Restoration of Normal Anatomy after Spinal Titanium Cage Fixation of Dorsal Spine in Caries

Muhammad Zeb Tunio, Abdul Malik Shaikh, Kashif Tabani, Faisal Nazir Hussain Sheikh, Irfan Mehboob

ABSTRACT

Objective: To observe the improvement in restoration of normal anatomy after spinal titanium mesh cage fixation in caries of dorsal spine.

Methods: This study was the observational clinical study conducted from 2004 to 2005. Total 30 patients with tuberculosis of dorsal spine with one or two adjacent collapsed vertebrate and Kyphotic angulation >25º were included, Patients were excluded from study below the age of 10 years and above of 70 years, more than three vertebral collapses, severe Osteoporosis with collapse patients unfit for general anesthesia and surgery due to the cardiac and pulmonary failure.

Results: Thirty cases of dorsal caries spine were operated. Deformity of spine was noted in all patients. On lateral X-ray it was recorded in degrees by Cobb method. Preoperative mean angle was 42.30±5.81° P<0.05 range was 24 to 55 degrees. Out of 30 patients, 8 (26.7%) had range of 24° to 35°, 20 patients (66.7%) had the range of 36° to 45° and 2 patients (6.6%) had range of angle from 46 to 55 degrees. Before surgery 42º.30º±5.81 p value <0.05 After Surgery, Immediate after surgery 37.70º±6.25º p value >0.05, 1 month 35.80º±6.43º >0.05, 3 months 33.77º±6.32º p value >0.05, 6 months 31.83º±6.05º p value >0.05**,** 9 months 30.60º±6.01º p value >0.05, 12 months 27.97º±6.11º p value >0.05.

Conclusion: Current recommendation for management of caries spine is operative intervention in progressive paraplegic patients who are not responding to chemotherapy. Therefore current study have followed the above recommendations of early decompression and correction of deformity for caries spine of early onset and achieved desired results. There are many methods available for fusion of spine but the insertion of newly designed titanium mesh cage used in this study with bone graft is one of the most effective methods in correction of deformity.

Key Words: Dorsal Spine caries, Restoration, Normal Anatomy, Titanium cage fixation

INTRODUCTION

Tuberculosis is very common all over the world, though most of patients present between 20 to 40 years of age. Tuberculosis of bones and joint issues are increasing all over the world and there is also a reasonable increase in the incidence of TB spine [1]. Spinal tuberculosis has existed for at least 5000 years. DNA of Mycobacterium was detected in 5400-year-old Predynastic Egyptian skeleton excavated from Northern Egypt showing evidence of mummified remains dating from 3400 B.C, which exhibits a kyphotic deformity, consistent with Pott's disease [2,3]. Incidence of spinal tuberculosis is rapidly increasing in developing countries because of poverty, ignorance and drug resistance and in Europe and America because of HIV infection [4,5,6].

As early as 1779, Sir Percival Pott recommended, "to reduce the discharge" meaning to drain the abscess, and reduce erosion of the bones. The concept of a "Spinal Cage" was developed in 1970s by Orthopaedic surgeon Dr. George Bagby of Spokane, Washington. His first cage was a perforated steel cylinder filled with the horse's own bone. In 1984 a number of clinicians including Steven Kuslich, Gary Michelson, Charles Ray and others developed different versions of Bagby's basic design for clinical application [7]. In humans, the first clinical applications were in the lumbar spine and smaller versions were then developed for use in the cervical spine. Titanium is a very good material, which is inert and MRI compatible. It has some drawbacks, like high radio opacity precludes assessment of bony fusion giving metallic artifacts on MRI and having a rather rigid structure [8].

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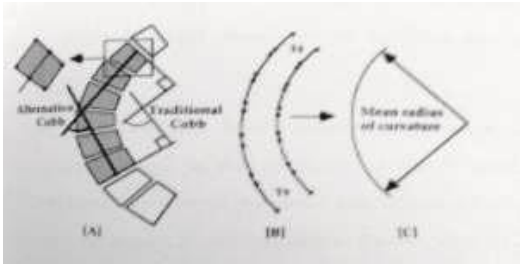
METHODS

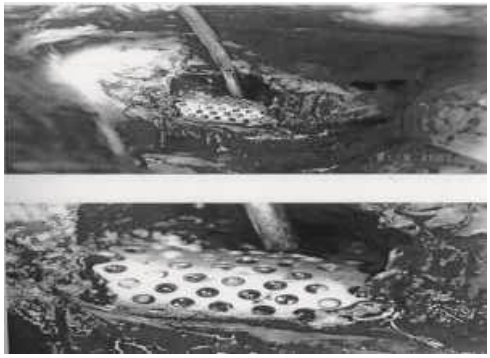
Thirty patients were included, before operation they were fully assessed regarding surgical approach. Fitness for surgery, site of involvement was also assessed and Anti Tuberculous Treatment for three weeks. Initial routine (CBC, ESR, Urea, Creatinine, Blood Sugar (Fasting and random), X-ray Chest, X-ray Dorsal Spine, ECG, Mantoux test) and specific investigations (MRI, which is a non invasive investigation of choice for detection of cord compression) were done. Demographic information (age, sex) and presenting complains were recorded.

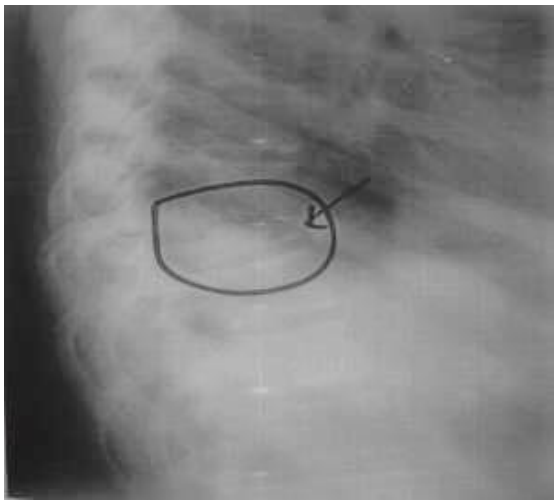
Patients with tuberculosis of dorsal spine with one or two adjacent collapsed vertebrate and Kyphotic angulation >25º were included. Patients were excluded from study below the age of 10 years and above of 70 years, more than three vertebral collapses, severe Osteoporosis with collapse, patients unfit for general anesthesia and surgery due to the cardiac and pulmonary failure.

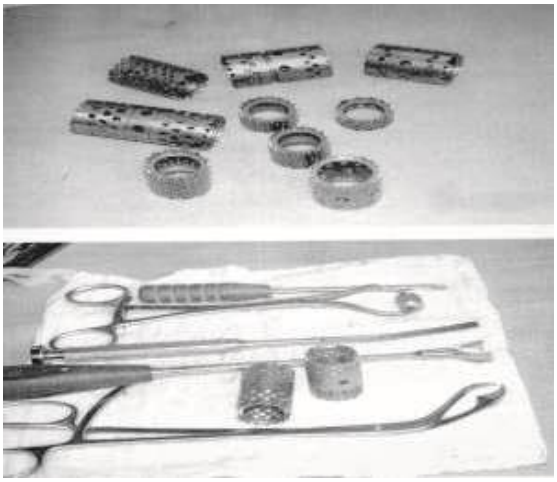
Measurement of Kyphotic angle by Cobb method

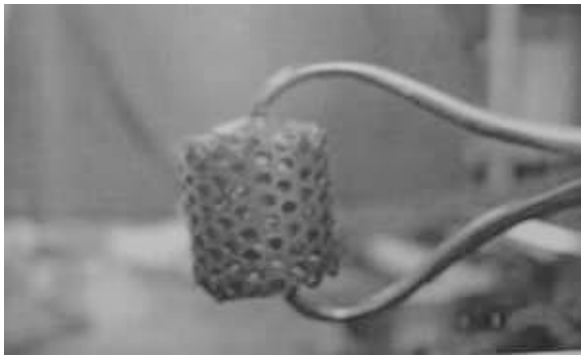
If there are collapsed vertebrate, two lines are drawn, one through the superior surface of the first non-collapsed end vertebra cephalad to the lesion, and one through the non-collapsed end vertebra caudal to the lesion. Perpendicular lines are drawn, from these lines and the angle of deviation is measured at their intersection. The angle is measured in preoperative periods as well as serially at each follows-up visits.

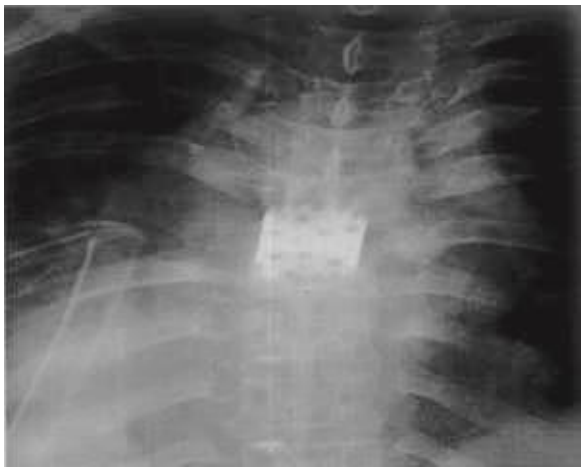


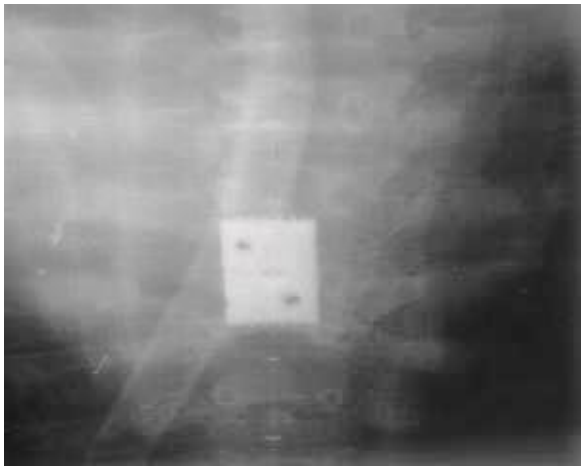












RESULTS

Thirty cases of dorsal caries spine were operated in Orthopaedic Unit, Lahore General Hospital, and Lahore.

Males predominated who were 18 (60%) and 12 (40%) were females. The ratio between male to female was 1.5:1 (Table 1).

Minimum and maximum age of presentation was 15 years and 70 years respectively. The mean age was 32.57±14.9 years. The age of thirteen patients (43.4%) was 36-45 years, age of 9 patients (30%) was 46-55 years, age of4 patients (13.4%) was 26-35 years, age of two patients (6.6%) was 15-25 years and the age of two patients (6.6%) was 56-70 years (Table 2).

In the present study, backache was present in all patients (100%). All patients complained about diffuse pain in thoracic region, mild to moderate in intensity, gradual in onset and were more at night. Swelling was present in 26 patients (86.71%) out of 30. It was mainly localized to the site of infection, was firm, nontender and nonfluctuant.

Deformity of spine was noted in all patients. On lateral X-ray it was recorded in degrees by Cobb method. Preoperative mean angle was 42.30±5.81° ($P<0.05$) range was 24 to 55 degrees. Out of thirty, eight patients (26.7%) had range of 24° to 35°, twenty patients (66.7%) had the range of 36° to 45° and two patients (6.6%) had range of angle from 46 to 55 degrees (Table 2).

Table 2: Distribution of kyphotic angle before surgery (n = 30)

Angle	Frequency	Percentage
24 – 35	8	26.7
36 – 45	20	66.7
46 – 55	2	6.6

Range of angle = 24 – 55

Mean±Standard deviation of angle = 42.30±5.81

All patients (100%) had raised ESR. Mean was 71.63. Less than 20 mm/hour was considered as negative for present study and above 25-mm/1st hour, Westergren took as method increased. Mantoux test was done in all cases. It was positive in twenty-two patients (73.3%). An induration of 10 mm was taken as positive at end of 72 hours. Liver and Renal profile were performed in all patients before and after antituberculous therapy (ATT) after every one month.

PCR and Mycodot tests were not done due to its cost, because majority of patients were from poor families.

X-ray chest posterio/anterior (P/A) view was done in all cases to get any primary foci to exclude the pulmonary tuberculosis. X-ray of dorsal spine anterior posterior and lateral views were done in each before operation suggestive of changes in vertebral bodies, vertebral collapse, kyphosis, and perivertebral abscess around the spine. MRI was performed in all cases, which was suggestive of cord compression collapse of vertebra and abscess in all cases. In present study it was noted that twenty-two patients (73.4%) had one

vertebra involved while eight patients (26.6%) had two vertebrae involvement. Region D5-D6 was involved in five patients (16.7%), D7-D8 in ten patients (33.3%) and D9-D10 region was involved in fifteen patients (50%). All the thirty patients (100%) had cord compression (Table 4).

During the operation material was obtained in all cases for histopathology. It's report revealed, caseating granulomas chronic inflammatory cells and Langhan giant cell. On Zheil-Nelson staining of the separate specimen of mycobacterium bacilli were not demonstrated in any one of the cases.

After operation all patients were strictly monitored for vitals, chest expansion physiotherapy, chest tube drainage, wound care, nutrition with proper dosing of chemotherapy and antibiotics.

X-ray were done for measurements of kyphotic angle, immediately after surgery, it was noted in means 37.70±6.25° (P>0.05). After one month the mean angle was 35.80±6.43° (P>0.05), at three months of surgery mean angle was 33.77±6.32° (P>0.05), six months the mean noted 31.83±6.05° (P>0.05), nine months of follow-up it was reduced to 30.60±6.7° (P>0.05) and at the end of twelve months the mean angle was 27.97±6.11° (P>0.05) (Table 3).

Table 3: Kyphotic angles in mean±SD (n = 30)

Angle	Mean±SD	P value
Before surgery	42.30±5.81	<>0.05
After Surgery		
Immediate after surgery	37.70±6.25	>0.05
1 month	35.80±6.43	<0.05
3 months	33.77±6.32	<0.05
6 months	31.83±6.05	<0.05
9 months	30.60±6.01	<0.05
12 months	27.97±6.11	<0.05

Key: SD = Standard deviation

DISCUSSION

This observational study comprised 30 consecutive patients of caries spine of dorsal vertebrae with cord compression causing neurological deficit, studied over a period of one year. All patients were operated and anterior decompression through anterolateral (transthoracic approach) with titanium mesh cage fixation was done.

Although various approaches to the surgical management of spinal tuberculosis have been described, many patients in whom medical management has failed have been treated by debridement, debridement with or without grafting or internal fixation. Some have found anterolateral drainage of the abscess to be an excellent treatment in the early stages of uncomplicated caries spine. Publications have suggested that if debridement is supplemented with strut grafts and a prolonged course of chemotherapy is given the resultant deformity can be prevented. Graft dislodgement and slippage has been a persistent problem in these cases. Major concern in the treatment of caries spine includes the reduction of bone stock in a diseased bone and unavailability of appropriate device to mechanically support the vertebral column, weakened by caries. Titanium mesh cages were developed to prevent these problems. Titanium cage appears to be aptly suited for application in-patient with severe kyphotic deformity. Current choice of implant is titanium cage with appropriate and proper fixation to the vertebral endplate [9]. Our study is an endeavor to study the usage of titanium mesh cages in cases of spinal tuberculosis.

Dorsal spine has been known to be the most commonly affected site in caries spine throughout the literature. In our study, the most common site of infection was at D9-D10, which is 50% (fifteen out of thirty), while a study conducted at Lahore General Hospital, Lahore during 1999 to 2003 that showed the infection of mid thoracic level that is 66.8% (twenty out of thirty) [4].

Table 4: Magnetic resonance imaging findings

Finding	Frequency	Percentage
Vertebrae involved		
One	22	73.4
Two	8	26.6
Region involved		
D5--D6	5	16.7
D7-D8	10	33.3
D9 – D10	15	50.0
Cord Compression	30	100.0

Key: D = Dorsal (thoracic)

A study conducted at the Peoples Hospital in 2002 in China, out of sixteen patients suffering from caries spine, eleven patients (68.7%) had lesion at T8 to T11, which is similar to our study. [10-11]. Another local study reported, that among the forty-seven patients with caries spine thirty five patients (74.5%) had lesion

at D7 to D12 level. However, Kim 1994 reported most common level as D5 to D7 [12].

In this study collapse of one vertebra was present in twenty-two patients (66.6%) out of thirty while collapse of two adjacent vertebrae was present in eight patients (26.4%).

Tuberculosis usually affects the vertebral bodies and spares the posterior elements. Extensive anterior destruction accounts for kyphosis. In present study mean preoperative kyphotic angle was found 42.30±5.81° while at the end of 12 months after surgery it was 27.97±6.11° (P>0.05). . Moon reported greater mean preoperative kyphotic angle of 37° [13], Sundararaj at Tamal Nadu in India found mean preoperative angle was 26.99° ranged between 10° to 60° [14].

Other procedures like filling the gap with bone graft only or bone graft and anterior plating, bone cement and plating have been used but the anterior approach is used because it is a simple procedure having good results. Mostly the infection begins in the vertebral body. An abscess usually involves the anterior spine and an epidural abscess or sequestrated bone compresses the spinal cord [2]. However, an anterior interbody fusion performed without internal fixation requires long-term bed rest, a body cast or additional posterior surgery. Zhao showed that combined anterior and posterior procedure are lengthy with increased morbidity, weakens the posterior columns and leads to inadequate surgical debridement, when posterior procedure is used. Although graft slippage has been reported despite of good clinical outcomes without firm bony union. Following anterior interbody fusion with strut grafting, there is an agreement over the need of a better spacing strut other than the bone. There is also an increased risk of post-operative complications, such as neurological damage, and injury to the major vessels and adhesions around the dislodged graft. Further studies revealed high rate of graft slippage, with resultant recurrence of kyphotic curve [15].

In present study five-drug combination therapy was selected (Rifampicin, Isonaizid, Ethambutol, PZA, Streptomycin and added with Pyrodoxine). In study at Turkey, drug was used from 6-18 months [16]. The use of fewer drugs than this leads to development of multidrug resistance (MDR).

Parathasarthy gave two drugs chemotherapy (Isoniazid and rifampicin) for 9 months [17].

Griffith reported good results with 6 or 9 months course of rifampicin and isoniazid, after 3 to 4 years follow-up [18].

Radiologically there is little evidence of removal of caseous or sequestrated materials, repair demands the collapse of affected vertebrae allowing contact between healthy bone and even then healing is often by fibrous union. Vertebral collapse of any magnitude in the thoracic region leads to structural changes of the chest wall, which may impair respiratory function. Vertebral collapse may also lead to kyphosis with its attendant problems. Furthermore, despite recent laboratory evidence that chemotherapeutic drugs can permeate caseous and sequestrated tissue, there is clinical evidence that patients treated conservatively with adequate chemotherapy may still suffer reactivation. [19-20-21].

Post-operative improvement in deformity of spine on X-rays of dorsal spine on anterioposterior and lateral views by Cobb method was observed. All patients started showing reduction in ESR within one month of chemotherapy also noted in a study in Turkey. The relatively large grade of correction achieved in that study signifies the very high kyphotic angle cases studied there. The average angle of deformity there was 78.3°[10]. We believe that, in the adult, in order to obtain a stable bony fusion with least collapse, it is necessary to perform a radical clearance preserving all apparently normal tissues. To obtain incorporation of the cage and fusion between the vertebral bodies, the disc or its remnants should be removed whenever the graft crosses a disc space. A graft should only be regarded as incorporated when there is radiological evidence of trabecular continuity with the host. In doubtful cases this can be demonstrated by lateral tomography. Cross trabeculations between the auto-graft and the vertebral body was noted at six months, with remodeling capability to take place in 30 months period [22]. However healing of bone graft was not recognized in early postoperative period, no new bone was seen, followed by callus formation between graft and vertebrae but no bridging trabeculae at three months, continuity of trabeculae was noted around the cage and vertebrae at six months in our study. Though fusion rate of cages has been observed as excellent. Liljenqvist 2003 [23] also proved a 100% fusion rate by fixation of titanium cages for the treatment of vertebral osteomyelitis. Thongtrangan 2003 [24] observed 100% fusion rate for those patients in whom

cages were applied after tumor resection. In another study overall fusion rate was 92%162 whereas similar fusion rates of 93.3% have been reported in another study [25].

In present study, there was no immediate major postoperative complication but delayed complication like superficial wound infection was noted in two patients after seven days. Pus was sent for culture and sensitivity, it was managed by antibiotics and daily dressing of the wound. One patient developed bilateral bronchopneumonea postoperatively after three days but responded favourably to the intravenous antibiotics and chest physiotherapy. However complications like haemothorax, pneumothorax, empymea, haemorrhage, deep vein thrombosis, dislodgement of cage and iatrogenic complications that frequently reported in the literature were not noted. There was no need for revision surgery and did not face any of the above complications with the procedure due to good technical expertise. No patient was given hyperextension brace due to stable fixation, no patient expired and none was lost during follow-up.

In developing countries such as ours' the resources for appropriate diagnostic and operative facilities are not available everywhere. Most patients present to the doctor late in the course of the illness with those few who do present early, rarely keep to the advice given. Furthermore, the availability of instrumental spinal surgery is limited.

Titanium mesh cage augmentation is well-established procedure for the surgical treatment of caries spine. Clinical improvement was seen in all patients in this study who underwent surgery. In the developing world, we should not be deterred by the duration of paraplegia and should offer such patients at least anterior decompression and titanium cage fixation with chemotherapy.

CONCLUSION

Current recommendation for management of caries spine is operative intervention in progressive paraplegic patients who are not responding to chemotherapy. We at Lahore General Hospital, Lahore have followed the above recommendations of early decompression and correction of deformity for caries spine of early onset and achieved desired results.

The study at conclusion points to the following observations:

- It is a good measure to correct, prevent and stop progression of a kyphotic spine in cases of caries spine where anterior stability is lost.
- Titanium cage fixation is a better procedure when compared to strut grafting.

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