Introduction
Possible use of ultrasound in pain therapy

Diagnostic ultrasound: neuroma, CTS, nerve lesions, metastasis ...
Diagnostic and therapeutic procedures on soft tissues
Intraarticular injections, musculoskeletal ultrasound
Diagnostic and therapeutic procedures on nerves
=> I will focus on this topic

Advantages of ultrasound
Pain therapy – specific

Reduction of radiation exposure
Ultrasound guidance for peripheral blockade may improve specificity of diagnosis in chronic pain conditions
Still no studies presently showing improved therapeutic benefit associated with ultrasound guided therapeutic pain procedures
But: ultrasound seems to be a logical approach in terms of safety and efficacy

=> Better diagnostic?
=> Better outcome?
=> Safety improvement?

Challenges, problems
Ultrasound-guided nerve blocks in pain therapy

Usually smaller nerves than regional anaesthesia
Ultrasound appearance of nerves very variable
To visualise small nerves (mm)
- High resolution needed (12-17 MHz)
- “Working dept” limited
A lot of different locations
=> wide anatomical knowledge essential
Number of patients qualifying for a certain therapy may be low
=> experience limited in some regions

Relation of ultrasound versus anatomy
Good anatomical knowledge is the prerequisite to understand ultrasound images
Ultrasound opens excellent possibilities to teach and learn about anatomy

Limitations of ultrasound
Penetration depth
- Depending on ultrasound-frequency (needed resolution)
Overlying structures
- Bone, air
Patient
- Tissue contrast (water content); obesity
Person performing the block
Some interventions better not done by ultrasound
Is there evidence for the use of ultrasound in pain therapy?

Ultrasound-Guided Interventional Procedures in Pain Management: Evidence-Based Medicine
Samer N. Narouze, Reg Anesth Pain Med 2010

“Ultrasonography in interventional pain management is still a new field in evolution; therefore, most of the publications are within the past few years and come from a small number of centers, and most procedures have been performed by a very few experienced pain physicians”

Examples for peripheral nerves
1. Greater occipital nerve (GON)
2. Cervical plexus and its nerves

Greater occipital nerve (GON)

Cervical plexus at level of cervical nerve root C3

Cervical spine

Obliquus capitis inferior muscle
Greater occipital nerve (GON)
**Third occipital nerve (TON)**

Eichenberger et al, Anesthesiology 2005

**Medial branches (mb) C4 and C5**

Siegenthaler et al, RAPM 2011

Siegenthaler et al, Anesthesiology 2012

**Cervical facet joints**

Lanz Wachsmuth, Praktische Anatomie, Springer 2004

**Stellate ganglion Anatomy**

Where to block the sympathetic chain?

Europe: usually at the level of C6

USA: usually at the level of C7

Lanz Wachsmuth, Praktische Anatomie, Springer 2004

**Stellate ganglion block, techniques**

Blind technique: palpation Chassagnac tubercle C6

Fluoroscopic guided paratracheal approach C6 or C7

Ultrasound guided block first described 1995 by Kapral et al.

**Stellate ganglion block, complications**

- **Vascular complications:**
  - Extraforaminal vertebral artery (1)
  - Branches from the thyrocervical trunk and ascending cervical artery (2)

  2. Huntoon MA, Pain Pract 2009

- Seizures, death

- Hematoma formation with airway compression

- **Potential oesophageal puncture**
Stellate ganglion block – blind method

What is on the way of the needle?

60 volunteers: ultrasound scan in the region of planned „blind“ block
Lateral dislocation of carotid artery using small curved array transducer (like finger tip but direct visualization possible)
Left side: oesophagus is in planned needle track:
- At C6 before dislocation manoeuvre in 22 of 60 cases
- Stayed after dislocation manoeuvre in 10 and appeared newly in 5 cases (total 15 cases)
- At C7 in 39 of 60 cases
- Stayed after dislocation manoeuvre in 22 and appeared newly in 8 cases (total 30 cases)
Vertebral artery at C6 in 2 cases; at C7 in 8 cases (no change with dislocation manoeuvre)
Other arteries: at C6 in 10 and at C7 in 17 cases (no change)

Siegenthaler et al, RAPM 2012
Lumbar facet joints (medial branch und periarticular)

Greher et al., Anesthesiology 2004

Does ultrasound help in this spine?

Depending on your skills!
Only if you have seen a lot of normal spines!

Selective transforaminal nerve root blocks?
Sonoanatomy: cervical root and lumbar foramen

Why not transforaminal by ultrasound

Major complications published (dead: cervical, paraplegia: lumbar)
Brouwer et. al, Pain 2001; Rozin et al., Am J Forensic Med Path 2003
Ludwig et al., Spine 2005; Glaser et al., Pain Physician 2005
Discussion of mechanism: intravascular injection
(radicular artery) of a particulate (crystalloid) steroid
Baker et. al Pain Med 2003; Tiso et al., Spine 2004,
Rathmell et al. Anesthesiology 2004

Too dangerous using ultrasound guidance
- You can not exclude intravascular injection because a radicular artery can often not be seen by Doppler-ultrasound

How to do nerve root blocks?

If transforaminal injection needed:
- Only under real-time fluoroscopy using digital subtraction
- Always LA test dose
- Inject only water soluble steroids
  Baker et. al Pain 20003

More superficial nerve root blocks may be ok but:
- No deeper than the lateral end of the transverse process at cervical level
- Use colour doppler (radicular artery may cross even at this point and may be visible)
- Psoas compartment block at lumbar level
- No crystalloid steroids!

Conclusion: you have to chose the optimal imaging technique for each block

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