Evaluation of Surgical Stabilization and Fusion in Management of Pathological Fractures of the Thoracic and Lumbar Spines

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Index

List of Figures

List of Figures

List of Figures

List of Figures

List of Tables

Introduction

Pathological fractures of the spine occur when a bone breaks in an area that is weakened by another disease process. Osteoporosis and osseous tumors (primary and metastatic) are the two most common causes of weakened bone leading to pathological fractures but may also be due to other pathologies such as infection or a bone cyst. [1]

Pathological fractures of the spine are a significant source of morbidity and a major public health concern. Fractures due to osteoporosis and malignancy with or without neurological compression can dramatically reduce a person's quality of life.[2]

Osteoporotic compression fractures of the spine are an increasing problem in ageing population. Although the majority can be treated with conservative treatment, a significant proportion of patients may benefit from interventional treatment. Vertebroplasty and kyphoplasty have been shown to be effective for appropriate patients.[3]

The location of the metastases is proportional to the volume or mass of bone in each vertebral region, 60% of metastases occur in the thoracic spine, 30% in the lumbosacral spine. Breast and lung cancer typically cause thoracic lesions, whereas colon and pelvic carcinomas commonly affect the lumbar spine .[4]

Compression can be prevented by early diagnosis, which requires a high index of suspicion on the part of patients, their families, and their clinicians. Disability arising from delays is associated with shortened patient survival .[5]

Infectious spondylodiscitis accounts for 2%-4% of cases of skeletal infection. Destruction of the vertebral body and intervertebral disk can potentially lead to instability and collapse. Infected bone or granulation tissue may be retropulsed into the spinal canal, causing neural compression or vascular occlusion .[6]

Back pain is the most common symptom, occurring in 83%–95% of patients, hours to months before the compression is diagnosed. Pain is usually described as sharp, shooting, deep, or burning. It is precipitated by coughing, bending, sneezing. Pain can be local, radicular, or both. The pain is caused by the expanding tumor in the bone, bone collapse, and/or nerve damage .[7]

Neurologic symptoms and signs often begin with radiculopathy (nerve root symptoms) and are followed by myelopathy (spinal cord compression). Radiculopathy in the thoracic spine occurs as a band-like pain at a segmental level. Radiculopathy in the lumbar spine causes pain or weakness in the lower extremity. Myelopathy begins as hyperreflexia, a positive Babinski reflex and or clonus, but progresses to weakness, proprioceptive sensory loss, and loss of pain and temperature below the level of the spinal cord compression .[7]

Autonomic dysfunction may result from spinal cord compression or cauda equina compression. Painless urinary retention suggests a neurologic cause. Isolated loss of bowel and bladder function in the absence of motor or sensory symptoms most often results from compression at the conus medullaris (tip of the spinal cord at approximately L1) .[7]

Management of metastatic spine disease is multidisciplinary including pain management, steroids, chemotherapy, radiation therapy and surgery.

Radiation therapy is a standard treatment for bony metastases, both for pain relief and prevention of morbidity and disease progression. Hypofractionated therapy is most frequently applied .[8]

Hormonal therapy is limited to certain responsive tumors, such as breast and prostate cancer. Chemotherapy does not provide adequate pain control. Bisphosphonates have been shown to partially relieve metastatic bone pain.[9]

Vertebroplasty and kyphoplasty offer patients a minimally invasive, percutaneuous procedure that dramatically reduces pain related to pathologic spinal fractures almost immediately with very low complication rates. Newer biomaterials, which are softer than currently used cement, may offer lower complication rates.[10]

Surgery may be required for severe deformity, spinal cord compression, unstable spine, or inability to receive further irradiation. Other investigators added a radio resistant tumor or a solitary metastasis **.**[11]

For thoracic and lumbar spine, direct anterior decompression and stabilization from a transthoracic or retroperitoneal approach is most appropriate for single level or occasionally for two level contiguous diseases. Postero-lateral decompression followed by instrumentation provides good opportunity for decompression of the anterior aspect of the spinal cord and for posterior decompression and stabilization of the unstable spine.[12]

Aim of the work

The aim of the work is to evaluate the current surgical modalities used in the treatment of pathological fractures of the thoracic and lumbar spines regarding postoperative stabilization and fusion of the spine.

Anatomy of the thoracic and lumbar spines

A) Bony anatomy:

1) The Thoracic vertebra:

The body is medium size and heart shaped. The vertebral foramen is small and circular. The spinous processes are long and inclined downward. Costal facets are present on the sides of the bodies for articulation with the heads of the ribs **(Fig. 1)**. Costal facets are present on the transverse processes for articulation with the tubercles of the ribs. The eleventh and twelfth thoracic vertebrae have no facets on the transverse processes. The superior articular processes bear facets that face backward and laterally, whereas the facets on the inferior articular processes face forward and medially.[13]

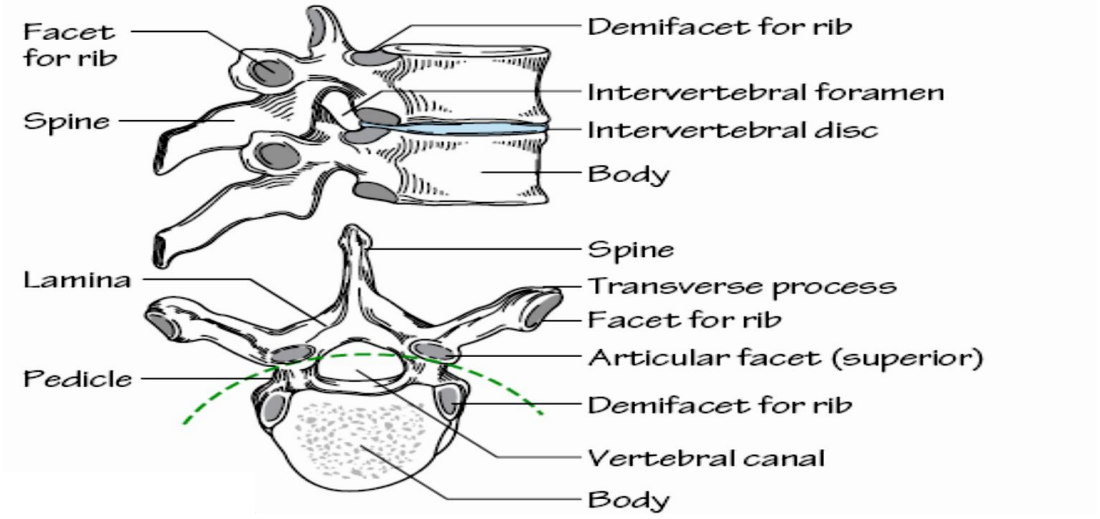

Figure (1): Typical thoracic vertebra: superior, lateral aspect.[14]

2) The Lumbar vertebra:

The body is large and kidney shaped. The pedicles are strong and directed backward. The laminae are thick **(Fig.2)**. The vertebral foramina are triangular. The transverse processes are long and slender. The spinous processes are short, flat, and quadrangular and project backward. The

articular surfaces of the superior articular processes face medially, and those of the inferior articular processes face laterally.[14]

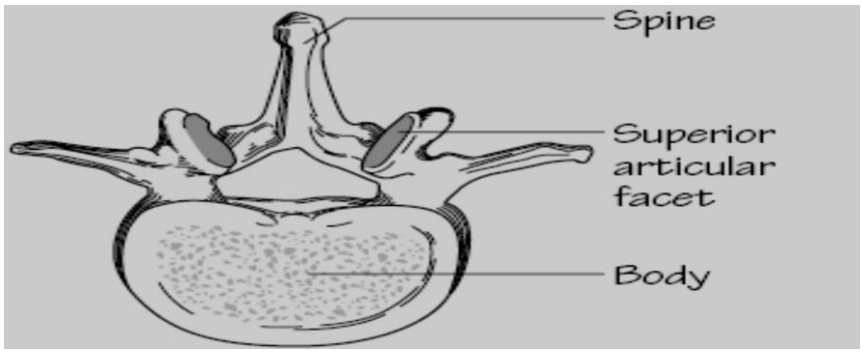

Figure (2): Lumbar vertebra, superior aspect.[14]

B) Articulations and Ligaments:

I) Vertebral body articulation:

1) The intervertebral disc:

It is a cartilaginous and articulating structure between the vertebral bodies. The intervertebral discs have the dual role of providing the primary support for the column of vertebral bones while possessing enough elasticity to permit the required mobility of the spine. Each disc is comprised of a ring of elastic collagen, the annulus fibrsous which surrounds the gelatinous nucleus pulposus **.**[15]

2) The anterior longitudinal ligament (Fig.3):

It is well developed in the thoracolumbar region, forming a thick band over the anterior surface of the vertebrae and thinning laterally.[16]

3) The posterior longitudinal ligament:

At midbody, it forms a narrow band which fans out as it approaches the region of the end plate and annulus. The posterior longitudinal ligament primarily functions to resist a flexion movement over several segments.[16]

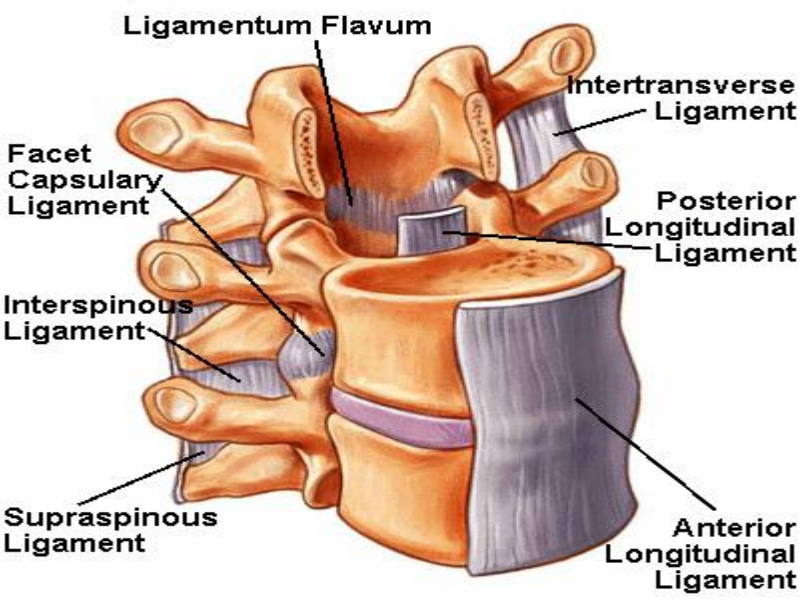

Figure (3): Ligaments of the vertebral body.[17]

II) Vertebral arch articulations:

1) Facet joint:

The facet joint is a true synovial joint with hyaline cartilage membrane, and is formed by the inferior articular process of one vertebra and the superior articular process of the subjacent vertebra .[18]

2) Ligaments:

a) Capsular ligaments:

Are composed partly of yellow elastic tissue and partly of white fibrous tissue. They encapsulate the synovial joints between the superior and the inferior articular processes of adjacent vertebrae.[18]

b) Supra spinous ligament:

A strong fibrous cord connecting the tip of spinous process from C7 to sacrum. It is thicker and broader at lumbar levels .[19]

c) Intertransverse ligament:

In the thoracic region they are cords intimately blended with adjacent muscles, in the lumbar region they are thin and membranous .[20]