Pain due to degenerative diseases of the cervical and lumbar spine is very common in the general population. The intervertebral disc and the adjacent vertebrae undergo changes with age. Some of these can cause local pain and may be associated with compression of the spinal cord or of a nerve root. As the intervertebral disc ages, the nucleus pulposus degenerates, losing its ability to retain water. MRI is very sensitive to detect these changes. The annulus thins with age and radial slits can appear in it, which allow the nucleus to bulge and even to rupture through. This is disc prolapse.

Those changes may occur with associated ligamentous hypertrophy. The bulging peripheral fibers of the annulus may become calcified and even form osteophytes. All these changes can lead to further narrowing of the spinal or root exit canal (intervertebral foramina). This is called cervical spondylosis.

Neurological involvement can therefore be caused by: (1) soft disc, (2) ligamentous hypertrophy, or (3) osteophytes. Those can produce compression over the:

- **Spinal cord**: may cause myelopathy.
- **Nerve root**: may cause radicular complaints.

There are two main patterns of cervical degenerative diseases:

1. **Cervical radiculopathy**. This is pain with radicular pain in the arm with signs of a lower motor neuron lesion usually affecting C6 or C7. The patient may complain of pins and needles and weakness, but the arm pain is the main symptom.
2. **Cervical myelopathy**. Cervical spondylosis is the most common cause of myelopathy in patients over the age of 55. This presents with pain and stiffness in the neck, with a gritty feeling in the tips of the fingers. Patients will complain of stiffness and a loss of dexterity, with unsteadiness of gait. Bladder sphincter symptoms are common (usually urgency). The symptoms are usually slowly progressive. On examination, there are signs of an upper motor neuron lesion with a glove and stocking distribution sensory loss. The neck pain may not be a major feature. Examination will usually reveal a restricted cervical spine movement.

The condition is more common in the midcervical region, and there may also be signs of radiculopathy at the affected level.

**Differential diagnosis**

- Cervical rib
- Ulnar or median nerve entrapment syndromes
- Metastatic disease in the cervical spine
- Brachial plexus by apical lung tumor (Pancoast syndrome)

**Investigations**

1. **Plain radiographs** in flexion and extension positions: provide details of the bony architecture and evidence of osteophytes formation. Instability can also be seen and measured (malalignment).
2. **MRI**: in sagittal and axial views allow detailed study of the spinal cords, including changes within the cord itself, together with the views of the exiting nerve roots and nerve canal.
Management

Nonoperative management includes:

- Rest
- Analgesia
- Use of cervical collar (in an attempt to reduce motion and hence the cumulative effects of trauma on the spinal cord)
- Physiotherapy

Radiculopathy

- Most of the patient will respond to conservative measures.
- Surgery is indicated depending on the duration and severity of the pain, physical signs, radiological appearance, and the most importantly, the patient's wishes. Surgical procedure is either (1) anterior discectomy, or (2) posterior laminectomy and foraminotomy.

Myelopathy

- The aim of surgery is to prevent further deterioration. Despite decompression, there may be further deterioration in about 30% of patients. The surgical procedure is to decompress the spinal cord and maintain or establish stability. This is usually done by posterior approach (decompressive laminectomy); and in specific situations, anterior approach may be used.

Degenerative Diseases of the Thoracic Spine

It's rare. Thoracic disc prolapse is more common in males and usually in the lower thoracic spine.

Clinical Presentation

- The features are those of progressive spinal cord compression. If undiagnosed, they can finally progress to paraplegia with a sensory level, and finally to loss of sphincter function.

Investigations

- MRI is the tool of choice.

Management

- The prolapse can be treated by a standard decompressive laminectomy (posterior approach), or anterior transthoracic approach.

Craniosynostosis

The skull consists of several bones that are fused by means of sutures to form the cranium, which encase the brain and from which the face hangs. Most growth of the cranium has occurred during the first 2 years of life. The normal skull has a remarkable degree of symmetry about the midline. If premature closure of any of the cranial sutures occurs, an abnormal shape of the head will develop; and this is called craniosynostosis.

The main types of craniosynostosis are:

- Scaphocephaly. The most common type is the synostosis of the sagittal suture, which result in the characteristic keel-shaped head.
- Trigonocephaly is caused by premature closure of the metopic suture.
- Plagiocephaly will result from unilateral coronal or lambdoid synostosis.

When > 1 suture is involved in the synostotic process, this may result in elevation of the intracranial pressure. These are commonly associated with syndromic craniosynostosis, such as Crouzon syndrome & Apert syndrome.
Management

Surgery for craniosynostosis is undertaken in specialized units. Surgery is directed towards:

- increasing the volume of the skull
- improving the cosmetic deformity

Functional Neurosurgery

Epilepsy surgery

- 20% of epileptic patients are not well controlled by the antiepileptic drugs; it is these patients who may benefit from surgery.
- \textit{Preoperative evaluation:}
  - History and examination (anticonvulsants use, febrile convulsions)
  - Electroencephalography (EEG)
  - Imaging
- \textit{Surgical procedures:}
  - Resection of the epileptic focus
  - Hemispherectomy (hemidecortication)
  - Corpus callosotomy

Surgery for movement disorders

- The principle pathological disorder in Parkinson’s syndrome is a depletion of dopamine stores in the cells of the substantia nigra and neostriatum. This produces the classical triad of tremor, rigidity and akinesia.
- Surgical procedures:
  - Lesion making (either by radiofrequency coagulation or deep brain stimulation) of one of the following targets:
    - Thalamus
    - Subthalamic nucleus
    - Globus pallidus
  - Neural transplantation of fetal mesencephalon to the neostriatum of the patient.

Pain

- Occasionally the underlying problem that causes pain cannot be identified or eradicated. When pain occurs in the absence of a diagnosis that would define a specific treatment resulting in cure and relief of the symptoms, then the focus necessarily falls on the pain itself.
- Patients with intractable pain are usually divided into two groups:
  - Those with diseases that limit life expectancy
  - Those with chronic benign pain
- Neurosurgical management of pain:
  - Electrical stimulation of the central nervous system:
    - Epidural stimulation
    - Deep brain stimulation
  - Intrathecal drug delivery
  - Neuroablative procedures:
    - Sympathectomy
    - Dorsal root entry zone lesioning
    - Cordotomy
    - Cingulotomy
    - Procedures for trigeminal neuralgia