Spinal Infections
Infections involving the spinal column are an important group of conditions, which can present at any stage of life. Despite advantages in microbiology, surgical techniques and public health, there is a significant morbidity and mortality rate from these conditions.

They have traditionally been described according to the effected anatomical region, as well as the microorganisms found, and the host response. Rather than using the anatomical separation between disc infection ('discitis') and bony infection ('osteomyelitis') the term 'Infectious Spondylitis' is used to include all infections that involve the vertebral column. It has been shown in a number of series that although there are differences in clinical behavior, the basic pathology is the same.

Intra-canal infections are described separately, as their presentation and course are distinct from vertebral column infections.

Irrespective of the site of infection or microorganism involved, there is only a small number of ways that the spine can be infected.

1) Septic embolic spread; this may be via the arterial, venous, or lymphatic routes, entering the vertebral body, or seeding in the epidural plexus. In nearly all adults, and occasionally in children, a primary source of infection can be identified. The most common ones being from the genito-urinary tract, soft tissue infections, and the respiratory tract.
2) Latrogenic; from investigative as well as therapeutic procedures, and finally,
3) Contiguous spread from adjacent tissue.

Imaging
Plain Radiographs
The plain film appearances lag behind changes demonstrated with radionuclide bone scanning and MRI. Local loss of bone density is followed by cortical destruction, especially well seen by comparison with normal end-plates elsewhere. Disc destruction follows and the disc height is lost (Slide 1 and Slide 2). In malignant disease, loss of disc height follows herniation into the diseased body without actual loss of discal mass. Similarly, end-plate depressions in Scheuermann's disease also result in loss of disc height, but the end-plates are sclerotic, even if irregular.

Subsequent extension into the adjacent vertebral bodies causes further bone destruction, involving first the cortex and then the medulla. Overlying gut gas may obscure these changes. Linear tomography shows the lesions more clearly and gives a more accurate estimation of the area of destruction, often showing it to be larger than the area seen on the plain film.

Radionuclide Studies
While the radiographs may be normal initially, the radionuclide bone scan will be abnormal early on in the disease. Gallium scans, when used in conjunction with technetium scans, have an accuracy of about 94%. However, gallium and technetium scans may be falsely negative in leukopeinic patients and patients that suffer from relative ischaemia.

Computed Tomography
Computed tomography (CT) scanning with sagittal and coronal reconstruction is of similar value in assessing cortical, medullary and disc destruction. Soft tissue masses around infected vertebrae are also clearly seen in axial scans.

Magnetic Resonance Imaging
Magnetic resonance imaging (MRI) is the modality of choice for diagnosing spinal infection (Slide 1 and Slide 2) and exceeds any other modality currently available, as it is 95% accurate. MRI demonstrates both anatomic change and local features of inflammation. Trabecular and end-plate destruction, and marrow and discal inflammatory changes are seen. If marrow is mainly red, inflammatory changes are best seen as an increase in signal on T2-weighted sequences or as an area of signal loss in fat on T1-weighted images. Gadolinium results in an increase in signal on T1-weighted sequences. T1-weighted

sequences have decreased signal intensity, with an indistinct margin between the two.

Infection may arise directly in the disc, especially in adolescents, as blood vessels still penetrate the end-plates to enter the discs. Subsequently the disease spreads to adjacent end-plates and vertebral bodies.

Subligamentous spread beneath the anterior longitudinal ligament causes anterior erosions of adjacent vertebral bodies. Here, soft tissue masses are especially prominent and enhance with gadolinium. In all cases, posterior extension into the spinal canal is demonstrated with CT and MR imaging.

The presence of a vacuum phenomenon indicates an absence of inflammatory change; when a vacuum phenomenon vanishes and adjacent end-plates lose density or clarity, infection in the elderly patient is quite likely.

Osteoporosis

Osteoporosis is a metabolic bone disorder characterized by decreased amounts of normal-quality bone resulting in an increased susceptibility to fracture.

Although most commonly found in post-menopausal females (Slide 1 and Slide 2), it can also be secondary to immobilization as well as a number of underlying conditions, e.g. steroid use, alcoholism and malignancy.

Imaging

Changes in Vertebral Body Shape

The normal vertebral body has essentially parallel end-plates, although there may be slight end-plate concavity with 1-2mm of central depression. In the thoracic spine, the anterior height of the vertebral body may be 1-2mm less than the posterior. This does not imply collapse and may be seen in contiguous vertebral bodies.

Osteoporosis may result in vertebral compression, which can be acutely painful or pass unnoticed by the patient. Wedging usually affects the upper end-plate more than the lower, so that the difference in height between anterior and posterior surfaces of the vertebral bodies is over 2mm. The radionuclide bone scan shows marked focal increase in uptake. Significant collapse results in flattening of the vertebral body, which usually does not expand significantly. Expansion in collapse is a feature of Paget's disease and occasionally of primary and secondary bone tumors. In most cases, a collapsed osteoporotic vertebra is said to implode. Callus formation is not usually seen in collapsed osteoporotic vertebrae but is seen in patients with Cushing's disease. Collapse in osteoporosis is not generalized throughout the spine and it is unusual to find many vertebral bodies affected by collapse in contiguity.

'Codfish' vertebrae resemble fish vertebrae in shape, with deep, smooth, biconcave end-plate depressions. This feature is seen in any condition associated with bone softening, including osteomalacia. In osteoporosis, the depressions may be more marked on the upper end-plates and affected bodies are not always contiguous. In osteomalacia, the change is seen more diffusely throughout the spine.

In young adults, a codfish type vertebral body may be seen, where the upper and lower end-plates show smooth depressions slightly posterior to the coronal mid-plane. This change lies around the discal nucleus, as can be seen at discotomy and MRI and usually occurs in the lumbar spine, where the discs are largest.

Osteoporotic patients form less new bone as part of a degenerative process and are probably more susceptible to vertebral collapse than those who have normal mineralization or are hyperostotic, as in diffuse idiopathic skeletal hyperostosis.