopic surgery recently has expanded its indications to include the management of sinonasal malignancies. We report our experience with the endoscopic management of nasoethmoidal malignancies possibly involving the adjacent skull base.
Materials and Methods
A retrospective analysis was performed of patients treated by an exclusive endoscopic approach (EEA) or a cranioendoscopic approach (CEA) from 1996 to 2006 managed by two surgical teams at the Departments of Otorhinolaryngology of the University of Brescia, and the University of Insubria-Varese, Italy. The surgical technique requires subsequential surgical steps to perform a multilayer resection of the tumour from the nose which are described. The surgical technique differs on the base of tumour hystology and extension.
Results
One-hundred eighty-four patients were considered eligible for the present analysis. An EEA was performed in 134 patients and the remaining 50 patients underwent the CEA. The most frequent histotypes encountered were adenocarcinoma (37%), squamous cell carcinoma (13.6%), olfactory neuroblastoma (12%), mucosal melanoma (9.2%), and adenoid cystic carcinoma (7.1%). Overall, 86 (46.7%) patients received some form of adjuvant treatment. The patients were followed up for a mean of 34.1 months (range, 2-123 months). The 5-year disease-specific survival was 91.4 +/- 3.9% and 58.8 +/- 8.6% (p = 0.0004) for the EEA and CEA group, respectively.
Conclusions
To the best of our knowledge, this is the largest series reported to date of malignant tumors of the sinonasal tract and adjacent skull base treated with pure endoscopic or cranioendoscopic techniques. A 5-year disease-specific survival of 91.4% and 58.8% for the EEA and the CEA groups, respectively, seem to indicate that endoscopic surgery, when properly planned and in expert hands, may be a valid alternative to standard surgical approaches for the management of malignancies of the sinonasal tract. To correctly plan surgery and to estimate the endoscopic endonasal resection feasibility, we always studied pre-operative imaging with our radiologist to evaluate tumor extension. Specifically dural and periorbit involvement from the lesion need dedicated radiological studies, this to differentiate intraorbital and intracranial content from the lesion

Solved and still-to-be solved questions: sinonasal tumors
Timothy Beale

This lecture reviews the role of imaging in sinonasal tumours illustrating the diversity of tumours in this region. The patterns of local and distant spread of sinonasl malignancy are demonstrated and the respective role of CT and MRI explained.

Critical imaging review areas are highlighted and the sites of tumour recurrence and the imaging features of recurrent tumour are discussed.
The lecture concludes with a summary of those challenging areas in imaging sinonasal tumours where questions may still need to be solved and tries to give a logical approach to solving them.

CSF leakage. Key points
Paolo Castelnuovo

Background
Skull base defects are difficult to diagnose and to treat. To reach the diagnosis is of extreme importance in order to avoid complications. Therefore the diagnosis flow chart, including skull base imaging, is discussed. Surgical techinique differs on the base of the site of lesion and the presence of brain herniation. Interesting cases with specific teaching points are also showed, with detailed analysis of the pre- and post-operative radiological findings.
Materials and Methods
Our series of patients who underwent skull base duraplasty for CSF-leak treated by an exclusive endoscopic approach or with combined transcranial approach between August 1995 and January 2009 at a tertiary referral center (Departments of Otorhinolaryngology of the University of Insubria-Varese, Italy) is of 242 cases. All patients underwent CT and MR previous surgery, which were discussed with neuroradiologist.. The locations, the pathogenesis of skull base defects and the surgical data were recorded.
Results
In our series of patients 82 skull base defects were located in the olfactory groove, 51 in the ethmoidal roof, 43 in the sphenoid sinus, 23 at the posterior wall of frontal sinus, 4 in the posterior cranial fossa, 39 patients had multiple sites of lesion. In the different sites of lesions pre-operative imaging shows some "characteristic features", in example at the olfactory groove the CT scan shows a little opacity which always correspond to a signal of iperintensity at the T2-weighted MR and which disappear in FLAIR sequences; CSF-leaks from the Sternberg canal instead showed at the CT a bone defect in the floor of middle cranial fossa just lateral to V2 canal.
Conclusions
Combination of CT and MR allow for a precise identification of the skull base defect and for the choice of the correct surgical approach. Meticulous pre-operative imaging is of paramount importance when dealing with such cases. CT scan must have high definition for the bony structures with subtle slices (1-2 mm). MR has always to comprehend not only T1/T2-weighted images but also FLAIR sequences. CISS sequences are needed to better define small defect. The use of angio-MR is not always indicate, but it can be useful in revision cases when surgery require major vessel identification.

CSF Leakage – Where Imaging stands
Luc Van den Hauwe

Cerebrospinal fluid (CSF) leak or fistula describes the egress of CSF from the intracranial cavity through an osseous defect within the skull base. This implies a breach or disruption of the underlying dura mater and adherent pia-arachnoid mater, resulting in a communication between the intracranial cavity and either the nasal or middle ear cavity. The diagnosis of CSF leakage may be challenging both for the radiologist and the referring physician, most often ENT surgeon, neurologist or neurosurgeon.
Previous medical history and clinical sypmtoms may rise the suspicion of a CSF leak. These patients may present with CSF rhinorhea, recurrent meningitis or a more complex clinical picture including orthostatic headache and tinnitus, suggestive for the diagnosis of spontaneous intracranial hypotension.
Spinal CSF leaks and associated intracranial hypotension may be observed after lumbar puncture, spinal surgery, trauma, or may be spontaneous. Typical findings on cranial MRI include subdural fluid collections, enhancement of the pachymeninges, engorgement of venous structures, pituitary

hyperemia, and sagging of the brain (mnemonic SEEPS). CT myelography is the study of choice to detect the CSF leak and is more reliable than radionuclide cisternography, but nonivasive imaging such as spinal MR imaging or MR myelography also may demonstrate evidence for extrathecal CSF. More recently, intrathecal gadolinium-enhanced MR cisternography has been advocated.
Cranial CSF leaks have been classified as traumatic (accidental or iatrogenic) and nontraumatic (congenital or tumoral pathology of the skull base). More recently a third group of patients with spontaneous CSF leakage has been defined. Imaging findings in the latter group of patients include total or partial empty sella and enlargement of the optic nerve sheaths. The number of patients with spontaneous CSF leaks seems raising and an association with obesity in middle-aged women is observed.
CSF rhinorhea and recurrent meningitis may occur as a result of trauma, or after functional endoscopic sinus surgery (FESS) and skull base surgery (e.g. transsphenoidal pituitary surgery). Patients may present with active CSF leakage or may complain from intermittent nasal discharge.
Once the diagnosis of CSF rhinorhea is established by demonstrating the presence of ß2-transferrin in the nasal discharge, imaging is performed to look for the exact localization of the defect.
CT and radionuclide cisternography have been the golden standard in the diagnostic evaluation in these patients for many years. However, their diagnostic accuracy diminishes when CSF leaks are intermittent. Moreover, the introduction of newer imaging modalities such as multidetector row CT (MDCT) with submillimetric isotropic images and reformats in three orthogonal planes, MR cisternography (heavily T2-weighted fast spin echo sequences with fat suppression) and MRI cisternography after intrathecal administration of gadolinium (Gd) has changed the approach in the patients with CSF leakage. Although the value of Cone-beam CT in demonstrating anterior skull base defects in a cadaver model has been published, its potential in the living patient still needs to be evaluated.
The value, limitations and indications of these different techniques will be discussed and imaging recommendations will be presented.

Suggested reading.
Lloyd KM, Delgaudio JM, Hudgins, PA. Imaging of skull base cerebrospinal fluid leaks in adults. Radiology 2008; 248:725-736.
Woodworth BA and Palmer JN. Spontaneous cerebrospinal fluid leaks. Curr Opin Otolaryngol Head Neck Surg 2009; 17:59-65

Early glottic and supraglottic squamous cell carcinoma. Laser excision. Update of the clinical work-up

Giorgio Peretti

Background
Transoral CO2 laser surgery for early and intermediate glottic and supraglottic cancers has been accepted as a valuable option in the head and neck surgical armamentarium and is currently considered an alternative to other treatment strategies. Such a conservative surgical approach must be always coupled with a meticulous endoscopic and radiologic work-up to evaluate the superficial extension of the tumor (by endoscopy) and its deep extension to the visceral (paraglottic and pre-epiglottic) spaces, cartilagineous framework, and extra-laryngeal soft tissues (by imaging).
Materials and Methods
We performed a retrospective study on 675 pts (595 glottic and 80 supraglottic tumors) endoscopically treated. Preoperative evaluation was based on fibrolaryngoscopy and videolaryngostroboscopy (VLS) coupled, since April 2007, with Narrow Band Imaging (NBI). Rigid endoscopy with 0° and angled telescopes was accomplished during microlaryngoscopy. High Definition Television (HDTV) was added in this scenario. Saline infusion (SI) into the Reinke's space has been employed in selected patients. In glottic T1b-T2 and supraglottic T2 tumors, CT or MRI was performed.
Results
Based on the results of our diagnostic work-up, different types of endoscopic excision were carried out. Resections were graded according to the European Laryngological Society Classification, including 5 types of cordectomy for glottic lesions and 4 types of supraglottic resections. Before

April 2007, the comparison between histopathologic findings and preoperative clinical diagnoses, showed an accuracy of 97% for VLS alone, 87% for SI alone, and of 94% for VLS+SI. Sensitivity (98%) and specificity (90%) of NBI-HDTV are high enough to ensure an accuracy of 92%.
Conclusions
The routine application of a meticolous diagnostic work-up, based on both pre- and intraoperative endoscopic evaluation of the superficial extension of the tumor, and on three-dimensional involvement of the deep anatomic laryngeal and extra-laryngeal structures by imaging are mandatory to optimize the correct endoscopic treatment of laryngeal tumors. Moreover, the association of endoscopy and imaging is of utmost importance during oncologic follow-up, in order to precociously detect tumor persistence or recurrence and possibly plan an appropriate rescue treatment.

Pre-treatment assessment of T. is it the time for MR? is CT adequate?
Jan Casselman

The role of imaging in laryngeal cancer is to detect the deep extension below the mucosa, cartilage invasion or early extralaryngeal extension, which are often clinically undetectable. Early cancer and superficial vocal cord or mucosal cancer is often a clinical diagnosis. Most often early cancer is treated with radiotherapy or laser therapy. If extension of the tumor in the vocal cords is deep, it may become more difficult to control the lesion with laser therapy although experienced surgeons can even treat relatively large tumors with laser therapy. Sometimes, even small or early laryngeal tumors can invade cartilage. The deep invasion in the vocal cords and cartilage invasion can be seen on CT and on MR, although MR is better suited to detect soft tissue involvement and cartilage invasion. However, when the patient is not able to cooperate then CT is often the best option. When MR is feasible then the use of small flex coils (8 cm) or even coupled microscopic coils are needed to provide the necessary detail. With this technique diffuse invasion of the vocal muscles, under a nearly normal mucosa and/or vocal ligament can be detected. MR has the same advantages in case of larger laryngeal tumors, but again, CT is the best alternative when sufficient cooperation is lacking.

The follow-up post laser excision. When Imaging?
Giorgio Peretti

Background
Transoral carbon dioxide laser surgery for glottic cancers is a conservative treatment that must be always coupled with a meticulous endoscopic and radiologic diagnostic work-up. In such patients a careful follow-up based on periodic endoscopic examination combined with imaging is mandatory to achieve an organ preservation rate comparable to the alternative therapeutic options.
Materials and Methods
We analyzed 120 patients affected by intermediate and advance glottic cancer (T2-T3) that underwent endoscopic partial laryngectomies (EPLs) between January 1988 and December 2005. All patients were followed every 2 months by endoscopic examination for the first 2 years and less frequently thereafter. Patients with symptoms and signs suggestive of tumor recurrence underwent CT or MRI. The weakness point of EPL is represented by scar tissue healing process that often may hide recurrences with submucosal pattern of spread not endoscopically detectable.
Therefore, we retrospectively analyzed the influence of the pattern of the recurrences on the ultimate local control with laser alone and the organ preservation rates.
Results
Thirty (25%) patients developed a local recurrence between 6 and 60 months after surgery. Our data showed that in case of local failure in the T2 group, the ultimate local control with laser alone and the ultimate laryngeal preservation rates were 85.6% and 95.1%, respectively. By contrast, in the T3 group a high percentage of submucosal recurrences not endoscopically detectable reduced the ultimate local control with laser alone and laryngeal preservation rates to 71.6% and 72.7% respectively.

Conclusions
Endoscopy presents several deficiencies in diagnosing recurrent disease after EPLs in intemediate and advance glottic tumors. The imaging plays a key role in the follow-up after EPLs to reduces the number of total laryngectomies due to late detection of recurrences that may develop beneath an intact mucosa not detectable by endoscopic evaluation. In light of this, we strongly recommend a careful radiologic follow-up by CT or MRI scan every 6 months for the first 2 years, in each patient treated by EPLs, although negative endoscopic findings.

Failures of laser excision. Salvage surgery options. Which role for Imaging?
Roberto Maroldi

Submucosal recurrent laryngeal carcinoma after laser resection may be undetected during endoscopic follow-up. If a submucosal mass is suspected or worsening of motility is recorded on endoscopic follow up, Imaging is required to assess/rule out recurrences. MDCT is insufficiently accurate in detecting early recurrent – or regrowing – tumor, usually in the paraglottic space. The main difficulty is related to the insufficient discrimination of tumor from scar. Cartilage invasion is observed in more advanced recurrent tumors, apart from those primarily located at the anterior commissure. PET-CT has been used to identify recurrences after radiation therapy for laryngeal carcinoma. Its sensitivity is estimated closer to 90%, the specificity about 75%. As MR provides a better contrast resolution than MDCT it may be used in the most challenging cases. Particularly when PET-CTfindings are uncertain. However, standard head and neck coils may result insufficent as the small laryngeal structures require high spatial resolution. The use of surface microcoils can increase the detectability of recurrences by improving signal to noise ratio and spatial resolution.

Concurrent chemo and radiotherapy. Current results and future trends. What do we need from Imaging?
Patrizia Olmi – Lisa Licitra

Data from published metanalyses have clearly confirmed that concomitant chemo-radiation represents the optimal treatment for stage III and IV head and neck cancer, with a survival improvement of 8% compared to radiotherapy alone, and 4% compared to different timings other than concomitant chemo-radiation. Treatment failure in head and neck cancer is mainly locoregional; in particular, in patients who have not been submitted to surgery, clinical response should be evaluated two-three months after conservative treatment completion, in order to proceed to surgery, in case of persistent disease. Most locoregional failures, depending on tumour and regional extension, are observed within the first two years. In initially resectable patient primarily undergoing concomitant chemoradiation a clinico-diagnostic evaluation is crucial in order to ensure a timely surgical salvage. In non resectable patients, the clinico-diagnostic evaluation of disease recurrence is particularly important both for judging resectability of neck nodes and/or for considering reirradiation on primary tumor.
In the light of the above, diagnostic imaging evaluations in the follow-up may be differentiated and intensified according to the availibility to perform salvage treatments. In this context diagnostic imaging procedures should be employed in order to evaluate the disease clinical status and, in suspicious cases, different modalities should concomitantly be used (MR, PET, ultrasonography for lymphnodes).
Future trends will include the use of neadjuvant upfront polychemotherapy. In order to avoid unnecessary toxicity from suboptimal drug's action an early tumor response evaluation will be more and more requested to imaging. Furthermore functional imaging will be strategic for the best selection of new agents.

The post-CT/RT neck. Morphological and „functional" imaging

Sotirios Bisdas

The behaviour of the squamous cell carcinoma of the head and neck (SCCHN) reflects a complexity of genetic, biological, histopathological and clinical heterogeneity. As the primary pattern of failure in SCCHN is locoregional, surgery and radiotherapy (RT) are recognized as key treatment modalities. The concomitant use of chemotherapy (CT) and RT has led to an additional survival benefit. The morphologic information obtained by cross-sectional imaging in the primary as well as treated SCCHN is often insufficient, despite its satisfactory spatial resolution, because of the highly infiltrative character of the tumor, the post-therapy edema or fibrosis, the distorted vasculature properties after CT/RT, and the difficulty to reliably recognize the lymph node metastases in apparently "normal" lymph nodes. Perfusion-CT (PCT) studies have shown significantly elevated blood flow (BF), blood volume (BV), and permeability surface product (PS) values as well as shorter mean transit time (MTT) values in the SCCHN compared to the surrounding healthy tissue. Interestingly, initial evidence shows that PCT measurements may be helpful in predicting response to radiation therapy as well as to induction CT and may serve as a therapeutic monitoring tool. Nevertheless, the time course of changes in perfusion parameters of the SCCHN during CT and/or RT has not been fully investigated yet. Therefore, studying dynamics of PCT parameters may be of importance in order to understand the therapy-induced functional changes in the tumor tissue, to help distinguish therapy-induced alterations in responders and non-responders, and to establish and validate PCT as a monitoring imaging modality. The aim of this presentation is to demonstrate the feasibility of the PCT in the treated SCCHN after CT/RT, to compare the provided information with the morphological imaging findings, to demonstrate the additional benefit of the dynamic PCT acquisitions, and to suggest imaging strategies for achieving the maximum therapeutic effect.

The post CT/RT neck: FDG-PET/CT only?

Nasreddin D. Abolmaali

Background
Besides clinical follow-up, assessment of treatment response may be done by morphological, functional and metabolic imaging modalities and is only needed if consequences, e.g. further therapy, are drawn from the results.
Materials and Methods
During CT/RT, the results of morphological and functional imaging are typically characterized by minor reductions of tumor size and blood volume. The assessment of treatment response during CT/RT by FDG (18F-Fluoro-deoxyglucose, interrogating glucose metabolism) and FMISO (18F-Fluoro-misonidazole, interrogating hypoxia) reveals high interindividual variability with contradictory results in different studies (most of them inquiring prognosis).
Results
Typically, residual tumor masses can be detected at the end of therapy by morphological imaging but may modify decisions only in case of insignificant tumor shrinkage or tumor growth. Frequently, the volume of local FDG uptake in the tumor region will have grown immediately after combined CT/RT as well. Therefore, the first image based follow-up should be done 12 weeks after the end of therapy. Most local recurrencies will be detected 9-12 months after the end of therapy defining a further optimal time slot to use imaging. Besides morphological imaging, preferably done by MRI, PET is the method of choice for follow-up.
Conclusions
Using the tracer FDG allows for sensitive detection of glucose avid lesions and FET/FLT may allow for better differentiation of inflammatory changes, reducing false positive results. Most probably, combined MRI/FDG-PET will emerge to be the method of choice to assess response to treatment in the post CT/RT neck.

Imaging of the acoustic pathways

Bert De Foer

1.Normal Anatomy of the Auditory Pathway.

The cell bodies of the cochlear nerve are located in the modiolus. The modiolus can be recognized on high resolution CT images as an H shaped density centrally located in the cochlea. On MR, especially on heavily T2-weighted images, it can be seen as an H shaped hypo-intensity in the high intensity fluid signal of the cochlear turns.

These spiral ganglia are bipolar, with one axon arising from the organ of Corti that receives auditory information and one axon that transmits this information to the brainstem.

The cochlear nerve is formed from these axonal fibers and exits the modiolus of the cochlea via a small opening in the fundus of the internal auditory canal (IAC), called the cochlear aperture. The cochlear nerve takes its place in the anterior inferior part of the IAC. The two other parts of the vestibulo-cochlear nerve (VCN) namely the inferior and superior vestibular nerve run respectively in the posterior inferior part of the IAC and the posterior superior part of the IAC. The facial nerve, running seperately in the cerebellopontine angle (CPA) and the IAC takes its place in the anterior superior part of the IAC. There is a significant variability between individuals in the exact site of union of these three nerves. However, the location is relatively symmetric in between individuals.

On computed tomography, the nerve elements cannot be identified, though their location can be inferred using bony landmarks. The superior half of the IAC fundus, containing the facial nerve and the superior vestibular nerve is separated from the inferior part of the IAC containing the inferior vestibular nerve and the cochlear nerve by the crista falciformis. The crista falciformis is best seen on coronal CT images and/or reconstructions. On a high resolution T2-weighted image, this crista falciformis might be seen as a signal void.

As the vestibulocochlear nerve transverses the CPA, it is located posterior to the facial nerve, with a size relation of 2 for the VCN to 1 for the facial nerve. This size relationship should always be looked after as in many congenital anomalies with aplasia or hypoplasia of the VCN this size relationship is no longer preserved.

Both of these nerves are intimately related to the anteroinferior cerebellar artery (AICA), branch of the basilar artery. In two thirds of normal cases, this artery loops into the IAC or projects into the porus acousticus. Up to four internal auditory arteries arise from the IAC to supply the inner ear. Care should be taken to interpret a close contact of the AICA to the VCN as a cause of tinnitus as many so called neurovascular contacts are also seen in normal asymptomatic patients.

The VCN enters the brainstem the upper lateral medulla immediately superficial to the inferior cerebellar peduncle. The cochlear component of the VCN synapses with 2 nuclei –a ventral and a dorsal nucleus- known as the cochlear nuclear complex. The cochlear nuclear complex produces a bulge of the medulla into the lateral recess of the fourth ventricle and the foramen of Luschka. Additional landmarks are the cerebellar flocculus which lies posterolateral to the nerve complex and the choroid plexus, which may protrude through the foramen of Luschka.

Some second-order neurons arising from the cochlear nuclear complex cross in the trapezoid body of the medulla, while some synapse in the superior olivary nucleus of the medulla. These fibers then ascend to the contralateral inferior colliculus of the midbrain. Other fibers do not cross, but ascend on the ipsilateral side to the inferior colliculus. These ascending crossed and uncrossed fibers form the lateral lemniscus of the pons.

Third-order neurons ascend from the inferior colliculus to the medial geniculate body of the thalamus where fibers from fourth-order cell bodies form the auditory radiation to the transverse temporal gyrus of Heschl.

Heschl gyrus is usually identified as a single gyrus and less commonly as two gyri at the posterior aspect of the superior temporal gyrus. It can best be seen on coronal images at MRI. Heschl's gyrus roughly corresponds to the primary auditory cortex in Brodmann's area 41 and 42.

2. Imaging of the Auditory Pathway.

Although a high resolution CT examination of the temporal bone can be performed to evaluate the bony delineation of membranous labyrinth, a state-of-the-art MRI examination of the posterior fossa is required in the evaluation of a patient with sensori-neural hearing loss in adults.

In children the situation is however different. Both examinations, CT and MRI, are needed in the evaluation if sensori-neural hearing loss to evaluate the congenital anomalies and deformities.

An MRI protocol for evaluation of sensorineural hearing loss should include following sequences:
a) Axial T2-weighted or fluid attenuated inversion recovery (FLAIR) sequence of the entire brain to evaluate central brain or brain stem pathology. A coronal plane is mandatory as the gyrus of Heschl is best evaluated in the coronal plane.
b) Axial submillimetric heavily T2-weighted sequence in order to evaluate the vestibulocochlear nerve and its branches in the CPA and IAC. Using these sequences, the signal intensity of the fluid in the membranous labyrinth can also be evaluated. Most frequently a 3D-turbo spin-echo (TSE) T2-weighted sequence, a 3D-fast spin-echo (FSE) T2-weighted sequence, a fast imaging employing steady-state acquisition (FIESTA) or a constructive interference in steady state driven equilibrium (DRIVE) sequence is used. Images should be reconstructed and evaluated in the axial and sagittal plane in order to see all branches of the VCN.
c) Axial T1-weighted sequence: a thin slice spin echo (SE) or TSE/FSE T1-weighted sequence (2 mm or less) can be used. As an alternative a submillimetric T1-weighted 3D gradient echo (GRE) sequence can be used.
With the advent of 3T machines in clinical practice, submillimetric T1-weighted sequences will become the sequence of choice as they offer the highest number of slices through the membranous labyrinth and IAC. Using these sequences, correlation between these 3D GRE T1-weighted sequence and heavily T2-weighted 3D sequences to identify pathology will become easy.
Discussion still remains whether unenhanced T1-weighted images are still required. Knowing the fact that –even in referral centres for inner ear pathology- dedicated inner ear MRI examinations for various indications are considered negative in 90 % of cases, one might consider using post contrast T1-weighted images only. In case of a possible enhancing lesion in the membranous labyrinth, an unenhanced T1-weighted sequence the day after still can be considered to evaluate signal intensity of the discovered lesion on unenhanced images.
Considerable debat still exists if an MRI examination for sensori-neural hearing loss can be performed using heavily T2-weighted sequences alone, omitting the post-gadolinium T1-weighted sequences. The reader has to be aware that -using these heavily T2-weighted sequences alone- various inflammatory and/or infectious pathologies can be missed such as for example labyrinthitis and otosclerosis. Very small intralabyrinthine schwannomas (ILs) can also be missed due to volume averaging, even on submillimetric high resolution heavily T2-weighted sequences.
Also central pathology in brainstem and auditory cortex will be overlooked.
Even in a follow-up of a know vestibulo-cochlear schwannoma, post-gadolinium T1-weighted images –preferably in a 3D sequence- are mandatory in order to calculate a volume of the lesion.
3.Pathology of the Auditory Pathway.
An overview of the entire scala of pathology of the auditory pathway is virtually impossible.
Usually pathology of the auditory pathway presents itself with the clinical symptom of sensori-neural hearing loss.
In children, congenital pathology should be excluded.
Aplasia or hypoplasia of the VCN can be subdivided in a type 1 and 2. For the evaluation of aplasia or hypoplasia of the VCN, axial and parasagittal reformations of a heavily 3D T2-weighted sequence are obligatory.
When evaluating the VCN, each of the branches should be looked after in both reconstruction planes.
In Type 1, the VCN is absent. A narrow IAC is found without any nerve in it or with just one nerve –the facial nerve- in it. However, the facial nerve can as well run in a separate canal. In all cases in the CPA, only one nerve –the facial nerve- can be found. A normal labyrinth is seen .
In type 2, a common VCN is present. Type 2 can be subdivided in a 2A and 2B type.
In Type 2A, a common or undivided VCN is found with an aplastic or hypoplastic cochlear branch. There is an associated labyrinthine malformation.
In Type 2B, a common VCN is found with an aplastic or hypoplastic cochlear branch but with a normal labyrinth. This subtype is by far the most common one. The identification of all 4 branches in the IAC should be done on every MRI of the inner ear and IAC as well as in the axial as in the parasagittal plane. By doing so, this congenital anomaly will easily be detected. It should be differentiated from the acquired form of hypoplasia of the VCN in which thinning of the nerve is caused by "disuse" of the nerve, for example as in the calcifying stage of labyrinthitis. Clinically,

these patients have had a history of normal hearing in the past contrary to the congenital type 2B form in which deafness has been present since birth.
There is another congenital anomaly that requires special attention, as imaging plays a key role in this entity: X-linked deafness. On imaging, an unusually wide neural aperture in the fundus of the IAC can be found with a broad communication between the cochlea and the IAC. This implies increased pressure within the perilymphatic space and predisposes to abnormal flow of perilymph (gusher) upon stapes manipulation. As these male patients present with mixed hearing loss masquerading as otosclerosis clinically, these findings are extremely important to the surgeon in order to avoid a gusher at surgery.
In adults, the most important and most frequent cause of sensori-neural hearing loss is tumoral pathology of the inner ear, internal auditory canal and cerebello-pontine angle.
Schwannoma of the VCN is by far the most common tumor in the CPA. They account 6 to 10% of all intracranial tumors and 60 to 90% of all CPA tumors. VCN schwannomas most commonly present as a combined IAC/CPA mass lesion. However, there are lesions which are entirely situated intracanalicular and lesions which are mainly arising extracanalicular, mimicking the aspect of meningiomas, exophytic brain stem gliomas or plexus papillomas.
There is still discussion regarding the exact site of origin of VCN schwannomas.
It has been postulated that they originate at the transition zone between peripheral and central myelin, situated in close proximity to the meatus of the IAC. It has also been suggested that these tumors originate from Scarpa's ganglion, situated on the vestibular nerves near the fundus of the IAC. This is confirmed by the fact that no vestibulocochlear schwannoma ever has been diagnosed near the brainstem or in the medial part of the cisternal segment of the nerve. Bilateral VCN schwannomas are regarded as the handmark of neurofibromatosis type 2.
Clinically, VCN schwannomas present most often with unilateral progressive sensorineural hearing loss. However, sudden deafness can also be the presentation of an VCN schwannoma in about ¼ th of all cases. Tinnitus and vertigo have also been reported as presenting symptom but are less frequent. Usually, tinnitus and vertigo are accompanying symptoms. Facial nerve palsy is highly unusual as the facial nerve is resistant to chronic pressure.
Despite the fact that hearing loss is the most important clinical finding, VCN schwannomas most frequently arise from the vestibular portion rather than from the cochlear portion of the nerve. There is an equal distribution between the superior and inferior branch.
On imaging, VCN schwannoma present as a mass lesion usually with an IAC and CPA component. On T1-weighted imaging, they have an isointensity to brain tissue with strong enhancement after gadolinium administration. On T2-weighted imaging, moderate hyperintensity is found.
However VCN schwannomas can also be entirely located in the IAC. When becoming large, internal areas of bleeding can be found, presenting as hyperintense zones on T1-weighted imaging. In larger lesions, cystic or necrotic parts can be found, presenting as clear hyperintensities on T2-weighted images.
Compared to CPA meningeomas, vestibulocochlear schwannomas are always centered over the IAC with extension in the IAC. They are usually round or round shaped with sharp angles with the posterior wall of the temporal bone .
In case of a large intracanalicular component, the presence of residual fluid in the fundus of the IAC as well as the signal intensity of the fluid in the membranous labyrinth should be evaluated. It is known that signal intensity in the membranous labyrinth may drop due to increased protein concentration in the perilymph. There is a clear positive correlation between the presence of residual fluid in the fundus of the internal auditory canal and a normal signal in the membranous labyrinth with hearing preservation surgery.
Intralabyrinthine schwannomas (ILSs) are extremely rare. They can account for up to 10% of all VCN schwannomas in referral centres for temporal bone imaging.
ILSs are benign tumors originating from the perineural Schwann cell sheath of the intralabyrinthine branches of the VCN. Intracochlear schwannomas develop on the intracochlear branches of the cochlear branch of the VCN.
Intravestibular schwannomas develop on the end branches of the vestibular nerve of the VCN.

Intracochlear ILSs are far more frequent than intravestibular ILSs accounting for about 80% of all ILS's. They are most often situated in the basal and second turn of the cochlea . The scala tympani is more frequently or more extensively involved than the scala vestibuli.
The main presenting symptoms are sensorineural hearing loss, mostly progressive. Tinnitus, mostly non-pulsatile, and vertigo are found as accompanying symptoms.
ILs are slightly hyperintense on unenhanced T1-weighted images, enhance strongly after gadolinium administration, are sharply circumscribed and hypointense on thin heavily T2-weighted 3D sequences. Those two imaging characteristics are the main features for differential diagnosis with acute labyrinthitis.
Follow-up imaging is mandatory in ILSs as about 50% of ILSs have a tendency to grow. Most of the intracochlear ILSs start in the scala tympani and only after growth involve the scala vestibuli. Gradually cochlear ILSs fill up the basal turn, mid turn to end with the apical turn. Once the cochlea is filled up, they start growing into the vestibule.
The rare growing vestibular ILSs have a tendency to involve the cochlea from the anterior part of the vestibule rather than invade the posterior part of the vestibule and the semicircular canals.
Pathology situated in the brain stem or temporal lobe can also be the cause of SNHL.
A large scale of pathologies can be found but in the brainstem most frequently ischemic lesions, demyelinating or tumoral lesions can be found.
In the temporal lobe most frequently tumoral pathology or vascular ischemic lesions are found.

References:
1/Chapter 18. Auditory System. In "The Human Central Nervous System" Nieuwenhuys, Voogd, Van Huijzen 4h edition Springer Berlin Heidelberg 2008
2/Chapter 8. The vestibulocochlear nerve, with an emphasis on the normal and diseased internal auditory canal and cerebello-pontine angle Christine M. Glastonbury Imaging of the temporal bone. Joel D. Swartz, Laurie A Loevner. 3rd edition. Thieme Medical Publishers 2009
3/ Swart JD Pathology of the vestibulocochlear nerve. Neuroimaging Clin N Am.2008;18:321-46
4/ Chapter 22. Anatomy and diseases of the temporal bone. JW Casselman, Alexander S. Mark, John A. Butman Magnetic Resonance Imaging of the Brain and Spine. Scott W. Atlas Fourth Edition, Lippincott Williams and Wilkins.

Survey of vestibular schwannoma. Where are we now?

Marc Lemmerling

The diagnosis of vestibular schwannoma (VS) has dramatically changed since the introduction of MRI. Where the combined use of T2WI and postGd T1WI still stands for the gold standard, more and more reports focus on the more cost-effective exclusive use of T2WI with thin slices.
More than 50% of all VS never grow after the diagnosis. In most cases, especially in small tumors and in the elderly, a 'wait and see' policy is established, using consecutive MRI scans. In case of growth tumor volume increases with 1-4 mm/year. Sometimes volume regression can be seen (5%), and occasionally exceptional growth is noted. Other management options are radiosurgery/radiotherapy and surgical removal.
After radiosurgery transient volume progression can be present. The follow-up MRI images after 2 and 5 years enable differentiation of transient progression from ongoing progression.
After surgical removal MRI scans give a more objective estimation of the resection degree than does an intaoperative assessment. If on the MRI scan one year after surgery enhancement or subtotal resection is seen serial imaging is needed. If total removal is noted recurrence is very rare.
Intralabyrinthine schwannomas can account for up to 10% of all vestibulocochlear schwannomas. They are mostly found in the cochlea, most often originate in the scala tympani, and only later grow into the scala vestibuli. They can grow from the cochlea into the vestibule, and vice versa.

Imaging of the facial nerve

Jan Casselman

Today high resolution CT imaging is still the imaging technique of choice to look for fractures running through the facial nerve canal or to look for a congenital abnormal course of the facial nerve at the level of the middle ear. Facial nerve canal involvement in case of cholesteatoma or

invasion by another head and neck tumor can also be evaluated by CT. Prior to surgery, exact localisation of the course of the facial nerve canal is also best seen on CT images.
However, in case of Bell's palsy, the diagnosis is best confirmed and other pathology is best excluded on gadolinium-enhanced T1-weighted MR images through the internal auditory canal (IAC). Submillimetric heavily T2-weighted images are needed to further distinguish whether the enhancement on the T1 images is caused by neuritis (fusiform enlargement) or by a schwannoma (nodular). Magnetic Resonance also replaced CT for several other indications: detection of central causes of facial palsy, congenital abnormal course of the facial nerve in the cerebellopontine angle or IAC, perineural tumour spread (parotid tumors or head and neck squamous cell carcinoma) along the facial nerve, lesions affecting the side branches (greater superficial petrosal nerve, chorda tympani…) of the facial nerve etc. Even in case of trauma, the oedema of the labyrinthine segment of the facial nerve which can cause severe ischemia of the nerve, can only be depicted on MR. Finally, hemifacial spasm is also best studied on MR.
The most frequent lesions of the facial nerve will be illustrated and discussed in this lecture and the value of CT and/or MR in the detection of these lesions will be addressed.

Vascular tinnitus. 3T. is it really a progress?
Christian Czerny

Tinnitus may have a wide range of pathologic entities and reasons. One reason for tinnitus is the so called vascular tinnitus.
Vascular tinnitus is best imaged by CT delineating the bony structures and MRI due to its superb soft tissue contrast visualizing soft tissue structures.
Vascular tinnitus maybe caused congenital reasons such as for – instance – a bony dehiscency and elongation of the internal carotid artery (aberrant carotid artery) into the middle ear or a persisting stabidial artery. Other congenital reasons maybe a styloid carotid compression syndrome also called "eagle syndrome" which is best visualized with CT. The elongated styloid process and its ossification is best seen on images obtained in the bone window level setting with 3D-reconstructions.
Additionally, tumour entities are may be the reason for vascular tinnitus. In most cases glomus jugulare tumours or glomus tympanicum tumours sometimes glomus jugulo-tympanicum tumours maybe the reason for vascular tinnitus. As all vascular tumours of the head and neck region they present on MR with so called salt and pepper sign. This is very characteristic for this kind of tumours. If these tumours yield to a bony destruction of the jugular foramen and its neighbour-ship, then CT is very useful to delineate the bony changes.
Additionally with high resolution MRI on high field units – especially on 3T MRI – MR-angiography can be performed excellently delineating feeding vessels of this kind of tumours as well as other – sometimes congenital – vascular structures being the reason for vascular tinnitus. In this lecture the different reasons and imaging procedures – especially those of 3T MRI – will be presented and discussed. Furthermore differential diagnosis will also be mentioned.

DWI in cholesteatoma. All you need to know.
Bert De Foer

Acquired middle ear cholesteatoma is a "cystic" lesion lined with keratin-producing squamous epithelium, filled with desquamation debris and is usually located in the middle ear. In most cases, it results from ingrowth of keratinizing stratified squamous epithelium from and through the tympanic membrane into the middle ear cavity. It can simply be considered as the presence of "skin in the wrong place".
The epitheliazed pocket will grow slowly in a dry ear, but exfoliation is hastened in the presence of infection. An acquired cholesteatoma is almost always associated to an inflammatory middle ear. The lesion has –by slowly growing- a mass effect eroding ossicles and the bony walls of tympanic cavity and mastoid (1).

Moreover, there are two other entities with included "skin" or ectodermal elements in the head. At the time of closure of the neural groove, aberrant epithelial remants can get included in the head. When included in an intradural location -usually in the cerebellopontine angle and in the middle cranial fossa- they are called epidermoid cysts or epidermoid tumors. When included extradural, in the temporal bone, they are usually called congenital cholesteatomas. Epidermoids, congenital and acquired cholesteatomas are histologically exactly the same (3,4). The content of these lesions is made of keratine. Hence they present on MRI –apart from the location- exactly the same.

The evaluation of an acquired middle ear cholesteatoma has upon till now mainly relied on high resolution CT. CT has been the imaging tool for the evaluation of middle ear and mastoid aeration and/or opacification (1). It is able to demonstrate ossicular erosion and lateral semicircular canal erosion. The integrity of the tegmen tympani can be evaluated and eventual anatomical variants can be noted. In a pre-operative setting CT scan is a valuable and indispensable tool for the surgeon.

However MR is gaining increasing importance in differentiating an opacified middle ear as MR is able to differentiate cholesteatoma from associated inflammation and infection and from cholesterol granuloma (2).

On standard T1-weighted MR sequences, cholesteatomas –congenital or acquired- as well as epidermoids have an iso-intense appearance to gray matter of brain. As cholesteatoma is by definition a non-vascularized lesion, it does not enhance after intravenous gadolinium administration. Sometimes the enhancement of the surrounding epithelium –the so-called matrix- can be seen as a small enhancing line. However, in case of associated infection/inflammation, the discrimination of the surrounding epithelium or matrix can be difficult.

On T2-weighted sequences, it has a clear intermediate signal intensity almost equal to the intensity of gray matter of brain but definitely lower than the intensity of inflammatory changes or fluid.

On diffusion-weighted MR images, cholesteatoma has an obvious hyperintensity on B 1000 images. In literature, this is explained by a combination of diffusion restriction and T2 shine through effect. However, in our experience, cholesteatoma seems to have a restriction in diffusion when compared to middle ear inflammation, scar tissue or cholesterol granuloma.

A recent report from the group of F. Veillon uses ADC maps to differentiate middle ear cholesteatoma from abscess and surrounding inflammation (5).

Early reports already mentioned the possibility of MRI to differentiate cholesteatomatous tissue from granulation tissue due to the fact that cholesteatomatous tissue –contrary to granulation tissue- is avascular tissue and does not enhances after iv administration of Gadolinium (6).

In spite of this differentiation possibility, early reports failed to demonstrate the possibility of MRI to replace second look surgery for residual cholesteatoma (7).

One of the major challenges for radiologists still remains the evaluation and characterization of a completely or partially opacified post-operative middle ear cavity. In surgery, mostly the technique of the canal-wall up mastoidectomy is used creating a postoperative cavity leaving the bony wall of the external auditory canal intact. This however carries the risk of leaving cholesteatoma behind.

In the past few years, two major techniques have been used in the MR evaluation of middle ear cholesteatoma and post-operative cholesteatoma more specifically.

Marc Williams described the use of late post-gadolinium T1-weighted MR images based upon the fact that granulation tissue and/or scar tissue in postoperative cavities rather slowly enhance (8,9). On early post-gadolinium T1-weighted MR images differentiation -due to this slow enhancement- between cholesteatoma and granulation and/or scar tissue is impossible. Williams states that –using this technique- it is possible to visualize 2.5 mm small postoperative residual cholesteatomas. In his reports, Williams clearly tries to demonstrate the -usually very small and difficult to demonstrate- postoperative residual cholesteatomas (8,9).

Cholesteatoma should be looked after on these late post-gadolinium T1-weighted MR images as a hypointense non-enhancing lesion in surrounding inflammation or scar tissue.

Fitzek was one of the first to use echo-planar diffusion-weighted (EPI DWI) MR images to demonstrate acquired middle ear cholesteatoma and to differentiate it from middle ear inflammation. In his study Fitzek examined acquired middle ear cholesteatomas in non-operated middle ears (10). Cholesteatoma appear on these EPI DWI MR images as hyperintense usually nodular lesions. Drawbacks of EPI DWI sequences are the often distorted aspect of the lesion, the low resolution of the sequence and the relative thick slices. Major drawback is the curvilinear

artifact at the air-bone interfaces of the temporal bone and the temporal lobe (11). This technique was used in several papers to demonstrate late post-operative recurrent or relapsing cholesteatoma (12,13,14). In these papers, the authors included post-operative ears, usually a few years after prior surgery. These relapsing or recurrent cholesteatomas develop by definition from the tympanic membrane or graft and are usually larger. This is in contrast with the so-called residual cholesteatoma, that is a cholesteatoma pearl left behind at first stage surgery. These residual cholesteatomas are much smaller and more difficult to detect. This is also the reason why about one year after first stage surgery, a second look intervention is usually performed.
Most papers set the limit of visualization on EPI DWI of relapsing or recurrent cholesteatoma at 5 mm (15).
EPI DWI is clearly less usefull in case of pre-second look evaluation of an operated middle ear, looking for the smaller residual cholesteatoma. As already mentioned these residual cholesteatomas are -contrary to the relapsing or recurrent cholesteatomas- much smaller and much more difficult to demonstrate (15). Taking into consideration that EPI DWI can miss smaller cholesteatomas (false negatives), it is important to know that EPI DWI has no false positives: if one sees a clear hyperintensity on EPI DWI, diagnosis of a cholesteatoma is clear. One should take care not to misinterpret hyperintense artefacts as a cholesteatoma on EPI DWI (15).
Recent reports have stressed the importance and usefulness of non-echo planar based DWI sequences (11,16). These sequences have the possibility of using thinner slices and a higher imaging matrix. Major advantage of these sequences is the complete lack of artifacts at the interface temporal lobe and temporal bone (11).
The size limit for visualization of a cholesteatoma on non-EPI DWI is set at 2 mm in a recent paper (17). Two very recent reports have demonstrated that non-EPI DWI is indeed able to replace second look surgery (18,19). It is even suggested that non-EPI DWI alone can be used to screen for middle ear cholesteatoma (19).
In Sint-Augustinus hospital, patients are selected for second look surgery based upon MRI and the non-EPI DWI sequence more specifically. By doing so, the number of second look interventions has dropped from over 65% to less than10 %.
In a recent retrospective study, we compared three different MRI protocol for the evaluation of cholesteatoma patients as well in first stage surgery patients as well in a pre second look situation (20). Late post-Gd T1-weighted sequences were compared to non-EPI DWI and the combination of late post-Gd T1-weighted sequences and non-EPI DWI sequences. Our results demonstrate that there is no statistically significant difference between the protocol using non-EPI DWI sequences alone and the combination of non-EPI DWI and late post-Gd T1-weighted sequences. This confirms the findings of a prior study (19) that screening for middle ear cholesteatoma can be performed using non-EPI DWI sequences alone. Our results also demonstrate that there is a statistically significant lower sensitivity and specificity for the protocol using late post-Gd T1-weighted sequences alone (20). This is probably explained by the mixture of patients prior to first stage surgery and patients prior to second look surgery. This results in a complex mixture of signal intensities on late post-Gd T1-weighted images making the diagnosis of a cholesteatoma on these sequences alone very difficult.
Based upon these results, our MR imaging protocol for cholesteatoma has been changed. Contrast administration is no longer required and delayed post-Gd T1-weighted sequences are no longer performed. Apart from the non-EPI DWI sequence, two TSE T2-weighted sequences are performed in order to localize eventual detected lesions on the non-EPI DWI sequence.
The reduction of the number of second look interventions together with the fact that contrast administration is no longer needed, will result in an important cost saving for the health care system.
Moreover, these results might completely change the imaging strategy in cholesteatoma patients. One might consider to start imaging evaluation of a patient suspected of having a middle ear cholesteatoma using non-EPI DWI rather than using CT. CT can then be reserved for patients in an immediate pre-operative setting to evaluate pre-operative anatomy such as the aspect of the ossicular chain and several anatomical variants.

REFERENCES
1) Lemmerling M, De Foer B. Imaging of cholesteatomatous and non-cholesteatomatous middle ear disease. In: M. Lemmerling, SS. Kollias. Radiology of the Petrous Bone, 1st edn. Springer Verlag Berlin Heidelberg New York, 2004: 31-47
2) Lemmerling M, De Foer B, VandeVyver V, Vercruysse JP, Verstraete KL. Imaging of the opacified middle ear. Eur J Radiol 2008. 66:363-371
3) Robert Y, Carcasset S, Rocourt N, Hennequin C, Dubrulle F, Lemaitre L. Congenital cholesteatoma of the temporal bone: MR findings and comparison with CT. Am J Neuroradiol 1995. 16: 755-761
4) Ikushima I, Korogi Y, Hirai T, Sugahara T, Shigematsu Y, Komohare Y, Okuda T, Takahashi M, Ushio Y MR of epidermoids with a variety of pulse sequences. Am J Neuroradiol 1997. 18: 1359-1363
5) Thiriat S, Rhiem S, Kremer S, Martin E, Veillon F. Apparent diffusion coefficient values of middle ear cholesteatoma differ from abscess and cholesteatoma admixed infection. Am J Neuroradiol 2009. 30:1123-1126. Epub 2009 Feb 26.
6) Martin N, Sterkers O, Nahum M. Chronic inflammatory disease of the middle ear cavities: Gd-DTPA-enhanced MR imaging. Radiology 1990. 176: 399-405
7) Vanden Abeele D, Coen E, Parizel PM, Van de Heyning P. Can MRI replace a second look operation in cholesteatoma surgery ? Acta Otolaryngol 1999. 119: 555-561
8) Williams MT, Ayache D, Alberti C et al.: Detection of postoperative residual cholesteatoma with delayed contrast-enhanced MR imaging initial findings. Eur Radiol 2003. 13: 169-74
9) Ayache D, Williams MT, Lejeune D et al.: Usefulness of delayed postcontrast magnetic resonance imaging in the detection of residual cholesteatoma after canal wall-up tympanoplasty. Laryngoscope 2005.115: 607-610
10) Fitzek C, Mewes T, Fitzek S et al.: Diffusion-weighted MRI of cholesteatomas of the petrous bone. J Magn *Reson Imaging 2002. 15: 636-641*
11) De Foer B, Vercruysse JP , Pilet B et al.: Technical Report: Single-shot Turbo Spin Echo Diffusion-weighted MR Imaging versus Spin Echo Echo Planar Diffusion-weighted MR Imaging in the Detection of Acquired Middle Ear Cholesteatoma. AJNR Am J Neuroradiol 2006. 27: 1480 – 1482
12) Aikele P, Kittner T, Offergeld C et al. Diffusion-weighted MR imaging of cholesteatoma in pediatric and adult patients who have undergone middle ear surgery. Am J Roentgenol 2003. 181: 261- 265
13) Maheshwari S, Mukherji SK. Diffusion-weighted imaging for differentiating recurrent cholesteatoma from granulation tissue after mastoidectomy: case report. Am J Neuroradiol 2002. 23: 847-849
14) Stassola A, Magliulo G, Parrotto D, Luppi G, Marini M. Detection of postoperative relapsing/residual cholesteatoma with diffusion-weighted echo-planar magnetic resonance imaging. Otol Neurotol 2004. 25: 879-884
15) Vercruysse JP, De Foer B, Pouillon M et al.: The value of diffusion-weighted MR imaging in the diagnosis of primary acquired and residual cholesteatoma: a surgical verified study of 100 patients. Eur Radiol 2006. 16: 1461-1467
16) Dubrulle F, Souillard R, Chechin D, Vaneeclo F, Desaulty A, Vincent C, Diffusion-weighted MR imaging sequence in the detection of postoperative recurrent cholesteatoma. Radiology 2006. 238: 604-610
17) De Foer B, Vercruysse JP, Bernaerts A, Maes J, Deckers F, Michiels J, Somers T, Pouillon M, Offeciers E, Casselman JW. The value of single-shot turbo spin-echo diffusion-weighted MR imaging in the detection of middle ear cholesteatoma. Neuroradiology 2007. 49:841-848
18) De Foer B, Vercruysse JP, Bernaerts A, Deckers F, Pouillon M, Somers T, Casselman J, Offeciers E. Detection of postoperative residual cholesteatoma with non-echo-planar diffusion-weighted magnetic resonance imaging. Otol Neurotol 2008. 28:513-517.
19) Dhepnorrarrat RC, Wood B, Rajan GP. Postoperative non-echo-planar diffusion-weighted magnetic resonance imaging changes after cholesteatoma surgery: implications for cholesteatoma screening. Otol Neurotol 2009. 30:54-58.
20) De Foer B, Vercruysse JP, Bernaerts A, Meerschaert J, Kenis C, Pouillon M, De Beuckeleer L, Michiels J, Bogaerts K, Deckers F, Somers Th, Hermans R, Offeciers E, Casselman JW. Value of non echo-planar diffusion-weighted MR imaging versus delayed post gadolinium T1-weighted MR imaging for the detection of middle ear cholesteatoma. Radiology, accepted.

Essential information for decision making

Tore Arne Larheim

TMD (temporomandibular disorder) is an umbrella diagnosis that includes a number of conditions characterized by facial pain and mandibular dysfunction. It is crucial to decide whether the patient has a TMJ, i.e., a joint disorder, or not. Masticatory muscle disorder is the most commonly reported type of TMD, and radiological examination does not play a role in the patient management. When it is clinically suspected that the patient primarily has a joint problem, it is important to perform diagnostic imaging because multiple studies have shown that clinical diagnosis of different joint conditions is not reliable, with MR used as the "gold standard". Soft tissue and bone abnormalities will be shortly reviewed and discussed (findings in asymptomatic healthy individuals, differentialdiagnostics), and the value of follow-up examinations emphasized.

New concept! The importance of lateral vectors in TMJ movement
Christiane Bodin

Commonly the clinical and MR evaluations of the TMJ disorders are based on the opening jaw movement, from the closed to the full-opened position. As some TMJ pain are worsened in protrusive and/or lateral movements, we purpose a complementary TMJ study with MRimages in the lateral TMJ movements. Specifically, when the jaw moves laterally, the contralateral TMJ shows a combined shift (anterior; medial; down lawn) whereas the ipsilateral TMJ shows a lateral shift and rotation. Consequently the articular-disks endure asymmetric pressures responsible of twisting and placements strongly different compared to the disk morphology and positions of the opening TMJ movement.

MR findings. How to do and report MR of the TMJ
Massimo Pregarz

Background
Modalities, protocols and report used for the patients with Temporo Mandibular Disorders (TMDs) are presented. Magnetic Resonance (MR) is an appropriate imaging modality for Temporo Mandibular Joint (TMJ) analysis because of soft tissues high contrast resolution and multiplanar data acquisitions. Multi Detector Computed Tomography (MDCT) or Cone Beam Computed Tomography (CBCT) are complementary when osseous analysis is required.
Materials and Methods
Since the image acquisition do not respond to the physiological posture, because of patient supine position durig data acquisition, all TMDs patients before MR exam, have a gnatologic evaluation and report. Our images are achieved through two 1.5 MR systems (Magnetom Avanto, Erlangen, Germany and Signa Hdi, General Electric, Milwaukee, Winsconsin, USA). Images are obtained with TMJ protocols using head or surface coils. T1 and T2 images are obtained in closed and open mouth, without forcing the opening, sometimes with more cooperative patients, we complete the exam with a cine sequence. Individual patient device is prepared before data acquisition in the lateral jaw position.
Results
TMJ are evaluated in all three planes for better assessment of the morphological, for the intercondilar angle measurement and for the disc position and its changes with mouth closed and open. Outline base are necessary in film reading.
Conclusions
TMDs exams require accuracy in preparation and execution; high relevance has the inter-professional communication. Report must be thorough informative and easy understanding too.

TMJ & Facial pain. Update on treatment of TMJ disorders
Tore Arne Larheim

A number of treatment approaches are available for patients with TMD (temporomandibular disorder); pharmacological intervention (such as anti-inflammatory drugs, muscle relaxants), physical medicine (low-level laser therapy, electrical stimulation), oral appliances (different types), and biobehavioral therapy (counseling, stress management, biofeedback). In addition, if a joint disorder is diagnosed, specific treatment of the TMJ itself can be performed. The following TMJ treatment options, some of which will be discussed, is available: Local non-surgical treatment (physical therapy, acupuncture, application of ointments), intraarticular injection, and surgical management; arthrocentesis, arthroscopy, discoplasty, discectomy, and synovectomy (patients with rheumatoid arthritis and related diseases).

The pre-auricular mass in a child

Nicole JM Freling

A preauricular swelling in a child may be caused by a large variety of different pathologies from acute infection to a highly malignant tumour.
Imaging plays a crucial role to confirm or refute the first clinical impression. Imaging helps the surgeon in deciding where to take a biopsy. And imaging has great impact in planning treatment be this surgical, medical or follow-up only.
Ultrasound is the first imaging modality applied in children, but exact delineation of lesions to the deep spaces of the face often demands other cross-sectional techniques. And although contrast-enhanced MRI is preferred to CT because of the absence of ionizing radiation, these techniques are in some cases complementary. In young children – up to about 7 years - general anaesthesia is necessary to obtain good quality MRI and/or CT examinations.
Differential diagnosis of pediatric head and neck masses may be categorized as follows: congenital – inflammatory – neoplastic.
A congenital lesion often presents at or shortly after birth but can become manifest at an older age as well.
In the preauricular area one may think of a first or second branchial cleft cyst or a vascular malformation (venous, lymphatic or mixed).
In an acute situation, a preauricular swelling may represent acute parotitis or lymphadenitis.
Non-acute inflammatory disease may be infectious (catscratch disease), granulomatous (sarcoidosis, tuberculosis) or auto-immune disease (Sjoegren's disease, HIV).
Neoplastic diseases may be benign or malignant and may derive from soft tissues, lymphoid tissues, skin or bone.
Benign neoplasms often are slowly progressive, non-tender masses. Malignant tumours are recognized by rapid, relentless progression often accompanied by tenderness and cranial nerve deficit. A sudden acute change may be due to bleeding within the tumour.
Imaging is often not required in acute inflammatory disease unless a deep neck abscess is suspected. But it may play a role in the evaluation of chronic disease and during follow-up.
Imaging is mandatory for evaluation of a neoplasm to define the origin, the extension and – sometimes - the nature of the lesion and to differentiate solitary disease from bilateral and/or multiple lesions.
In malignant tumours imaging is needed for primary staging to delineate the exact extension in relation to the deep spaces of the face, the skull base and the intracranial compartment and to assess the absence or presence of perineural enhancement, which may indicate tumour extension beyond primary surgical treatment. And of course imaging should address the question of cervical lymph node involvement at the ipsi- and/or contralateral side.
The age of the child must always be taken into consideration as some tumours are more likely in infants and others more likely to occur in older children.
For example: haemangioma is a benign tumour which may be present shortly after birth, and show rapid increase in size. A rapidly growing mass in a 4 years old child may represent a benign or malignant parotid tumour, but statistically about 50% of H&N soft tissue tumours in children is a rhabdomyosarcoma. In a 12 years old child a rapidly growing lesion is more likely to be an osteosarcoma but can be a soft tissue sarcoma as well.
Multiple skull lesions in a 2 years old child may represent Langerhans' cell histiocytosis, but radiologically this cannot be differentiated from malignant lymphoma.
A biopsy therefore must be performed in all patients with a mass lesion to obtain a final histologic diagnosis before planning treatment whenever this can be done without damaging vital structures.
The radiologist plays an important role in the multidisciplinary team involved in diagnosis and treatment of children with tumours of the head and neck and should be familiar with the most commonly encountered pathologies.

Hemangioma & vascular malformations in a child

Martin G. Mack

Background
The goal of this lecture is to summarise the main types of soft tissue hemangiomas, to explain the signal characteristics of hemangiomas on US, CT and MR, and to propose a strategy for the diagnosis and follow up.
Materials and Methods
The cause of soft tissue hemangiomas is currently unknown. Two different types of hemangiomas can be differentiated. Capillary hemangioma are benign and composed of capillaries, and appear early in life. They enlarge during the first year of life, but stop enlarging by the end of the first year and start involuting. Each year they involute more and more such that by the age of 9 years 90% of them have disappeared. Cavernous hemangioma appears in infancy and they persist. They are due deeper, more blood filled blood vessels and hence have a nodular purplish appearance but are completely benign. Biopsy is difficult, as blood is involved. According to the ISSVA classification. cavernous hemangiomas are actually considered to be (s)low-flow venous malformations.
Results
Radiographically ossfications of soft tissue is a characteristic finding. It is recommended to check for phleboliths (smooth, round radiodense areas) and/or periosteal thickening of nearby bone; phleboliths may also be seen in vascular malformation. Venography is the best test for showing caverous spaces of hemangioma. Bone scan show little or no increase in radioisotope uptake MRI is superior to CT for imaging lesion from surrounding normal tissue. The presence of fat and serpentine blood vessels provides distinctive appearance. Hemangiomas show markedly increased signal on T1 and T2 weighted images. Hemorrhage and thrombosis can also cause increase in signal on T1-images; Clinical studies have shown that ultrasound is an excellent tool for helping to make the diagnosis, although MRI is preferred for surgical planning. The role of CT is limited.
Conclusions
The knowledge of the clinical and imaging appearance of hemangioma and vascular malformation is essential for imaging and staging.

Infrahyoid neck mass in pediatrics

Manigandan Subramanyam Thyagjarajan

The majorities of infrahyoid cystic neck masses in children are congenital malformations and include thyroglossal duct cysts, branchial apparatus cysts, dermoid cysts, epidermoid cysts, teratoid cysts and lymphatic malformations. Other cystic lesions include abscess, duplication cysts, laryngoceles,
The benign and malignant extra thyroid infrahyoid solid neck masses in children are fibromatosis colli, inflammatory adenopathy, hemangioma, neurofibromatosis, teratoma, lymphoma, rhabdomyosarcoma, neuroblastoma, and metastasis adenopathy.
We discuss the relationship/origin/ involvement of the above lesions with respect to the various spaces of the infrahyoid neck and the role of imaging modalities such as ultrasound, CT, MRI including functional imaging in anatomical localization and characterization.

Pediatric cochlear implantation: what we should know about the brain.

Lorenzo Pinelli

Cochlear implants are semi-implantable electronic devices that provide hearing sensation to individuals with profound sensorineural hearing loss (SNHL) "by-passing" the impairment of sensory cells in the organ of Corti. Initially indicated only for adults with post-lingual deafness, over recent years cochlear implants have demonstrated to be effective in pediatric age as well: actually they are now widely used in deaf children. To be feasible and possibly effective, cochlear implant needs a cochlea, allowing the insertion of the electrodes, and a cochlear nerve, to transmit the impulse from the electrodes to the cochlear nuclei in the brainstem. Therefore, screening of the

candidates with MR and CT is especially focused on the inner ear and the cochlear nerve, and less attention has usually been paid to brain imaging, especially in adult patients . Nevertheless, based on the small experience of our cochlear implantation group in Brescia (Italy), we think there are several good reasons to extensively and accurately study the brain by MRI in deaf children, mainly because of the different etiology of deafness in pediatric versus adult age.

In some pediatric patients, brain findings are directly related to the congenital or acquired deafness, giving clues to a previosuly unsuspected etiological diagnosis: this typically happens in congenital infections (where temporal bone or cochlear nerve imaging is usually unremarkable), especially for Cytomegalovirus (CMV) encephalopathy. Often not diagnosed at birth because asymptomatic, congenital CMV encephalopathy causes multifocal white matter abnormalities, with a characteristic temporal tip involvement by cystic lesions (from the neuroradiological point of view, anterior temporal lobes "cystic" lesions in the pediatric age can raise the question of a differential diagnosis among completely different pathological entities). Notably, hearing impairment due to congenital CMV infection can be very mild and therefore not detected at birth, and become clinically apparent during early childhood, mimicking an acquired deafness; therefore, the history of "appearance" or worsening of profound SNHL in a pediatric candidate to cochlear implantation is far from excluding the hypothesis of congenital CMV encephalopathy. Less specific pattern of white matter abnormalities can be caused by other infectious agents, mainly from the TORCH group, like rubella.

In some patients with a clinical history of prematurity, faint white matter abnormalities can be seen around the ventricles (especially around the trigones), possibly due to a very mild form of hipoxic-ischemic encephalopathy, not always clinically evident. Some other cases of "leukoencephalopathy" are actually aspecific white matter abnormalities, possibly related to paraphysiologic delayed myelination, with no clear clinical correlation and no impact on the cochlear implant outcome.

Overall, white matter abnormalities are emerging as a quite common brain finding in pediatric cochlear implant candidates: they are invariably hyperintense in T2WI, without restriction on diffusion-weighted imaging, often multifocal or confluent, without mass effect nor enhancement after i.v. contrast medium injection: corpus callosum, brainstem and cerebellar white matter are typically spared, as is (somehow surprisingly) the central acustic pathway. When they are diffuse and there is not a proved diagnosis of congenital infectious encephalopathy, white matter abnormalities can raise the doubt of a progressive degenerative or a rare metabolic disorder, which is usually not the case. Therefore, white matter abnormalities should not be considered "per sè" a contraindications to cochlear implantation in deaf children, especially if the patient is neurologically normal or is affected by a static encephalopathy.

Deafness is a frequent sequela of kernicterus, and brain MRI can disclose the typical selective signal abnormality in the globus pallidus also when a clear history of kernicterus is lacking. Actually, even nowadays, the neonatal clinical diagnosis of kernicterus is probably underreported, especially in pre-term very low birth weight infants, in which multiple factors determine selective neuronal damage without a clearly pathologic level of bilirubinemia.

Rarely, cerebral MRI disclose the presence of a brain malformation, especially in syndromic patients: even if brain findings are often not specific, sometimes they allow a precise diagnosis. This is the case of a very recently described new brainstem and cerebellar malformation, named "pontine tegmental cap dysplasia", with a typical "bulging" on the dorsal surface of the pons, probably related to a bundle of transversely oriented axons (maybe ectopic transverse pontine fibers) . These patients suffer from cerebellar ataxia and multiple cranial neuropathies: despite that, the constant involvement of the acoustic nerve can make them candidates for pediatric cochlear implant when the malformation has not yet been discovered (the disorder may be more common than generally realized and may have been misdiagnosed as pontocerebellar hypoplasia or Möbius syndrome). Regarding syndromic patients, a notable example of the importance of brain imaging is the CHARGE syndrome: apart of the typical head and neck malformations (a/hypoplasia of the semicircular canals, eye coloboma and choanal atresia), the recent discovery of arhinencephaly as a new finding almost invariably associated to the syndrome gives one more clue to the diagnosis of the syndrome.

Finally, incidental cerebral findings not related to deafness can be found, some of them with a "benign" nature and no direct impact on the management of the patient (for example, hamartomas or arachnoid cysts), other ones with more ominous clinical significance (for example, an

undiagnosed hydrocephalus in a post-meningitic deafness or an asymptomatic arteriovenous malformation) which can alter the management of the patient, post-posing or even precluding cochlear implantation.
It is likely that in many centres brain MRI is already performed during the neuroradiological screening of deaf children candidate to cochlear implantation, but the results of these studies are probably underreported: considering the clinical relevance of the brain MRI findings in the small population of our study, we encourage to extend the MR study to the whole brain in any pediatric candidate to cochlear

Fibroosseous lesions in the head-neck
Herwig Imhof

Fibroosseous lesions are challenging and a diverse group of pathologic conditions that are difficult to classify and treat. There are no universally accepted criteria to distinguish these lesions absolutely from one another either clinically, radiographically or histopathologically.
The common denominator to all fibroosseous lesions is the replacement of bone with benign fibrous tissue containing varying amounts of (calcified) material. There are two main groups: fibrous dysplasia, of which the polyostotic form is more often found in the head-neck region, and such lesions which originate from the periodontal ligament (e.g. cement forming fibromas) or bone-forming tumors like osteomas, osteoid osteomas and ostoblastomas or tumor-like lesions as giant-cell-tumors and aneurysmal bone cysts. For all those lesions – except the osteomas and polyostotic dysplasia – the head-neck region is not a common location. Typical localisation, tumor-margins, age of patient and tumor-matrix are of great help in the differential diagnosis. The activity of the tumor can be classified by means of nuclear-medicine.

Odontogenic tumors. Imaging strategies
Nadine Martin-Duverneuil

Odontogenic tumors represent a particularly large spectrum of entities comprising the lesions issued from the odontogenic apparatus, those of osseous and cementous origin and last the epithelial maxillary cysts. If some of these lesions display characteristic patterns (such as odontoma, benign cementoblastoma, palatine torus...), numerous can present only evocative findings, while others can display a large varied appearance – particularly related to their degree of mineralisation - . An other difficulty is moreover due to the possible and not rare intrication of the odontogenic tumors whose prognosis is related to the more agressive component. So, based on the knowledge of the histopathological classification of these tumors, the precise analysis of standard views, the CT and sometimes MRI data, will precise the radioluciencies patterns – erosive, blowing... – and their extension, the dental findings, the presence of radioopacities and included teeth and allow to establish a diagnostic semiological tree. The correlation with the histopathological findings is in all cases necessary to precise the diagnostic (including the cases with non specific pathological data requiring the knowledge of the radiological analysis) and also to orientate the survey in cases of agressive or intricate lesions.

Imaging of skull base meningiomas
Frederique Dubrulle – Romain Kohler

The aim of this presentation is to describe typical aspects of skull base meningiomas with their extensions, in particular to sinusonasal cavities, orbit and skull base foramina. The bony modifications related to the skull base are described.
We try also to expose, how MR imaging particularities can reflect some of their characteristics like vascularity, consistency, natural evolution and can reflect some histopathological findings which are important for the management of the tumor and the prognosis.

Bone infection & necrosis. Key imaging findings

Soraya Robinson

Bone infection can be caused by hematogenous spread or more commonly in the head and neck area directly from infected cavities. In otherwise healthy people, dental disease typically leads to longstanding, chronic ostitis surrounding the affected root apices, which is characterized by diffuse sclerotic thickening of the bony trabeculae. Poor oral hygiene, low immune response and high virulence of the infectious agent may also lead to osteomyelitis, where also the bone marrow is affected. The pattern is unspecific and heterogenous. Sclerotic areas and lytic lesions can be found. A sequester (a piece of dense and dead bone is surrounded by a hypodense layer of infected bone) can maintain the infection. Active inflammation typically enhances with contrast agent in MRI. If the cortical bone is penetrated in ostitis or osteomyelitis, a fistula track may extend into the soft tissue and open itself to the skin. Dental disease or foreign bodies, especially in diabetic patients can give rise to fungal paranasal infection. The soft tissue component affects the paranasal sinuses, the bony component is typically partly sclerotically thickened and partly destroyed.
Wegener's granulomatosis can also affect the upper respiratory tract, where soft tissue masses, sclerotic bony wall thickening, but also nasal ulcers are common.
Head and neck cancer patients after radiation therapy are at risk to develop radioosteonecrosis, where parts of the alveolar process are devitalised. This is more likely, when a lot of periodontal and periapical disease is present. The bone pattern is patchy and irregular.
Biphosphonate treatment of patients with multiple myeloma or bony metastases inhibits osteoclast-mediated bone resorption and can lead to bone necrosis of the jaws. The typical onset would be nonhealing tooth extraction sockets and painful bone exposure. In this clinical setting, osseous sclerosis also encroaching on the alveolar canal, thickened lamina dura or widened periodontal ligaments and osteolytic areas should remind one of this entity and make one advise against biobsies, because the healing will cause problems.
Avascular necrosis of the temporomandibular condyle has similar etiologies as in other joints and is characterized initially by diffuse bone marrow edema, where eventually the convexity of the condylar head collapses. Lack of bony erosions and severe synovial villi speak against rheumatoid arthritis. In osteoarthritis, one would expect more subchondral sclerosis and osteophytes.

Imaging post endonasal surgery

Roberto Maroldi

The endonasal surgical approaches are rapidly spreading into the ENT surgery both for inflammatory and neoplastic lesions. New techniques have been recently developed to treat lesions arising from or involving the frontal sinuses and the anterior skull base. The Head and Neck radiologist has to be aware and updated on the different approaches and should know the normal post-treatment anatomy and the expected changes. Of course, the knowledge of patient history and the type of treatment remain a critical issue.
The most important findings to be demonstrated after endonasal surgery for inflammatory lesions are related to the areas not (easily) explorable by endoscopy (frontal sinuses, extra-mucosal tissue and structures as the orbit, mucoceles). CT is usually sufficient. Bone changes (dehiscences, erosion, sclerosis) are accurately assessed.
Tumor recurrence beyond the mucosal lining can be suspected or completely undetected on endoscopy and clinical examination. Follow up of neoplastic patients require a combination of clinical examination, endoscopy and imaging. MR is in our experience the technique of choice. The use of DWI MR may improve the accuracy when rapidly spreading tumors are (melanoma, SCC, lymphoma) are examined.

Flaps in the neck!
Antonello Vidiri

Background
The flap is a tissue transferred to close a defect that result from resection of advanced head and neck neoplasms. Based on the vascular system unique to that flap it is possible to distinguish three types of flaps; local flap is rearrangement of tissue adiacent to the site of surgery; pedicle flap is local unit of tissue that has its original vascular pedicle and it is rotated into the defect ; free flap is distant unit of tissue, in this flap artery and venous system are transected and surgical reconnected to the recipient vessels by microsurgical anastomosis. Based on the components of the flap it is possible to distinguish a simple axial flap that is compose by skin – subcutaneous tissue, artery and vein and composite flap that consists of more than one primary tissue and generally have a muscular or bony component. The imaging has an important role in the evaluation of the relapse in the patients with flap reconstruction, because the physical examination of these patients is very difficult in relation to the distortion of the anatomy and changes in the soft tissue after surgery and radiation therapy.
Materials and Methods
The imaging that can be used in the follow-up of neck neoplasms after reconstructive surgery are CT or MRI. We prefere to use. MRI. MRI is superior to CT for better contrast resolution and in the evaluation of the relapse in presence of flaps, while MRI and multidetector CT are similar in multiplanariety imaging. We use CT Angiography for pre-surgical evaluation of the lower limb in patients underwent to mandibular reconstruction with free fibula flap; in these patients we use CT in the evaluation of the sites of osteotomy. In the evaluation of the local recurrence, we use baseline imaging with MRI after 3 months after surgery; PET-CT can be used and biopsy may be required.
Results
On MRI the flaps appear hyperintense on T1 and hypointense on T2 sequences and on CT as an area of the homogeneous hypodensity. That aspect is in relation to the fatty component of the flap and or fatty involvement after denervation. When the muscular component is prevalent the flap appears on MRI as an area with signal intensity similar to muscle; on MRI and CT can be see the presence of muscular striations. The flaps, generally, don't show enhancement after contrast medium infusion, but in some cases can show enhancement. The enhancement can be to correlate to vascular disruption and neovascularization or in relation to the increase of extracellular space after denervation.
Conclusions
In conclusion the points that aid in interpreting the images in patients underwent to reconstructive surgery using the flaps are: knowlgde of the surgical procedure, type of the flap utilized, familiarity with the expected appearance of the flap on MRI or CT. For these reasonces it is very important the close communication between the referring surgeron and radiologists.

Cone beam CT and maxillo-facial trauma
Christian R. Habermann

Conebeam x-rax CT (CBCT) is a recent installment in the growing inventory of clinical CT technologies. Surprisingly, the first clinical CBCT scanner was already adapted for angiographic applications in 1982. The developements and advances regarding the improvements in flat panel detector technology gave a major impact to the introduction in clinical settings. The major advantage of CBCT is the relatively low power requirements of the x-ray tubes used in CBCT and the high spatial resolution with isotropic voxel as small as 0.125m2. This imaging technique uses a cone-shaped X-ray beam, in contrast to the fan-shaped X-ray beam used in conventional CT, to acquire projection data via a flat panel detector. Data are acquired during a single 360° rotation, from which a volumetric data set is reconstructed using algorithms similar to those used in conventional CT.

The talk wants to discuss the advantages and disadvantages of CBCT in the diagnosis of maxillo-facial trauma, the use pre- and perioperative use, the potential as a intraoperative navigation tool, and the potential for postoperative imaging with regard to artifacts of metal implants.

Blunt trauma & perforations of midface. Key information. Strategies
Martin G. Mack

Background
The face is the most vulnerable area of the body and is usually the least protected. Blunt trauma and perforations of midface are critical injuries which have to be evaluated carefully.
Materials and Methods
Blunt trauma and perforation injuries of the midface are common injuries in the head and neck. Causes for this type of injuries are mainly road accidents, sport injuries and violence injuries. Depending on the clinical finding different the examination protocol and the examination method has to be adapted. In mild trauma conventional xray is still playing an important role in the diagnostic workup. In severe injuries or in high velocity trauma multidetector CT is the method of choice in the diagnostic work up.
Results
Proper initial assessment and management of injuries may prevent unfavorable long-term results and permanent facial deformities. The most common types of facial trauma are the soft tissue injuries and the fractures of the "T-Zone" bones (the nose, the zygoma, and the mandible). These injuries often occur in combination.
Conclusions
Common bony injuries and soft tissue injuries will be presented during thins presentation.

Laryngeal trauma. Essential
Guy Moulin

Traumatic injuries of the larynx (TIL) are rare, accounting for < 1 % of all acute traumatisms, and involve mainly young males.
Patients with TIL can present with an open wound (15 to 20 % of the cases); open lesions account for 0.2 to 8 % of the neck wounds reported. However 80 to 85 % of TIL are closed and are in general reported as part of a multiple traumatic injury (road accident) or attempted suicide by hanging. Intubation can also sometimes cause TIL; in such cases the injuries are not usually serious, but sometimes cause functional sequelae at a later stage.
Whatever the cause TIL is a serious, life-threatening condition in 40 % of the cases of blunt traumatic injury. However, the functional outcome is generally satisfactory as long as the patient is suitably managed.
When managing patients with TIL the initial goal is to ensure the patency of the upper airways to circumvent or treat acute respiratory distress (emergency intubation/tracheostomy).
The initial evaluation of the patient should include nasal fibroscopy and a CT scan of the larynx to assess the laryngeal lesions and any other associated neck lesions hematoma, emphysema, vascular lesions, bone lesions etc...; this examination can be performed at the same time as a whole body scan for a patient with multiple traumatic injuries.
The CT-scan will be helpful to classify the lesions and choose a suitable treatment, whether the patient needs surgery or not. 3D reconstructions are especially useful to determine whether the cartilage is fractured. Fractures of the thyroid cartilage can be vertical, horizontal or complex.
Fractures are often difficult to visualize in adults and young children whose cartilage is not yet calcified or ossified. MRI can be a useful complementary examination if it is available. Fractures of the cricoid cartilage can be bilateral; cricothyroid dislocations are also reported in serious traumatic injuries.
Cricoarythyroid disclocations are frequently reported in cases of moderate internal or external traumatic injury (intubation). The treatment can be either functional or surgical, either managing

the patient as an emergency or deferring treatment until later according to the degree of severity and the type of lesion.
Later complications of TIL (granuloma, stenoses, abcesses,...) also justify complementary examinations and endoscopic exploration.

US of the salivary glands. When is it exhaustive?
Giuseppe Salvaggio – Giuseppe Caruso

In Europe, US is widely accepted as the first imaging method for assessment of major salivary glands diseases. Due to their superficial position, parotid and submandibular glands can be imaged with high-resolution transducers. Inflammatory diseases are the most common diseases affecting the major salivary glands. In acute inflammatory diseases sonography can differentiate between obstructive or non-obstructive sialoadenitis. The accuracy of sonography in assessment of sialolithiasis is approximately 90%. In acute inflammation, salivary glands are enlarged and hypoechoic. They may be inhomogeneous, contain multiple small, oval, hypoechoic areas, and may have increased blood flow at color Doppler. In chronic inflammation, salivary glands are normal sized or smaller, hypoechoic, and inhomogeneous and usually do not have increased blood flow at color Doppler. Salivary gland tumors are rare lesions: approximately 1% of all tumors arise in the salivary glands. In the parotid gland approximately 60-70% of the salivary gland tumors are benign. Pleomorphic adenoma is the most frequent tumor, followed by Warthin's tumor. Pleomorphic adenomas are usually hypoechoic, well-defined, lobulated lesions with posterior acoustic enhancement that may contain calcifications; Warthin's tumors are usually oval, hypoechoic, well-defined lesions that often contain anechoic areas. When tumor US appearance is analyzed, many common features may be found, but definitive differential diagnosis is not always possible with US, even between benign and malignant tumors. Ultrasound is also an optimal tool to guide fine needle aspiration cytology with its ready availability and ability to provide real time image guidance. A limitation of ultrasound is the exploration of the deep parotid lobe which is also partially obscured by the body of the mandible: for lesions of the deep lobe MRI and CT are the modalities of choice. Moreover, lesions originating from it and extending towards the parapharyngeal space should be further investigated with CT or MRI.

MR Imaging techniques in benign lesions of the parotid gland
Christian R. Habermann

Among all other human organs, the salivary glands offer the largest variety of different histologic types and subtypes of primary neoplasms, most of them arising in the parotid gland. Most important for choosing the appropriate surgical approach regarding a primary tumor of salivary glands is not only the preoperative differentiation between benign and malignant lesions, but also the determination of the exact entity within these groups. The risk for recurrence of a Warthin tumor is much lower, if enucleated, as the risk for recurrence of a pleomorphic adenoma, treated with the same surgical approach. Hence, the demand for an imaging tool is not only to localize a lesion, but also to give an assertion regarding a histologic subtype. The modality of choice for this request is at present the magnet resonance tomography.
The talk wants to discuss the different MR techniques that might be helpful to differentiate benign primary salivary gland tumors with considering the different surgical procedures for tumor resection.

Beyond perineural spread. Where Imaging fails in ACC?
Davide Farina

Adenoid cystic carcinoma (ACC) is an indolent salivary malignancy characterized by mucosal and submucosal spread, eventually leading to subperiosteal bone invasion, permeative invasion of adjacent connective spaces containing fat tissue and muscles, perineural spread. Surgery is the

mainstay of treatment, actually complete resection has significant impact on disease-free survival and local control. However, several literature reports proved this goal to be a challenging one with rates of complete resection oscillating between 60-70% of cases. Part of surgical failures may be due to inaccurate preoperative tumor staging. In our unpublished retrospective review of 28 preoperative examinations, MRI – which should be regarded as the technique of choice for head and neck ACC staging – achieved only 62.5% sensitivity and 82.5% accuracy in the detection of muscular infiltration. Bone invasion was also underestimated in a substantial number of cases 73.6% sensitivity and 79.6%. These results emphasize the need to optimize the acquisition protocol: this can be done increasing spatial and contrast resolution with submillimetric isotropic sequences (such as VIBE); acquiring precontrast SE T1 sequences to amplify the detection of subtle bone marrow abnormalities; adapting the field of view in order to includeall the most common paths of perineural spread. On the other hand part of imaging and surguca failures are also due to microscopic tumor spread which unfortunately is also beyond the capabilities of any morphological imaging technique.

Wegener granulomatosis of the face
Timothy Beale

This lecture will demonstrate the CT and MRI Imaging features of wegeners granulomatosis of the face highlighting those features that may suggest the diagnosis. Examples of other pathology that should be considered in the differential diagnosis will be demonstrate.

Lymphoma of the face and sinuses
Sabrina Kösling

Lymphoid neoplasms are common malignancies. About 50% of them have head and neck manifestations, most often as cervical lymphadenopathy. Only 10% of head and neck lymphomas occur as extranodal disease preferring the tonsils, thyroid and sinonasal tract. Primary extranodal lymphomas of the face and paranasal sinuses are rare malignancies in Europe. More often they are found in the orbit, where their percentage is about 5 to 10% of all orbital masses. In the face, sinonasal and orbital region NHL is the most common type. It is supposed to occur mainly in elderly patients. Sites of predilection are: nasal cavity, maxillary sinus and superotemporal orbital quadrant
The diagnosis and therapeutic decisions are mainly based on histological typing. Several, non-comparable lymphoma classifications were used in the past - among them the Kiel classification (German-speaking Europe) and Working Formulation (U.S.A., English- speaking countries). To end this unsatisfactory situation a 'Revised-European-American- Lymphoma-Classification' (REAL) was introduced in 1994 as first word-wide unique classification. Types of lymphoid malignancies are defined on the basis of morphological, clinical, immunophenotypical and molecular genetic data. The currently valid WHO classification can be considered as updated version of the REAL classification. In it lymphoid neoplasms primarily stratified according to their tumour cell lineage into: B-cell neoplasms, T-/NK-cell neoplasms and Hodgkin lymphomas. B-cell and T-/NK-cell are further subdivided into precursor and mature neoplasms. The latter are distinguished in disseminated/leukaemic, nodal and extranodal disease according to their clinical manifestation and localisation.
Lymphomas with first manifestation in the sinonasal area, face and orbit are in almost all cases B-cell lymphomas. Clinical symptoms are unspecific and depend on the localisation and malignant potential of the tumour. Their development within a short time has proved to be an important hint.
The variety of imaging findings will be demonstrated by typical and less typical cases. The basis are own patients who were identified retrospectively from a RIS-analysis of 12 years. Lymphomas often appear as lobulated, sharply demarked, expansive mass without signs of infiltration of neighbouring structures. Due to high cellularity they have a high density on native CT and an intermediate signal on T2-weighted images. The enhancement is moderate. Remodelling is the dominate type of bony changes.

Fungal infections of the sinuses

Heidi B. Eggesbø

Fungal infections of the sinuses are classified as invasive with three subtypes: acute, chronic and chronic granulomatous and non-invasive with two subtypes: allergic and fungus ball (mycetoma). These five subtypes are distinct entities with different clinical and radiologic features. The acute invasive form is most common in immunocompromised and diabetic patients, while the others are more common in immunocompetent individuals.
The radiologic findings are often unspecific but in patients with chronic rhinosinusitis, fungal infection should always be considered. CT should be the primary modality using both bone and soft tissue algorithms, while extrasinonasal complications are best evaluated using MR. When invasive fungal sinusitis is suspected, endoscopic examination with biopsy is mandatory.
Acute invasive: The fungal organisms invade the mucosa and submucosa leading to painless, necrotic nasal septal ulcer and sinusitis that may progress to the orbit and brain within days/weeks causing death in 50-80%.
CT shows opacification and bony destruction of the involved sinuses, however CT findings of the sinuses may be sparse since the fungal organisms invade through the blood vessels. To evaluate orbital, leptomeningeal and cerebral extension MR is the superior modality.
Chronic invasive: As in the acute subtype, the inhaled fungal organisms invades the mucosa, submucosa, blood vessels and bones, but the progression proceeds over months and years. A history of chronic rhinosinusitis is common.
CT demonstrates mucosal thickening accompanied by osteitis. A diagnostic clue is hyperattenuation of the tissue outside the sinus walls due to fungal invasion and inflammation. MR is the modality of choice to evaluate extrasinonasal complications
Chronic granulomatous invasive: This is a rare subtype, most common in Africa and South Asia, and usually caused by Aspergillus flavus, with formation of soft tissue non-caseating granulomas. The course is similar to the chronic invasive subtype.
Allergic non-invasive: This is the most common subtype, with geographic variation corresponding to warm, humid climates. It is caused by allergic reaction to inhaled fungal organisms. The patients usually have symptoms of chronic rhinosinusitis with multiple sinuses involved.
CT demonstrates opacification with high attenuation due to inspissated mucus. Additional sinus expansion and bone remodeling are valuable diagnostic findings. At MR, the opacified sinus shows typical low signal intensity at T2W images and intermediate signal intensity at T1W images.
Fungus ball (mycetoma): This entity is uncommon and probably caused by retention of fungal organisms due to obstruction of mucociliary drainage. Symptoms may be sparse.
CT usually demonstrates opacification with punctuate calcifications and at MR low signal intensity at T2W images and intermediate signal intensity at T1W images due to paramagnetic properties of the fungal organisms.

Anatomy of the orbit at ocular pathways

Christian Czerny

The orbit and its content can be anatomically separated in several compartments. The bony orbit, the extraconal compartment, the conal compartment (muscle conus), the intraconal compartment and the globe.
Bony structures are best visualized with CT in a bone window level setting. As the orbit and its content contain mainly of small soft tissue structures being in a close neighbourship, the content of the orbit is excellently visualized with MRI. Also the visual pathways intracranially are excellently visualized with MRI. Especially high field MRI enabling fiber tracking imaging delineate the fibers of the optic of the intracerebral optic pathway. In this lecture the compartment model of the normal anatomy of the orbit, the orbital neighbourship and of the visual pathways will be shown and discussed on CT images and MRI images.
Furthermore the close relationship of intraorbital structures to the paranasal sinuses and vessels structures and nerval structures will be delineated. Also the imaging techniques of CT and MRI will

be explained in this lecture and the usefulness of imaging in several planes such as in the axial, the coronal, and sagittal planes.
Also the relation of CT images in comparison to MRI images will be delineated in this lecture.

Diplopia due to extra-orbital lesions
Marc Lemmerling

Of the six external ocular muscles the superior oblique muscle is supplied by the trochlear nerve (N. IV), the lateral rectus muscle by the abducent nerve (N. VI), and all other external muscles by the oculomotor nerve (N. III). All of these nerves have nuclei situated in the brain stem, and have an interpeduncular or prepontine cisternal course, before running through the cavernous sinus and the superior orbital fissure. The abducent nerve has a long cisternal course making it extra vulnerable. In its cisternal course the oculomotor nerve runs very close to the circle of Willis, making it vulnerable to aneurysmal disease.
MRI examinations in patients with diplopia should visualize the complete brain and brain stem, including the central skull base. A wide variety of lesions can be seen at different locations outside the orbit, such as the brain (demyelinating disease, ischemia, …), the brain stem (ischemia, …), cisterns (meningioma, infectious disease, carcinomatous meningitis, neurogenic tumor, …), cavernous sinus, and superior orbital fissure (neoplastic disease, neurogenic tumor, vascular disease, …).
MRI examinations for diplopia are performed with T2WI of the brain and brain stem, and T1WI covering the course of the IIIrd, IVth, and VIth cranial nerves. Specific sequences can be added in younger (FLAIR) and older patients (DWI). In case of oculomotor nerve disease performing an mra of the circle of Willis is mandatory. After gadolinium injection the T1WI are repeated.

Oral Cavity Carcinoma
Julian Kabala

Key anatomy
The oral cavity is defined by the following structures;
- Anteriorly; lips (which are considered part of the oral cavity)
- Posteriorly; junction of the hard and soft palate, the anterior tonsillar pillars and the circumvalate papillae (running across the superior surface of the tongue, approximately in line with the anterior aspect of the mandibular rami)
- Laterally; buccal mucosa
- Inferiorly; mylohyoid muscle

The anterior two thirds of the tongue lies within the oral cavity. It is divided into two halves by the midline fibrous lingual septum. It is largely composed of intrinsic and extrinsic muscles (genioglossus and geniohyoid medially, hyoglossus laterally, palatoglossus and styloglossus).
The sublingual space lies inferior to the tongue and contains the sublingual salivary glands, the submandibular duct, the deep part of the submandibular gland and the neurovascular structures (lingual artery, vein and nerve and cranial nerves IX and XII). It is defined inferolaterally by the mylohyoid muscle while posteriorly it communicates freely with the submandibular space.
The retromolar trigone is the small area posterior to the last lower molar tooth. The mucosa here is considered as part of the buccal mucosa. It overlies the pterygomandibular raphe (the ligament that runs from the mandible to the pterygoid process) which may act as a route for tumour spread.
Key pathology
Squamous cell carcinoma accounts for more than 90% of oral cancer.
Six subsites of oral cavity cancer have been defined (buccal mucosa, upper alveolus and gingiva, lower alveolus and gingiva, hard palate, tongue and floor of mouth). The single commonest site for carcinoma is the tongue.
Early stage tumours are staged according to size (T1 < 2 cm, T2 > 2 cm and < 4 cm, T3 > 4cm). T4 are defined by extension either local (T4a; cortical bone, extrinsic muscle of tongue, maxillary

sinus, skin) or distant structures (T4b; masticator space, pterygoid plates, skull base, encasement of internal carotid artery).
Up to 35% of carcinoma of the tongue presents with lymph node metastases, 5% bilateral. Approximately 30% of patients with clinical N0 neck will have occult nodal metastases. The predominant first order drainage is to the submandibular and jugulodigastric nodes. Typically this is to the ispilateral nodes from the lateral margins of the tongue and bilateral from the centre. Generally therefore the deeper the tumour invades from the lateral margin, the greater the chance of bilateral nodal involvement. Submental lymph node involvement is uncommon apart from tumours of the anterior tip of the tongue.
In the TNM system N1 disease is defined as a single ipsilateral lymph node up to 3 cm in maximum diameter. N2 is defined as a single ipsilateral lymph node > 3 cm but no larger than 6 cm in maximum diameter (N2a) or multiple ipsilateral (N2b) or bilateral/contralateral (N2c) lymph nodes no larger than 6 cm maximum diameter.
Treatment options
Curative treatment aims to ablate the expected (or proven) primary tumour and regional lymph node extent. Clinical and imaging assessment of tumour site and extent is required to optimally plan the choice of treatment and the surgical approach.
Early cancers have a local cure rate in excess of 90% with surgery or radiotherapy. Both modalities may be combined in high risk patients (eg positive surgical margin, tumour invasion in excess of 5 mm).
Radiotherapy combined with surgical treatment of moderate to advanced cancers can achieve local control in 30 – 65% of cases with satisfactory function using reconstructive techniques.
Particularly advanced cancers where surgery would be unacceptably radical to achieve local clearance may be candidates for chemoradiotherapy.
Choice of imaging modality
MRI is widely used to image the primary tumour by virtue of its ability to provide high quality demonstration of the tumour extent, normal soft tissue anatomy and (relative) resistance to dental amalgam induced artefact. CT however offers much higher resolution and better assessment of cortical bone erosion. It is also a more rapid technique and better suited to patients who are unable to lie motionless for more than a minute and for assessment of pulmonary metastases. There is a strong argument for using both modalities.
Reporting the scan
The scan report follows logically from the anatomy and pathology. Description of the primary tumour starts by defining the size and the epicentre of the tumour.
Local invasion can be described by considering tumour extension in the six standard directions (superior, inferior, lateral, medial, posterior and anterior). This is likely to encompass most important structures. Depending on the original site of the tumour and its size certain structures warrant specific consideration and mention and include;

- Tongue
    - Depth of invasion of intrinsic muscle relates to
        - increasing risk for lymph node metastases
        - reduced chance of viable partial glossectomy, especially when tumour crosses the midline
- Sublingual space and contents (particularly the neurovascular bundle)
    - Involvement of both neurovascular bundles generally precludes partial glossectomy
- Tongue base, valleculae
- Oropharynx (and beyond into larynx)
- Mandible (body, ramus)
- Buccal space
- Masticator space, pterygoid plates, pterygopalatine fossa
- Skull base
- Hard palate, sinus, nasal cavity
    - The mucosa of the roof of the mouth is closely applied to the hard palate leading to early bone erosion

Lymph node status is described based on the following features;

- Necrosis

- Extracapsular spread
- Increase in size
- Round configuration

The presence of necrosis and extracapsular spread are the most reliable features when present. Size criteria for involvement remain controversial and some would advocate an upper limit of normal of 6-7 mm maximum transverse diameter although 10 mm maximum transverse diameter is probably used more widely. Whatever limit is accepted the accuracy is poor.
It is also important to describe the relationship of the primary tumour and any metastatic lymph node mass to the carotid artery is important (encasement, invasion).

Post-RT complications

Alexandra Borges

Conservative, organ-preserving, treatment protocols are increasingly used in head and neck cancer to avoid the disfigurement and loss of function associated to mutilating surgical procedures. These protocols may include different types of radiation therapy in isolation or associated to chemotherapy regimens, with surgery reserved for salvage in case of treatment failure or recurrence. Evaluation of response to therapy relies on a strict, usually multimodality, imaging follow-up. Therefore the radiologist should be familiar with the expected post-treatment changes as well as with potential complications of conservative treatments, particularly to be able to differentiate these changes from persistent or recurrent neoplasm. Post-radiation complications may appear immediately after radiotherapy (acute) or months or even years after completion of therapy (late). The most commonly seen after irradiation of head and neck cancer include: soft tissue necrosis with or without fistula formation, osteoradionecrosis and chondronecrosis. Radiation induced fibrosis of the neck may lead to important dysfunction and to morphological changes such as esophageal stenosis. CNS complications can also be seen including radiation necrosis of the brain parenchyma or spinal cord, transverse myelitis, neuritis of the cranial nerves or brachial plexus. Post-radiation arteriopathy is a common occurrence and may lead to occlusive/ subocclusive carotid disease or aneurysm formation. Secondary benign and malignant neoplasms are amongst the most feared late complications.

Chronic rhinosinusitis

Andy Whyte

WHAT IS CHRONIC RHINOSINUSITIS (CRS)?
Compilation of symptoms (American academy of OHNS – Task force on Rhinosinusitis)
Major: Facial pain (pressure), nasal obstruction, congestion, purulent rhinorrhea and postnasal discharge.
Minor: Headache, halitosis, fatigue, dental pain, cough and otalgia.
NB: Wide range of symptoms, many of which are vague.
WHAT ARE THE CAUSES OF CHRONIC RHINOSINUSITIS?
Multifactorial: Physiological: impaired mucociliary clearance.
Mechanical obstruction: narrowed sinus drainage channels. Stamberger and Kopp postulated that anatomical variations in the sinonasal cavity (especially the anterior ethmoid region) result in obstruction → stasis of mucus → infection, i.e. Basic principle of FESS: restore normal mucociliary clearance via clearly patent drainage channels.
DO ANATOMICAL VARIATIONS PREDISPOSE TO CRS?
Multiple studies: Variable results. However, overall conclusion is that anatomical variants do NOT show consistent correlation with the pathogenesis of sinusitis.
However: experimental obstruction of the ostiomeatal unit (OMU) can produce CRS symptoms without antral fluid or mucosal disease.

WHAT IS THE ROLE OF IMAGING IN CRS?

1. Aid to diagnosis of CRS
   - Scoring systems for CRS: Lund MacRay – clinical, radiological, endoscopic and surgical findings.
2. Patterns of Mucosal Disease
   - Frontal recess.
   - Ostiomeatal unit (OMU or anterior OMU)
   - Spheno-ethmoidal recess (SER or posterior OMU)
   - Complications/2o effects: retention cysts and antrochoanal polyps (ACP)
     mucoceles
     aspergilloma (fungal balls)
     sinonasal polyposis (SNP)
     complications of infection
3. Predisposing Factors

Local: Obstructing lesions: Inverting Papilloma, Malignant tumours.

Dental disease: Periapical pathology and advanced periodontitis, i.e. premolar and molar apices project into the antrum. 50% increase in maxillary sinus mucosal thickening.

General:Cilial disorders, e.g. cystic fibrosis.

4. Anatomical variants which may affect FESS and its outcome
5. Prediction of likely success of FESS 1o Factor correlating with success of FESS was the severity of disease on the initial CT scan. i.e. ↑ severity = ↑ need for further surgery. Chow JM. Current Opinions in OLHNS 2002, 10 : 33-35
6. Diagnosis of unsuspected malignancy

MRI also indicated.

7. Diagnosis of regional pathology

Especially important when facial pain is the 1o symptom. i.e. dentition, TMJ, T-bones, parotid glands, skull base.

WHAT IMAGING TECHNIQUE?

- Plain radiographs and US are of no value in the diagnosis of CRS.
- MDCT (not direct coronal CT) is the imaging technique of choice – allows multiplanar evaluation: axial, coronal and sagittal.
- CBCT can also be used in young patients, or when there is a need to limit dose, e.g. repeat scanning.

HOW TO EVALUATE THE SCAN DATA

- PACS not film.
- Initial review: Axial data set, superior to inferior → overview and fluid levels.
- Detailed Analysis: Coronal/sagittal supplemented with axial data set and X-referencing on PACS. Reprocessed soft tissue axial images.

1. Anterior Sinus Groups (Frontal, Anterior Ethmoid and Maxillary Sinuses)
   - Severity of disease in each sinus.
   - Occlusion/patency of drainage channels (frontal recesses and OMU's)
     - Widely accepted that anterior ethmoid disease is the key to OMU obstruction and 2o frontal and maxillary sinusitis.
     - Clear understanding of normal anatomy and neurovascular relationships of the ethmoid.
     - Document anterior ethmoid air cell variants (see handout), i.e. Roadmap for FESS.
2. Posterior Sinus Groups (Posterior Ethmoid and Sphenoid Sinuses)
   - Severity of disease. Mural sclerosis is common in the sphenoid sinuses.
   - Occlusion/patency of the spheno-ethmoidal recess (SER,posterior OMU)
   - Anatomical variants are important because of potential neurovascular injury during FESS.
   - Position and curvature of the spheno-ethmoidal plate (boundary between the posterior ethmoid and sphenoid sinuses) : axial and sagittal.
   - Onodi cells. Position/dehisence of carotid/optic canals.
   - Intersphenoid septum. Variants of clival ossification.

3. Nasal Cavity
- Septum: deviation, spur, perforation
- Turbinates: swelling, nodularity, variants
- Position and symmetry of cribriform plate & fovea ethmoidalis

4. Post Nasal Space / Nasopharynx
- Adenoidal hypertrophy
- Other soft tissue masses.

5. Review Areas
- Maxilla
- Pituitary
- Skull base
- Orbits
- Lower brain
- TMJ/T-Bones

CONCLUSION
- Clinically relevant
- Grade disease (mild-moderate-severe) : discrete pattern or generalised
- Complications
- Coincidental pathology

CLASSIFICATION OF FRONTAL RECESS (FR) AIR CELLS

ANTERIOR TO FR

AGGER NASI (AN): Most anterior ethmoid air cell

FRONTO-ETHMOIDAL AIR CELLS:

♦ KUHN
- TYPE 1 [K1]: Single air cell superior to AN
- TYPE 2 [K2]: Tier of air cells superior to AN
- TYPE 3 [K3]: Single air cell extending superior to frontal beak

POSTERIOR TO FR

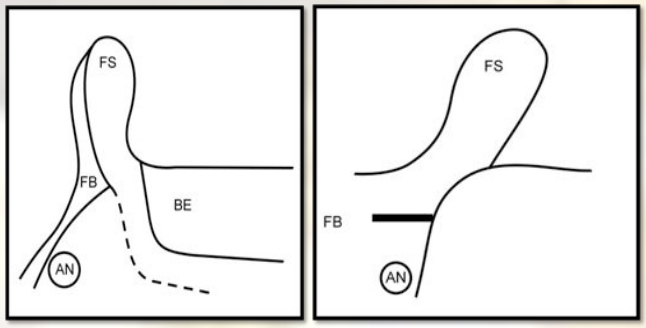
SUPRABULLAR CELL (SB): Air cell superior to the bulla ethmoidalis (BE)

FRONTAL BULLAR CELL (FB): Air cell superior to the BE extending above the frontal beak

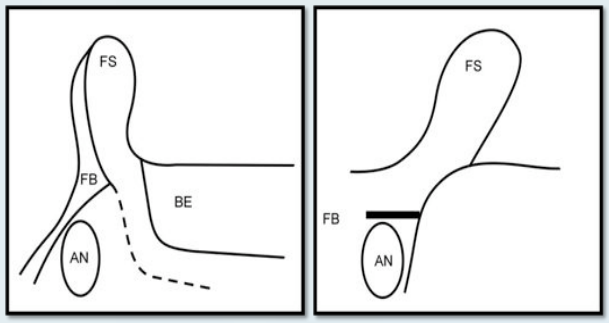
INTERSINUS SEPTAL CELL (ISSC): Medially situated air cell associated with the frontal sinus septum

SUPRA-ORBITAL ETHMOIDAL AIR CELL (SOEAC): Laterally extending FB cell

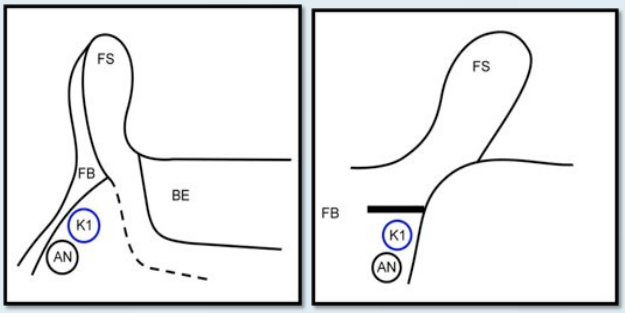
Whyte, Boeddinghaus et al
Submitted for publication 2009



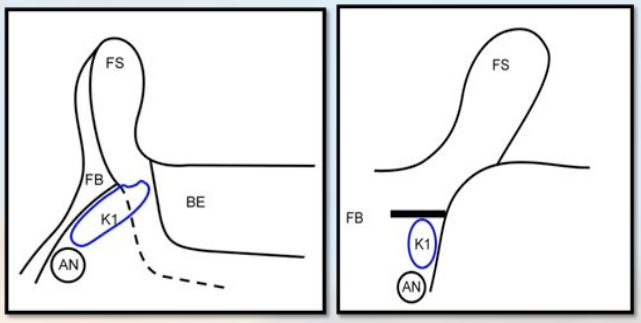
1a AGGER NASI [AN] 1b AGGER NASI [AN]



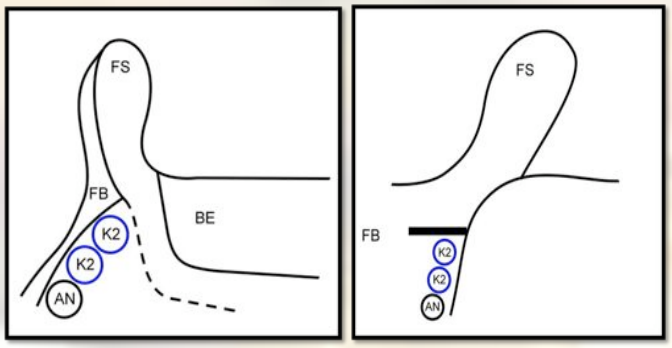
2a LARGE AN 2b LARGE AN



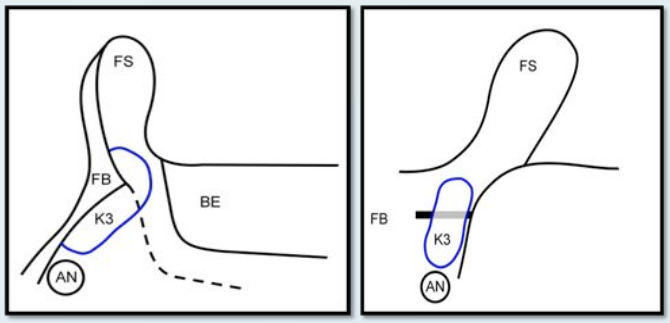
3a KUHN TYPE 1 [K1] 3b K1



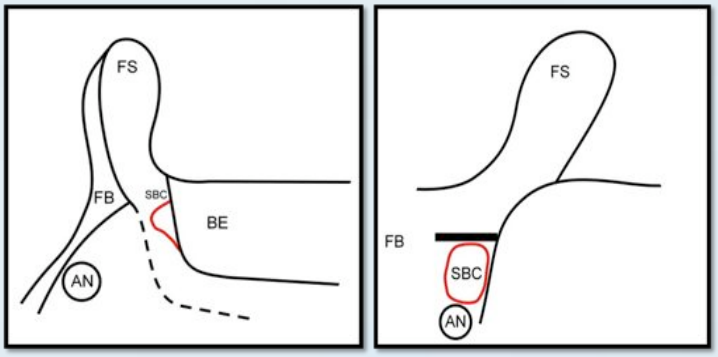
4a LARGE K1 4b LARGE K1



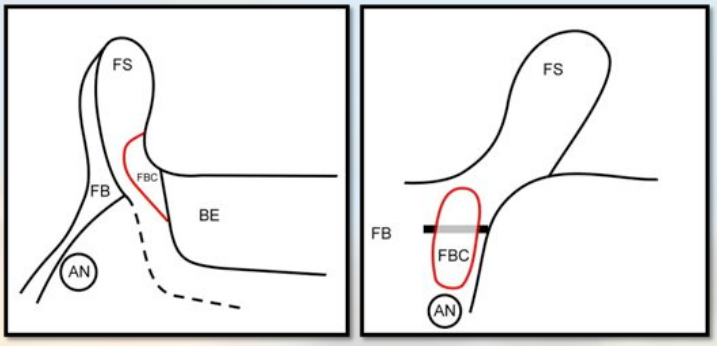
5a KUHN TYPE 2 [K2] 5b K2



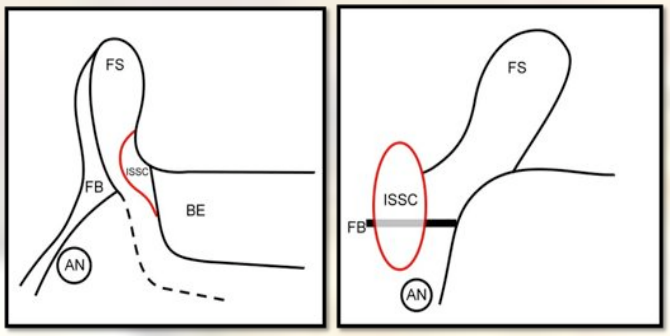
6a KUHN TYPE 3 [K3] 6b K3



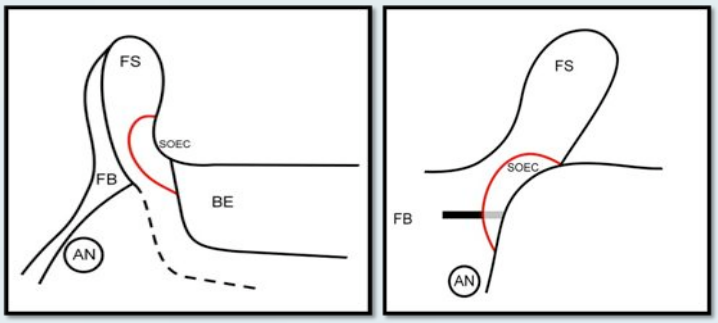
7a SUPRABULLAR CELL [SBC] 7b SBC



8a FRONTAL BULLAR CELL [FBC] 8b FBC



9a INTERSINUS SEPTAL CELL [ISSC] 9b ISSC



10a SUPRA-ORBITAL ETHMOIDAL CELL [SOEC] 10b SOEC

The Integration between the Engineer and the Radiologist experiences
Frederik De Keyzer – Vincent Vandecaveye

Diffusion-weighted magnetic resonance imaging (DWI) is a relatively new technique gaining importance in many diagnostic fields. It is based on the Brownian motion of water protons in the tissue, and as such provides information on the underlying cell density and structures. Quantification of DWI is usually performed using the Apparent Diffusion Coefficient (ADC), which relates to the amount of signal loss in subsequent images acquired with different diffusion sensitization (b-value).
In clinical routine, DWI is used in most centres for the detection of intracranial tumours. However, when introducing this technique in the head and neck, some additional factors need to be taken into account. First, the head and neck is comprised of a large number of tissues in close proximity with very different MR characteristics, such as cell density, vessel structures, and air and fat content. This makes for a very heterogeneous MR background, inducing many susceptibility effects. Second, lots of centres around the world are experimenting with DWI in the head and neck, and each uses own experience in choosing DWI parameters, leading to strongly different optimizations. These differences lead to results which can often not be compared with other centres. Third, as opposed to most intracranial DWI applications, head and neck DWI relies strongly on the calculation of the ADC value of the tissue of interest, which in turn is heavily influenced by the choices of b-values. Therefore, it is very important to interpret the effects on the ADC values when choosing a set of b-values for a particular clinical question.
In this talk, we'll give an overview of the most important do's and don'ts when setting up a DWI examination for the head and neck, both in patient handling and most important sequence parameters. The different results between centres will be touched upon, and some general guidelines are provided to allow getting maximal information from a single DWI examination. Also, a brief overview will be given on the different applications where DWI can help in making the correct diagnosis.

Neck neurogenic tumors
Simonetta Gerevini

Approximately 20% of peripheral nerve sheath tumors (NSTs) arise in brachial plexus. NSTs are benign or malignant mesenchymal tumors and they originate from periaxonal Schwann cells (schwannoma) and fibroblasto (neurofibroma/neurofibrosarcoma).
Neurogenic tumors may involve any component of the plexus, altough the roots are the most frequent site.
Although most NSTs grow outside the dura mater (extradural) they may extend along the pathways of the nerve roots into the intervertebral foramen. Once inside the spinal canal they may develop an intradural-extramedullary component or even an intradural-intramedullary component.

The most common neurogenic tumors of the plexus are the benign nerve sheath tumors: neurofibroma represents the 50-60% of cases; scwannoma the 18-20%. About a third of the patient with neurofibromatosis have localized or plexiform neurofibromatosis and are associated with von Recklinghausen's disease (NF-1). By definition a solitary neurofibroma occurs in a patient who does not have NF-1.
Schwannomas and neurofibromas are both derived from schwann cells, but they differ from each other. They are distinctive lesions that can be reproducibly distinguished from one another by their pattern of growth, cellular composition, associated syndromes, and cytogenetic alterations. They are generally benign and rarely recur.
Neurofibromas are areas of increased thikness of the nerve, often dumbell shaped and sited next to the intervertebral foramina. There are different subtypes of neurofibromas: Localized cutaneous neurofibroma, that is a polypoid or nodular lesion; Localized intraneural neurofibroma, that is a fusiform mass in a peripheral nerve, well circumscribed but not at proximal or distal margins; Plexiform neurofibroma: that is a multinodular tangles when involves multiple trunks of a plexus ("bag of worms") or rope-like thickening of a major non-branching nerve trunk; Diffuse cutaneous neurofibroma, that presents with diffuse growth pattern but localized involvement of skin and subcutaneous tissue; and Massive soft tissue neurofibroma, or "elephantiasis neuromatosa", that is an represented by an extensive, massive involvement of soft tissue. Neurofibromas occasionally involve spinal nerve roots, but almost never cranial nerves.
Localized cutaneous neurofibroma is a circumscribed but unencapsulated tumor with poorly defined margins. Localized neurofibromas arising from medium to large nerves, often remain confined to the nerve, encompassed by thickened epineurium (capsule). The multiple fascicles of plexiform neurofibromas expanded by tumor cells, collagen and myxoid matrix, commonly contain residual nerve fibers at their centers. Large diffuse neurofibromas contain characteristic tactile-like structures (pseudo-Meissnerian corpuscules) and may contain melanotic cells. In contrast to schwannomas blood vessels in neurofibromas generally lack hyalinization. Growth of neurofibroma cells initially along the course of nerve fibers, which become enmeshed by the tumor. Tumors arising in small nerves spread diffusely into surrounding dermis and soft tissue. There are different variants: epithelioid, granular cell and pigmented neurofibromas.
Scwhannoma (or neurinoma, neurilemmoma) is a benign, non-recurring nerve sheath tumor, generally most > 5cm in diameter. Usually in mostly adulthood, without sex predilection, and with a wide anatomic distribution. The site of the lesion is mostly intradural, less frequently extradural or dumbdell, and rarely intramedullary. There is a intracanalicular and intrarachial extension of the tumor, causing the enlargement of the vertebral canal and of the interpeduncular distance observed on plain x-ray images. Many scwhannomas, while growing, cause erosion of the vertebral somas, mainly in the peduncles and the foramens.
In most cases they are a asymptomatic, but sometimes they presents with radicular pain and signs of nerve root compression, so that pain is the most common presentation in cases of schwannomatosis. Motor symptoms are uncommon as schwannomas favor sensory nerve roots. Malignant change is extremely rare. The majority of schwannomas are in peripheral location: head, neck and flexor aspects of lower and upper extremities (spinal roots, cervical, sympathetic, vagus, peroneal, and ulnar nerves most commonly affected). Skin and subcutaneous tissue can be involved and also deeply situated tumors mostly in posterior mediastinum and retroperitoneum. The tumor presents an ubiquitary evolution in the spine, even if a major incidence in the cervical and lumbar tracts is reported in literature.
In contrast to neurofibromas, tend to be attached to nerve trunks. Visceral and intraosseous schwannomas are rare.
They are encapsulated tumor, composed entirely of neoplastic Schwann cells with rare normal mitotic figures. Hystologically there are dense hypercellular areas (Antoni A pattern) with frequent nuclear palisading arrangements (Verocay bodies) and by loose less dense cellular areas (Antoni B pattern) or reticular-type areas. Devoid of axons (but there are frequent exceptions!) – in their absence the neoplastic cells enwrap collagen fibers. Thick-walled, hyalinized blood vessels with lipid-laden cells, hemorrhage, degeneration, nuclear pleomorphism, cytoplasmic intranuclear inclusions.
The hystologica types are: conventional, cellular, plexiform, congenital and childhood plexiform cellular, melanotic and epithelioid.

The last kind of lesion is perineurioma that is a soft tissue tumor composed of cells resembling normal perineurium. It is less common than neurofibromas and schwannomas.
It is a rare benign neoplasm, previously mistakenly considered as a form of hypertrophic neuropathy. It consists of proliferating perineurial cells within endoneurium, forming characteristic pseudo-onion bulbs. It is common in adolescence or early adulthood without sex predilection. Mostly it involves peripheral nerves, but rarely cranial nerves. Clinically it is characterized by progressive muscle weakness that is more frequent than sensory disturbances. Hystopathologically it can appears as classical perineurioma (extraneural perineurioma), sclerosing perineurioma, or reticular perineurioma. Olso a malignant soft tissue perineurioma is possible.
Malignant peripheral nerve sheath tumors account for 14% of the neurogenic tumors. They divided into malignant schwannoma or neurofibrosarcoma.
They are large (> 5 cm) infiltrative, often hemorrhagic, soft tissue mass related to neurovascular bundle. They are circumscribed or infiltrative soft tissue mass. They are located in paravertebral region usually in posterior mediastinum or retroperitoneum, and rarely intraspinal.
MRI can be used to differentiate between neurofibroma and schwannoma, a distinction crucial for surgical planning.
The "target sign" with peripheral high signal and central low intensity on T2-weighted images favours a neurofibroma (58% neurofibromas, compared with 15% in schwannoma), whereas the "fascicular sign" (salt and pepper appearance on T2-weighted images) is common in schwannoma. An encapsulated, extrinsic appearance relative to the nerve fascicles, with inhomogeneous diffuse enhancement favours schwannoma, with compression and displacement of the nerve around the periphery of the lesion. Neurofibromas tend to be fusiform, longitudinally oriented lesions in the nerve distribution, with central homogeneous enhancement. Schwannomas arise from the Schwann cells and, therefore, tend to grow eccentrically, with the displacement of the nerve fibres, making it easier to remove the tumour without sacrificing the nerve. In contrast, neurofibromas infiltrate the nerve without any definite capsule, which makes these lesions more difficult to resect without damaging the nerve.
CT of Neurofibromas: they are isodense to spinal cord; they can determine or not enlarged neural foramina; there can be rare calcification. Enhancement is mild to moderate.
MRI of Neurofibromas: in T1W: they show similar signal intensity (SI) to spinal cord and nerve roots; on T2W they are iso/hyperintense, and hyperintense on STIR; there can be the "target sign": periphery high SI, central low/intermediate SI; that is suggestive but not patognomognic for NF. If plexiform NF there are hypointense septations throughout. Hemorrhage is uncommon. Enhancement can be mild/moderate, and relatively homogeneous.
CT of Schwannomas: on CT scan they are well marginated mass, isodense to the cord and nerve roots; cystic modification are common, whereas gross hemorrhage and calcifications are rare. Adjacent bone erosion with remodelling and frequent enlargement of neural foramina with "dumbbell" lesion. As a matter of fact larger lesions may expand canal and there can be posterior vertebral body scalloping. There can be moderate solid or peripheral enhancement.
MRI of Schwannomas: in T1W: they are iso/hypointense to spinal cord and nerve roots (a part from melanotic schwannoma that is hyperintense); on T2W a majority are hyperintense, and hyperintense on STIR; and in 40% of cases there are cystic changes. Occasionally there can be the "target sign". Hemorrhage is present only in 10% of cases. Enhancement can be intense, and relatively homogeneous but also heterogeneous or present at periphery.

REFERENCES

- Diagnostic Imaging: Spine. Ross
- Weber AL: Neurogenic tumors of th neck. Radiol Clin Noth Amer. 38 (5): 1077-90, 2000.
- Beggs I: pictorial review: imaging of peripheral nerve tumors. Clin Rad. 52:8-17, 1997.

ABSTRACTS of ORIGINAL PAPERS

(in order of presentation)

CT AND MRI FINDINGS IN 121 COCHLEAR IMPLANT CANDIDATES

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Background

Multichannel cochlear implantation is an accepted method for rehabilitation of totally deaf patients. The imaging of the ear is important in determining the suitability of the ear for receiving the implant, selection of the ear to be operated upon, and to detect additional findings.

The ENT clinic in the University Hospital, Linkoping, is a regional centre for cochlear implantation in the SE region of Sweden and our department performs CT and MRI of the ears in every implant candidate.

Materials and Methods

Between January 2001 and December 2008 132 patients underwent cochlear implantation in Linkoping. The CT and MRI images of 121 of them could be retrospectively analysed by the author.

41 patients (34%) were prelingually deaf while 80 (66%) postlingually deaf. 38 of the prelingual cases were children while there were only 6 children in the postlingual group.

The ethiology of deafness in 4 of the prelingually deaf patients were maternal rubella infection during pregnancy, congenital cytomegalovirus infection, CHARGE syndrome and one boy with idiopathic hearing loss had got systemic Gentamycin. The rest of the patients in this group had idiopathic deafness.

The patients in the postlingually deaf group suffered from a broad spectrum of diseases, from hereditary hearing loss to meningitis. Approximately half of the cases were idiopathic.

Results

Imaging revealed alterations of the inner ear in 21 of the prelingual cases (52%). In 4 cases all parts of the inner ear – cochlea, semicircular canals and 8th nerve – were deformed or non existing. There were 2 cases of Mondini dysplasia with or without enlarged vestibular aqueduct (LVAS). The superior semicircular canal was dehiscent in 9 patients. One had hypoplasia of the lateral semicircular canal. 4 had hypoplasia or deformity of the cochlear or vestibular nerves without alterations in the cochlea or semicircular canals.

Only 34 (42%) of the postlingually deaf ears showed any pathology.

7 were deafened by purulent meningitis, but only 4 of them had MRI findings of cochlear pathology. 7 patients had some kind of hereditary hearing loss, six of them had imaging findings (lateral semicircular canal hypoplasia, LVAS, or malformation of the cochlea) that could explain the deafness. When LVAS or cochlear otosclerosis was clinically suspected the imaging confirmed the diagnosis. Only 15 of the 50 idiopathic cases hade some morphological changes – otospongiosis, hypoplasia of the lateral semicircular canal, LVAS, dehiscence of the superior semicircular canal, tiny intracanalicular vestibular schwannoma, or cochlear nerve atrophy of traumatic origin.

The original report was changed in 36% of the prelingual and 20% of the postlingual cases after the images were re-evaluated by a head and neck radiologist.

Conclusions

Imaging is a very valuable tool in the preoperative evaluation of cochlear implant candidates. The radiologist should be an integral part of the cochlear implant team.

NEW INSIGHTS IN INSERTION TRAUMA DURING COCHLEAR IMPLANT SURGERY BASED ON 3-DIMENSIONAL IMAGE EXPLORATION OF THE COCHLEA.

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Background

Insertion trauma is a feared risk in cochlear implant surgery, potentially causing neural degeneration and altered performance of the implant. In literature insertion trauma is reported to

occur at specific locations, due to surgical technique and the size of the implant in relation to the size of the scala tympani. This study investigates whether there is another underlying anatomic substrate contributing to the risk for trauma at specific locations.

Materials and Methods

The 3-dimensional path of the cochlear spiral was determined by segmentation, skeletonization, distance mapping and wave propagation technique applied on microcomputer tomographic images of 8 isolated human temporal bones. The most likely positions at which a cochlear implant might induce pressure on the basilar membrane and wall of the scala tympani along this path was estimated by linear regression.

Results

The cochlea showS a noncontinuous spiraling path leading to potential pressure poInts during cochlear implantation at the basilar membrane in the region of 180-225° and 725° and at the floor of the scala tympani around 0-90°, 225-270° and 405-450°.

Conclusions

Our data favour the idea that the intrinsic cochlear anatomy contributes to the risk for insertion trauma during cochlear implantation at specific locations.

CT ASSESSMENT OF COCHLEAR IMPLANT ELECTRODE POSITION RELATIVE TO THE SCALA TYMPANI USING A ROUND WINDOW APPROACH

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Background

The surgical approach and electrode design in cochlear implantation ideally work together to optimize electrode placement. High scala tympani (ST) insertion rates are associated with improved auditory outcomes, particularly when residual hearing preservation is a goal (combined electro-acoustic stimulation). A round window (RW) approach was adopted to improve the precision of CI electrode placement. We wished to test the hypothesis that this approach improved rates of ST insertion.

Materials and Methods

All patients included were implanted with the Advanced Bionics Corporation HiRes 90K 1J electrode. A CT grading system (with 5 zones extending anteroposteriorly from the scala vestibuli to the scala tympani) was used to assess the post implantation electrode position at four points along the cochlea basal turn (covering 360°). Two groups of 34 CIs were compared: a retrospective cochleostomy group and a prospective round window (RW) group . Two radiologists scored the cochlea electrode position at each point.

Results

The proportion of insertions via the RW tended to increase through the study period from 72% in 2006 to >90% in 2008. When the mean zone scores for each CI electrode studied were compared, the RW group was significantly more likely to tend towards ST insertion ($p<0.01$, mean difference = 0.46, 95% CI: 0.13 –1.05). This pattern of advantage for RW insertion occurred at all four HRCT assessed positions (range: 0.33 – 0.54). For RW insertions, when the insertion started in the correct compartment (ST) it tended to stay there. However, for the earlier cochleostomy group, 25% of the failures actually started in the ST and crossed to the SV compartment. Ultimately the RW centered approach achieved a significantly higher proportion of ST insertions (94% versus 74%, $p<0.01$) even when a cochleostomy anterior to the RW was required.

Conclusions

A RW centered approach to CI leads to greater surgical precision in placing the electrode into the ST and appears to be associated with a lower incidence of the electrode crossing into the SV as it advances into the cochlea.

RADIATION DOSE AND QUALITY IMAGE COMPARISON BETWEEN CONE BEAM CT AND MULTI SLICE CT IN THE STUDY OF BIONIC EAR

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Background
Recently Cone Beam Computed Tomography (CBCT) was introduced in the study of the temporal bone and in particular in the evaluation of patients with hypoacusia. CBCT has the advantage to generate a low ionizing radiation dose in comparison to Multi Slice Computed Tomography (MSCT). The purpose of the study is to evaluate the CBCT in terms of radiation dose and image quality in patients with bionic ear.
Materials and Methods
120 patients with hypoacusia were included in the study (average age 23 y, range 7-43 y) and they performed radiological examinations after the surgical treatment: 100 patients were implanted with a Vibrant SoundBridge (VSB) at the round window, while 20 with a VSB at the incus. The absorbed and effective doses were measured using both techniques following the ICRP guidelines. The evaluation of the quality of the images was performed using an AAPM CT phantom.
Results
CBCT effective dose was three times lower than MSCT (0,11 vs 0,28 mSv). CBCT images had a lower quality in comparison to MSCT ones, but they resulted enough diagnostic to detect the correct position of the prosthesis.
Conclusions
CBCT may be considered a feasible alternative to MSCT in the postoperative follow up of patients with bionic ear.

MRI FOLLOW UP OF ACOUSTIC NEUROMAS FOLLOWING TREATMENT WITH SRS

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Background
Stereotactic radiosurgery (SRS) is an established treatment modality for acoustic neuroma and MRI is standard follow up. We investigate the evolution of MRI findings in SRS patients undergoing linear accelerator stereotactic radiosurgery at a tertiary referral centre in the United Kingdom. We correlate the MRI response with the number of isocenters used at SRS, and compare the MRI findings with clinical response or complications.
Materials and Methods
Retrospective study of patients undergoing linear accelerator radiosurgery for acoustic neuroma since 2002 when dose was standardised to 12Gray. All patients had to have pre and post-procedure imaging, with a minimum length of follow up of 2 years following SRS. MRI studies were evaluated for changes in tumour size and presence of presumed necrosis. These findings were correlated with the number of isocentres used at SRS, and the clinical outcome.
Results
A total of 56 patients underwent SRS since January 2002, of which 13 had inadequate imaging/follow up. Of the 43 with adequate imaging, 9 (21%) showed reduction in size, 32 (74%) were stable in size, 2 (5%) increased in size, and 13 (30%) showed evidence of post-treatment necrosis. The disease control rate (defined as no change in size or reduction in size) was therefore 95%.
One isocentre was used in 23 patients and two isocentres were used in the remaining 20 patients. There was no significant difference in disease response between these two groups.
There was no documented worsening of hearing loss in any of the patients. The two patients who demonstrated an increase in the size of their lesions had no clinical evidence of post-treatment trigeminal neuropathy or facial nerve palsy. One patient whose lesion remained stable in size and one patient whose lesion decreased in size demonstrated evidence of facial nerve palsy. Three

patients whose neuromas decreased in size showed evidence of trigeminal neuropathy following the procedure.

Conclusions

Our control rate for acoustic neuromas treated with linear accelerator stereotactic radiosurgery is 95%. This is in keeping with published literature. There was no correlation between imaging findings and clinical response or complications. The number of isocentres used for SRS does not appear to correlate with disease response.

CT PERFUSION OF HEAD AND NECK MALIGNANT NEOPLASMS: DIFFERENCES OF BLOOD FLOW, BLOOD VOLUME, MEAN TRANSIT TIME, AND PERMEABILITY-SURFACE PRODUCT PARAMETERS.

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Background

CT perfusion imaging is a promising technique for noninvasive quantitative assessment of microcirculatory changes in cancer. Our aim is to assess its feasibility for functional evaluation of head and neck tumors (HNT) through quantitative analysis of perfusion parameters.

Materials and Methods

Twelve patients with pathologically-confirmed HNT (five tongue carcinomas, three pharyngeal squamous cell carcinomas, two lymph node metastases from carcinoma of suspected oropharyngeal origin, one carcinoma of the maximally sinus, and one carcinoma of the hard palate) underwent a cine-mode CT perfusion acquisition covering the lesion site, which had previously been detected through a preliminary local staging spiral CT scan. The acquisition started 6 seconds after contrast material injection (40mL of 320mgI/mL iodixanol at 5mL/s flow rate) with a 50-second duration. CT perfusion data were exported to a workstation (Advantage Windows 4.4, General Electric, Milwaukee, WI), and regions of interest (ROI) were traced inside the neoplasm, on its contralateral side (CS), and on the ipsilateral sternocleidomastoid muscle (SM). By using the CT Perfusion 3 plug-in, the following perfusion parameters were computed: Blood Flow (BF), Blood Volume (BV), Mean Transit Time (MTT), and Permeability-Surface Product (PS). Values are expressed as mean ± standard deviation.

Results

BF, BV, MTT, and PS were significantly different among the three groups (Kruskal-Wallis test: $p<0.0001$, $p<0.00001$, $p=0.0228$, and $p<0.0001$, respectively). Between individual groups, BF was significantly higher in HNT (124.9 ± 65.3) compared with CS (36.4 ± 27.6 ml/min/100g) and SM (17.9 ± 18.9 ml/min/100g) (Bonferroni-adjusted Mann-Whitney test: $p=0.0015$ and $p=0.0003$, respectively). Also BV was significantly increased (6.05 ± 2.26 ml/100g) compared with CS (1.97 ± 0.84 ml/100g, $p=0.0003$) and SM (1.02 ± 0.71 ml/100g, $p=0.0003$). MTT was significantly lower in HNT than in SM (4.71 ± 3.26 s vs 8.38 ± 5.85 s, $p=0.0417$), but not significantly so compared with CS (6.97 ± 3.48 s, $p=0.18$). Finally, PS was significantly higher in HNT (14.85 ± 9.52 ml/100g/min) than in CS (5.54 ± 5.53 ml/100g/min, $p=0.0453$) and in SM (2.33 ± 2.65 ml/100g/min, $p=0.0006$). In HNT, BF correlated significantly with BF (Spearman rank test: $rs=0.6909$, $p=0.0186$), and a statistically significant inverse correlation existed between MTT and BF ($rs=-0.7818$, $p=0.0045$).

Conclusions

CT-based quantitative evaluation of BV, BF, PS and, to a lesser extent, MTT allows to distinguish HNT from normal tissue.

PERFUSION CT FOR MONITORING INITIAL RESPONSE IN ADVANCED SQUAMOUS CELL CARCINOMA OF THE HEAD AND NECK TREATED WITH CONCOMITANT CHEMORADIOTHERAPY

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Background
Our aim was to demonstrate prospectively the changes in primary tumor perfusion parameters during concomitant cisplatin-based chemoradiotherapy of locoregionally advanced squamous cell carcinoma of the head and neck (SCCHN) and to evaluate their predictive value for response of the primary tumor to therapy.
Materials and Methods
Seventeen patients with locoregionally advanced SCCHN underwent perfusion CT scans before therapy and after completion of 40 Gy and 70 Gy of chemoradiotherapy. Blood flow (BF), blood volume (BV), mean transit time (MTT), and permeability surface area product (PS) of primary tumors were quantified. Differences in perfusion and tumor volume values during the therapy as well as between responders and non-responders were analysed and Receiver Operator Characteristic (ROC) curves were used to assess predictive value of the baseline and follow-up functional parameters.
Results
No significant differences were observed between perfusion parameters at 0, 40, and 70 Gy in the pooled patients. The tumor volume at 40 Gy and at 70 Gy was significantly lower compared to baseline value ($p=0.007$ and $p=0.014$). In the nonresponders (8 patients), measurements at 40 Gy showed a non-significant trend of increased BF, BV and PS values compared to the baseline values. As predictors of primary tumor response to chemoradiation were identified: at 0 Gy – BV ($p=0.01$); at 40 Gy - BF, BV and MTT (in all three, $p=0.03$); at 70 Gy – BV ($p=0.01$) and PS ($p=0.03$).
Conclusions
The results suggest that in advanced SCCHN the perfusion CT monitoring might be of predictive value for identifying tumors that may respond to the cisplatin-based chemoradiotherapy.

DCE-MRI ESTIMATES OF BLOOD FLOW IN PATIENTS WITH HEAD-AND-NECK TUMORS

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Background
Hypoxia in solid tumours is known to cause resistance to radiotherapy and failure of treatment. Dynamic contrast-enhanced (DCE-) MRI can be used to provide estimates of blood flow, microvessel permeability-surface area and blood volume (Brix G, et al. 2004) in such tumours. DCE-MRI parameters have been shown to correlate with measures of hypoxia (Newbold K, et al. 2009), such as pimonidazole and carbonic anhydrase 9 (CA9). Pre-treatment estimates of blood flow and blood volume have been shown to differ in patients where treatment resulted in either local control or local failure (Cao Y, et al. 2008).
Materials and Methods
Eight patients undergoing curative surgical resection for head-and-neck cancer were scanned prior to surgery. MRI studies were performed on a 1.5 T Philips Intera using a either SENSE head or head-and-neck coil. A transverse 3D T1-w FLASH sequence (TR/TE 3.6/0.95 ms, α = 30o, 128 x 128 x 20 matrix, 220 x 220 x 100 mm FOV, acquisition time ~1.5 s) was used for the dynamic acquisition. Individual arterial input functions (AIFs) were obtained from the carotid arteries. Whole

tumour regions-of-interest (ROIs) were defined and concentration-time curves were analysed using a general two-compartment exchange model (Brix G, et al. 2004) to obtain estimates of blood flow (Fb), permeability-surface area (PS) and blood volume (vb). Tumour volumes were calculated using the number of pixels within the ROI multiplied by the voxel volume. A Pearson correlation was performed to examine the relationship between DCE-MRI parameters and tumour volume and age of the patient. Spearman correlations were performed to examine relationships between DCE-MRI parameters and stage. A one-way ANOVA test was applied to assess whether DCE-MRI parameters varied with tumour site.

Results

The mean age of the patients was 62.5 years (range 50.4 - 72.7 years). Tumours were classified as oral cavity (n=3), larynx (n=3) and hypopharynx (n=2) and were stage I (n=1), II (n=3), and IV (n=4). The mean tumour volume was 15.3 cm3 (range 0.6 – 44.5 cm3). DCE-MRI parameters did not correlate significantly with any of the above clinicopathologic parameters. Fb averaged over 8 patients was 29.1 ± 18.5 ml/min/100ml, PS was 5.0 ± 4.3 ml/min/100ml and vb was 11.4 ± 5.6. DCE-MRI parameters did not differ significantly between tumour sites.

Conclusions

These tracer kinetic parameter estimates obtained using DCE-MRI agree well with a PET study presented by Komar et al. (2008). Our estimates of blood flow are low compared to those presented by Cao (Cao Y, et al. 2009) (DCE-MRI) and Bisdas (Bisdas S, et al. 2008) (DCE-CT). However, this may be due to differences in the tumour types studied and the models used for data analysis. In the future, the relationship between these tracer kinetic parameters and measures of hypoxia (pimonidazole staining) and angiogenesis (microvessel density) will be investigated.

ADC AND SUV VALUES IN PRIMARY HEAD NECK SQUAMOUS CELL CARCINOMA

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Background

The purpose of this prospective study was to correlate the values of the apparent diffusion coefficient (ADC) with diffusion-weighted MR imaging (DWI) and the uptake of 18 FDG (standardized uptake value; SUV) in head and neck squamous cell carcinomas.

Materials and Methods

Twenty consecutive patients (15m, 5f; age: 35-78 years) with biopsy-proven ENT squamous cell carcinoma were examined on a clinical 3T MRI and a 64-row detector PET-CT, with a maximum of 14 days difference between the two examinations. In addition to conventional MR sequences acquired with a 16-channel head and neck coil, two different types of diffusion-weighted sequences were obtained: DWIBS in the axial plane for the whole neck and a navigated EPI in the sagittal plane through the center of the tumor, both using b-values of 0 mm2/s and 800 mm2/s. The ADC maps were calculated automatically. The tumors' ADC values were measured with 3 standard-size ROIs and an ROI covering the entire tumor. 18FDG PET-CT was performed after i.v. 18FDG and iodinated contrast administration in the venous phase, with a scanning range from head to thigh. The SUV max was measured for every tumor using a freehand ROI, covering the entire tumor.

Two-way repeated measures ANOVA was used for group comparisons. Spearman rank correlation of ADC and SUV values was performed.

Results

The twenty SCC had a mean ADC value of 0.901 (±0.136) with a standard-size ROI, and 0.925 (±0.163) with large ROI measurements with the DWIBS sequence. The tumors' ADC values were higher when measured with the EPI: 1.097 (±0.224) and 1.119 (±0.221). We observed a high correlation between the measurements of the large ROIs and the mean value of the 3 standard-size ROIs for both sequences (DWIBS rho=0.88; $p<0.001$; nEPI rho= 0.81; $p<0.001$). The difference in ADC values between the two sequences was significant ($p<0.001$), but there was a substantial correlation between the two sequences (rho=0.62; $p=0.004$).

The mean SUV max (30.87 ±12.04) did not correlate with ADC values on DWIBS or EPI.

Conclusions
Our findings suggest that different ADC reference values must be established for different diffusion-weighted sequences. Nevertheless, the good correlation between the ADC values on DWIBS and EPI enable a comparison. The SUV appears not to be related to the ADC.

18F-FLUORODEOXYGLUCOSE-PET/CT TO EVALUATE TUMOR, NODAL DISEASE , AND GROSS TUMOR VOLUME OF OROPHARYNGEAL AND ORAL CAVITY CANCER: COMPARISON WITH MR IMAGING AND VALIDATION WITH SURGICAL SPECIMEN

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Background
18F-FDG-PET/CT is increasingly used in the diagnosis and staging of head and neck cancer. Our aim was to evaluate the impact of adding combined 18FDG-PET/CT to MRI for T and N staging of the oral and oropharyngeal cancer and calculation of the gross tumor volume (GTV) having the histopathology as reference standard.
Materials and Methods
PET/CT and MRI were performed in 66 patients with suspected oral and oropharyngeal cancer (41 primary tumors and 25 recurrent tumors) and nodal disease (114 nodes). Statistical analysis included the McNemar test, sensitivity, specificity for the diagnostic modalities as well as regression analysis, and Bland-Altman graphs for the calculated tumor volumes.
Results
There was no statistically significant difference between the two modalities compared to the pathological findings regarding the detection of the disease ($P \geq 0.72$). The sensitivity/specificity for tumor detection were 100/80% and 96.72/60% for MRI and PET/CT, respectively. The sensitivity/specificity for nodal metastases were 88.46/75% and 83.81/73.91% for MRI and PET/CT, respectively. In 18% of the cases the MRI-based T staging resulted in an overestimation of the pathologic tumor stage. The corresponding rate for PET/CT was 22%. Regarding the treated necks, both modalities showed 100% sensitivity for detection of the recurrent lesions. In necks with histologically N0 staging, MRI and PET/CT gave 22% and 26% false positive findings, respectively. The mean tumor volume in the pathologic specimen was 16.6±18.6 ml, the mean volume derived by the MR imaging was 17.6±19.1 ml while the estimated by PET/CT volume was 18.8±18.1 ml ($P \leq 0.007$ between the three methods). The Bland-Altman analysis showed a better agreement between PET/CT and MRI.
Conclusions
The diagnostic performance of FDG-PET/CT in the diagnosis and local staging of oral and oropharyngeal cancer is not superior to that of MRI. The GTV overestimation is also a significant drawback of both modalities.

PREOPERATIVE RADIOLOGICAL ASSESSMENT IN PEDIATRIC PATIENTS WITH COCHLEAR NERVE APLASIA

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Background
To verify the contribution of radiological tests, in particular Multi Slice Computed Tomography (MSCT) and Magnetic Resonance Imaging (MRI), in the correct choice of candidates for an Auditory Brainstem Implantation (ABI).
Materials and Methods
28 children with sensorineural hearing loss (SNHL) were included in the study (average age 5,6 y, range 11 m-16 y). During the preoperative assessment they underwent a complete pattern of functional examinations, to prove their hearing impairment, and then a MSCT scan, focused on the temporal bone, and brain/cerebello-pontine angle MRI. All the patients subsequently were implanted with ABI.

Results
CT and MRI confirmed suspected congenital malformations of the inner ear structures in all patients (28/28). Every children had a cochlear nerve aplasia (28/28) and in 16/28 of them this condition was associated with cochleovestibular anomalies: in particular, 7/16 patients had a common cavity, 4/16 had a type 1 incomplete partition, 4/16 had a type 2 incomplete partition and 1/16 had a simultaneous type 1 and 2 incomplete partition. 12/28 patients were without cochleovestibular anomalies: CT scan was able to suspect a cochlear nerve absence in 9/12 of them because of hypoplasia of the internal auditory canal (IAC); the last 3/12 children had a normal-sized IAC, so in those cases MRI resulted essential for the diagnosis.
Conclusions
Preoperative assessment is mandatory in patients with SNHL, in order to choose the best treatment. CT provides the correct information about the bony anomalies, while MRI is the only radiological examination, which is able to highlight the absence of the VIII cranial nerve or central nervous system diseases.

COMBINED EARLY AND LATE CONTRAST ENHANCEMENT WITHIN ONE CT SCAN IN THE EVALUATION OF DEEP NECK INFECTIONS

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Background
In comparison to other parts of the body such as the thorax and abdomen, relatively little work has been performed to improve CT imaging of the skull base and neck. We report our early experience with a CT protocol that includes early and late contrast enhancement during the same scan for the evaluation of deep neck infections.
Materials and Methods
During the first half of 2009, 17 patients (7 women, mean age 39 years, range 19-82 years) with clinical suspicion of deep neck infections were imaged with a our new CT protocol developed on the basis of previous experience. Imaging consisted of contrast enhanced CT with iodixanol 320 (70 ml at 3 ml/s, 35 s acquisition delay and 70 ml at 3 ml/s, 2-3 min acquisition delay) followed by a saline flush. CT was performed using a 64 or 16 channel MDCT scanner (LightSpeed, GE Healthcare) equipped with automated tube current modulation. Patients were scanned from the skull base to the thorax aperture with a slice collimation of 0.625 mm. Multi-planar reconstruction images were obtained in the axial and coronal planes with a thickness of 2.5 mm. Enhancement values of abscesses, rim, carotid artery, jugular vein and jugular bulb at the skull base were recorded.
Results
According to CT, the site of infection was tonsils (n=11), dental (n=3), salivary gland (n=2) and postoperative wound (n=1). Thirteen of 17 patients had abscesses confirmed at surgery or by aspiration of pus while 4 patients had inflammatory changes, but no abscess. The mean attenuation value of the hypodens centre was significantly lower than the surrounding rim of abscesses (25 vs. 110 HU, p=0.004). Excellent contrast media opacification above 120 HU of neck vessels was achieved in all patients. Minor streak artifacts from concentrated contrast medium in the supraclavicular vessels were recognized in two patients.
Conclusions
It is possible to combine the advantages of early and late contrast enhancement within one CT scan in the evaluation of patients with deep neck infections. Excellent anatomic visualization was achieved, including stable contrast opacification of vessels and rim enhancement of abscesses

TREATMENT OF CRANIAL DURAL ARTERIO VENOUS FISTULAE (DAVF) BY ENDOVASCULAR INFUSION OF ONYX: OUR EARLY EXPERIENCE IN 9 PATIENTS

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Background
Endovascular treatment of cranial DAVF has been accepted practice. Most centres use platinum coils or N- butyl- cyano acrylate for this treatment. We evaluated the technical aspects, efficacy and safety of endovascular infusion of Onyx as an alternative primary treatment.
Materials and Methods
We did a retrospective analysis of 7 patients with cranial DAVF who were treated in our institution, a tertiary neurosciences unit over a 12-month period (Year 2006). Clinical and radiological data were reviewed.
Results
7 patients with a mean age of 58 years and a male: female ratio of 3:4 were identified. Spontaneous sudden onset tinnitus in 3, brainstem haemorrhage and hydrocephalus in 2, spontaneous frontal lobe haemorrhage in 1 and sudden onset tinnitus following an assault in another. 5 patients had Cognard Type 1; I had Type 2 and another Type 4.
Onyx was the sole embolic material used in 5 patients. Platinum coils and N- butyl- cyano acrylate were used in addition to Onyx in 2 patients in the treatment of large and complex fistulae. Trans arterial route was chosen in all treatment procedures, except in one, where closure was achieved during a third stage procedure via trans venous approach from direct internal jugular puncture. Angiographic obliteration was achieved in 6, and one patient is awaiting a second stage treatment procedure for a small residuum. Complete obliteration was achieved in a single treatment procedure in 3 patients, a second stage procedure was necessary in 2 patients, and another needed a third stage procedure. 1 patient is awaiting a second stage procedure.
6 patients are asymptomatic following completion of treatment. Recently treated one patient with a smaller residuum on the follow up angiogram, continues to have tinnitus, although less severe.
Complications include post embolisation transient limb weakness and sensory inattention where there was a minimal reflux of Onyx into the posterior cerebral artery, rotatory nystagmus corrected with lens in a patient where anterior inferior cerebellar artery had to used to access the feeder and persisting mild truncal ataxia in another patient who presented with brainstem haemorrhage.
Conclusions
In this small series, endovascular infusion of Onyx proved to be a safe and effective option in the treatment of cranial dural arterio venous fistulae of various types (Cognard). Technical considerations of this treatment are discussed.

RADIOLOGICAL INVESTIGATION OF THE NECROTIZING EXTERNAL OTITIS (NEO)

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Background
To present and analyse the role of the initial and follow up MR imaging and CT – scans in a consecutive series of 15 patients with Necrotizing External Otitis (NEO)
Materials and Methods
15 patients suspected of NEO were studied with computed tomography (CT) and magnetic resonance imaging (MRI) with and without contrast enhancement of the cranium and mastoid region. The clinical diagnosis of NEO was based on the criteria of otitis externa refractory to conventional treatments, pseudomonas detection ,severe pain and history of diabetes mellitus or other immuncompromizing conditions . The initial CT images were evaluated to define the incidence of soft tissue thickening and cortical erosion in the external auditory canal (EAC), and of medullary trabecular change and cortical erosion in the skull base. The initial MRI images of all 15

patients were evaluated for: infectious retrocondylar fat infiltration, parapharyngeal fat infiltration, lateral nasopharyngeal wall thickening, preclival soft tissue infiltration, skull base bone marrow infiltration, masticator space infiltration, condylar bone marrow infectious infiltration, dural enhancement in the middle and posterior cranial fossa and foramen magnum, and flow void abnormality of the internal carotid artery

Results

All patients (12 male and 3 female) were refractory to usual treatments for otitis externa and had severe ear pain . Additionally, 3 had a preexisting diagnosis of diabetes mellitus , 3 cardiovascular disease, 2 both diabetes mellitus and cardiovascular disease, 3 were immune suppressed. All patients had documented microbiological evidence of pseudomonas aeroginosa ear swab culture and 3 showed additionally staphyllococcus aureus and Enterococcus faecalis. The imaging studies (CT-MRI) of all 15 patients showed evidence of soft tissue lesions within the external auditory canal or periauricular, with MRI being sensitive in this term. These lesions were located along the external canal, mastoid, mandibular joint, supra and infraauricular, F.lacerum, epi-meso-parapharyngeal prevertebral areaand in the cerebellopontine cistern with sinusvenous thrombosis in one patient and cranial nerve palsies (fifth,sixth,seventh and twelfth nerves) in 3 patients .

CT-scan was more accurate in demonstrating bony destructions. 9 out of 15 patients demonstrated evidence of bony destructions in a variety of locations, which include the bony structures of the external auditory canal, matoid, petrous bone, clivus, mandibular joint and foramen lacerum . 3 showed involvement of the petrous apex, manifesting with cranial nerve palsies (twelfth, fifth , sixth). In three patients the infection extented to the middle ear with perforation of the tympanic membrane in 2 of them.

Conclusions

CT scanning was found to be a fast and economical tool in the initial assessment of patients with necrotiting external otitis with superiority in detecting bony involvement. MRI was superior in delineating the soft tissue involvement, inflammatory extent, bone marrow and cranial nerve involvement. It was also superior in early diagnosis the soft tissue involvement without bony erosion .

IS PERFUSION COMPUTED TOMOGRAPHY (CTP) PREDICTIVE OF RESPONSE TO CHEMORADIOTHERAPY AND DISEASE FREE SURVIVAL (DFS) AT 2 YEARS IN PATIENTS WITH LOCALLY ADVANCED SQUAMOUS CELL CARCINOMA OF THE UPPER AERODIGESTIVE TRACT TREATED WITH CHEMORADIOTHERAPY?

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Background

Concurrent chemotherapy and radiotherapy have the best local and regional control in the group of patients, with locally advanced squamous cell carcinoma (SCC) of the upper aerodigestive tract, who desire organ preservation or have unresectable disease; however toxicity, local failure and distant recurrences remain significant problems. We evaluated if CTp can predict response to chemoradiotherapy and DFS at 2 years in this group of patients.

Materials and Methods

Thirty-one patients with locally advanced SCC of upper aerodigestive tract were prospectively enrolled from February 2005 to June 2007, all candidated to induction chemotherapy followed by chemoradiotherapy.. All patients underwent CTp and a thin-section (1.2 mm thickness) MDCT for tumour volume assessment in the same sitting at baseline. CT Perfusion 3 software (GE, Milwaukee, US) was used for CTp analysis, providing the following parameters: blood flow (BF), blood volume (BV), mean transit time (MTT) and permeability surface (PS). Tumour volume was calculated with sum-of-areas technique (sum of all tumor areas, obtained by the regions of interest (ROIs) that were manually drawn along visible margins of the tumor, in each slice where it was detectable, multiplied by slice thickness). CTp parameters and volumes were correlated with response to chemoradiotherapy and DFS at 2 years. Data analyses were carried out by Wilcoxon-Mann-Whitney nonparametric test, log-rank test and Cox regression.

Results
Three patients were excluded for toxicity and 3 patients were lost at follow-up. Among the twenty patients who had complete response after chemoradiotherapy, baseline PS was significantly lower in those with DFS at 2 years than in those who had recurrence within 2 years (p=0.03), also after adjusting for age and stage (p=0.003). Survival analysis indicated that increasing baseline PS value significantly increased the risk of recurrence (HR; 95%CI=1.37; 1.10-1.71). No correlation was found for other CTp parameters and for tumor volume.
Conclusions
Lower PS at baseline seemed to predict a better outcome in our cohort of patients; further studies are required to confirm this preliminary observation.

FOLLOW UP OF SQUAMOUS CELL CARCINOMA OF THE ORAL CAVITY/OROPHARYNX: SHOULD WE RECONSIDER THE ROLE OF MRI?
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Background
To assess the role of MRI in the follow up of patients treated for SCC of the oral cavity/oropharynx.
Materials and Methods
149 consecutive patients treated for SCC of the oral cavity (67/149) and oropharynx (82/149) were followed up – clinically and with MRI - during the period 2005-2009. Primaries were classified as Tis (1/149), T1 (28/149), T2 (59/149), T3 (17/149) and T4 (23/149). 97/149 patients had surgical treatment (combined with chemotherapy and/or RT in 52/97), 52/149 had non-surgical treatment (15/52 RT alone, 37/52 combined radio-chemotherapy). Overall, 318 MRI examinations were reviewed, findings were matched to clinical examinations. Pathology (biopsies and surgical specimens) or subsequent follow up examinations were adopted as gold standard.
Results
15 recurrences were seen in 14 patients (10.1%), 5/15 occurred on N. As for the detection of recurrences of T, MRI had sensitivity 80%, specificity 96.4%, NPV 99.3% and PPV 42.4%; clinical assessment showed sensitivity 60%, specificity 98.6%, NPV 98.6% and PPV 60%. Accuracies of the two modalities were not statistically different (p=NS).
Conclusions
Though the results may be influenced by the low prevalence of recurrences, in this series MRI did not prove to add to clinical examination.

PLANNED NECK DISSECTION AFTER CHEMIORADIOTHERAPY IN LOCALLY ADVANCED HEAD AND NECK CANCER: ROLE OF NECK US, MRI AND PET-TC IN DETECTING RESIDUAL NECK DISEASE.
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Background
The role of planned neck dissection after chemioradiation therapy for locally advanced head and neck cancer is evolving. Routine planned neck dissection adds significant morbidity to treatment and should ideally be avoided in those patients in whom surgery is either unnecessary (no residual tumor). Recent data suggest that a percentage of patients with extensive (N2-N3) neck disease who demonstrate a complete response to chemoradiation therapy may harbor residual occult metastases, and identification of this subset of patients remains a clinical challenge.

The purpose of this prospective study was to determine the ability of neck ultrasonography (US), magnetic resonance image (MRI) and positron emission tomography (PET) in detecting residual cervical metastasis after chemoradiation therapy in patients with advanced nodal disease to identify the subset of patients who would benefit of planned neck dissection from those who will not.

Materials and Methods

29 patients with clinical neck disease staged as ≥N2 have been enrolled in the study. All patients were treated with radical chemioradiation therapy. After 12 weeks 21 patients were evaluated with neck US, MRI and PET. Regardless clinical and radiological response all patients were underwent neck dissection. The remaining 8 patients are currently waiting for completation of the imaging evaluation and are not included in the study.

Results

The histhopathological node status of each patients were compared to imaging findings (US, MRI and PET) to determine the specificity, sensibility and diagnostic accuracy of each radiological technique.

The sensitivity, specificity and diagnostic accuracy of neck US were 90%, 72.7% and 81% respectively. The sensitivity, specificity and diagnostic accuracy of MRI were 80%, 54,5%, and 66,7% respectively. The sensitivity, specificity and diagnostic accuracy of PET were 40%, 90,9%, and 66,7% respectively.

Conclusions

Our preliminary results indicate that PET performed 12 weeks after chemioradiation therapy has the highest specificity in the detection of residual disease. Neck US has the highest sensitivity with the best negative predictive value. MRI has high sensitivity but a low specificity.

Based on this preliminary analysis we suggest that patients with no clinical residual disease in the neck and negative MRI, US and PET 12 weeks after definitive chemioradiation therapy are highly reliable for the absence of residual cervical nodal disease and can be safely observed avoiding neck dissection and its complications. In patients with clinical residual nodal disease in the neck and metabolically inactive radiological pattern (negative PET, no contrast enhancement and low signal in T2 and fat suppressed sequencies at MRI and no vascularization at US)12 weeks after chemioradiation therapy selective neck dissection is feasible. In patients with positive PET, neck US or MRI a planned modified or radical neck dissection is advisable.

NECK ADENOPATHY: A LEVEL HEADED APPROACH TO DIAGNOSIS

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Background

The ability to distinguish infection from tumour lies in both the pre-test probability and the discriminatory power of the test. This study assesses the incidence of pathology confined to the anterior triangle compared with the posterior triangle and the accuracy of ultrasound for diagnosis.

Materials and Methods

Prospective data from consecutive cases referred for neck ultrasound and FNA between January 2003 and April 2009 were retrospectively reviewed to show differences between pathology confined to the anterior triangle and pathology involving the posterior triangle. Ultrasound diagnoses were correlated with cytology and microbiology. Histology was used as an arbiter in cases where FNAC was non-diagnostic or when there was discrepancy. Ultrasound examination by a single operator identified the site of the abnormal nodes, likely diagnosis, and guided the FNA. The final diagnosis for anterior triangle and posterior triangle was contrasted to identify differences in disease presentation. Accuracy of the ultrasound diagnosis was assessed against the final diagnosis on cellular pathology and microbiology. Non diagnostic aspirates with no histological or microbiological confirmation were excluded.

Results

Over 75 months 565 consecutive cases were assessed. The mean age was 47 (range 8-95 years). Of these 297 had adenopathy confined to the anterior triangle and 268 had adenopathy in the posterior triangle. There were significant differences in the distribution of diseases presenting as posterior triangle adenopathy. The following causes of adenopathy are more common in the

posterior triangle: TB (34% vs. 12%) , lymphoma (12% vs. 4%), and Kikuchi's disease (2% vs, 0%). Metastatic malignancy is more commonly seen in the anterior triangle (21% vs 12%). Only 6% of FNACs were non-diagnostic. Of those cases with a cellular diagnosis, 92% of ultrasound diagnoses were concordant with the final diagnosis. This was similar for both adenopathy confined to the anterior triangle and posterior triangle adenopathy.

Conclusions

TB adenitis and lymphoma are significantly more likely to be the cause of posterior triangle adenopathy and metastatic nodal disease more likely in the anterior triangle. Ultrasound is reliable to discriminate between these aetiologies.

POSTERIOR TRIANGLE ADENOPATHY: WHICH ULTRASOUND CLUES TO CHOOSE

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Background

The causes of adenopathy in the posterior triangle differ from that in the anterior triangle. Common causes in the posterior triangle are TB (due to our high immigrant population), lymphoma, metastases and reactive nodes. The purpose of this study is to identify the ultrasound features with the highest sensitivity for suspected aetiologies.

Materials and Methods

Consecutive cases referred for neck ultrasound and FNAC were correlated with cytology and, when appropriate, microbiology. Histology was used for discrepant cases or where cytology was non-diagnostic. Cases were excluded where there was no confirmed diagnosis on cytology, microbiology or histology. The patterns of US appearances for the common diagnoses were identified using the following 8 features: size, shape, flow pattern, matted nature, unilateral or bilateral involvement, presence of necrosis, echogenicity and hilar preservation.

Results

Over 75 months 268 cases with posterior triangle adenopathy were identified, 11 of which were excluded as they had no confirmed cellular diagnosis. The mean age was 45 years (range 11-87 years). The commonest aetiologies were TB (36%), lymphoma (12%), metastases (12%) and reactive (36%). Other diagnoses include sarcoid, Kikuchi's and Rosai-Dorffman disease.

The most sensitive feature is peripheral flow for TB (98%), lymphoma (91%) and metastases (94%). For reactive nodes, central flow and ellipsoid shape (79-80%) are most sensitive. After identifying cases with both central flow and an ellipsoid shape to discriminate normal from abnormal nodes, the most useful features for distinguishing the common diseases are: TB- matted nature or hilar preservation (sensitivity 90%); lymphoma- hypoechogenicity or absence of hilar preservation (sensitivity 94%); and metastasis- hyper/isoechoic or necrotic appearance (sensitivity 80%).

Specificity is maximised by combining several features: TB- necrosis, hilar preservation and matted nature (96%); metastases- round shape, hyper/isoechoic appearance and peripheral flow (87%); lymphoma- round shape, hypoechogenicity and peripheral flow (66%); and reactive- central flow and ellipsoid shape (97%).

Conclusions

A peripheral flow pattern is the most sensitive (91-98%) US feature to identify TB, lymphoma and metastases within the posterior triangle. In addition to this, combinations of other features (necrosis, hilar preservation, matted nature, shape and echogenicity) improve specificity of ultrasound diagnosis, achieving specificities of 66 – 96%.

PATTERNS AND SEVERITY OF BENIGN LYMPHOID HYPERPLASIA ON MRI IN PATIENTS REFERRED FOR SUSPECTED NASOPHARYNGEAL CARCINOMA.

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Background
MRI is an established complementary investigation for patients referred for suspected nasopharyngeal carcinoma (NPC). Emerging evidence suggests MRI may have a primary role in screening of high risk patients as it may achieve accuracies at least equivalent to endoscopy and biopsy alone. In this context, awareness of the range of benign MRI nasopharyngeal appearances in the high risk group is important although, to date, this has not been systematically reviewed nor is it known whether this differs significantly from the normal population.
Materials and Methods
We retrospectively reviewed MRI studies of the nasopharynx, performed as part of a screening study in our institution, in 106 patients with suspected NPC based on clinical symptoms or abnormal serology who had a final benign histological diagnosis. These were compared with a control population of 100 patients who had undergone MRI that included the nasopharynx, performed for indications unrelated to nasopharyngeal, infective or lymphoproliferative pathology. Mucosal thickness at different sites within the nasopharynx was recorded and combined to produce an overall grade for the severity of lymphoid hyperplasia. This was correlated with histologic findings from subsequent nasopharyngeal biopsy in the screening group. Other findings including mucosal pattern, presence of asymmetry and cysts were also documented.
Results
In the NPC screening group without cancer (SWOC), normal nasopharyngeal mucosa, mild, moderate and severe lymphoid hyperplasia were found in 24%, 42%, 27%, 7% patients, compared to 56%, 37%, 6%, 1% of controls. A higher severity of lymphoid hyperplasia was found in the SWOC group ($p<0.0001$) and correlated with the presence of lymphoid follicles ($p<0.001$) and acute inflammation ($p<0.03$) on histology. In particular, mean adenoid thickness in the SWOC group (7.4±5.3mm) was higher than in controls (4.2±3.1mm), $p<0.0001$. A striped appearance of the adenoids was seen in 25% of the SWOC group, and 41% contained cysts. Asymmetry of the mucosa between right and left sides was seen 4% of SWOC patients and 1% of controls.
Conclusions
Awareness of the variable morphological appearance and higher grade of lymphoid hyperplasia in patients referred for suspected NPC is important to avoid false positives on MRI. In this context, the presence characteristic adenoid stripes can be used to delineate enlarged adenoids from other masses including NPC in a quarter of high risk patients. Furthermore, mucosal asymmetry caused by lymphoid hyperplasia is an uncommon finding in this group, which is promising as it suggests that this sign may have a high positive predictive value for NPC.

WHAT SHOULD BE THE 'GOLD STANDARD' CLINICIAN REQUIREMENTS FOR SUCCESSFUL FINE NEEDLE ASPIRATION UNDER ULTRASOUND GUIDANCE?

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Background
Fine needle aspiration (FNA) with ultrasound guidance is performed in most imaging centres. It is a simple yet safe and effective tool in the diagnosis of head and neck lumps.
Aim: The aims of this study were to carry out a retrospective survey to assess the success rates for fine needle aspiration under ultrasound guidance from different sites in the head and neck region, performed under different clinical conditions to try to determine the ideal 'gold standard' clinician requirements to obtain the highest possible diagnostic yield.
Materials and Methods
Hospital records of all patients with head and neck lumps, investigated with fine needle aspiration under ultrasound guidance by dental and maxillofacial (DMF) radiologists at 2 hospitals in the UK

between January 2007 and June 2009, were analysed. The patients were divided into 4 groups depending on where they were investigated and by whom.
Group A – Hospital 1 (A1) - FNAs were performed by one DMF radiologist specialising in head and neck FNA with a biomedical scientist (BMS) in attendance.
Group B- Hospital 1 (B1) – FNAs were performed by the same operator as group A1 but with no BMS in attendance.
Group C – Hospital 1 (C1) - FNAs were performed by various DMF radiologists, but who do not perform FNA routinely, and with no BMS in attendance.
Group D – Hospital 2 (D2) - FNAs were performed by the same operator as Group A1, but at the second hospital, and with no BMS in attendance.
In Hospital 1, all FNAs were reported by a team of cytologists while in Hospital 2 the reports were done by a team of pathologists.
For each Group of patients the sites of FNA were separated into lymph nodes, thyroid tissue, mass (excluding thyroid, salivary and lymph nodes) and salivary gland tissue.
Results
A total of 530 patients were seen in both hospitals. 307 in Group A1, 109 in Group B1, 73 in Group C1 and 41 in Group D2. Success rates were 93.5% for Group A1, 88.1% for Group B1, 74% for Group C1 and 63.4% in Group D2. Without the BMS present, thyroid and mass lumps were found to be the most difficult sites to obtain adequate cell samples.
Conclusions
The highest success rate of 93.5% was achieved when the FNAs were performed by an experienced radiologist, routinely performing FNAs, with BMS in attendance and working in collaboration with a competent and experienced cytologist. This combination is recommended as the 'gold standard' of clinical care to maximise diagnostic yield from FNAs of head and neck lumps.

OCCULT PRIMARY HEAD AND NECK TUMORS - FDG PET CT

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Background
To assess the value and long term patient survival of [F-18] fluorodeoxyglucose positron emission tomography computed tomography in patients with squamous cell and undifferentiated cancer neck nodes and no primary site on conventional assessment.
Materials and Methods
78 patients with neck nodal metastases from an unknown primary cancer were studied. PET/CT was performed in all patients 1 hour post FDG injection and results were corelated with histological verification. Survival rates were reviewed an average of 4.3 years after the initial PET/CT scan.
Results
Uptake suspicious of an occult primary cancer on PET/CT was seen in 46/78 (59%) of patients. Subsequent investigations confirmed a primary site in 30 of the patients in the base of the tongue, pharyngeal palatine tonsil, post cricoid and lung. PET/CT diagnosed primary cancers in 30/78 patients (38.5%), showing a sensitivity of 100% and a specificity of 66.7%.
Follow up data after an average of 4.3 years following the initial PET/CT scan showed that patients with occult neck nodes, who had their primary tumour initially identified on PET/CT, demonstrated a significant survival advantage ($p \leq 0.01$).
Conclusions
It appears that FDG PET/CT is of considerable value in the assessment of patients with occult head and neck cancers and is associated with a long term survival advantage for patients with occult primary head and neck tumours, whose primary site was initially identified on PET/CT

FEASIBILITY OF REAL TIME HEAD AND NECK ULTRASOUND FUSED WITH CT AND MR 3D VOLUMES. WORK IN PROGRESS.

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Background

Background. CT and MR are the Imaging techniques of choice to assess the local extent of upper aero-digestive tract neoplasms. Frequently, the neck nodal metastases suspected on CT or MR undergo US-FNA citology. Though CT or MR studies are available, a precise topographic correlation of the neck node suspected with real time US findings may be difficult because of the different imaging plane or due to a lesser familiarity with MR or CT of the neck.
The aim of the study is to assess the feasibility and accuracy of the fusion of 3D CT or MR volumes with US real time Imaging.

Material and Methods

Twenty-one patients affected by H&N SCC who underwent to CT or MR have been subsequently imaged by US (GE HEALTHCARE LOGIQ E9). The LOGIQ E9 employs electromagnetic tracking sensors (EMT) for volume navigation. The CT and MR volumes of the head and neck had been obtained after contrast agent administration, isotropic voxels of .7 mm were acquired. Two types of synchronization of CT or MR with US were available. The standard fusion mode required to identify on real time US and CT or MR volumes three reference points, the best fusion mode permitted to match up to 10 points. The time required to obtain fused US-CT/MR and spatial resolution accuracy (spatial mismatch) were evaluated.

Results

The fusion between CT or MR and US was obtained in all patients. For the standard fusion mode the most distal point of the thyroid midline (first reference point, mandatory in the axial plane) and both carotid bifurcations (splitting of the common carotid artery) were selected (second and third reference points, axial or para-axial plane). The average time required to fuse CT or MR volumes with the US anatomy in the standard mode was 30 seconds. A mean shift of about 3 mm was computed between CT/MR and US equivalent structures. When best fusion mode was used, additional points from different structures were selected (up to 8), the shift between the center point of US and equivalent CT or MR structures ranged from 1.2 to 1.5 mm. The average time required to select the additional reference points did not exceed 3 minutes.

Observations

According to our results, fusion imaging is feasible; the spatial accuracy varies according to the fusion mode selected. When side by side correlation between real time US is sufficient to correlate the two anatomies, the standard fusion mode is adequate. If superimposed CT/MR-US images are necessary (as in selecting a target to biopsy), a more precise registration is required, and needs additional reference points and additional time. Next steps are the introduction of the EMT-biopsy system and the fusion with CT-PET volumes. With these two advances, both the identification and sampling of biological active targets on US-FNA citology will greatly improve.

FUNCTIONAL IMAGING OF PAROTID GLANDS USING DIFFUSION-WEIGHTED ECHO-PLANAR MRI: EVALUATION OF DIFFERENT STIMULATION METHODS AND DIFFERENT B VALUE SETTINGS

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Background

The purpose was to evaluate the influence of different oral stimulation methods and different b value settings for measuring different functional conditions of parotid glands using diffusion-weighted (DW) echo-planar imaging (EPI).

Materials and Methods

Twelve healthy volunteers were examined with a DW EPI sequence using a 1.5 T system (b factors: 0, 500, and 1,000 sec/mm2) once prior and 17 times after oral stimulation. Volunteers

were prospectively randomized in two groups and examined three times. Group A was stimulated for first and third examination with 5 cc of a commercially available lemon juice, secondly with a 500 mg tablet of ascorbic acid. Group B was stimulated at first and third examination with ascorbic acid, secondly with lemon juice. ADC maps were generated with two different b value settings (setting one: 0, 500, and 1,000 sec/mm2, and setting two: 500, and 1,000 sec/mm2) and evaluated with a manually placed region of interest (ROI) containing the entire gland. Measurements were performed by two independent observers. For evaluation of interobserver variability an intraclass correlation was computed. For further comparison, the Student's t test, and an ANOVA with post hoc comparison was used.

Results

The intraclass correlations were calculated between 0.96 and 0.99 for all measurements. The mean value for all volunteers prior to stimulation with lemon juice was 1.09 x 10 ⁻³ mm ²/sec (SD ± .08) and 1.1 x 10 ⁻³ mm ²/sec (± 0.09) prior to stimulation with ascorbic acid. In all volunteers first measurement after stimulation showed an increase of ADC. The ADC after stimulation with ascorbic acid (1.21 x 10 ⁻³ mm ²/sec ± 0.11) proofed to be significant higher compared to stimulation with lemon juice (1.17 x 10 ⁻³ mm ²/sec ± 0.12; p= 0.005). Over 14 measurements ADC decreased stepwise to the initial ADC value for both stimulation methods. Both groups showed no statistical significance between first and third examination (p=0.53 to 0.99). Setting one for b values caused significant higher ADC values for every measurement compared to setting two (p=0.001 to 0.033), but no change in ADC course.

Conclusions

DW EPI imaging displays functional changes in parotid glands with high reproducibility. The stimulation method and the choice of b values have influence on the extent of ADC changes, but not on the course.

DIFFUSION-WEIGHTED ECHO-PLANAR MRI OF PRIMARY PAROTID GLAND TUMORS: DOES A HIGHER B VALUE SETTING IMPROVE THE DIAGNOSTIC POTENTIAL?

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Background

The purpose was to determine the influence of different b value settings regarding the value of diffusion-weighted (DW) echo-planar (EP) magnetic resonance (MR) imaging in differentiating various entities of primary parotid gland tumors.

Materials and Methods

149 consecutive patients with a suspected tumor of the parotid gland were examined with a DW EP sequence using a 1.5 T unit. ADC maps were generated with two different b value settings (setting one: 0, 500, and 1,000 sec/mm2, and setting two: 500, and 1,000 sec/mm2) and evaluated with a manually placed ROIs containing the entire tumor. Analysis was performed by two radiologists independently and intraclass correlation coefficient was computed. Histological diagnosis was obtained in every patient. For comparison of apparent diffusion coefficients (ADC), paired two-tailed Student t-test with Bonferroni correction was used.

Results

In 129 patients a primary parotid gland tumor was confirmed by histology. Among the observers a high correlation was calculated (0.98). For setting one, ADC values of pleomorphic adenomas (2.09 x 10-3 mm2/sec ± 0.16; mean ± standard deviation) were significantly higher than all other entities, except for myoepithelial adenomas (1.86 x 10-3 mm2/sec ± 0.18; p=0.54). ADC values of Warthin tumors (0.85 x 10-3 mm2/sec ± 0.1) were different from myoepithelial adenomas, lipomas, and salivary duct carcinomas (p<0.001, 0.013, and 0.037, respectively). Mucoepidermoid carcinomas, acinic cell carcinomas, and basal cell adenocarcinomas were not differentiable from Warthin tumors (p=0.094, 0.396, and 0.604, respectively). For setting two, ADC range of all tumors was lower, and only pleomorphic adenomas (1.88 x 10-3 mm2/sec ± 0.09) and

myoepithelial adenomas (1.69 x 10-3 mm2/sec ± 0.11) were distinguishable from all other entities (p=0.03 to 0.001). All other entities could not be differentiated based on ADC values.
Conclusions
DWI has a potential for differentiation of various entities of primary parotid gland tumors. Choosing a higher b values impairs the potential of DWI in differentiating primary parotid gland tumors.

SINONASAL WEGENER GRANULOMATOSIS: SPECTRUM OF FINDINGS AND ANALYSIS OF THE ROLE OF MRI IN 28 PATIENTS
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Background
To assess the patterns of presentation of sinonasal Wegener granulomatosis and to evaluate the impact of MRI in the diagnostic work-up.
Materials and Methods
Retrospective review of 28 MRI examinations performed in patients (17 male, 11 female; age range 13-74 yr) affected by WG in its active phase. Nasal cavities and paranasal sinuses were scrutinized for the presence of mucosal thickenings and signal patterns before and after contrast application were recorded. Bone changes, cranial nerves abnormalities, and lesions within the orbit and deep spaces of the face were also assessed.
Results
Bilateral mucosal thickenings were seen in 15/28, monolateral thickenings in 7/28, no mucosal abnormality in 6/28. WG involvement of sinonasal mucosa was suggested on MRI by mucosal thickenings with hypointense T2 signal in 10/28 patients (35.7%); in 7/9 patients contrast enhancement was moderate. Among the 12/28 patients with mucosal signal pattern indistinguishable from aspecific chronic rhinosinusitis, six exhibited bone erosions highly suggestive of localization of the disease. Finally, in 6/28 patients sinonasal involvement could be reasonably ruled out based on absence of clinical signs and symptoms and on normal MRI findings.
Conclusions
Overall MRI was inconclusive as to sinonasal involvement of WG in only 6/28 (21.4%) patients. In addition, MRI may play a role in improving the targeting of sinonasal biopsies, thus increasing their diagnostic accuracy.

DETECTION OF NASOPHARYNGEAL CARCINOMA: ACCURACY OF MRI OF THE NASOPHARYNX IN HIGH RISK PATIENTS.
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Background
Nasopharyngeal endoscopic biopsy is used to detect undifferentiated nasopharyngeal carcinoma (NPC) in patients with a high index of suspicion for NPC based on clinical findings or abnormal serology. The majority of patients who undergo endoscopic biopsy do not have NPC, while small NPCs located in the submucosa or deep in the fossa of Rosenmuller may escape detection. The aim was to determine the accuracy of MRI of the nasopharynx in detecting primary NPC, and thus determine whether MRI can be used as a screening test to firstly identify normal patients who do not require endoscopic biopsy and secondly detect small tumours that may be missed by endoscopic biopsy.
Materials and Methods
Patients considered at risk of NPC were recruited for this prospective study with informed consent. All patients underwent MRI of the nasopharynx followed by endoscopy and biopsy. Any lesion suspected to be NPC on endoscopic inspection underwent biopsy, while random biopsies were performed in patients with an endoscopically normal nasopharynx. After analysis of the results of MRI and endoscopic biopsy, any patient with a normal biopsy but abnormal MRI returned for a repeat biopsy targeted to the site of the MRI abnormality.

Results

149 patients underwent investigation of which 47 ultimately had NPC and 102 did not have NPC. MRI correctly diagnosed 47 patients with NPC and 98 patients without NPC (sensitivity 100%, specificity 96%, NPV 100%, PPV 92%, accuracy 97%). There were four false positive cases on MRI which arose in patients who were found to have benign lymphoid hyperplasia. Endoscopic biopsy correctly diagnosed 45 patients with NPC and 102 patients without NPC (sensitivity 96%, specificity 100%, NPV 98%, PPV 100%, accuracy 99%).The two false negative cases on endoscopic biopsy arose in patients with small tumours deep in the fossa of Rosenmuller that were finally confirmed after repeat biopsies targeted to the site of the tumour demonstrated on MRI.

Conclusions

MRI of the nasopharynx is an accurate tool for detecting NPC. It has the potential to be used to screen out normal patients who do not require endoscopic biopsy and improve detection of small tumours that may be missed by endoscopic biopsy.

ABSTRACTS of POSTERS

P. 001 POSITIONAL VERTIGO ASSOCIATED WITH PNEUMOLABYRINTH: RARE COMPLICATIONS OF STAPES SURGERY

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Background

To present a rare delayed complication of stapes surgery, represented by an intractable paroxysmal positional vertigo, corresponding to a pneumolabyrinth, involving vestibule, cochlea and semicircular canals on Computed Tomography (CT) examination.

Materials and Methods

In 1981 a 67-year-old-man had a successful stepedectomy on his left ear because of otosclerosis. In 1989 the patient had a barotrauma; after that episode he started to suffer from left side severe hearing loss, tinnitus in his left ear, so he performed a CT scan that showed a possible dislocation of the prosthesis without inner ear involvement. Many functional test and therapy were tried without satisfaction. From September 2008 the patient suffered disabling episodes of positional vertigo that were treated with liberatory maneuvers for 4 months without any improvement. In January 2009 the patient performed a new high resolution CT scan, focused on the temporal bone using a specific bone window.

Results

The high resolution CT scan showed the presence of a pneumolabyrinth with air **in the** vestibule, cochlea and semicircular canals; the prosthesis was not clearly identifiable. The following explorative surgery confirmed the CT findings and allowed closure of the large defect of the stapes footplate. After the procedure the patient had no more episodes of disabling positional vertigo.

Conclusions

This is the second description in Literature of pneumolabyrinth as late complication of stapes surgery and it represents the most delayed case ever described (28 years after the procedure). Even if this condition is so rare, a high resolution CT scan ought to be performed in these patients in order to understand the pathogenesis of their symptoms and treat them properly.

P. 002 THE ROLE OF IMAGING IN THE PRE- AND POST- OPERATIVE ASSESSMENT OF ACTIVE MIDDLE EAR IMPLANTS.

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Background

Middle ear implants have been used in the treatment of conditions such as otosclerosis for a number of years with much success. These usually take the form of Total or Partial Ossicular Replacement Prostheses (TORPs and PORPs). More recently the number of Vibroplasty (active middle ear implant) procedures has increased with direct implantation into the round window possible as well as the more traditional oval window/stapes approach. There is little in the current radiology literature regarding these devices.

Materials and Methods

Indications for active middle ear implants will be covered along with those design features that influence placement and surgical approach. Their differences from traditional TORPs and PORPs will be highlighted. The status of the mastoid, middle ear, ossicular chain, round window and facial nerve are crucial pieces of information in the pre-operative assessment to ensure correct patient selection and reduce the risks of device failure/ complications. Radiology in the form of high-resolution helical CT is essential to provide this information. We will systematically cover each area in our review, highlighting those features that influence patient selection.

Results
The place of imaging in the post-operative setting will also be briefly discussed.
Conclusions
Middle ear implantation is an expanding field, particularly with the introduction of vibroplasty devices that can not only be placed along the ossicular chain but also directly into the round window. This may help patients with mixed forms of hearing loss as well as those with conductive deafness alone. To do this safely and to select the correct patients high quality imaging and reports are crucial. It is essential that the Radiologist knows about the device, how it is placed and what factors influence the decision to implant. We aim to address these issues as there is little in the current Radiology Literature about them.

P. 003 ARTEFACTS AT HF-MRT (3T) IN HEAD AND NECK IMAGING

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Background
A large number of artefacts occur in Magnetic Resonance Imaging (MRI). They may be divided in artefacts that are mainly protocol dependent (aliasing, radiofrequency interference, shading, partial volume averaging) and artefacts predominantly inherent to physics of MRI (chemical-shift artefacts, motion and truncation artefacts and "ghosting").
Several artefacts are more pronounced at high-field MRT using a static magnetic field of 3.0Tesla.
Motion and truncation artefacts, as well as "ghosting artefacts", chemical-shift artefacts, flow related artefacts and susceptibility artefacts are all more pronounced at high-field MRT. Other artefacts only can be seen at hfMRI including standing wave artefacts due to dielectric forces.
Materials and Methods
We collected representative examples of artefacts at our institute acquired with a 3.0T system.
Results
1. Motion artefacts, Gibbs effect, Parallel-imaging techniques (PAT)
2. Chemical-shift artefacts
3. Magnetic Susceptibility (B0 inhomogeneity):
4. Standing wave effects (Dielectric forces)
5. Flow-related Artefacts
6. B1-inhomogeneity

Conclusions
There are clear benefits of high-field MRI (3.0T) such as higher signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR). Studies can be accomplished faster and there is better spatial resolution compared with lower field-strength (1.5T). However, some artefacts that are negligible at lower field-strength can be much more pronounced at higher magnetic field-strength. For some of those artefacts various compensation techniques can be applied.

P. 004 CLINICAL, HISTOPATHOLOGICAL AND IMAGING FINDINGS IN INTRAORBITARY EXTENSIONS OF PERIORBITAL LESIONS

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Background
The aim of this study is to present the clinic, histopathologic, and imagistic aspects of intraorbitary extension of different periorbitar lesions
Materials and Methods
A retrospective study was conducted using the clinical and imagistic records of 54 patients with periorbitary lesions explored with CT (n=30), CBCT(n=20) and MRI (n=4) between January 2004 –

January 2009, in the Radiology Department of the University of Medicine and Pharmacy Gr. T. Popa Iasi and University of Medicine and Pharmacy Iuliu Hatieganu, Cluj Napoca, Romania.

Results

The clinical findings of the evaluated cases were: unilateral exophthalmia (n=54), reduction of visual acuity (n=47), vision changes, diplopia, strabismus, choroidal folds, optic disc edema or atrophy, orbital congestion, globe displacement, lid retraction or blepharoptosis.

From the histological point of view the 54 lesions ware classified as: periorbitary abces (n=1), mucocel (n=2), fibrosarcoma SM (n=1), rabdomiosarcoma (n=1), accessory salivary gland pleomorphic adenoma (n=1), inflammatory pseudotumor (n=2), meningioma of the sphenoid great wing (n=3), ethmoidal and maxillary sinus carcinoma (n=31), intraorbitary extended lymphoma (n=2), subacute subperiostal hematoma (n=1), meningioma of the optical nerve sheath (n=2), neurofibroma (n=2), cavernous hemangioma (n=2) and fibrous displasya (n=3). CT, CBCT and MRI have shown the site of lesions and the extension pathways inside the orbit.

Conclusions

CT-CBCT-MRI investigations are offering the opportunity of a diagnosis, which correlated with the histological aspect of the lesions are leading to the use of a standard treatment plan.

P. 005 CORRELATION BETWEEN OLFACTORY SYSTEM ANATOMY AND OLFACTORY FUNCTION: A PRELIMINARY STUDY

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Background

The olfactory system is formed of several essential structures for the olfactory function : olfactory bulb (OB), olfactory tract in olfactory sulcus.

It's a preliminary study to establish a control's group to a study about the correlation between olfactory system anatomy and olfactory function in hyposmic population.

Materials and Methods

With 22 randomly selected subjects (12 men and 10 women, age range: 9 to 83 years), the present study aimed to build a data base of morphologic norms of olfactory system (olfactory bulb volume, depths of olfactory sulcus, lengths of olfactory sulcus) with a adapted protocol in a population qualified "standard". All participants were examined using a 3T MRI system (T1-weighted 3D TFE in coronal plane; T2-weighted VISTA 3D in coronal plane). The measurements of different studied parameters (BO volume, depth and length of olfactory sulcus OS) were performed by two independent observers. All participants received an olfactory test to eliminate subjects with olfactory deficit.

Results

It's a preliminary study to establish a control's group to a study about the correlation between olfactory system anatomy and olfactory function in hyposmic population. The sex don't need to be taken into account. No significant correlations between OB volumes and age were observed. The OB volume can be measured in a reliable way on coronal slices T1-weighted MRI. These results are then independing observers.

Conclusions

In conclusion there are not correlation between olfactory system and participants sex. OB volumes don't decrease with age. The OB volume is measured in a reliable way on coronal slices T1-weighted MRI and is not depending observers. The measurements on sagittal slices T2-weighted MRI are more fluctuating. Concerning the depth and the length of olfactory sulcus, other measures are necessary with a more precise method and more participants.

P. 006 CT MYELOGRAPHY IN OBSTETRIC BRACHIAL PLEXOPATHY

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Background
Part of patients with obstetric brachial plexopathy will not recover spontaneously and need reconstructive surgery. CT myelography evaluates damage to the intraforaminal spinal nerve roots which alters the surgical approach.
Materials and Methods
We studied all patients who underwent CT myelography and surgery between 2004-2008 in our institution. CT myelography was performed under general anesthesia using iodinated contrast medium administered intrathecally by lumbar puncture. Two blinded observers assessed multiplanar reconstructions of CT images of the cervical spine to Th2 for the quality of the examination, the presence or absence of the ventral or dorsal rootlets C5 to Th1 and avulsion cysts. Consensus reading was performed and intra-observer reproducibility calculated. Surgical reports will be correlated with these findings.
Results
Preliminary findings in a subgroup of 111 patients in which CT myelography was performed on an average age of 5 months revealed root avulsions for C5, C6, C7, C8 and Th1 in respectively 27%, 52%, 56%, 25% and 11%, with >50% of patients suffering from a root avulsion at at least one level.
Conclusions
Damage to intraforaminal or extraforaminal nerve roots require different operative techniques. By detecting intraforaminal root avulsions in a significant number of patients, CT myelography aids in pre-operative planning.

P. 007 ANATOMICAL VARIATIONS OF THE SPHENOID SINUS ASSESSED WITH MDCT

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Background
The aim of this study was to assess the incidence of the anatomical variations of the sphenoid sinus in 293 patients studied by multidetector computed tomography (MDCT).
Materials and Methods
The MDCT (64 rows) studies of the paranasal sinuses of 293 patients, performed in 2006-2009, were reviewed to assess anatomical variations of the sphenoid sinus and related neurovascular structures. Anatomical variations were evaluated on 1 mm thick MPR reformations, displayed on a high resolution workstation screen. Pneumatization of the anterior clinoid process (ACP), pterygoid recess (PR), protrusion of the internal carotid artery (ICA), optic nerve (ON), maxillary and vidian nerve into the sphenoid sinus, as well as insertion of sphenoid sinus septa on neurovascular canals were assessed. Onodi cells were also recorded.
Results
MDCT findings were: pneumatization of the ACP with ON protrusion in 78 patients (26.6%); Onodi cells in 107 patients (36.5%); PR in 83 patients (28%); protrusion of ICA in 107 patients (36%); protrusion of maxillary nerve in 120 patients (40%); protrusion of vidian nerve in 120 patients (40%); sphenoid sinus septa in 34 patients (11.6%); insertion of sphenoid sinus septa on neurovascular canals in 33 patients (11.25%), of whom on optic canal in 2 patients, on carotid canal in 30 patients, on vidian canal in 1 patient; in 1 patient (0.3%) maxillary and vidian nerves protruded in a right Onodi cell that formed a pterygoid recess.
Conclusions
Preoperative recognition of the anatomical variations by computed tomography is mandatory before FESS, to prevent surgical complications.

P. 008 COMBINED INTRA-ARTERIAL AND SYSTEMIC CHEMOTHERAPY AND RADIOTHERAPY FOR MAXILLARY CARCINOMA.

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Background
Recently, intra-arterial infusion chemotherapy has been established as a oragan preserving therapy for local advanced head and neck SCCs. High-dose cisplatinum infusion method as RADPLAT protocol is most popular, however, efficacy of the combined intra-arterial and systemic chemotherapy for maxillary carcinoma has not been well documented. The objective of this study is to optimize chemoradiotherapy for maxillary carcinoma.
Materials and Methods
Twenty-seven (consecutive) patients with maxillary carcinoma underwent combined intra-arterial and systemic chemotherapy with concomitant radiotherapy from 2004 to 2008. In all the patients, squamous cell carcinoma was proven histologically, and 19 men and 8 women (median 61 years) were included. T -stage was T2 (n=2), T3 [4], T4 (21), and the classified stages were II (2), III (3), and IV (22). Three-year overall survival rate (observation period 4-60 months) was assessed.
Chemotherapy regimen of DCF (docetaxel, cisplatinum and 5-FU) consists of intra-arterial infusion of 40mg/m2 of docetaxel via the femoral or brachial artery by Seldinger method on day 1 followed by intra-venous instillation 60mg/m2 of cisplatinum for one day, and continuous systemic 5-fluorouracil (5-FU) of 350-600mg/m2 day for 5 days from day 2. Radiotherapy was started from day one (total dose more than 60 Gy) for 4 weeks. The course of chemotherapy was repeated at least two courses to complete the treatment.
Results
Overall tumor response was CR (74.1%, 20/27), PR (22.2%, 6/27), PD (3.7%, 1/27). The CR rate of each stage was stage II (50%, 1/2), III (100%, 3/3), IV (72.2%, 16/22). In CR cases, feeding arteries (median 2.6) were fewer than those of PR and PD cases. Local-regional recurrence and cervical metastasis occurred in 5% and 10% in CR cases respectively. Seven cases (recurrence in the primary site: 5 cases; cervical lymph nodes: 2 cases) underwent salvage surgery. Three-year overall survival rate was 70.8%. In two cases with tumor-feeding arteries arising from the ophthalmic artery, we had to preserve visual function, resulting pCR.
Conclusions
Selection of the branch of internal maxillary artery seemed to be critical since only super-selective approach succeeded in CR in some cases.

P. 009 A PIT STOP TOUR OF THE SELLAR AND JUXTASELLAR PATHOLOGY

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Background
The pituitary gland is an important structure in the central skull base without which a number of other endocrine glands and end-organ systems would fail to function successfully. We will discuss a systematic approach to assessing intrasellar and juxtasellar lesions.
Materials and Methods
Knowledge of the microanatomy of the pituitary fossa is crucial to understanding the clinical presentation of patients with mass lesions in the sellar region. This allows the radiologist to accurately assess the extent of disease and to guide the clinician appropriately.
MR with its exquisite soft tissue detail and multiplanar capability forms the modality of choice, although CT can be a complimentary method in selected cases, to evaluate the degree of calcification within a lesion and assess bony detail.

A diagnostic pathway for assessing intrasellar and juxtasellar pathology is presented with particular reference to the anatomical and clinical picture. The commonest pathologies such as pituitary adenomas, apoplexy, craniopharyngioma and infundibular abnormalities are discussed, as well as more unusual pathologies such as granulomatous lesions and dural AV fistulas. Diagnostic dilemmas with potential for misinterpretation can occur even with common disorders.
Radiological input is vital in guiding the optimal treatment with management involving both medical and surgical therapy. Specific cases will be used to illustrate various pathologies and their management including current surgical techniques. Furthermore, post-treatment follow-up imaging will be outlined.
Results
A diagnostic pathway for assessing intrasellar and juxtasellar pathology is presented with particular reference to the anatomical and clinical picture. The commonest pathologies such as pituitary adenomas, apoplexy, craniopharyngioma and infundibular abnormalities are discussed, as well as more unusual pathologies such as granulomatous lesions and dural AV fistulas. Diagnostic dilemmas with potential for misinterpretation can occur even with common disorders.
Conclusions
Radiological input is important when assessing sella and juxtasellar pathology. It is important for all radiologists to be aware of the common radiological features and pitfalls when assessing this complex area.

P. 010 IMAGINS OF TRAUMAS OF CERVICAL SPINE

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Background
For imaging and diagnosis of cervical spine ussually sufficient conventional radiographs. After traumas in cycle is first reference method CT examination. Pre opperative is need 3 D CT imagine with reconstruction.
Materials and Methods
26 patients / at 5-70 years / by bycicle has becomme trauma of head and of cervical spine. Conventional radiographs detected luxations or spondylolisthesis . CT and mainly 3D CT demonstrated connection by medulla.
Results
11 patients had vertebral fractures, 4 had changes of intervertebral disc and neurological complications. 1/3 of patients has neurological symptoms indistinct
Conclusions
At indistinct neurological symptoms is very good 3D CT examination too. Sometimes also difficult has indistinct neurological manifestation.

P. 011 RADIOLOGICAL DIAGNOSTICS OF NEUROFIBROMATOSIS IN THE MAXILLOFACIAL AREA.

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Background
Neurofibromatosis of the first type (Recklinghausen disease) – a systematic hereditary disease that is characterized by congenital anomaly of the embryonal tissue anlages. The disease has a hereditary character according to the autosomal dominant type of inheritance. The diagnostics among the children of tender age is difficult. The disease is clinically evident when a child reaches the age of 5-15 years old due to the pigment spots, neurofibromas in the projection of the subdermal adipoid fiber and in the nerve trunks, and also to the skeletal dysplasia.

Materials and Methods
19 patients of 5-20 years old were examined. For the assessment of the soft tissue component the patients were examined with the help of US of high resolution, the assessment of the bone structures of the facial area was estimated with the help of dental cone beam tomography.
Results
All patients had tissue changes in two or more facial zones, the diffusive effect of the half of the face has formed in 12 cases. Neurofibromatosis of buccal and parotic-masticatory zones was identified in 5 patients under their own facia of the face due to the cumulation of the changed tissues of lowered echogenicity with multiple small srtuctures of increased or high echogenicity. muscle groups and parotic salivasy glands contours were not clearly visualized, the fascias were defined as hypoechoic. In two observations (pediatric patients) in the buccal and submandibular zones there was established skin thickening up to a half centimeter with a rough inner contour of derma; the soft tissues had changed structure with echo firm areas and singlehypoechoic areas of small sizes. There was no pathologic vascularization in the projection of the lumps.
Conclusions
The complex application of the US investigation in combination with dental cone beam tomography males it possible to diagnosticate neurofibromatosis, to assess more accurately the sizes of the affect, the peculiarities of the vascularization in the area of interest and detect the assident changes of the bone structures in the facial skull with the given category of the patients.

P. 012 THREE CASES OF RHINOLITHIASIS: A RARE CAUSE OF NASAL OBSTRUCTION

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Background
Rhinolithiasis, or nose stone, is a rare cause of nasal obstruction. A rhinolith is most often found during routine examination of the nasal cavity and is rarely symptomatic. Aspecific symptoms, like nasal obstruction, foetor ex ore or rhinorrhoe, can exist for a long time. A calcification in the nasal cavity is formed due to deposits of mineral salts around endogenous (e.g. bloodcloth or spina) or exogenous material (food, beads). Treatment of a rhinolith is surgical removal of the stone.
Materials and Methods
In this report three patients were presented, by whom inspection of nasal cavity showed a nasal obstruction.
Results
High-resolution CT scan of the sinuses showed a large calcification in the nasal cavity with erosion of the surrounding mucosa. In one case the removed rhinolith was geochemically examined with electron microprobe. Analysis showed that the rhinolith consisted of concentric growth rings, suggesting periodical accumulation of mainly calcium phosphate and inflammation deposits.
Conclusions
All three patients were fully cured.

P. 013 CT ASSESSMENT OF WOODWORKERS' NASAL ADENOCARCINOMAS CONFIRMS ORIGIN IN THE OLFACTORY CLEFT

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Background
To demonstrate radiologic signs that corroborate the olfactory cleft as the site of origin for woodworkers adenocarcinoma (ADC)

Materials and methods
We designed a retrospective study comparing CT of 27 unilateral olfactory cleft ADC with 30 nasosinusal polyposis (NSP) and 33 healthy sinus controls (HSC). Enlargement of the olfactory cleft, lateralisation of the ethmoidal turbinate wall and contralateral bulging of the nasal septum were measured on the coronal scan passing through crista galli.
Results
The nasal septum was significantly bulging across the midline in ADC (4,6 +/-3mm) compared to NSP (0,7 +/-1mm) or HSC (0,5+/-1mm). The olfactory cleft was significantly wider in ADC (15,1+/-4,5mm) than in NSP (3,6+/-0,4mm) or HSC (3,3+/-0,7 mm). Whereas the angle between conchal lamina and vertical midline was close to zero degree in both NSP (0,03+/-2,25°) and HSC (0,45+/-2,13°), it reached 39,7+/-13° in ADC.
Conclusions
CT confirms the origin of woodworkers adenocarcinoma in the olfactory cleft and not in the ethmoid.

P. 014 CBCT ASSESSMENT OF WELL DEFINED RADIOLUCENT JAWBONE LESIONS

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Background
Radiological analysis of bone jaw tumors needs an exact assessment of the topography and extant of the lesions as well the identification of specific features need for differential diagnosis of the disease. The aim of this study was to investigate the CBCT image features of well defined radiolucent lesions and to correlate this with the histological findings.
Materials and Methods
This study included 24 patients with intra-osseous radiolucent jaw lesions in the maxilla or mandible on panoramic radiography. All patients were scanned with NewTom 3G CBCT machine to assess the extent of the lesions and the relationship with the teeth and surrounding tissue. On CBCT images were analyzed the specific features of lesions: location, border, internal architecture of the lesion, bone expansion and cortical changes. The correlation between CBCT findings of the lesions and histological findings was investigated.
Results
The postoperative pathological examination identified a number of 10 odontogenic and 3 non – odontogenic cysts, 6 ameloblastoma, 3 fibrous displasia and 2 lesions with giant cell. CBCT was superior to the panoramic radiography in identifying the report of the lesion to the dental roots or to the neighboring structures: the mandibular canal or the maxilla-sinus plate. Compared to the panoramic radiography the CBCT identified accurately the bone expansion and the modifying of the cortical bone. In the case of bone destruction and displasia, the CBCT gave a precise and exact topography of the bone lesion, even in the case of skull bones or in the cervical vertebrae. The internal architecture of the ameloblastoma cases was better assessed by the CBCT than by the panoramic radiography.
Conclusions
CBCT offers a series of extra information compared to the data supplied by the panoramic radiography, regarding the extent, reports and internal arhitecture of the radiolucent bone lesions, being a highly useful tool in the setting of an accurate diagnosis of these lesions.

P. 015 PERIPHERAL DENTINOGENIC GHOST CELL TUMOR: EVALUATION OF CLINICAL, HISTOPATOLOGIC AND RADIOLOGICAL FINDINGS

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Background
Since Gorlin and his colleagues described the calcifying odontogenic cyst (COC), numerous additional reports dealing with this unusual odontogenic lesion have appeared in the literature. In 1971, the World Health Organization described the COC as being a non-neoplastic cystic lesion; nevertheless, they classified it under the category of benign tumors related to the odontogenic apparatus. COCs account for only 1% to 2% of all odontogenic tumors, and only 2% to 14% of all COCs are solid tumors. It has been proposed that COC sometimes grows to be neoplastic in potential. The histological variations led some authors to regard the lesion as a neoplasm to be qualified by several descriptive terms. These include calcifying ghost cell odontogenic tumor, cystic calcifying odontogenic tumor, dentinogenic ghost cell tumor, dentinoblastoma, ameloblastic dentinoma, and so on.
Materials and Methods
A 77-year-old man presented with a gingival mass on the alveolar crest mucosa of canine to first premolar of the right mandibular region. According to clinical and radiological examination, peripheral ossifying fibroma was diagnosed initially. An excisional biopsy was performed, and the specimen was submitted for histopathologic evaluation. It was finally diagnosed as peripheral dentinogenic ghost cell tumor after excision with a margin of sound bone.
Results
The purpose of this report is to present a new case of dentinogenic ghost-cell tumor and review the literature
Conclusions
The tumor in this report showed characteristic findings on conventional radiographs and CT studies that correlated well with clinical and histological findings.

P. 016 CT AND MR FINDINGS IN SYNOVIAL CHONDROMATOSIS OF THE TMJ

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Background
Aim of this study was to compare Computed Tomography (CT) and Magnetic Resonance (MR) features and their diagnostic potential in the assessment of Synovial Chondromatosis (SC) of the Temporo-Mandibular Joint (TMJ).
Materials and Methods
Eight patients, retrospectively selected from those who were referred to our Department because of symptoms and signs compatible with disfunctional disorders of the TMJ, underwent CT and MR scan. We considered the following parameters: soft tissue involvement (disk included), osteostructural alterations of the joints, loose bodies and intra-articular fluid.
These parameters were evaluated separately by two radiologists with a "double blinded method" and then, after agreement, definitive assessment of the parameters was given. CT and MR findings were compared .
Results
Histopathological results showed metaplastic synovia in all patients and therefore confirmed diagnosis of SC. MR resulted better than CT in the evaluation of all parameters except the osteostructural alterations of the joints, estimated with more accuracy by CT scan
Conclusions
CT scan is excellent to define bony surfaces of the articular joints and flogistic tissue but it fails in the detection of loose bodies when these are not yet calcified.
MR scan therefore is the gold standard when SC is suspected since it can visualize loose bodies at early stage and also evaluate disk condition and eventual extra-articular tissues involvement. The

use of T2-weighted images and contrast medium allows identifying intra-articular fluid, estimating its entity and discriminating from sinovial tissue.

P. 017 MAXILLARY SINUS FINDINGS IN RELATION TO DENTAL FINDINGS

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Background
Mucous thickening and mucosal antral cyst (MAC) in maxillary sinus are incidental findings in panoramic radiographs. Knowledge regarding epidemiology of their prevalence and association with dental findings in general have not been established. The aim of this study was therefore to determine the prevalence of radiographically assessed maxillary sinus findings in an adult population and to establish the extent to which the findings are related to pathologic dental findings in a nationally representative sample.
Materials and Methods
Study sample consisted of 5 021 participants of a nationally representative Health 2000 Health Examination Survey examined by means of panoramic radiography (2 812 women and 2 209 men). The mean age was 51.7 years: 52.4 for women and 49.6 for men. Analyses were also performed separately in right and left premolar and molar area, effective sample sizes then being n= 4 650 in right and n= 4 665 in left.
Panoramic radiographs were taken with a digital PM 2002 radiographic apparatus (Planmeca 2002 CC Proline, Planmeca Oy, Helsinki, Finland).
Outcome of the present study were findings in the maxillary sinus that were recorded and categorized into three groups: mucous thickening, MAC or some other finding. In addition, any pathologic finding in the maxillary sinus was recorded.
Periapical lesion, horizontal alveolar bone loss, vertical infra bony pockets, furcation lesions and root canal treatments were recorded.
For the analyses, age was grouped into five categories: 30-39 years old, 40- 49 years old, 50-59 years old, 60-69 years old, and 70 years or older. The interview included information of level of education, smoking history and self-reported morbidity.
Results
Mucosal changes in the maxillary sinus were found in 19% of the subjects. Findings were more common in men (27%) than in women (13%), $p<0.001$. The most common finding was mucous thickening found in 12% of subjects, in 8% of women and in 18% of men. MAC was detected in 7% of subjects, in 5% of women and in 10% of men. Prevalence of any other findings was low and no differencies between sex or age groups were seen. Mucous thickening was most often seen in those aged 40-49 years while MACs were most common in younger age groups both in men and women .
Periapical lesions, horizontal alveolar bone loss, vertical infra bony pockets as well as furcation lesions were all significantly associated with mucous thickening being similar on both sides of the jaws. With MACs the associations were not as obvious.
According to bivariate analyses sex, age, level of education and smoking history were significantly associated with sinus findings. Environmental allergy, hay fever or allergic rhinitis were associated with mucous thickening whereas no association was found between sinus findings and asthma.
Conclusions
In conclusion this study showed significant association between pathologic dental findings and mucous thickening in the maxillary sinus also when adjusted by known confounding factors.

P. 018 SURFACE MICRO-COILS IN MR IMAGING OF THE TREATED LARYNX: FEASIBILITY, TECHNICAL CONSIDERATIONS AND CHALLENGING CASES.

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Background
Submucosal recurrent laryngeal carcinoma after laser resection or chemoradiation may be undetected during endoscopic follow-up. MRI provides a better contrast resolution than MDCT and can be employed in the most challenging cases. However, standard head and neck coils may result insufficient as the small laryngeal structures require high spatial resolution. The use of surface microcoils can increase the detectability of recurrences by improving signal to noise ratio and spatial resolution.
Material and methods
36 patiens treated for laryngeal carcinoma (surgery, laser resection and/or chemoradiation) underwent MR study with surface microcoils. Two microcoils (4cm loop coils) were applied to the neck in each patient. The study protocol comprised TSE-T2 or blade-TSE-T2 sequences and SE-T1 or blade-SE-T1 sequences pre- and post- gadolinium administration. Sequence parameters were the following: matrix 512 or 448, FoV 180mm or less, slice thickness 2.5-3mm, phase encoding direction A-P (axial plane) or F-H (coronal plane). A comparison between sequences obtained in the same MR study with microcoils and standard phased-array neck coil was feasible in some patients.
Results
Sequences obtained with surface microcoils provide better signal alterations detectability and more detailed lesion extension depiction than those obtained with standard phased-array neck coil. Motion artefacts and difficult microcoils positioning worsened image quality insomuch as they preclude exam interpretation in 6 patients. Pre-saturation pulses reduced flow artefacts. Blade sequences permitted to reduce phase-encoding artefacts due to breathing and swallowing in uncooperative patients but reduce contrast resolution on soft tissues in T2-weighted and T1-weighted pre-gadolinium sequences .
Conclusions
Surface microcoils provide an high signal-to noise ratio and allow the use of higher matrix values and thinner slices. This advantage can be crucial in the larynx MR imaging for the differential diagnosis between recurrent submucosal carcinoma and post-treatment changes (scar tissue, chondronecrosis). Motion artefacts reduction and improvement of microcoils handiness are necessary to extend the use of this technique.

P. 019 DIAGNOSTIC VALUE OF TUMORAL VOLUME IN SUPRAGLOTTIC CANCER OF THE LARYNX

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Background
Tumour volume measurement in the supraglottic larynx cancer can help in predicting the chance of local control in HNSCC treated with surgery, or with radiotherapy or with both techniques. Tumour volume correlates with the risk of local recurrence (as the TNM staging) and some authors assert that this association is even stronger than the T stage. The aim of this work was to verify the relationship between tumour volume calculated on preoperative CT and the risk of local recurrence within 24 months. This risk was compared with other clinical-radiological parameters too.
Materials and Methods
The study consists in a retrospective analysis of 30 patients with supraglottic laryngeal cancer, evaluated between 1998 and 2005 performing a dedicated CT protocol with the aim of obtaining a preterapeutic radiological staging.
All the CT scans of these patients were reassessed considering the following parameters:
- tumour volume;
- laryngeal cartilage involvement;
- pre-epiglottic space (PES) involvement;

- TNM staging.
Univariate analysis were performed using those parameters; than, regression multivariate analysis using backward elimination were performed in order to identify the most significant independent parameter.
Results
The cohort was composed of 30 patients (n° 27 male and n° 3 females) with mean age of 67.7 years (range 49-86).
Univariate analysis found a statistically significant relationship between the risk of local recurrence and tumour volume, laryngeal cartilage involvement and pre-epiglottic space involvement.
Multivariate analysis demonstrate that only tumor volume can be considered an independent risk factor for local recurrence.
Conclusions
This study concludes that pretreatment tumour volume measurement on CT imaging is the most important prognostic independent parameter in evaluation of patients affected by supraglottic carcinomas. Besides, the association of tumor volume and other parameters such as preepiglottic space and laryngeal cartilage involvement, contributes to the creation of risk classes, useful for an appropriate therapeutic choice.

P. 020 MULTIMODALITY IMAGING WITH CT, MRI AND PET/CT IN THE ASSESSMENT OF LARYNGEAL CANCER- CORRELATION WITH CLINICO-PATHOLOGICAL FINDINGS

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Background
Laryngeal carcinomas assessment encompasses a multi-disciplinary team approach. Patients with post therapy changes are notoriously difficult to assess using MR and CT imaging alone. However, PET/CT is a novel imaging technique. We present a review of the impact of PET/CT on the staging of laryngeal carcinomas pre and post therapy with radiological-pathological findings.
Materials and Methods
A retrospective analysis of laryngeal carcinomas referred to a quarternary oncology treatment centre in a state of Australia over a 6 months period was performed. The impact of the addition of PET/CT to MRI & CT for the clinical management and tumor staging with radiological-pathological outcome was assessed.
Results
The review of cases demonstrated that PET/CT has an impact on the clinical management and tumor staging than MRI and or CT alone. This was appreciated on post-operative and post therapy cases. The findings are illustrated with respective examples.
Conclusions
Peter Mac is a quarternary oncology referral treatment centre for the state of Victoria, Australia with a specialist PET/CT unit. PET/CT is a complimentary imaging tool to MRI and CT in oncology staging, in particular patients with post-treatment changes.

P. 021 ARYTENOID AND CRICOID CARTILAGE SCLEROSIS IN THE GENERAL POPULATION AND PATIENTS WITH LARYNGEAL CANCER.

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Background
Sclerosis of the arytenoid and cricoid cartilages is regarded as an adverse feature in laryngeal cancer on staging CT scans. The significance is often unclear and there is only limited evaluation of cartilage sclerosis in patients without cancer. This study looks at the demographics of arytenoid and cricoid cartilage sclerosis in the general population and compares it to patients with laryngeal cancer.

Materials and Methods
CT scans of the neck region in 498 consecutive patients during a 2 year period were evaluated retrospectively and grouped into those with laryngeal cancer and those without.
Results
As demonstrated in a previous study there is a much higher incidence of arytenoid sclerosis in females, 48.8% overall compared to 10.2% in males. The age distribution is similar for both males and females with none under the age of 20, the peak incidence in the fifth decade and a small secondary increase in incidence in the 9th and 10th decades. The overall incidence of arytenoid cartilage sclerosis in patients with laryngeal carcinoma was 23.3% compared to 23.6% in the general population with a similar age range.
Cricoid cartilage sclerosis is much less common (4.8% in females and 1.5% in males overall), and more sporadic in both men and women. The overall incidence of sclerosis in the cricoid cartilage in the cancer group was 6.8% and in the non-cancer group was 2.1% with a similar age range.
Conclusions
More detailed analysis of the relationship of laryngeal cancer to the incidence of arytenoid and cricoid cartilage sclerosis will be presented.

P. 022 A PICTORIAL REVIEW OF HYPOPHARYNGEAL CARCINOMAS AND THEIR AJCC STAGE.

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Background
Hypopharyngeal squamous cell carcinomas (SCC) are uncommon compared to other sites in the Head and Neck. The site of occurrence in the hypopharynx determines local spread. The hypopharynx is also has a rich lymphatic supply, thus early nodal spread is common. Assessment and staging of hypopharyngeal squamous cell carcinomas present a challenge to general radiologists and trainees.
Materials and Methods
A retrospective review of hypopharyngeal SCC cases from a quarternary oncology treatment centre in a state of Australia is preformed. The cases are also classified according to the American Joint Committee of Cancer Staging system.
Results
As a quarternary referral treatment centre we have a selection of hypopharyngeal cases with correlated radio-pathological findings. Pre and post-treatment assessment involves CT, MRI and in some cases PET/CT imaging. We illustrate a pictorial review of the different sites of hypopharyngeal SCCs with the respective AJCC stage.
Conclusions
Knowledge of site-specific oncological staging of Head & Neck SCC is a challenge. This exhibit will permit understanding of the nodal classification and staging using the American Joint Committee for Cancer specific to the hypopharynx.

P. 023 EVALUATING ORAL CAVITY CANCER FOR SURGICAL MANAGEMENT: WHAT DOES VOLUMETRIC MEASUREMENT WITH MRI OFFER?

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Background
Magnetic resonance imaging (MRI) plays a crucial but underutilized role in the surgical management of oral cavity squamous cell carcinoma (OCSCC). This work studied the value of the MRI-measured tumour volume (Tv) as a predictor of two-year disease-related survival (DRS) and disease-free survival (DFS), as well as occult cervical lymph node metastasis, in oral cavity cancer.

Materials and Methods
180 patients presenting with oral cavity squamous cell carcinoma, having staging MRI and undergoing surgical resection with curative intent between 1998 and 2008 were identified retrospectively. The Tv (cm3) was determined using manual segmentation. Duplicate measurements were done by a single observer using available T2-weighted, T1-weighted and short-tau inversion recovery (STIR) studies in the coronal and axial planes.
Results
The probability of occult cervical lymph node metastasis increased with increasing Tv (Binary Logistic Regression, p=0.002, HR=1.07 per cm3 [95% CI 1.03 – 1.12]. Similarly, two-year disease-related and disease-free survival were found to decrease with increasing Tv (Cox Proportional Hazards; DRS: p<0.001, HR=1.05 per cm3 [95% CI 1.03 – 1.07]; DFS: p=0.001, HR=1.04 per cm3 [95% CI 1.02 – 1.06].
Conclusions
Tumour volume measured on MRI can play a role in the staging of oral cavity squamous cell carcinoma and offers an avenue for refinement of current TNM staging criteria. Volume can identify patients with clinically occult cervical lymph node metastases during the surgical planning phase of treatment.

P. 024 DYSPHAGIA FOLLOWING CHEMORADIATION FOR LOCALLY ADVANCED NECK CANCER: VIDEOFLUOROSCOPY SWALLOWING STUDY

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Background
To assess the prevalence, severity and morbidity of dysphagia following in patients candidates to chemoradiation for neck cancer.
Materials and Methods
30 patients with locally advanced neck cancer (stage III and IV) underwent concurrent chemotherapy and radiation were evaluated for their ability to resume oral feeding following treatment. Videofluoroscopy swallowing study (VFLSS) was performed the patients complained of dysphagia or if there was clinical suspicion of aspiration. The severity of dysphagia was graded on a scale of 1–7.
Results
Among 30 patients who underwent VFLSS following treatment: 12 patients (40%) had silent aspiration (grade 6–7 dysphagia), 13 patients (43%) developed grade 4–5 dysphagia, which required prolonged enteral nutritional support to supplement their oral intake, and 5 patients (17%) developed grade 1–2 (dysphagia within functional limits or abnormal oral or pharyngeal stage but able to eat a regular diet without modifications or swallowing precautions).
Most patients had severe weight loss (0–21 kg) during treatment, likely due in part to mucositis in the orodigestive tube.
Conclusions
Dysphagia is a common, debilitating and potentially life-threatening sequela of concurrent chemoradiation for neck malignancy. Physicians should be aware that the clinical manifestations of aspiration may be unreliable and insidious, because of the depressed cough reflex. VFLSS must be made following treatment to assess the safety of oral feeding and the structural integrity of the pharynx and esophagus.

P. 025 COMPLICATIONS AFTER LARYNGEAL SURGERY: VIDEOFLUOROSCOPY EVALUATION OF 50 PATIENTS.

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Background
Videofluoroscopy assessment of the spectrum and incidence of swallowing complications after state-of-the-art laryngeal cancer surgery.
Materials and Methods
We retrospectively studied videofluoroscopy examinations of 50 patients with suspected complications after laryngeal resection (partial laryngectomy, 20; total laryngectomy, 30). Swallowing function (i.e., oral bolus control, laryngeal elevation and closure, presence of pharyngeal residue, aspiration) and structural abnormalities such as strictures, fistulas and tumour recurrence were assessed by videofluoroscopy.
Results
Abnormalities were found in 30 patients, including strictures 5, 4 fistulas and 8 patients with mass lesions. Aspiration was found in 18 patients (partial laryngectomy, 18/20), occurring before swallowing in 5, during swallowing in 8, after swallowing in 3 and at more than one phase in 3 patients. Pharyngeal paresis was detected in 3 and pharyngeal weakness in 5 patients. Pharyngo-oesophageal sphincter dysfunction was observed in 5 cases.
Conclusions
Aspiration is a very common complication after partial laryngeal resection. It is mainly caused by incomplete laryngeal closure, sphincter dysfunction or pharyngeal pooling. Videofluoroscopy is the only radiological technique able to identify both disordered swallowing function and structural changes after laryngeal resection. Detection of these complications is crucial for appropriate further therapy.

P. 026 INTRAPAROTID FACIAL NERVE SCHWANNOMA: MRI FINDINGS.

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Background
Intraparotid facial nerve schwannoma (IFNS) is rare and often diagnosis is made during surgery: the aim of this paper is to describe the MRI findings in IFNS.
Materials and Methods
3 patients affected by IFNS, were submitted to a MRI study using multiplanar TSE T2 and T1 sequences, before and after i.v. paramagnetic contrast medium injection. All patients underwent surgery with histologic confirmation of diagnosis.
Results
INFS were located in the main trunk (2/3 patients) or peripheral branches (1/3) of facial nerve. MRI findings in all cases showed an oval lesion, with regular borders, content of low intensity on T1 images and high intensity on T2 images, strongly enhancing after i.v. contrast medium injection.
Conclusions
MRI allows INFS detection, although findings are low specific and histology is mandatory for differential diagnosis with other parotid lesions.

P. 027 ULTRASONIC EXAMINATION OF MAJOR SALIVARY GLANDS IN DIFFERENTIAL DIAGNOSTICS OF SIALOSIS AND SJOGREN SYNDROME .

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Background
US is widely accepted as the first imaging method for assessment of soft-tissue diseases in the head and neck, including major salivary glands. Sialosis is a noninflamatory, non neoplastic, recurrent, painless salivary gland swelling, usually bilateral, which most often concerns the parotid glands. In Sjorgen's syndrome the prevalence of parotitis in women versus men is approximately 9:1. The cause is unknown.
Materials and Methods
260 patients aged 20-75 years were examined with a suspicion of parotic salivary glands disease. All of them were examined with the help of US of high resolution. The alterations of salivary glands akin to sialosis were revealed in 32 of the observations, and akin to Sjogren's syndrome – in 56 of the observations.
Results
At Sjogren's syndrome there was established a growth in the sizes of the parotic salivary glands and thickening of the velum. The echostructure of the parenchyma was visualized as multivendor. In the projection of the glands there were a lot of zones and structures of oval and roundish form, of moderately and sharply lowered echogenicity, which conformed to the zones of lymphoid infiltration, destruction of the parenchyma and enlarged canals. The mentioned structures fused into conglomerates, mainly in the projection of the lower poles. Vascularization in the projection of the parenchyma and in the peripheral parts of the conglomerates was intensive.
At sialoses the sizes of the parotic glands also enlarged, the velum thickened , the echogenicity was normal or with a tendency to lowering, the structure was multivendor with the presence of small hypoechoic inclusions. In the process of Doppler sonography there was established a diffusive intensification of the vascularization. The changes were even in the submandibular glands which were visualized with difficulty because of the uneven rough contours and marked structural discontinuity.
Conclusions
Results of the US examination alone may suggest the final diagnosis or supply important differential diagnostic data, such as sialosis and Sjogren's syndrome.

GENERAL INFORMATION

ESHNR Annual Meeting
October 1st/3rd, 2009

ESHNR Refresher Course
October 3rd, 2009 – from 02.00 till 06.30 p.m.

Meeting Venue
The Meeting will be held in Verona (Italy) at the Palazzo della Gran Guardia (Piazza Brà – 32121 Verona – Phone +39 045 8033400). The suggested and nearest parking lot is Parcheggio Arena – Saba Italia srl (Via Aldo Ettore Kessler – 37122 Verona – Phone +39 045 8009333), at about 7 minutes walk from the Congress Venue.

Access to the Meeting Venue
All participants should wear the identification badge collected at the Secretariat Desk upon registration during all Meeting sessions and social event/s. Accompanying persons are not entitled to attend scientific sessions (their participation is restricted to the Gala Dinner, after payment of the related fee).

Meeting Official Language
The whole Meeting will be held in English.

Secretariat desk hours

Thursday, October 1st	07.30 a.m. – 07.00 p.m.
Friday, October 2nd	07.30 a.m. – 06.30 p.m.
Saturday, October 3rd	07.30 a.m. – 07.00 p.m.

On.site Registration Fees (only cash payment)

Members and Otorhinolaryngologists (full participation/3 days)	€ 330,00
Non-members (full participation/3 days)	€ 380,00
Otorhinolaryngologists/Surgeons (single day/October 1st)	€ 150,00
Radiographers (full participation/3 days)	€ 330,00
Residents/Students (full participation/3 days)	€ 310,00

The fees include: admittance to the Scientific Sessions; Final Programme and Abstract Book; Coffee-Breaks and Lunches; Welcome Cocktail on Thursday October 1st; Certificate of Attendance.

Gala Dinner for participants and/or Accompanying People	€ 70,00
Single Day Fee (with no CME accreditation)	€ 130,00

Certificate of Attendance
A certificate of attendance will be given to all registered participants. The same certificate will include also the statement regarding the accreditation of the U.E.M.S. and the one of the Italian Ministry of Health for those participants deserving the Credits.

CME credits

The Conference "22nd Annual Meeting and Refresher Course of the European Society of Head and Neck Radiology" *(organized by Symposia srl – 21334)*, date from 01.10.2009 – 03.10.2009 has been accredited by the European Accreditation Council for Continuing Medical Education (EACCME) to provide the following CME activity for medical specialists. The Conference "22nd Annual Meeting and Refresher Course of the European Society of Head and Neck Radiology" is designated for a maximum of, or up to **18 European CME Credits (ECMEC's)**.

The Meeting has been accredited by the Italian Ministry of Health as follows:

- **n.14 Credits for Radiologists, Otorhinolaryngologists and Radiotherapists** (participation at the whole Meeting)
- **n.15 Credits for Radiographers** (participation at the whole Meeting)
- **n.3 Credits for Otorhinolaryngologists** (participation only for Thursday, October 1st)

Insurance and Liabilities

The organizers cannot be held responsible for any personal injury, loss, damage or accident to private property, or for additional expenses incurred as a result of delays or changes in air, rail, road or other services, strikes, sickness, weather and other causes. All participants are therefore encouraged to make their own arrangements for health and travel insurance.

23rd Annual Meeting and Refresher Course of the ESHNR

Vienna (AT) - September 9th/11th, 2010

For detailed information and registration: H. Fischer, C. Arnecker

osteo-mr@meduniwien.ac.at - www.eshnr2010.org

ESHNR AWARDS and SPECIAL MEETING SESSIONS

ESHNR award

A prize of € 750 is awarded each for the best poster and the best oral presentation. A second prize (free registration to the ESHNR Meeting in 2010 and free socials) is awarded each for the second best poster and second best oral presentation. A panel of specialists designated by the ESHNR makes their selection based on submitted abstracts and on site viewing of the posters and listening to the oral presentations. The attribution of the prizes is done during the Gala Dinner at Palazzo Giusti on Friday October 2nd, 2009.

Junior Film reading Session

The Junior Radiologist Film Reading Session is an entertaining and challenging radiological quiz for trainee and junior radiologists. This year's Film reading panel is entitled "*Italy versus rest of the world*" and will oppose two teams of three to four radiologists in training (one team "Italy" and one team "Rest of Europe") who will compete against each other. Panelists are chosen from meeting participants. In addition, panelists can apply via the webpage. Each team will have the opportunity to solve several unknown cases and answer joker questions. A referee will ensure that the panelists comply with the rules and will adjudicate on the awarding of marks. The team who solves most of the cases will receive a diploma and will be announced in the ESHNR newsletter. The moderator of the Junior Radiologists Film Reading Session is Prof. Martin G. Mack from Frankfurt, Germany

Case of the Day

Different cases will be displayed in the Poster Area on Thursday, October 1st and on Friday, October 2nd, 2009 from 08.00 a.m. to 04.00 p.m. giving all participants registered in the Meeting the opportunity to take part in the quiz; the results will be published on the following day. The participant who will have solved the major number of cases will receive a diploma and will be announced in the EHNR newsletter. The coordinators of the ESHNR 2009 Case of the Day competition are Dr. Davide Farina, Dr. Enza Gatti, Dr. Silvia Michelini and Dr. Marco Ravanelli from Brescia.

PRACTICAL INFORMATION

Verona and its surrounding areas offer a wide range of interesting sightseeing attractions; for further information, please visit these websites:

- www.tourism.verona.it
- www.veronissima.com
- www.verona.world-guides.com

Travel Information - Plane

Airports Distances of Verona city center from main nearby airports:

15 Km from Verona Villafranca airport (VRN), about 20 minutes by car. www.aeroportoverona.it
(within the above-mentioned link, for Travel Information please visit the page "How to reach us")

70 Km from Brescia Montichiari airport (VBS), about 50 minutes by car. www.aeroportobrescia.it
(within the above-mentioned link, for Travel Information please visit the page "How to reach us")

120 Km from Bergamo Orio al Serio airport (BGY), about 70 minutes by car. www.sacbo.it
(within the above-mentioned link, for Travel Information please visit the page "Public Transports")

130 Km from Venezia airport (VCE), about 80 minutes by car. www.veniceairport.it
(within the above-mentioned link, for Travel Information please visit the page "Transports")

160 Km from Milano Linate airport (LIN), about 110 minutes by car. www.sea-aeroportimilano.it
(within the above-mentioned link, for Travel Information please visit the page "Connection")

200 Km from Milano Malpensa airport (MXP), about 120/180 minutes by car. www.sea-aeroportimilano.it
(within the above-mentioned link, for Travel Information please visit the page "Connection")

Travel Information – Train Stations/Public Buses

It is easy to reach Verona by train, both from Milan, Bergamo, Brescia and Venezia; for more information, please visit the website www.trenitalia.it (Remember to validate the train ticket before the departure with the special stamping machines located close to the platforms).

The railway station in Verona (Piazzale XXV Aprile – 37100 Verona - Customer Service: +39 045 8000861) is connected with the Congress Venue and its surroundings by a regular public bus service; the Buses connecting directly the railway station to Palazzo della Gran Guardia are line 11, 12, 13, 51 and 72 (it takes about 10 minutes from the railway station to Piazza Brà and vice-versa). For more information, please visit the website www.apt.vr.it

Travel Information – Public Taxis/Car Rental

Public Taxis Stands can be found outside all the Airports and the Railway Stations. Verona Public Taxis Service is available round the clock (Radiotaxi Verona: +39 045 532666). Different Car Rental Services can be found outside all the Airports and the Railway Stations. Outside Verona Railway Station can be found the following Services:

- Hertz: +39 045 8000832 – www.hertz.it
- Maggiore Autonoleggio: +39 045 8032184 - www.maggiore.it

Travel Information – Car

A4 Motorway (Torino/Trieste) - exit Verona Sud (follow directions for city center/Arena)

A22 Motorway (Modena/Brennero) - exit Verona Nord (follow directions for city center/Arena)

For further information, please visit the website: www.autostrade.it

SOCIAL PROGRAMME

Get-together Cocktail – October 1st, 06.00 p.m.

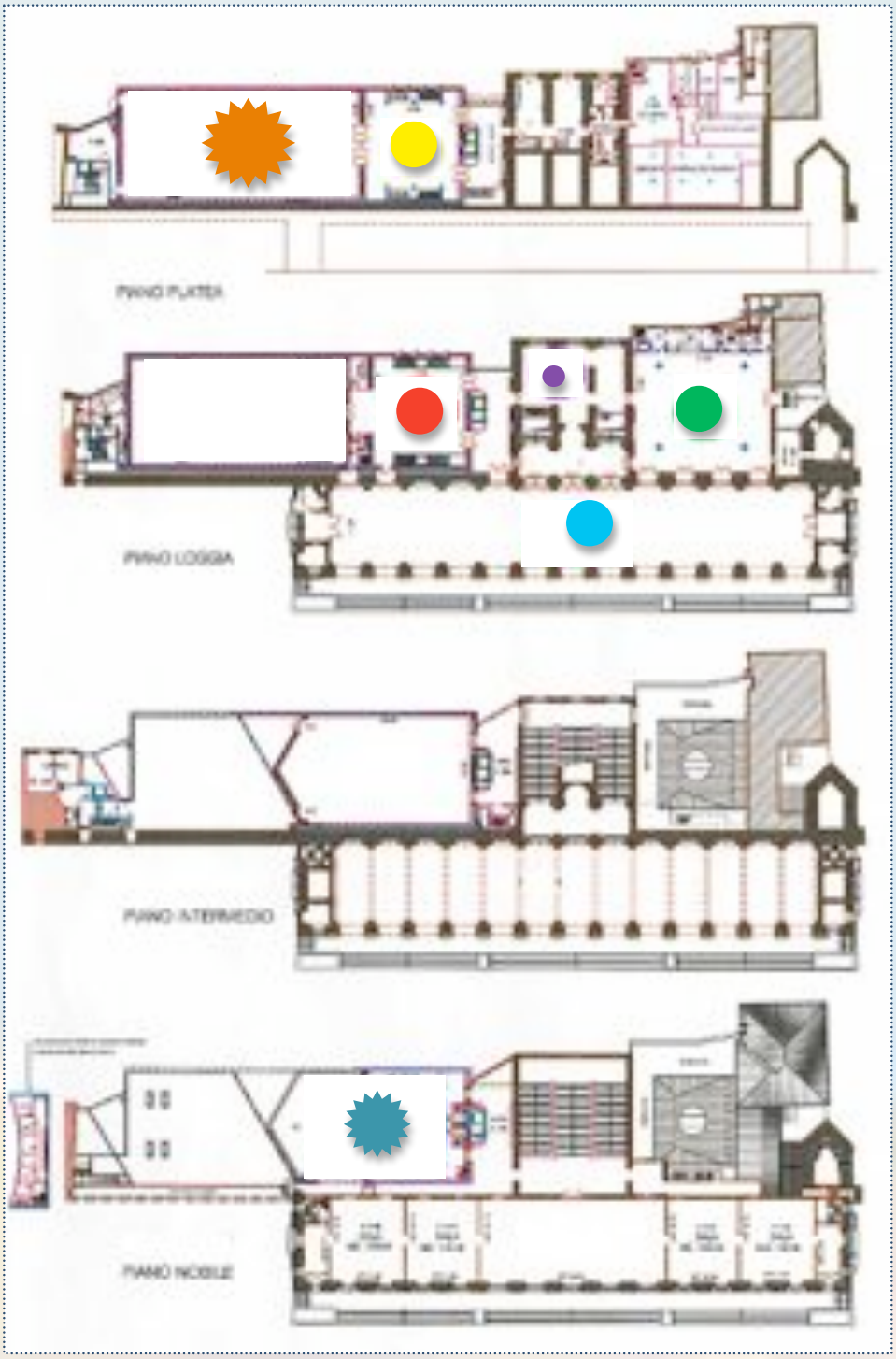
The Cocktail will take place on Thursday, October 1st at about 06.00 p.m. at the Meeting Venue (the catering service will be hosted in the Loggiato of the Palazzo della Gran Guardia). The participation is free for all the registered Participants, Chairmen and Speakers of the Meeting.

Gala Dinner – October 2nd, 08.00 p.m.

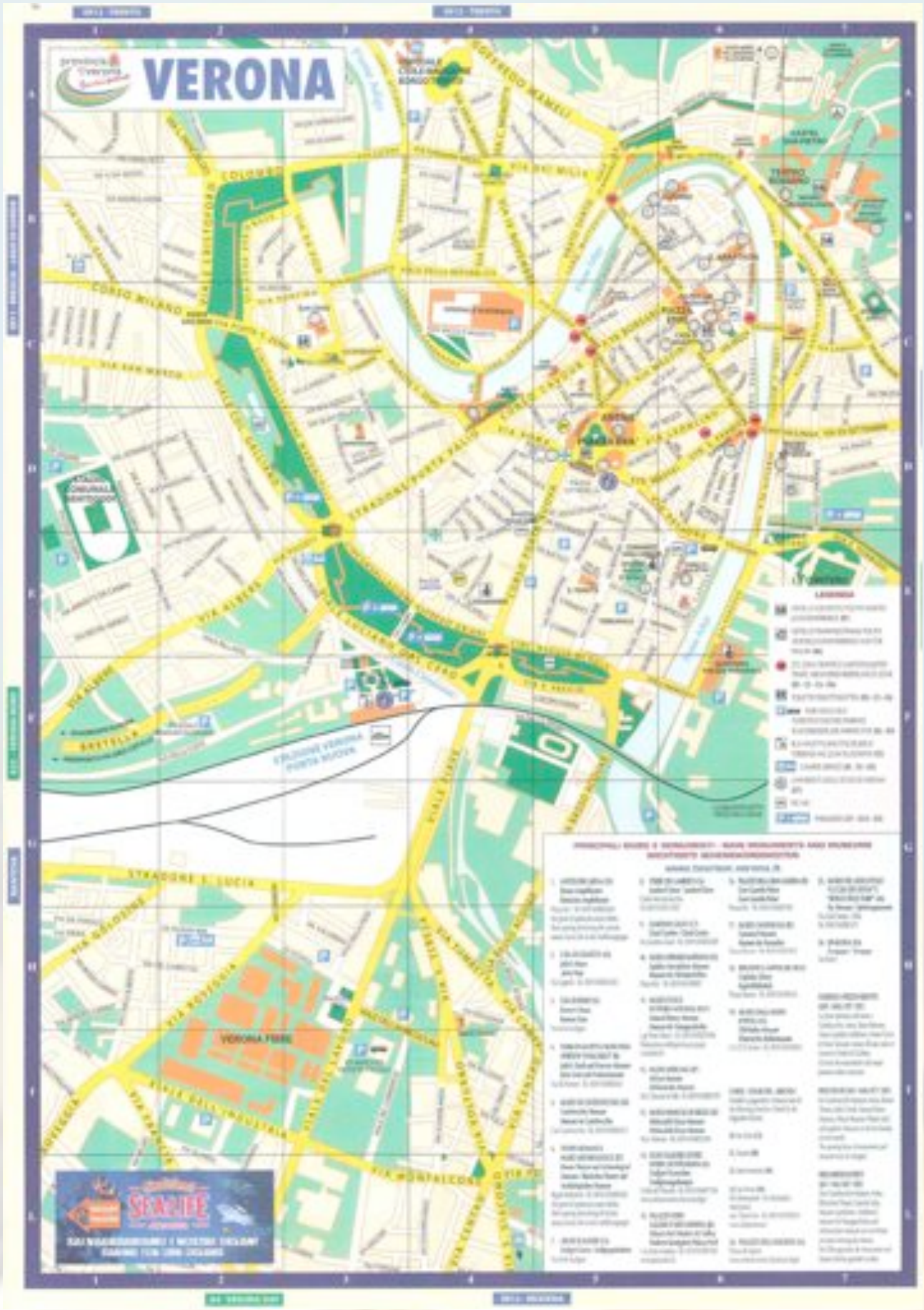
The Gala Dinner will take place on Friday, October 2nd at about 08.00 p.m. at Palazzo Giusti (Via Giardino Giusti, 2 – 37129 Verona – Phone +39 045 8034029). The Palazzo Giusti is only at 15 minutes walk from the city center and, together with its garden, it is one of the most noteworthy hidden-treasures of Verona.

The participation fee for the Dinner is € 70,00 VAT included both for registered participants and accompanying people. Because of the limited number of places available, registration for the Gala Dinner will be on a *first come- first served* basis; therefore, we kindly recommend you to book your place on time.

Venue Map



- Main entrance (from Piazza Brà, 1)
- Secretariat and Sponsors' Exhibition
- Preview Room
- Posters' Exhibition
- Catering
- Main Room (plenary sessions)
- Room for Parallel Sessions


VERONA
VERONA FIERE

NOTES