Role of Posterior Fixation Technique in Surgeries for Pathological Fractures of the Dorsal and Lumbar Spine Secondary to Neoplastic Causes

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Abstract

Objective: The aim of this work is to evaluate the outcomes of surgical posterior decompression and fixation of pathological fractures secondary to metastasis in the dorsal and lumbar spine.

Methods: 15 patients having pathological fractures secondary to metastasis in the dorsal and lumbar spine were included in this study and were operated upon using posterior decompression and fixation technique. Operative procedures included tumor debulking, subtotal resection, and gross total resection. Postoperatively, patients were evaluated and followed-up for their neurological integrity, deficits and outcome.

Results: 15 patients were operated upon posterior fixation technique. The median age of presentation in this study was 47 years. There was 8 males (54%) and 7 females (46%). In this study the main presentation of patients with metastatic fractures of the dorsal and lumbar spine was pain in all the 15 patients (100%), motor affection in 10 patients (67%), and sphincteric affection in 10 patients (67%). In this study the distribution of vertebral compression fracture for metastatic spine fractures was from the sixth dorsal vertebrae to the fifth lumbar vertebrae with 58% of the fractures in the dorsal spine and 42% in the lumbar spine. Postoperatively, in this study seven patients (47%) showed pain improvement, two patients (13%) showed motor power improvement and no patients showed any improvement in the sphincteric affection. The complication rate for management of metastatic fractures of the dorsal and lumbar spine was 33% (5 patients) equally distributed between wound infection, implant malposition, pulmonary embolism, DVT.

Conclusion: Our study confirms that posterior decompression and fixation technique is generally safe, effective and well-tolerated by patients.

However, Studies have proven that the functional neurological outcome following surgical posterior decompression and fixation is intimately influenced by several factors including: pre-operative neurological deficits, histopathology of the tumor and extent of surgical resection.

Key Words: Metastasis – Posterior decompression – Posterior fixation – Neurological deficits.

Introduction

METASTASES are by far the most common skeletal tumors seen, and the spine is the most common site of skeletal involvement. Spine metastases are most commonly secondary to carcinomas of breast, lung, prostate, renal, thyroid or gastrointestinal. Multiple myeloma, plasmacytoma and lymphoma are considered metastatic or primary lesions [1].

The location of the lesion within the vertebrae is an important prognostic factor for benign or malignant disease. The majority of malignant tumors both primary and metastatic will originate anteriorly involving the vertebral body and possibly one or both pedicles. Strictly posterior localization even when more than one level involved is far more typical of benign lesions [2].

Surgical posterior decompression and fixation of pathological fractures secondary to metastasis in the dorsal and lumbar spine is a safe and well-established procedure.

Although an anterior approach is optimum for tumor resection and reconstruction, these goals may also be achieved by undertaking a posterior or posterolateral approach. The operation is usually performed with uni- or bilateral facet joint or pedicle resection. This allows for anterior decompressive surgery to be performed, although often not complete, and for instrumentation to be placed posteriorly.

Patients and Methods

This is a prospective study of 15 patients having pathological fractures in the dorsal or lumbar spine secondary to neoplastic causes at Kasr El-Ainy University Hospital from 2011–2012.
The rationale of this work was to evaluate the role of posterior fixation technique in surgeries for pathological fractures of the dorsal and lumbar spine secondary to neoplastic causes.

Patients of all ages and both sex were included in the study.

The study included all patients having pathological fractures in the dorsal or lumbar spine due to neoplastic causes.

Pre-operative patient evaluation:

History:

Personal history included; name, age, sex, occupation, residence, marital status, and special habits of medical importance.

The presenting complaint was the most single distressing complaint to the patient, in addition to other complaints included in the patient's symptoms.

Present history included evaluation and analysis of the patient's symptomatology regarding the onset, course and duration, in addition to analysis of other neurological symptoms in focus.

Neurological symptoms included; symptoms of motor affection, sensory affection or sphincteric disturbance.

Past history included analysis of history of previous surgeries, medications received, previous irradiation and other associated medical disorders such as diabetes and hypertension.

Examination:

Complete general examination including: the patient's vital signs, height, weight, head, neck, chest and abdomen was performed for all patients.

A fully detailed and thorough neurological examination that included sensory examination (superficial and deep sensations), motor examination for the motor power and reflexes examination was performed for all patients.

Investigations:

Radiological investigations the diagnostic modalities that can be used to identify thoracic and lumbar fractures range from simple plain radiography to CT and MR imaging. Each imaging modality has its advantages and drawbacks. The complete evaluation of a patient with a thoracic or lumbar fracture will include a combination of various imaging techniques. It included pre-operative plain X-ray (AP, lateral views) were used as a routine screening for all patients, CT scan (without contrast) and MRI (T 1 W, T2 W and T 1 W with contrast if a neoplastic lesion is suspected). MR imaging is the imaging modality of choice for assessing soft tissues, including the spinal cord and was used as a complementary diagnostic modality for all patients in this study.

Pre-operative management:

Patients, who had evident lower limb weakness rendering them not ambulant, were closely monitored for proper hydration and were given prophylactic dose of short acting anticoagulants (fractionated low molecular-weight Heparin); 40 units/day in average weight patients and 80 units in severely obese patients and those with previous history of deep venous thrombosis. These anticoagulants were stopped 12 hours before surgery.

Patients who had history of, or turned out “on examination or by investigations”, to have medical disorders such diabetes or hypertension, were subjected to proper assessment and were given the proper corresponding medications.

All patients were given 1 gm of a third generation cephalosporin 6 hours before surgery (after performing an intra-dermal sensitivity test) and after induction of anaesthesia.

Operative management:

The surgical procedure and postoperative management were discussed with patient and his relative and the surgeon answered any question the patient had in mind about the operation.

All cases in our study where subjected to general anaesthesia.

Anaesthesia was given to patient while lying supine beside the operating table. During surgery we did not request Hypotensive anaesthesia.

Patients were operated on prone position on special radio-translucent table. The patient was placed on special radio-translucent frame were the injured area was clear for C-arm to take images. The frame makes the patient more stable and abdomen hang free during surgery.

Surgical findings included tumor composition, consistency, extension, adhesion.

The surgical microscope was used in all neoplastic cases to provide proper illumination and magnification, in order to perform proper dissection and haemostasis.
Surgical removal in neoplastic cases was categorized into: Total resection, Subtotal resection, tumor debulking and open biopsy. All tissue specimens obtained during tumor resection were sent for histopathological examination.

And posterior pedicular screws were inserted using the C-arm image.

Post-operative management:

- All patients were kept in an intermediate care unit for the first postoperative 24 hours, then they were transferred to the regular patients’ ward.
- Patients were given 1 gm of third generation cephalosporin intravenously once postoperative unless infection or wound collection was noticed, where in such cases IV antibiotics were continued.
- Patients were also continued on steroids in certain cases in gradual tapering doses.
- All patients were subjected to a complete and detailed postoperative neurological clinical evaluation comprising cranial nerves, motor and sensory functions.
- All patients had a postoperative control X-ray.
- Patients having motor weakness were closely monitored for proper hydration and prophylactic anticoagulants were resumed in addition to physiotherapy.
- Patients were kept in the hospital until they were stable enough for discharge. Before discharge, all patients were referred to the oncology department to adjuvant radio or chemotherapy according to their histopathology results and according to the oncology department protocols.

Follow-up and outcome:

All patients were followed-up at intervals of 1 month, 3 months, 6 months and 1 year whenever possible as ten patients didn’t show at their scheduled follow-up dates.

Results

The study included 8 males (54%) and 4 females (46%). The median age of presentation in this study was 47 years.

In this study the distribution of vertebral compression fracture for metastatic spine fractures was from the sixth dorsal vertebrae to the fifth lumbar vertebrae with 58% of the fractures in the dorsal spine and 42% in the lumbar spine.

In this study the main presentation of patients with metastatic fractures of the dorsal and lumbar spine was pain in all the 15 patients (100%), motor affection in 10 patients (67%), sensory affection in 9 patients (60%) and sphincteric affection in 10 patients (67%).

In this study seven patients (47%) showed pain improvement, two patients (13%) showed motor power improvement and no patients showed any improvement in the sensory or sphincteric affection.

In this study the complication rate for management of metastatic fractures of the dorsal and lumbar spine was 33% (5 patients) equally distributed between wound infection, implant malposition, pulmonary embolism, DVT and severe intraoperative bleeding.

Regarding motor power: Two patients (13%) showed motor power improvement.

Regarding sensory affection: No patients showed sensory improvement.

Regarding pain: Seven patients (47%) showed pain improvement.

Outcome: Seven patients (47%) had excellent outcome, five patients (33%) had good outcome, two patients (13%) had fair outcome and one patient (1%) had a poor outcome.

Regarding sphincteric affection: No patients showed sphincteric improvement.

A male patient 63 years old complaining of low back pain, incontinence of urine and bilateral lower limb weakness. MRI was done which revealed L1 compression fracture operated upon by posterior decompression and stabilization. Postoperatively the patient improved regarding the motor weakness and the back pain. Pathology revealed metastatic hepatocellular carcinoma.

Female patient, 38 years old, complaining of LBP and Lt sciatic pain 5 months ago. Patient with a history of hysterectomy 4 years ago. CT abdomen shows Lt ovarian cyst and a peritoneal mass. The patient has weakness of Lt lower limb G IV. The patient was operated upon by posterior decompression and fixation. Postoperatively pain improved. Pathology revealed metastasis from uterine tumor.

A male patient 55 years old complaining of severe low back pain, with weakness in both lower limbs, retention of urine of 6 month duration. MRI lumbosacral spine was done which revealed a compression fracture in L4 which was managed by posterior decompression and stabilization the patient didn't improve regarding the motor power or the retention with partial improvement regarding the pain. Pathology revealed metastatic bronchogenic carcinoma.
A male patient 50 years old presented by severe low back pain bilateral claudication pains and retention of urine. MRI was done which revealed a compression fracture at L5 body. The patient was operated upon by posterior decompression and stabilization. The pathology was plasmacytoma. The patient improved regarding the pain but retention did not improve.

Fig. (1): MRI showing compression fracture in L1 vertebrae.

Fig. (2): MRI showing compression fracture at L5.

Fig. (3): A post operative X-ray showing decompression and stabilization.

Fig. (4): MRI showing compressed fracture of L4.

Fig. (5): MRI showing compression fracture of L5 body.

Fig. (6): X-ray lateral view showing posterior fixation by 2 rods and 4 screws L4 to the Sacrum.
Discussion

In this study there were 15 patients presenting with metastatic vertebral compression fractures 8 (53%) of them were males and 7 (47%) were females which was close to the results obtained by Frank et al. [3] in which male population was 56% and female were 44%. The results obtained by ALAN T. et al., 2005 in which the male represented 55% of the study and female represented 45% of the study, the results obtained by Peter et al. [4] in which male represented 54% of the study and female represented 46% of the study and also close to the results obtained by Peter et al. [5] in which male represented 60% of the study and female presentation was 40% but was far from the results obtained by Peter et al. [6] in which male presentation was 23% and female presentation was 67%.

In this study the mean age of presentation for metastatic fractures of the dorsal and lumbar spine was 47 years old which was less than all the other results obtained. In the study by Frank et al. [3] the mean age of presentation was 53 years old also in the study by Peter et al. [6] the mean age of presentation was 72 years old, in addition the study done by Alan et al. [7] showed mean age of presentation 52 years old, also the study done by Peter et al. [8] showed mean age of presentation of 58 years and the study by Peter et al. [4] showed mean age of presentation of 58 years.

In this study the distribution of vertebral compression fracture for metastatic spine fractures was from the sixth dorsal vertebrae to the fifth lumbar vertebrae with 58% of the fractures in the dorsal spine and 42% in the lumbar spine which was consistent with the results obtained by Frank et al. [3] in which 66% of fractures was in the dorsal spine and 34% was in the lumbar spine, also consistent with the results obtained by Peter et al. [6] in which 61% of fractures was in the dorsal spine and 39% was in the lumbar spine, and also close to the results obtained by Alan et al. [7] in which 62% of fractures was in the dorsal spine and 38% was in the lumbar spine, and also close to the results obtained by Peter et al. [8] in which 60% of fractures was in the dorsal spine and 40% was in the lumbar spine and was far from the results obtained by Peter et al. [4] in which 72% of fractures was in the dorsal spine and 28% was in the lumbar spine.

In this study the main presentation of patients with metastatic fractures of the dorsal and lumbar spine was pain in all the 15 patients (100%), motor affection in 10 patients (67%), sensory affection in 9 patients (60%) and sphincteric affection in 10 patients (67%) which was different from all the other studies in which pain was the only presentation in all patients [3-7].

In this study 15 patients (100%) were managed by posterior decompression and stabilization. Which was different from the results obtained by Frank et al. [3] in which 60% of the patient underwent anterior decompression and fixation and 40% underwent posterior decompression and fixation. Results obtained by Peter et al. [6] was also different as all patients of this study had combined kypholasty and radiosurgery. In addition the results obtained by Alan et al. [7] were also different in which 52% of the patients had anterior resection and reconstruction and 48% of patients had combined anterior and posterior decompression and reconstruction. Also the results obtained by Peter et al. [8] were different as all his patients had thoracoscopic corpectomy and stabilization. Finally the results obtained by Peter et al. [4] were totally different as all his patients had transpedicular corpectomy followed by kyphoplasty and spinal radiosurgery.

In this study seven patients (47%) showed pain improvement, two patients (13%) showed motor power improvement and no patients showed any improvement in the sensory or sphincteric affection which was worse than the results obtained by all other studies. Frank et al. [3] obtained results showing that pain improved in 95% of patients. Also in the study by Peter et al. [6] results showed improvement in back pain by 92%. In addition to the study by Alan et al. [7] in which results showed 85% improvement in pain. And also results obtained by Peter et al. [8] showed 100% improvement in pain. And finally the results obtained by Peter et al. [4] which showed 100% pain control.

In this study the complication rate for management of metastatic fractures of the dorsal and lumbar spine was 33% (5 patients) equally distributed between wound infection, implant malposition, pulmonary embolism, DVT and severe intraoperative bleeding which was more than any complication rate obtained at any other study. Frank et al. [3] obtained results showing that complication rate was 10% (5% infection, 3% hardware failure and 2% CSF leak). In addition to the study by Alan et al. [6] in which results showed complication rate of 15% (5% infection, 5% CSF leak and 5% DVT). And finally the results obtained by Peter et al. [6], Peter et al. [8] and Peter et al. [4] showed no complications.
Conclusion:

Our study confirms that posterior decompression and fixation technique is generally safe, effective and well-tolerated by patients.

However, studies have proven that the functional neurological outcome following surgical posterior decompression and fixation is intimately influenced by several factors including: pre-operative neurological deficits, histopathology of the tumor, extent of surgical resection.

References