CASE REPORT

Smith-Peterson osteotomy and lordotic posterior column compressive screw fixation proceed by postural pillow reduction improved realignment for unstable lumbar burst fracture

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Abstract

Lumbar burst fractures (LBF) is a common trauma case of the spine, recently still a difficult problem to solve. Experts have published the approaches and techniques, but there is still a high incidence of morbidity and mortality, unsatisfactory clinical and radiological results especially in developing countries. The minimal tissue destruction approach with rigid screw-rod construction allowed to lowering surgical costs and earlier patient recovery with successfully clinical and radiological results in the short term follow up.

Keywords: Lumbar burst fracture, Lordotic posterior column, Postural pillow, Smith-Peterson osteotomy

Introduction

Lumbar burst fracture (LBF) or thoracolumbar burst fracture is a frequently unsolved problem. LBF often result in spinal trauma in the form of kyphosis and even spinal cord injury. This fracture often occurs at a young age and can disrupt daily activities.¹⁻⁴ A good posture is a vital indicator of bone and muscle health. A disturbance in the system will result in mechanical stress, which can lead to spinal pain. Some previous studies use pillows of a specific size and thickness to improve posture and to reduce pain.⁵⁻⁸

Surgery is needed for an unstable LBF or Thoracolumbar fracture accompanied by nerve disorders. Previous studies feature several surgical techniques, including the Smith-Peterson osteotomy (SPO) technique, which is often used in cases of adult idiopathic scoliosis, despite the controversy about its usefulness and effectiveness for clinical patients.⁹⁻¹¹ We treated our patients with Smith-Peterson osteotomy and posterior column compressive screw fixation proceed by postural pillow reduction and short segment fixation.

The preoperative customized pillow was placed below the fracture site to allow indirect external restoration to the spine. Customized pillow made from a rolling blanket about 10 cm height. The timing of postural pillow use for reduction is 1-3 days (Figure 1A). Giving analgesics during the procedure. Interval neurological assessment was done.¹

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Procedures

After the procedure of anesthesia, the patients change into prone position. A pillow was placed over the thoracic region, and the pelvis region, thus free area below the abdominal space to allow compression force during surgical correction of lumbar kyphosis (Figure 1B).¹ A midline linear skin incision and subperiosteal muscle dissection performed to expose the posterior spine structure. A screw-rod construct fixation with open conventional technique under the guidance of fluoroscopy.¹

After the fluoroscopy checking level for SPO, we performed resection of the inferior and superior facet complex bilaterally and inferior laminotomy for upper lamina and superior laminotomy for lower lamina to achieve a significant osteotomy space. Typically, the space of the osteotomy is 7 to 10 mm but slightly larger in the second case (Figure 2A). The screw-rod construct fixation according to the degree of lumbar spine curvature (Figure 2B).^{1,12-14}

Figure 1. (A) Before surgery, spine postural pillow reduction, height 10 cm (white arrow). (B) During surgery, the asterisk indicates the direction of compressive force during fixation screw-rod.

Case Report

Case 1

A 48-year-old male with a history of traumatic injury presented to the emergency department of our hospital after a fall from a height of approximately 5-meters with severe lower back pain, sensory loss, and weakness bilateral leg. On physical examination, body temperature was 37.3°C, blood pressure was 120/70 mm Hg, heart rate was 82 beats per minute, respiratory rate was 21 breaths per minute, and oxygen saturation was 98 while the patient was breathing ambient air. The

patient was fully conscious. He had tenderness in the thoracolumbar region. On neurological examination, bilateral muscle strength was 4/5, and the patient had superficial hypesthesia from the level of the inguinal. Increase tendon reflex or central nervous system pathology was identified. Disturbance of urination also reported. The back pain visual analog scale (VAS) scored 7. Plain X-ray demonstrated a burst fracture at L1. Magnetic resonance imaging (MRI) demonstrated a burst fracture at L1 compressed the conus medullaris. The patient was diagnosed with a burst fracture at L1 (Figure 3).

Figure 2. (A) Smith-Petersen osteotomy (asterisk). (B) After correction and screw-rod fixation

Figure 3. (A) T2WI MRI preoperative show kyphosis. (B) Plain X-ray preoperative. (C) Improved sagittal balance after surgery

Case 2

A 19-year-old male presented to the emergency department of our hospital after a multi-vehicle accident with severe lower back pain, sensory loss, and weakness on both legs. On physical examination, body temperature was 36.6°C, blood pressure was 110/70 mm Hg, heart rate was 92 beats per minute, respiratory rate was 18 breaths per minute, and oxygen saturation was 98 while the patient was breathing ambient air. The patient was fully conscious, but weakness on both legs. He had tenderness in the lower lumbar region. On neurological examination, bilateral muscle strength was 2/5, and the patient had superficial

hypesthesia from the level below the knee. Increase tendon reflex or central nervous system pathology was not identified. Disturbance of urination also reported. The back pain visual analog scale (VAS) scored 8. Plain X-ray demonstrated a burst fracture at L4. Magnetic resonance imaging (MRI) demonstrated a burst fracture on L4 compressed the cauda equina. The patient was diagnosed with a burst fracture at L4 (Figure 4)

Figure 4. (A) CT-scan preoperative burst fracture. (B) T2WI MRI preoperative

Figure 5. (A) Plain X-ray preoperative show burst fracture and kyphosis. (B) Improved sagittal balanced after surgery

Discussion

To obtain optimal results, the surgery requires careful planning and a complete radiological examination.¹³ Kim *et al.*, recommend a technique of gradual restoration and low pressure using a postural pillow before surgery using ligamentotaxis, aiming to help restore the fractured bone height and to reposition broken bone fragments in the nerve canal at the same time. Some previous studies of thoracolumbar fractures performed the SPO technique. Schwab *et al.*, also recommend

the same technique, but other previous studies also state that the use of conventional surgical techniques such as laminectomy can result in the instability and failure of buffer implants.^{2,4,8,10,14-15}

Previous studies revealed successfully treated nonsurgically with conservatively or with hyperextension bracing or casting no neurological deterioration was reported.¹⁶ Installation of pedicle instrumentation can help improve kyphosis, reduce indirect narrowing of the nerve canal, and facilitate faster postoperative mobilization. Conventional techniques, which are one level above and below the fractured bone, have the potential to fail and redefine kyphosis. Therefore, some previous studies recommend modifying the old technique of screw installation on broken bones or administration of bone cement. Some studies suggest that the surgery results in an improvement, either the "short segment or long segment" techniques.^{3,17}

In our case, the technique applied in a preoperative kyphosis. After 3-months, postoperative kyphosis was improved 66.7% from baseline. Preoperative pain complaints indicated a VAS scale improved 62.5% from baseline (Figure 3) (Figure 5). In the case no-1, improvement of motoric grading 20% from baseline and 60% from baseline on the case no-2. Less bleeding, decreased surgical time, and length of hospital stay. No complication during outpatient department visits.

There has been no consensus between the improvement of the narrowing of the spinal nerve canal and the repair of nerve disorders. Some studies state that the improvement of symptoms depends on the level of nerve damage. This study was conducted in a private hospital with limited government insurance coverage. Thus, the authors suggest further research discussing canal remodeling indicators, more complete radiological modalities and longer duration of observations.¹⁸

Conclusion

This technique improved the realignment of kyphosis. Postoperative improvement of pain and neurological deficit related to restoration of sagittal alignment. In addition, this technique, which was applied to the lumbar burst fractures, could be a useful alternative to another extensive approach.

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