Surgical management of spinal tuberculosis in Papua New Guinea

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SUMMARY

Two cases of spinal tuberculosis (TB) presented with deteriorating myelopathy despite chemotherapy. Surgery of anterior decompression and fusion was successfully carried out resulting in both the patients ambulating and being continent on discharge. This highlights the importance of early surgery and a multidisciplinary approach to the management of this condition.

Introduction

Spinal tuberculosis (STB) is the single most important infection affecting the vertebral column in Papua New Guinea (PNG). Though the majority of cases improve on antituberculous therapy a few cases that do not respond or deteriorate rapidly require surgical intervention.

In 2003 and 2004 there were 1663 cases of tuberculosis (TB). There were 784 extrapulmonary cases from which 18 STB cases were reported and registered in the Tuberculosis Clinic. Out of these there were 4 anterior decompressions including non-instrument autologous bone fusion. These cases all did well after surgery and two are reported here as case presentations. The rest of the STB cases were treated with chemotherapy and did not require surgery.

It is known that STB is predominantly a disease of the vertebral body. An anterior approach enables the surgeon to effectively remove the dead vertebral body and leave the healthy posterior and middle columns (pedicles and laminae) (1-5). The anterior decompression and fusion with a bone graft is often termed the ‘Hong Kong operation’ and was originally reported by Hodgson and Stock in 1956 (6). The procedure was assessed in Medical Research Council (MRC) trials over the subsequent 30 years.

The posterior elements of the vertebral column are rarely involved in STB (1,7,8). Their preservation minimizes the risk of spinal instability and further deformity in the long run. This is important in PNG, where synthetic implants are not readily available. Thus the anterior approach enables the surgeon to perform vertebrectomy and directly perform bone fusion. This in addition treats and prevents further kyphoscoliosis.

Case reports

Case 1

A female aged 36 years presented to the medical ward after 3 months of numbness of the legs. She was admitted to the TB ward on 20 February 2005 by the physicians.

Examination by the medical team on 28 February 2005 showed normal power of the lower limbs. She had already been on TB treatment for 1 week. There was gibbus at the mid-thoracic region. On 11 March 2005 she developed paraplegia of the lower limbs from the hip joints down and urinary retention requiring catheterization. The surgeons were consulted on 14 March 2005. The spine X-
ray showed a paravertebral shadow at T6-T9 with collapsed T8/9 in an anterior wedging deformity (Figure 1).

On 17 March 2005 an anterior decompression was performed via a right thoracotomy. The diseased T8 vertebra and the TB abscess were removed by vertebrectomy to expose the spinal cord. A piece of rib removed at thoracotomy was inserted into the vacant T8 space.

1. Postoperatively the protocol included:
   - Adequate analgesics
   - Antibiotic cover
   - The thoracic spine was kept neutral (straight) at all times with no active movement of the back for 10 days
   - There was no need for ventilation support; however, it is important that these patients are kept in the high-dependency ward for at least 24 hours before moving to the regular ward
   - Aggressive chest physiotherapy
   - Chest drain was removed after a few days when there was a minimal collection
   - TB treatment was continued the day after surgery: in her case the TB drugs were rifampicin 600 mg, isoniazid 300 mg, pyrazinamide 750 mg and ethambutol 1000 mg – all daily for 2 months.

2. In terms of mobilization and spinal support the protocol was:
   - No active movement of the back for 10 days
   - Sit and walk upright from day 14 onwards with the help of a thoracic corset
   - By 6 weeks to 3 months the corset can be removed at rest but worn during physical exertion
   - From 3 months on the corset can be removed if the X-rays show no evidence of worsening kyphosis or scoliosis compared to preoperative angulation.

3. Her progress neurologically was as follows:
   - By day 2 after operation sensation returned
   - 2 weeks after surgery the indwelling catheter (IDC) was removed and she became continent
   - On day 20 after surgery power in the lower limbs returned: the right leg was grade 2/5 and the left leg 4/5
   - She went home 7 weeks after surgery

Figure 1. Paravertebral shadow on spinal X-ray (Case 1).
When seen 8 weeks after surgery the kyphosis and angulation of the spine was stabilized (30° preoperation, 28° postoperation) and power in the lower limbs returned to grade 5/5; she continued on TB treatment

Six months after surgery she was able to walk without support when seen on 12 September 2005.

Case 2

A female aged 26 years, the mother of a 2-month-old baby, presented with back pain for 5 months. She lived in Mt Hagen with her husband and had been started on TB treatment but had defaulted before she presented in Port Moresby. She was admitted to the medical ward and started on TB therapy. Her chest X-ray showed a miliary pattern (Figure 2).

When examined on admission on 14 April 2005 she had back pain with grade 3/5 power in the lower limbs from the hips down and no sensory level.

The surgeons were consulted 2 days after admission and in view of the lack of a sensory level and the miliary tuberculosis, we opted to treat with TB drugs and watch closely for deterioration. She was given rifampicin 600 mg, isoniazid 300 mg, pyrazinamide 750 mg and ethambutol 1000 mg daily with a plan to continue four drugs for the first 2 months.

By day 14 of admission she had developed a sensory level at T7/8 and incontinence so surgery was then done as an emergency on 28 April 2005.

The operative technique was similar to Case 1 approaching the paravertebral shadow around T8/9 (Figure 3).

Postoperative course:

- By day 6 there was a return of sensation in the lower limbs
- By day 9 after surgery the power in the lower limbs had improved to grade 5/5
- On day 14 after surgery she started walking with the aid of a frame and she became continent so the IDC was removed; the back was kept straight with the support of a thoracic corset whilst she was ambulating
- She was well enough for discharge 21 days after the procedure; she was advised to continue TB treatment and was registered in the TB Clinic; the postoperative X-ray is shown in Figure 4.

Figure 2. Chest X-ray showing the miliary pattern (Case 2).
Discussion

Choice of STB treatment and rationale

Most spinal TB cases markedly improve on chemotherapy without the need for surgery (9-13). Our treatment program comprised the short-term chemotherapy (STC) regimen (12-15). The STC has recently been upgraded to Directly Observed Treatment Short-Course (DOTS) to reduce non-compliance (16-17).

Surgery is indicated in the following situations:

- There is deterioration of neurological deficits whilst on tuberculosis treatment: the causes include a) mass effect, b) severe kyphosis or scoliosis, and c) poor compliance on chemotherapy.
- No improvement in neurology after 4 weeks of chemotherapy (18).
Worsening kyphosis: this is significant when more than 30° in adults but in children is significant when more than 15° (2).

The above situations are shown in algorithm form in Figure 5.

**Surgical options in PNG**

The operative choices available to PNG surgeons are anterior decompression and non-instrument bone fusion or costotransversectomy, which is predominantly a debridement and drainage procedure.

The choice whether to do costotransversectomy or anterior decompression and fusion depends on the surgeon's experience, availability of equipment, anaesthetic personnel, the patient's chest findings and comorbidities. For anterior decompression the chest X-ray should be clear, the patient should be fit for a major procedure and there should be the ability to collapse the lung during surgery with a double-lumen tube.

We prefer anterior decompression and fusion for the following reasons:

1. Most spinal tuberculosis affects the anterior segment of the vertebral column. Although we do not have computed tomography (CT) to confirm...
this, the fact that CT scan is absent gives more impetus to operate anteriorly since most spinal tuberculosis affects the anterior segment.

2. The anterior approach preserves the usually undamaged posterior vertebral column and goes straight for the diseased vertebrae.

3. Anterior decompression allows the preservation of whatever is left of the normal posterior segment of the vertebral column. This is going to help with stability in the long run.

4. The anterior decompression allows the surgeon to insert a bone block strut directly into the gap where the vertebral body used to be and this both helps with spinal stability and arresting the tendency to increasing kyphosis.

5. The anterior approach allows the use of rib for the graft without having to look elsewhere to obtain bone for graft and fusion and in the developing world setting avoids the use of metal.

The operation of costotransversectomy as the name suggests is the excision of the rib at its attachment to the transverse process by the anterior and medial transverse ligaments. It is a useful operation to remove a paravertebral abscess collection in an emergency situation. The main disadvantage is its potential to disrupt the normal posterior column, which will worsen deformity and instability in an already diseased anterior segment, though normally this does not occur. It is not necessarily a simpler operation than anterior decompression. Its place in the surgical treatment of spinal tuberculosis has been described by Clezy in the early 1970s (19).

Costotransversectomy is preferred in situations where:

1. The posterior segment is more damaged than the anterior segment of the vertebral column (rare).

2. In cases where thoracotomy is too risky due to lung disease or other comorbidities.

3. There is no kyphosis resulting from a diseased vertebral body. The vertebral body is normal from radiology. A posterior approach is embarked upon to cater for a possible spinal tumour. This is sometimes imperative in PNG where radiology back-up is not always ideal. A myelogram is preferred before surgery especially when there is no gibbus or paravertebral shadow.

4. A general or orthopaedic surgeon is not familiar or comfortable with the anterolateral approach and thoracotomy but is able to do a costotransversectomy.

The trials by the MRC over 30 years have not compared a non-instrument anterior approach (vertebrectomy and bone fusion) to the posterior approach (costotransversectomy). The outcome measures that would need to be assessed include spinal deformity, recurrence of active TB and spinal stability. Answers to these issues based on proper clinical trials could be further researched in PNG where spinal TB remains common.

**Difficulties and challenges in STB treatment in PNG**

*The pathology of the spinal tuberculosis*

The actual pathology of the spinal tuberculosis is the real determinant of the outcome of surgery. Large collections of pus respond well to surgery. Those lesions that are predominantly fibrous scar tissue as opposed to caseation and abscess formation are usually nonresponsive to surgery. CT scan images do help delineate the predominance of fibrous tissue or abscess. In PNG the lack of a CT scan or MRI (magnetic resonance imaging) means that such information is not available to the surgeon preoperatively and therefore it is wise to explore on the grounds discussed above.

Spinal X-rays are not sensitive enough to detect and differentiate an abscess collection from predominantly fibrous tissue (20). Both lesions produce a paravertebral shadow on X-rays. Pointing gibbus suggests a predominant purulent collection and that surgery is most likely to improve neurology. However, not all paravertebral abscesses have a pointing or fluctuant gibbus.
Spinal tuberculosis in children

Spinal tuberculosis in children will significantly affect the growth of the vertebral column. The kyphosis or scoliosis must be treated aggressively. Correction of spinal deformity in children is imperative. An angulation of 15° is enough to cause significant growth stunting. The treatment options in PNG are limited, particularly with the unavailability of metal implants, so surgeons and paediatricians must treat spinal TB in children aggressively. Some cases may need referral to centres that can fuse the spine after urgent decompression.

Multiple levels of vertebral involvement

Multiple levels of vertebrae (>2 vertebral bodies) involved pose a serious risk of worsening kyphosis. Again, cases may need to be referred to centres where spinal implants are available. However, we know of no such cases where multiple vertebral body involvement has proved a surgical challenge. Perhaps some may have been missed on plain X-ray, as there is no CT scan available, or such cases coming to surgery are indeed very rare.

History and background

The treatment of STB has gone through a number of changes in the past half-century. Conservative treatment was advocated for ambulating cases in Nigeria by Konstam and Konstam in 1958 (21). But a more aggressive approach was advocated by Hodgson and Stock in 1960 (6) in Hong Kong, where they performed radical surgery and non-instrument spinal fusion. Both groups reported successful outcomes.

The Medical Research Council (MRC), in its research on TB, set up a working party in 1963 to investigate different treatments of STB in Africa, Korea and Hong Kong. Reports were issued up to the 1998 15-year assessment of controlled trials (10). The important conclusions of these controlled trials were: 1) the STC comprising rifampicin, streptomycin, pyrazinamide and ethambutol for 6 months is sufficient; 2) the adjuvant treatment of bed rest or thoracic brace to the STC has no added advantage to ambulant treatment; 3) the long-term follow-up of 10 to 15 years for cases operated on by the radical procedure of anterior decompression with non-instrument fusion compared with those of debridement alone showed less loss of vertebral body height and kyphosis in the radical procedure.

Recent work has further affirmed the conclusion regarding STC (11-13). The issues of worsening kyphosis, multilevel vertebral disease and childhood STB with implications for growth are problems for ongoing research. Children with significant kyphosis and adults with multiple-level disease are best treated with anterior implants after vertebrectomy and bone fusion.

Conclusions and Recommendations for PNG

The reports of the MRC published in 1998 (10) and other studies published since have guided our current practice in PNG:

1) Most STB cases are treated conservatively and STC is recommended.
2) Indications for surgery are as recommended in Figure 5 and are essentially for dysfunctional myelopathy and significant kyphosis.
3) The surgical technique recommended is the anterior approach of decompression, radical removal of TB foci and non-instrument fusion using autologous bone.

Surgery of the spine to correct kyphoscoliosis and its stabilization by use of implants is not feasible at present in PNG. The treatment of spinal TB calls for a multidisciplinary effort. The medical team is important as well as allied health workers. The family and the patient need to be educated and encouraged to complete the course of chemotherapy whether or not they undergo surgery.

REFERENCES
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