

Retrospective Evaluation of Our Surgical Approach and Treatment Results in Subaxial Cervical Spine Injury

Subaksial Servikal Omurga Yaralanmalarında Cerrahi Yaklaşımımız ve Tedavi Sonuçlarımızın Retrospektif Değerlendirilmesi

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Cite as: Karakoyun DO, Uzlu O, Yılmaz A, Işık HS. Retrospective Evaluation of Our Surgical Approach and Treatment Results in Subaxial Cervical Spine Injury. Kocaeli Med J 2021;10(2):33-38.

Abstract

INTRODUCTION: Objective: The aim of the study is to evaluate the treatment management applied to the cases operated by a single spinal surgeon for Subaxial cervical trauma (SCT) according to the Subaxial cervical spine injury classification (SLIC) and AOSpine criteria, and to analyze the clinical and radiological results of the cases retrospectively.

METHODS: The clinical and radiological results of 9 patients who were operated for SCT in our clinic between 2019-2020 were evaluated.

RESULTS: The age distribution of the cases was between 18 and 74 (mean = 46.2). The follow-up period of the cases was 5-27 (mean = 17.3) months. When the trauma levels were examined, it was seen that there were lesions at the C5-C6 level in 7 (77.8 %) cases and at the C6-C7 level in 2 (22.2 %) cases. The SLIC scores of the cases were in the range of 5-9 (mean =6.4). When the preoperative American Spinal Injury Association (ASIA) scores of the cases were examined, it was seen that it was A in 2 cases, C in 4 cases, and D in 3 cases.

DISCUSSION AND CONCLUSION: SCT are pathologies with high morbidity and mortality risk. By performing decompression with anterior, posterior or combined approaches, spinal stability and neurological recovery can be achieved. Facet joints should be carefully evaluated in terms of fractures in SCT and 360° fusion should be performed in the presence of radiological findings suggesting that the stabilization is insufficient.

Keywords: subaksiyel travma, cervical spine, cervical fracture, 360° fusion

Öz

GİRİŞ ve AMAÇ: Çalışmanın amacı Subaksiyel servikal travma (SST) nedeniyle tek bir omurga cerrahi tarafından ameliyat edilen olgulara uygulanan tedavi yönetimini Subaksiyel Servikal Travma Klasifikasyonu (SLIC) ve AOSpine klasifikasyon kriterlerine göre değerlendirmek ve olguların klinik ve radyolojik sonuçlarını geriye dönük olarak incelemektir

YÖNTEM ve GEREÇLER: 2019-2020 yılları arasında kliniğimizde SST nedeniyle opere edilen 9 hastanın klinik ve radyolojik sonuçları değerlendirildi.

BULGULAR: Olguların yaş dağılımı 18 ile 74 arasındaydı (ortalama = 46,2). Olguların takip süresi 5-27 (ortalama = 17,3) ay idi. Travma düzeyleri incelendiğinde 7 (%77,8) olguda C5-C6 düzeyinde, 2 olguda (%22,2) C6-C7 düzeyinde lezyonlar olduğu görüldü. Olguların SLIC puanları 5-9 (ortalama =6,4) aralığındaydı. Olguların ameliyat öncesi Amerikan Omurga Derneği Sınıflama (ASIA) skorları incelendiğinde 2 olguda A, 4 olguda C, 3 olguda D olduğu görüldü.

TARTIŞMA ve SONUÇ: SST yüksek morbidite ve mortalite riski olan patolojilerdir. Anterior, posterior veya kombine yaklaşımlarla dekompresyon yapılarak spinal stabilite ve nörolojik iyileşme sağlanabilir. SST’de faset eklemler kırık açısından dikkatle değerlendirilmeli ve stabilizasyonun yetersiz olduğunu düşündüren radyolojik bulguların varlığında 360° füzyon yapılmalıdır.

Anahtar Kelimeler: subaksiyel travma, servikal omurga, servikal fraktür, 360° füzyon

Geliş tarihi / Received:

22.06.2021

Kabul tarihi / Accepted:

27.07.2021

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INTRODUCTION

There are 7 vertebrae in the cervical region and the C3-7 region is called the subaxial cervical region. Subaxial cervical trauma (SCT) usually occurs after a fall from a height or a motor vehicle accident. These injuries carry a high risk of mortality and morbidity. All cervical vertebrae may be injured due to trauma, but in more than half of the cases, the localization of trauma is the subaxial region (1).

Permanent loss of neurological function can be seen among the devastating sequelae of SCT. Therefore, it is important to use a consistent and proven algorithm in the diagnosis and treatment of injury (2). There is still no clear consensus for the treatment of SCT (4). For the last 20 years, determining which of the anterior or posterior approach is the treatment method is a matter of debate (3-4). Factors such as the cases neurological status, classification of fracture and/or dislocation, presence of fracture or dislocation in facet joints, unilateral or bilateral lesion in facet joints, presence of traumatic disc play a role in surgical planning (5).

The aim of the study is to evaluate the treatment management applied to the cases operated by a single spinal surgeon for SCT according to the Subaxial cervical spine injury classification (SLIC) and AOSpine criteria, and to analyze the clinical and radiological results of the cases retrospectively.

MATERIALS AND METHODS

The permission dated 17.06.2021 and numbered 156 was obtained from the Ethics Committee of XXX University Faculty of Medicine. The clinical and radiological results of 9 cases who were operated for SCT in our clinic between 2019 and 2020 were evaluated retrospectively.

Age, gender, cause of trauma, follow-up period, lesion level, preoperative and postoperative American Spinal Injury Association Impairment Scale (ASIA) Score of all cases were evaluated. The evaluation of the pathology detected in the cases according to the SLIC and AOSpine classification scores and the surgical procedures performed were examined. In addition, our cases were evaluated in terms of observed complications, screw malpositions and fusion formation.

SURGERY TECHNIQUE

Anterior approach; The case was in the supine position and under general anesthesia, after the necessary site cleaning and sterilization procedures, distance was determined with the help of C-arm fluoroscopy. After subcutaneous detachment, the platysma was opened parallel to the sternocleidomastoid (SCM) muscle. The lesion level was reached by taking the trachea and esophagus medially, carotid and SCM laterally. Depending on the lesion type, discectomy or corpectomy and anterior decompression of the spinal cord were performed. Subsequently, anterior stabilization was achieved with a polyether-ether-ketone

(PEEK) cage or corpectomy cage and anterior plate/screw. Following hemostasis, the layers were closed in the anatomical plane.

Posterior approach; The case was operated in the prone position. After the necessary site cleaning, a skin incision was made at the Occiput - C7 level. Paravertebral muscles were lateralized from the midline at the level of the ligamentum nucha. Distance was determined by C-arm scope, lateral mass for C4-5-6 vertebrae and transpedicular screws were applied for C7 and T1 vertebrae. Total laminectomy and flavectomy were performed at the required distances for posterior decompression of the spinal cord. In cases with facet joint skipping, the superior articular process was resected with the help of a 2 mm Kerrison rongeur and lordotic sagittal alignment was achieved. Subsequently, posterolateral stabilization was performed with the aid of bilateral rods. Synthetic and autologous bone grafts for fusion were placed. Following hemostasis, the layers were closed in the anatomical plane.

RESULTS

In our study, 9 cases who were operated due to subaxial cervical trauma; 6 are male and 3 are female. Surgical procedure was performed in all cases. The age distribution of the cases was between 18 and 74 (mean = 46.2). The follow-up period of the cases was 5-27 (mean = 17.3) months. Considering the trauma etiologies of the cases; It was observed that cervical injury developed as a result of traffic accident (TA) in 6 cases, fall from height (FH) in 2 cases, and diving in 1 case. When the trauma levels were examined, it was seen that there were lesions at the C5-C6 level in 7 (77.8 %) cases and at the C6-C7 level in 2 (22.2 %) cases. When the preoperative ASIA scores of the cases were examined, it was seen that it was A in 2 cases, C in 4 cases, and D in 3 cases. In the postoperative follow-up of the cases, improvement was observed in the ASIA Score of 6 cases, while no change was observed in 3 cases. The injury information, levels and change in ASIA score of the cases are given in Table 1.

The SLIC and AOSpine classifications of the cases and the surgical interventions performed on the cases are given in Table 2. The SLIC scores of the cases were in the range of 5-9 (mean = 6.4). Adequate stabilization was achieved in 3 cases with only posterior stabilization application. The other 4 cases were stabilized 360° with anterior and posterior approaches in the same session. Decompression and stabilization was performed with the anterior approach in 2 cases, but posterior stabilization was applied to these cases after the cases were observed that the anterior stabilization was not sufficiently stable in the tomography imaging performed after mobilization.

A deep neck abscess developed 3 months after the operation in 1 case whose ASIA score did not change. Abscess drainage of the case was performed. Esophageal rupture was considered, but the ruptured site and the pathology causing the rupture could not be detected during the operation. An esophageal rupture was

Table 1: Age of the cases, lesion levels and change in American Spinal Injury Association Impairment Scale (ASIA) scores

Case	Age, Sex	Follow-up time	Etiology	Lesion level	Preoperative ASIA	Postoperative ASIA
1	20,F	26	TA	C5 and C6 fracture	C	D
2	18,M	27	TA	C5 and C6 fracture	C	E
3	58,M	26	TA	C5-6 dislocation	C	C
4	74,F	25	TA	C5-6 fracture, dislocation	D	E
5	61,F	8	FH	C6-7 dislocation	D	E
6	59,M	12	TA	C5-6 dislocation	C	E
7	69,M	21	FH	C5-6 dislocation	D	E
8	18,M	5	Diving	C5 and C6 fracture	A	A
9	39,M	6	TA	C6 and C7 fracture	A	A

TA: Traffic accident, FH: Falling from high

Table 2: Subaxial cervical spine injury classification (SLIC) and AOSpine classifications of cases and surgical interventions for case

Case	SLIC	AOSpine	Anterior approach	Posterior approach
1	5	C5-C6: A3 (N3)	C5, C6 Corpectomy, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (same session)
2	6	C5-C6: A2 (N3)	C5, C6 Corpectomy, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (different session)
3	9	C5-C6: C (N3,M2)	C5 Corpectomy, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (same session)
4	5	C5-C6: B2 (N1)	-	C4,5,6 Lateral mass, C7 transpedicular screw+rod
5	5	C6-C7: B2 (N1)	-	C4,5,6 Lateral mass, C7 transpedicular screw+rod
6	9	C5-C6: C (N3,M2)	C5-6 discectomy, PEEK cage, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (same session)
7	9	C5-C6: C (F3,N3,M2)	C5-6 discectomy, PEEK cage, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (different session)
8	5	C5-C6: A2 (N4)	C5, C6 Corpectomy, plate + screw	C4,5,6 Lateral mass, C7 transpedicular screw + rod (same session)
9	5	C6-C7: A4 (N4)	-	C4,5,6 lateral mass, C7, T1, transpedicular screw+ rod

PEEK: Polyether-ether-ketone

detected in the postoperative fluoroscopy imaging performed by drinking a contrast agent. It was determined that the esophagus was ruptured in the region of the anterior cervical plate and there was contrast material leakage. Antibiotherapy was arranged according to the culture results. However, the case died due to sepsis that developed 1 month after his hospitalization. No neurological or vascular complications related to screw malposition were observed in our cases. In the follow-up, it was observed that bone fusion developed in all our surviving cases.

CASE 7

A 69-year-old male who applied to the emergency department due to a fall from a height of approximately 4 meters. Right thigh flexion was 4/5, anal tone and reflex were normal, and urinary incontinence was not defined. C5-6 Fracture dislocation

and left facet fracture were detected in the cervical tomography examination. At C5-6 level, it was observed that the spinal cord was compressed from the anterior and there was a traumatic disc (Figure 1). The case, discectomy was performed with anterior approach. After discectomy, anterior stabilization was achieved by placing a PEEK cage at the C5-6 disc distance and using an anterior plate and screw. No additional neurological deterioration was observed in the follow-up of the case. However, after out-of-bed mobilization, it was observed that the case had slipped anterior plate screw and anterior stabilization was not sufficient. Therefore, the case was re-operated, posterior C4-5-6 lateral mass and C7 pedicle screw were applied, and then the system was stabilized with the help of a rod. In the follow-up, cervical stabilization was achieved in the case, and in the follow-up 6 weeks later, complete neurological recovery was observed. Bone fusion was observed in the 6th month control of the case (Figure 2).

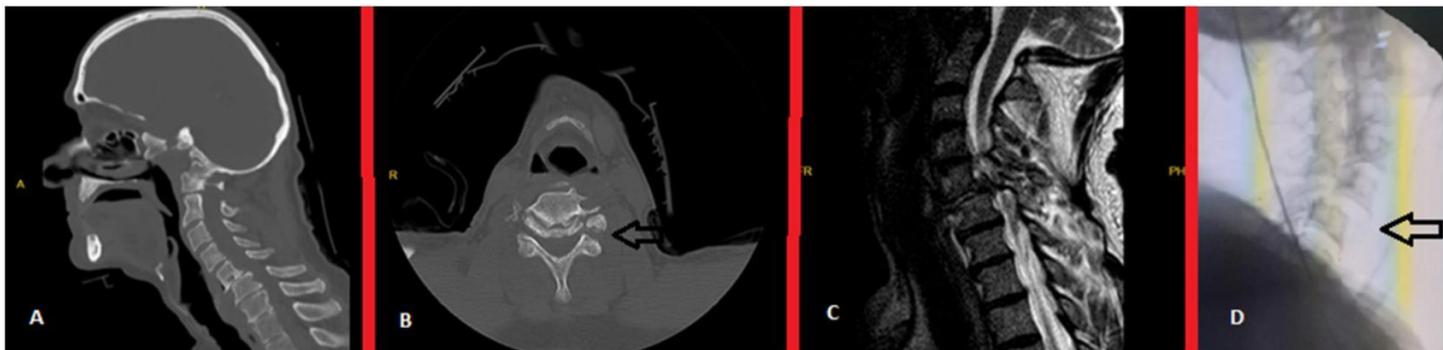


Figure 1: A- C5-6 anterior dislocation is seen in cervical CT sagittal imaging. B- - Cervical CT axial imaging shows a fracture in the left C5-6 Facet joint. C- Disc compression to the spinal cord is observed in cervical MRI T2 sagittal examination. D- Anterior dislocation is observed after intraoperative discectomy.



Figure 2: A- Sagittal CT examination taken within 24 hours after anterior stabilization in the case. B- Sagittal CT examination of the case taken 72 hours after mobilization C- sagittal CT examination of the case after posterolateral stabilization D- Postoperative cervical MR T2 sagittal imaging of the case.

DISCUSSION

Subaxial spine injuries are causes of trauma with high mortality and morbidity. Considering the localization distribution of acute cervical traumas, 55% arise from the C5-6 and C6-7 segments (4). When the trauma levels were examined, it was seen that there were lesions at the C5-C6 level in 7 (77.8 %) cases and at the C6-C7 level in 2 (22.2 %) cases. In order to make the surgical decision in cases, Allen and Ferguson made a classification based on the radiological findings of the injury to infer the mechanism of occurrence (6). Harris et al. added rotational components to this classification (7). In addition to the injury morphology, SLIC was defined by recommending the evaluation of the case's neurological findings and disco-ligamentous structure integrity (8). In this scoring system; In cases of 3 points or less, conservative treatment is left to the experience of the surgeon at 4 points, while surgical treatment is recommended considering instability for scores of 5 and above. Samuel et al. They reported that they performed surgery on fewer cases with a SLIC score of 4, and they treated 65% of the cases conservatively (9). Some studies have reported that this classification system is reliable, valid, reproducible, and has good agreement among surgeons (10-12). In all of our cases, the SLIC scale was used in the decision of surgical instability. All of our cases had a score of 5 and above. However, most of the studies supporting SLIC Scoring are retrospective and have limited prospective data (11). At the same time, it has been reported in more recent studies that only the morphological integrity of

the disco-ligamentous complex does not constitute sufficient observer data (11). For this reason, the AOSpine classification system, which is a comprehensive and simple classification system based on morphology and has high interobserver reliability, has been developed (13). This classification includes injury; It aims to define according to injury morphology, facet injury, neurological status, and presence of specific modifiers. Urita et al. In their study, they reported that this scoring system allowed sufficient agreement between different observers and in different situations of the same observer (14). Facet joint injuries occur especially with flexion-distraction injuries and may include a rotational component (2). Facet joints are especially important in the evaluation of disco-ligamentous damage and in deciding on the surgical approach (15). In our study, our cases were scored by AOSpine, but surgical decisions were made according to the SLIC scale in all cases. In our 2 cases who only underwent anterior approach, it was thought that the anterior approach did not provide sufficient stabilization due to facet joint damage, and stabilization was achieved with the posterior approach in different sessions. Therefore, the facet joint evaluation of the AOSpine scoring can be seen as an advantage. We think that it is extremely important for the surgical approach in the evaluation of the facet joint in the evaluation of instability, especially in facet fractures.

When subaxial burst fractures, flexion/compression injuries have a SLIC score in the operative range; it is generally treated with corpectomy, bone grafting, and restoration of the anterior column (2). After the anterior surgical approach of

the spine, esophageal rupture can be seen in 0-1.62% (16). Patel et al. reported a rate of 0.1% (17). In one of our cases, death due to esophageal rupture was observed. In case of significant discoligamentous damage, combined anterior and posterior approaches may be required (2). Corpectomy was performed in 4 cases and discectomy in 2 cases followed by anterior fusion with anterior approach. Three of our cases were treated with posterior stabilization only. Screw fixation after subaxial instability is very important for a good arthrodesis (10). To achieve a good pulling response, it is recommended to use transpedicular screws compared to lateral mass screws, but there is a high risk of vascular and neurological injury in transpedicular screw applications in the cervical region (18). In all of our cases, screws were applied to the transpedicular for C4-6 lateral mass and C7 vertebrae. Transpedicular screw was applied to T1 vertebra level in one of our cases. No vascular or neurological damage was observed due to screw application.

The use of methylprednisolone in subaxial spine injuries is still controversial (2,19,20). Fehlings et al. reported that high-dose methylprednisolone, when started within the first 8 hours and continued for 24 hours, has a small benefit on long-term motor recovery and is a treatment option (21). In all of our cases, methylprednisolone at a trauma dose was used after cervical trauma, and no complications related to steroid use were observed during the follow-up period. In the follow-ups of our 8 cases who survived, ASIA score increased to E level in 5 of our cases, to D level in 1 case, and there was no change in the scores of 2 of our cases.

Cases with a SLIC score below 4 who received conservative treatment, cases who underwent surgical treatment due to upper cervical traumas and cervical spondylosis, and tumoral lesions in the spine and spinal cord were not included in the study.

This study has some limitations. The limited number of cases in our study and the nature of the retrospective study limit our results. This study was carried out by a single surgical team, and we only selected cases from our medical center. Therefore, prospective, large-scale, multicenter clinical trials are needed to further validate our results.

CONCLUSIONS

SCT are pathologies with high morbidity and mortality risk. By performing decompression with anterior, posterior or combined approaches, spinal stability and neurological recovery can be achieved. Facet joints should be carefully evaluated in terms of fractures in SCT and 360° fusion should be performed in the presence of radiological findings suggesting that the stabilization is insufficient.

Ethics Committee Approval: Ordu University Clinical Research Ethics Committee Decisions (17.06.2021 / 156)

Conflict of Interest: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study received no

financial support.

Informed Consent: Retrospective study.

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