

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

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Index

Topic		Page
Introduction		1-3
Aim of the work		4
Review of the literature	Anatomy	5-17
	Causes	18-25
	Pathophysiology of spinal cord injury	26-31
	Biomechanic of spine	32-38
	Investigation	39-51
	Clinical picture	52-61
	Management	62-79
	Complication	80-89
Patients and methods		90-102
Results		103-115
Discussion		116-126
Case presentations		127-140
Summary		141-143
Conclusion		144-145
References		146-164

List of Figures

No	Figures	
1	Typical thoracic vertebra: superior, lateral aspect.	
2	Lumbar vertebra: superior view.	
3	Ligaments of the vertebral body.	
4	The vertebral venous plexus.	
5	Cross section of the spinal cord and spinal nerves.	
6	Spinal cord ,laminae and cell groups.	
7	Major ascending and descending cord tracts.	
8	Arteries supplying the spinal cord.	
9	Benign spine tumors staging	
10	Malignant tumors of the spine.	
11	The column concepts of spinal stability. The concepts described by Louis (left). Denis's three-column concept (right). The two column concept (left).	
12	The vertebral body can be depicted as a cube composed of 27 smaller cubes to indicate tumor location: oblique (A) and lateral (B) views.	
13	Destruction of the middle third in the axial plane (A) results in gross instability, whereas destruction of the middle third in the sagittal plane (B) may not be associated with significant destabilization. A lesion in the ventral portion of the vertebral body in the coronal plane (C) affects stability more than a lesion in the middle (D) or dorsal (E and F) portions.	
14	The radiographic signs of spinal metastases are changes in vertebral body contours with vertebral body collapse and kyphotic deformity.	
15	Lateral plain film of the lumbar spine of a 65- year-old. Note blurring and irregularity of the sclerotic endplates and severe disc space narrowing.	
16	Degenerative changes in the spine (note the reduction of the disc space, osteophyte formation, hypertrophied facet and narrowing of the intervertebral foramen.	
17	The CT scan of a large cyst of the left pedicle.	
18		

List of Figures

19	MR images with osteoporotic fracture of the fourth lumbar vertebral body. (a) Sagittal T1-weighted spin-echo image shows complete bone marrow replacement. (b, c) Sagittal STIR images show hyperintensity in the fractured vertebral body and posterior bulging into the spinal canal. Adjacent to the fractured upper end plate is a focal area of fluid like hyperintensity representing the fluid sign (arrow).
20	The predominant findings of spinal metastases are the bone marrow replacement with decreased signal intensity on (a) T1W and increased signal on (b) T2W images, the preservation of disc structure on T1W and T2W images, the spinal cord compression on T1W images and the compression of subarachnoid space on T2W images.
21	The predominant features of spinal infections are decreased vertebral body signal intensity on T1-weighted images. (b) loss of endplate definition and increased disc signal on T2-weighted images, increased vertebral body signal intensity on T2-weighted images and increased signal intensity on T1-weighted fat-suppressed images after injection of gadopentetate.
22	
23	Typical spotted bright signal intensity changes within the vertebral body of L1 on aT1W and bT2W image suggesting a benign hemangioma.
24	
25	Neurological symptom.
26	Neurological sign.
27	Level of affection between studied groups.
28	Comparison of radioisotopes between studied groups.
29	Comparison of Intervention between studied groups.

List of Figures

30	Comparison of duration between onset of sign and intervention between studied groups. Comparison of ASIA between studied groups.	
31	Comparison of Karnofsky scale between studied groups.	
32		
33	Comparison of Visual Analog score of Pain between studied groups.	
34	Pre operative MR and CT showing fracture of L2, L3.	
35	Post operative X xray fixation of the lumbar spine with augmentation of the vertebrae by bone cement.	
36		
	Pre operative MR and CT showing fracture of L2	
37	Post operative plain x ray, AP and lateral view.	
	Postoperative CT with fixation with bone graft.	
38	Preoperative (A) positive isotopic bone scanning and (B)	
39	Sagittal C.T showing D 10 destruction of vertebral body and decrease of the height.	
40	Preoperative (A) and (B) MRI of T10 vertebral secondary with cord compression.	
41	Postoperative lateral views X-rays with posterior spinal fixation and anterior Titanium mesh cage reconstruction with good position of the cage.	
42		
43	Pre operative CT of the fracture with canal compromise.	
	Pre operative MRI of the fracture with canal compromise.	
	Post operative CT fixation.	

List of Figures

	Preoperative MR with fracture of D11-12. CT, sagittal and axial post operative fixation.	
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List of Tables

No	Table	
1	Comparison of demographic data between studied groups.	
2	Comparison of symptoms and signs between studied groups	
3	Lab investigations among studied groups.	
4	Comparison of level of affection between studied groups	
5	Comparison of Radioisotopes between studied groups.	
6	Comparison of Intervention between studied groups.	
7	Comparison of duration between onset of sign and intervention between studied groups.	
8	Comparison of Complications between studied groups.	
9	Comparison of ASIA between studied groups.	
10		
11	Comparison of Karnofsky scale between studied groups. Comparison of Visual Analog score of Pain between studied groups.	

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, percutaneous 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

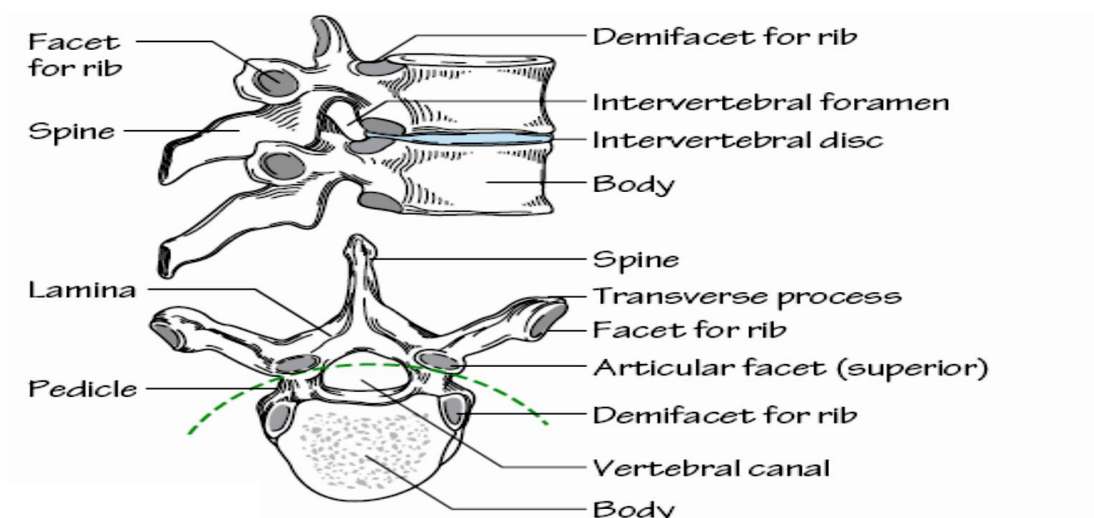


Figure (1): Typical thoracic vertebra: superior, lateral aspect.¹⁴

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

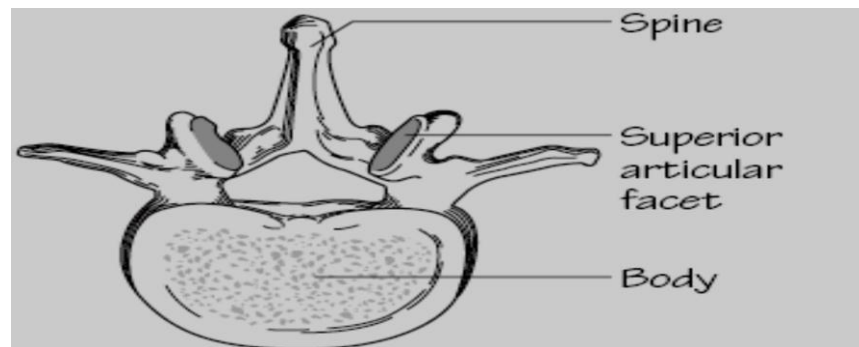


Figure (2): Lumbar vertebra, superior aspect.¹⁴

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 fibrosus 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

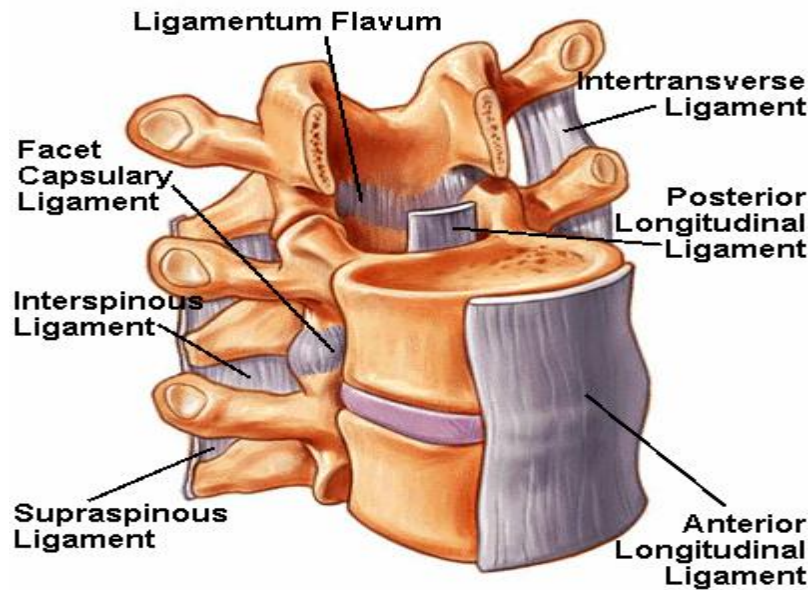


Figure (3): Ligaments of the vertebral body.¹⁷

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