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POSTERIOR APPROACH IN TRAUMATIC THORACIC AND THORACOLUMBAR SPONDYLOPTOSIS

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ABSTRACT

Objective: Traumatic spondyloptosis a 100 % or more subluxation of a vertebral unit over another inferior unit in the sagittal or coronal plane is a very rare pathology. In this study, clinical findings and follow-up results of 12 patients with spondyloptosis that occurred after a high-energy trauma were evaluated.

Material and Methods: Twelve cases with the thoracic and thoracolumbar region traumatic spondyloptosis at two separate centres in the city of Gaziantep between 2010 and 2016 were examined retrospectively. The clinical and radiological results, additional system injuries and long-term results of the patients were evaluated.

Results: The mean age of the patients (9 men and 3 women) was 30.4. The causes of trauma were falling down from a height (8 cases) and a traffic accident (4 cases). Spondyloptosis was detected at the upper thoracic level in two cases (Th3-4 and Th4-5); Th9-10, one case; Th10- 11, four cases; Th11-12, three cases and Th12-L1, two cases. Pre- and postoperative neurological status of all cases was ASIA A. In all cases, 5 levels of fixation were performed after reduction with posterior intervention. In addition, 2 patients died; specifically, one patient with thoracic trauma and one with embolism due to deep vein thrombosis at the third month post-op. Severe fusion was observed in 9 of our living patients and 1 had a moderate fusion.

Conclusion: Acute thoracolumbar spondyloptosis can only be achieved via a posterior approach. The intense intercostal area can be used for a fusion bed.

Keywords: Spondyloptosis, trauma, surgery, fusion

Level of Evidence: Retrospective clinical study, Level III.

INTRODUCTION

Traumatic spondyloptosis is a very rare pathology that is defined as a 100 % or more subluxation of a vertebral unit over an inferior unit in the sagittal or coronal plane following high-energy trauma, such as a traffic accident or falling down from a height. Generally, together with dural tear, it causes complete transection of the spinal cord, paraplegia, and additional organ injuries, resulting in death [4,6,8,11,15].

Correction of vertebral alignment and stabilisation can be provided via an anterior or posterior approach or a combination thereof. Correction of traumatic spondyloptosis affecting the thoracic vertebrae via only the anterior approach has difficulties (e.g., failure to repair dural tear and failure to provide reduction), and it may also cause morbidity and complications [10]. It may be necessary to add a posterior approach due to accompanying fracture and/or compression in adjacent or non-adjacent vertebrae.

Unfortunately, these patients have to live with permanent neurological deficits as the integrity of the spinal cord is impaired, and their treatment management is very important. The treatment is primarily targeted towards resolving the pulmonary complications arising due to the thoracic trauma, correcting vertebral alignment, repairing dural tear as well as achieving stabilisation and fusion [4,8,10]. As long-segment stabilisation is usually required, insufficient fusion during rehabilitation may cause implant dysfunction, and additional interventions may be required.

In this study, we retrospectively examined cases with traumatic thoracic and thoracolumbar spondyloptosis, where the vertebral alignment was corrected via the posterior approach only and stabilisation was achieved using pedicle screws.

MATERIALS AND METHODS

Twelve cases with traumatic thoracic and thoracolumbar spondyloptosis from three separate centres in the city of Gaziantep between 2010 and 2016 were examined retrospectively. In the images obtained through preoperative sagittal and coronal reconstruction, these cases where a vertebra shifted over an adjacent vertebra with a degree of 100 % or more **(Figure-1)** were evaluated as traumatic spondyloptosis [4,6,8,10-11,15]. Age, sex, trauma patterns, neurological status, additional organ injuries as well as factors causing morbidity and mortality were analysed retrospectively. Management of the cases, preoperative computed tomography (CT) and magnetic resonance imaging (MRI), and their CT taken during postoperative follow-up were evaluated. The American Spinal Injury Association (ASIA) scoring was used to determine the neurological deficit of all cases with spinal trauma, while the thoracolumbar injury classification and severity (TLICS) scale was used to determine the severity of trauma [12]. For evaluation of posterolateral fusion, the classification of no fusion, mild (less than 50 %), moderate (more than 50 %), severe (100 % fusion), suggested by Lowery et al., [7] was used.

RESULTS

The mean age of the patients (9 men and 3 women) was 30.4. The causes of trauma were falling down from a height (8 cases) and a traffic accident (4 cases). Spondyloptosis was detected at the upper thoracic level in two cases (Th3-4 and Th4-5); Th9-10, one case; Th10- 11, four cases; Th11-12, three cases and Th12-L1, two cases. In one case with Th10-11 spondyloptosis, burst fracture and traumatic spondylolisthesis was detected at L1 in addition to fragmented fractures of the T10 and T11 vertebrae. The TLIC score was 8 in all cases (3 morphology, 3 posterior ligamentous complex, and 2 complete transection of the cord). The pre- and postoperative neurological status of all cases was ASIA grade A. Six patients without additional organ injury were operated within the first 2 hours. The 6 patients with polytrauma were operated within 10 days after haemodynamic improvement; in them, spinal injury was accompanied by pneumothorax, haemothorax, lung contusion, head trauma, extremity fractures and/or intraabdominal injury. After emergency medical intervention, especially for thorax and abdominal injuries, surgical procedures were performed for spondyloptosis **(Table-1).**

Table-1. Patients' clinicodemographic data.

Case No	Age Sex	Causal İnjury	Level	Dural Tear	Additional Injury	Treatment	Follow-up	Result	Fusion
1	27 F	Fall From height	Th 10-11	Present	-	Th9-L1 PSF	6 years	NI	Intense
2	50 M	Fall From height	Th 10-11	Present	Head trauma, pneumo-thorax	Th9-L1 PSF	5 years	NI	Intense
3	26 M	Fall From height	Th 3-4	Present	Pneumo-throax	Th2-6 PSF	4 years	NI	Intense
4	24 M	Fall From height	Th 9-10	Not Present	-	Th8-12 PSF	3 years	NI	Intense
5	27 M	Traffic accident	Th 12-L1	Not Present	-	Th11-L3 PSF	3 years	NI	Intense
6	32 M	Fall From height	Th 10-11	Present	Burst, calcenous fracture at L1 vertebra	Th8-L3 PSF	3 years	NI	Intense
7	31 M	Fall From height	Th 12-L1	Present	-	Th11-L3 PSF	2 years	NI	Intense
8	32 M	Traffic accident	Th 11-12	Not Present	Femur fracture	TH10-L2 PSF	2 years	NI	Intense
9	30 M	Fall From height	Th 11-12	Not Present	-	TH10-L2 PSF	2 years	NI	Intense
10	31 M	Traffic accident	Th 10-11	Present	-	Th9-L1 PSF	1 year	NI	Moderate
11	30 F	Fall From height	Th 11-12	Present	Retro-peritenal bleeding, pelvis fracture	TH10-L2 PSF	1 month	Death	None
12	25 F	Traffic accident	Th 4-5	Present	Hemo-thorax, pneumo-throax and lung contusion	Th3-7 PSF	3 months	Death	None

NI: No improvement

Reduction and stabilization

In all cases, reduction, decompression and stabilisation were achieved via the posterior approach only **(Figure-1).**

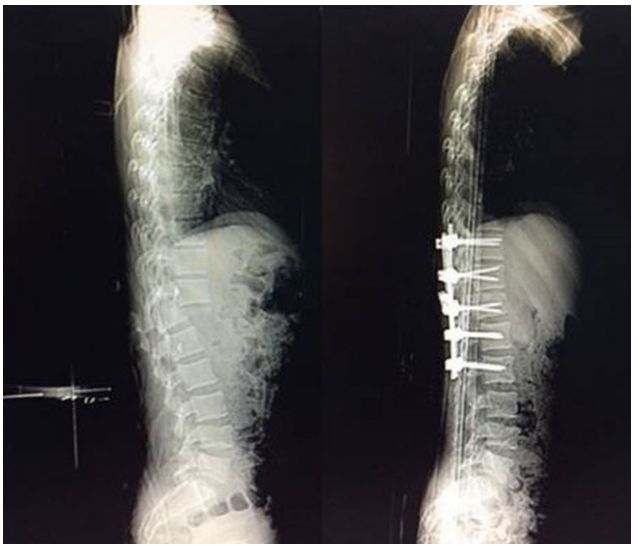

Figure-1. Spondyloptosis at Th 11-12 level.

First, pedicle screws were placed in the cranial and caudal vertebrae at the spondyloptosis level. In order to move the caudal and cranial vertebrae of the spondyloptosis level in a block-like manner, a rod was secured to each screw in the caudal and cranial region on both sides. Reduction was achieved through traction and rotation movements, if necessary, in simultaneous and block-like manner, of the cranial and caudal vertebrae bilaterally using scopy with the help of the rod holders. The facts that all three columns were damaged and that there was no delay in treatment were the most important factors facilitating realisation of reduction. After reduction was achieved, while the vertebrae were kept aligned with the help of two separate rods, the rods on the opposite sides were removed and a single long rod was secured. After unilateral stabilisation was realised, the rods on the other side were removed and replaced by a single rod. After ensuring reduction and stabilisation, laminectomy was performed for decompression. Eight cases had dural laceration, and there was either complete or almost complete transection of the spinal cord. Laminectomy was widened until normal dura was observed, and dura repair was performed in a water proof manner. The facet joints and ribs were decorticated and autografts (laminectomy and iliac wing-derived autograft) were laid on these wide fusion areas. Low- molecular-weight heparin was administered 24 hours postoperatively, they were put on anti- emboligenic surgical stocking and an in-bed rehabilitation program was started at early stage. In 11 cases where corpus integrity at the spondyloptosis level was preserved, 5 levels including the ptotic segment were fixated. In one case, 8 levels were fixated as there was an instable fracture in 2 vertebrae below the ptotic level.

One patient with haemothorax, pneumothorax and lung contusion died of lung infection and acute respiratory distress syndrome that developed while he was being followed up postoperatively with prolonged respiratory support, and one patient died of embolism associated with deep vein thrombosis third month postoperatively. In the other 10 cases, the follow-up period ranged from 1 year to 6 years Problems related to spinal instrumentation (loosening, screw or rod breakage) were not observed in cases where only the posterior approach was used. In the living patients, severe fusion was observed in 9 and moderate fusion in one **(Figure-2).**

Figure-2. Thoracic spondyloptosis where fusion developed posterolaterally at the 24th month.

DISCUSSION

Traumatic thoracic and thoracolumbar spondyloptosis is very rare and results in a permanent and complete neurological loss below the level of trauma. Often accompanied by thoracic injury, it may cause additional morbidity or even death. It should be ensured that cases with persistent neurological deficit become self-sufficient with rehabilitation and education to adapt to their new lives. Therefore, managing these cases in a hospital is very important.

Performing restoration of vertebral alignment, decompression, and achievement of fusion by stabilisation through repair of the dural injury and instrumentation in a single session is very important [4,8,10]. Usually, long-segment stabilisation is required; and because development of a deformation due to pseudoarthrosis and insufficient reduction requires additional surgical interventions, the success of the first surgery is very important for the quality of the new and disabled life style of these patients. Our study showed that thoracic and thoracolumbar spondyloptosis can be stabilised through reduction via the posterior approach in a single session. The intense intercostal area can be used for a fusion bed.

Traumatic spondyloptosis cases are categorised as fracture dislocation according to the Dennis spinal fracture classification, and they are considered unstable as all 3 columns are affected [5,8]. The aim of management of spondyloptosis is reduction, restoration of alignment and stabilisation [3,9]. For this purpose, reduction via the posterior approach only and stabilisation, corpectomy with anterolateral approach and anterior support, spondilectomy from posterior and posterior stabilisation are the surgical approaches [1-2,13-15]. There is no consensus in the literature on which approach should be used. Ramizadeh et al. reported that classifying a case as correctable or uncorrectable is important in determining the approach. They reported that in correctable cases, reduction can be easily achieved by performing distraction with posterior approach; but this approach is insufficient in chronic cases, where serious adhesion and scar tissue develop in uncorrectable spondyloptosis [9]. Because all of our patients had acute spondyloptosis and all the ligaments were damaged, reduction could be achieved through bilateral manipulation of the cranial and caudal vertebrae of spondyloptosis in a single session.

While some authors suggest stabilisation at 2-level below, 2-level above in traumatic spondyloptosis cases [8], some others suggest stabilisation at 3-level below, 3-level above [10]. Mishra et al. used posterior approach in 19 of 20 patients with spondyloptosis and placed corpectomy cage after transpedicular corpectomy in 7 patients [8]. There is controversy about whether or not corpectomy is needed before or after reduction in the treatment of traumatic spondyloptosis, how many levels should be included in stabilisation, the need for anterior support. For this reason, the patient's neurological damage level, level of spondyloptosis, presence of multilevel vertebra fractures accompanying spondyloptosis and post-traumatic time as it primarily leads to tissue healing and even development of abnormal fusion are very important in determining what approach should be followed.

Between 80 % and 100 % of spondyloptosis cases are associated with complex neurological deficits [8,11]. All of our patients had complex neurological deficits below the level of trauma. An in-bed rehabilitation program should be initiated primarily because of patients' limited mobility, long hospital stay and continuous bed rest. We believe that this measure prevents formation of a vectorial pressure that could lead to an implant failure. Therefore, posterior transpedicular stabilisation can provide adequate stabilisation for fusion development with the need for anterior support.

Interbody and posterolateral fusion facilitates arthrodesis [9]. In our patients, since spondyloptosis was present in the thoracic region, the intensely vascularised posterolateral intercostal region contributed to the formation of a large area for fusion. The thoracic vertebrae have less facet surface than the lumbar vertebrae. For this reason, in instabilities such as spondyloptosis especially where all three columns are damaged, formation of fusion in addition to achieving stabilisation is the most critical issue and it requires additional surgical procedures to obtain intervertebral fusion. With laminectomy and iliac wing-derived autografts, formation of fusion at posterolateral and intercostal distances to the thoracic vertebrae was achieved with the need of additional surgery. In our patients, corpus integrity at the spondyloptosis level was preserved in 11 cases, and 5 levels including the ptotic segment were fixated. In one case, 8 levels were fixated as there was an instable fracture in 2 vertebrae below the ptotic level.

Conclusion

Acute thoracolumbar spondyloptosis can only be achieved via a posterior approach. The intense intercostal area can be used for a fusion bed. This single-seam surgery can provide early mobilization and quality of life for patients.

Conflict of Interest Statement

The authors declare there are no conflicts of interest-financial or otherwise-related to the material presented here in.

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