Correction in a severe post-tuberculosis kyphosis using modified posterior vertebral column resection

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ABSTRACT

Introduction: Kyphotic Deformity is one of the complications that affect the quality of life in patients post-tuberculosis. Patients with significant kyphosis typically present cosmetic and functional problems related to the biomechanical changes. There are many types of kyphotic deformity corrections, the posterior approach allows bigger degree of correction, but its main problem is neurological deficit during or post-surgery. Therefore, we correct the deformity by performing gradual cantilever bending after vertebral resection.

Methods: We present a case: a 31 year-old female diagnosed with severe kyphosis in healed spondylitis tuberculosis. The patient was diagnosed with lung and spine tuberculosis 20 years ago and she was treated with anti-TB drugs for 12 months. Physical examination showed severe kyphotic deformity of 91 degrees. Although the patient did not have any neurological deficit or pain, the patient had difficulty when lying on bed and she also complained about getting easily fatigue, hence she agreed on the correction procedure. The procedure took place at Cipto Mangunkusumo Hospital dated January 24th 2017. The surgery was performed by an attending spine surgeon, one spine fellow surgeon and two orthopedic residents. The technique used was a modification of posterior approach of vertebral column resection with gradual bending. The length of surgery was 7 hours, with 2100 ml blood loss during the surgery.

Results: Pre- and post-operative X-rays was compared with Cobb method, pre-operative X-ray was 91.47° compared to post-operative X-ray which was 51.35°. There was no major event observed. The patient was discharged 7 days post-operative without any neurological deficit.

Discussion: A single stage posterior approach with posterior column resection could be one choice of treatment in patients with post-tuberculosis kyphosis. The advantages of this single stage approach is reduced possibility of what could occur in a two-stage surgery: extensive blood loss and longer duration of surgery.

Conclusion: We conclude that this procedure is an effective and a save method in correcting severe post-tuberculosis kyphosys.

Keywords: Post-tuberculosis kyphosis, posterior approach

ABSTRAK

Pendahuluan: Deformitas kifosis merupakan salah satu komplikasi yang memengaruhi kualitas hidup pasien pasca tuberculosis. Pasien dengan kifosis berat sering mengeluh perih fungsional dan kosmetik berkat perubahan biomekanik. Terdapat beberapa tipe koreksi deformitas kifosis, dimana pendekatan posterior menghasilkan koreksi yang lebih besar, namun seringkali terdapat masalah deficit neurologis intraoperatif maupun pasca operasi. Oleh karena itu kami melakukan tindakan koreksi gradual pendekatan posterior yang dimodifikasi.


Hasil: X-ray pre dan pasca operasi dibandingkan dengan metode Cobb, derajat kifosis x-ray pre-operasi adalah 91,47° dibandingkan dengan derajat kifosis x-ray pasca operasi yaitu 51,35°. Tidak terdapat komplikasi pasca operasi. Pasien pulang setelah hari ketujuh perawatan tanpa deficit neurologis.

Diskusi: Pendekatan posterior satu tahap diikuti dengan reseksi kolum tulang belakang diaptai dijadikan pilihan tindakan pada pasien kifosis pasca tuberculosis. Kelebihan satu tahap ini adalah mengurangi kemungkinan komplikasi yang terjadi pada operasi dua tahap, keliangan darah yang masih dari operasi yang lebih lama.

Kesimpulan: Prosedur pendekatan posterior satu tahap yang dimodifikasi adalah metode yang aman dan efektif untuk koreksi kifosis berat pasca tuberculosis.

Keywords: Post-tuberculosis kyphosis, posterior approach

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INTRODUCTION

Spinal tuberculosis is a common extrapulmonary form of tuberculosis. Spinal tuberculosis is one of the oldest diseases acknowledged in mankind and was found in Egyptian mummies dating back to 3400 BC. It is popularly known as Pott’s disease, tracing back to the description of tuberculosis infection of the spine by Sir Percival Pott in 1779. Spinal tuberculosis mostly affect young adults and children. Although the exact incidence in most parts are unknown, in countries with a high burden of pulmonary tuberculosis, it is estimated to be consistently high. The spine is the most common site to be affected, especially in the skeletal region. Spinal tuberculosis approximately accounts for 50% of bone and joint tuberculosis.¹

Treatment of tuberculosis of the spine include medication and also surgery, although medical treatment is the cornerstone of the treatment, surgery may be required in selective cases. The goal of the treatment itself is to eradicate the infection and also to prevent further sequelae, such as neurological deficit, pain, and kyphotic progression.¹ The prognosis is generally good when early diagnosis and early treatment is achieved, especially with patients without neurological deficit or deformity. Sequelae of the kyphosis include paraplegia or quadriplegia secondary to cord compression, whereas physiological and anatomic sequelae include cardiorespiratory compromise and impingement of the costal margins over the iliac crest, respectively.²

Patients with significant kyphosis typically present cosmetic and functional problems related to the biomechanical changes. Many patients with post-tuberculosis kyphosis also present with neurological symptoms, including compression of the spinal cord or over-distraction of the cord on the kyphotic deformity.³

The worst complications of progressive kyphotic deformity is progressive neurological deficit or paraplegia. Neurological complications can be due to the disease itself and the progression of the deformity.⁴

There are several techniques in addressing the problems of kyphotic deformity. Approach by using anterior, anterolateral, combined anterior and posterior, or posterior could be chosen by the surgeon depending not only by the severity of the deformity but also the surgeon’s preference.

Posterior approach might be one of the most used approach in correcting post-tuberculosis kyphotic deformity. There are three types of 3-column osteotomy: pedicle subtraction osteotomy (PSO), vertebral column resection and vertebral column decancellation. In PSO, correction is achieved 30 to 40 degrees per level. It is a V-shaped osteotomy with adequate resection of the posterior elements, pedicles and much of the vertebral body at each level, but the anterior cortex of the vertebral body remain intact. The intact cortex acts as a fulcrum of the osteotomy. In vertebral column resection, the posterior and anterior of the cortex, including the discs above and below the vertebral body, is removed. The resection enables more than 40 degrees of kyphotic correction per level. While vertebral column decancellation involves multiple vertebrae and removal of residual discs.²

Panchmatia et al² reviewed surgical approaches addressing the problems in post tubercular kyphosis. It was concluded that the anterior and anterolateral approaches are effective in dealing with neurological deficit problems but not correcting the deformity, compared to combined posterior – anterior and posterior only approach which is better in dealing with kyphosis problems.

This case report presents a severe kyphotic deformity in post-tuberculosis patient and the related pre-operative and intraoperative challenges.

CASE ILLUSTRATION

A 31-year old female complained about crooked back since 20 years ago. We obtained history of her past illness, she suffered spondylitis tuberculosis 20 years ago. She was treated with anti-tuberculosis drugs (with the regimen of Rifampicin, Isoniazid, Pyrazonamid and Etambuthol) for 9 months. During the treatment, she realized that her back began to curve. She did not seek medical attention for her crooked back. At the end of the Anti-Tb regimen, she noticed her crooked back was progressively worsen. No neurological deficit was recorded.

Five months ago, the patient began to feel uncomfortable especially when she was laying down and also with her horizontal gaze. Therefore she had her back checked to an Orthopedic surgeon. She was then referred to our Center for her kyphotic deformity.
At the physical examination, it was revealed that she had gibbus (sharp kyphotic deformity apparent in the clinical appearance). However, in the neurological examination no neurological deficit was recorded. Her reflexes are also within normal limit.

Laboratory findings showed no abnormality. The radiograph imaging showed extreme kyphosis at the thoracic vertebrae region with the degree of regional kyphosis (thoracic 8th - 10th) 91.71 degrees (n 10-40 degrees). MRI examination revealed no compression in the spinal canal. At the sagittal balance profile, the PI (pelvic incidence) was 53.7 and the sagittal vertical axis was 2 cm.

The patient was diagnosed with severe kyphotic deformity on healed spondylitis TB. The surgical procedure performed was kyphotic correction. Intraoperative monitoring and autotransfusion were also prepared by the team to detect early neurological problems and prevent excessive blood loss. The operation lasted for 420 minutes. One senior surgeon, one spine fellow and two residents performed the surgery.

The patient was set in a prone position under general anesthesia. The IOM and autotransfusion was placed and we performed posterior approach after confirming the level of approach using the image intensifier. We managed to expose three levels above and below the kyphotic site. We inserted 6 pedicle screws at the level T 5 – T 7 and T 11 – L1, and laminectomy, costotransversectomy and corpectomy level T8 – T10 were performed, also in a posterior manner. We proceeded to rod insertions and correction of the kyphotic deformity. By creating superior elements (the rod inserted at the level T5 – T7) as a lever, we manipulate the superior elements by pushing them to the floor and also by pushing down the inferior elements (the rod inserted at T11 – L1). After the correction, we were concerned about the neurological status, fortunately, the IOM was still in a good condition. Before inserting the other rod to the pedicle screws, the neurology colleagues found a slight deterioration in the MEP (muscle evoked potential) that at this time intraoperative-bleeding was excessive (1800 ml) although the autotransfusion helped to manage the profuse bleeding. It was believed that this was caused by hypotensive state (MAP below 80 mmHg). Fortunately, the anesthesiologist team was successfully managed the hypotensive state and make the MEP returned back to normal. The surgical team proceed to the last manipulation. We put the drain to monitor the post-operative bleeding. The patient was then sent to the ICU for further monitoring. Although the baseline of the IOM was similar to the pre-operative condition, we still did the wake up test where fortunately, no neurological deficit was recorded after the procedure.

The patient was then transferred to the regular ward, after spending 2 days in the ICU. She managed to stand up at the 5th day post-operative. She was discharged at the 7th day post-operative.

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After we dissected the soft tissue posteriorly, we managed to acquire adequate exposure. We inserted 6 pedicle screws at the level T5 – T7 and T11 – L1 (blue dots). Modification lies in the posterior approach manner when performing laminectomy, costotransversectomy and corpectomy of level T8 – T10 (yellow block). The structure of the spine in healed TB is relatively fibrotic. Therefore, meticulous soft tissue handling when performing these procedures (laminectomy, costotransversectomy and corpectomy) is needed. The difficulty in doing this approach was releasing the spinal cord as we perform the decompression. We proceeded by performing rod insertions and correction of the kyphotic deformity. The superior elements (rod inserted at the level T5 – T7) acting as a lever was then manipulated by pushing them to the floor and also by pushing down the inferior elements (rod inserted at T11 – L1).

**DISCUSSION**

Tuberculosis of the spine remains a challenging disease for our health. It accounts for at least half of all cases of musculoskeletal tuberculosis. Tuberculosis is still increasing in developing nations. Tuberculosis of the spine affects mostly young adults in their most productive years.\(^1\) In our case, a 31-year old female with previous history of tuberculosis of the spine when she was 11 years of age, the infection was successfully eradicate by antibiotic regiment alone but in the expense of progression of vertebrae destruction which was not managed by the local physician.
According to Rajasekaran, the progression of kyphotic deformity depends on the extent of the initial vertebral loss. There are three types of collapse and healing of the anterior column: a) partially destroyed vertebrae, b) patients with dislocation of a facet joint, restabilization occurred by contact, and c) loss of 2 to 3 vertebrae in thoracolumbar region making the superior segment rotated 90° causing the superior segment horizontal.

(Figure 6) The latest type of healing pattern was apparent in our case, leaving a 92° of kyphotic deformity.

**Figure 6.** Pattern of healing after the anterior column destruction A) partially destroyed vertebrae, no dislocation of facet joints; B) single facet joint, restabilization by contact; C) loss 2-3 vertebrae, the superior segment 90 degree. (Rajasekaran)

Jain et al. reviewed the prevention and correction of kyphosis in the spinal tuberculosis, which is varied depending on the stage. A healed stage (or post-tuberculosis kyphosis) should be addressed not only for the cosmetic reasons. Our patient is an active adult. She complained not only for her cosmetic appearance, but also for her quality of life. Y. Zeng et al. also mentioned that patients with significant kyphosis typically present with cosmetic and functional problems, including spinal balance on the functions and the quality of life. Rajasekaran also mentioned that severe post-tubercular kyphosis was also associated with poor self-image, back pain and easy fatigability, cardiorespiratory compromise and neurological deficits.

Kyphosis in tuberculosis of the spine can be addressed either at the acute stage or at the late healed stage. At latter stage, stiffness of the vertebrae and lung disease are the considerations for the approach and technique. In the acute stage, according to the literature review and experience from a SRS-GOP site by Boachie-Adjei et al., anterior transpleural approach is commonly used. On the contrary, antero-lateral or direct posterior approach is more favored for the late / healed treatment.

There are several approaches in managing the kyphotic deformity in post-tuberculosis of the spine: anterior, posterior, or combination of both. Anterior approach enables excision of the kyphus, visualization of the dura, and debridement of non-vital tissues. The strut graft is easier to be inserted in the dead space created from the debridement. Combined anterior and posterior approach enables the surgeon to access all 3 spinal columns. However, Yau et al. reported 13 peri-operative complications in a serial case, in which 3 patients died from cardiac arrest, ileus or tracheostomy-related complications.

We conducted a one-stage posterior approach to the patient instead of combined anterior and posterior approach. The disadvantages of the combined anterior and posterior procedure are the need for two approaches hence increasing the likelihood of blood loss, prolonged the surgical time. In our case, we performed a single stage posterior approach. According to Suk et al., posterior approach when compared to combined posterior and anterior approach resulting in a better surgical outcome with reduced duration of the surgery and less blood loss. Posterior approach according to Rajasekaran, et al. in a 3 year follow-up of 17 patients underwent correction using single stage closing-opening wedge osteotomy of the spine, concluded that the procedure is reliable, effective and save in correcting severe post-tuberculosis kyphosis (PTK).

Kalra et al. also studied the posterior approach only for rigid PTK, they used pedicle subtraction osteotomy (PSO) to correct the deformity. They achieved significant improvement post-operatively. This approach also offers the advantages of a single stage procedure, which is reduced of blood loss, reduced duration of the surgery compared to the two-stage procedure. The mean operative time in the study was 210 minutes, whereas in our case, it was 420 minutes. There is a possibility that it was due to the rarity of such cases in our Institution. However, we managed to correct the deformity from 91.7° to 51.4° (40 degrees of correction), which is comparable to Kalra et al. (a mean correction of 44.2 degrees).

A retrospective study carried out by Cho et al. to 23 patients with rigid fixed kyphosis resulted in 57% rate of correction. Although the study combined all approaches (anterior, posterior, and combined posterior and anterior), the result was comparable to our case, where the rate of correction was 56%.

A study by Y Zeng et al. followed up 36 cases in 2 years.
They conducted a posterior correction for the treatment of moderate to severe PTK. The mean kyphotic angle was 89.3 degrees, and after 2 years follow up the mean kyphotic angle was 29.3 degrees (67.2% correction); they also had a satisfaction rate of 88.9%.

Preoperative preparation is vital in such procedure. In our case, we prepared auto-transfusion and intraoperative monitoring of the neurologic functions. Intraoperative blood loss was 1200 ml in comparison to other single stage approach, which was 820 ml (range 500 – 1600 ml), of Rajasekaran that performed meticulous handling of the hemostasis and the use of hypotensive anesthesia. It was comparable to our procedure, where the colleagues from anesthesia also did the hypotensive anesthesia during the procedure. The blood loss in our case was lower compared to the procedures conducted by Suk et al where there was extensive 2980 ml blood loss.

What concerned us was the distraction of the dural spine, it could lead to elongation of the dura, which would consequently disturb the neurological functions. Fortunately, intraoperatively, it did not happen. Although spinal stretching force was the cause reported by Wang et al, the loss of IOM usually occurs after the completion of VCR.

Intra-operative monitoring loss was apparent, and it was founded by our colleagues from neurology during the procedure, the surgical team stopped the procedure for a while. After the discussion on the surgery, anesthesia and neurology, it was believed that this was due to hypotensive anesthesia (MAP <80 mmHg), hence the problem was successfully managed by performing resuscitation. Intraoperative blood loss is also an essential and potential high-risk factor for IOM loss according to Wang et al. Intraoperative itself may evoke potentials to loss and electroencephalogram can detect the pathophysiological state occurring in acute ischemia, in which neurons are nonfunctional but still alive and salvageable by reperfusion.

Although reports showed that healed tuberculosis with kyphosis is less satisfactory and technically difficult, a thorough preparation of the procedure, including preoperative discussion on which approach and techniques will be used, accurate prediction of the blood loss and duration of the procedure, and the use of intraoperative monitoring are helpful in preventing complications, such as intraoperative profuse blood loss and post-operative neurological deficit.

CONCLUSION

Correcting Kyphotic deformity in a patient with kyphosis post-tuberculosis of the spine using a single stage posterior approach and vertebral column resection is considered as a safe approach. The key is in good pre-operative planning by providing a good surgical and anesthesia team, autotransfusion for preventing profuse blood loss and intraoperative monitoring of the neurological functions.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

REFERENCES


