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Research Article

Evaluation of implant stabilization in tubercular Spondylodiscitis: a prospective study

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ABSTRACT

Background: Stabilization in tubercular spine is very often employed for various indications. Many papers have detailed the management strategies and outcome in the management of spinal tuberculosis. There are not many papers detailing the complications that followed stabilization in tubercular spine, which are very essential in the development of safe surgical procedures and avoiding complications. In the present study 50 patients who were stabilized for tubercular spine were followed up for a period of 2 years. Various complications encountered during this period were detailed with a possible mechanism for the same and a strategy to address such a complication.
Methods: 50 consecutively available patients who underwent a standard stabilization procedure for spinal tuberculosis and were available for follow-up for a period of 2 years were subjects of the study. All the complications encountered in these patients during the follow-up period were noted and were managed.
Results: Mechanical failure of the implant was the most commonly encountered complication. Neurological complications included progressive neurologic deterioration, hoarseness of voice, cauda equina syndrome, foot drop. Persistent worsening of pain, DVT and pressure ulcers were the complications encountered that are not specific to a region of spine.
Conclusions: Stabilization is not without complications in tubercular spine. But with strict adherence to guidelines the complications can be minimal and are not dismal.

Keywords: Tubercular spine, Implant stabilization, Complications of stabilization

INTRODUCTION

Tuberculosis is as old as mankind. Neolithic skeleton found in Arene Candide cave (Liguria, Italy) represent one of the earliest cases of this disease localized to the lower thoracic and upper lumbar vertebrae.[1] Skeletal TB accounts for 1- 3 percent of the tuberculosis and 50% of skeletal TB is confined to the spine. The dorsal spine is most commonly involved accounting for 42% of the spinal TB cases followed by lumbar spine in 26% of the cases. 98% of the spinal tuberculosis involves the vertebral body.[4] Though primary vertebral TB has been rarely reported in children mostly it is a secondary infection from Lung or Genitourinary primary site spreading by hematogenous route.

The treatment objective in spinal tuberculosis is to avoid the neural complications and to correct or to prevent the progression of deformity and achieve a stable healing of the diseased segment. Though surgery is not considered

the appropriate first choice of treatment in most of the spinal TB cases[2] there are definite indications for surgical correction and stabilization. Stabilization is not indicated in all cases of spinal. The indications for stabilization in TB spine are the presence of long segment disease which can cause instability following debridement, gross deformity (Kyphotic angles of ≥ 500 to 600), progressively increasing deformity, Instability at the level of involvement, Chronic pain following medical management that is related to deformity, and sometimes to prevent or treat complications like late-onset paraplegia and tetraplegia.

Various techniques that are currently employed for stabilization in TB spine are Posterior stabilization with transpedicular screws and rods with posterolateral fusion, Anterolateral stabilization with plate and screws or by Screws and rods and anterior stabilization with plate and screws following decompression and fusion with autograft.

Theoretically, the use of a metal implant at an infected site is controversial. However Oga et al. showed that no persistent or recurrent infection follows posterior stabilization in Spinal TB.[3] The adherence and colonization of Mycobacterium on metal implant is meagre and forms a scanty biofilm on the implant whereas Staphylococcus colonizes heavily and form a thick biofilm.[3] And hence the use of metal implant in the presence of tubercular infection is relatively safe.

Following surgery majority of the patients who are compliant with ATT medication will have a favorable outcome though the complications are not infrequent. The various complications that can be expected following the radical surgery consisting of resection of the spinal focus and bone grafting followed by stabilization for spinal TB are region dependent. In the present study we followed up 50 post-operative cases of tuberculosis spine which were managed by stabilization for a period of 2 years from the time of first review at 30 days. We have reviewed the various complications encountered during this period and evaluated the prognosis following stabilization in spinal tuberculosis.

METHODS

This is a prospective study. The subjects in the study were those patients who were operated by us for an established radiological diagnosis of Tubercular spine extending anywhere from C1 to S5 level between 2010 and 2012. Those patients who had an established radiological diagnosis of tubercular spine and having an indication for stabilization were operated by an appropriate approach. All were operated by one of the 3 standard approaches, the anterior, anterolateral or the posterior approaches. The aim of surgery was radical excision of the diseased segment, followed by autograft fusion and stabilization with either Plate and screws or Screws and Rods depending on the type of approach. The radiological diagnosis was confirmed by histopathology postoperatively. Post operatively all the patients were started with an ATT regimen consisting of thrice weekly, body weight adjusted dosages of HRZE (INH, Rifampicin, Pyrazinamide and Ethambutol) for 2 months and followed by thrice weekly, body weight adjusted dosages of HR (INH and Rifampicin) for 7 months.

Postoperatively all those patients who were available for follow-up at 30 days, during their first post-operative visit, were followed up at regular intervals for a period of 2 years. All were asked to review regularly at one month intervals and were also asked to report immediately if any untoward symptoms emerge during this period. Routine AP and Lateral view X rays of the stabilized region were taken at 3, 6, 12, 18 and 24th post-operative months to see the status of the construct. During their visits all the complications identified were noted down and the patients were managed accordingly.

Those patients who were lost to follow up and/or not cooperative were eliminated from the study.

Figure 1: Type I asterion (Presence of sutural bones).

RESULTS

50 cases were followed up to the target period of 2 years. All the complications observed during this follow-up period were noted and tabulated as below (Table 1). Of the 50 subjects 21 were males and 29 were females. In these 7 were below the age of 18 years. The youngest of the group was 9 years old and the oldest was 69 years old. The mean age was 34.56 years (Table 2). Of these 50 followed up cases 61 surgeries were performed which included 11 redo surgeries.

The regional distribution of the primary surgical procedures were 17 cervical, 1 cervicodorsal, 18 dorsal, 4 dorsolumbar and 10 Lumbar surgeries. In the remaining 11 redo surgeries 2 were cervical and 1 was done in the lumbar region and 8 in the dorsal region.

All the cases were managed primarily by one of the 3 approaches namely the anterior, the anterolateral or the posterior approach. 17 cases were operated by anterior approach, 2 cases were operated by Anterolateral approach, and 31 cases were operated by posterior approach. All the 11 redo surgeries were approached posteriorly (Table 3).

All the primary surgeries done in the cervical spine were approached anteriorly. A D1/D2 level disease was approached posteriorly by Pedicle screws stabilization to C7 and D3 and posterolateral fusion. Of the 18 dorsal spine surgeries 2 cases at D7/D8 and D6/D7 levels were approached anterolaterally. Both of these were decompressed by extrapleural anterolateral approach and fused with rib graft. D7/D8 level was stabilized with screws and rods while D6/D7 with Plate and screws. The

remaining 16 dorsal lesions were decompressed posteriorly and fused with autograft harvested either from fibula or posterior iliac spine and stabilized with Pedicle screws and rods. All the surgeries performed in the Dorsolumbar and lumbar spine were approached posteriorly with decompression and posterolateral fusion with autograft and stabilization with pedicle screws and rods.

Table 1: Record of complications.

Complication	Number of Patients
CERVICAL SPINE	
Progressive Neurologic deterioration	2
Persistent Dysphagia	1
Persistent Discharging Sinus	1
Fractured Strut graft and sinking of the graft	1
Fusion failure	1
Persistent Hoarseness of voice	1
CERVICODORSAL/DORSAL SPINE	
Progressed deformity	3
Progressed paraparesis	1
Paraplegia	1
Cauda Equina Syndrome	1
Mechanical failure of the Implants	
1. Dislodged inner tightening screw and dislodged rod	1
2. Loosening of the rod and slipping down	1
3. Extruded Screws and Rods	2
4. Subcutaneous metal prominence and painful adventitious bursitis	3
Dorsolumbar and Dorsal Spine	
Permanent right sided foot drop	1
Screw loosening and slipping out of the pedicle	1
Screw fracture	1
Complications not specific to region	
Persistent worsening of pain	4
Progressive increase in the size of the lesion	1
Appearance of the fresh lesion	3
Surgical site infection	2
Donor site infection	2
Deep venous thrombosis	3
Pressure sores	6

Table 2: Age range.

Age Range	Number	Individual Ages (in years)
1-10	02	9,10
11-20	06	12, 16, 18, 19, 12, 14
21-30	10	23, 25, 27, 29, 30, 26, 24, 28, 30, 22,
31-40	11	31, 33, 34, 36, 40, 39, 38, 32, 31, 33, 39
41-50	13	41, 41, 44, 47, 45, 49, 50, 44, 42, 42, 43, 41, 46
51-60	05	58, 54, 52, 50, 51
61-70	03	61, 69, 64

In the 2 redo surgeries performed in the cervical spine one case was operated for a persistent discharging sinus at 6 months. She was operated for spondylodiscitis involving C4/5 disc and collapse of C4 body. She also had post burn contractures involving the neck region. Pus culture had grown staph aureus. At redo surgery the infected cervical plate was removed and posterior stabilization was done with lateral mass screws to C3, C4 and C5. Another case was operated for a Fusion failure presented with gradually increasing pain and deformity. He was operated initially for involvement of C5/6 vertebra with C5 corpectomy and fusion stabilization.

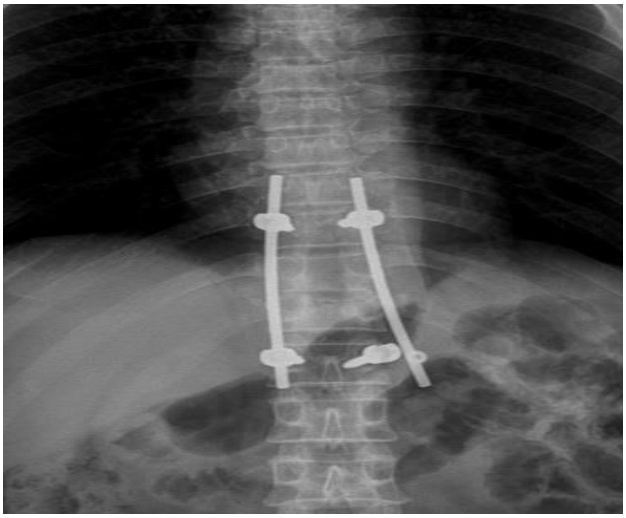

Figure 1: X-ray DL Spine AP view showing the dislodged inner tightening screw and laterally displaced rod on the left side.

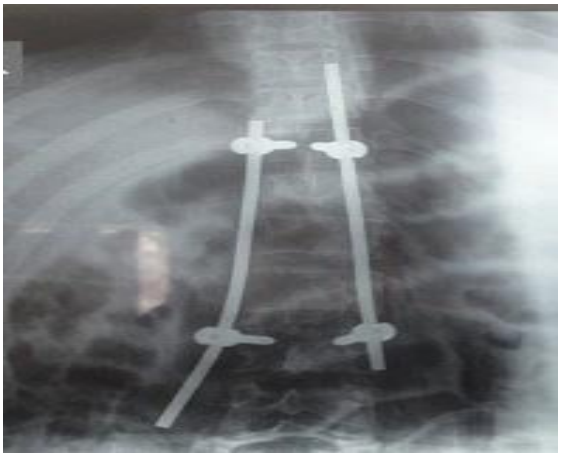

Figure 2: X ray dorsolumbar spine AP view showing slipped down rod secondary to loosening of the inner tightening screw on the right side.

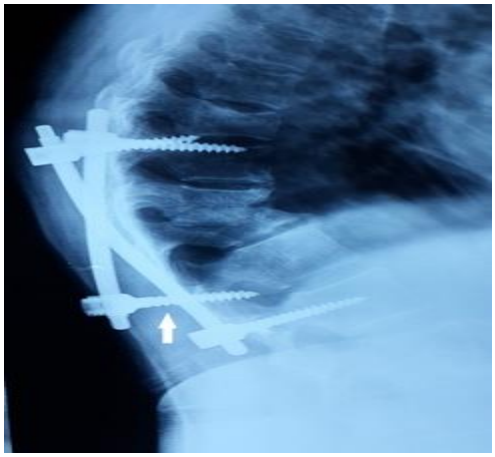

Figure 3: X day dorsolumbar spine lateral view showing progressed Kyphotic deformity with pulled out screw from the pedicle (white arrow).

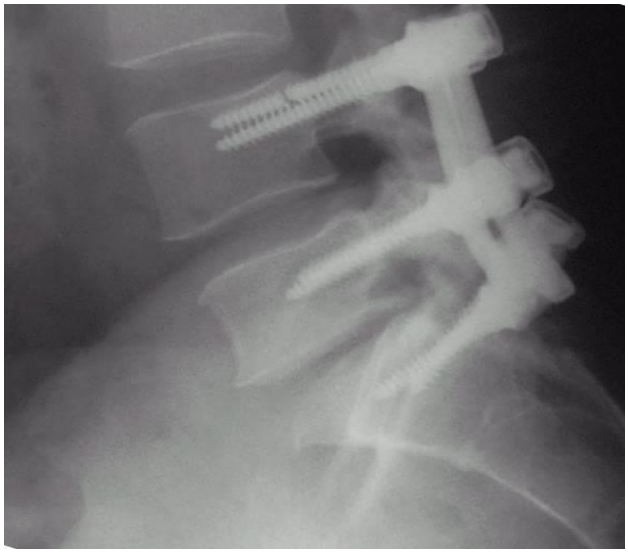

Figure 4: X ray LS spine lateral view showing fractured screw at the L4 vertebral level. At surgery the screw in the S1 on the right side was found pulled out.

Figure 5: Photograph showing the surgical site infection in a patient operated in the dorsal spine region.

At redo surgery he was stabilized with lateral mass screws to C4, C5 and C6 vertebra. In the dorsal spine 2 cases were operated for progressively increasing deformity. These were operated at 12 and14 months follow-up at D10 and D8 levels respectively. Both were approached posteriorly with an attempted correction of the deformity and strengthening of the construct by placement of extra screws a level above and below the initial stabilization.

The mechanical failure of the implant was encountered in 7 cases operated in the dorsal region and 1 case operated in the lumbar region. Of these, a case of loosening of the inner tightening screw was operated at 3rd month follow up. A redo surgery was done and the loosened inner screw was replaced with a new inner tightening screw. Another redo surgery was performed for a loosening and

slipping down of the rod was done at 6 months follow up. A redo surgery was performed and the loosened rod was replaced with a new rod. 2 cases of extruded screws and rods were identified at 14 and 18 month interval. In both the cases the extruded rods and screws were removed. In one of the case 2 new screws were placed at a level above the level of removal of the screws and stabilization was done. In the second case identified at 18 months interval the screws and rods were removed and as the lesion was healed radiologically and as the fusion was stable no further stabilization was employed. 3 patients developed painful adventitious bursitis following subcutaneous metal prominence during the second year. In these 2 patients underwent redo surgery for repositioning of the rods and one was managed conservatively.

Table 3: Regional distribution of surgeries based on approaches.

	Primary Surgeries	Redo surgeries		
	Anterior	Anterolateral	Posterior	Posterior
Cervical	17	X	X	2
Cervicodorsal	X	X	1	X
Dorsal	X	2	16	8
Dorsolumbar	X	X	4	X
lumbar	X	X	10	1

One patient who was operated for severe low back pain and L5/S1 tubercular discitis with L4 to S1 pedicle screws developed a fracture of the screw in the L4 pedicle on the right side and a pulled out screw from the right S1 pedicle. He presented with increasing pain at 10 months. He underwent redo surgery where in the fractured and the pulled out screws were removed and redo stabilization was done with rescue screws (6x45 mm, Poly axial screws)

In the cervical region we encountered 2 cases of neurological deterioration. In one case there was deterioration of power from grade 3/5 to 1/5 in both the upper limbs and in another case from grade 3/5 to total quadriplegia even though the postoperative evaluations showed good fusion and stable constructs in both the cases. In these cases the progression would have been due to the chronicity of the disease and the irreversible cord changes that progressed even after adequate decompression and stabilization. We encountered a case of esophageal injury while operating at C4 level, which was repaired primarily. This patient had persistent dysphagia even though had a good neurological improvement. He was evaluated with upper GI endoscopy and was found to be normal. In another patient where in fusion was done with a fibular graft following 2 level corpectomy there was a fracture and sinking of the graft even though the construct was good. He didn't have any complaints. So he was managed conservatively with close observation. One patient who was operated for a C5 level disease developed hoarseness of the voice postoperatively which persisted.

2 patients operated for dorsal disease at D5/D6 and D6, 7 and D8 disease had progressive neurologic deterioration. One progressed to paraplegia and another to grade 1/5 power. This could possibly be due to vascular compromise either due to disease perse or following stabilization. A patient who underwent D12 laminectomy and pedicle screw stabilization to D10 and L1, L2 levels for a D12 level disease developed cauda equina syndrome. One patient who was operated for L4/L5 disease developed right sided foot drop in the post-operative period. Her foot drop was persisting at 2 year follow-up, even though her tubercular lesion healed and the construct was stable.

There were 4 cases of progressive worsening of pain inspite of good fusion and a stable construct. Of these 3 were adults and 1 was a 14 year child. All these were managed by decreasing physical activity and increasing dosages of analgesics. In one patient there was progression of the lesion inspite of being compliant with ATT medication. He was reevaluated and managed by initiation of second line of ATT medication (Considered MDR TB). In 3 patients there was appearance of fresh lesions elsewhere in the spine. Of these 3 patients one had patient stopped ATT after 3 months and he was restarted with medication at 6 months. Other 2 were considered as MDR resistant and started with second line ATT. There were 2 cases of superficial surgical site infection and another 2 cases of donor graft site infection which subsided with a course of antibiotic. There were also 3 cases of Deep vein thrombosis. Of the 3 one was bilateral. All were managed with subcutaneous LMH heparin in the acute phase and with oral warfarin subsequently. 6 of the series developed pressure ulcers at the bony prominences. All these cases were managed with the guidance of a plastic surgeon.

DISCUSSION

Spinal tuberculosis is a medical disease[5] where surgery is not the primary modality of treatment. Though not indicated in all the cases of spinal TB, instrumentation play a significant role in improving the overall prognosis

of this crippling disease. So instrument stabilization is widely practiced and is relatively safe. There is varied number of complications associated with any surgical procedure. Likewise complications are not infrequent in tubercular spine following stabilization as the procedures are uniquely complex. But the chance of complications is usually small. There is a large body of literature available on TB spine, various methods of management and various stabilization procedures performed in TB spine and their outcome.[6,7] However there are very few published papers detailing the complications associated with stabilization in tubercular spine. Understanding the complications associated with a procedure is very important in the evolution of the technique and making the procedure safe to the patient. In the present study we reviewed various complications encountered with stabilization in tubercular spine in a series of 50 patients.

The number of complications encountered in the dorsal region stabilization outnumbered the other regions. Progressed neurologic deterioration was the most common complication in the stabilizations performed in the cervical region (n=2). This could probably be related to the chronicity of the disease and involvement of the cervical cord as there were no problems seen with the fusion or construct in the follow-up period. Some of the complications encountered in our study could have been prevented with a better planning and a possible better technique. Persistent discharging sinus was seen in a patient who was operated through a post burn scar. During one cervical surgery there was an accidental esophageal injury. This happened while debriding the fibrous and the granulation tissue, as there were dense adhesions between the esophagus and the cervical spine. Though the injury was immediately identified and repaired dysphagia persisted. The patient who persisted with hoarseness of voice could have had an unidentified recurrent laryngeal nerve injury. The fracture associated with the strut graft is supposed to be due to the long size of the graft which was placed following a 2 level corpectomy.

In tubercular spine the kyphosis continues to progress even after surgical decompression.[8] All the 3 cases which had progression of deformity in the form of increasing kyphosis in the dorsal region were in the pediatric age group. Of these 2 underwent redo surgery with attempted correction of the deformity. In the other the deformity was not significant enough to consider for a redo surgery. The neurological deterioration encountered with dorsal stabilizations could have been due to vascular compromise, as the cord is more prone for ischemic changes in the watershed zones of the cord. Mechanical complications were more frequently encountered in dorsal spine stabilization (n=7). All but for one case of subcutaneous metal prominence needed redo surgical correction. In the lumbar spine there was a case of right sided foot drop following surgical debridement and fusion stabilization. This was due to radicular injury involving the right L5 root. There was another case of mechanical failure of implant which needed surgical correction in the lumbar spine.

We have encountered 4 cases of worsening pain following stabilization which included a pediatric age group patient. All were managed conservatively with analgesics and reduced physical activity. All these patients had good fusion and a stable construct. We suspected arachnoiditis and secondary scar formation following surgery to be the cause for this persistent pain. Fibrosis secondary to arachnoiditis is one of the important causes of radicular pain.[9] However other causes like missed piece of granulation tissue compressing the nerve root, mechanical trauma to the roots during surgery, and surgery done on an already damaged nerve root could not be ruled out. 3 patients were considered as MDR tuberculosis. Although the incidence of MDR TB is not very high[10] the suspicion of MDR TB is of paramount importance in refractory cases of spinal TB. All these patients got stabilized following starting of second line of ATT drugs. 6 patients developed pressure ulcers at bony prominences. All these patients had limb powers less than grade 3/5 and were not mobilized adequately following surgery. All these showed good response to treatment under the guidance of a plastic surgeon. 3 out of these 6 patients developed DVT of the lower limbs. One among them had bilateral DVT. All these were managed initially with subcutaneous LMW heparin and later with oral warfarin. Those with unilateral disease showed good response and was weaned off warfarin after 9 months of therapy. One with bilateral disease still continues to be on oral warfarin after 14 months of therapy. Surgical site infection was encountered in 4 sites which were managed medically with antibiotic based on culture and sensitivity.

CONCLUSION

Stabilization has an important role in management of TB spine. But the indications are specific. With strict adherence to the accepted treatment guidelines, appropriate patient selection, stringent surgical procedure and post-operative care followed by strict compliance to ATT medication the complications following stabilization in tubercular spine are not fearful.

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