

Surgical Management of Destructive Neoplastic Spine Lesions

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ABSTRACT

The spine is one of the most common sites of metastasis from distant structures, following the lung and the liver.

Aim: to review the pathological distribution, clinical presentation and different surgical procedures and outcome of cases with neoplastic spine lesions managed at our departments.

Patients and methods: this is a review of 29 patients presented with destructive spine lesion with compromised neural structure at different degrees, with no history of trauma or infection. All patients subjected to full neurological examination and ASIA scoring, and full radiological evaluation. Different surgical approaches were utilized.

Results: this a retrospective study of 29 patients, 11 males and 18 females. Mean age of presentation was 50 years old. The affected vertebral bodies are 47 distributed among vertebral regions: 6 sacral (12.8%), 16 lumbar (34%), 6 thoracolumbar (12.8%), 12 thoracic (25.5%), 3 cervicothoracic (6.4%), and 4 cervical (8.5%). As regard surgical procedures, 5 patients CT guided biopsy. One case operated by core biopsy and vertebroplasty. 4 patients were managed by posterior neural decompression and debulking. 12 patients operated posterior excision and reconstruction. 3 cases approached by anterolateral thoracotomy. 2 cases operated posterior excisional biopsy and Craniocervical fixation. One case was managed by anterior transoral excision. One case approached through anterior cervical corpectomy.

Conclusion: in selected cases surgical management of patients with spine neoplastic lesions followed by adjuvant therapy is considered to relieve pain, decompress neural structures, stabilization and correction of deformed spine, and local control with also improvement of quality of life but not the survival.

Keywords: Destructive Neoplastic Spine Lesions.

INTRODUCTION

Tumors that affect the vertebral column may be primary spine tumors or secondary tumors from distant organs. The occurrence of primary tumors is very rare in comparison to metastatic lesions, its occurrence less than 5% of all spine neoplasm; it is recorded to be forty times less than metastatic spine lesions and has been estimated at 2.5–8.5 per 100000 people per year ^(1,2). Up to 70% of patients with systemic cancer will have spine metastasis, and approximately 61,000 persons, will develop spinal metastasis each year ⁽³⁾.

Certain tumors have the preferentiality to metastasize to the spine, and the most often tumors to do that are breast (72%), prostate (84%), thyroid (50%), lung (31%), kidney (37%), and GIT (33%) ^(3,4). The most frequently affected vertebral regions are lumbar, thoracic and lastly cervical spines, although thoracic lesions (70%) are most often presented due to the narrow spinal canal and limited space for the spinal cord in this region, followed by lumbar (20%) and cervical (10%) lesions ⁽⁵⁾.

Most spinal metastatic lesions are extradural up to 97%, while intramedullary and intradural extramedullary much less common, where the dura make a relative barrier for metastatic spread⁶. Vertebral body and especially the posterior half firstly involved in metastatic disease followed by

neural arch, while in primary spine lesions certain tumors affect the whole body or start from neural arch ^(4,7).

In neoplastic spine lesions whether primary or metastatic pain is typically the first presenting symptom, its nonspecific and may be overlooked in primary lesions, where's in metastatic lesions its progressive unremitting not relived by rest worsen at night, generally pain described as constant and localized as a result of periosteal stretch occurring with tumor expansion, radicular pain usually due to compromised neural foramen or thecal sac, or axial pain, coinciding with motor deficits and these resulted from vertebral collapse, pathological fracture and instability ⁽⁸⁾.

As regard radiological evaluation plain radiography is an excellent screening tool, but negative results doesn't exclude malignancy, computed tomography (CT) is a superior radiological tool to give bony spine information, while magnetic resonance imaging is excellent to give detailed soft tissue and neural tissue information, isotopic bone scanning have been the standard for screening skeletal metastases, however false negative and false positive (super scan) results decrease its sensitivity ^(1,3).

The surgical intervention in metastatic lesions almost is palliative, where's it gives a chance for true

cure in primary spine lesions especially with early diagnosis (4,1). Surgical intervention has been evolved from laminectomy, to lateral or anterolateral approaches with direct attack of the lesion, or posterior corpectomy or vertebrectomy (9,10). The decision to go through certain surgical approach depends on, patient's general condition and life expectancy, tumor location, spinal instability, and compromised neural structures, the surgical objective is, pain control, preserve neural function and stabilization and anatomical reconstruction of the spine (8,9,10).

Aim of the work: to review the pathological distribution, clinical presentation and different surgical procedures and outcome of cases with neoplastic spine lesions managed at our departments.

PATIENTS AND METHODS

This is a retrospective study of 29 patients managed at Neurosurgical departments of Shebin Elkom Teaching Hospital, Al-Azhar University Hospitals and Nasr City Hospital for Health Insurance from January 2014 to December 2017. All patients presented with destructive spine lesions with compromised neural structure at different degrees with no history of trauma and infection. Two

patients have history of breast carcinoma. The affected vertebral bodies are 47 distributed among vertebral regions: 6 in sacral region, 16 in lumbar region, 6 in thoracolumbar region, 12 in thoracic region, 3 in cervicothoracic region, and 4 in cervical region.

All patients subjected to full neurological examination and ASIA scoring, and full radiological evaluation by ordinary plane radiography, computed tomography, contrast enhanced magnetic resonance imaging and isotopic bone scanning.

Different surgical approaches were utilized; CT guided biopsy, core biopsy and vertebroplasty, posterior approach, anterolateral approach and craniocervical fixation. The decision to utilizing certain approach depends on patient general condition, neurological status and location of the lesion.

Ethics approval and consent to participate

The medical ethics committee of Faculty of Medicine for Girls, Al-Azhar University, approved this study. The reference Number of the committee is not available and the date of approval was at Jan 2014. Before and during this study the informed consent was obtained from all study participants after brief discussion and explanation with them.

Illustrated cases

Case 1:

Male patient 64 years old presented with neck pain, dysphagia and right upper limb monoparesis. Plain radiography shows C2 disturbed anatomy and instability; CT shows detailed bony lesion destruction of C2 and MRI shows anterior retropharyngeal and right posterior neural encroachment as shown in figure 1.

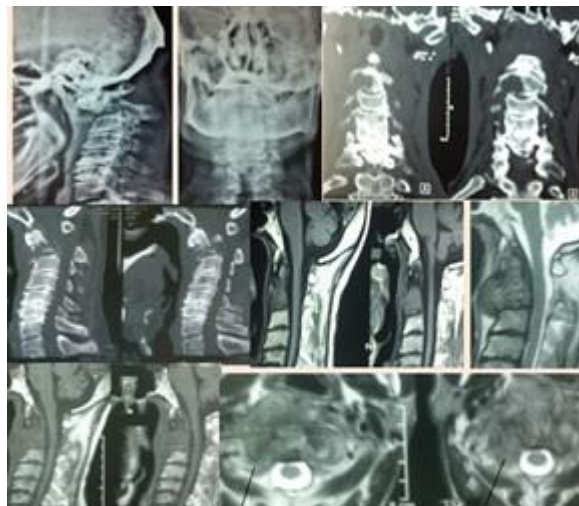


Figure (1)

He was operated by posterior craniocervical fixation and right transpedicular intralésional decompression as shown in figure 2. The pathology was large cell lung carcinoma metastasis.



Figure (2)

Case 2:

Male patient 54 years old presented with history of neck pain and progressive left sided weakness, MRI cervical spine with contrast show destructive C3 lesion compromising the neural canal. CT cervical spine show retropulsed bone fragment compressing the cord as shown in figure 3:

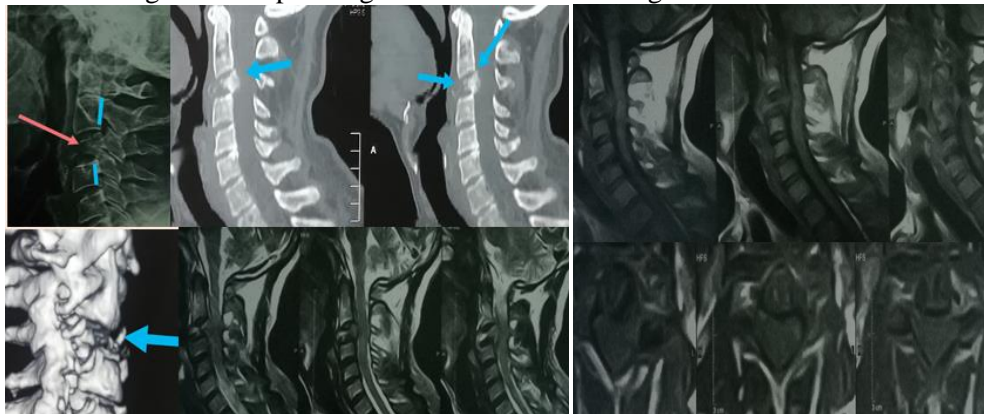


Figure (3)

He was operated by anterior cervical approach and reconstruction by pyramidal and plate system as shown in figure 4. Histopathology was metastatic undifferentiated carcinoma.

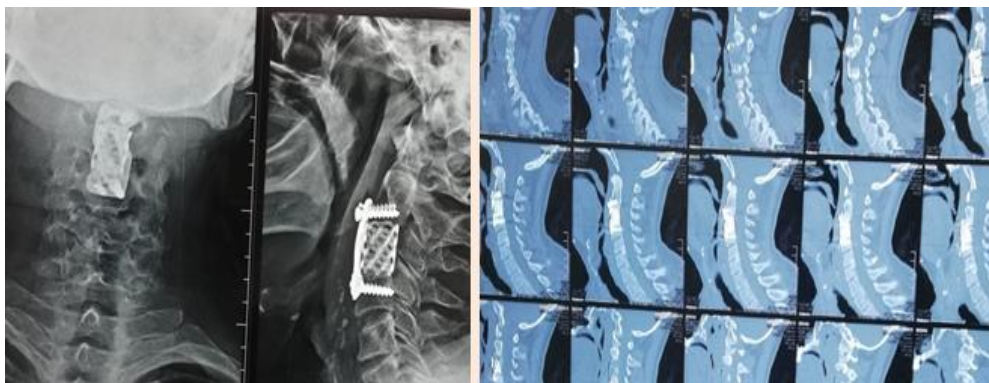


Figure (4)

RESULTS

This a retrospective study of 29 patients 11 males and 18 females. Mean age of presentation 50years old, the maximum is 72 years the minimum is 12years.

The most common presenting symptom in studied group is pain alone 7 patients (24%), or pain in association with neurological deficit (all other patients). The total number of affected vertebral bodies is 47 distributed among vertebral regions.

Six sacral (12.8%), sixteen lumbar (34%), six thoracolumbar (12.8%), twelve's thoracic (25.5%), three cervicothoracic (6.4%), and four cervical (8.5%) of total 47 vertebral bodies affected. As regard surgical procedures, five patients by CT guided biopsy. One case approached through pedicle cannulation for aspiration biopsy and vertebroplasty.

Four patients operated by posterior neural decompression and excisional biopsy. Twelve's patients operated by posterior excision and transpedicular screw fixation as a reconstruction. Three cases approached by anterolateral thoracotomy with bone cement reconstruction and z-plate fixation.

Two cases operated by posterior excisional biopsy and Craniocervical fixation. One case operated by anterior transoral excision. One case approached through anterior cervical corpectomy. As regard pathological distribution the metastatic spine lesions were 55.2%, primary spine lesions were 44.8%.

The most common metastatic lesion was breast 20.7%, then prostate 17.2%. The most common primary spine lesion was MM and hemangioma (aggressive with papillary hyperplasia) 13.8% for each followed by ABC10.3%.

As regard radiological pattern 24 cases were osteolytic lesions (82.8%), 5 cases were osteosclerotic (17.2%). After three years follow up the overall mortality among patients with primary spine lesions was two cases 15% and 2.9% of the whole studied group. In patients with secondary spine lesions (sixteen cases) the overall mortality was (eleven cases) 69% and 38% of the whole studied group after three years follow up.

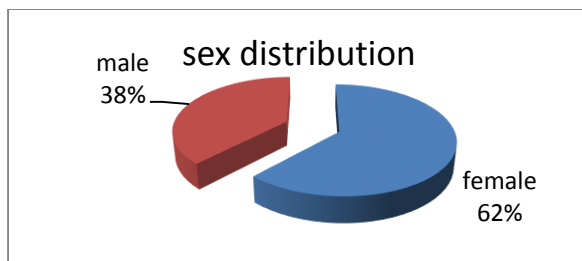


Figure (5): Sex Distribution

Table (1): Age distribution

No.	29
Mean	50
Median	52
St. deviation	16
Minimum	12
Maximum	72

Table 1 and figure 5 demonstrate the sociodemographic data of the studied group 11 males, 18 females with mean age 50 years.

Table (2): Patients' clinical presentation

cases	Clinical finding	scale
1	Pain and paraplegia	A
2	Pain and complete cauda	A
1	Pain and paraplegia	B
5	Pain and paraparesis	C
4	Pain and monoparesis	C
3	Pain and monoparesis	D
3	Pain and paraparesis	D
1	Dysphagia and hemiparesis	D
2	Pain and urinary urgency	E
7	Pain	E

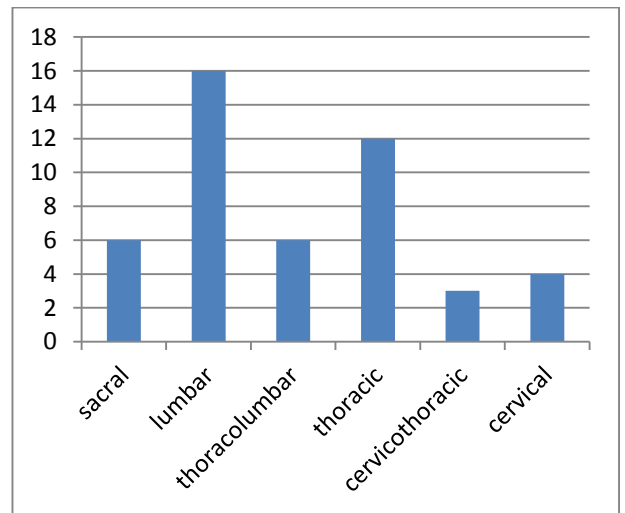


Figure 6: distribution of lesions in relation to vertebral bodies.

The total number of affected vertebral bodies is 47 distributed among vertebral regions. Six sacral (12.8%), sixteen lumbar (34%), six thoracolumbar (12.8%), twelve's thoracic (25.5%), three cervicothoracic (6.4%), and four cervical (8.5%) of total 47 vertebral bodies affected.

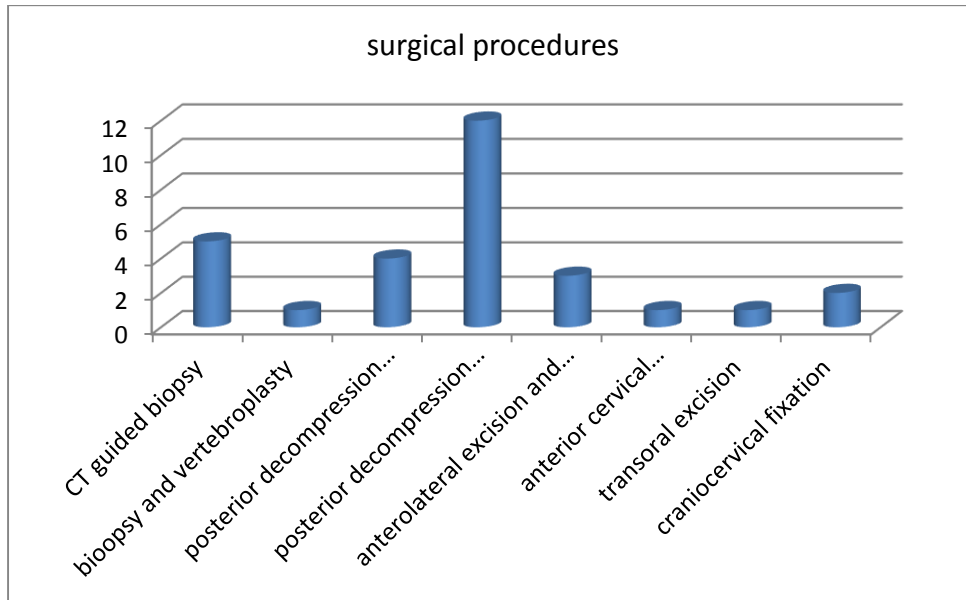


Figure 7: surgical procedure.

Five patients operated by CT guided biopsy. One case approached through pedicle cannulation for aspiration biopsy and vertebroplasty. Four patients operated by posterior neural decompression and excisional biopsy. Twelve's patients operated by posterior excision and transpedicular screw fixation as a reconstruction. Three cases approached by anterolateral thoracotomy with bone cement reconstruction and z-plate fixation. Two cases operated by posterior excisional biopsy and Craniocervical fixation. One case operated by anterior transoral excision. One case approached through anterior cervical corpectomy.

Table (3): Pathological distribution of the lesions of the studied group

Primary		Secondary	
Myeloma	4	Breast	6
Chordoma	1	Prostate	5
Ewing sarcoma	1		
Aneurysmal bone cyst	3	Thyroid	2
Aggressive Hemangioma	4	Lung	1
		GIT	2
Total	13	Total	16
	44.8%		55.2%

The metastatic spine lesions were 55.2%, primary spine lesions were 44.8%. The most common metastatic lesion was breast 20.7%, then prostate 17.2%. The most common primary spine lesion was MM and hemangioma 13.8% followed by ABC 10.3%.

Table (4): demonstrates the initial clinical presentation

Type Presentation	Primary spine lesions		Secondary spine lesions	
Pain	5 cases	38.45%	3 cases	18.75%
Pain with paresis	6 cases	46.15%	4 cases	25%
Pain with plegia	1 case	7.7%	7 cases	43.75%
Pain with sphincter	1 case	7.7%	2 cases	12.5%

In primary spine lesions pain with paresis were 46.15%, and pain only was 38.45%, this reflecting the fact that primary lesions grow slowly. In secondary spine lesions Pain with plegia were 43.75%, Pain with paresis

were 25%, and pain alone was 18.75%, and this reflecting the initial neurological entrapment from rapid tumor growth and vertebral body destruction.

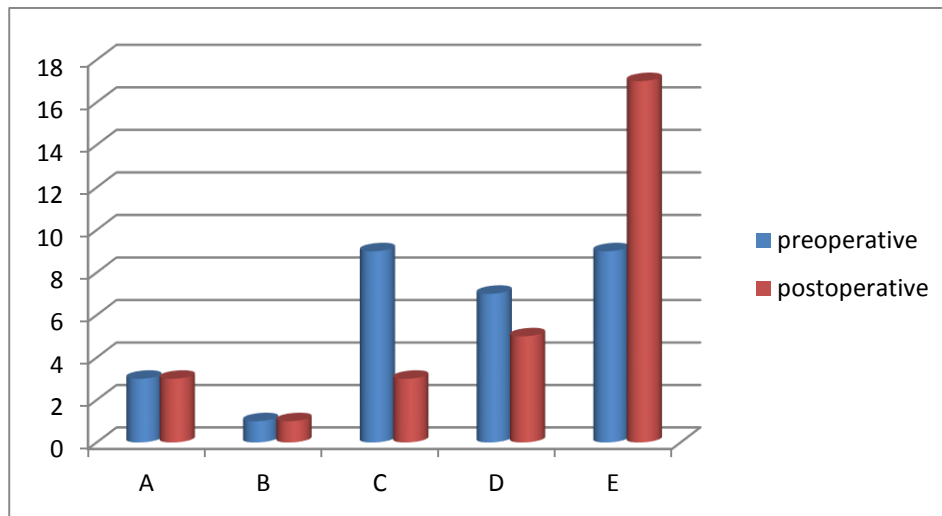


Figure 8: demonstrate preoperative and postoperative change of ASIA scale.

As regard radiological pattern, plain radiography show positive finding only in 12 patients (41%) in the form of loss of bone density at the affected vertebral body, kyphotic deformity, and loss of vertebral body height. On CT 22 cases were Osteolytic lesions (75.8%), 7cases were osteosclerotic (24.2%) of these 2cases prostatic adenocarcinoma (6.9%), 1 case breast adenocarcinoma (3.5%) and 4 cases aggressive hemangioma with papillary hyperplasia (13.8%). Contrast enhanced MRI in 22 patients (76%) show epidural soft tissue extension compressing the neural structure, and in all cases shows infiltrative marrow changes (100%).

Bone scan show worm spot in 17 patients (58%). After three years follow up the overall mortality among patients with primary spine lesions was two cases 15% and 2.9% of the whole studied group. A case of Chordoma died after one year due to bad general condition, and a case of multiple myeloma died after two years after completion of adjuvant therapy.

In patients with secondary spine lesions (sixteen cases) the overall mortality was (eleven cases) 69% and 38% of the whole studied group after three years follow up. Of them the worse prognosis was metastatic lung large cell carcinoma (one case), metastatic GIT carcinoma (two cases), metastatic prostatic adenocarcinoma (three cases), died within the first year of treatment. To some extent more better prognosis Metastatic thyroid adenocarcinoma (two cases), and metastatic breast adenocarcinoma (four cases) they died after three years.

DISCUSSION

Neoplastic spine lesions are predominantly metastatic lesions and occurrence of primary lesions is very rare (less than 5% of all spine neoplasms)^(1,2). In this work the metastatic spine lesions were 55.2%, and primary spine lesions were 44.8%, although the percentage of metastatic lesions higher than the primary one but the narrow spectrum than the stream of literatures is attributed to small number of patients of the study.

The pathological distribution among metastatic group was, breast 37.5%, prostate 31.25%, thyroid 12.25%, GIT 12.25% and lung 6.25%, while the pathological distribution among primary lesion group multiple myeloma (MM) and hemangioma (aggressive with papillary hyperplasia) 31% for each followed by ABC 23%, Chordoma 7.5% and Ewing sarcoma 7.5%, and these findings in concordance to the general predilection of systemic cancer which metastasize to the spine, where, breast (72%), prostate (84%), thyroid (50%), lung (31%), kidney (37%), and GIT (33%) reported to be the most frequent cancers to metastasize to the spine, and also the reported data about pathological distribution of primary lesions where hemangioma, MM, osteoma, ABC, chordoma and Ewing's sarcoma are the commonest primary spine lesion respectively^(3,4,7).

The location of lesions in relation to vertebral region were lumbar (34%), thoracic (25.5%), thoracolumbar (12.8%), sacral (12.8%) cervical (8.5%), and cervicothoracic (6.4%), and these almost coincident to **Robert et al.**⁽⁵⁾, where they find that, the most frequently affected vertebral regions are lumbar, thoracic and lastly cervical spines,

although thoracic lesions are most often presented due to the narrow spinal canal and limited space for the spinal cord in this region, followed by lumbar and cervical lesions. In the studied group pain is the hallmark presenting symptom where's pain alone was in 24% of patients, and pain in association with neurological deficit was in 76% (all other patients), means that it's the presenting symptom in almost all patients. Also in cases of primary spine lesions pain with radiculopathy were 46.15%, and pain only was 38.45%, this reflecting the fact that primary lesions grow slowly and presented with irritative symptoms, in metastatic cases Pain with myelopathy were 43.75%, Pain with radiculopathy were 25%, and pain alone was 18.75%, and this reflecting the initial neurological entrapment from rapid tumor growth and vertebral body destruction, and pain with sphincteric problems 7.7% in primary cases and 12.5% in metastatic cases .

These findings coincident to the literature where, its reported that pain is the presenting symptom in more than 90%, radiculopathy secondary to posterior element involvement and subsequent nerve root impingement also can occur up to 47%, myelopathy can occur up to 60% and sphincteric problems from 14% to 70% ^(11,12,13).

The indications for surgical management in neoplastic spine lesions included; spinal instability due to bony destruction, progressive neurologic deficit secondary to compression of neural structures, intractable pain, and unresponsive to non-surgical treatment, the aim of surgery is to relieve the pain, improve neurological functions and stabilization of the spine and reduction of tumor mass ^(14,15,16). In the studied group all patients matches these indications as clinical and radiological signs of instability, intractable pain, compromised neural canal and neural deficit so the decision was the initial surgical treatment.

Patient's general condition, life expectancy, tumor location, spinal instability, and neural functions were the determinant of the surgical approach. In their series, **Sundaresan *et al.*** ⁽¹⁷⁾ surgically approaching the neoplastic spine lesions depending on the anatomical and radiological location and extent of the lesion by posterior, posterolateral, anterior, or combined approaches. Also, it's reported that there are variations in surgical techniques used for spinal tumors management as, decompression and stabilization, intralesional resection or complete en bloc resection, in association with reconstruction techniques, all these operations can be performed by either the anterior, posterior or combined approach ⁽¹⁸⁾.

In this work we utilizing simple CT guided biopsy and core biopsy with vertebroplasty in unfit

patients, posterior decompressive laminectomy and excision of extradural compressing tumor tissue in cases with the tumor located at posterior vertebral column, posterior decompression with posterior intralesional tumor mass reduction through facetectomy, with posterior transpedicular screws fixation and vertebral body augmentation by bone cement, in tumor extending to posterior and middle column, while tumors restricted to anterior or anterior and middle column, completely excised through anterior or anterolateral approaches with reconstruction.

As regard neurological status pre and post-operative, patients presented with class A or B, ASIA scoring didn't improve while class C and D almost improved to class E, and these findings support the surgical decompression procedures in selected cases, before got to adjuvant radiation /chemotherapy improve quality of life. After three years follow up the overall mortality among patients with primary spine lesions 2.9% of the whole studied group, chordoma and multiple myeloma were the worst died within the first two years. In patients with secondary spine lesions mortality 38% of the whole studied group, of them the worse prognosis was metastatic lung large cell carcinoma, metastatic GIT carcinoma, and metastatic prostatic adenocarcinoma, died within the first year of treatment.

CONCLUSION

Neoplastic spine lesions either primary or metastatic can destruct the vertebral body and lead to extradural invasion.

In selected cases surgical management of patients with spine neoplastic lesions followed by adjuvant therapy is considered to relieve pain, decompress neural structures, stabilization and correction of deformed spine, and local control and also improve quality of life but not the survival.

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