Outline

- Ultrasound basics
- Nerve blocks in physiatric setting
- Ultrasound with nerve blocks
Ultrasound Basics

• Sound wave energy is transformed when it interacts upon different medium
  – Reflected
  – Absorbed
  – Transformed
Sound Wave Transformation

- Frequency
- Energy – heat, electricity, mechanical energy / vibration...etc.
- Density of median -> impedance
- High impedance difference -> high echogenicity
  - Mineral, fluid, gas
Ultrasound Machines

- Transforms electricity to ultrasound
- Receives reflected ultrasound and transforms to electricity
- Display of digital images
Ultrasound transducers

• Transforms electricity to vibrations of the piezoelectric crystals
• Higher frequency -> higher resolution, lower penetration
• 15 – 17 MHz
Sonographic Appearance

- Fluid – anechoic
- Muscle – relatively hypoechoic
- Tendon – hyperechoic
- Nerve – hyperechoic
- Bone, cortex – hyperechoic with acoustic shadow
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Doppler Effect

- Sound wave travelling away decreases in frequency
- Sound wave travelling towards increases in frequency
Doppler Imaging

Anisotropy
Anisotropy
Nerve Blocks

- Management of spasticity, contractures
- Pre-serial casting transient blocks
- Pre-manipulation blocks
- Diagnostic / therapeutic
Ultrasound Imaging for Nerve Blocks

- Brachial Plexus
- Suprascapular
- Median – elbow, carpal tunnel
- Ulnar
- Radial
- Femoral
- Obturator
- Sciatic
- Tibial
Brachial Plexus

- Preparation for regional shoulder manipulations
- Anesthetic block
Surface anatomy of the brachial plexus emphasizing the approaches for brachial plexus block

- Cervical approach
- Supraclavicular approach
- First rib
- Clavicle
- Humerus
- Axillary sheath
- Axillary approach

- Cricoid
- Sternocleidomastoid

Arm
Brachial Plexus – Anatomical Approach
Brachial Plexus – Interscalene Approach
Brachial Plexus - Interscalene

- [Link](http://www.eorthopod.com/content/thoracic-outlet-syndrome)
Brachial Plexus - Interscalene

- [http://www.eorthopod.com/content/thoracic-outlet-syndrome](http://www.eorthopod.com/content/thoracic-outlet-syndrome)
Brachial Plexus –
Suprascapular Artery
• Yasuyuki Shibata. The Suprascapular Artery and the Brachial Plexus.
suprascapuloar artery

BP

AIM

Brachial Plexus - Supraclavicular

Figure 2A

Figure 2B

ASM
MSM
SA
RIB 1

Supraclavicular – Suprascapular Nerve
Brachial Plexus – Infraclavicular
Brachial Plexus – Infraclavicular

Axillary artery
Axillary vein

• Yasuyuki Shibata. Ultrasound-Guided Infraclavicular Brachial Plexus Block.
Brachial Plexus – Infraclavicular

- Yasuyuki Shibata. Ultrasound-Guided Infraclavicular Brachial Plexus Block.
Musculocutaneous Nerve
Musculocutaneous and Axillary

Relationship of the brachial plexus to the axillary artery

- Ventral rami (roots)
- Upper trunk
- Middle trunk
- Divisions
- Lateral cord
- Coracoid process

Cervical nerves
- C5
- C6
- C7
- C8

Lower trunk
- T1
- Thoracic nerve

- Posterior cord
- Axillary artery
- Medial cord
- Pectoralis minor
- Axillary nerve
- Musculocutaneous nerve
- Ulnar nerve
- Median nerve
- Radial nerve

Posterior divisions and their branches dark green
Musculocutaneous and Axillary

Relationship of the brachial plexus to the axillary artery

Ventral rami (roots)
Upper trunk
Middle trunk
Divisions
Lateral cord
Coracoid process
C5
C6
C7
C8
Cervical nerves
Lower trunk
Thoracic nerve
T1
Posterior cord
Axillary artery
Medial cord
Pectoralis minor
Axillary nerve
Musculocutaneous nerve
Ulnar nerve
Median nerve
Radial nerve
Posterior divisions and their branches dark green

AnaesthesiaUK: Home>>Resources>>Anatomy>>Anatomy for anaesthetists>>Applied anatomy for upper limb blocks
Suprascapular Nerve

• Preparation for regional shoulder manipulations
• In conjunction with other blocks
  – Axillary nerve
  – Intra-articular
  – Acromio-clavicular
  – Sub-acromial bursa
Suprascapular Nerve
Suprascapular Nerve
Median Nerve

- Diagnostic / Therapeutic blocks
- Carpal tunnel injections
Median Nerve
Carpal Tunnel Anatomy

- Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, [www.MSKSono.com](http://www.MSKSono.com), SonoSite
Carpal Tunnel Anatomy

• Daniel Shelton, Carpal Tunnel: Bifid Median Nerve - SonoSite Case Study, www.MSKSono.com, SonoSite
Carpal Tunnel Anatomy

- Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, [www.MSKSono.com](http://www.MSKSono.com), SonoSite
Carpal Tunnel Anatomy

- Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, www.MSKSono.com, SonoSite
Carpal Tunnel Anatomy

- Daniel Shelton, Carpal Tunnel: Bifid Median Nerve - SonoSite Case Study, www.MSKSono.com, SonoSite
Proximal Carpal Tunnel Probe Placement

- Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, [www.MSKSono.com](http://www.MSKSono.com), SonoSite
Proximal Carpal Tunnel Probe Placement - Transverse
Daniel Shelton, Carpal Tunnel: Bifid Median Nerve - SonoSite Case Study, [www.MSKSono.com](http://www.MSKSono.com), SonoSite
• Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, www.MSKSono.com, SonoSite
Daniel Shelton, Carpal Tunnel: Bifid Median Nerve -SonoSite Case Study, www.MSKSono.com, SonoSite
Proximal Carpal Tunnel Probe Placement - Longitudinal

Ultrasound Evaluation for Carpal Tunnel Syndrome, Viewsono.com
Proximal Carpal Tunnel Probe Placement - Longitudinal
Daniel Shelton, Carpal Tunnel: Bifid Median Nerve - SonoSite Case Study, www.MSKSono.com, SonoSite
Median Nerve Edema

Daniel Shelton, Carpal Tunnel: Bifid Median Nerve - SonoSite Case Study, www.MSKSono.com, SonoSite
Carpal Retinaculum Release
Ulnar Nerve

- Finger / wrist flexor denervations
  - Pre splinting / casting
- Epicondylar groove
Radial Nerve
Femoral Nerve

- Extensor contracture of quadriceps
- Diagnosis of the extent of tone versus soft tissue contracture prior to placing a temporary intrathecal baclofen infusion pump
Femoral Nerve

Lateral

Medial
Obturator Nerve

• Adductor spasticity / contractures
• Primarily for neurolysis
Obturator Nerve
Obturator Nerve

• Rabah, Danny M. and Ahmed K. Thallaj. Phase 1 Study, Safety and Feasibility of Ultrasound Guided Obturator Nerve Block in Transurethral Surgery
US Guided Obturator Nerve Block

• Rabah, Danny M. and Ahmed K. Thallaj.
• Phase 1 Study, Safety and Feasibility of Ultrasound Guided Obturator Nerve Block in Transurethral Surgery
• 18 consecutive men, ages 54-95, mean 69
• Mean time for procedure 4.2 min
• Successful block 97.2%
Yasuyuki Shibata. Ultrasound-Guided Obturator Nerve Block.
Yasuyuki Shibata. Ultrasound-Guided Obturator Nerve Block.
Sciatic / Tibial Nerves

- Pre-serial short leg casting of ankle contractures
- Diagnostic block
  - Deformity, e.g. hammer toe refractory to intramuscular motor point blocks
  - Versus diagnostic motor point blocks
Sciatic Nerve
Sciatic Nerve
Sciatic Nerve
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Shibata, Yasuyuki, and Misako Harato. Ultrasound-Guided Anterior Sciatic Nerve Block.
Tibial Nerve
Resources

- Atlas of Ultrasound- and Nerve Stimulation-Guided Regional Anesthesia
- Anatomical overlay of key muscles
- Real time videos on DVD
Resources

• Atlas of Ultrasound- and Nerve Stimulation-Guided Regional Anesthesia
• Extensive list of detailed peripheral nerve blocks
Resources

• Atlas of Ultrasound-Guided Regional Anesthesia: Expert Consult
• Online videos
Resources

• Ultrasound Guided Regional Anesthesia and Pain Medicine
• Numerous pain / sensory nerve blocks
Resources

• Ultrasound in Anesthetic Practice (with DVD)
Resources

• Critical Care Ultrasonography (with DVD)
• Alexander Levitov, Paul Mayo, Anthony Slonim
Resources

- Practical Ultrasound in Anesthesia for Critical Care and Pain Management (with CD)
- Philip M. Hopkins, Andrew R. Bodenham, Scott T. Reeves