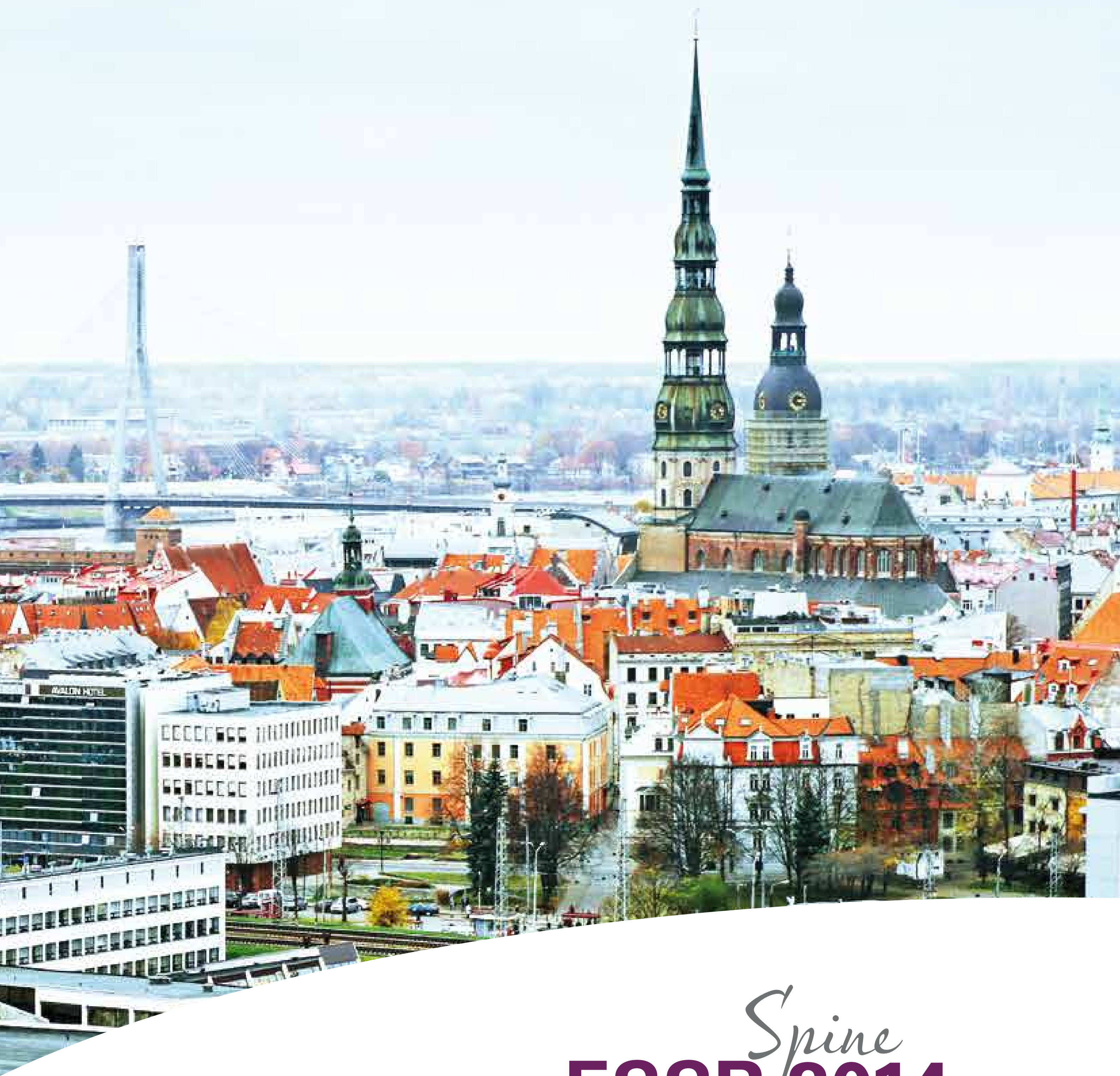
Final Programme



Spine

ESSR 2014

MUSCULOSKELETAL RADIOLOGY

JUNE 26–28, RIGA/LATVIA


AVALON HOTEL

CONTENTS

GENERAL INFORMATION

CONGRESS VENUE

Radisson Blu Hotel Latvija
Elizabetes 55
LV-1010 Riga

CERTIFICATE OF ATTENDANCE/CME ACCREDITATION

The Certificate of Attendance/CME Accreditation can be viewed and printed after the congress upon entering your ESSR MyUserArea at the ESSR website (www.essr.org/myuserarea). To enter the MyUserArea, please use your last name in combination with your Personal ID from your congress badge.

Continuing Medical Education (CME) is a programme of educational activities to guarantee the maintenance and upgrading of knowledge, skills and competence following completion of postgraduate training. CME is an ethical and moral obligation for each radiologist throughout his/her professional career, in order to maintain the highest possible professional standards.

CONFERENCE LANGUAGE

The meeting will be held in English. No simultaneous translation will be offered.

REGISTRATION OPENING HOURS

Thursday, June 26	10:00 – 18:00
Friday, June 27	07:30 – 18:00
Saturday, June 28	07:30 – 18:00

REGISTRATION FEES ONSITE

ESSR Non-Member	EUR 650.00
ESSR Member	EUR 490.00
Resident ESSR Non Member	EUR 280.00
Resident ESSR Member	EUR 200.00
Student	EUR 75.00

Member Registration

Only available for ESSR members in good standing.

Resident Registration

Only available for residents under the age of 36. A proof of your resident status has to be presented at the registration desk.

Student Registration

Registrations categorized as “Student” are limited to students without any academic title under the age of 30. A proof of your student status to be presented at the registration desk.

NAME CHANGES

Name changes will be treated like the cancellation of the registration and a new registration of the other participant.

ONSITE PAYMENT

Onsite payment can only be made by credit card (Visa or Euro/Mastercard) or in cash (Euro).
Please understand that no other payment facilities like cheques, etc. will be accepted.

COFFEE BREAKS

Complimentary coffee, tea and refreshments will be served during the official coffee breaks to all congress delegates.

DISCLAIMER/LIABILITY

The ESSR cannot accept any liability for the acts of the suppliers to this meeting or the attendees' safety while travelling to or from the congress. All participants are strongly advised to carry adequate travel and health insurance, as ESSR cannot accept liability for accidents or injuries that may occur. ESSR is not liable for loss or damage of private property.

EPOS™

ESSR 2014 is using EPOS™, the Electronic Presentation Online System, the electronic format of the scientific exhibition developed by the European Congress of Radiology (ECR). Several workstations are available in the EPOS™ Area at which the current electronic exhibits can be viewed by the congress participants during the congress.

NEW: Connect your own mobile device and browse through ESSR 2014 Posters: http://posterng.netkey.at/essr/online_viewing

WIFI

Free wireless LAN access is available throughout the congress venue.
Please log in with the following data:
Access point: ESSR
Password: ESSR2014

FUTURE MEETING DESK

This area – located in the grand foyer – offers you an overview of future meetings in the field of radiology and related disciplines, from all over the world. Feel free to contribute flyers and posters to promote your own meetings and courses.

MEDIA CENTER

Speakers are reminded to check in at the media center at least two hours prior to their scheduled presentation. Workstations and trained staff will be at the speakers' disposal. Please note that the media center should not be used to prepare your entire presentation and that due to the large number of speakers the workstations are only available for minor editing.

SCIENTIFIC PRESENTATION AWARDS

The authors of the best tumor presentation, scientific paper and scientific/educational poster will be awarded a certificate at the ESSR General Assembly.

ESSR/ISS Prize: Best scientific paper presentation

Poster Prize: Best scientific/educational poster presentation

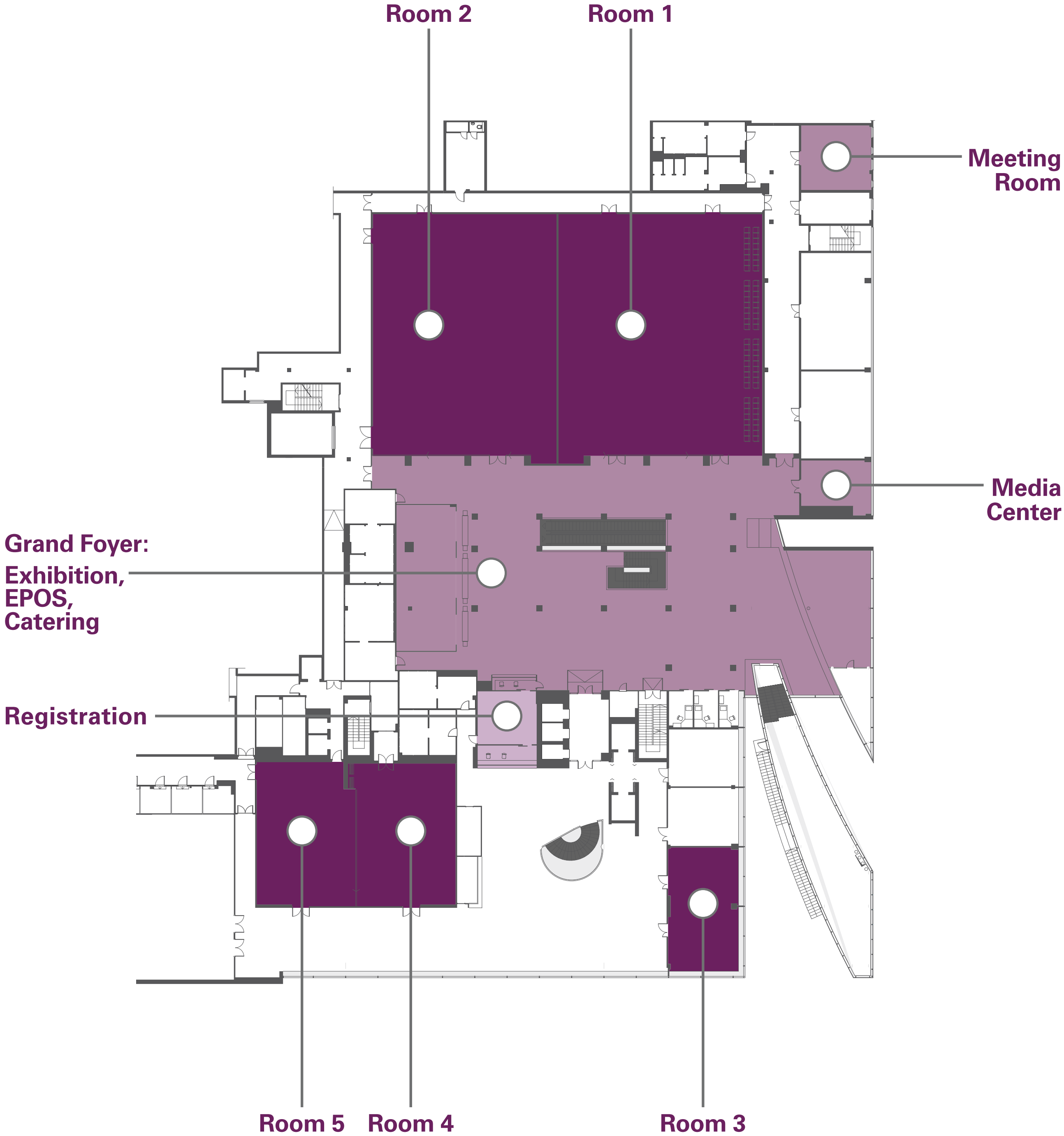
Tumor Prize: Best presentation on tumors

ESSR QUIZ

A radiology quiz presentation will be shown in loop on a monitor in the grand foyer. Please fill out the answer sheet (available at the monitors) and hand it in at the registration counter until Saturday, 12:00 (local time). The quiz winners will be announced at the ESSR General Assembly.

FLOOR PLAN

FLOOR PLAN



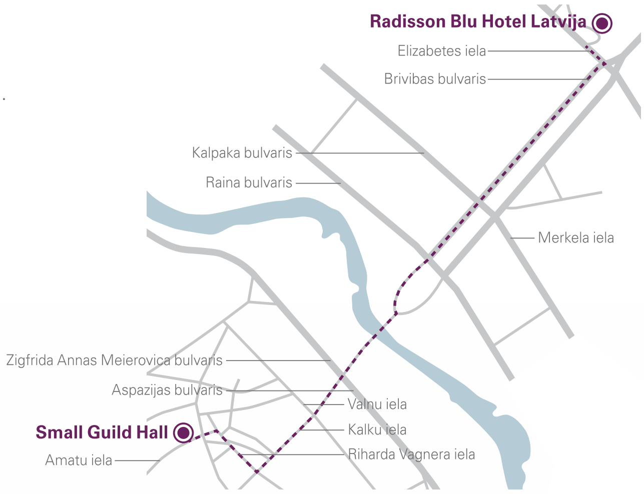
Gala Dinner

Saturday, June 28, 2014 I Riga Small Guild Hall

Spine
ESSR 2014
MUSCULOSKELETAL RADIOLOGY
JUNE 26–28, RIGA/LATVIA

19:30 Meeting point Riga Small Guild Hall
Small Guild Hall/Maza Gilde, Amatu iela 3/5

The venue is within walking distance from the Radisson Blu Hotel Latvija.
Price per ticket EUR 80.00



Fotocredit: © Diego Delso


Esaote, the
MSK Imaging
Specialist
G-scan brio
eXP
Technology
MyLab Twice
eHD
Technology
CrystaLine
esaote
ESSR 2014 Annual Scientific Meeting, Saturday June 28, 12.30-13.30 Room 1
Esaote Lunch Symposium: Latest imaging advances and clinical benefit
www.esaote.com
Esaote S.p.A. Via di Caciolle, 15 50127 Florence, Italy, Tel. +39 055 4229 1, Fax +39 055 4229 208
Via A. Siffredi, 58 16153 Genoa, Italy, Tel. +39 010 6547 1, Fax +39 010 6547 275
esaote
Creativity in Healthcare

EXHIBITION

The exhibition area will be located in the grand foyer, with easy access to the main auditorium rooms and diverse meeting rooms.

Thursday, June 26	13:00 – 17:00
Friday, June 27	09:00 – 17:00
Saturday, June 28	09:00 – 17:00

LIST OF EXHIBITORS

EOS imaging

esaote Creativity in Healthcare

GE Healthcare

TOSHIBA Leading Innovation

bk medical

AprioMed

SonoScape

HITACHI Inspire the Next
ALOKA illuminate the change

DFINE

PHILIPS

Spine
ESSR 2014
MUSCULOSKELETAL RADIOLOGY
JUNE 26–28, RIGA/LATVIA

Welcome Reception

Friday, June 27, 2014
Riga Latvian Society House | Golden Hall
19:00–22:00

ALL DELEGATES ARE WELCOME!



WELCOME

Dear colleague

It is our pleasure to welcome you and over 500 other delegates to Riga at the 21st Annual Congress of the European Society of Musculoskeletal Radiology.

The theme of this year's meeting is ***The Spine***. Over the next two days there will be a comprehensive lecture programme delivered by an expert faculty that will cover normal development and variants, congenital and dysplastic conditions, a wide variety of acquired diseases, and interventional techniques in the spine. We hope that the lectures will be informative, stimulating and provocative.

Parallel sessions will cover non-spine topics such as sports imaging, rheumatology and metabolic bone disease.

The highly popular hands-on ultrasound course on Thursday covers ***Nerves*** and is sold-out.

A highlight of the meeting will be the annual quiz on Saturday afternoon, conducted by Victor Cassar-Pullicino. This is your chance to compare your diagnostic skills with the experts – and possibly win a prize! The two opposing teams have to cope with radiological and non-radiological questions. You can sit back, relax and enjoy!

The electronic posters on EPOS are always informative and popular.

There will be a technical exhibition. We are grateful to our trade collaborators and dependent on their support. Please find time to visit them.

Please enjoy the Welcome Reception on Friday evening and the Gala Dinner on Saturday evening. If you have not purchased tickets for the dinner and wish to attend, please contact the ESSR staff at the registration desk.

Try to also find time to explore Riga. It is one of the original Hanseatic ports dating from the Middle-Ages. The city centre retains a rich heritage of medieval buildings, and is also endowed with one of the best collections of art nouveau buildings in Europe. The surrounding countryside is verdant and has many lakes and forests. The Baltic beaches of Latvia are famous. The Jurmala beach is only a short drive from Riga and has 30km of glistening white sand.

The weather in Riga at the end of June should be warm. The days are long and nights are short, so there will be plenty of time for you to enjoy the meeting and also Riga.

Mara Epermane
ESSR Congress President, 2014

Ian Beggs
ESSR President, 2014

COMMITTEES

LOCAL ORGANISING COMMITTEE

M. Epermane (LV) – Congress President 2014
J. Deicmane (LV)
A. Dzirkale (LV)
I. Engele (LV)
I.L. Laudere (LV)
P. Likums (LV)
E. Neilande (LV)
M. Pinnis (LV)
& ESSR Subcommittee Chairpersons

ESSR EXECUTIVE COMMITTEE

President:	I. Beggs (UK)
Past President:	M. Padron (ES)
President Elect:	M. Zanetti (CH)
Vice President:	G. Guglielmi (IT)
Treasurer:	D. Wilson (UK)
Secretary:	F. Vanhoenacker (BE)
Councilors:	A. Plagou (GR), X. Tomas (ES)

ESSR COMMITTEE

Education:	C. Martinoli (IT)
Research:	L. Sconfienza (IT)

ESSR SUBCOMMITTEE

Arthritis:	C. Schüller-Weidekamm (AT)
Sports:	M. Shahabpour (BE)
Tumour:	I.M. Nöbauer-Huhmann (AT)
Ultrasound:	Ph. O'Connor (UK)

Potential Conflict of Interest Disclosures

It is the policy of the European Society of Musculoskeletal Radiology to ensure balance, independence, objectivity, and scientific rigour in the congress programme. Knowledge of possible relationships with sponsors of any kind is mandatory in order to reinforce the educational and scientific message and to relieve any suspicion of bias.
Any potential conflict of interest involving the organising committee should be made known so that the audience may form their own judgements about the presentation with a full disclosure of the facts. It is for the audience to determine whether the presenter's external interest may reflect a possible bias in either the work carried out or the conclusions presented.

None of the organising committee members listed above disclosed any relationships.

INVITED FACULTY

J. Adams, Manchester/UK
M. Adriaensen-van Roij, Heerlen/NL
S.I. Alam, Qatar/QA
G. Allen, Oxford/UK
N. Amoretti, Nice/FR
M. Anderson, Charlottesville/US
G. Andreisek, Zurich/CH
M. Aparisi Gomez, Valencia/ES
F. Aparisi Rodriguez, Valencia/ES
R. Arkun, Izmir/TR
G. Astrom, Uppsala/SE
J. Bauer, Munich/DE
A. Baur-Melnyk, Munich/DE
A. Bazzocchi, Bologna/IT
F. Becce, Lausanne/CH
I. Beggs, Edinburgh/UK
N. Bhatnagar, New Delhi/IN
G. Bierry, Strasbourg/FR
J. Bloem, Leiden/NL
K. Bohndorf, Augsburg/DE
I. Boric, Zagreb/HR
A. Bueno, Alcorcon/ES
M. Calleja, Stanmore/UK
R. Campbell, Liverpool/UK
V. Cassar-Pullicino, Shropshire/UK
J.-A. Choi, Seoul/KR
H.N. Choudur, Hamilton/CA
A. Cotten, Lille/FR
M. Court-Payen, Frederiksberg/DK
M. de Jonge, Amsterdam/NL
M. De Maeseneer, Brussels/BE
E. de Smet, Duffel/BE
X. Demondion, Lille/FR
P. Diana Afonso, Lisbon/PT
T. Dietrich, Zurich/CH
E. Drakonaki, Heraklion/GR
S. Dzelzite, Riga/LV
A. Dzirkale, Riga/LV
I. Engele, Riga/LV
M. Epermane, Riga/LV
A. Feydy, Paris/FR
D.K. Filippiadis, Athens/GR
K. Friedrich, Vienna/AT
E. Geusens, Leuven/BE
S. Giannini, Rome/IT
J. Gielen, Antwerp/BE
R. Graham, Oxford/UK
A. Grainger, Leeds/UK
J. Grisar, Vienna/AT
G. Guglielmi, Foggia/IT
A. Heuck, Munich/DE
R.J. Hughes, Aylesbury/UK
J. Jacobson, Ann Arbor/US
L. Jans, Dendermonde/BE
A.G. Jurik, Aarhus/DK
F. Kainberger, Vienna/AT
J.K. Kloth, Heidelberg/DE
J. Kramer, Linz/AT
Ch. Krestan, Vienna/AT
K. Kupcs, Riga/LV
R. Lalam, Oswestry/UK
Th. Le Corroller, Marseille/FR
F. Lecouvet, Brussels/BE
A. Leone, Rome/IT
E. Llopis, Alzira/ES
M. Lohman, Helsinki/FI
T. Marshall, Norwich/UK
J. Martel, Alcorcon/ES
V. Mascarenhas, Lisbon/PT
E. McNally, Oxford/UK
F. Miese, Dusseldorf/DE
M. Moynagh, Rochester/US
E. Neilande, Riga/LV
I.M. Nöbauer-Huhmann, Vienna/AT
Ph. O'Connor, Leeds/UK
P. O'Donnell, Stanmore/UK
E. Oei, Rotterdam/NL
S. Orguc, Istanbul/TR
D. Orlandi, Genoa/IT
M. Padron, Madrid/ES
V. Pansini, Lille/FR
V. Parmar, Southampton/UK
A. Plagou, Athens/GR
H. Platzgummer, Vienna/AT
J. Rankine, Leeds/UK
M. Reijnierse, Leiden/NL
W. Reinus, Philadelphia/US
W. Rennie, Leicester/UK
Ph. Robinson, Leeds/UK
M. Rupreht, Maribor/SI
M. Sampson, Southampton/UK
P. Sarap, Tartu/EE
C. Schüller-Weidekamm, Vienna/AT
L. Sconfienza, Genoa/IT
M. Shahabpour, Brussels/BE
C. Sofka, New York/US
I. Sudol-Szopinska, Warsaw/PL
R. Sutter, Zurich/CH
A. Tagliafico, Genoa/IT
M. Taljanovic, Tucson/US
J. Teh, Oxford/UK
M. Terra, Amstelveen/NL
N. Theumann, Lausanne/CH
B. Tins, Oswestry/UK
J. Tuckett, Newcastle upon Tyne/UK
P. Tyrrell, Shropshire/UK
C.F. Van Dycke, Alkmaar/NL
J. Vandevenne, Genk/BE
F. Vanhoenacker, Antwerp/BE
K. Verstraete, Gent/BE
M. Vlychou, Larissa/GR
M.-A. Weber, Heidelberg/DE
R. Whitehouse, Manchester/UK
D. Wilson, Oxford/UK
R. Windhager, Vienna/AT
K. Wörtler, Munich/DE
M. Zanetti, Zurich/CH

PROGRAMME OVERVIEW

THURSDAY, JUNE 26, 2014

	Room 1	Industry Hands-on Rooms
12:00	Anatomy Demonstrations	
12:15		
12:30		
12:45		
13:00		
13:15		
13:30		
13:45	Coffee Break	
14:00	Video Demonstrations 1 2 3 4 5	Hands-On Demonstrations 6 7 8 9 10
14:15		
14:30		
14:45		
15:00	Video Demonstrations 6 7 8 9 10	Hands-On Demonstrations 1 2 3 4 5
15:15		
15:30		
15:45		
16:00		
16:15	Rapid Fire Lectures	
16:30		
16:45		
17:00		
17:15		
17:30		
17:45		
18:00		

FRIDAY, JUNE 27, 2014

	Room 1	Room 2	Room 3	Room 4	Room 5
08:00					
08:15					
08:30					
08:45					
09:00	**Anatomy and development**	**Trauma I The cervical spine**	**Basic arthritis**		
09:15					
09:30					
09:45					
10:00					
10:15					
10:30					
10:45	Coffee Break				
11:00	**Opening Ceremony**				
11:15	**Degenerative spine disease**	**Spinal intervention 1**	**Sports injuries: Rapid Fire Session**		
11:30					
11:45					
12:00					
12:15					
12:30					
12:45					
13:00	Lunch Break				
13:15					
13:30					
13:45					
14:00	**Scientific Papers 1 Cartilage and knee**	**Scientific Papers 2 Hip**	**Scientific Papers 3 Interventional**	**Scientific Papers 4 Spine 1**	**Scientific Papers 5 Tumour**
14:15					
14:30					
14:45					
15:00					
15:15					
15:30	Coffee Break				
15:45					
16:00	**Tumours**	**Metabolic bone disease**	**Spinal alternatives**		
16:15					
16:30					
16:45					
17:00					
17:15					
17:30					
17:45					
18:00					
18:15					
18:30					
18:45					
19:00					

SATURDAY, JUNE 28, 2014

	Room 1	Room 2	Room 3	Room 4	Room 5
08:00					
08:15					
08:30	Trauma II The thoracic and lumbar spine	Paediatric/ Adolescent spine	Non-spinal intervention		
08:45					
09:00					
09:15					
09:30					
09:45					
10:00					
10:15					
10:30	Coffee Break				
10:45	Spondylo-arthropathies	Spinal intervention 2			
11:00					
11:15					
11:30					
11:45					
12:00					
12:15					
12:30	Industry Lunch Symposium				
12:45					
13:00					
13:15					
13:30	Scientific Papers 6 US intervention	Scientific Papers 7 Arthritis, muscles, nerves, osteoporosis	Scientific Papers 8 Various	Scientific Papers 9 Spine 2	Scientific Papers 10 Intervention spine
13:45					
14:00					
14:15					
14:30					
14:45	Infection/ Post-operative spine	Pitfalls in sport			
15:00					
15:15					
15:30					
15:45					
16:00					
16:15	Coffee Break				
16:30					
16:45	ESSR 2015 York/UK				
17:00	ESSR Quiz				
17:15					
17:30					
17:45	General Assembly				
18:00					
18:15					
18:30					
18:45					
19:00					

PROGRAMME

THURSDAY, JUNE 26, 2014

12:00–13:40	**Anatomy Demonstrations**	**Room 1**
12:00	Introduction	
12:10	Anatomy of the upper limb peripheral nerves M. Court-Payen, Frederiksberg/DK Ph. O'Connor, Leeds/UK	
12:55	Anatomy of the lower limb peripheral nerves R. Campbell, Liverpool/UK A. Grainger, Leeds/UK	

14:00–16:00	**Video Presentations (alternating with Hands-On Demonstrations)**	**Room 1**
14:00 & 15:00	Brachial plexus A. Tagliafico, Genoa/IT	
14:20 & 15:20	Ultrasound guided nerve root block A. Bueno, Alcorcon/ES	
14:40 & 15:40	Interesting nerve cases E. Drakonaki, Heraklion/GR	

16:15–17:45	**Rapid Fire Lectures**	**Room 1**
16:15	Shoulder and upper arm nerve lesions A. Plagou, Athens/GR	
16:30	Elbow and forearm L. Sconfienza, Genoa/IT	
16:45	Wrist and hand R. Campbell, Liverpool/UK	
17:00	Common peroneal nerve J. Jacobson, Ann Arbor/US	
17:15	Ankle, foot and calf lesions E. McNally, Oxford/UK	
17:30	All you need to know about ultrasound of nerve tumours in 15 minutes M. Reijnierse, Leiden/NL	

FRIDAY, JUNE 27, 2014

09:00–10:45 Anatomy and development — **Room 1**

Chairs: V. Pullicino, Shropshire/UK; K. Wörtler, Munich/DE

09:00 Embryology and development of the osseous spine
F. Vanhoenacker, Antwerp/BE

09:20 The intervertebral disc and end-plate
B. Tins, Oswestry/UK

09:40 Vertebral ligaments
R. Lalam, Oswestry/UK

10:00 Anatomy of the sacro-iliac joint
A.G. Jurik, Aarhus/DK

10:20 Normal variants in the spine
M. Anderson, Charlottesville/US

09:00–10:45 Trauma I – The cervical spine — **Room 2**

Chairs: S. Dzelzite, Riga/LV; J. Rankine, Leeds/UK

09:00 Patterns of injury: The Occiput to C2
M. Sampson, Southhampton/UK

09:20 Patterns of injury: Below C2
W. Reinus, Philadelphia/US

09:40 Brachial plexus injuries
J. Rankine, Leeds/UK

10:00 Battlefield spinal injuries
R. Graham, Oxford/UK

10:20 „Whiplash": Is it a radiological diagnosis
M. Adriaensen-van Roij, Utrecht/NL

09:00–10:45 Basic arthritis — **Room 3**

Chairs: A. Grainger, Leeds/UK; M. Terra, Amstelveen/NL

09:00 The beauty of x-rays in crystal deposits
H. Platzgummer, Vienna/AT

09:20 How to differentiate between rheumatoid arthritis and osteoarthritis
F. Miese, Dusseldorf/DE

09:40 How to image vasculitis?
J.K. Kloth, Heidelberg/DE

10:00 Complications in RA
F. Kainberger, Vienna/AT

10:20 Scoring in rheumatology
V. Pansini, Lille/FR

11:10–11:30 Opening Ceremony — **Room 1**

11:10 Opening Remarks
I.Beggs, Edinburgh/UK; M.Epermane, Riga/LV

11:20 Honorary Membership Awarding
I. Beggs, Edinburgh/UK

11:30–13:00	**Degenerative spine disease** *Chair: K. Friedrich, Vienna/AT; A. Leone, Rome/IT*	**Room 1**
11:30	Disc herniation: usual and unusual A. Cotten, Lille/FR	
11:45	Spinal stenosis N. Theumann, Lausanne/CH	
12:00	Pathology of the posterior elements S.I. Alam, Qatar/QA	
12:15	Schmorl's nodes P. Tyrrell, Shropshire/UK	
12:30	Osteophytes, syndesmophytes, DISH, OPLL R. Whitehouse, Manchester/UK	
12:45	Foramenal stenosis X. Demondion, Lille/FR	

11:30–13:00	**Spinal intervention 1** *Chairs: R. Campbell, Liverpool/UK; D. Wilson, Oxford/UK*	**Room 2**
11:30	Does cement augmentation work? D. Wilson, Oxford/UK	
11:40	Outcome assessment and factors influencing the success of imaging-guided therapeutic spine interventions T. Dietrich, Zurich/CH	
11:55	The role of cement augmentation in preventing spine insufficiency fractures W. Rennie, Leicester/UK	
12:10	Interventions in spine tumors J. Martel, Alcorcon/ES	
12:30	The advantages of cryoblation over thermal and mechanical methods for bone metastases M. Moynagh, Rochester/US	
12:45	Who should manage the patient referred for musculoskeletal image guided intervention? PANEL DISCUSSION	

11:30–13:00	**Sports injuries: Rapid Fire Session** *Chairs: J. Kramer, Linz/AT; M. Shahabpour, Brussels/BE*	**Room 3**
11:30	How to describe cartilage injury A. Heuck, Munich/DE	
11:40	BME in ankle and foot J.-A. Choi, Seoul/KR	
11:50	PTT insufficiency & spring ligament injuries C. Sofka, New York/US	
12:00	Injuries around the medial corner E. Llopis, Alzira/ES	
12:10	Postero-lateral corner injuries M. De Maeseneer, Brussels/BE	
12:20	Snapping hip Th. Le Corroller, Marseille/FR	
12:30	Upper limb injuries in gymnastics M. Terra, Amstelveen/NL	
12:40	Upper limb injuries in racquet sports E. McNally, Oxford/UK	
12:50	Intercostal/abdominal muscle injuries Ph. O'Connor, Leeds/UK	

14:00–15:30 **Scientific Paper Session 1 – Cartilage and knee** **Room 1**

Chairs: A. Dzirkale, Riga/LV; M. de Jonge, Amsterdam/NL

3 Tesla high resolution and delayed gadolinium enhanced MR imaging of cartilage (dGEMRIC) after matrix based autologous chondrocyte transplantation of the hip
A. Lazik, Essen/DE

Cartilage imaging in a guinea pig knee joint model of different ages using high resolution propagation-based phase-contrast CT
A. Horng, Munich/DE

Propagation-based phase-contrast CT: an X-ray based high-resolution method for the assessment of in-situ human knee cartilage. Comparison with clinical CT and 3T-MRI
T. Geith, Munich/DE

Evaluation for MRI criteria to predict the visual morphological development and clinical outcome of ACT grafts
B.O.Th. Sabel, Munich/DE

Prediction of short-term clinical outcomes of single- and double-bundle anterior cruciate ligament reconstruction by using magnetic resonance imaging
M. Bankaoglu, Istanbul/TR

Knee injuries in wrestlers: A prospective study from the Indian subcontinent
S. Agarwal, Rohtak/IN

New positioning devices in kinematic MR imaging of patients with patellar malalignment and ACL injuries
C. Muhle, Vechta/DE

MRI evaluation of the knee after double bundle ACL reconstruction; Association of graft findings
M.F. Farghaly Amin, ElMinya/EG

Measurement of bone marrow lesions by MR imaging in knee osteoarthritis: The sensitivity to change assessed by two quantitative methods
F.K. Nielsen, Aarhus/DK

14:00–15:30 **Scientific Paper Session 2 – Hip** **Room 2**

Chairs: I. Engele, Riga/LV; M. Rupreht, Maribor/SI

Predictive value of preoperative anesthetic hip injections, MR imaging features, and demographics in determining functional outcomes following arthroscopic surgery
L.M. Ladd, Madison, WI/US

Femoroacetabular impingement: Normal values of the morphometric parameters in asymptomatic hips
P. Omoumi, Lausanne/CH

Does the presence of femoroacetabular impingement morphotype lead to early osteoarthritis? Comparison of non-osteoarthritic hips of young and old asymptomatic individuals
P. Omoumi, Lausanne/CH

Multiple hereditary exostoses and ischiofemoral impingement: a case-control study
D. McKean, Oxford/UK

Neurogenic myositis ossificans of the hip: Correlation between enhanced CT and surgical findings
B. Law-ye, Paris/FR

Ischiofemoral space on MRI in an asymptomatic population: Normative distance measurements and soft tissue signal variations
Z. Maras Ozdemir, Malatya/TR

Ultrasound of adductor's tendinopathy with surgical correlation
L. Pesquer, Merignac/FR

Hamstring muscles proximal attachment complex: Ultrasound-dissection correlation study
A. Pérez-Bellmunt, Sant Cugat del Valles/ES

The role of SPECT-CT in the evaluation of painful total hip arthroplasties
N. Papadakos, London/UK

14:00–15:30 Scientific Paper Session 3 – Interventional **Room 3**
Chairs: J. Gielen, Antwerp/BE; W. Rennie, Leicester/UK

Thermal ablation techniques: A curative treatment of bone metastases in selected patients?
F. Deschamps, Villejuif/FR

The relationship between CT grading of sacroiliac arthropathy and efficacy of steroid injection treatment: Does high-grade arthropathy have an adverse effect on outcomes?
B. Haberal, Ankara/TR

CT-guided biopsy approach and technique for intra-articular soft tissue masses of the knee
A. Kirwadi, London/UK

Technical outcome, complications and effective patient dose of percutaneous CT-fluoroscopy guided screw placement for the fixation of unstable pelvic fractures
F. Strobl, Munich/DE

CT-confirmed accuracy of open and percutaneous iliac screw placement using anteroposterior fluoroscopy
G. Pasquotti, Pordenone/IT

Diagnostic performance of flat-panel CT arthrography for cartilage defect detection in the ankle joint: Comparison with MDCT arthrography with anatomy as reference standard
Th. Le Corroller, Marseille/FR

C-arm flat panel CT arthrography of the shoulder: Feasibility study and radiation dose considerations
R. Guggenberger, Zurich/CH

Reducing radiation dose in MDCT arthrography of the shoulder: How low can we go?
J. Aguet, Lausanne/CH

14:00–15:30 **Scientific Paper Session 4 – Spine 1** **Room 4**

Chairs: F. Kainberger, Vienna/AT; E. Neilande, Riga/LV

Effect of up-right position on tonsillar position in adolescent idiopathic scoliosis
C.H. Nung, Hong Kong/HK

Do positional magnetic resonance imaging changes of dural sac measurements in supine versus standing correlate with clinical symptoms of lumbar spinal stenosis?
J.C.M. Sitt, Hong Kong/HK

Comparison of apparent diffusion coefficient in spondylarthritis axial active inflammatory lesions and type 1 Modic changes.
B. Dallaudiere, Paris/FR

Diagnostic imaging in young athletes suffering from back pain. Scoliosis?: It's not always true
S. Giannini, Rome/IT

„Romanus" lesion of the spine in MRI studies as a marker of sacroiliitis
A. Garcia-Bolado, Santander/ES

The correlation of the initial clinical, laboratory and MRI findings with the disease outcome in patients with vertebral osteomyelitis
M. Mustapic, Zagreb/HR

MRI dynamic study on the lumbosacral rachis, in athletes suffering from persistent low back pain
S. Giannini, Rome/IT

Reliability of a segmentation method for the quantification of height and T2 relaxation time of lumbar intervertebral discs using magnetic resonance imaging
V. Abdollah, Kowloon/HK

Measurement of magnetically controlled spinal growth rod length: Radiography vs ultrasound
W.W. Yoon, Adelaide/AU

14:00–15:30 **Scientific Paper Session 5 – Tumour** **Room 5**

Chairs: P. Diana Afonso, Lisbon/PT; P. Sarap, Tartu/EE

The grade of cartilage lesions correlates significantly with bone tracer uptake using SPECT/CT
A. Hirschmann, Basel/CH

Neurovascular invasion by soft-tissue sarcoma: Assessment with MR imaging in 174 cases
P. M. Jungmann, Munich/DE

Diagnostic performance of US in the detection of limb soft tissue sarcomas recurrences: A retrospective study with MRI, surgical findings and follow-up as reference standard
B. Bignotti, Genoa/IT

Diagnostic performance of real-time elastography in miscellaneous limb soft tissue masses
A. Tarsi, Bologna/IT

Soft tissue and bone tumour-like lesions in the upper limb; incidence and imaging findings at a tertiary musculoskeletal oncology centre
I. Pressney, Stanmore/UK

Soft tissue synovial sarcoma: MR parameters that predicts histopathology
V. Vasilveska Nikodinovska, Skopje/MK

Extraskeletal Ewing's Sarcoma
V. Vasilveska Nikodinovska, Skopje/MK

High-resolution ultrasound of the iliohypogastric, ilioinguinal and genitofemoral nerves
B. Bignotti, Genoa/IT

16:00–18:00 Tumours **Room 1**
Chairs: S. Orguc, Istanbul/TR; M.-A. Weber, Heidelberg/DE

16:00	Radiological diagnosis of primary bone tumours of the spine J. Bloem, Leiden/NL
16:20	Tumor mimics of the spine I. Beggs, Edinburgh/UK
16:40	Spinal mets A. Baur-Melnyk, Munich/DE
17:00	Soft tissue tumors at and around the spine I. Nöbauer-Huhmann, Vienna/AT
17:20	Advanced MR imaging in multiple myeloma K. Verstraete, Gent/BE
17:40	Surgery of spinal tumours R. Windhager, Vienna/AT

16:00–17:40 Metabolic bone disease **Room 2**
Chairs: G. Guglielmi, Foggia/IT; Ch. Krestan, Vienna/AT

16:00	The role of radiologists in osteoporosis M. Aparisi Gomez, Valencia/ES
16:20	DXA in clinical practice J. Adams, Manchester/UK
16:40	Osteoporotic fractures on radiographs M. Vlychou, Larissa/GR
17:00	Differential diagnosis of vertebral fracture: CT vs MRI Ch. Krestan, Vienna/AT
17:20	Hyperparathyroidism in renal failure J. Bauer, Munich/DE

16:00–17:10 Spinal alternatives **Room 3**
Chairs: F. Aparisi Rodriguez, Valencia/ES; W. Reinus, Philadelphia/US

16:00	Inside the dural sac for non-neuroradiologists E. Oei, Rotterdam/NL
16:20	Can 'short' MRI replace radiographs? J. Teh, Oxford/UK
16:30	Can physiotherapy triage replace MRI V. Parmar, Southampton/UK
16:40	The economics of spinal MRI W. Reinus, Philadelphia/US
17:00	Antibiotics for back pain J. Tuckett, Newcastle upon Tyne/UK

SATURDAY, JUNE 28, 2014

08:30–10:30 Trauma II – The thoracic and lumbar spine — Room 1

Chairs: M. Epermane, Riga/LV; C.F. Van Dycke, Alkmaar/NL

08:30	Patterns of injury in the T & L spine: Where and why they happen R.J. Hughes, Aylesbury/UK
08:50	T & L spine trauma: Is the fracture stable? J. Kramer, Linz/AT
09:10	Strategy of spinal trauma G. Andreisek, Zurich/CH
09:30	The spinal cord following trauma E. de Smet, Duffel/BE
09:50	CT of spinal trauma: Look beyond the spine, common soft tissue findings G. Bierry, Strasbourg/FR
10:10	Rigid spine in trauma M. Taljanovic, Tucson/US

08:30–10:20 Paediatric/Adolescent spine — Room 2

Chairs: I. Boric, Zagreb/HR; P. O'Donnell, Stanmore/UK

08:30	Paediatric spinal trauma E. Geusens, Leuven/BE
08:50	Congenital anomalies: Spina bifida, Klippel-Feil etc. P. O'Donnell, Stanmore/UK
09:10	Dysplasias eg achondroplasia, spondylo-epiphyseal dysplasia M. Calleja, Stanmore/UK
09:30	Scoliosis A. Feydy, Paris/FR
09:50	Back pain in children and adolescents I. Boric, Zagreb/HR

08:30–10:20 Non-spinal intervention — Room 3

Chairs: G. Allen, Oxford/UK; D. Wilson, Oxford/UK

08:30	Thermal ablation of bone lesions other than osteoid osteoma T. Marshall, Norwich/UK
08:50	Ablation of peripheral nerves in the treatment of joint pain L. Sconfienza, Genoa/IT
09:10	At what point does injection therapy fit into the management of shoulder impingement G. Allen, Oxford/UK
09:30	Intra-articular injections (hyaluronidase, steroids, ozone, PRP) S. Giannini, Rome/IT
09:50	What is the evidence of benefit from injection therapy for tendonosis R. Campbell, Liverpool/UK
10:10	Magnetic resonance guided focused ultrasound surgery and treatments for skeletal disorders: Current status of an emerging technology A. Bazzocchi, Bologna/IT

10:45–12:30 **Spondyloarthropathies** **Room 1**
Chairs: N. Egund, Aarhus/DK; C. Schüller-Weidekamm,Vienna/AT

10:45	Spondyloarthritis: An overview for the radiologist J. Grisar, Vienna/AT
11:05	How best to image SpA: Radiographs and MRI C. Schüller-Weidekamm, Vienna/AT
11:25	Imaging sacroiliitis: What does it look like and which modality should I use? I. Sudol-Szopinska, Warsaw/PL
11:45	Imaging the complications of spondyloarthritis M. Taljanovic, Tucson/US
12:00	Imaging of peripheral SpA – do we need an MRI L. Jans, Dendermonde/BE
12:15	Whole body MRI in SpA F. Lecouvet, Brussels/BE

10:45–12:25 **Spinal intervention 2** **Room 2**
Chairs: K. Kupcs, Riga/LV; D. Wilson, Oxford/UK

10:45	Is there a role of percutaneous disc therapy N. Amoretti, Nice/FR
11:05	Different guidance methods to the lumbar facet joints D. Orlandi, Genoa/IT; D.K. Filippiadis, Athens/GR
11:25	Mortality and serious morbidity resulting from cervical root blocks R. Sutter, Zurich/CH
11:45	Access routes and reported decision criteria for lumbar epidural drug injections: A systematic literature review G. Andreisek, Zurich/CH
12:05	Caudal epidural and S.I.Joint blocks under ultrasound guidance N. Shrivastava, New Delhi/IN

★ **12:30-13:30** **Industry Lunch Symposium** **Room 1**
Latest imaging advances and clinical benefit
Chair: M. Epermane, Riga/LV

Clinical implications of WB MRI of the lumbar spine and the potential to improve patient treatment and outcome
M. Boesen, Copenhagen/DK

Finger Ultrasound: From extreme imaging resolution to scanning technique (including live demo US scan)
C. Martinoli, Genoa/IT

13:30–14:30 **Scientific Paper Session 6 – US intervention** **Room 1**
Chairs: H.N. Choudur, Hamilton/CA; L. Sconfienza, Milan/IT

Ultrasound-guided percutaneous injection for De Quervain's Disease using three different techniques: Preliminary results of a randomized controlled trial
D. Orlandi, Genoa/IT

Efficacy of intra-tendinous injection of Platelet-Rich Plasma under US guidance to treat tendinopathy: Assessment on a long-term follow-up experience
B. Dallaudiere, Paris/FR

Diagnosis and treatment of a myotendinous II and III degree insertional Hamstrings's lesion: Effectiveness of the treatment with growth factors, for faster return to sports.
S. Giannini, Rome/IT

Intra-articular US-guided infiltration of oxygene-ozone gas mixture associated with hyaluronic acid for pain control in coxarthrosis
A. Tarsi, Bologna/IT

US-guided percutaneous treatment and physical therapy in calcific tendinopathy of the shoulder: Outcome at 3 and 12 months
G. Pasquotti, Pordenone/IT

13:30–14:30 **Scientific Paper Session 7 – Arthritis, muscles, nerves, osteoporosis** **Room 2**
Chairs: J. Adams, Manchester/UK; J. Jacobson, Ann Arbor/US

Detection and characterization of Ssnovitis in the human finger using fluorescence-mediated tomographic imaging
R. Meier, Munich/DE

Whole-body muscle MRI diagnostic strategy in myopathies and congenital muscular dystrophies with rigid spine syndrome
B. Law-Ye, Paris/FR

Medial plantar entrapment neuropathy, commonly missed diagnosis, applicability of high resolution ultrasound
F. Elahi, Iowa City/US

Contrast effects on bone mineral density (BMD) measurements derived from triphasic multi-detector computed tomography (MDCT)
H. Liebl, Munich/DE

Diagnostic accuracy of routine computed tomography for osteoporosis: An external validation study
G.R. Dijkhuis, Nieuwegein/NL

Prediction of femoral bone strength by grating-based X-ray dark-field vector radiography
Th. Baum, Munich/DE

13:30–14:30 **Scientific Paper Session 8 – Various** **Room 3**
Chairs: M. Adriaensen-van Roij, Utrecht/NL; M. Lohman, Helsinki/FI

WARP imaging of metal-on-metal hip resurfacing arthroplasty at 1.5T and 3T MRI compared to standard sequences and correlation of findings with clinical status
A. Lazik, Essen/DE

Metal artifacts in unicompartmental knee prosthesis MRI: Impact of slice-encoding for metal artifact correction
Ch.A. Agten, Zurich/CH

Evaluation of a T1-w 3D-SPACE sequence for 3T imaging of osteonecrosis and diffuse sclerosing osteomyelitis of the jaw
M. Notohamiprodjo, Munich/DE

The role of intravenous Gadolinium in magnetic resonance imaging diagnosis of metatarsophalangeal joint plantar plate and capsular tears
H. Umans, New York/US

CT of ancient urns containing cremated skeletal remains
M. Cavka, Zagreb/HR

Direct comparison of conventional radiography and cone beam computed tomography in trauma of small bones and joints
E. De Smet, Antwerp/BE

Is there a correlation between lateral acromial and acromioclavicular angles in patients with rotator cuff pathology; MRI findings with arthroscopic confirmation
M. Bankaoglu, Istanbul/TR

13:30–14:30 Scientific Paper Session 9 – Spine 2 Room 4
Chair: P. Sarap, Tartu/EE; J. Teh, Oxford/UK

Differentiation of acute benign and malignant vertebral body fractues with a diffusion-weighted ssTSE sequence: Which is the best combination of b-values for ADC calculation?
T. Geith, Munich/DE

Comparison of lumbar disk height measurements between EOS system and digital radiography
N.E. Regnard, Paris/FR

Assessment of a 3D DCE-MRI sequence in the study of lumbar bone marrow at 3T
G. Lefebvre, Lille/FR

An analysis of 189 spinal trauma patients at a level 1 trauma centre
N. Purohit, Southampton/UK

Coronal imaging of the spine (CIOS)
A. Isaac, London/UK

13:30–14:30 Scientific Paper Session 10 – Intervention spine Room 5
Chair: G. Andreisek, Zurich/CH; T. Marshall, Norwich/UK

Prospective randomized comparative trial between standard vertebroplasty and vertebral augmentation with biocompatible polymer (KIVA implant) in split or incomplete burst fractures
G. Velonakis, Athens/GR

Effectiveness of fluoroscopy-guided infiltrations in terms of pain reduction and mobility improvement in patients with Baastrup disease
G. Velonakis, Athens/GR

Low radiation dose CT versus fluoroscopy guided facet joint injections – A study of clinical and radiological outcomes
A. Isaac, Stanmore/UK

Clinical outcome and technical success of radiofrequency ablation in the treatment of osteoblastomas at various localisations
M.-A. Weber, Heidelberg/DE

Spinal osteoid osteoma and osteoblastoma – Clinical outcome and technical advances of radiofrequency ablation
M.-A. Weber, Heidelberg/DE

14:50–16:20 **Infection/Post-operative spine** **Room 1**
Chairs: V. Mascarenhas, Lisbon/PT; P. Tyrrell, Oswestry/UK

14:50	Pyogenic infection K. Bohndorf, Augsburg/DE
15:05	TB and unusual pathogens R. Arkun, Izmir/TR
15:20	Do I need to biopsy for spinal infection and how do I do it? G. Astrom, Uppsala/SE
15:35	Devices and materials inspinal surgery R. Windhager, Vienna/AT
15:50	Failed back surgery: Non hardware related J. Vandevenne, Genk/BE
16:05	Failed back surgery: Hardware related M. Zanetti, Zurich/CH

14:50–16:20 **Pitfalls in sport** **Room 2**
Chairs: A. Heuck, Munich/DE; M. Shahabpour, Brussels/BE

14:50	Elbow M. Zanetti, Zurich/CH
15:05	Knee M. Shahabpour, Brussels/BE
15:20	Ankle Ph. Robinson, Leeds/UK
15:35	Shoulder A. Grainger, Leeds/UK
15:50	Hip M. Padron, Madrid/ES
16:05	Wrist F. Becce, Lausanne/CH

16:45–16:50 **ESSR 2015 York/UK** **Room 1**
A. Grainger, Ph. Robinson

16:50–17:50 **ESSR Quiz** **Room 1**
Chair: V. Pullicino, Shropshire/UK

Team 1	Team 2
Eva Llopis	Klaus Wörtler
Anne-Grethe Jurik	Judith Adams
Richard Whitehouse	Hans Bloem
Rob Campbell	Claudia Schüller-Weidekamm

17:50–18:50 **General Assembly** **Room 1**

Diploma and Young Researchers Grant-Awardings

INVITED ABSTRACTS

Anatomy of the lower limb peripheral nerves

R.S.D. Campbell; Liverpool/UK

Dr Rob Campbell, Royal Liverpool University Hospital, UK
Dr Andrew Grainger, Leeds University Teaching Hospitals, UK

The demonstration will comprise a combination of powerpoint presentation and live US demonstration of the major peripheral nerves of the lower limb that are commonly evaluated by US.

Femoral Nerve:
Emerges from lateral aspect of the psoas major muscle to enter thigh via femoral canal lateral to femoral artery, and deep to the inguinal ligament. About 4cm distally it divides into anterior and posterior branches.
Motor supply:
Sartorius & pectineus (anterior division).
Rectus femoris, and the vasti muscles (anterior division).
Sensory supply:
Antero-medial thigh (anterior division).
Anterior knee and antero-medial lower leg (anterior division).

Lateral Femoral Cutaneous Nerve of the Thigh:
Runs over lateral aspect of iliacus to enter the thigh just medial to the anterior superior iliac spine, and usually deep to the inguinal ligament (or occasionally through the ligament. In the upper thigh it lies on the superficial surface of sartorius.
Sensory supply:
Lateral aspect of thigh

Sciatic Nerve:
Emerges from thigh inferior to piriformis muscle and lateral to ischium and hamstring tendons. Runs in posterior thigh superficial to the adductor magnus muscle and deep to biceps femoris muscle.
Motor supply (thigh):
Biceps, semitendonosis & semimembranosus
Terminal Branches:
Tibial Nerve
Common Peroneal nerve

Common Peroneal Nerve:
Arises from the sciatic nerve in the distal thigh, passing superficially to lie behind the biceps femoris muscle. It winds around the neck of fibula and divides into deep and superficial branches.
Superficial branch of Peroneal Nerve:
Emerges from peroneal muscle belly in mid lower leg.
Motor supply:
Peroneus brevis & longus
Sensory supply:
Antero-lateral lower leg
Majority of dorsum of foot
Deep Branch of Peroneal Nerve:
Emerges from peroneal compartment and lies adjacent to dorsalis pedis artery at level of ankle.
Motor supply:
Tibialis anterior, EHL,EDL & peroneus tertius
Sensory supply:
1st dorsal web space.

Tibial Nerve:
Arises from sciatic nerve in distal thigh. Passes through popliteal fossa, and gives rise to the sural nerve. Runs in calf deep to soleus muscle. At the level of the ankle it passes behind medial malleolus with posterior tibial artery, between tendons of FHL & FDL.
Terminal Branches:
Medial & Lateral plantar nerves & infero-medial calcaneal branch.
Motor Supply:
Gastrocnemius, soleus, plantaris, Tibialis Posterior, FDL & FHL.

Sural Nerve:
Runs in calf superficial to fascia between medial & lateral heads of gastrocnemius. Passes lateral to Achilles in distal lower leg and behind lateral malleolus to become lateral dorsal cutaneous nerve.

Medial Plantar Nerve:
Runs under abductor hallucis and superficial to flexor digitorum brevis.
Motor Supply:
Abductor hallucis, flexor digitorum brevis, flexor hallucis brevis & 1st lumbrical
Sensory supply:
Plantar aspect of medial 3½ digits.

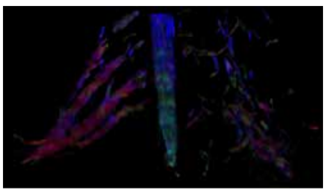
Lateral Plantar Nerve:
Runs in foot between flexor digitorum brevis & quadratus plantae
Motor Supply:
Quadratus plantae, adductor hallucis, flexor digiti minimi, abductor digiti minimi, interossei, & the 3 lateral lumbricals.
Sensory supply:
Lateral plantar surface and lateral 1½ digits.
Exec. Member, Delhi State , IRIA
Member SIMC, State PNDT
Gen. Secretary, Muskuloskeletal Ultrasound Society.

Brachial plexus

A. Tagliafico; Genoa/IT

In the diagnostic workup for brachial plexus pathology, electrophysiological studies are often nonspecific or nonlocalizing, especially at the early stage of some brachial plexopathies, or in cases of mild abnormalities. Imaging modalities, therefore, are necessary for the diagnostic assessment of most brachial plexus disorders. Imaging is currently based on magnetic resonance (MR) imaging, computed tomography (CT), ultrasound (US), and rarely on CTmyelographic techniques or radiography. The use of ultrasound for evaluation of peripheral nerve disorders is gaining importance among different kind of specialists, including anesthesiologists. US has recently proved to be effective in depicting normal brachial plexus anatomy at several levels, including the paravertebral area, the interscalene triangle, the supraclavicular region and the retropectoralis minor space; it is difficult to assess the retroclavicular area. In addition, US is promising in the evaluation of different pathological conditions affecting the brachial plexus, such as traumatic plexopathies, tumors, post-radiation therapies, and other disorders. It has been shown that US is a useful imaging technique for preoperative diagnosis of brachial plexus lesions and differentiation between preganglionic and postganglionic brachial plexus lesions.
The aim of the presentation is to show the normal anatomy, the potential and limitations of brachial plexus US. Comparison with MRI is also discussed.

Take Home Points
US of the brachial plexus is a highly specific test in the setting of suspected brachial plexus lesion, especially a mass lesion or a traumatic lesion.
US is highly sensitive in patients suspected of having a mass lesion involving the brachial plexus.



DTI of a mono lateral brachial plexus lesion

Ultrasound guided nerve block

Á. Bueno Horcajadas; Alcorcón/ES

To know the ultrasound guided nerve block procedures which can be interesting to the interventional musculoskeletal radiologist: indications, start precautions, technical considerations (probe, technical adjustments), the ultrasound guide technique (transversal and longitudinal approaches the needle in relation to the probe), and to describe the specific main peripheral nerve blocks in the upper and lower limb.

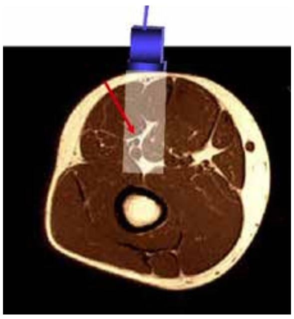
Technical considerations
Peripheral nerves are usually small structures. Therefore it is necessary to use ultrasound machines with good quality image for soft tissue. The high frequency (9-17 MHz) linear probes get excellent resolution image to see these small nerve branches at superficial locations (less than 4 cm). We will use high frequency probes except for the gluteal sciatic approach, which is located deeper. In order to get the best image the focus level of the ultrasound beam must be adjusted at the level or just below the target. We can improve the visualization of the needle tract on longitudinal approach tilting the ultrasound beam by steer tool.

Ultrasound-guide technique
It is necessary to see on real time the progression of the needle tip. We can do transversal or longitudinal approach. The first one is "out of plane". The needle tract is not displayed. It is only seen the tip as a bright (hyperechoic) spot which may show a comet tail artefact. However, it is better if we do not have enough space to puncture the skin in the long axis of the probe. Moreover the needle tract is shorter than with the longitudinal approach, which does show the whole tract.

Start precautions
Take into account the possible toxicity of the local anesthetic (LA), mainly if we accidentally inject it into a vascular vessel, which might produce severe adverse neurological or cardiovascular reactions. Don't forget possible anaphylactic reaction. To alkalize (1:10) the LA (lidocaine and mepivacaine) improve the faster anesthetic effect. All the material we use must be sterile in order to avoid infection. We can cover the probe with a sterile adhesive sheet or with a sterile bigger plastic sheath. We can use sterile water-soluble gel or clorhexidine.

Peripheral nerves of the upper limb Median nerve. At proximal forearm level or more distally. Anterior approach with forearm supination, from lateral side (brachial artery at the medial side).Radial nerve. At elbow level (distal arm). Anterolateral approach through the brachiorradialis muscle.Ulnar nerve. At proximal or distal level of the ulnar tunnel (superficial to the long head of triceps brachialis muscle or next to flexor carpi ulnaris muscle), from a medial approach.

Peripheral nerves of the lower limb Femoral nerve. The probe is located parallel and 2-3 cm below the inguinal crease. Lateral approach to the posterior part of the nerve, under the iliac fascia.Saphenous nerve. At the distal third of the thigh, with external hip rotation and posteromedial approach (femoral artery at the lateral side).Sciatic nerve. At gluteal level. Lateral decubitus of the patient with the target limb up. The probe is located on the line between greater tuberosity (GT) and ischial tuberosity (IT). The nerve is close to the IT. At the sub-gluteal level, the nerve (with typical triangular shape) is behind the common tendon of the biceps femoris long head and semitendinosus. Lateral longitudinal approach. At the popliteal level, just at the division into common fibular and tibial nerves (see-saw maneuver) (figures). And at the tarsal tunnel.Sural nerve.



Take Home Points:
- Ultrasound guided peripheral nerve block is a very useful technique: more efficient, safer and faster.
- However it is necessary to know in detail the ultrasound anatomy of the peripheral nerve and to get the skill of this procedure at the different peripheral nerves.

INVITED ABSTRACTS

Shoulder and upper arm nerve lesions

A. Plagou; Athens/GR

Ultrasound (US) in the shoulder and upper arm area can be used for the evaluation of several peripheral nerve abnormalities such as nerve transection, neuroma formation, nerve entrapment and peripheral nerve sheath tumors. In entrapment neuropathies direct signs such as hypoechoic, swollen appearances of the nerves or indirect signs of muscle atrophy can be assessed with US.
The role of US in the assessment of the nerves in the shoulder region (suprascapular, axillary, long thoracic, and spinal accessory nerves) varies depending on the anatomical course of the nerve and in some cases (such as axillary neuropathy) MR is the method of choice.

The **suprascapular nerve** is particularly susceptible to compression. The suprascapular notch and the spinoglenoid notch are the most frequent sites of nerve entrapment. US can be useful in evaluating suprascapular neuropathy by determining the presence of causes that compress the nerve such as paralabral cysts, spinoglenoid varicosities and also by assessing rotator cuff muscles for atrophy.

Long thoracic neuropathy is usually caused by repeated microtrauma in athletes. Only segments of the nerve can be visualized with US. The role of imaging (preferably MR) in this entity lies mainly in the detection of denervation signs of the serratus anterior muscle.

The **spinal accessory nerve** supplies the trapezius and sternocleidomastoid. Its external branch is mainly a motor nerve and has a superficial course beneath the superficial cervical fascia where it is vulnerable to blunt trauma, traction, and penetrating wounds or surgical procedures, such as cervical lymph node biopsy. US examination with high-end equipment has high spatial and contrast resolution and is even more efficient than MR in revealing stump neuromas or scar tissue.

In the upper arm the **radial nerve** is predisposed to injury and entrapment at the spiral groove of the humerus usually after a humeral diaphysis fracture, most often in children. Ultrasound findings of spiral groove syndrome can vary from hypoechoic swelling of the radial nerve to complete nerve transection.

The **musculocutaneous nerve** is a sensitive and motor nerve that gives motor innervation to the flexor muscles of the forearm. It can be identified with abduction and lateral rotation, in the medial side of the proximal third of the arm, between the biceps and the coracobrachialis muscles. High resolution ultrasound is very helpful in assessing lesions of the musculocutaneous and lateral antebrachial cutaneous nerves.

Take Home Points
Ultrasound is a useful diagnostic tool for the assessment of nerve lesions in the shoulder and upper arm. Direct signs such as changes in nerve morphology and indirect signs such as muscle denervation and atrophy can be demonstrated with US. High-resolution US is particularly useful in the assessment of small, superficial nerves. In cases of nerves at deeper locations, US can be used as a diagnostic tool provided that the anatomic area of study is visualized with US. Sound knowledge of the anatomy and the course of peripheral nerves is a prerequisite to an efficient US examination

Elbow and forearm

L.M. Sconfienza; Milan/IT

Neuropathies of the elbow and forearm may affect different nervous structures. The most common condition around the elbow is certainly the cubital tunnel syndrome, the second most common neuropathy of the upper limb after the carpal tunnel syndrome. It is a compression neuropathy that can occur either at the condilar groove or at the edge of the arcuate ligament. Causes of compression include direct extrinsic compression on the condilar groove, bone abnormalities, and soft-tissue lesions. Spectrum of clinical findings include elbow pain and sensory symptoms in the area innervated by the ulnar nerve. Diagnosis is mainly based on electrophysiological studies but US may demonstrate the presence of nerve thinning/thicknening and associated abnormalities. Ulnar nerve instability at the cubital tunnel is also a common finding and it has been reported to be asymptomatic in up to 47% of patients. When symptoms are present, US may demonstrate nerve thickening with hypervascularization.
Moving distally, anterior and posterior interosseous neuropathies can be encountered. Anterior interosseous neuropathy (also known as Kiloh-Nevin syndrome) occurs where nerve branches off the median nerve, in proximity to the pronator teres and the tendinous bridge connecting the heads of the flexor digitorum superficialis. When this syndrome is clinically suspected, US evaluation is usually inconclusive, as the nerve is very thin. However, abnormal reflectivity of innervated muscles (i.e., flexor pollicis longus, the flexor digitorum profundus and the pronator quadratus). Posterior interosseous

neuropathy is an uncommon condition of the posterior interosseous nerve that typically impinges near or behind the supinator muscle at the proximal third of the forearm, where it enters a strong fibrous arcade (i.e., arcade of Frohse). Clinical presentation is typical and US is able to identify the thickened nerve impinging in the arcade of Frohse.

Wrist and hand

R.S.D. Campbell; Liverpool/UK

Median nerve

Enters the wrist via carpal tunnel. Sensory supply to thenar eminence, volar aspect of thumb, index, middle and radial ring finger (and dorsal fingers). Motor supply to thenar muscles (APB, FBP & OP) and 1st/2nd lumbricals.
Clinical relevance & US applications:
Compression neuropathy: Carpal Tunnel Syndrome. The role of US includes:US diagnosis of CTS. Findings include: Nerve flattening in CT and swelling proximal to CT, bowing of flexor retinaculum, peri-neural vascularity on Doppler, and increased CSA >10-12mm2 (or differential CSA >2mm2 between CT & PQ).Exclusion of secondary causes of CTS e.g. flexor tenosynovitis or proximal peripheral nerve sheath tumoursDiagnostic/therapeutic nerve blockade for equivocal cases, or for temporary CTS e.g. pregnancy.

Ulnar nerve

Enters the wrist within Guyon's canal adjacent to ulnar artery & divides into superficial sensory (hypothenar eminence & volar aspect of little finger & ulnar border of ring finger) and deep motor branches (interossei, 3/4th lumbricals and hypothenar muscles).

Clinical relevance & US applications:
Compression neuropathy due to ganglia, ulnar artery aneurysm/thrombosis, or hook of hamate fractures. Sensory/motor involvement depends on site of compression.

Anterior Interosseous nerve

Branch of median nerve, 4cm distal to elbow. Lies on anterior surface of interosseous membrane. Motor supply to FPL, PQ and FDP 1&2.
Clinical relevance & US applications:
Compression neuropathy resulting in weakness & paralysis of muscles. US used to identify muscle atrophy to confirm diagnosis (MRI more sensitive for early muscle denervation oedema). US especially useful for isolated involved of FDP1, when it may mimic tendon rupture of index finger.

Distal Anterior & Posterior Interosseous nerve

No cutaneous sensory fibres in the AIN or PIN.ButPIN: sensory fibres to dorsal wrist capsule, & AIN terminates in PQ muscle and wrist joint.
Clinical relevance & US applications:
US guided nerve blockade in distal forearm for patients with chronic wrist pain (e.g. end stage arthrosis) as a diagnostic test prior to surgical neurectomy.

Superficial branch of the Radial Nerve

Sensory fibres to dorsal aspect of thumb, index finger, radial aspect of middle finger and radial half of the wrist.
Clinical relevance & US applications:
Wartenberg's syndrome. Compression neuropathy at site of exit between brachioradialis & ERCL during forearm pronation, or as it crosses extensor group I tendons at wrist. Differential: de Quervains tenosynovitis & intersection syndrome. US: to exclude other causes of wrist pain. Consider neural blockade for compression neuropathy prior to surgical release.

Digital Nerves

Terminal branches of ulnar & median nerves.
Clinical relevance & US applications:
Diagnosis of digital neuromas (differentiate from glomus tumours).

Common peroneal nerve

J.A. Jacobson; Ann Arbor, MI/US

The common peroneal or fibular nerve forms at bifurcation of sciatic nerve with tibial nerve (L4, L5, S1, S2), which then courses posterior to biceps femoris and fibula and wraps around fibular neck. The common peroneal nerve then divides into superficial branch (motor innervation to peroneal muscles and sensory to dorsolateral foot and ankle) and deep branch (motor innervation to anterior compartment muscles and extensor digitorum brevis and sensory to first dorsal interspace). The common peroneal nerve also gives off the lateral sural cutaneous nerve and three articular branches, the latter of which is the proposed mechanism for intraneural ganglion cyst formation. Pathologic conditions of the common peroneal nerve and its branches include trauma, entrapment, intraneural ganglion, and nerve sheath tumor. Trauma may be in the form of laceration (from external forces or from a fibula fracture) and compression (habitual leg crossing), both of which may result in neuroma formation. Entrapment may involve the common peroneal nerve where it passes between the fibula and peroneus longus muscle, as well as the superficial peroneal nerve where it pierces the crural fascia approximately 9 cm proximal to the fibula tip. Intraneural ganglion cyst formation is due to joint fluid from the tibiofibular joint entering retrograde into the common peroneal nerve via its articular branches. Patients with a high body mass index are more prone to this condition, given higher likelihood of joint effusions and increased intra-articular pressure in the knee joint, which may communicate to the tibiofibular joint. The resulting intra-neural ganglion cyst may extend proximal into the sciatic nerve or again distal via the tibial nerve. Peripheral nerve sheath tumors will appear as a round or oval hypoechoic mass with low level internal echoes in continuity with an entering and exiting peripheral nerve. Regardless of the underlying nerve pathology, it is important to evaluate the innervated muscle distally for signs of denervation, which appear as increased muscle echogenicity, and atrophy, which additionally shows decreased muscle size.

Take Home Points

Ultrasound is an ideal imaging method to evaluate the peroneal nerve given the superficial location of the common peroneal nerve, high resolution of ultrasound, and ability to directly correlate with patient symptoms. Common peroneal nerve pathology includes trauma, entrapment, intraneural ganglion cyst formation, and peripheral nerve sheath tumor.

Ankle, foot and calf nerve lesions

E.G.G. McNally; Oxford/UK

Nerve entrapment syndromes below the knee are relatively uncommon with tarsal tunnel syndrome and Morton's neuroma accounting for the vast majority of cases. Compression of other nerves including the superficial and deep peroneal, medial and inferior calcaneal, medial and lateral plantar, sural and saphenous nerves result in less familiar syndromes but it is important for imagers to consider them in the differential diagnosis of non-specific ankle and foot pain. In some cases the cause of neural compression is obvious and a mass lesion: ganglion, synovial cyst or tumour is found. Nerve injury should be considered when there has been trauma, including iatrogenic trauma from fracture fixation or arthroscopy and overuse. Other causes are more subtle and extrinsic compression or intrinsic nerve changes are not so obvious. In such cases, a careful review of the course of the nerve, looking for more subtle deviation, compression, localised tinels sign and secondary muscle changes for motor nerves, may lead to the correct diagnosis. Localised injections of local anaesthetic can also assist with sensory nerve compression.

Take Home Points

Tarsal tunnel and Mortons neuroma are common, other lesions are rare, but need to be considered when the cause of symptoms remains elusive

All you need to know about ultrasound of nerve tumours in 15 minutes

M. Reijnierse; Leiden/NL

The purpose of this presentation is
- to get an overview of peripheral nerve tumours
- to show US examples of nerve tumours
- to learn advantages and limitations of ultrasound

The Ultrasound (US) diagnosis of a nerve tumour is based on the demonstration of continuity of a mass with a nerve, both on the proximal and distal side. Its manifestation can be nerve pain or tingling, motor or sensory nerve disturbances, but a mass without symptoms is frequently present (1,2). Peripheral Nerve Sheath Tumours (PNST) are predominantly benign and include both schwannoma (also called neurilemmoma, or neurinoma) and neurofibroma. US differentiation between

these two is difficult, however the peripheral location of a mass relative to a nerve favours schwannoma (3, 4). The demarcation of the tumor with a small amount of fat is called the "split fat sign" (1,2) and a benign sign.
Malignant PNST are associated with neurofibromatosis 1: they are typically larger (>5 cm), ill-defined, increase in size rapidly and may show central necrosis (1,2).
Neurinoma can develop secondary to compression or entrapment neuropathy, the mortons neurinoma is a well known example. A stump neuroma can develop after amputation or penetrating injury(1).
The non-neurogenic origin of a mass infiltrating or connecting to a nerve should be considered.
The superficial location of peripheral nerves and the high spatial resolution of the US equipment, with high frequency probes up to 18 MHz, are a good combination for radiological diagnosis of a nerve tumour. However, the deeper location of e.g. the sciatic nerve and femoral nerve might favour the use of a curved 5 MHz transducer (1). This is where US has its limitations. The use of MRI should be considered in order to get an overview of the exact location and extension of a larger mass. Plexiform neurofibroma can have a complex extension.

Conclusion
The specific US characteristics and the superficial location make nerve tumours well suited for ultrasound.

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Take Home Points
Most nerve tumours are benign: the most common are schwannoma, neurofibroma, perineurinoma, morton neuroma, traumatic neuroma.
Malignant PNST are associated with neurofibromatosis 1.
Pathognomic for a nerve tumour is the connection of a mass proximal and distal to a nerve.
US has a high spatial resolution and is suited for superficial locations; use MRI for deeper locations and better tumour assessment.

Embryology and development of the osseous spine

F.M.H.M. Vanhoenacker[1], B. Denoiseux[2], B. Loeys[2]; [1]Antwerp/Ghent/BE, [2]Antwerp/BE

Learning objectives
- To summarize the different stage in development of the osseous spine
- To illustrate how errors of these embryologic steps may result in congenital abnormalities and variants.

Discussion
The development of the vertebral column comprises 3 major stages, the precartilaginous stage, the cartilaginous stage and finally the bony stage.
The precartilaginous stage or mesenchymal stage starts at week 4 of foetal life with sclerotome formation followed by resegmentation of sclerotomes.
The cartilaginous stage (chondrification) begins at week 6 of foetal life.
The bony stage (ossification) starts during the embryonic period and is completed by the age of 25.
At the end of the embryonic period, 3 primary ossifications centers appear, i.e. in the centrum and in each half of the vertebral arch.
At birth, each vertebra consists of 3 osseous parts connected by cartilage. The vertebral arch halves fuses at 3-5 year of age. Fusion of the posterior elements occurs first at the lumbar region and spreads then cranially.
At puberty, 5 secondary ossification centers are present, i.e. 2 rim epiphyses at the superior and inferior vertebral body respectively, at tip of each transverse process and one at the tip of spinous process. Fusion of these secondary ossification centers is completed at the age of 25.
Errors in formation (Fig. 1.), resegmentation (Fig. 2.), chondrification (Fig. 3.) and ossification may result in morphological anomalies of the vertebral column.
During the fetal period, the normal curve of the vertebral column is kyphotic. During infancy, cervical lordosis develops as the child is holding its head upright, whereas lumbar lordosis develops secondarily due to sitting and standing posture. In 95 % of the population 7 cervical vertebrae, 12 thoracic vertebrae, 5 lumbar vertebrae en 5 sacral vertebra are present. In 3 % of the population, 1 or 2 additional vertebrae are seen, whereas 2 % has less.

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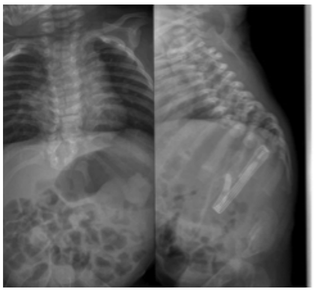


Fig. 1. Error in formation of the lumbar spine. Caudal regression syndrome.

Fig. 2. Error in segmentation of the cervical spine.

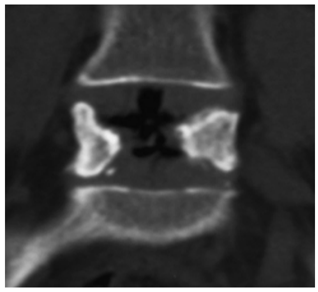


Fig. 3. Error in chondrification in L5.

Take Home Points
1. Development of the osseous spine is complex and follows 3 main stages.
2. Thorough understanding of the errors that may occur during embryogenesis may be helpful to explain morphological abnormalities of the spine.

Anatomy of the sacroiliac joint

A.-G. Jurik; Aarhus/DK

The sacroiliac joints (SIJs) play a major role in the diagnosis of spondyloarthritides. In recent years, MRI of the joints has increased dramatically to obtain an early diagnosis. The anatomy of the SIJs is complex and knowledge hereof is important to determine/detect normal and pathological findings by MRI.
The SIJs are composed of two different joint portions, a C- or an L-shaped cartilage covered (cartilaginous) portion anteriorly/inferiorly and a ligamentous portion posteriorly/superiorly.
Histologically, the cartilaginous portion is proximally built as a symphysis with the articular cartilage being connected by ligaments. There is no synovia in the upper part, but synovia is present in the most distal part where fluid-filled pouches may be visualized by MRI. The ligamentous joint portion is built as a syndesmosis.
Macroscopically, the cartilaginous joint facets vary in size, shape and contour but are typically formed corresponding to the sacral segments S1-S3 in males whereas inclusion of the whole S3 segment is uncommon in females. The cartilaginous joint facets are thus usually smaller in females than in males, and the position is often more horizontal. The sacral joint facet may be concave, relatively straight or convex and may vary cranio-caudally. The corresponding iliac joint facet has the opposite contour resulting in a slim joint space with a maximum width of 2-3 mm in young adults, gradually narrowing with age.
The interosseous SIJ ligament encloses the cartilaginous joint posteriorly as well as fills the spaces between the sacrum and the ileum. This ligament has the most extensive bony origin and volume of all SIJ ligaments and is thereby a major site of entheses. A clear visualisation of this joint portion by MRI requires a semi-axial slice orientation.
In addition to the complex joint structure, anatomical variants simulating disease are frequent.
In conclusion, visualisation by MRI requires axial slices as well as perpendicular coronal slices to provide adequate anatomical information and thereby a possibility to detect disease-specific characteristics and normal variants.

Take Home Points
The anatomy of the SIJs is complex. Knowledge hereof is important to determine/detect normal and pathological findings.

Normal variants in the spine

M.W. Anderson; Charlottesville, VA/US

Normal variants are extremely common in the spine and may simulate true pathology. As such, a familiarity with the spectrum of spinal variants is important for accurate diagnosis. Additionally, some variants may be a source of back pain in which case, CT and especially MRI are often helpful adjuncts in their evaluation. This session will cover common normal variants of the spine, including those that may cause symptoms, and discuss the imaging features that assist in their accurate identification.

Topics that will be discussed include:

C1-C2
- Os terminale
- Os odontoideum
- Defects in the C1 ring

Dysraphism
Block Vertebrae
Vertebral Wedging
Endplate Variants
- Schmorl's nodes
- Limbus vertebra

Baastrup's Disease
Transitional Vertebrae

Take Home Points

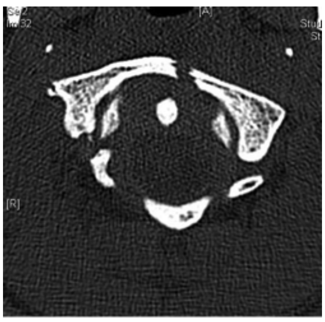
1. Normal variants are common in the spine. A familiarity with the imaging appearances of the most common variants is important when trying to differentiate these from true pathology.
2. While most are asymptomatic, some „variants" may be a source of back pain.
3. CT and especially MR imaging are useful for determining the clinical significance of a given finding.

Patterns of injury: The Occiput to C2

M. Sampson; Southampton/UK

The upper 2 segments of the cervical spine form a highly specialised complex, which, together with the occipital condyles, support a large cranial mass while allowing a wider range of movement than elsewhere in the spinal column. The vertebrae have unique anatomical and osteological characteristics and are subject to a different range of mechanical stresses than the sub axial spine. The injury patterns which are seen from C0 to C2 are thus specific to this level and have potentially devastating consequences. Diagnosis can be challenging and a combination of radiography, computed tomography and magnetic resonance imaging are often necessary to fully assess the injury pattern.
This review will look at the specific anatomical features, injury patterns and diagnosis of upper cervical injuries with particular reference to some of the more common injury patterns such as fractures of the occipital condyles, arch of the Atlas, hangman's fracture and fractures of the odontoid peg.

flexion extension injury lateral radiograph



axial CT

same case - sag fat suppressed MR

Take Home Points

1. Any fracture is simply the bony manifestation of a larger soft tissue injury.
2. The alignment shown on diagnostic imaging reflects the position once reduced, stabilised for admission and imaging and it may appear deceptively normal.
3. The position of the vertebral artery is not uniform and should be described in all fractures involving C1/2.
4. Any upper cervical abnormality on a plain radiograph in the context of trauma should lead to additional imaging with CT scanning.
5. CT does not detect ligamentous injury.
6. MRI may overlook fractures especially at the occipital condyles and C1 due to the small amount of marrow at these levels.

Imaging Cervical Spine Trauma Inferior to C2

W. Rennie; Leicester/UK

In this brief presentation we will cover imaging of the most common and devastating of cervical spine injuries. It is important to recognize that ~20% of patients will have more than a single injury to the cervical spine. Overwhelmingly these second injuries occur in the same mechanistic grouping. Hyperflexion is the most common mechanism of trauma, but other devastating injuries occur in the other mechanistic groupings as well. We will review the most common and devastating of cervical spine trauma, including imaging of flexion and extension teardrop fractures, bilateral and unilateral facet dislocations, burst fractures, and hyperextension dislocations.

Brachial plexus injuries

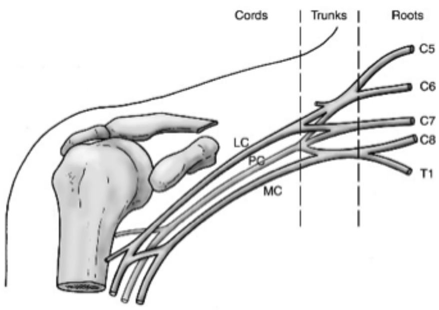
J. Rankine; UK

Trauma to the brachial plexus

Recent advances in neurosurgical technique have improved the outlook for patients with brachial plexus injuries. Surgical options include nerve grafting, nerve transfer and most recently root implantation into the spinal cord (1). The choice of surgical procedure depends on the level of the injury and the radiologist has an important role in guiding the surgeon to the site of injury.

Traditionally brachial plexus injuries have been investigated with myelography, which more recently has been combined with CT. Initial studies in the use of MRI showed that MRI was not as accurate as CT myelography (2). Recent advances in MRI allow images of much higher resolution so that MRI can now match the diagnostic accuracy of CT myelography (3) (4).

This lecture will describe the anatomy and patho-physiology of traction brachial plexus injury in the adult. The neurosurgical options available will be described with emphasis on the information that the surgeon wants from imaging studies of the brachial plexus. The relative merits of MRI and CT myelography will be discussed.



Diagrammatic representation of the brachial plexus. LC lateral cord, PC posterior cord and MC medial cord.

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Battlefield spinal injuries

R.N.J. Graham; Bath/UK

Been learnt about imaging battlefield casualties in the acute setting. Multidetector CT allows accurate determination of battlefield trauma injuries. Spinal injuries feature in battlefield trauma and their nature depends on mechanism of injury. Mechanisms of injury that cause spinal injury in the battlefield are mounted and dismounted blast injury, gunshot wound, road traffic collision and falls from height. This review will present examples of battlefield spinal injury and which types to expect from the different mechanisms. The content of the review is based in the author's experience as a deployed radiologist in Afghanistan in 2010 and 2013.

Take Home Points

MDCT is the best modality for imaging battlefield spinal trauma
Different mechanisms of injury produce different spinal injuries
Identification of spinal injuries is crucial in the management of battlefield casualties

"Whiplash": Is it a radiological diagnosis?

M. Adriaensen; Heerlen/NL

Aims

To understand the difference between whiplash, whiplash injuries, and WAD (Whiplash-Associated Disorders).
To become familiar with a biomechanical model of whiplash.
To know the role of the radiologist with regard to whiplash.

Method

In this presentation the definition of whiplash as introduced by the Quebec Task Force in 1995 will be used. A four phase biomechanical model of whiplash will be presented. The difference between whiplash injuries and whiplash-associated disorders will be explained. And a clinical classification of grades of whiplash-associated disorders indicative of the seriousness of the injury sustained will be presented. Finally, the role of the radiologist will be discussed.

Take Home Points

There is a difference between whiplash, whiplash injuries, and Whiplash-Associated Disorders.

How to differentiate between rheumatoid arthritis and osteoarthritis

F. Miese; Düsseldorf/DE

Rheumatoid arthritis (RA) is a systemic autoimmune disease leading to joint destruction, chronic pain and disability, if untreated. Early diagnosis is important for disease control with antiinflammatory therapy can lead to remission and halt joint destruction. Diagnosis is made based on clinical and laboratory parameters, typical imaging features may help to establish diagnosis. The presence of erosions at diagnosis has prognostic value for an adverse course of the disease and conventional radiographs of the hand and feet should be taken at first diagnosis. The roentgensymtomatology is characterized by erosions, osteoporosis, joint-space narrowing and soft tissue swelling with the MCP and the wrist being most frequently involved.

Although osteoarthritis (OA) is the most frequent form of arthritis, its pathophysiology remains poorly understood. Nodal OA of the hands has a high prevalence in the elderly with a female predominance and needs to be differentiated from RA. The involvement of DIP, PIP and first MCP with subchondral sclerosis, osteophytes, cysts and asymmetrical joint space narrowing are radiographic findings that help to distinguish OA from RA. In the erosive subtype of OA there is an inflammatory component with synovitis and soft tissue swelling, which may show overlapping imaging findings with RA and may need to be addressed with anti-inflammatory therapy.

Undifferentiated peripheral inflammatory arthritis is a term used to describe the condition of patients that cannot be classified as having RA or another definite form of arthritis. It may represent the early form of a specific disease, a self-limited condition or is considered an entity by itself by some authors. It remains a diagnosis of exclusion without pathognominic imaging findings.

In the differential diagnosis of RA and OA, conventional radiographs of the hand and feet will frequently be sufficient. MRI has been shown to be more sensitive to inflammation and bony destruction yielding a much higher count of erosions, compared to radiography. Due to the long imaging times, MRI is frequently limited to small number of joints. Scintigraphy can help to assess the involvement pattern of a polyarthritis and add valuable information for the differential diagnosis. PET-CT and hybrid PET-MRI quantitatively assess inflammatory activity and have demonstrated high potential in scientific studies on inflammatory joint diseases.

Take Home Points
Radiography in patients with peripheral joint complains aims at the establishment of differential diagnoses.
The involvement of DIP, PIP and first MCP with subchondral sclerosis, osteophytes, cysts and asymmetrical joint space narrowing are radiographic findings that help to distinguish OA from RA.
The development of bony erosions in patients with an aggressive course of RA still requires several months: the absence of erosions does not rule out early RA.
The presence of erosions in the initial diagnosis of RA is an adverse prognostic marker.

How to image Vasculitis?

J.K. Kloth; Heidelberg/DE

Vasculitides may involve small, medium-sized or large arteries. There are several radiologic modalities available, each having specific indications. In large-vessel vasculitis, circumferential wall swelling and smoothly tapered luminal narrowing are typical findings in diagnostic imaging, whereas aneurysms are a hallmark of medium-sized artery vasculitides. Imaging lungs, nasal sinuses, cerebrum and parenchymateous organs is important in small-vessel vasculitides. Determination of disease extension and disease activity is in the foreground of diagnostic imaging. It has led to a better understanding of the nature and distribution of vasculitides and plays a substantial role in interdisciplinary disease-management.

Take Home Points
High-resolution magnetic resonance imaging (MRI) depicts granulomas and mucosal inflammations in paranasal sinuses, nasal cavity and orbits and is also an established screening modality for CNS vasculitides, allthoug there are limitations with regard to specificity.
MR-angiography (MR-A) is also a non invasive too to diagnose vascular disease in Takayasu's arteritis and giant cell arteritis involving predominantly large and medium sized vessels.
Computed tomography (CT) detects osseous lesions of the skull and provides a thorough analysis of lung disease in pulmonary vasculitides.
Percutaneous transluminal angiography has proven to be an effective and save therapeutic modality for the cure of vascular stenosis and occlusion.

Complications in RA

F. Kainberger, H. Platzgummer, G. Bodner, C. Schueller-Weidekamm; Vienna/AT

Along with new treatment options and earlier diagnosis of rheumatoid arthritis (RA) the spectrum of complications has been changed. Complications may result from extension or compression of inflammatory pseudotumours, from drug toxicity, or skeletal instability. They should be viewed in the context of the systemic and extraskeletal manifestations of RA.

Indications for imaging: the following scenarios may request imaging: infection, signs of secondary neoplastic disease, neuropathy, dyspnoea, symptoms of cardiovascular disease, bleeding disorders, instability (especially of the cervical spine or due to orthopaedic ware failure).

Interpretation: Local anatomic distribution patterns and characteristic imaging features are helpful to differentiate the often synchronous appearance oflocal or systemic infections from autoimmunologic manifestationslymphoma and solid malignancies from rheumatic lymphocytic infiltrationDrug-induced leukencephalopathy or meningeal disease from RA-related vasculitis or meningitis,peripheral toxic neuropathies from neuritisinterstitial lung diseasesatherosclerosisFelty's syndrome and Kaplan's syndromeArthritis-associated osteoporosis, osteonecrosis, or endoprosthetic loosening.

Conclusion: In aggressive forms of RA, a systematic search for complications should be done as they are associated with a life shortening of 10 years compared to the general population.

Scoring in rheumatology

V.M. Pansini; Lille/FR

Several scoring systems are available in rheumatology.
In many cases these are based on composite algorithms including clinical and biological features and sometimes imaging abnormalities.
Radiologists may be involved in both scoring rheumatic diseases for diagnostic purposes and following up in clinical and therapeutic settings.
According to the ACR-EULAR 2010 criteria, clinical examination is the gold standard in affirming diagnosis of rheumatoid arthritis.
Erosions are visible on radiograms late in the progression of the disease, and for this reason conventional radiography is not considered unless evident erosions are visible in at least three different joints.
However, this technique is largely used to score the evolution of the disease and also to assess the results of therapy. The most common used scores in clinical practice are:
Larsen, Sharp score modified by Van der Heijde, SENSE (Simple Erosion Narrowing Score) and GENANT.
Ultrasound has been proposed by the OMERACT group for follow up and to evaluate the efficacy of the treatment.
RAMRIS and SAMIS scores are MRI scores that can be used to detect attenuation of synovitis, tenosynovitis, and to asses the presence and modifications of bone edema and erosion. However, these scores are generally used only in clinical trials and are not used routinely.
The Criteria Modified of New York 1984, and the AMOR criteria were revised by the ESSG (European Spondyloarthropathy (SPA) study Group). None of these classifications consider MRI for the diagnosis.
The ASAS was the first group to include MRI findings for the assessment of the diagnosis.
Moreover, they classified SPAs into two main categories. The two categories were based on the preponderance of (1) axial or (2) peripheral joint involvement.
In axial SPA, MRI plays a pivotal role in evaluating the activity of the disease by monitoring both the spine and sacro-iliac joints. As a result, the Berlin and Canada scores have been introduced.
In peripheral SPA, a modified Sharp score, (including assessment of distal inter phalangeal joints), has been introduced to monitoring erosion on hand plain films in patients affected by psoriatic arthritis.
Although many studies enhance the potential benefit of MRI and ultrasound to evaluate the effects of anti-TNF-α on disease progression, no straight recommendations have been given. Just one MRI score, (PsAMRIS), aims to quantify detected abnormalities.

Take Home Points
Several score systems are used to assess rheumatic diseases for diagnosis and follow-up. Radiologists should be familiar with the most common scoring systems in order to answer clinicians needs adequately.

Disc herniation: usual and unusual

A. Cotten; Lille/FR

Disc herniation is one of the most common causes of back pain and one of the main clinical indications of CT and MR imaging of the spine. Even if the diagnosis is frequently straightforward on imaging, the role of radiologists is fundamental in the precise description of imaging features (location, type, extent, compression of adjacent structures, associated miscellaneous findings...).
However, unusual presentations of disc herniations exist and may be particularly misleading (unusual location, density or signal...), suggesting other spinal disorders.
The aim of this presentation is to present usual and more unusual imaging features of disc herniations.

Take Home Points
Imaging features of disc herniations have to be precisely described on CT and MR.
Disc herniations may be associated with unusual imaging features.

Spinal stenosis

N.H. Theumann[1], D. Schizas[2]; [1]Lausanne/CH, [2]Vrilissia - Athens/GR

Objective
To devise a qualitative grading of lumbar spinal stenosis (LSS), study its reliability and clinical relevance.

Summary of background data
Radiologic stenosis is assessed commonly by measuring dural sac cross-sectional area (DSCA). Great variation is observed though in surfaces recorded between symptomatic and asymptomatic individuals.

Methods
We describe a 7-grade classification based on the morphology of the dural sac as observed on T2 axial magnetic resonance images based on the rootlet/cerebrospinal fluid ratio. Grades A and B show cerebrospinal fluid presence while grades C and D show none at all. The grading was applied to magnetic resonance images of 95 subjects divided in 3 groups as follows: 37 symptomatic LSS surgically treated patients; 31 symptomatic LSS conservatively treated patients (average follow-up, 2.5 and 3.1 years); and 27 low back pain (LBP) sufferers. DSCA was also digitally measured. We studied intra- and interobserver reliability, distribution of grades, relation between morphologic grading and DSCA, as well relation between grades, DSCA, and Oswestry Disability Index.

Results
Average intra- and interobserver agreement was substantial and moderate, respectively (k = 0.65 and 0.44), whereas they were substantial for physicians working in the study originating unit. Surgical patients had the smallest DSCA. A larger proportion of C and D grades was observed in the surgical group. Surface measurements resulted in overdiagnosis of stenosis in 35 patients and under diagnosis in 12. No relation could be found between stenosis grade or DSCA and baseline Oswestry Disability Index or surgical result. C and D grade patients were more likely to fail conservative treatment, whereas grades A and B were less likely to warrant surgery.

Conclusion
The grading defines stenosis in different subjects than surface measurements alone. Since it mainly considers impingement of neural tissue it might be a more appropriate clinical and research tool as well as carrying a prognostic value.

Take Home Points
The grading defines stenosis and carries a prognostic value.

Pathology of the posterior elements

S.I. Alam[1], M. Khanna[2], A.M. Refaat[2]; [1]Qatar/QA, [2]Doha/QA

One of the most common causes of low back pain and neck pain is degenerative disc disease of the spine, however it is not uncommon to have low back pain due to pathologies of the posterior elements which are often missed or underreported. This has been true for most of the spine imaging in the era of X- rays. With the utilization of cross sectional imaging such as CT or MRI, this hidden structure on X rays, and its pathologies are getting more and more diagnosed and reported.
We are going to present common degenerative prosess of the different ossesous and ligamentous structures that comprise the so called posterior elements of the spine. Anatomical entities discussed will include: posterior inter spinous ligament, spinous process and facet joints which are often among the common locations that are affected in combination or in isolation to the diffuse degenerative changes involving the spine.

Posterior Interspinous ligament and Spinous process
Kerochanna G et al classified the interspinous ligament degeneration of the lumbar spine on MRI describing it into four (A to D) grades (1).
A --Low or iso signal intensity on T1 and T2 weighted sequence.
B--High signal intensity on T1 and T2 weighted sequence.
C--Low on T1 and high on T2 weighted sequence.
D--Low or iso on T1 and T2 weighted sequence with hypertrophy, marrow signal alteration and narrow interspinous interval.
Kaeorochana et al reported Grade A changes to be the most common. Grade C or the Baastrup's disease, although the 3rd commonest subtype, has been traditionally been treated surgically. It remains the most commonly underreported pattern on imaging. MRI in Baastrup's disease can show fluid signal between the involved spinous processes representing adventitious bursa formation and interspinous bursitis. Fluid within this bursa has been described to track into the posterocentral epidural space causing central canal stenosis (2).

Facet Joints

Implicated as a major source of neck and low-back pain. Both cervical and lumbar facet syndromes is well described in the literature (3).

The intervertebral disc and the facet joints function as a three-joint complex. Degenerative changes of the intervertebral disc therefore affects the normal anatomy and function of the facet joints also.

Degenerative changes of the facet joints are similar to those observed in peripheral joints and is characterized by osteophytes, hypertrophy, osteosclerosis, subchondral bone erosions and cartilage abnormalities. Schinnerer KA et al reported presence of exaggerated fluid in the facet joints on MR as a predictor of instability (4).

Weishaupt et al reassessed Patharia et al four point grading for facet degeneration and highligthed the usefullness and applicability on MRI and CT(5).

The changes on MRI and CT were graded into:

Grade Criteria

Grade 0- Normal facet joint space (2–4 mm width)

Grade1- Narrowing of the facet joint space (<2 mm) and/or small osteophytes and/or mild hypertrophy of the articular processes

Grade2- Narrowing of the facet joint space and/or moderate osteophytes and or moderate hypertrophy of the articular processes and/or mild sub articular bone erosions

Grade 3 -Narrowing of the facet joint space and/or large osteophytes and/or severe hypertrophy of the articular processes and/or severe subarticular bone erosions and/or subchondral cysts

Another degenerative process involving the facet joints is spondylolisthesis especially at 4th and 5th lumbar vertebral levels. Boden et al have atributed this finding to more sagittal orientation of the facets at these levels (6).

Juxtafacet or Juxtaarticular cysts, as the name suggests, are synovial cysts in relation to the facet joint capsule which are almost always associated with facetal degenerative changes. Although its anterior extension has been reported in 2-3% only, its intraspinal extension has the potential to cause posterolateral canal narrowing.

Ligamentum Flavum

Hypertrophy and or calcification involving the ligamentum flavum in the setting of degenerative spine is a frequently observed finding with facet arthropathy. (7).

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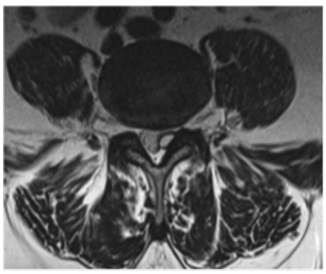
Epidural cyst with Baastrup's Disease



Ligamentum Flavum Cyst

Take Home Points

Degenerative changes of the spine are not only limited to the vertebral endplate or disc involvement .The continuum of the process is involvement of the posterior elements also which either gets underreported or buried in the description of a report.

Timely identification of the changes involving the posterior elements and its contribution to the patient's symptoms, can be appropriately dealt either with conservative management or image guided minimally invasive interventional procedures.

Osteophytes, syndesmophytes, DISH, OPLL
R. Whitehouse; Manchester/UK

Osteophyes and Diffuse idiopathic skeletal hyperostosis are very common radiographic findings in the spine. Syndesmophytes are less common and ossification of the posterior longitudinal ligament and/or ligamentum flavum even less so. This lecture will illustrate some of these appearances in the classical diseases of diabetes, ankylosing spondylitis, pseudogout and „degenerative" spondyloarthropathy, along with rarer conditions such as hypophosphatemic osteomalacia and hypoparathyroidism.

Take Home Points
Diabetes is common, DISH is associated with this condition
Spinal ankylosis predisposes to unstable spinal fracture
OPLL is uncommon in Europe

Foraminal stenosis
X. Demondion; Lille/FR

The intervertebral foramen is a space located between two adjacent vertebrae that allows communication between the spinal canal and the extraspinal region. It serves as the path crossed by spinal nerve roots, as well as vascular structures, including some which play a role in vascularization of the spinal cord. Knowledge of the anatomy of the intervertebral foramen and understanding of pathoanatomy along with the lumbar foraminal stenosis are essential for a better interpretation of imaging and management of patients.
The aim of the presentation is to review the anatomy and radioanatomy of the intervertebral foramina in the cervical and lumbar spine and to present the pathoanatomy of foraminal stenosis as well as its illustration with imaging.

Take Home Points
- The intervertebral foramina, regardless of the segment considered, are crossed not just by nerve roots but also by veins and arteries, some going to the spinal cord.
- Any pathology that occludes or reduces the size of an intervertebral foramen such as loss of disc height, herniation of the intervertebral disc, degenerative changes of the zygapophyseal joint can lead to compression on the spinal nerve.

Does cement augmentation work?
D.J. Wilson; Oxford/UK

Cement augmentation is a term that covers vertebroplasty, Kyphoplasty and other variations of percutaneous injections of materials to support insufficiency fractures of the spine.
The first therapy of this type was undertaken by Deramond and his co-workers in Amiens in the late 1980's. Since then there have been many thousands of patients treated. Scientific analysis of the results showed good but less than perfect pain and disability outcomes. As the symptoms are self-limiting in a majority of patients analysis is difficult. The first studies that raised doubts were published in the New England Journal of Medicine in 2009. Two similar prospective randomised double blind trials indicated that an injection of local anaesthetic into the painful region was as effective as cement injection. There are two possible reasons for this; either there is no effect from cement augmentation other than placebo or perhaps the local anaesthetic was therapeutic in some patients. Subsequent non randomised research showing a 36% recovery when all patients were treated by bupivacaine injection supported the later view.
More recently preliminary results from a more tightly controlled repeat of the „sham procedure" research has shown early identical results to the 2009 data but a significantly better result in the long term outcome for the cement augmentation results.
It seems to me that we are still not good at selecting those for treatment. The key to good management is to identify those who have pain from spinal overload and joint stress from the overall deformity and those who have fracture pain.

Take Home Points
Back pain following vertebral insufficiency fracture has many causes.
Patient selection is key.
Simple anaesthetic injection may exclude those who have mechanical pain.
Cement augmentation may be the best method for treatment of pain due to fracture instability.
Long term outcome is better when cement augmentation is part of the treatment regimen.

Outcome assessment and factors influencing the success of imaging-guided therapeutic spine interventions

T. Dietrich; Zurich/CH

Introduction: Many patients with cervical and lumbar pain respond favourably to spinal injections. Assessment of patients' outcomes after imaging-guided therapeutic spine interventions is an important integral component of routine patient assessment and for scientific evaluation. Valid, reliable and simple outcome quantification tools are available (1-7).
Numerical Rating Scale for Pain (NRS): Pre- and post-injection pain levels can easily be assessed using the 11-point numeric rating scale (NRS-11), thus the NRS-11 enjoys widespread clinical use. Patients are asked to rate their pain on a scale from 0 to 10, in which 0 represents no pain and 10 represents the worst pain imaginable (5, 8).
Patient's global impression of change (PGIC) scale: Patients' quality of life outcomes after the injection may be assessed using the 'patient's global impression of change (PGIC) scale'. The PGIC is a short patients' questionnaire and includes a 7-point verbal scale assessing multiple aspects of the patient's quality of life and response to treatment. The PGIC scale response options includes 'much worse,' 'worse, 'slightly worse,' 'no change,' 'slightly better,' 'better,' and 'much better.' Clinically relevant 'improvement' includes the responses of 'much better' or 'better' on the PGIC scale. The responses 'slightly worse', 'worse' and 'much worse' are considered as clinically relevant 'worsening'. The remaining PGIC responses are interpreted as 'no change' (6-7, 9-10).
Differences in outcome analysis between patients' cohorts: Two studies reported that patients returning postal questionnaires revealed worse outcomes after imaging-guided lumbar spinal injections compared to telephone interview patients. Furthermore patients receiving facet injections at more than one level reported greater levels of pain reduction (1, 3).
Several investigations have shown gender differences in response to pain and analgesics. The most significant differences for diagnosis-specific sex differences in reported pain were found in patients with disorders of the musculoskeletal, circulatory, respiratory and digestive systems. However gender comparisons for pain revealed no significant differences in pre-treatment pain level and at 1-month post-injection after imaging-guided spinal injections between males and females in a prospective outcome study on 3900 patients with musculoskeletal complaints. Opposed to spinal injections, the authors described significantly higher baseline pain levels in females for glenohumeral, subacromial and knee injections with no significant differences for any of these injections at 1-month follow-up. Thus the authors concluded, that evaluating pain levels at one point in time may not be sufficient to assess the patients' pain, and that the change in pain over time may be more important to the patient (2, 11-14).
Sociodemographic factors, overweight, cigarette smoking, and psychiatric and physical comorbidity are also associated with neck and lower back pain and affect treatment outcome. However, no published outcome data of these variables are available for imaging-guided therapeutic spine injections (15-20).
In summary optimal pain control for each individual is required. Simple, valid and reliable assessment tools for patients' outcomes after imaging-guided therapeutic spine interventions can easily be applied at any institution. However method of data collection and differences of the study cohorts should be considered when reporting treatment outcomes (3).

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Take Home Points
- The Numerical Rating Scale for Pain (NRS) and Patient's global impression of change (PGIC) scale are valid, reliable and simple patients' outcomes quantification tools after imaging-guided therapeutic spine interventions.
- Method of data collection and differences of the study cohorts should be considered when reporting treatment outcomes.

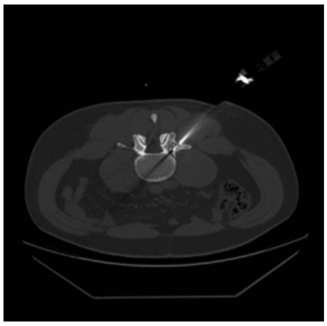
Interventions in spine tumors

J. Martel, A.L. Bueno; Alcorcon/ES

The aim of this speech is to perform a general review of the different radiological percutaneous procedures used to diagnose and treat the spine tumors. These procedures can be merely diagnostic, such as biopsy, or only therapeutic, such as tumour ablation (osteoid osteoma, osteoblastoma, metástasis) or embolization (hemangioma). I´ll review the indications, advantages and complications of these techniques avoiding talking about vetebroplasty and cementoplasty.

Vertebral biopsy

Bone biopsy needle



Osteoid osteoma ablation

Take Home Points
1. How to perform vertebral biopsy: technique
2. Pre- procedural steps
3. Complications following percutaneous CT-guided biopsy
4. How to perform spinal osteoid ablation
5. Special technical considerations
6. Other percutaneous ablation

The advantages of cryoblation over thermal and mechanical methods for bone metastases

M. Moynagh; Rochester, MN/US

Thermal ablation has an emerging role as a minimally invasive alternative to conventional therapies in the palliation of painful osseous metastases and potentially treatment of oligometastatic musculoskeletal disease. Skeletal metastases are common and may cause intractable pain, pathologic fracture, reduced performance status and quality of life. This talk will include:

1. Review of current treatment therapies for multidisciplinary management of osseous metastases, focusing upon patient selection and determining treatment goals – pain palliation, local control and/or bone stabilization.
2. Review the role of cryoablation compared to alternative ablation techniques for the treatment of spine osseous metastases – effectiveness, limitations and advantages. Advantages of cryoablation include intraprocedural ice-ball visibility and improved periprocedural pain relief.
3. Discussion of intraprocedural techniques for reducing the risk of nerve injury, including the role of electromyographic monitoring with somatosensory or transcranial-stimulated-motor-evoked potentials (MEPs).
4. Case illustration and discussion. A series of clinical cases will be discussed to highlight the advantages and limitations of cryo- and radiofrequency ablation of osseous metastases.

Take Home Points
Suggested algorithm for successful ablation treatment of bone metastases.

BME in ankle and foot

J.-A. Choi; Seoul/KR

Bone marrow edema describes non-specific, ill-defined areas of hypo- and hyperintense signal intensity on T1-weightd and T2-weighted sequences, respectively. Many disorders manifest as bone marrow edema in the foot and ankle, which may appear similar. The cause may be due to fluid, hemorrhage, fibrosis, and necrosis.
Bone marrow edema pattern may be multifocal or localized in specific bones.
Common causes of multifocal bone marrow edema include, stress, high turnover in children, altered biomechanics, contusions or fractures, immobilization, complex regional pain syndrome (CRPS), infarcts, osteoarthritis, inflammatory arthritis, neuroarthropathy, and transient osteoporosis.
Localized bone marrow edema in specific bones may results from the following: trauma due to avulsion fracture or contusion, osteoarthritis, inflammatory arthritis, impingement.
According to specific bone, there may be lesions as follows:
Distal tibia: traumatic disorders, such as contusions, occult fractures, avulsions of flexor retinaculum, syndesmotic and deltoid ligaments, impingements, posterior tibialis dysfunction, arthropathies, osteoarthritis, osteochondral impaction injuries.
Distal fibula: stress and occult factures, avulsion fractures, calcaneofibular ligament avulsion, impingement, superior peroneal retinacular injury or friction.
Talus: trauma, impingement, inflammatory arthritides, sinus tarsi syndrome.
Calcaneus: stress and occult fractures, ligament avulsions, Achilles tendon and peroneus longus tendon abnormalities, fasciitis, osteoarthritis, inflammatory arthritides, impingement.
Clinical history, knowledge of anatomy, and familiarity with specific patterns of bone marrow edema distribution may provide helpful hints for MRI diagnosis of bone marrow edema.

Take Home Points
There are various causes of bone marrow edema in ankle and foot, including stress, high turnover in children, altered biomechanics, contusions or fractures, immobilization, complex regional pain syndrome (CRPS), infarcts, osteoarthritis, inflammatory arthritis, neuroarthropathy, and transient osteoporosis, trauma due to avulsion fracture or contusion, osteoarthritis, inflammatory arthritis, impingement.
Clinical history, knowledge of anatomy, and familiarity with specific patterns of bone marrow edema distribution may provide helpful hints for MRI diagnosis of bone marrow edema.

PTT insufficiency & spring ligament injuries

C. Sofka; New York, NY/US

Carolyn M. Sofka MD
Hospital for Special Surgery
New York, New York USA

In this Rapid Fire Session, the normal anatomy of the posterior tibial tendon (PTT) and spring ligament will be reviewed in addition to a presentation of common pathologies and their magnetic resonance and sonographic imaging appearances. There will be an emphasis on the relationship of PTT and spring ligament insufficiency with respect to the acquired adult flatfoot deformity. The clinical relevance of injuries to these structures and surgical treatment options will also be discussed.

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Take Home Points

1. The posterior tibial tendon (PTT) and spring ligament can be reliably visualized on MRI as well as ultrasound
2. Abnormalities of the PTT and spring ligament are often seen in the setting of acquired adult flatfoot deformity
3. Characterizing the severity of these injuries is important as there is significant clinical relevance for surgical treatment options

Injuries around the medial corner

E. Llopis; Alzira-Valencia/ES

We will review the complex anatomy of the medial side of the knee, the injuries patterns of the posteromedial corner of the knee, biomechanical impact on instability, imaging MRI findings and briefly treatment alternatives
Medial side of the knee can be divided into static and dynamic structures. Medial collateral ligament has superficial and deep parts. Posteromedial corner is different in function and structures from the MCL. Structures included are the posterior oblique ligament (POL) as a separate structure, the semimembranous distal expansions including the oblique popliteal ligament and the postero-medial horn of the meniscus. The intimate relationships between the posteromedial structures are critical for dynamic stability.
Instability and injuries of the posteromedial structures have been associated with ACL graft failure. Posteromedial corner injuries are frequent with multiligament knee injuries and occur more frequent than isolated MCL injuries.
Coronal plane together with axial MRI planes provide exquisite visualization of these structures however semimembranous extensions are difficult to individualize.
Injuries of the semimembranous insertions include avulsions of its tibial attachment, partial and complete tears. POL injuries comprise sprains, partial and complete tears. OPL merges with the posterior capsule and when injured soft tissue edema surrounds posteromedial capsule.
Knowledge of anatomy and precise MR evaluation is essential to avoid chronic instability and failure of ACL grafts

Take Home Points

Posteromedial corner structures function is to restrain anteromedial rotary instability.
Posteromedial corner structures are: posterior oblique ligament, semimembranous expansions, oblique popliteal ligament and posterior horn of the medial meniscus.
Posteromedial corner injuries are frequently associated with ACL ruptures.

Postero-lateral corner injuries

M. de Maeseneer, M. Shahabpour; Brussels/BE

The posterolateral corner can be looked at in a broad and narrow sense. In a broad sense all lateral and posterolateral structures contribute to this area. In a narrow sense only the small posterolateral corner ligaments make up this area.
Our discussion focuses on anatomy and injuries of the following structures: iliotibial band, anterolateral ligament (Segond fracture), fibular collateral ligament, biceps tendon, fabellofibular ligament, popliteofibular ligament, arcuate ligament,and oblique popliteal ligament.
The anatomy of these structures is shown on MR correlated with cadaveric dissection and slices. Examples of injuries are shown.

Conclusion
Although injuries of the posterolateral structures are rare, affliction of multiple structures with subsequent instability warrants repair. This area has a complex anatomy and we aim to clarify it in this focus session.

Take Home Points
1. Understand the complex anatomy of lateral and posterolateral structures.
2. Recognize patterns of injury.
3. Understand Segond fracture.

Snapping hip

T. Le Corroller, M. Cohen, P. Champsaur; Marseilles/FR

Snapping hip presents as an audible and/or palpable snapping that occurs around the hip during motion, and can be associated with or without pain. Advances in imaging techniques have improved diagnostic accuracy of the various causes of snapping hip, mainly by providing real-time imaging assessments of moving structures during the snapping phase. The causes of snapping hip have been divided into two distinct categories: extra-articular and intra-articular.
Extra-articular snapping hip can be further subdivided into external and internal causes. The external form of snapping hip is the most common cause. It is associated with snapping of the iliotibial band and/or gluteus maximus over the greater trochanter during return to full extension of the hip. Internal snapping hip occurs anteriorly and involves the iliopsoas tendon, which may be difficult to differentiate from intra-articular causes of hip pain. Dynamic ultrasound is a well-suited complementary tool to MRI/arthrography for diagnosing snapping hip because of its real-time visualization of the snapping structures. Ultrasound-guided injections can also help for both diagnostic and therapeutic purposes.
On the other hand, intra-articular causes of apparent snapping hip are actually mechanical hip symptoms often described as locking, catching, or giving way, that include labral tears, paralabral cysts, intra-articular bodies, fracture fragments, and synovial osteochondromatosis. Unlike extra-articular causes of snapping hip, dynamic ultrasound is not useful for the diagnosis of intra-articular pathology.
Most snapping hip cases will be treated conservatively. Yet, a treatment algorithm can help identify those refractory cases that require surgery.

Take Home Points
1. The causes of snapping hip have been divided into two distinct categories: extra-articular and intra-articular. Extra-articular snapping hip can be further subdivided into external and internal causes.
2. Advances in imaging techniques have improved diagnostic accuracy of the various causes of snapping hip, mainly by providing real-time imaging assessments of moving structures during the snapping phase.
3. Image-guided treatments can also be useful in the diagnostic work-up of snapping hip given the complexity and multitude of causes of hip pain.

Upper limb injuries in gymnastics

M. Terra, L. Kox, M. Maas; Amsterdam/NL

Gymnastics is a very challenging and physical demanding sport and predisposes to diverse injuries of the musculoskeletal system. The high intensity and volume of training required to be competitive make young gymnasts with an immature skeleton extreme vulnerable to injury during their training and competition years.
Gymnastic related injuries can roughly be divided in two main categories, acute injuries and chronic overuse problems. Acute injuries usually result from a fall or faulty landing, while chronic overuse problems often are a result of chronic repetitive injury to tissue, especially the epiphysis and apophysis, over an extended period of time.
During gymnastic activities the upper extremity is generally used to support body weight and is subjected to many different types of stress, including repetitive motion, high impact loading and axial compression.
Many typical gymnast-related injuries of the wrist, elbow and shoulder can be seen in elite gymnasts. In the presentation we will focus on gymnastic wrist injuries, an important overuse injury of the wrist, and its radiological features as seen in our institution.

Take Home Points
Physicians should be alert to recognize the typical injuries of the growing skeleton, which can especially be found at the epiphysis and apophysis.
Most of the overuse injuries of the upper extremity in elite gymnasts are found in the wrist.

Upper limb injuries in racquet sports

E.G.G. McNally; Oxford/UK

Upper limb injuries in racquet sports can involve the neck, thoracic inlet, shoulder, elbow and wrist. Biomechanical adaptations including, tennis shoulder, GIRD and sick scapular syndrome contribute to shoulder disorders, which include subacromial subdeltoid bursitis, glenohumeral instability, internal impingement, neural entrapment and rotator cuff disease. Posterosuperior impingement and rotator cuff disease will be emphasised. Other conditions include symptomatic os acromiale, biceps tendinopathy, chondral injury, ACJ and SCJ OA.
The commonest elbow lesion is CEO enthesopathy. CFO and disorders of the UCL are less common. Neural impingements include high radial nerve compression, but all other nerves may be involved.
The commonest tendon disorders at the wrist involve extensor compartment 1 and 6. Radial pain may also be caused by SLL disruption and ulnar sided pain by TFC, pisiform subluxation and hook of hamate injury, with associated injury to the ulnar neurovascular bundle.

Take Home Points
Posterosuperior impingement, rotator cuff and sasd impingement, CEO enthesopathy, extensor compartment 1 and 6 tendon disorders and scapholunate and TFC disease are the most common imaging diagnoses.

Radiological diagnosis of primary bone tumours of the spine

J.L. Bloem; Leiden/NL

Only 5% of spinal tumors are primary osseous tumors. In this course we'll focus on making a specific diagnosis. Although tumors can arise or extend anywhere in the spine, there are some preferential locations. Lesions that are more commonly found in the vertebral body are; hemangioma, GCT, Langerhans cell histiocytosis, chordoma, lymphoma. Lesions are more commonly located in the posterior elemens: osteoid osteoma, osteoblastoma, osteochondroma, ABC, osteosarcoma and chondrosarcoma. Chondroblastoma is equally found in the vertebral body and posterior elements.

Preferential levels in the spine are; cervical: chordoma, osteochondroma; thoracic-lumbar; enostosis, chondrosarcoma, osteosarcoma, ABC; lumbar; osteoid osteoma; sacrum; chordoma, Ewing, GCT, benign notochord tumor.

In addition to these diagnostic clues, imaging features that are different from other locations will be discussed.

Take Home Points
Primary osseous tumors are rare in the spine, with the exception of hemangioma
Most primary osseous lesions occur in the posterior elements

Spinal mets

A. Baur-Melnyk; Munich/DE

Bone metastases are the most common secondary bone tumors of the spine. There are 3 types of metastases, osteolytic, osteoblastic and mixed type. These have a different presentation in x-rays, CT, MRI and PET-CT. X-ray is often false negative. CT can clearly demonstrate tumor matrix and the extent of osseous destructions. The radiologist should give a fracture risk assessement. MRI is the most sensitive method for metastasis detection by showing directly bone marrow involvement. Different pseudotumors and bone marrow lesions and variations can mimic metastases. These are e.g. bone marrow islands, Schmorl´s nodes, hemangioma, bone marrow edema and inflammations. Sometimes malignant collapse of a vertebra is the first sign of a malignancy. It is of clinical importance to differentiate it form an acute benign osteoporotic vertebral collapse. Morphologic as well as special sequences, such as DWI, can help in finding the correct diagnosis.

Take Home Points

- To learn the typical image characteristics in X-ray, CT, MRI and PET-CT of spinal mets.
- To know the mimikers of spinal mets.
- To differentiate acute benign from malignant vertebral collapse.

Soft tissue tumors at and around the spine

I.M. Noebauer-Huhmann; Vienna/AT

Soft tissue tumours of the spine are rare, and only a small proportion is malignant. However, early recognition and correct diagnosis of the few unsuspected sarcomas, resulting in early appropriate therapy, is crucial for the clinical outcome. MR is the imaging modality of choice for imaging of soft tissue tumours at or around the spine. CT serves as an additional modality for the assessment of matrix calcification and/or bone involvement.
Several common benign soft tissue tumours and those of intermediate dignity, as well as tumour-like lesions of the spine may exhibit typical MR features, e.g., lipoma, cystic structures, schwannoma or neurofibroma, or fibromatosis.
MR findings of low/high differentiated liposarcoma may also be characteristic. Lesions that are indeterminate or likely malignant require histologic diagnosis. Biopsy should preferably be performed by image-guidance; ultrasound-, CT- or MR-guidance may be used.
The importance of MRI for staging of soft tissue tumours will also be discussed, including spine-specific compartmental involvement.

Take Home Points

1. To understand the basic principles and algorithms of diagnostic imaging of soft tissue tumours at and around the spine.
2. To become familiar with the most important soft tissue tumour entities at and around the spine, and their typical imaging presentations.
3. To learn about important pitfalls and differential diagnoses of soft tissue tumours at and around the spine.

Advanced MR imaging in multiple myeloma

K.L.A. Verstraete[1], J.C. Dutoit[2]; [1]Ghent/BE, [2]Vichte/BE

Bone marrow invasion by multiple myeloma (MM) and its precursors [smouldering myeloma (SMM) and monoclonal gammopathy of unknown significance (MGUS)] can be investigated with whole body MRI (WB-MRI), dynamic contrast-enhanced MRI (DCE-MRI) and diffusion-weighted MR imaging (DWI).
WB-MRI allows to calculate a "skeletal score", providing information on the number of skeletal areas that are affected by the disease. Also the pattern of infiltration (focal, salt-and-pepper or mixed, diffuse, and a combination of focal and diffuse infiltration) can be recognized.
DCE-MRI allows to study tissue vascularization (angioneogenesis), perfusion, capillary permeability and the volume and bulk water flow in the interstitial space. Qualitative evaluation by analysis of the shape of the time-intensity curve and quantitative analysis using the Tofts model allow to identify highly vascular tumoral tissue.
DWI displays the Brownian motion of water molecules, and is influenced by cellularity of the bone marrow, ratio of fatty/red bone marrow, trabecular bone and bone destruction, and tissue perfusion.
Diagnosis and monitoring therapy can be done using a combination of whole body MRI, DCE-MRI and DWI. MGUS, SMM and patients responding to therapy have slower perfusion and cellularity than MM and relapsing disease.
Fatty rim sign, myxoid transformation and fading of lesions are signs of good response.
There are a few of lesions mimicking MM, such as herniation pit, Schmorll nodule, enchondroma, …

False positive errors can be made in younger patients and after bone marrow stimulation with erythropoietin or GCSF. False negative errors can be made in MGUS and SMM, resembling normal bone marrow.
Hematologists request MRI in non-secretory myeloma, cases with uncertain diagnosis, MGUS and SMM (stable or progressive), to monitor therapy and before and after autologous stem cell transplantation.

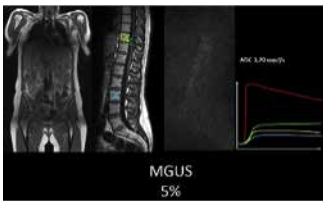

Fig 1.: WB-MRI, DCE-MRI (+TIC) and DWI in MGUS with 5% plasma cells

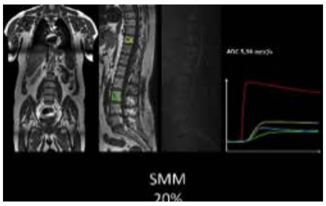

Fig 2.: WB-MRI, DCE-MRI (+TIC) and DWI in smouldering myeloma with 20 % plasma cells

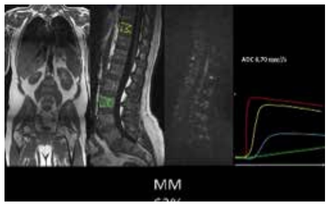

Fig 3.: WB-MRI, DCE-MRI (+TIC) and DWI in multiple myeloma with 62 % plasma cells

Take Home Points
A combination of whole body MRI, DCE-MRI and DWI is required for evaluation of multiple myeloma and its precursors
MGUS, SMM and patients responding to therapy have slower perfusion and cellularity than MM and relapsing disease
False positive errors can be made in younger patients and after bone marrow stimulation with erythropoietin or GCSF
False negative errors can be made in MGUS and SMM, resembling normal bone marrow.

The role of the radiologist in osteoporosis

M. Aparisi Gomez; Valencia/ES

Osteoporosis is a very important health issue in our current ageing societies. Effective treatments to prevent fragility fractures derived from osteoporosis are available.
Imaging techniques are able to identify individuals at risk of fracture that could benefit from treatment and can monitor response to these treatments.
In this talk we will review the different techniques to measure bone strength based on quantity and quality assessment.
DXA is currently the most commonly used technique to quantitatively measure bone density and diagnose osteopenia/ osteoporosis. Other techniques such as quantitative CT play a role as well, especially on monitoring response to treatment.
We will discuss techniques that will allow a qualitative bone strength assessment such as high resolution peripheral quantitative CT, MDCT, MRI and quantitative US.
Finally we will summarise and emphasise the key steps in which the role of the radiologist is determinant, with special attention to the diagnosis of prevalent fragility fractures that will alter patient care.

Take Home Points
The role of the radiologist in the assessment of osteoporosis is a determinant one, from diagnosis to monitorisation of treatment, specially important in the detection of fragility fractures and communication of the increased fracture risk, so that action can be taken.

DXA in clinical practice

J. Adams; Manchester/UK

Bone Densitometry: DXA in clinical practice
Dual energy X-ray absorptiometry (DXA), introduced in 1980s, is now most widely utilised method for bone mineral densitometry (BMD)(1). Strengths of DXA: low radiation dose (1-6 microSv per scan site) (2); good precision (CV = 1%-2.5% depending on site, if executed by a few, well-trained/experienced technical staff), is applied to sites relevant to osteoporotic fractures (spine [L1-4]; hip [femoral neck FN; total hip]; forearm [distal radius], is applicable to WHO definition of osteoporosis (T score at or below -2.5) & since 2010 DXA FN BMD is used in WHO 10 year fracture risk tool calculator (http://www.shef.ac.uk/FRAX/)(3,4). Main limitations of DXA are: measures integral (cortical + trabecular) bone & provides 'areal' BMDa in g/cm2 so is size dependent, resulting in under-estimation in small bones, a particular issue in

children. Number of methods suggested to correct for this size dependency in children by calculating volumetric bone mineral apparent density (BMAD) or height-adjusted Z-scores which are recommended (5,6).
DXA images mus be scrutinised for artefacts which cause erroneous BMDa (1) so relevant vertebrae can be excluded; must be a minimum of 2 vertebrae for interpretation. With technical developments in DXA (improved detectors, slight increased radiation dose, C arm etc) spatial resolution & image quality has improved & images of whole spine are feasible to perform vertebral fracture assessment (VFA)(7) (http://www.iofbonehealth.org/vertebral-fracture-teaching-program).
As 50% of vertebral fractures may be asymptomatic, but strong predictors of future fracture, diagnosis is important to management. We perform VFA in women over 65y; men over 70y & those on oral glucocorticoids with no spinal imaging in past 12m.
Developments have occurred in body composition assessment but remains a research application (8)

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Take Home Points

1) technical aspects of DXA bone densitometry
2) strengths and limitations of technique
3) who should have DXA
4) how to interpret results
5) artefacts & how to correct for them
6) in who to perform DXA VFA
7) interpretation of VFA
8) what can be measured by whole body DXA

Differential diagnosis of vertebral fracture: CT vs MRI

C. Krestan; Vienna/AT

This lecture focuses on the abillity of computed tomography (CT) and magnetic resonance imaging (MRI) in differentiating osteoporotic from malignant vertebral fractures. Benign and malignant vertebral collapse is common in the middle-aged and elderly population. The prevalence and the most common sites of benign and malignant vertebral fractures and their clinical implications are discussed. Differential diagnosis sometimes remains difficult using radiographs, (CT) and (MRI) if strong edema is present. Morphological changes of cortical and trabecular bone of vertebral bodies help to distinguish between osteoporotic and non-osteoporotic vertebral fractures, which applies to CT and MRI. Magnetic resonance imaging is a very sensitive tool to visualize bone marrow abnormalities associated with vertebral fractures and allows differentiation of benign versus malignant fractures to a certain extent.Newer methods include MR-spectroscopy (MRS) and the apparent diffusion coefficient (ADC) obtained by diffusion-weighted read-out-segmented echo-planar imaging. Functional imaging including Positron emission tomography combined with CT or MR (PET-CT/PET-MR) with hybrid-scanners are promising tools for future imaging of the spine. Increased fluorodeoxyglucose (FDG) uptake accounts for the neoplastic cause of a fracture. Hyperintensity on diffusion-weighted images and an elevated perfusion on MRI are associated with the malignant cause of a fracture.

Take Home Points

However, the combination of all modalities/criteria should be taken into account for differential diagnosis.

Hyperparathyroidism in renal failure

J.S. Bauer; Munich/DE

To ensure calcium homeostasis, there is a strong endocrinologic link between bone and kidney. In chronic renal impairment, the endocrine function of the kidney is deranged prior to the exocrine function. Both lead to a wide spectrum of bone and soft tissue abnormalities. This mixture of secondary hyperparathyroidism, osteoporosis, osteomalacia and soft tissue calcification – the typical form of renal bone disease – is less frequently seen, while adynamic bone disease is increasing with current therapies. Also nowadays, plain radiographs remain the main imaging tool to differentiate those bony changes. Typical changes must be appreciated by every radiologist.

Take Home Points

- To understand fundamental interactions between bone and kidney.
- To appreciate typical imaging findings in renal bone disease.
- To differentiate secondary hyperparathyroidism in renal failure from adynamic bone disease.

Inside the dural sac for non-neuroradiologists

E. Oei; Rotterdam/NL

This lecture will start with a discussion of the compartmental anatomy of the spine, emphasizing the anatomy of the dural sac and its contents. The normal appearance of the spinal cord, conus medullaris, cauda equina, and dorsal root ganglion on MRI is illustrated. Next, a brief overview of traumatic, degenerative, inflammatory, and degenerative intradural pathologies is presented, focusing on lesions that may be encountered as incidental findings on musculoskeletal MRI examinations. Common pitfalls and MR artefacts are also reviewed.

Take Home Points

- Adequate understanding of the compartmental anatomy of the spine is essential for determining a correct differential diagnosis of spinal pathologies.
- Common intradural abnormalities with a characteristic appearance can be diagnosed with confidence, even when encountered as an incidental finding on musculoskeletal MRI examinations.
- Occasionally, a dedicated MR examination of the spinal cord is necessary to narrow the differential diagnosis.

Can 'short' MRI replace radiographs?

J. Teh; Oxford/UK

Most patients with low back pain respond to conservative management and do not require imaging.In a small proportion, pain is more persistent and imaging is requested to exclude sinister disease. The principal causes that should be excluded are malignancy, infection, vertebral collapse, spondylitis and pars defects. Plain radiographs were the traditional first-choice imaging technique, but their relative insensitivity, particularly to the early disease, should be recognized. Visualization of a destructive lesion on plain radiography requires loss of at least 80% of medullary bone. Even when abnormalities are detected, plain radiographs may not define them completely. For example, acute vertebral collapse cannot be distinguished from chronic and, in comparison to MR, benign causes are difficult to separate from malignant ones. If plain radiographs are performed and are negative this may wrongly reassure clinicians that there is no significant pathology. Limited or "short" MRI using sagittal T1 and STIR sequences has the ability to exclude significant pathology in the spine, and used judiciously can replace radiographs in most circumstances

Take Home Points

1. Plain radiographs may be insensitive, and falsely reassuring
2. Limited or „short" MRI comprises sagittal T1 and STIR sequences
3. Limted MRI can replace radiographs

Can physiotherapy triage replace MRI

V. Parmar[1], H.-U.R. Aniq[2]; [1]Southampton/UK, [2]Liverpool/UK

Aim: To compare sensitivity of pathology on imaging between referrals from primary care, physiotherapists, spinal surgeons and from other secondary care providers.
Methods: A retrospective review of 200 consecutive MRI scans of patient's first presentation to radiology for MR lumbar scanning at a tertiary orthopaedic centre. A scan report was defined as positive if there was any evidence of neural compromise. Fisher exact 2x2 contingency analyses performed.
Results: 87 scans were positive (43.5%) and 113 (56.5%) negative. 44% of GP scans were reported as positive compared to 57% of scans referred from physiotherapists. Only 40% of scans referred from the specialist spinal surgeons, and only 20% of referrals from non-spinal team secondary care providers were positive. Physiotherapists are statistically more likely to refer MRI lumbar spine scans that are positive, compared to general practitioners (p=0.05), spinal surgeons (p=0.03) and others (0.004).
Conclusion: We should encourage, when appropriate, referrals via the extended physiotherapy service rather then directly from general practitioners. To improve efficiency and reduce the workload on both the radiology department and spinal surgical unit, with appropriate training and in the appropriate clinical context, extended physiotherapy services could be extended to inpatients and accept outpatient referrals from other secondary care providers and not just from general practitioners

Take Home Points
We should encourage, when appropriate, referrals via the extended physiotherapy service rather then directly from general practitioners.

The economics of back pain

W.R. Reinus; Philadelphia, PA/US

In this presentation we will examine the economics of caring for back pain. While most data arise from Westernized nations, this has been shown to be a problem that is universal. As many as 36% of adults will have an episode of serious back pain over the course of a year and it is estimated that a median of nearly 38% of individuals are suffering from back pain at any given time. The prevalence is increasing. The media duration of an episode of low back pain is about 42 days. In the vast majority of patients, the cause of back pain (85%-90%) is unclear.
In considering the societal costs of low back pain, we include the direct costs of medical care and the societal costs of lost productivity. In general, the direct costs of medical care account for only 3% to 16% of treating low back pain while indirect costs account for 84% to 97% of the costs of low back pain. Fewer than 10% of patients with pain lasting more than a year account for 65% to 85% of medical costs.
Of the direct costs, about 7% is accounted for by medical imaging. Physician services (20%), non-physician services (30%), hospital costs (30%) and pharmaceuticals (~14%) account for the remainder of direct costs. Of total costs, imaging accounts for less than 1% of costs.
What is the values of MRI in evaluating patients with low back pain? As many as 64% of asymptomatic patients have findings on MRI, including disc bulges (~51%) and protrusions (23%-31%). Suggests that positive findings in many symptomatic patients are coincidental and therefore imaging findings cannot be interpreted in vacuo. Furthermore, no single finding correlates effectively in patients with low back pain over control patients. The severity of low back pain also does not correlate with the severity of MR findings in patients with radicular pain.
Some studies have suggested that MRI in patients with low back pain regardless of radiculopathy, provide no benefits and may even prolong the duration of the disability based on "objective" findings. This increases both direct and indirect costs. Current evidence-based practice guidelines suggest that MRI not be done for patients with nonspecific low back pain, but only for patients with high yield disease, e.g. infection, neoplasm and cauda equina syndrome.

Antibiotics for back pain

J. Tuckett; Newcastle-upon-Tyne/UK

A recent high profile article has suggested a certain subset of patients with low back pain may derive symptomatic benefit from a long course of antibiotics. This follows proposals that in some patients, back pain may be due to low grade anaerobic bacterial infection. The article attracted considerable attention from both the medical and lay media, with proponents describing it the "stuff of Nobel prizes" and detractors raising a number of concerns. This short presentation will describe the study undertaken and attempt to contextualise this change in our understanding of back pain.

Take Home Points

Critical review of recent high profile research.

Patterns of Injury in the T & L spine: Where and why they happen

R.J. Hughes; Stoke Mandeville/UK

The anatomy of the thoracic and lumbar spine in combination with injury mechanism and patient factors dictate patterns of spinal injury in the thoracic and lumbar spine.

A relatively fixed kyphotic upper and mid-thoracic spine has some protection from the ribs and thoracic cage. Injuries to this area tend to be high velocity. The lumbar spine is relatively flexible and the thoracolumbar junction is particularly vulnerable as the thoracic kyphosis meets the normal lumbar lordosis. The majority of thoracolumbar injuries occur at T10-L2.

The nature of injury will be partly dependant on the predominant mechanism of trauma and the force vectors generated. This can be useful information to the interpreting radiologist. Axial load, flexion/ compression, flexion/ rotation, lateral compression, extension and shear injuries in their pure form will produce predictable injury patterns. In reality force vectors in high velocity trauma can be complex and mixed however. Patient factors such as reduced bone density and ankylosing spinal conditions also influence injury patterns and will be discussed.

Take Home Points

A knowledge of injury mechanism and clinical background features are invaluable in assisting radiological interpretation of thoracic and lumbar spinal injury.

T & L spine trauma: Is the fracture stable?

J. Kramer; Linz/AT

Injuries to the spinal column and spinal cord are a major cause of disability. Although most spinal trauma involves the cervical spine not rarely injuries to the thoracic or lumbar spine can be observed. Almost all these trauma have an important consequence regarding lifetime care, cost for rehabilitation and lastly outcome of the clinical situation of the patient. Fractures of the thoracic and lumbar spine are often complex and are caused by a combination of mechanisms. The most common fracture is the compression or wedge fracture, which is frequently stable. However, in severe cases instability in these injuries may occure. Wedge fractures are characterized by compression and a fracture of the anterior aspect of the end plate of the vertebral body. Several variants of flexion injuries with distraction in the thoracic spine are recognized. The most common is the socalled „seat belt injury" with its subtypes (chance fracture, Smith fracture, and annulus fibrosus involvement). Burst fractures very frequently occur in the thoracic and lumbar spine and are associated with a high incidence of injuries to the spinal cord. They are caused by a combination of wedge compression of the anterior column and a fracture of the posterior aspect (middle column) of the vertebral body. Displacement of fractured bony elements into the spinal canal are observed frequently. Burst fractures can easily be misdiagnosed as simple compression fractures. To prevent misdiagnosis an early use of CT and MR imaging is recommended to evaluate all aspects of possible soft tissue and bony injuries.

Take Home Points

Mechanism of injuriesinstability considerations

Strategy of spinal trauma

G. Andreisek; Zurich/CH

Objectives

To learn and discuss about strategies in spinal trauma imaging

Within this review lecture, three topic will be covered. First, the challenges of spinal imaging in trauma patients will be reviewed and important clinical aspects will be discussed. Current challenges include availability of imaging techniques 24/7 as well as availability of an experienced radiologist to read the trauma images. Advantages and disadvantages of the different imaging techniques will be reviewed briefly considering their use as emergency imaging modalities and considering the severity of the trauma. Another challenge of providing spine imaging in trauma patients is the impact on therapy. Sometimes imaging is performed only for legal reason but without any clinical consequences. Cost, radiation and reliability of the imaging are further challenges, which cannot be neglected, as most health care systems are financially burdened. In the second portion of this lecture, current imaging guidelines will be reviewed and summarized, including the American College of Radiology (ACR) appropriateness criteria, the National Emergency X-Radiography Use Study (NEXUS) criteria, and the Canadian Cervical Spine Group (CCR) criteria. In the final portion of the lecture, possible future directions will be given based on recent reports in the literature. As an example for the increasing use of imaging in spine trauma, the advantages of emergency MR imaging within the first 24h of injury will be presented by presenting data from recent studies. As an example for the application of a new imaging modality, the potential use of dual source CT in acute spine trauma will be outlined based on some early reports in the literature.

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Take Home Points

Challenges of spinal imaging in trauma patients will be discussed. Current imaging guidelines will be reviewed and summarized. Use of emergency MR imaging and dual source CT are discussed as possible future directions

The spinal cord following trauma

E. de Smet[1], F.M.H.M. Vanhoenacker[2], P.M. Parizel[1]; [1]Antwerp/BE, [2]Antwerp, Ghent, Mechelen/BE

Spinal Cord Injury (SCI) originates from flexion, extension, dislocation or penetrating traumata.
The initial lesion ('primary injury phase') causes immediate cellular, axonal and vascular damage and triggers a cascade of pathophysiological processes ('secondary injury phase'). These processes initiate inflammation, thereby enhancing recovery and increasing damage at the same time.
Magnetic Resonance Imaging (MRI) is the preferred modality to examine the injured spinal cord and has both diagnostic and prognostic value. The 'classic' sequences (T1, T2, FLAIR, GRE) allow visualization of acute spinal cord lesions, including edema and hemorrhage, as well as long-term changes (cyst or syrinx formation). Diffusion Weighted Imaging (DWI) and Diffusion Tensor Imaging (DTI) are recent techniques that may be used to assess axonal integrity of spinal white matter tracts.

Take Home Points

MRI is the preferred imaging modality for the evaluation of traumatic myelopathy, both in the acute and subacute stage.
Recognising the different patterns of spinal cord injury is not only of diagnostic but also of prognostic value.
Recent techniques such as DWI and DTI allow assessment of axonal integrity, but require further research to overcome technical limitations.

INVITED ABSTRACTS

CT of spinal trauma: Look beyond the spine, common soft tissue findings

G. Bierry; Strasbourg/FR

Soft tissue injuries can be overlooked in spinal trauma on CT, as radiologists will focus mostly on bone abnormalities. CT is indeed considered as of low sensitivity for the detection of soft tissue damages in spinal trauma, as compared to MRI. Nevertheless, soft tissue injuries have to be looked for, as they could reveal subtle bone lesions, or generate by themselves pain and further disabilities, and specific management might be required. Commonly injured soft tissues are intervertebral disc, muscle (erector spinae, psoas), skin, thoraco-lumbar fascia and ligaments (supraspinous and interspinous ligament, ligamentum flavum, part of the posterior complex with articular capsule). Acute traumatic disc injuries generally manifest as intervertebral space increase, or less frequently decrease. Muscles are injured either by direct trauma or by distraction and avulsion. Muscles injuries are identified as muscle enlargement with loss of fat lines. Thoracolumbar fascia rupture is suggested by large subcutaneous tissue hematoma. Ligaments integrity cannot be directly assessed on CT, therefore strain and rupture are revealed by posterior vertebral arch displacement with widening between spinous processes. Lastly, skin injuries range from mild contusion to Morel-Lavallee-like lesion (degloving injury).

Take Home Points

Acute traumatic disc injury appears in most of cases as intervertebral widening.
Widening between spinous processes is the best sign for ligament rupture.
Muscle involvement is revealed by belly enlargement with loss of fat stripes, and can be associated with process avulsion.
Large sub-cutaneous hematoma can reveal fascia rupture.
Skin lesions range from simple contusion to degloving injury.

Rigid spine in trauma

M.S. Taljanovic; Tucson, AZ/US

Ankylosing spondylitis is a chronic progressive seronegative spondyloarthropathy primarily affecting the sacroiliac joints and the spinal column characterized by enthesopathy frequently resulting in spinal bony ankylosis. Spinal DISH is a common bone-forming disorder in the middle-aged and elderly population. DISH is characterized by presence of four or more vertebral bodies with continuous ossification of the anterior spinal ligaments and relative absence of degenerative disc disease. Ankylosing spondylitis (AS) and diffuse idiopathic skeletal hyperostosis (DISH) both lead to development of rigid spine.

The ankylosed spine is more prone to fracture than the normal spine. Fractures in both AS and DISH can occur even after minor trauma. Spinal fractures in AS are more common when compared to DISH which is likely secondary to osteoporosis associated with AS. Spinal fractures are up to four times more common in patients with ankylosing spondylitis than the general population, with a lifetime incidence ranging from 5% to 15%. Fractures in DISH are typically associated with advanced disease.

In AS, the thin vertical syndesmophytes form at the outer fibers of annulus fibrosus and bridge the adjacent vertebrae. Chondroid metaplasia, calcifications, and ossifications progress through and weaken the involved disc spaces over time. In early stages of AS, the majority of fractures occur through the disc space. In the late disease, the association of osteopenia with ossification of the entire disc, results in weak vertebral bodies and the fractures may occur through the vertebral body rather than through the disc space.

In contrast, DISH is characterized by the exuberant, broad, and irregular bridging ossifications which encompass the annulus fibrosus, anterior longitudinal ligament, and paraspinal connective tissue, with an anterior distribution. These bridging ossifications are thickest at the level of the disc space and attach to the adjacent vertebral bodies covering the broad areas on their proximal and distal thirds, leaving the sites above and below their attachment with the least amount of hyperostosis. Therefore, taking in consideration the pattern of ossification in DISH with relative preservation of disc space, it is logical to expect fractures to occur in the regions of least resistance which is through the mid vertebral body, above or below the flowing ossifications attachment sites. The other type of spinal fracture in DISH patients involves the end of an ankylosed segment causing disc space disruption (at the level of stress risers at the junction of the mobile and fused spine).

Fractures in DISH are more common in the thoracic and cervical spine than in the lumbar spine. The most common mechanism of injury is hyperextension. Odontoid fracture, the atlantoaxial instability, and facet joints fractures/dislocations have been reported in the cervical spine. The patients with longer ankylosed segments are prone to more severe spinal cord injuries. Fractures in DISH may involve the vertebral body in ankylosed segment or may occur close to the endplate, with associated disruption of the intervertebral disk. They also may occur through the intervertebral disc. Majority of spinal fractures in AS are transdiscal but they also can occur through the vertebral body. Spinal fractures in patients with AS frequently result from a low-energy mechanism, such as a fall from standing height. Approximately 75% of these

fractures are a hyperextension mechanism, largely due to preexisting kyphotic deformity that makes a patient more susceptible to an extension moment. Other patterns include flexion-type, rotation-type, and acute compression fractures. Continuous motion at the ankylosed segments fracture sites can result in pseudoarthrosis, which can also develop at the junction of the fused and mobile spine secondary to chronic abnormal stresses. This complication manifests radiographically as single-level intervertebral disk space destruction, vertebral endplate erosions, marked vertebral sclerosis, and large osteophytes, and can mimic infective spondylitis or neuropathic changes.
The imaging starts with radiography. Multidetector CT examination with multiplanar reformatted images and superb spatial resolution provides excellent evaluation of the extent of these injuries. In AS and DISH fractures, MRI is the study of choice in evaluation of the spinal column, including spinal cord, ligamentous injuries, spinal canal and paraspinal hematomas.
Treatment of spinal fractures in AS and DISH starts with early stabilization. Initial immobilization in the patient's preinjury alignment is mandatory to prevent iatrogenic neurologic injury. Operative stabilization is usually required for significantly displaced and unstable fractures in DISH. Fracture complications in the AS patient population are high, with upwards of 65% sustaining neurologic injury and a mortality rate reaching 15% to 30%. Surgical management should be undertaken in patients with unstable fracture patterns, progressive kyphosis, or neurologic deterioration. Surgical treatment commonly involves posterior instrumentation and bone grafting, with decompression if indicated. Neurologic improvement is more common in patients who undergo surgery, but postoperative respiratory complications are common.

Take Home Points
AS and DISH both lead to development of rigid spine. Spinal fractures in AS and DISH may occur after minor trauma. In early stages of AS, the majority of fractures occur through the disc space. In the late disease, the fractures may occur through the vertebral body rather than through the disc space. Fractures in DISH occur in the regions of least resistance which is through the mid vertebral body, above or below the flowing ossifications attachment sites. The other type of spinal fracture in DISH patients involves the end of an ankylosed segment causing disc space disruption. Different patterns of spinal fractures in patients with AS, and those with DISH, can be explained by differences in the pathogenesis of these two diseases.

Paediatric spinal trauma

E.A.M. Geusens, V. Goosens; Leuven/BE

Spinal trauma in children is not so common. It can be incurred after a high velocity accident, but also after minor trauma such as a fall, or during sport activity.
In this lecture, we will focus on cervical spine injury.
Although CT is the exam of choice to detect and evaluate spinal trauma, plain films still are currently performed in our hospital since they are easy to perform and are able to detect most of the major injuries. We always take a lateral view, mostly with an additional AP view. Open mouth view is only performed if the child is able to open his or her mouth during the exam. It is, in any case, not considered in younger children. In our department, we no longer take oblique views for cervical trauma.
Also, flexion and extension views of the cervical spine are not taken at the emergency radiology department, but can be performed at a later stage, when the rigidity due to spasm has resolved.
If CT is indicated, we always perform spiral CT from C0 to Th 1, with axial, sagittal and coronal reconstructions.
In case of suspected rotatory fixation C1-C2 we perform CT of this region with rotation to the left as well as to the right to evaluate the motion/fixation.
In cases where a ligamentous lesion is suspected, we perform MRI. Also in patients with suspicion of spinal lesions without obvious radiological anomaly (SCIWORA), we perform MRI to detect spinal cord lesions. Our image protocol consists of sagittal, axial and coronal TIR, T2 and T1 weighted images.
MRI can also be used to evaluate for vascular injuries without radiation.

When reading C-spine films in infants, it is important to bear in mind that a child is not a small adult. Some findings are indeed typical for children, such as physiologic wedging of cervical vertebrae, ring apophysis, physiologic anterior displacement of C2 or C3, or hypertrophic tonsils that can simulate prevertebral soft tissue swelling. When the radiograph is taken in flexion, this may also simulate soft tissue swelling.
Children can also present with lesions that do not appear in adults, such as fractures of the synchondroses or fractures of the ring apophyses.
Some examples of cervical spine lesions are illustrated in this lecture

Take Home Points
1) Spinal trauma in children is not so common.
2) When reading C-spine films in infants, it is important to bear in mind that a child is not a small adult.

Congenital anomalies: Spina bifida, Klippel-Feil, etc

P.G. O'Donnell; Stanmore/UK

Bone Lesions
Vertebral: failed segmentation, failed formation, mixed defects. Further classified into syndromic and non-syndromic anomalies (e.g. VACTERL syndrome).
Klippel-Feil: congenital cervical vertebral fusion; associated with Sprengel deformity (congenital failure of descent of scapula). Rib lesions can also be classified into failures of segmentation and formation and are frequently associated with anomalies of the adjacent vertebrae.

Spinal Dysraphism (SD)
Congenital abnormality of the spinal cord due to defects developing in early embryonic life (weeks 2-6). Classified as follows: Open spinal dysraphisms(neural tissue exposed) and closed spinal dysraphisms (neural tissue covered by skin).
Open spinal dysraphisms (OSDs): Myelomeningocele accounts for the majority of these (98%). OSDs associated with Chiari II malformation (100%).
Closed spinal dysraphisms (CSDs): subdivided into those with and without a mass:

Closed dysraphisms with a subcutaneous mass: in the lumbosacral region, the mass is usually a lipoma (lipomas with dural defect [lipomyelomeningocele, lipomyelocele]), or, more rarely, a meningocele. Cervicothoracic CSDs with a mass are uncommon.
Closed dysraphisms without a subcutaneous mass: simple dysraphic states [intradural lipoma, filar lipoma, tight filum terminale, persistent terminal ventricle, dermal sinus]complex dysraphic states [disorders of notochord integration (e.g.diastematomyelia); disorders of notochord formation (e.g. caudal agenesis)]. There may be a birthmark (hairy naevus, hyperpigmented patch, capillary hemangioma) or dermal sinus.

Back pain in children and adolescents

I. Boric; Zabok/HR

Back pain is a relatively common complaint among children and adolescents, and it is becoming a public health concern. A linear increase of back pain prevalence has been reported by increased age.
Benign musculoskeletal disease and trauma account for most cases of back pain in children and adolescents. Different categories have been reported as possible etiologies of back pain in children:

I. More common musculoskeletal and mechanical etiologies
- a. Nonspecific low back pain
  - i. Muscular strain
- b. Special diagnosis
  - i. Spondylolysis/ spondylolisthesis
  - ii. Malalignment
    - 1. Scheuermann disease
    - 2. Scoliosis
  - iii. Intervertebral disk herniation

II. Other etiologies
- a. Vertebral column fractures
- b. Infectious diseases
- c. Inflammatory
  - i. Ankylosing spondylitis
  - ii. Juvenile idiopathic arthritis
  - iii. Arthritis
- d. Neoplastic disorders
  - i. Spinal column
    - 1. Primary neoplasms
    - 2. Secondary neoplasms
  - ii. Spinal cord
    - 1. Intramedullary
    - 2. Extradural tumors
    - 3. Intradural-extramedullary
- e. Congenital and heamatologic diseases

The most common causes of back pain in the preadolescent population are infection, tumor, and trauma. In the adolescent population, trauma, spondylolysis/spondylolisthesis and hyperlordosis are commonly seen.
Spending long time for watching television, psychosocial difficulties, sports participations, obesity, positive family history of back pain and sedentary life have been reported as possible risk factors for back pain among children and adolescents. More importantly, it has been reported that those with back pain in childhood are at higher risk of back pain in adulthood.
The diagnostic algorithm includes clinical examination, laboratory studies and imaging methods: radiographs, computed tomography, magnetic resonance imaging and bone scan. Ultrasonography has many limitations in spinal pathology.
In evaluation of back pain in children and adolescents it is necessary to reduce the radiation dose and avoid the use of radiography whenever is possible. MR is method of choice because of multiplanar approach, good contrast and spatial resolution and lack of ionizing radiation. But, MRI shows lot of positive finding in the general asymptomatic population. Therefore, correlation of clinical and radiologic findings is crucial.

Take Home Points

- Back pain is a relatively common complaint among children and adolescents;
- The most common causes of back pain in the preadolescent population are infection, tumor, and trauma;
- The most common causes of back pain in the adolescent population are trauma, spondylolysis/spondylolisthesis and hyperlordosis;
- In evaluation of back pain in children and adolescents it is necessary to reduce the radiation dose;
- MR is method of choice in evaluation of back pain in children and adolescents.

Ablation of peripheral nerves in the treatment of joint pain

L.M. Sconfienza[1], L. Callegari[2]; [1]Milan/IT, [2]Varese/IT

Joint pain is a very common condition. Excluding acute events, pain is usually given by a series of degenerative processes that usually affect elderly people. Several options are available to treat these conditions, including injections, oral NSAIDs and prosthesis. However, for a number of reasons, patients may not want to undergo these kind of procedures, generally due to concurrent co-morbidities. Ablation of nerves that provide innervation to these joint may represent a valuable alternative to take care of joint pain. Most of these procedures can be performed under ultrasound guidance, as these nerve usually have a very superficial course. Concurrently, ultrasound guidance can be extremely useful to perform ablation procedures of neuropathies around the body in case of compressions, inflammatory neuropathies, or amputation neuromas. For these purposes, different drugs can be used, such as steroids, anesthetics, or alchool. In some cases, radiofrequency ablation can be used.

At what point does injection therapy fit into the management of shoulder impingement

G. Allen; Oxford/UK

This lecture will discuss the use of shoulder injection therapy, whether blind or guided by ultrasound in the algorithm of managing a patient with shoulder impingement and at what point in the patients care should injections by considered and what types of injections should be performed.

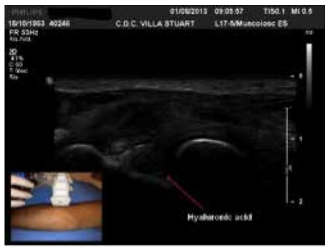
Intra-articular injections (hyaluronidase, steroids, ozone, PRP)

S. Giannini, R. Guitaldi, M.L. Iocca; Rome/IT

The medical team responsible for ultrasound (US) guided infiltration is composed of radiologists and physiatrists. Department of Radiology supports orthopedics and physiatrists during infiltration of hyaluronic acid or PRP (Platelet Rich Plasma) in the joints.
In the last three years we performed ultrasound guided infiltration in every joint using dedicated bracket for each individual probe or freehand. Only for knee, just few times, were treated without ultrasound help.
For all patients we always paid attention to asepsis and correct execution of procedure.
Usually we make three infiltration of PRP per patient and we used different kind of hyaluronic acid. Basically we decided number and timing of infiltrations depending on viscosity of the drug we used and joint we treated.
The choice of the medical device depended on the severity of chondropathies and patient's age.
In sportsmen we preferred the use of PRP, whereas, hyaluronic acid was predominantly used in chondropathies advanced.
We performed 2551 US guided infiltrations in 1627 patients: 1472 knees, 726 tendons or muscles, 133 hips, 72 elbows, 55 shoulders, 35 ankle, 10 wrists.
We used hight, medium and low molecular weight hyaluronic acid; Hymovis, Sinvisc One and Hyalubrix 60 (for hip, knee and elbow), Hyalubrix 30 and Sinvisc (for hip, knee, shoulder and ankle), Hyalgan (for knee, tendon and muscle).
We also performed, in last 12 months, 12 US guided radiofrequency procedures in patients affected by Morton's Neuroma; only 2 patients, after 3 months, underwent surgical therapy because of the failure of radiofrequency.
Infiltration of sacro-ilac synchondrosis, especially in patients with rheumatic disease with erosions and joint effusion, was performed under US guide and using a spinal 22 gauge needle otherwise in patient suffering from advanced osteoarthritis and low back pain we preferred the guide of fluoroscopy.
Our experience in treatment of joints has recently been enriched by using ozone therapyunder fluoroscopic guide.
We used an O2O3 mixture of 22-23% with different amount of drug depending on kind of joint we treated; each cycle consisted of a minimum of 4 to a maximum of 6 infiltrations.
There were no complications during all the procedures.

US guided injection of sacro-iliac joint with bracket

US guided injection of hip with bracket in sagittal view



longitudinal view in US guided freehand injection of Hyaluronic acid in the elbow joint

Take Home Points
We have to obtain the correct choice of the therapy, accuracy in medical device and procedure selection for each patient.
Asepsis and good hygiene practices.
Reduction of the use of ionizing radiation.

What is the evidence of benefit from injection therapy for tendonosis

R.S.D. Campbell; Liverpool/UK

Tendonosis is a histological description of a tendon that displays degenerative change that is devoid of inflammatory infiltrate. This term has been widely adopted in radiology when describing examinations of tendons presenting with pain & swelling. However, neither MRI nor US can exclude the presence of associated tendon inflammation. In the last 2 decades it has been commonly presumed that tendonopathy is a purely degenerative process. However, recent publications have emphasised that there are inflammatory mediated processes present in chronic tendonopathy; although it is likely that mechanical overload remains the primary factor in development of tendonopathy

There is a wide evidence base that intra-tendinous corticosteroid injection has only short-term benefit, and perhaps more importantly has the potential to weaken the structural integrity of tendons. As a result a wide variety of interventional injection therapies have been proposed for treatment of tendonopathy, often performed under US guidance. These are either peri-tendonous or intra-tendonous.

The aim of injection therapy is to achieve either:Pain relief by disruption of neural ingrowth. These "denervation" procedures include; sclerosants, prolotherapy and paratenon stripping.Promotion of tendon "repair" through use of blood products. These include tendon fenestration procedures which maybe accompanied by autologous blood injections, platelet rich plasma (PRP), and even stem cells.

There are many published articles that have assessed the efficacy of these techniques in the Achilles tendon, patellar tendon, the extensor & flexor tendons of the elbow and the plantar fascia. Smaller numbers of papers have evaluated the impact on hamstring tendonopathy, gluteal tendonopathy and tendonopathy at other sites.

With the possible exception of mid-Achilles tendonopathy, injection therapy has yet to provide real evidence of effective tendon "healing". There is a lack of level 1 evidence in the literature. Furthermore, one of the problems encountered when comparing different studies is a lack of consistency in methodology.

The apparent failure of effective treatment options may in part be due to failure to address the underlying aetiological factors that predispose to the development of tendonopathy. Larger randomised controlled trials are needed. It is possible that truly effective therapeutic regimes will require a combination of physical therapy, and interventions that not only promote tendon "repair", but which also counteract inherent inflammatory processes.

Reference:

Rees, JD. Tendons – Time to revisit inflammation. Br J Sports Med. 2013; Mar 9 [epub]

Magnetic resonance guided focused ultrasound surgery and treatments for skeletal disorders: Current status of an emerging technology

A. Bazzocchi; Bologna/IT

Interventional procedures for musculoskeletal disorders are performed in a wide range of population, in terms of age and features, for malignant as well as for benign lesions, occurring in axial and appendicular locations; multiple-session treatments or re-treatments are often carried out. Thus, the use of minimally invasive forms of energy to ablate or to modulate or to deliver therapies on tissues and the use of high-spatial/contrast/time resolution imaging techniques as guidance of surgical/medical procedures are of major importance.

The aim of this lecture is to introduce the newest applications of magnetic resonance guided focused ultrasound surgery (MRgFUS) for skeletal diseases, as recently approved and updated by the European Community (CE conformity marking) and to discuss clinical investigations and personal experience on this topic with a critical appraisal of advantages and limitations to be overcome.

High-intensity focused ultrasound (HIFU, or focused ultrasound surgery – FUS) was developed in the 1940s as a viable approach for thermal ablation of biological tissues, basically as a new non-invasive surgical tool. Despite decades of use for HIFU and its potential benefits over conventional or minimally invasive surgery, the technique has not become as widely used as one would expect. In the early 1990s, magnetic resonance (MR) guidance was applied to HIFU to overcome critical limitations of ultrasound guidance and to substantially improve three pivotal elements: a) treatment planning, b) monitoring during procedure, and c) assessment of therapeutic effects. MR guidance and thermometry allowed for expanding the potential applications of HIFU, and this was crucial especially for diseases involving bone and other tissues forming the musculoskeletal system.

In the last few years, MRgFUS has been accepted by CE and USA Food and Drug Administration, as well as by the authority of other countries worldwide, for palliation in painful bone metastases. CE conformity for MRgFUS devices is progressively widening the horizon to new applications on the basis of new clinical and pre-clinical evidences. The latest update of CE certificate (2013, 27th June) for the most advanced among commercially available MRgFUS equipments states the suitability of the device for „treatment of bone metastases, multiple myeloma, (local tumor control), bone denervation for local treatment of cancerous and benign primary and secondary bone tumors or facet joint syndrome".

Moreover, a new mobile and bone-dedicated transducer (so-called "conformal bone system") has been introduced and CE approved. Preliminary and more-than-promising data were reported in clinical literature for pain palliation and tumor control of metastatic bone disease, for the treatment of osteoid osteomas, and for facet joint syndrome (and knee osteoarthritis). The efficacy of the technique in palliation of painful bone metastases has been recently proved by clinical trial, while only pilot studies exist for other applications. However, interesting results are coming from both oncology and degenerative sides of musculoskeletal pathology, and a few potential applications may be useful also for soft tissue diseases. Furthermore, a part from properly "surgical" approaches, other medical intents deserve special consideration for the future (e.g. sonophoresis, sonoporation, sono-dynamic therapy, etc.).
Investigations and evidences on the potential of this technology are exponentially growing. The spectrum of applications, for oncological and non-oncological purposes, is still probably at dawn.

Take Home Points

- MRgFUS (or MRgHIFU) is a technology combining focused ultrasound therapy with MR imaging – no lancets, no needles, no ionizing radiation
- MR guidance allows a complete pre-treatment planning and post-treatment evaluation, as well as the monitoring of energy delivery – today mainly on the basis of (near) real-time temperature mapping
- In the musculoskeletal field, several applications have been successfully tested (e.g. bone metastases, osteoid osteoma, osteoarthritis) – however, there is a need for more extensive analysis and confirmation

Spondyloarthritis: An overview for the radiologist

J. Grisar; Vienna/AT

The field of Spondyloarthropathies underwent significant changes within the last years with regard to both diagnosis and therapy. New classification criteria have been postulated and facilitate the diagnostic procedure. Amongst the large group of Spondyloarthropathies, especillaly axial Spondyloarthritis (SpA) and the non-radiographic (nr)-axial SpA represent disease entities, where rheumatologists rely on imaging and the diagnosis of the radiologist. Diagnosis of nr-axial SpA is defined as sacroiliitis either in the x-ray and/or the MRI plus distinct symptoms and clinical features underlining the high importance of imaging in this chronic inflammatory disease.
Nr-axial SpA can progress to ankylosing Spondylitis (AS), but as several data reveal, this is not the case in all of the patients. Predictors for progression of nr-axial SpA to AS are elevated CRP, smoking and male sex. Females however and patients with normal CRP have a higher probability to remain in the non-radiographic stage.
In general, Spondyloarthritides can be divided into those with mainly axial involvement (as mentioned above) and those with mainly peripheral involvment, i.e. the peripheral joints. Amongst them, psoriasis arthritis, reactive arthritis and inflammatory bowel disease are the most common ones. Spondyloarthritis exhibit an association to the genetic marker HLA-B27. Almost 50 % of the patients exhibit extraarticular manifestations like uveitis, dactylitis, enthesistis or distinct skin manifestations.
Treatment of these diseases has been much improved by the use of TNF blockers, however one of the main goals for the future is to reduce the latency between disease outbreak and diagnosis which is estimated around 5-8 years in the axial forms of the disease.

Take Home Points

Axial SpA has an estimeted prevalence of around 0.7 %. In axial SpA, we distinguish between ankylosing spondylitis (AS) and nr-axial SpA.
Clinical and extra-articular manifestations as well as laboratory parameters in SpA can be very inhomogenous .
With regard to the diagnosis of axial SpA imaging is extremely important, requiring a close communication between radiologists and rheumatologists.

How best to image SpA: radiographs and MRI

C. Schueller-Weidekamm; Vienna/AT

On average, axial Spondylarthropathy (SpA) is misdiagnosed for up to seven years from the onset of symptoms. An early imaging of the sacroiliac joints (SIJs) and the spine should be performed in patients with suspected SpA. This talk will detail the diagnostic algorithm for imaging SpA. Although radiography is still accepted as the baseline imaging modality, we should be aware that negative radiographs cannot rule out SpA. Thus, in patients with negative or equivocal radiographs, MRI examinations of the SIJs as well as the spine, if necessary, are required. The consensus MRI protocol of the Arthritis Imaging subcommittee of the ESSR will be introduced for imaging the SIJs and the spine. The value of different imaging modalities will be discussed. For planning the examination and for adequate image analysis, a knowledge of the anatomy and the pathologic changes in chronic and acute inflammation of the SIJs and the spine is mandatory, and will be reviewed in this talk.

Take Home Points

* early inflammation of the SIJs and the spine is missed by radiographs
* MRI plays an important role in the diagnosis of early SpA
* a thorough knowledge of anatomy, morphologic SpA features in MRI and radiography, and differential diagnosis enables appropriate image interpretation

Imaging sacroiliitis: What does it look like and which modality should I use?

I. Sudoł-Szopinska; Warsaw/PL

Inflammation of the SIJ remains the hallmark for the diagnosis of spondyloartropathies (SpA). The spectrum of SpA includes several related disorders: ankylosing spondylitis, psoriatic arthritis, enteropathic SpA, SpA associated with Crohn's disease and ulcerative colitis, reactive arthritis, and differentiated SpA. Depending on which inflamed part of the skeleton dominates, SpAs are divided into axial, and peripheral forms.

Imaging plays a major role in diagnosing predominantly axial forms of SpA, which are less accessible to clinical examination than peripheral SpA. Until recently, their diagnosis was based on clinical assessment combined with radiographs demonstrating sacroiliitis evaluated according to NY criteria.

It has been shown that it may take several years before sacroiliitis becomes apparent on radiographs. Long-term multi-centre studies comparing SIJs radiographs with MRIs showed that MRIs possess higher sensitivity and specificity for diagnosing sacroiliitis than plain radiographs. Consequently, the new ASAS classification criteria for axial SpA were introduced in 2009. According to that guidelines, for the first time, certain radiologic features (either radiographic or MRI evidence of sacroiliitis) have been recognized as a major diagnostic criterion of SpA, and presence of those along with at least one clinical feature of SpA serve to make a diagnosis.

According to the ASAS guidelines, radiographs remain the initial imaging modality for identifying sacroiliitis, when the modified NY criteria for the AS are used. MRI is a second best choice examination, which is used predominantly in patients not fulfilling modNY criteria on X-rays.

SIJ Xrays have a number of limitations resulting from either a complex anatomy of the SIJs or physical properties of an Xray technique. Long term studies had confirmed that MRI is more sensitive and specific for the diagnosis of sacroiliitis than plain radiographs. Active inflammatory lesions on MRIs include first of all BME, whereas synovitis, capsulitis, and enthesitis without BME are not sufficient to diagnose sacroiliitis.

In conclusion, the introduction of the new diagnostic criteria for SpA increased sensitivity and specificity for the diagnosis of SpA. MR seems the optimal diagnostic method, its specificity however remains questionable. Low grade BME may be present in up to 30% of healthy controls and 23% of people with MBP. Correlation between BME and inflammatory infiltrates remains unclear due to limited number of histopathological studies of SIJs in SPA patients. Also, there has been lack of significant correlation between BME and HLA-B27, CRP and ESR findings.

Take Home Points

Plain radiography remains an initial method in the diagnosis of sacroiliitis, it is the method of choice for chronic inflammatory changes, as well as assists in differential diagnosis. It has low sensitivity and specificity in the diagnosis of early sacroiliitis.

MR seems the optimal diagnostic method, although its specificity remains questionable.

Further research is still needed to identify the best imaging approach to sacroiliitis.

INVITED ABSTRACTS

Imaging the complications of spondyloarthritis

M.S. Taljanovic; Tucson, AZ/US

The classical types of spondyloarthritis (spondyloarthropathies) include ankylosing spondylitis (AS), the prototype of SpA, psoriatic arthritis (PsA), reactive arthritis (ReA) and enteropathic arthritis (EA), i.e. a chronic inflammatory axial and/or peripheral arthritis associated with inflammatory bowel disease, and enthesitis-related juvenile idiopathic arthritis. Complications of spondyloarthropathies may be divided into skeletal and extraskeletal. Proper radiological work-up is necessary for early diagnosis of the disease and for identification and treatment of spndyloarthropahty complications which may seriously impact morbidity and mortality.

Skeletal complications in AS include spinal fractures following minimal trauma, pseudoarthrosis (Anderson lesion), vertebral compression fractures, and infection. Posttraumatic spinal fractures tend to occur near the thoracolumbar and cervicothoracic junctions. These include often the transversely-oriented "chalk-stick" type, unstable 3-column fractures which may traverse a disk and/or vertebral body as well as the posterior elements and anterior syndesmophytes and ossified anterior longitudinal ligament. Apart from syndesmophytes and ankylosis of the spine resulting in rigidity, in longstanding AS, also focal destructive discovertebral lesions (Andersson lesion- AL) can occur. It has been recognized that these destructive lesions represent spinal pseudoarthrosis that occur after a failed fracture healing of the ankylosed spine in response to minor trauma or local stress. In addition, the combination of spinal pseudarthrosis and a pre-existing severe thoracolumbar kyphotic deformity caused by AS may result in a painful kyphotic AL. Imaging should start with radiographs. CT imaging of an AL shows irregular vertebral or discovertebral osteolysis with surrounding reactive sclerosis. Magnetic resonance imaging (MRI) is considered the best modality in visualizing AL with the highest sensitivity. An AL is defined as an abnormality in the discovertebral junction that shows on MRI diffuse endplate destruction, with associated bone marrow edema and fat replacement or sclerosis. The fracture cleft through the disk space or vertebra itself is depicted as a decreased signal on T1 weighted and increased signal on fluid sensitive sequences with enhancement on T1 weighted imaging after Gd-DTPA administration, reflecting reactive edema of the fracture. The important fact is that an AL requires immobilization and may require surgical stabilization, in contrast with the physical therapy normally prescribed in AS patients. MRI is superior to other imaging modalities in the evaluation of ligamentous disruption or hypertrophy, and dural, spinal cord and nerve root changes. Differential diagnosis includes infectious spondylodiscitis and metastatic disease. Bone scintigraphy is rarely utilized for imaging of AS and its complications. Medicamentous treatment of spondyloarthropathies includes anti-tumor necrosis factor (anti-TNF) agents which are associated with increased risk for serious infections, including tuberculosis. Imaging of musculoskeletal infection should start with radiographs followed by MRI which is the imaging modality of choice in evaluation of osteomyelitis, infectious spondylodiscitis, septic arthritis, and soft tissue infections. For confirmation, imaging guided aspirations and biopsies are frequently performed. Patients who received local corticosteroid injections have an increased risk for tendon rupture, which can be diagnosed by ultrasound or MRI examination.

Extraskeletal complications may be divided into neurological (dural ectasia; arachnoiditis; cauda equina syndrome), ophthalmologic (anterior uveitis/iritis), cardiac (aortitis; pericarditis; complete heart block), pulmonary (apical-predominant fibrosis and cavitation; restricted ventilation secondary to limited chest wall excursions), gastrointestinal (inflammatory bowel disease), and genitourinary (nephrolithiasis; renal failure secondary to amyloidosis).

Take Home Points

1. Complications of spondyloarthritis (spondyloarthropathies) may be divided into skeletal and extraskeletal.
2. Skeletal complications in AS include spinal fractures following minimal trauma, pseudoarthrosis (Anderson lesion), vertebral compression fractures, and infection.
3. Anderson lesions (AL) represent spinal pseudarthrosis that occur after a failed fracture healing of the ankylosed spine in response to minor trauma or local stress. AL requires immobilization and may require surgical stabilization.
4. MRI is the study of choice in evaluation of musculoskeletal complications associated with spondyloarthropathies including but not limited to spinal fractures, AL, and infection.

Imaging of peripheral SpA – do we need an MRI

L. Jans; Ghent/BE

Peripheral spondyloarthritis is a subgroup of SpA with patients presenting with symptoms in the arms and legs. Common clinical features of these peripheral joint manifestations include arthritis, heel enthesitis and dactylitis.
Clinical examination often clearly demonstrates these features. Ultrasound may be used to confirm these findings and to assess their extent. Ultrasound is particularly useful in demonstrating Achilles tendon enthesitis and arthritis of the small joints of the foot, hand and wrist.
MRI plays a role in peripheral spondyloarthritis as MRI may demonstrate more subtle forms in the early stages of disease or at sites that are difficult to evaluate clinically or with ultrasound. Whole body MRI may show multiple affected sites in a single study. MRI of the sacroiliac joints may demonstrate occult sacroiliitis.

Take Home Points

- Ultrasound is the imaging modality of choice for the evaluation of heel enthesitis and small joint arthritis in peripheral spondyloarthritis.
- (Whole body) MRI plays a role in early diagnosis and allows evaluation of sites that may difficult to assess clinically or with ultrasound.

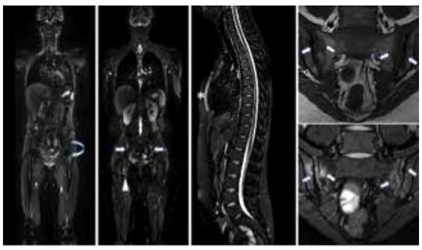
Whole body MRI in SpA

F. Lecouvet, B. Vande Berg, A. Larbi, J. Malghem; Brussels/BE

The use of MRI in ankylosing spondylarthitis has been extensively studied and validated. The technique has shown its ability to detect infra-clinical involvement, and lesions that are occult on imaging techniques available until now, i.e. radiographs, CT, and scintigraphy. MRI is able to detect early involvement (pre-structural changes), consisting in bone marrow edema adjacent to joint or enthesal involvement, pre-erosive disease, and, at a later more chronic stage, structural damage (fatty "transformation" , erosions, bone destruction or sclerosis, ankylosis). MRI has a prognostic value, as early detection of enthesis or joint involvement appears significatively correlated with the later development of structural lesions.
The most frequently involved sites, i.e. the sacro-iliac joints (SIJ) and the thoraco-lumbar spine (TLS) are adequately covered using MRI of the axial skeleton (AS-MRI).
The typical appearances of SpA involvement have been described at these levels, and MRI plays a key role in early initiation of most recent effective treatments.
WB-MRI has been showed at least equivalent or even superior to AS-MRI for SIJ and TLS evaluation, although specific sequences and planes dedicated to these frequently involved sites appear necessary.
Most importantly, WB-MRI extends the evaluation of the disease to the thoracic wall, axial (shoulders, hips) and peripheral joints, multiple entheses and tendons, which enables an exhaustive work-up of the disease extent and activity. Synovitis, bursitis, and enthesitis may be detected, in addition to sacro-iliitis and spondylitis (figure).
This whole body coverage remains crucial by the time of disease follow-up under treatment for multiple site evaluation of disease activity or response.
This course highlights the roles, limits, protocols and requirements of WB-MRI. It illustrates typical and less known lesions, with emphasis on "non-axial" lesions specifically detected by WB-MRI.

Take Home Points

Whole body evaluation in SpA is feasible using MRI.
WB-MRI covers the most frequently involved sites: SIJ and thoraco-lumbar spine, with the same accuracy as axial MRI.
WB-MRI extends the screening of active lesions and structutal changes to central and peripheral joints and entheses.
Several typical areas and patterns of involvement must be known for systematic image check.
Acquisition protocols are suggested.



Coronal and sagittal STIR images show evident sacro-iliitis (arrows), right ischiatic enthesitis, extensive marrow edema in the sternum (*). Synovitis is seen in the left hip (curved arrow). Spinal involvement is limited to some vertebral angles.

INVITED ABSTRACTS

Is there a role of percutaneous disc therapy

N. Amoretti[1], *N.H. Theumann*[2], *P. Browaeys*[2], *L. Huwart*[3], *O. Hauger*[4]; [1]*Nice/FR*, [2]*Lausanne/CH*, [3]*Paris/FR*, [4]*Bordeaux/FR*

Medical therapy is the initial treatment of symptoms due to lumbar sciatica, mainly with the use of anti-inflammatory or analgesic agents. In case of no response to these treatments, besides the classical surgical intervention, new therapeutic options have been proposed secondary to the progress in interventional imaging. A variety of minimally invasive techniques have been investigated over the years as a treatment of back pain related to disc disease. Techniques can be divided into those techniques that are designed to remove or ablate disc material and thus decompress the disc:percutaneous lumbar diskectomy, laserdiskectomy, disc decompression using radiofrequency energyor those that are designed to alter the biomechanics of the disc annulus. Percutaneous disc decompression has been used in the treatment of herniated discs for over 40 years and in over 500,000 patients. While the basic mechanism of percutaneous disc decompression has been wellunderstood, each of the previous methods has suffered from limitations. Randomized clinical trials are important to assess treatments of painful conditions and low back pain. Due to the expected placebo effect, the subjective nature of pain assessment in general and the variable natural history of low back pain that often responds to conservative care. New therapeutic options provide reproductible results among all centers. Multicenter pilot trial shows significant clinical improvement. The role of such procedure will definitively find a place in the arsenal of percutaneous treatment of herniated disk.

Take Home Points:

Yes, there is a role for percutaneous disc therapy.

Radiologists have an important place in the diagnosis and the treatment of inter vertebral disc syndroma. Percutaneous disk therapies are useful tools with an excellent benefits/risks ratio. In the future, the role of such procedure will definitively find the principal place in the arsenal of percutaneous treatment of herniated disk.

Percutaneous herniectomy

Different guidance methods to the lumbar facet joints

D. Orlandi; *Genoa/IT*

Lower back pain and radiculopathy are very common conditions in general population. Physical therapy and other rehabilitative methods are always the first-line treatments of these conditions, however, injections targeted to the facet joints or to the nerve roots are well established as an effective and minimally-invasive treatment of lumbar radiculopathy. Currently, facet joint injections are performed using computed tomography (CT), fluoroscopy (CR) or ultrasound (US) guidance. CT and fluoroscopy are precise but needs emission of ionizing radiations. US has been introduced by several authors as a reliable guidance but lacks of spatial resolution and require a quite long training to be performed properly.
In this setting, the development of new imaging guidance methods assisted by GPS-enhanced fusion systems allows combining the precision and panoramic view of CT modalities with the dynamicity of US imaging.
The clinical application of such technique could be helpful to improve the monitoring of lumbar facet joint injections, increasing safety and target accuracy, and shortening the time of the procedure, without radiation exposure.
In our experience we evaluated 45 patients (23 males, 22 females, mean age 67 years, range 51-78 years) with a clinical diagnosis of low back pain and previously investigated with CT or MR in order to confirm the presence of lumbar facet joints degenerative changes. All patients received facet joints injection of steroid and long acting anaesthetic (2 ml methylprednisolone acetate + 2 ml mepivacaine 7,5%) of the affected levels under US guidance coupled with a GPS-enhanced fusion system using MR or CT volumetric images. In the first 15 treated patients, needle position check was obtained with a low-dose CT scan. Patients' pain were recorded at 0,2,8,24 weeks using a visual analogue scale (VAS).
No immediate or delayed complications were encountered. Lumbar facet joint injection was performed and in all checked cases CT showed the needle tip into the facet joint or in the periarticular space. VAS scale significantly decreased from 7.3 ± 2.7 (mean ± SD) at baseline to 3.9 ± 2.1 at 24 weeks ($P<0.01$).

Our series demonstrates that US-guided fusion imaging-assisted guidance allows for safe and effective injection of degenerative lumbar facet joint disease and could be easily applied to patients with a previous diagnostic CT or MRI. This technique may be readily translated also to other applications in which spinal needles are used (e.g. nerve root blocks).
In conclusion, because of the increased demand for spinal joint injections from referring physicians, it is important to be able to safely perform them with a minimum patient discomfort. In this setting is mandatory to follow the technical developments in order to choose the imaging guidance method that appears to provide better results also reducing complication rates.

Take Home Points
The development of new imaging guidance methods allows combining the precision and panoramic view of CT/ MR modalities with the dynamicity of US imaging.

Different guidance methods to the lumbar facet joints

D. Filippiadis; Marousi/Athens/GR

It is estimated that approximately 70-90% of the population will experience at least once during their lifetime an episode of low back pain with facet joints accounting as a causative agent in 25-40% of the cases. Facet joints are frequently affected by osteoarthritis resulting in joint space narrowing, intra-articular vacuum phenomenon/fluid, osteophytes, synovial cyst formation and flaval ligaments hypertrophy.
Percutaneous facet joint steroid infiltrations are minimally invasive therapeutic or diagnostic procedures that involve injection of corticosteroid with or without local anesthetic inside the zygapophyseal joints of the spine. The procedure is performed under minimal or no anesthesia aiming to control painful symptoms during the acute phase. In addition infiltrations provide diagnostic verification of a certain facet joint acting as pain source.
Conservative therapy is initially proposed. Image guided infiltrations can either be combined to this course or solely performed as an intermediate step between any of the rest therapeutic options which are either percutaneous (ablation) or surgical. The injectate in the vast majority of cases contains a long acting corticosteroid mixed to local anaesthetic. Alternatively, sodium hyaluronate solutions or ozone were tested, however more and extensive studies are necessary. Fluoroscopy, Computed Tomography or Magnetic Resonance can be used as guidance imaging methods for percutaneous spinal infiltrations. Fluoroscopy is governed by the advantage of real time imaging during needle progression and especially during contrast medium injection which will verify the extravascular and intrarticular needle positioning. Computed Tomography provides more detailed anatomy of the region of interest but is governed by increased radiation dose for the patient. However, there is no radiation for the operator as opposed to fluoroscopy which is governed by lower radiation doses but for both the patient and the operator. A novel and attractive alternative seems to be pulsed fluoroscopy with cone beam CT which can provide CT-like reconstructions at lower radiation dose rates. Magnetic Resonance although lacking ionizing radiation is of higher cost and of longer duration. Recent study upon the cost of MR-guided infiltrations concluded that it is twice the cost of CT-guided ones. In addition, MR guidance also lacks the real time imaging during contrast medium injection although needle advancement can be performed under real time guidance at all three levels. Comparing all three modalities, fluoroscopy requires the shortest time duration of an infiltration session.
Outcome of facet joint infiltration greatly depends upon proper patient selection (59-94% immediate and 27-54% long term relief). Level of evidence for therapeutic facet joint infiltrations is limited to moderate for lumbar spine concerning short- and long-term improvement. However, even in the most recent guidelines released from the American Society of Pain Physicians it is stated that the technique is the oldest and most commonly used one.
The moderate to high success rates of the technique, its safety profile and least invasiveness seem to constitute intra-articular facet joint infiltrations as an attractive therapy for low back pain caused by facet joints.

Take Home Points
Imaging guidance increases efficacy and safety rates of facet joint infiltrations in the lumbar spine augmenting proper intra-articular needle positioning Fluoroscopy offers real time imaging at the expense of radiation for both the patient and the operator. Computed Tomography provides more detailed anatomy of the region of interest at the expense of higher radiation for the patient. Pulsed fluoroscopy with cone beam CT provides CT-like reconstructions at lower radiation dose rates. Magnetic Resonance although lacking ionizing radiation is of higher cost and of longer duration. Comparing all three modalities, fluoroscopy requires the shortest time duration of an infiltration session.

Mortality and serious morbidity resulting from cervical root blocks

R. Sutter; Zurich/CH

Cervical nerve root compression can be a source of substantial pain and disability. As an alternative to spinal surgery many patients undergo cervical transforaminal nerve root blocks, where a combination of local anaesthetics and corticosteroids is injected. However, a growing number of studies report on rare but extremely serious side effects of cervical root blocks, such as transient or permanent tetraplegia, arterial dissection, or death.

In recent years, the etiology of serious adverse events resulting from cervical root blocks has been much debated. Some data show that such severe adverse events might be linked to crystalloid steroid preparations that aggregate and form emboli when inadvertently injected into an artery, leading to spinal cord or brain infarction. Other investigations suggest that accidental arterial penetration may lead to a vasospasm or arterial dissection, with subsequent damage to the spinal cord. Imaging guidance with fluoroscopy or CT and the injection of contrast material prior to the therapeutic injections have been proposed in order to prevent inadvertent administration of corticosteroids into an artery. Other suggested measures that might prevent serious morbidity after cervical root blocks include a change of steroid preparations or a test dose of local anaesthetics prior to the corticosteroid injection.

This lecture gives an overview of the different pathomechanisms and anatomical considerations that are currently being discussed in cases with serious morbidity after cervical root blocks. Several techniques for cervical root blocks are presented, comparing fluoroscopic guidance and CT-guidance as well as direct and indirect cervical root blocks, and focusing on the feasibility of the techniques, short-term and long-term outcome, as well as patient safety. The clinical experience at our specialized orthopaedic/neurology hospital will be presented, including the changes in interventional protocols we implemented following two cases of serious morbidity due to cervical root blocks that were treated at our hospital. Finally, interventional guidelines will be reviewed that introduce specific measures in order to reduce the likelihood of serious adverse events after cervical root blocks.

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Take Home Points

A growing number of studies report on rare but extremely serious side effects of cervical root blocks. There is still much debate about the etiology of these serious adverse events.A number of measures have been suggested that might prevent serious morbidity or mortality after cervical root blocks, including a change of the injection approach by performing indirect cervical root blocks.

Access routes and reported decision criteria for lumbar epidural drug injections: a systematic literature review

G. Andreisek; Zurich/CH

Objectives

To learn and discuss about access routes and reported decision criteria for lumbar epidural drug injections.

Abstract

Epidural drug injections via different routes have shown a steady increase over the past decades and are nowadays one of the most commonly performed procedures in the treatment of chronic low back pain (1). In the Medicare population, the number of lumbar epidural injections quadrupled within seven years (1994-2001) (1). Epidural injections are used to treat lumbosacral radicular pain, but also in patients with lumbar spinal stenosis and other degenerative changes (1). The discussion is still ongoing whether epidural injections are effective or not.

Within this review lecture, the results of a recent systematic literature review will be summarized and discussed. First, the different access routes will be presented along with their advantages, disadvantages as well as risks. Then, the reported decision criteria for the different access routes are discussed. It need to be noted that this review lecture does not present the authors personal opinion; rather all presented data are gained from a literature research and can be considered evidence-based.

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Take Home Points
Different access routes for lumbar epidural drug injections are presented. Reported decision criteria for the different access routes are discussed.

Caudal epidural and S.I.joint blacks under ultrasound guidance

N. Bhatnagar; New Delhi, Delhi/IN

Intractable lower back pain is increasingly adding to the morbidity of general population. Conservative therapy failure and refusal for operative procedures has led to the use of regional pain options in form of caudal epidural blocks. Increasingly popular with the anesthetists in cases of pediatric patients for lower abdominal surgeries, caudal epidural anesthesia has transgressed that boundary from the operating theaters to the OPD and orthopedic practice for pain relief in form of steroid injections. Blind procedures till not so long ago had been making rounds in the OPD's with sometimes failed (5-25%) and sometimes good results. With the advent of MSK dedicated USG machines, such procedures when performed under USG guidance have taken an enormous leap in the pain management mainly because of less complications rate, accurate needle placement in the sacral hiatus and less percentage of failed blocks.
Indications...why Ultrasound guidance

1. up to 25% injections do not enter the epidural space.
   (Tsui BC, et al. Anesthesiology 1999; 91:374–8)
2. to avoid accidental puncture of the dural sac and subsequent risk of intra-thecal injection of medication.
3. confirmation of caudal needle placement.
4. radiation free, easy to use
5. only one attempt
6. The av. time span - locating the sacral hiatus to the insertion of the caudal epidural needle into the caudal space< 2min.

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Pyogenic infection

K. Bohndorf; Vienna/AT

Infective spondylodiscitis represents 2 – 4% of all cases of osteomyelitis. Usually patients in the age of 50 – 80 are affected, but infective Spondylodiscitis may appear in all age groups. The most common causative pyogenic organisms are Staphlococcus aureus, followed by Streptococcus and Pneumococcus. On rare occasions spondylodiscitis is the result of infection with gram-negative bacteria (Escherichia coli, Pseudomonas, Klebsiella, Salmonella), non-pyogenic microrganisms (Myobacterium tuberculosis, fungi) or parasites. Typically the lumbar spine is involved, followed in frequency by the thoracic, sacral and cervical spine infection.
The hematogenous spread of infection via the arterial or venous system is the most common route of contaminatin. Arterial spread seems to be more frequent than transmission through Batsons´s paravertebral plexus. Direct implantation

of micro-organisms may follow diagnostic or therapeutic disc punctures leading to primary infection of the intervertebral disc. In the vast majority of cases the inflammation begins as vertebral osteomyelitis with subsequent extension of infection into the disc space (spondylodiscitis). Below the age of four, end arteries perforate the vertebral endplates and enter the disc space. Therefore this particular age group will primarily develop discitis. However during disc degeneration vascular invasion of the disc space may occur, therefore primary discitis is possible even in older patients. In the majority of cases infection spreads from an anterior focus through the vertebral endplate into the disc space. Later on the neighbouring endplate is also destroyed with affection of the opposite vertebral body. Infection may also continue into the paravertebral and epidural space and extend subligamentously. Epidural abscess can compress spinal cord and cause paraplegia.
In the early stage of infection, plain films may be normal. The first radiographic signs include small and irregularly shaped radiolucencies localized within the subchondral region followed by loss of definition of the endplate and narrowing of the intervertebral disc. The progression of the infection is characterised by further destruction of the vertebral body with affection of the opposite endplate. Generally, though there are exceptions, the presence of a vacuum phenomenon excludes disc space infection.
MRI nowadays is the method of choice to diagnose spondylodiscitis. In the acute phase the vertebral bodies adjacent to ill-defined endplates are diffusely hypointense on T1-weighted spin echo MRI noncontrast images and hyperintense on fat-saturated PD- or T2-weighted images. The disc space is also of high signal intensity. T1-weighted Gadolinium postcontrast images reveal enhancement of the vertebral bodies and of the intervertebral disc.
Suspected infective spondylodiscitis is an indication for giving gadolinium-based contrast medium intravenously. This allows better delineation of soft tissue and epidural involvement, including the demonstration of abscess collections. Persistent or progressive changes in the disc and bone on follow-up studies may occur despite clinical improvement and positive response to therapy. The restoration of fatty marrow on unenhanced T1 imaging is the best imaging criterion for improvement, but occurs late in the course. As a result follow-up studies are only indicated to exclude or monitor complications (particularly abscess formation).

Note
- Ingrowth of granulation tissue into the intervertebral disc can occur in the setting of disc degeneration. Consequently contrast enhancement in the disc does not help in the differentiation.
- Fluid inclusions within a disc may occur in the setting of degeneration

Take Home Points:
- MRI is the method of choice to evaluate patients with suspected spondylitis and spondylodiscitis
- Use of gadolinium based contrast media is helpful to improve diagnostic accuracy.
- Main criteria to distinguish infectious spondylodiscitis from degenerative disease is the extensive soft tissue infiltration with or without abscess formation in case of infectious disease.

TB and Unusual Pathogens

R. Arkun; Izmir/TR

Spine infections occur by three major agents: bacteria, causing pyogenic infections; tuberculosis, brucellosis or fungi, responsible for granulomatosis infections; or by parasites,
which are the less common etiology. In the past, tuberculosis infection was the major cause of spinal infections, however, due to the success on diagnosis and treatment of lung tuberculosis, its incidence has decreased during the last 50 years. In spine infections, vertebral bodies and intervertebral discs are most frequently affected with primary or secondary involvement of the epidural space, posterior elements, and paraspinal soft tissues. Confirmation and localization of a spinal infection usually depend on imaging findings. Although plain radiography has low specificity in spondylodiscitis diagnosis especially at the early phase of disease, it should be performed in an initial evaluation for suspected pathology of the spine. Computed tomography (CT) remains the best test for
evaluation of bony changes, including early changes of vertebral endplates, the presence of bone necrosis, and pathological calcifications suggestive of tuberculosis. Magnetic resonance (MR) imaging is preferred because of its high sensitivity and specificity to provide detailed anatomical information about surrounding soft tissues and epidural space. Tuberculosis (TB) lesions preferentially affect the thoracic spine, often involving more than two levels, which differentiates it from pyogenic spondylodiscitis. Three important findings of spinal TB on MR imaging are endplate disruption, paravertebral soft tissue abscess and the presence of increased signal intensity of intervertebral disc on T2- weighted images. Tuberculosis spondylitis has an extensive bone destruction pattern with relative sparing of the intervertebral disc, heterogeneous enhancement of the vertebral body, and large paravertebral
abscesses.

Brucellosis is a multisystemic disease that can have acute, subacute, and chronic manifestations. In musculoskeletal system, the spine, sacroiliac joint and large joints are frequently affected. The spine is the most frequent site of musculoskeletal brucellosis, and spinal involvement is among the most serious complications of the disease. Brucellar spondylitis is unique among other types of spondylitis in that it may appear as either focal or diffuse and the most common location is in lumbar vertebrae. Spinal brucellosis usually starts in the superior endplate, because of its rich blood supply, but occasionally the inferior end-plate may also be involved. Characteristic MR imaging features of brucellar spondylitis include a predilection for the lower lumbar spine, intact vertebral architecture despite evidence of diffuse vertebral osteomyelitis, a marked increase in signal intensity in the intervertebral disc on T2-weighted and contrast-enhanced MR images, and facet joint involvement. Paraspinal or epidural abscesses which are rare findings compared other infective spondylodiscitis, and cord or root compression related to brucellosis can be seen, especially in the early phase of spondylodiscitis. In the early stages, there is also bone destruction in the superior vertebral end-plate and, while the bone is healing, the new bone formation is called "parrot beak" osteophyte as seen in focal form of disease.
Fungal spondylodiscitis is relatively uncommon, mainly in a non-immunocompromised patient. Candida and Aspergillus are the most common causes of mycotic infections in these persons. Manifestations of fungal infection in the spine include osteomyelitis, discitis, and meningitis. In MR imaging, an absence of disc hyperintensity and preservation of the intranuclear cleft on T2- weighted images are suggestive findings for fungal spondylitis. Recognition of MR characteristics of fungal spondylitis should prompt biopsy and may alter management of spondylitis in the immunocompromised host.

Take Home Points

1. Spine infections occur by three major agents: bacteria, causing pyogenic infections; tuberculosis, brucellosis or fungi, responsible for granulomatosis infections; or by parasites,
2. TB spinal infection is suggested by a lack of disc involvement and the presence of large paraspinal abscesses, posterior vertebral changes, meningeal enhancement and involvement of multiple non-contiguous levels with greater bone destruction.
3. There is "parrot beak" osteophyte with preservation of vertebral body in brucellar spondylitis.
4. In MR imaging, an absence of disc hyperintensity and preservation of the intranuclear cleft on T2- weighted images are suggestive findings for fungal spondylitis.
5. An awareness of typical and atypical MR imaging findings of early infectious spondylitis is important to avoid diagnostic delay and unnecessary diagnostic procedures.

Failed back surgery: Non hardware related

J. Vandevenne; Genk/BE

Failed back surgery syndrome (FBSS) refers to postsurgical intractable pain in the back and lower extremities with some functional incapacitation. The etiology of FBSS is diverse, and many causes can be categorized as mechanical, inflammatory/infectious, diagnostic or surgically related.
Diagnosis related causes in the pre-operative setting include failure to identify the structural source of pain, symptomatic disc lesion at other level, peripheral nerve or joint lesion, dual pathology and transitional vertebra. Surgery related causes include nerve injury, postoperative hemorrhage, pseudomeningocele, and textiloma. Mechanical causes include recurrent or residual disc herniation, stenosis (spinal canal/lateral recess/foraminal), joint strain (facet joint, sacro-iliac joint), and spinal ligament or muscle sprain. Inflammatory/infectious causes include epidural fibrosis, arachnoiditis, infectious of sterile spondylodiscitis, and epidural or paraspinal abscess.
MR imaging is the preferred imaging modality to identify structural causes of FBSS. A typical MR imaging protocol to evaluate the postoperative lumbar spine consists of sagittal T1- and T2-weighted sequences, axial T1- and T2-weighted sequences, axial and sagittal T1-weighted sequences after IV gadolinium contrast injection. Fat saturation can be used for T2-weighted sequences or post contrast T1-weighted sequences.
In the clinical setting of patients with FBSS, a distinction between early and late failure after surgery is made. Early postoperative failure includes hemorrhage, spondylodiscitis and paraspinal abscess/phlegmon, residual stenosis, and unrecognized dual pathology. Late postoperative failure includes recurrent disc herniation, epidural fibrosis, arachnoiditis, radiculitis, textiloma and stenosis.

Sports Ankle: Pitfalls

P. Robinson; Leeds/UK

Dr Philip Robinson MRCP, FRCR.
Consultant Musculoskeletal Radiologist.
Honorary Clinical Associate Professor, Leeds, UK.

This talk will review, describe and illustrate the common ankle pitfalls in sports imaging that can be misinterpreted when imaging athletes. Normal variants and pathology that present in athletes will be illustrated while concentrating on pathophysiology and clinical features where relevant. Anatomical areas that can mimic pathology to be reviewed will include; Osseous and Osteochondral imaging findings. Capsular and ligamentous variation. Accessory muscles and tendon variation.
In addition some clinical scenarios will be presented to illustrate where imaging can be misleading for the severity of injury present.

Take Home Points

1. Understand normal anatomical variation that can mimic pathology.
2. Understand normal anatomical variation that can be also symptomatic in athletes.
3. Understand the limitations of imaging and importance of clinical correlation.

Pitfalls in Sports Imaging: Shoulder

A. Grainger; Leeds/UK

The most frequent sports related injuries occurring in the shoulder relate to problems with the rotator cuff and bursa (for instance impingement and tears) and to the labroligamentous structures (for instance Bankart lesions and SLAP tears). Such sports related injuries are usually imaged with MRI or, for the rotator cuff, ultrasound. Although the imaging technologies now available provide exquisite imaging of the relevant structures using either imaging modality, pitfalls which may lead to misdiagnosis exist. Given the time constraints available this talk will concentrate on pitfalls in MRI and MR-arthrographic diagnosis of shoulder sporting injury.

Learning Objectives

1) To learn about techniques to optimize the accuracy of MRI and MR-arthrography of the shoulder, to minimize reporting errors
2) To recognize normal anatomical variants which may simulate pathology in the shoulder, and how to distinguish them from pathological appearances
3) Become familiar with strategies which may help identify subtle pathology which may otherwise be overlooked

Wrist

F. Becce; Lausanne/CH

The hand and wrist are common injury sites in athletes. Injuries can be categorized into two main groups: traumatic (acute, mainly in contact sports or after a fall on the outstretched hand), and overuse (chronic, typically in racquet or stick sports). Imaging plays an important role in making the proper diagnosis, and may contribute to the appropriate management, including a rapid return to sports. However, various pitfalls can be encountered either on conventional radiographs or cross-sectional imaging techniques. These pitfalls can be considered as being of technical (artifacts) or anatomoclinical (variants) origin. The anatomic complexity of the hand and wrist, with numerous joints, tendons and a myriad of ligaments, makes the diagnosis even more challenging. The purpose of this lecture is to review the most common pitfalls in sports imaging of the hand and wrist.

SCIENTIFIC POSTERS

P-0006 **Analysis of the relationship between lumbar facet joint angle and degenerative changes.**
N. Zengin, A. Yucel; Afyon/TR

P-0013 **Pediatric sports injuries in foot and ankle**
Y. Kobashi[1], T. Mogami[1], S. Yamazoe[1], A. Baba[2], S. Ogiwara[1]; [1]Chiba/JP, [2]Tokyo/JP

P-0016 **Skeletal bone diffusion and functional Diffusion Map (fDM): Is fDM and Bone Diffusion able to find Antihormonal Resistance in Bone Metastases under oncological therapy?**
A. Gutzeit[1], C. Reischauer[2]; [1]Luzern/CH, [2]Zurich/CH

P-0017 **Correlation between Facet Joint Asymmetry and Lumbar Disc Degenerative Disease: using different method in assessing this relation**
A. Sorani[1], V. Parmer[2], T. Jaspan[1]; [1]Nottingham/UK, [2]Birmingham/UK

P-0022 **Prevalence of Hawkins sign after ankle fractures.**
J.-H. Opsahl[1], A.P. Parkar[2]; [1]Drammen/NO, [2]Bergen/NO

P-0026 **Reporting of Spinal Fractures**
H. Al-Chalabi, C. Groves; Bradford/UK

P-0028 **Work in progress: Cone Beam Computed Tomography (CBCT or Extremity CT) – a new tool for evaluation of erosions in patients with rheumatoid arthritis.**
Y. Aurell[1], M. Malac[1], K. Forslind[2]; [1]Mölndal/SE, [2]Helsingborg/SE

P-0031 **How often can MRI detect a knee joint at risk of osteonecrosis?**
N. Sabir, F. Ufuk; Denizli/TR

P-0032 **The use of multi-parametric non contrast MRI to identify synovitis in patients with osteoarthritis of the knee.**
C. Burnett[1], A.C. Redmond[1], A.-M. Keenan[1], A. Grainger[1], J. Ridgway[1], R. Hodgson[2]; [1]Leeds/UK, [2]Warrington/UK

P-0034 **Diagnostic yield and accuracy of imaging-guided percutaneous core-needle biopsy of musculoskeletal tumours in children**
K.S. Tse, S. Cheng, K.C. Lai, S.W. Chan, M.K. Chan; Hong Kong/HK

P-0037 **Fracture of metacarpal and hamate bones– a not so rare combination in punch injury**
A.-L. Chang[1], D. Keane[2]; [1]Tyne & Wear/UK, [2]South Tyneside/UK

P-0039 **Dynamic Rotation MRI of the Wrist: Detecting Subluxation/Luxation of the Extensor Carpi Ulnaris Tendon**
B. Henninger, F. Kellermann, R. Arora, M. Gabl, M. Lutz, C. Kremser, A. Rudisch; Innsbruck/AT

P-0041 **Prevalence and Imaging Findings of Accessory Head of the Biceps Brachii Tendon**
J.L. González Montané, J.D. Guerrero Bravo; Jaén/ES

P-0042 **Imaging features in Adams-Oliver syndrome 2 (AOS2)**
L.H.L. De Beuckeleer, K. Carpentier, M. Pouillon; Antwerp/BE

P-0043 **Detection of clinically suspected scaphoid bone fractures using a dedicated cone-beam CT (CBCT). A retrospective study of 139 patients.**
L.H.L. De Beuckeleer, K. Carpentier, B. De Foer, M. Pouillon; Antwerp/BE

P-0044 **Cone Beam CT-arthrography of the wrist: high resolution images at low radiation dose**
L.H.L. De Beuckeleer, K. Carpentier, B. De Foer, M. Pouillon; Antwerp/BE

P-0046 **Prevalence of pitfalls in previous dual energy X-ray absorptiometry (DXA) scans according to technical manuals and International Society for Clinical Densitometry.**
C. Messina[1], M. Bandirali[2], M. Petrini[2], F.M. Ulivieri[1], L.M. Sconfienza[2], F. Sardanelli[2]; [1]Milan/IT, [2]San Donato Milanese/IT

P-0047 **Prevalence of pelvic incidental findings at magnetic resonance imaging of the hip and bony pelvis performed for musculoskeletal pathology**
C. Messina[1], A. Poloni[2], L.M. Sconfienza[3], G. Mauri[1], M. Bandirali[3], F. Sardanelli[3]; [1]Milan/IT, [2]Arcene/IT, [3]San Donato Milanese/IT

P-0048 **Percutaneous CT-Fluoroscopy guided needle aspiration in three cases of disc cyst, which demonstrated different clinical courses.**
H.-S. Kim, J.-H. Park, J.-Y. Yu, S.H. Lee; Seoul/KR

SCIENTIFIC POSTERS

P-0050 **Radiographic interpretation of hip replacement hardware. A pictorial essay.**
A. Balanika, S. Theocharakis, S. Vrizidou, C. Drosos, C. Baltas; Athens/GR

P-0051 **Superficially-based soft tissue sarcomas: can MRI predict infiltration of the superficial muscular aponeurosis?**
A. Barta, C. Bourdet, R. Campagna, A. Feydy, H. Guerini, F. Larousserie, J.-L. Drapé; Paris/FR

P-0054 **Changes of the intervertebral disc under traction therapy with the GammaSwing device**
M. Kastlunger[1], C. Siedentopf[2], A. Klauser[2]; [1]Gnadenwald/AT, [2]Innsbruck/AT

P-0055 **MR measurements of subcoracoid impingement using a new method and its relationship to rotator cuff pathology at MR arthrography**
N. Porter, J. Singh, B. Tins, R.K. Lalam, P. Tyrrell, V. Cassar-Pullicino; Oswestry/UK

P-0061 **Cryoablation of Musculoskeletal Metastases: Initial Experience**
N. Purohit, L. King; Southampton/UK

P-0065 **The reproducibility of the radiological features in Kellgren-Lawrence grading scale in the assessment of the hip joint osteoarthritis**
J.-S. Suomalainen, A.K. Joukainen, P. Sipola, J.P.A. Arokoski; Kuopio/FI

P-0075 **Rare association of multi-focal intraosseous pneumatocysts with Biopsy proven Acute Myeloid Leukaemia (AML).**
R. Khosla[1], R. Mannion[2], D. King[2], C.E. Davies[2]; [1]Leeds/UK, [2]York/UK

P-0076 **The efficacy, accuracy and safety of corticosteroid injections of the osteoarthritic knee**
J.G. McGarry, Z. Daruwalla; Dublin/IE

P-0077 **Early detection of subperiosteal collections using Ultrasound guidance in Sickle cell patients presenting with acute limb pain in the DGH**
N. Lee[1], A. Tindall[2], M.S. Gulati[2], R. Gupta[3], B. Bhatthacharjee[1], G. Constantinescu[2], D. Tao[2]; [1]Dartford/UK, [2]London/UK, [3]Woolwich/UK

P-0078 **CT-guided radiofrequency (RF) ablation of osteoid osteoma (OO) performed at York Teaching Hospital, England from 1997-2013.**
R. Khosla[1], C.E. Davies[2], D. King[2]; [1]Leeds/UK, [2]York/UK

P-0082 **Efficacy of CT-guided injections for Coccydynia**
S. Jayaraman, P. Robinson; Chichester/UK

P-0083 **Evaluation of Knee Joint After Double-bundle ACL Reconstruction with Isotropic Three-dimensional SPACE MRI**
S.-W. Lee, Y.M. Jeong; Incheon/KR

P-0084 **Three-Dimensional Isotropic MRI for Accurate Diagnosis of Posterolateral Corner Injury.**
S.-W. Lee, Y.M. Jeong; Incheon/KR

P-0088 **Imaging of Lumbar Spondylolysis among children and adolescents**
T.N. Spyridopoulos[1], S. Stathopoulou[2], I. Vlachou[2], T. Dagla[2], I. Lavda[1], K. Tsilikas[2], M. Petra[1], I. Paspati[1], I. Hager[1], N. Evlogias[2]; [1]Penteli/GR, [2]Athens/GR

P-0093 **Efficacy of Stentoplasty in acute vertebral body fractures type AO A1 und A3.1: preliminary results of a prospective randomized single center study.**
R. Patzwahl, K. Käch, S. Mey, A. Boger, C.A. Binkert; Winterthur/CH

P-0094 **Familial spondylo-costal dysostosis due to a new mutation in DLL3 (C661T-R221X) gene**
C. Ottonello[1], C. Turchetti[1], A. Giardino[2], O. Scarciolla[3]; [1]Rome/IT, [2]San Donato Milanese (Mi)/IT, [3]Matera/IT

P-0095 **Unstable degenerative spondylolisthesis: role of prone position MRI in the detection of lumbar facet joint effusion**
C. Ottonello[1], L. Lombardi[1], P. Giuliani[1], A. Giardino[2], C. Turchetti[1], F. Sardanelli[2]; [1]Rome/IT, [2]Milan/IT

P-0096 **MRI diagnosis of knee and ankle articular cartilage lesions in professional athletes of winter sports.**
I. Dutova, A.K. Karpenko; St. Petersburg/RU

P-0097 **Interpretation of radiology images in invasive and minimally invasive spinal surgeries for spinal fusion and decompression**
G. Malik; Dubai/AE

P-0098 **Patella position in the trochlea groove: comparison between supine and standing radiographs**
N. Skou, N. Egund; Aarhus/DK

P-0105 **Spinal MRI findings in Spontaneous Intracranial Hypotension – Case Report**
M. Tzalonikou[1], D. Kechagias[2], A. Plomaritoglou[2], A. Agathonikou[1], N. Kritikos[1], A. Roussakis[1]; [1]Athens/GR, [2]Marousi/GR

P-0106 **To determine the utility of a bi-planar X-rays device, called EOS, in the quantitative evaluation of spinal deformities in patients with Adolescent idiopathic scoliosis (AIS)**
D. Mueller, T.E. Lichtenstein, N. Sinzig, D. Maintz; Cologne/DE

P-0112 **Coronal Imaging of the Spine (CIOS)**
A. Isaac[1], D. Dalili[1], I. Pressney[2], L.F. Wilson[2], P.A. Tyler[2]; [1]London/UK, [2]Stanmore/UK

P-0113 **Low Radiation dose CT Versus Fluoroscopy guided Facet joint injections – A Study of Clinical and Radiological outcomes**
A. Isaac[2], D. Dalili[2], A. Gupta[1], A.K. Zaveri[1], L.F. Wilson[1], P.A. Tyler[1]; [1]Stanmore/UK, [2]London/UK

P-0114 **Intra-articular soft tissue masses of the knee: An imaging review of biopsy proven diagnoses**
A. Kirwadi[1], S. Raniga[2], R. Hargunani[1], A. Saifuddin[1]; [1]Stanmore/UK, [2]Muscat/OM

P-0117 **Metal Artifact Reduction Sequence and postoperative Spine: Does it prove to be useful-Preliminary Results?**
M. Tzalonikou, P. Tagalakis, N. Kritikos; Athens/GR

P-0118 **Degenerative Disk Disease of the Cervical Spine: Spectrum of Imaging Findings**
M. Tzalonikou[1], S. Yarmenitis[2], F. Laspas[2], G. Delimpasis[1], J. Andreou[2]; [1]Athens/GR, [2]Marousi/GR

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P-0007 **Femour Fibrous Dysplasia associated with calf mixoma: a new case of "Mazabraud Syndrome"**
A. Faccinetto, G. Pasquotti, G. De Conti, D. De Faveri, L. Rubaltelli, U. Marchioro; Padua/IT

P-0008 **Incidental Benign Musculoskeletal Findings on PET-CT: an Educational Pictorial Review**
F. Moloney, J. Ryan, M. Twomey, S. McSweeney; Cork/IE

P-0009 **Educational review of common pediatric musculoskeletal injuries presenting to the emergency department of a level one-trauma center**
F. Moloney, J. Ryan, M. Twomey, N. Marshall; Cork/IE

P-0010 **Pathological plain-film findings related to patellar resurfacing in total knee replacement**
P. Melloni, M.T. Veintemillas, A. Marin, R. Valls, P. Bermúdez; Sabadell/ES

P-0011 **MR Imaging Findings of Priformis Syndrome**
Ö. Kizilca, C. Cevikol; Antalya/TR

P-0012 **Recurrent hemarthrosis of the knee joint due to vascular malformation: simulating hemophilia like arthritis**
C. Cevikol; Antalya/TR

P-0014 **Pediatric ultrasound for development dysplasia of the hip: an educational pictorial review**
F. Moloney, M. Twomey, M. Moore; Cork/IE

P-0015 **MR arthrography of the shoulder: a pictorial educational review**
F. Moloney, M. Twomey, N. Marshall; Cork/IE

P-0018 **Imaging Appearances of Metallosis: A Pictorial review.**
J.M. Bondia Gracia, P. Slon, J.D. Aquerreta; Pamplona/ES

P-0019 **Role of Ultrasound in the Assessment of Locoregional Spread of Cutaneous Melanoma.**
J.M. Bondia Gracia, P. Slon, J.D. Aquerreta; Pamplona/ES

P-0020 **Uncommon complications following orthopedic surgery**
S. Baleato González[1], J.C. Vilanova[2], X. Tomàs Batlle[3], M. Ageitos Casaia[1], D. Blanco Mella[1], G. Bierry[4]; [1]Santiago de Compostela/ES, [2]Girona/ES, [3]Barcelona/ES, [4]Strasbourg/FR

P-0021 **Lunate and triquetrum fractures revealed with CT reconstruction**
Y. Seki[1], H. Kuroda[2]; [1]Nagano/JP, [2]Chiba/JP

P-0023 **Ischiofemoral impingement in young patients**
M. Vansevenant[1], F.M.H.M. Vanhoenacker[2], K.L. Verstraete[1]; [1]Gent/BE, [2]Antwerp/BE

P-0024 **Use of basic concepts of muscular anatomy of the thigh as a guide for performing Ultrasound.**
J.M. Bondia Gracia, P. Slon, J.D. Aquerreta; Pamplona/ES

P-0025 **How Can We Improve the Diagnostic Yield of Radiologically Guided Biopsies For Vertebral Osteomyelitis?**
V. Parmar, H.-U.R. Aniq; Liverpool/UK

P-0027 **MRI of the Knee: A Proposal for a Systematic Reading**
J.M. Bondia Gracia, P. Garcia Barquin, F.M. Caballeros, J.D. Aquerreta; Pamplona/ES

P-0029 **Bone tumors of foot and ankle: Spectrum of imaging findings**
S. Orguc[1], M. Argin[2], R. Arkun[2]; [1]Istanbul/TR, [2]Izmir/TR

P-0030 **Metatarsal and Phalangeal Dysgenesis, Thick Femoral Condylar Cartilage, Epyphyseal Dysgenesis of Both Femoral Heads: Early Onset of Degenerative Osteoarthritis in a New Phenotype**
H.T. Sanal, S. Pay, S. Tunay, S. Guran; Ankara/TR

P-0033 **Radiographic Analysis Of Foot Deformities in Cerebral Palsy: Which Angles Should I Measure on Foot X-rays?**
H.T. Sanal, M. Serindere, N. Menekseoglu, M. Tasar; Ankara/TR

P-0035 **MRI of hip arthroplasty**
O.L. Casado Verdugo[1], E. Prieto[1], M.J. Ereño Ealo[2], P. Ruiz[3], T. Salinas Yeregui[4]; [1]Vitoria/ES, [2]Galdakao/ES, [3]Vizcaya/ES, [4]Bilbao/ES

P-0036 **Magnetic Resonance Imaging in Synovial Disorders**
R. Arkun[1], S. Orguc[2], M. Argin[1]; [1]Izmir/TR, [2]Istanbul/TR

P-0038 **Improving diagnostic accuracy in US of soft tissue masses**
B. Chari, R. Campbell; Liverpool/UK

P-0040 **Tibial cortical lesions: a multi-modality pictorial review**
P.A. Tyler[1], P. Mohaghegh[1], J. Foley[2], A. Isaac[3], A. Zavareh[1], C. Thorning[4], A. Kirwadi[5], G. Rajeswaran[1]; [1]London/UK, [2]Glasgow/UK, [3]Stanmore/UK, [4]Epsom/UK, [5]Sheffield/UK

P-0045 **Proximal Iliotibial Band Syndrome; An uncommon cause of hip pain found on ultrasound**
D. Yu, M.J. Bradley; Bristol/UK

P-0049 **Measurements in Femoro-Acetabular Impingement: How to do it?**
J. De Roeck, F.M.H.M. Vanhoenacker; Antwerp/BE

P-0052 **US guided treatment of calcific tendinopathies of the shoulder: how and when.**
F. Ruschi, S. Vitali, M. Rossi, A. Paolicchi, D. Caramella; Pisa/IT

P-0053 **Carpal bossing – review and an unrecognized variation.**
K.B. Puhakka, L. Roemer, B. Munk; Aarhus/DK

P-0056 **The role of ultrasound in the diagnosis of vascular pathology in athletes**
S. Giannini, M. L. Iocca; Rome/IT

P-0057 **Spinal Surprise**
B. Pass[1], N.J. Menon[2], P.P. Nagtode[2]; [1]Leeds/UK, [2]Wakefield/UK

P-0058 **Fractures of the Occipital Condyles - a pictorial review of our experience at Vancouver General Hospital**
G. Antoniades[1], S. Barrett[1], L. Louis[1], P.I. Mallinson[2], P. Mc Laughlin[1], S. Nicolaou[1]; [1]Vancouver, BC/CA, [2]Leeds/UK

P-0059 **Sports related stress fractures: Imaging evaluation**
N. Ramesh[1], N. El Saeity[2]; [1]Portlaoise/IE, [2]Cheshire/UK

P-0060 **An analysis of 189 spinal trauma patients at a Level 1 Trauma Centre**
N. Purohit, V.T. Skiadas, S. Vicknesvaran; Southampton/UK

P-0062 **MRI appearances of Aseptic Lymphocytic Vasculitis-Associated Lesions in metal-on-metal hip replacements.**
D. Papoutsi[1], N. Purohit[2], J.M. Latham[2], V.T. Skiadas[2]; [1]Liverpool/UK, [2]Southampton/UK

P-0063 **Sports related injuries in cricket: a Pictorial review**
N. Ramesh; Portlaoise/IE

P-0064 **Magnetic resonance arthrography of the wrist with and without axial traction**
T. Kirchgesner[1], L. Pesquer[2], A. Larbi[1], P. Meyer[2], M.H. Moreau durieux[3], A. Silvestre[2], B. Dallaudiere[4]; [1]Brussels/BE, [2]Merignac/FR, [3]Bordeaux/FR, [4]Paris/FR

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S. Giannini, G. Montanari, A. Rocchi, P. Tripodi, M. Claps; Rome/IT

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C.A. Gademsetty[1], A. Rastogi[1], J.N. Papanikitas[2], S.G. Cross[1], R. Jalan[1]; [1]London/UK, [2]Oxford/UK

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X. Tomás, L. Visa, J. Ramirez, A.I. Garcia-Diez, A.B. Larque, D. Fuster, J. Pomes-Tallo; Barcelona/ES

P-0070 **Soft tissue calcification: Pictorial review**
N. Ramesh; Portlaoise/IE

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M.J. Ereño Ealo, E. Montejo, B. Sancho, E. Pastor; Galdakao/ES

P-0073 **Intraneuronal Ganglion Cyst. Diagnosis and treatment**
F. Diez Renovales[1], B. Ruiz[1], J. Cardenal Urdampilleta[1], I. Corta[2], S. Cisneros[1], A. Viteri[1]; [1]Bilbao/ES, [2]Vitoria/ES

P-0074 **Musculoskeletal injuries associated with hurling in young adults: imaging review**
N. Ramesh; Portlaoise/IE

P-0079 **Sacro-iliac joint imaging: beyond inflammatory disease**
M.O.E. Castro[1], B.M.Q. Santos[1], L. Silva[1], C. Bilreiro[1], F. Aleixo[2]; [1]Portimao/PT, [2]Estombar/PT

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L.A. Rödiger, G. Armbrecht; Berlin/DE

P-0081 **MSK Findings in Systemic Sclerosis – Multi Modality Approach**
J. Brtkova; Hradec Kralove/CZ

P-0085 **Paediatric joint infections – a tertiary centre imaging case review**
A. Rastogi, S.G. Flanagan, C.A. Gademsetty, S.G. Cross, R. Jalan; London/UK

P-0087 **US of the ankle – yes, it can be simple!**
J.T. Soares[1], R. Duarte[2], E. Matos[1], P. Portugal[1]; [1]Vila Nova de Gaia/PT, [2]Zaventem/BE

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B. Ruiz[1], I. Corta[2], F. Diez Renovales[1], G. Lecumberri[1], N. Nates Uribe[1], D. Grande[1]; [1]Bilbao/ES, [2]Vitoria/ES

P-0090 **Avulsion injuries of Pelvis: An imaging spectrum**
S.I. Alam, D. Kumar, M. Khanna, H. Hina, M. Heidous, O.M. Osman, A.M. Refaat; Doha/QA

P-0092 **Soft tissue calcification; a pictorial review**
I. Pressney, A. Isaac, P.A. Tyler; Stanmore/UK

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A. Vlajkovic, C. Schueller-Weidekamm; Vienna/AT

P-0100 **Imaging Characteristics of The Morel Lavallee Lesion**
N.L. Robertson, I. Anwar, K. Nayagam, R. Katz, J. Farrant, B. Holloway, H. Marmery; London/UK

P-0101 **Imaging in spinal trauma: current concepts and pictorial review**
E. De Smet, F.M.H.M. Vanhoenacker, P.M. Parizel; Antwerp/BE

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V. Martinelli, E. Federici, D. Beomonte Zobel, C. Dell'atti, N. Magarelli, L. Bonomo; Rome/IT

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S.A.M. Ahmed Alzubaidi[1], M. Al Raddadi[2], S.R.S. Khalil[1], H.S. Alhejaili[2], A. Elmur[1], A.S. Sacarana[1]; [1]Almadina Almunawarra/SA, [2]Madina/SA

P-0104 **The posterolateral corner of the knee: the normal and the pathological**
M. Bartocci, C. Dell'atti, E. Federici, V. Martinelli, N. Magarelli, L. Bonomo; Rome/IT

P-0107 **Olecranon lesions: Radiographic Appearances with Cross Sectional Imaging Correlation**
U. Kularatne[1], N. Evans[2], S.L.J. James[2]; [1]Nottingham/UK, [2]Birmingham/UK

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P-0109 **The role of Imaging in Ewing sarcoma**
D. Beomonte Zobel, C. Dell'atti, M. Bartocci, V. Martinelli, N. Magarelli, L. Bonomo; Rome/IT

P-0110 **MRI Evaluation of Anterior Cruciate Ligament Reconstruction and Clinical Correlation**
V. Njagulj[1], A. Ragaji[1], M. Bjelan[1], K. Koprivsek[1], M. Milankov[2], M.A. Lucic[1]; [1]Sremska Kamenica/RS, [2]Novi Sad/RS

P-0111 **Coronal Imaging of the Spine (CIOS)**
A. Isaac[1], D. Dalili[1], L.F. Wilson[2], P.A. Tyler[2]; [1]London/UK, [2]Stanmore/UK

P-0115 **Imaging of Soft-Tissue Sarcomas: a case report.**
E. Federici, C. Dell'atti, M. Bartocci, D. Beomonte Zobel, N. Magarelli, L. Bonomo; Rome/IT

P-0116 **Image guided thermal ablation of bone lesions – when, where and how?**
M.S. Posadzy[1], M.-A. Thénint[2], J. Garnon[2], A. Gangi[2]; [1]Poznań/PL, [2]Strasbourg/FR

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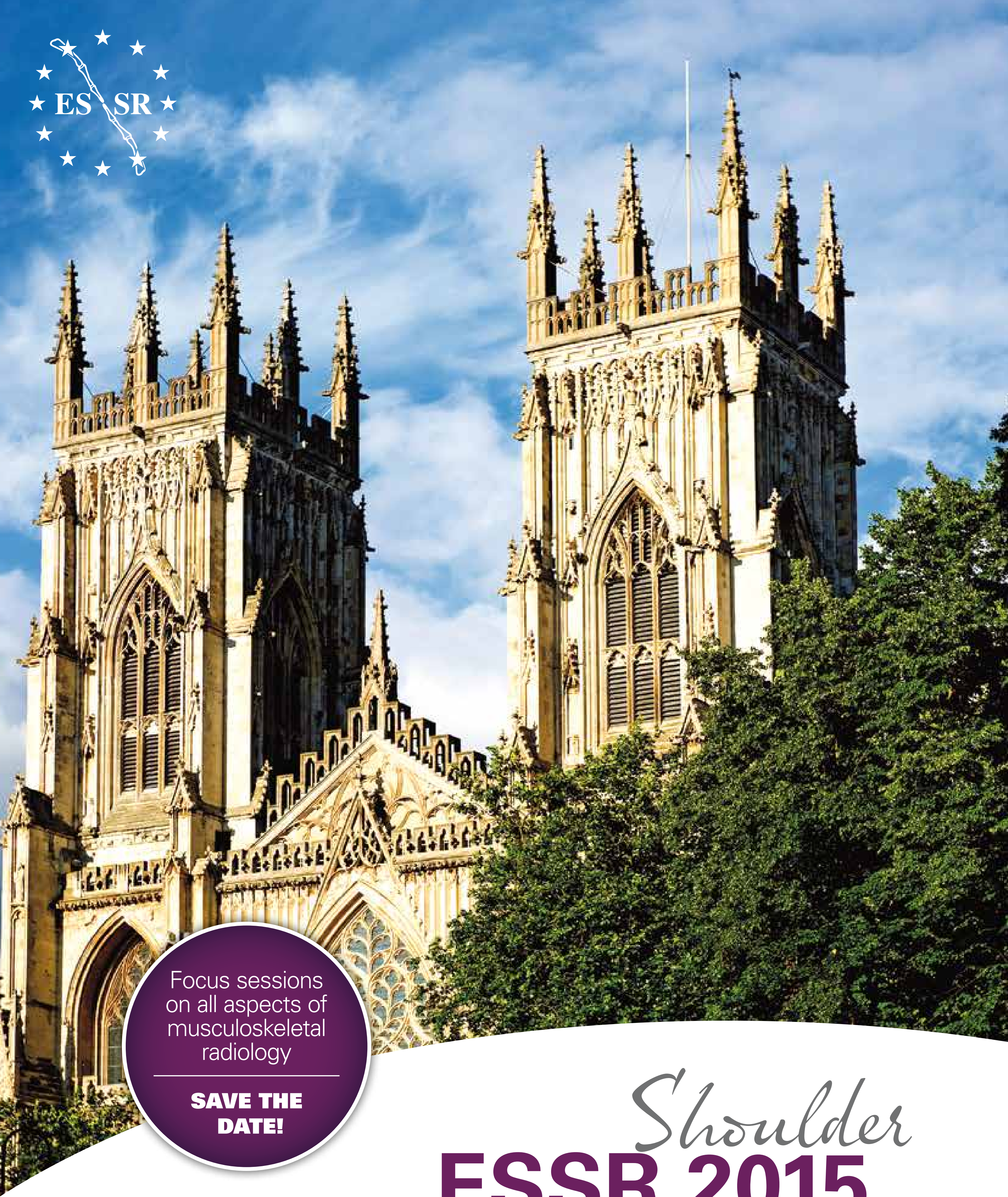
NOTES



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