

The changing trends in management of spinal tuberculosis: Are we hitting a better road?

A staggering one-third of the world's population is likely to be infected with tuberculosis (TB).^[1-4] According to current World Health Organization estimates, TB kills 1.68 million people a year, world-wide.^[2] With an increasing number of immune compromised patients related to human immunodeficiency virus, there may be a world-wide resurgence of TB. Of all the patients suffering from TB, nearly 5% has involvement of the skeletal system. Vertebral TB constitutes about 50% of all cases of skeletal TB.^[3,5-10] This number is not small as this translates into roughly 80,000 patients being affected by spinal TB, roughly 60% of which may be present in India!

With contemporary imaging techniques such as magnetic resonance imaging, spinal TB is being diagnosed much earlier^[4,10,11] and patients may be treated with drugs effectively before they develop neurological deficits, the most crippling complication of spinal TB. Unfortunately, still a significant number of patients present late after disease onset with severe neurological dysfunction^[4] and spinal deformity especially in a developing country like India. These patients are more likely to become candidates for surgery.

TB is probably as old as the human civilization.^[12] In 1779, Percival Pott published the first modern description of spinal deformity and paraplegia resulting from spinal TB.^[13,14] Unlike historical times, effective management of spinal TB is now possible. The treatment of this disease has undergone a sea change since the advent of effective anti-TB drugs in the latter half of the 20th century.^[12,15] Although medical treatment is the mainstay of therapy, surgery is required in certain situations. In addition, with an increase in sophistication of the instrumentation, indications of surgery have gained a wider spectrum of usage, not just to correct or prevent neurological deficits, but also to correct deformities.^[10,16-23]

To analyze the pattern of the clinical spectrum over a period of time, we divided our series into 2 sub-cohorts (Group I, <2004; Group II, >2004).^[24] There were no differences between patterns of clinical presentations except for paraplegia, which was more common after 2004. It would be difficult to analyze the reason for this, in view of presence of multiple variables, many of them beyond the scope of this study. However it is possible that while a majority of the patients are optimally treated with anti-tubercular chemotherapy, a small proportion of patients who develop resistant TB may develop progressive symptomatology and may thus present with severe precipitous symptoms. This is also supported in our study, where about 92% of patients were already started on anti-tubercular chemotherapy and one-fifth of our patients were receiving second line therapy. This data perhaps represents the tip of the iceberg, where indiscriminate use of drugs may result in resistance that in turn may lead to the development of severe precipitous clinical features.

Comparing the two groups before and after 2004, it was seen that the incidence of severe vertebral body collapse was more after 2004 ($P < 0.001$). So was the incidence of cord compression ($P < 0.01$). Again, this finding is surprising, as one would expect a reduction of severity of clinical features over a period of time, especially with good National community programs in place it is once again likely that increasing drug resistance may contribute toward development of more severe pathology, at least in a smaller sub set of patients. This is strengthened by the fact that about 1/5th of our patients received second line chemotherapy prior to admission and 94% of them presented to us after 2004. This fact is disturbing as our center being the referral center represents the tip of the iceberg of the existing problem in the community. Thus drug resistance may result in early failure of medical therapy and may present in more serious forms much early in the course of the disease. However, we do agree that we do not have the drug sensitive cultures of these patients to corroborate these findings.

The management of spinal TB is a continuing matter of debate. The controversy was sparked in 1960 when Hodgson *et al.*^[25] advocated surgical intervention and Konstam and Blesovsky^[16] advocated conservative treatment. This led to randomized clinical trials, conducted by the British Medical Research Council in

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1970's.^[17-23] They concluded that the best results were seen in the group in which radical operation was done, as they had more rapid abscess resolution, as well as earlier and more frequent bony fusion.^[17-23,26,27] In a multivariate analysis of TB spine by Park *et al.*,^[10] it was found that patients who underwent radical operation had a better outcome in terms of their clinical scores (myelopathy, pain and deformity).

The above studies swung the balance in favor of early surgical intervention in carefully selected patients, instead of considering this disease solely as a medical condition. Cochrane review of randomized control trials^[28] added new fuel to the controversy, when they concluded that there was no significant benefit from routine addition of surgery to the chemotherapy. Nene and Bhojraj^[29] showed in their study that 98% in their series could be treated conservatively. Tuli^[30-32] advocated a "middle path" regimen, which included a less radical surgery along with chemotherapy. Although these strategies work in a majority of cases, a more radical surgery (especially complex instrumented fusions) should not be denied in patients where it is indicated. In addition, unlike pyogenic abscesses, the incidence of implant related infections are very low.

Surgical intervention evacuates the pus, debris and sequestera of disc/bone, thereby removing the compression over the cord. It also breaks barriers and opens up new vascular channels thereby reducing the total healing time of the lesion.

Our study presents a greater bias toward surgery^[24] due to the following reasons (1) Better quality of instrumented fusion allows the patient to have early mobilization (2) Early surgery allows early drainage of the infected material and a better penetration and efficacy of drugs (3) Higher experience of surgeons involved provides lower risk of complications and a better clinical outcome. We do agree that most of these findings are observational and not based on an evidence-based comparison with series where surgery was resorted as a last measure. However, it is worth to be mentioned that the last major series as reported by Tuli *et al.*^[30-32] based most of their paradigms of management on providing conservative treatment as during this time most of the spine instrumentation (at least in this part of the world) was of sub-optimal quality (stainless steel based more on wiring techniques) rather than as of today, where excellent instrumented fusion techniques are available for more anterior and posterior elements of the spine. In addition, there are many more trained spine surgeons as of today providing a better safety margin for surgery. Thus, this series reflect the treatment paradigms offered

in the present scenario where a more radical surgery is offered quite early in the course of the disease allowing a faster clinical improvement, earlier immobilization and a better correction of deformity as opposed to conservative treatment. This is reflected in our series, where about 1/5th of our patients offered conservative treatment had similar clinical outcome as those offered surgery, but the deformity increased by about 17°.

Hence these series provide an insight for the role of complex surgical management in TB spine. Our series show that a greater proportion of instrumented surgeries were performed after 2004 (67% vs. 33%) when compared to before that. Similarly 80% ($n = 20$) of all circumferential fusions were performed after 2004. It may be partly related to the fact that the incidence of cord compression and severe vertebral body collapse were higher after 2004. However, it is also possible that better instrumentation techniques were also available after 2004, allowing the surgeon to perform more complex surgeries like circumferential fusions. Therefore, we suggest that rigid principles should not be followed in the management of spinal TB and that treatment should be tailored for the individual patient. At the same time, offering surgery early in the course of the disease provides a benefit of early immobilization and better correction of the deformity.

Spinal TB primarily affects the anterior structures and the best manner to approach this would be through an extended postero-lateral approach, which allows not only adequate removal of abscess and destroyed tissues but allows access to the vertebral body for performing circumferential instrumented fusion. From this approach, one can drain the abscess, excise all the avascular material and decompress the spinal cord more safely. In addition, contamination of thoracic or abdominal viscera may be prevented which could be a potential problem if this route is undertaken. Correction, or at least stabilization of kyphosis, is another advantage of this approach.^[33-38] Current literature seems to echo the fact that this approach is a safe and effective method in the management of TB of spine.^[33-38]

In the present series, patients operated by extended postero-lateral (to the vertebral body) and posterior approaches had similar results in terms of neurological outcome (89% in posterior approach as compared to 91% in anterior approach). The kyphotic angle did not increase and the correction was maintained until the last follow-up. Among patients treated conservatively or by posterior approaches, there was an increase in kyphotic angle (average: 17°) but none was greater than 50° at final follow-up. No patient was symptomatic for the

spinal deformity and therefore, none required correction of deformity. Similar results were documented by Rezaei *et al.*^[15] who reported an average decrease of 7° of kyphosis and no increase in angulation in any patient at the time of follow-up in the group of patients who underwent radical debridement.

In our series, 59 out of 69 patients (85.5%) with thoracic and thoraco-lumbar involvement improved neurologically, while 47 out of 48 patients (98%) with cranio-vertebral, cervical and lumbo-sacral TB showed neurological improvement. These findings are similar to those already reported. Tuli^[30-32] noted good neurological outcome in patients with paraparesis undergoing surgery in 76% of patients having spinal TB with thoracic compression when compared with 83% at other levels. Moon *et al.*^[36,39] observed a higher incidence of paraplegia in patients with spinal TB affecting the thoracic spine and noted a recovery rate of 86% when compared to 91% in those with lesions at other levels. The narrower thoracic spinal canal when compared with the rest of the cord could be a possible explanation for the above-mentioned finding.

In our series, out of 39 patients who presented with long duration of paraplegia (>1 month), 32 (82.1%) improved with surgical treatment. This is consistent with the observation made by Sai Kiran *et al.*,^[4] who reported remarkable improvement in all five patients with paraplegia of >2 months duration, with motor function improving to Frankel Grade D/E. Similar findings were reported by Moula *et al.*^[40] Therefore, we strongly recommend that late presentation with paraplegia should not preclude surgery.

Our series allowed us to propose a management paradigm. Based on Tuli's criteria, we proposed 2 categories of patients to be considered for surgery [Table 1]. These include (1) Significant category (patients with potential deterioration) and (2) Severe category (patients with impending deterioration). We feel that these criteria may be easier to follow when compared to those proposed earlier from a practical point of view. Based on our experience, we proposed that all patients with severe category may undergo surgery irrespective of the clinical grade. However, patients with significant category may undergo surgery only if they have a poor clinical grade (Frankel A/B). Patients with significant category with a good clinical grade (Frankel C/D/E) may be first given a trial of medical therapy only. It is also important to note that patient management should be individualized, as even after using these guidelines, about 12% (23) patients initially treated with medical therapy ultimately required surgery. We do agree that in these proposed guidelines

Table 1: A new practical guideline for indications of surgery in tuberculosis with a suggested flow chart given below

Significant category (patient with potential deterioration): Consider one or more features

Consider surgery if

There is deterioration or non-response to medical therapy

All patients with poor clinical grade (A/B)

Patient's request

Vertebral body collapse

Cord compression

Deformity

Para-spinal abscess with spinal epidural extension

Severe category (patients with impending deterioration): Consider one or more features

Consider surgery in all cases

Cord compression more than 50%

Spinal column instability (severe deformity>40°, pan column involvement and/or destruction)

"Large" para-spinal abscess with spinal epidural extension

Severe incapacitating pain

for surgery, there are certain shortcomings and some subjective parameters have been left to the discretion of the treating surgeon. For example, if a patient has a paravertebral abscess with spinal epidural extension, the patient may be categorized under significant category. If the patient has a 'large' paravertebral abscess with spinal epidural extension, we have included this under severe category as the presence of this may have an imminent risk of deterioration, hence should be tackled with surgery as soon as possible. However the definition of large is left to the discretion of the surgeon, as even after analyzing the data thoroughly, it was not possible to reach a certain volume of abscess as a "cut-off" point. Similarly, we have not included a paravertebral abscess only (without epidural extension), either in significant or severe category, as most of these pathologies may be adequately treated with chemotherapy only. Furthermore, if the paravertebral abscess is very large but still without any epidural extension, it is likely to cause pain. Thus once again, this situation will merit surgery, as it will fall under the severe category.

We have also not included vertebral body collapse itself either in significant or severe category. The reason being, vertebral body collapse as long as not causing cord compression or instability has usually resulted in a good outcome with medical treatment only (in our series). This is also supported from various studies in the literature.^[22,26,29,41-43] However it is important to remember once again the vertebral body collapse in the cervical region is more likely to cause instability than in thoracic and lumbar region, hence individual consideration and

clinical judgment is of utmost importance. Last but not the least, we wish to state the above proposed parameters are meant to be general guidelines, which we have found after analyzing our large series and may be help for the surgeon to decide in favor of surgery.

As may be observed, our series is biased more towards surgery, as ours being the referral center deals more with such pathologies. A number of cases, which do not merit surgery, are treated at a district level only. Thus the parameters proposed are most useful in deciding whether or not surgery is required in such difficult cases.

Since Tuli's^[30-32] paper, there has been a significant development in the management of TB spine including the spinal instrumentation. In most of the cases of TB a relatively good margin of safety in surgery is offered due to the following reasons (1) The pus found is sterile, hence its drainage itself offers a good relief to the patient (2) Significant correction of the spinal deformity is not mandatory. Most of the cases involve a straightforward placement of instrumentation. The idea of surgery is to provide optimal stabilization and prevent further progression of the deformity. It is uncommon to find in the present era, even in a tertiary center like ours extremely advanced cases especially with the marked efficacy of chemotherapeutic drugs (3) With immensely improved instrumentation, early surgery helps the patients in early mobilization (4) Surgery helps in the opening of loculated and contained cavities of tuberculous abscesses. This helps in better penetration of chemotherapeutic drugs and a better response to medical treatment.

CONCLUSION

Anti-tubercular chemotherapy remains the corner-stone of management of spinal TB. TB of the spine should not be looked upon as a purely medical or a surgical condition and management should be individualized in each patient. In the present study, a total of 80% were subjected to surgery. Surgeries varied in complexity. There has been a definite shift in the clinical features over a period of time. The incidence of paraplegia, severe vertebral body collapse and cord compression has increased after 2004 and could be due to multiple variables. These features are proportionately reflected by an increase in instrumented surgeries, and circumferential fusions. Outcome following surgery seems to be good even when surgery was offered in late stage (myelopathy improving in 89%, pain in 71% and bladder symptoms in 88%). This is also reflected in also patients with paraplegia (showing improvement in 77% of patients, demonstrating that surgery should not be refused even to this subset of patients. Early surgery showed improvement especially for

bladder symptoms. Improvement was better with bladder symptoms if operated within 3 months. No patient on indwelling catheter improved if operated after 2 weeks of presentation. The analysis of this large cohort also helped to devise a new practical management paradigm for deciding whether or not surgery is required.

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