KEY-POINT & REFERENCES

1. **Mechanisms of Head and Brain Injury - Andrew Maas**

KEYWORDS

- traumatic brain injury: the main cause of death in young adult males
- secondary brain damage: preventable and treatable
- cerebral ischemia: a major target for therapy
- penetrating head injury: a different disease on the increase
- prognosis: radiological characteristics are important

REFERENCES

1. Andrew I.R. Maas, MD, Mark Dearden, MD, Franco Servadei, MD, Nino Stocchetti, MD, and Andreas Unterberg, MD, Current recommendations for neurotrauma, Current Opinion in Critical Care 2000, 6:281-292
   Also on the website: www.braintrauma.org

2. **Maxillofacial Trauma and Skull Base Fractures - Spyros Kollias**

KEY PHRASES

1) A tripod or trimalar fracture involves the three processes of the zygoma (orbital, zygomatic, maxillary) and produces a separation of the zygoma from the remainder of the facial skeleton.
LE fort I fracture is a transverse fracture above the level of the hard palate producing a horizontal separation of the caudal maxilla and resulting in “floating palate”. The pterygoid is the bone which is involved in all types of Le Fort fractures.

2) Axial and coronal high-resolution CT remains the imaging mainstay for evaluation of skull base and maxillofacial trauma. MRI plays an important role in the delineation of parenchymal...
abnormalities and extracerebral collections and is recommended when intracranial abnormalities are suspected.

3) The maxillary division (V3) of the trigeminal nerve can be injured during fractures of the sphenoid in its proximal portion at the level of the foramen ovale, or during fractures of the mandible in the inferior alveolar canal.

4) Development of pituitary insufficiency after skull base trauma should prompt careful MRI examination of the hypothalamic pituitary axis.

5) Temporal bone fractures are classified as longitudinal (parallel to the long axis of the temporal bone), transverse perpendicular to the long axis of the temporal bone), and complex (exhibiting both transverse and longitudinal components).

REFERENCES


3. Brain Trauma - Paul Parizel

KEY PHRASES

1) In the acutely head-injured patient, multidetector CT (MDCT) is the preferred technique for detection of parenchymal injury, intracranial hemorrhage and skull fractures. In major trauma cases, evaluation of the cervical spine should be included in the initial MDCT work-up.

2) Posttraumatic cerebral oedema with intracranial hypertension is a life-threatening secondary traumatic brain lesion. It starts immediately after injury, but massive edema usually takes 24 to 48 hours to develop. Neuroradiologists must be familiar with the CT and MRI findings indicating subfalcine or transtentorial herniations.

3) In diffuse axonal injury, CT underestimates the true extent of the lesions, because non-hemorrhagic lesions are difficult to identify. Therefore, when a patient's neurologic or psychiatric status is worse than predicted from the CT findings, MRI must be performed.

4) In patients craniocerebral trauma, diffusion-weighted MRI plays an increasingly important role in the detection of parenchymal injuries, especially for acute diffuse axonal injuries, traumatically induced hypoxic-ischemic brain damage (e.g. shaken baby syndrome), or secondary ischemic lesions (carotid or vertebral artery dissection, fat embolism syndrome).
5) In patients with a history of head trauma, gradient echo T2*-weighted MRI is the best technique for demonstration of hemosiderin deposits in old hemorrhage.

REFERENCES


4. Head Trauma in Children & the Battered Child - Philippe Demaerel

KEY-POINTS

All children aged two years or younger, should undergo a brain CT when there is suspicion of non-accidental cranial injury.

The association of a subdural haematoma and the “reversal sign” are highly suggestive of non-accidental cranial trauma.

Subdural haematoma with different densities on brain CT are suspicious of non-accidental cranial injury.

When CT remains normal in suspected non-accidental cranial injury, brain MR is always indicated.

Diffusion-weighted MR images are mandatory in non-accidental cranial injury as they may play a prognostic role.

REFERENCES


5. **Neonatal Hypoxic-ischemic Injury - Olof Flodmark**

**KEY-POINTS**

1. The stage of brain development at the time of an insult determines the morphology of the resulting brain injury.

2. The intensity or depth of a hypoxic/ischaemic insult to a term infant determines the location of injury to grey matter.

3. Periventricular white matter damage occurs between 24 and 34 gestational weeks.

4. Periventricular white matter damage is the most common reason for cerebral palsy.

5. Total cessation of oxygen supply to the term brain is the most common reason for cerebral palsy with athetoid or dyskinetic movements.

**REFERENCES**


**KEY POINTS**

1. Spinal stability
2. Biomechanics
3. Spinal instability
4. Spinal traumas
5. Axial-Loaded-CT/MR
REFERENCES


7. Spinal Trauma - Johan Van Goethem

KEY-POINTS

1. A set of clinical criteria can be very useful in identifying patients who have an extremely low probability of injury of the cervical spine and who consequently have no need for imaging studies. Patients have to meet five criteria in order to be classified as having a low probability of injury: no midline cervical tenderness, no focal neurologic deficit, normal alertness, no intoxication, and no painful, distracting injury.

2. In a large series of patients with cervical injuries the combination of cross-table lateral (CTL), AP and OM-views missed 61% of all fractures, 36% of subluxations and dislocations and falsely identified 23% of the patients, half of whom had unstable cervical injuries, as having normal cervical spines.

3. CT is indicated in all acute trauma patients when there is no optimal visualization of the cervical spine on plain film, when unexplained focal neck pain or a neurologic deficit exists with a negative plain film, when there is unexplained prevertebral soft tissue swelling or whenever the plain film is abnormal. Some centers perform screening helical CT in patients at high risk for cervical spine injury based on a clinical prediction rule, while others suggest to replace plain films by helical CT in all cervical spine trauma victims.

4. Definite indications for MR imaging include myelopathy, radiculopathy, progressive neurologic deficit, spinal cord injury and an unexpected level of signs above the level of radiographically seen injury. MR should probably also be used in all patients who have persistent complaints after trauma or significant findings at any other investigation, since these patients have a worse prognosis and may exhibit significant MR findings.

REFERENCES


8. **Whiplash-injuries - Jostein Krakenes**

**KEY-POINTS**

1. Craniovertebral articulation
2. Alar ligaments
3. Transverse ligament
4. Tectorial membrane
5. Posterior atlanto-occipital membrane
6. Occipital membrane

**REFERENCES**

9. **Spinal Cord Trauma - Philippe Demaerel**

**KEY-POINTS**

Spinal cord injury can occur in the absence of a fracture or dislocation. In the presence of neurological signs, MR imaging is to be considered as an extremely urgent procedure.

Spinal cord oedema and/or hematomyelia have a prognostic significance.

Spinal cord injury at the craniocervical junction is almost always associated with disruption of muscles and/or ligaments. The tectorial membrane plays a crucial role.

Progressive posttraumatic myelomalacic myelopathy and syringomyelia are different radiological entities with a different therapeutic approach.

One may distinguish high-pressure and low-pressure syringomyelia on MR imaging and these have a prognostic significance.

**REFERENCES**


10. **New developments of functional neurorehabilitation in neurosurgery - Klaus von Wild**

**KEY-POINTS**

1. Take home massages:

1.1. **Spectrum of neurosurgical Neurorehabilitation:** Today, increasingly more patients survive their highly dangerous diseases thanks to the art of modern medical management and progress in rescue, first aid, intensive care as well as in diagnostic in many cases, however, at the price of considerable functional impairment of individual organs and above all the central nervous (CNS) and peripheral nervous system (PNS) suffering from disabilities or handicaps with restriction in their daily life and society, dependent on the sex of the person, his/her age, and social cultural factors. From the very onset of neurological surgery,
the preservation and restoration of impaired CNS and PNS functions as an original task for neurosurgeons demand their involvement with issues of functional Neurorehabilitation. In this connection the close and trusting cooperation with all partners of the rehabilitation is mandatory: e.g. with the emergency and intensive care physician, neuroradiologist, neuropsychologist, physiatrists, nurses, therapists and social worker. Within the spectrum of neurosurgical rehabilitation functional rehabilitation must start at the beginning, this means at the side of the accident respectively in the ICU and before the first neurosurgical intervention. First step: careful planning of a comprehensive, holistic rehabilitation concept which is aimed at the patient’s social reintegration.

1.2. **Functioning**: Functioning as defined by the WHO-ICF 2001 (International Classification of Functioning) serves as an umbrella term encompassing all body functions, activities, and participations. ICF, therefore, describes components of health and some health-related components of well-being. These domains are described from the perspective of the body, the individual, and the society in two basic lists:  

a) Body functions and structures, and

b) Activities and participation

Functioning describes the neurological and cognitive neurobehavioral impairments in a positive way, while disability and handicap nowadays is limited for impaired functioning in negative terms equivalent to limitation and restriction of social activities daily quality of life (QoL)

1.3. **Neurorehabilitation**: All neurorehabilitative measures have one common goal namely to avoid or elevate diagnosable or impending damage to the CNS and PNS. This means prevention of secondary and tertiary complications by enacting medical, therapeutically measures to overcoming the impedence of social handicap (assessed in respect to patient’s morbidity, impairment, activity, participation, and social relationship). Functional Neurorehabilitation means to simultaneously employ therapeutic programmes with and without special tools to influence functional neurological and cognitive-behavioural impairments in such a way that every day skill can be regained or use of acquisition of skill through brain plasticity.

1.4. **Diagnosis**: Careful assessment of the underlying aetiology and pathology by diagnostic investigation is the base for the proper and individual functional Neurorehabilitation. State of art diagnostic investigations include clinical neurological, electrophysiological, chemical, neurophysiological, and neuroradiological studies: plain X-rays, tomography, DSA, digital videoscopy, CT including 3D-reconstrucction and spiral CT, MRI as well as functional MRI, SPECT and PET studies for the evaluation of brain metabolism prior to invasive neurosurgical procedures and re-engineering regarding the presumable prognosis of neurological and cognitive-behavioural impairments.

1.5 **Neurosurgical rehabilitation:**

1.5.1: Conservative treatment: first aid, Intensive care, early and postacute rehabilitation

1.5.2 Operative procedures in brain, spinal cord, and peripheral nerve lesions:

a) tumour resection with preservation of nerves and nervous tissue

b) vascular surgery with preservation of local and global CBF (Laser-Doppler) vascular by-pass before resection of tumours or main cerebral vessels

c) Neurotraumatology: Decompressive craniotomy; resection of haemorrhagic contusions, resection of scar tissue (posttraumatic epilepsy), microneurolysis
d) Congenital malformations: Reconstructive procedures, CSF shunting procedures, stabilisation and fixation techniques, dural grafting

e) Reconstructive surgery of cranial and peripheral nerves and nervous plexus, arterial and venous vessels, computer assisted planning and reconstructive surgery of large skull bone and vertebral defects (neuronavigation, neuroendoscopy, biocompatible materials), restoration of locomotion by CNS PNS connection in paraplegic patients TH 6 – Th 11 (Brunelli’s Paradigm)

f) Functional neurosurgery: Implantation of electrodes for cortical and subcortical deep brain and brain stem stimulation to treat disorders of central motor function with involuntary movements (e.g. Parkinson’s disease, writers cramp, spasticity) and central deafferentiation pain,

h) Treatment of spastic functional disorders by intrathecal Baclofen R application via implanted pump or today, by repeated intramuscularly injections of Botulinum toxin A; alcohol and phenol nerve blocks may still be indicated.

g) Re-engineering of brain and spinal cord lesions: Central functional electrical stimulation (FES) (lower brain stem, median nerves) for arousal in comatose and vegetative state patients, phrenicus nerve pacing and urinary bladder stimulation in spinal cord lesions, vagus nerve stimulation in resistant epilepsy. Neuroprosthesis for acoustic nerve and visual cortex stimulation, retinaprosthesis

REFERENCES:


11. Vertebroplasty - John Mathis
1. Percutaneous Vertebroplasty (PV) is rapidly becoming the standard of care for the treatment of pain associated with vertebral compression fractures of the spine.
2. Patients appropriate for PV are those that experience severe pain caused by an acute or recent vertebral collapse.
3. Patients need little laboratory analysis that primarily insures that they have normal clotting function and are not actively infected.
4. All patients should receive IV antibiotics (such as 1 gram of cephazolin) 30 minutes prior to the procedure. The PV is performed using image guidance, usually fluoroscopy. Almost all patients are performed awake with local anesthetics and conscious sedation (Fentanyl and Versed) titrated to the individual patient needs.
5. The classic and still most common route is transpedicular.
6. For safe percutaneous introduction of PMMA into the vertebral body, real time fluoroscopic monitoring is employed.
7. The quantity needed for adequate filling is determined empirically at the time of the procedure and depends on the size and residual volume of the compressed vertebra.
8. The volume of cement needed to relieve pain at any one area of the spine has not been clinically determined. In an ex vivo study of osteoporotic vertebral bodies, we found that Simplex P restored pre-fracture strength and stiffness with 4.0 ml in the thoracic and thoracolumbar regions while 8 ml was needed in the lumbar area (2).

REFERENCES


12. Evidence Based Medicine and Low Back Pain - Maurits van Tulder

KEY NOTES

- There is still a huge gap between research and clinical practice
- Advice to stay active is the best treatment for acute low back pain
Exercise therapy, behavioural therapy and multidisciplinary treatment are most effective for chronic low back pain
International guidelines on acute low back pain are quite consistent in their recommendation that X-rays are not routinely indicated for low back pain
For patients 50 years of age and older or those whose findings suggest systemic disease, plain radiography and simple laboratory tests can almost completely rule out underlying systemic diseases.

REFERENCES


13. Spinal Degenerative Disease: Degenerative Disc Disease & Herniation - Massimo Gallucci

KEY NOTES

1. disk is fused together with end-plate cartilage and spongy bone: disk pathology invariably associate with bone changes.
2. Normal ageing implicates disk dehydration and intranuclear clefts, while extranuclear fissures are pathological
3. Disk diseases have natural tendency to spontaneous regression in 65-90% of cases after 1 year
4. Free fragments spontaneously involve in 100% of cases, T2-w hyperintense herniation in 80% while hypointense herniations, protrusions and bulging have less favourable course.
5. Inteventional techniques can relief pain in up to 80 % of cases.

REFERENCES


14. **Spinal Degenerative Disease: Facet Joints, Stenosis & Osteoporosis - Paul Parizel**

15. **Postoperative Spine - Johan Van Goethem**

**KEY-POINTS**

5. Knowledge of the type of surgical procedure performed, the disease process leading to the surgical procedure, the age of the patient, the time lapsed since the surgical procedure and the duration and quality-quantity of the postsurgical clinical syndrome is indispensable in the evaluation of imaging of the postoperative spine.
6. Knowledge of the normal or at least expected postoperative changes is imperative in evaluating the postoperative spine.
7. The differentiation between epidural fibrosis and recurrent disc herniation is most accurately made on post-contrast MR imaging.
8. Postoperative spondylodiscitis can be ruled out on MRI, but cannot be positively confirmed.
9. In general MRI is superior to CT in imaging the postoperative spine.

**REFERENCES**

16. Imaging Guided Pain Management - John Mathis

KEY-POINTS

1. Common nonvascular spine interventions include:
   1. Epidural Steriod Injections (ESI)
   2. Selective Nerve Root Blocks (SNRB)
   3. Facet Joint Injections and RF Ablation (FJ)
   4. Sacroiliac Joint Injections (SI)
   5. Selective Ganglionic Blocks
   6. Image Guided Spine Biopsies
   7. Discography
   8. Intradiscal Electrothermal Therapy
   9. Vertebroplasty
   10. Kyphoplasty

2. The risks associated with these procedures are low but can be more problematic if one does not have adequate initial training and appropriate choices are not made about drugs and materials that will be used.

3. The ESI, SNRB, FJ and SI injections are commonly grouped together and are used as a method of minimally invasive pain management for spine and SI joint pain. The most common steroid used over the last several decades has been Depo-Medrol. This material has proven to be generally safe but is contraindicated for use in intravenous and intrathecal locations.

4. Ganglionic Blocks: temporary or permanent blockade of sympathetic ganglia are helpful for controlling severe visceral pain created most commonly by malignant disease. The common areas treated are the celiac, thoracic and stellate ganglia. Impar (pelvic) ganglia may be blocked to treat problems of autoregulatory vascular disfunction (Sudec’s Atrophy).

5. Discography: discography is a diagnostic (not therapeutic) procedure but has potential complications that are of similar severity and frequency to the above-mentioned procedures.

6. Intradiscal Electrothermal Therapy (IDET): this is a relatively new therapy that uses heat to change the structural properties of collagen in the disc with the intent of reducing or relieving disc related pain. Patients considered for this procedure should have failed conservative therapy and be otherwise candidates for surgical therapy such as disc fusion.

17. Multiple Sclerosis - Frederik Barkhof

KEY-POINTS

1. MS is a perivenular inflammatory demyelinating disease, leading to specific locations and shapes of lesions, with a phase of enhancement
2. Grey matter lesions occur frequently in MS: involvement of U-fibres by juxtacortical lesions differentiates MS from ischemic disease
3. In the most recent diagnostic criteria for MS, MRI is indispensable to demonstrate dissemination in space and dissemination in time
4. Spinal involvement in MS is extremely common, but very rare in ageing and ischemia, and can be used to increase specificity of MRI in elderly and hypertensive patients
5. Considerable axonal damage occurs in MS from the earliest stages, manifesting itself as cerebral atrophy and black holes on T1-SE images

REFERENCES


18. New Insights and Treatments in Multiple Sclerosis - James Nicoll

TO BE ISSUED

19. Other White Matter Disease - Frederik Barkhof

Please see Multiple Sclerosis (Scheduled Speech n. 17)

20. Infectious disease of the Brain - Turgut Tali

KEY WORDS

1. Meningitis
2. Encephalitis
3. Cerebritis
4. Ventriculitis
5. Plexitis
6. Infection
7. Bacterial
8. Granulomatous
9. Fungal
10. Parasitic

SUGGESTED READINGS

1. Atlas S. W. MRI of the Brain and Spine. Lippincott Williams &Wilkins, Philadelphia, 2002; 1099-1177
2. Osborn A. G. Diagnostic Neuroimaging, Mosby Year Book, St. Louis, 1994; 673-712
21. Infectious disease of the Spine and Spinal cord - Claude Manelfe

TO BE ISSUED

22. Neuropathology of dementia: new insights - James Nicoll

TO BE ISSUED

23. Imaging in dementia, including Alzheimer Disease - Frederik Barkhof

**KEY-POINTS**

- A normal medial temporal lobe and hippocampus on coronal MRI rule out Alzheimer’s disease; however, hippocampal atrophy also occurs in vascular dementia, and is not specific for Alzheimer’s disease
- Strongly asymmetric hippocampal atrophy and temporal pole atrophy are found in fronto-temporal dementia (FTD)
- MRI is mandatory for a diagnosis of vascular dementia, and positive findings include strategic infarcts, such as bilateral thalamic lesions
- White matter changes also occur in Alzheimer’s disease, perhaps as a sign of mixed dementia and should be treated independently
- In dementia with Lewy Bodies, MRI findings are non-specific, but often the hippocampal region is relatively spared

**REFERENCES**

24. **Other Degenerative Brain Disease (Parkinson, ALS & Cerebellar, ...) - Massimo Gallucci**

**KEY NOTES**

1. Non-emic iron is normally present in basal ganglia of adults, its accumulation being more relevant in pallidi rather than putamina.
2. In Idiopathic Parkinson Disease MRI usually does not show abnormalities.
3. In case of Multi-System Atrophy wider involvement of the substantia nigra and dorso-lateral putamina is evident (increase in iron deposits)
4. In case of Olivo-Ponto-Cerebellar Atrophy imaging findings are typical (pontine atrophy, demyelination of pontine transverse fibers)
5. Iron accumulates intracellularly even in other cases of degenerative diseases: in ALS iron deposits can be detected inside primary motor cortex.

**REFERENCES**


25. **Temporal lobe epilepsy - Pia Sundgren**

**KEY-POINTS**

Background to Epilepsy
Imaging and work-up for epilepsy
Imaging protocol
Mesial temporal lobe epilepsy
Malformation of cortical development

**REFERENCES**


26. **Spondylarthropathies - Claude Manelfe**

**TO BE ISSUED**