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Role of Anterior Cervical Decompression Fusion and Plating in Lower Cervical Spine Caries

Dr. Muhammad Sohaib Anwer[1], Dr.mumtaz Ali narejo[2], Muhammad Munwar Ali[3], Dr waqas mehdi[4], Dr Sana Ullah[5] and Dr Mehtab Khan[6]

[1]associate Professor Neurosurgery Sheikh Zayed Hospitalrahimyarkhan.

[2]Assistant professor neurosurgery department,Gambat medical college,pir Abdul qadir Shah jeelani institute of medical sciences, gambat.

[3]Assistant professor.Neurosurgery departmentSMBBMU larkana.

[4]Assistant professor, Department of neurosurgery King Edward medical University/mayo hospital lahore

[5]Resident of Neurosurgery departmentKing Edward medical university/Mayo hospital lahore

[6]Resident of neurosurgerydepartment King Edward medical University/mayo hospital lahore

Abstract

Cervical spine injury is one of the leading causes of spinal cord injury in the year 2013. In 2013, a total of 43.9% of cases of cervical spine injury was reported worldwide. The incidence of cervical spine injuries occurred due to accidents that happened in prime age. The major goal of this research was to explore the role of anterior cervical decompression fusion and plating in lower cervical spine caries.

Methodology: This prospective study was conducted in Sheikh zayed hospital rahim yar Khan in duration of January 2017 to December 2019, a total of 365 patients were presented in the emergency department of Sheikh zayed hospital rahim yar khan for the subaxial cervical spine surgery. All these patients were analyzed and only 21 patients matched the inclusion criteria of our study. The neurological condition of patients was accessed through American Spinal Injury Association (ASIA) impairment scale (AIS). All the patients underwent through radiological assessment. With the help of an X-ray on the cervical spine, we measured parameters including local segmental angle formed between two lines, Ishihara curvature index, the step of distance, and angle of cervical lordosis.

Results: Association of disc herniation was reported in six patients. Among these of six one was reported with injury level at C3-4, in 2 cases level was C4-5 and C5-6 reported in 3 patients. In one case longer plate fixation, C4-7 was performed due to injury at C4-5 level associated with C6 fracture. We observed 16.3% as the mean value of the NDI score We did not find any significant correlation of NDI with kyphotic angle.

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Conclusion: Our study concluded that anterior reduction decompression and fusion with plating is an effective method to manage subaxial cervical trauma injuries. The fusion state and patient feedback were highly satisfactory and considered as one of the successful positive outcomes of the anterior decompression method. Anterior decompression takes less time as compared to the posterior approach. However, this method failed to achieve the full reduction and the injured segment did not return to its normal lordosis.

Keywords: Anterior cervical decompression fusion, cervical lordosis, spine injuries

Introduction:

Cervical spine injury is one of the leading causes of spinal cord injury in the year 2013. In 2013, a total of 43.9% of cases of injuries related to cervical spinal carries were reported worldwide[1]. The incidence of cervical spine injuries occurred due to accidents that happened in prime age and patients are usually in an active lifestyle before cervical spine injuries[1]. Spinal stability is critical to access after any traumatic spine injury. The stability of the cervical spine can be achieved by 3 column theory[2]. In the case of 1 column disruption, the risk of spinal cord injury is less whereas when 2 columns are injured than the cervical spine can cause severe cord compromise[3]. Cervical spine management can be achieved through internal fixations and external fixations including orthosis or halo fixation to surgical decompression[4]. The internal fixation depends upon the fracture type, instability, and presence of cord compression[4]. The major aims of surgical management of cervical spine injuries are nervous structures decompression and injured vertebral stability[5].

The subaxial cervical spine is more prone to traumatic injuries due to proximity to moe rigid thoracic region. Sometimes injuries related to the cervical spine are not properly diagnosed which can lead to quadriplegia and severe permanent disability. Screening of cervical injuries should be done after the stabilization of patient condition but limited resources of screening may cause delay[6]. In the past, different methods were introduced to classify subaxial cervical spine trauma including Allen and Ferguson classification[7,8]. The major goal of this research was to explore the role of anterior cervical decompression fusion and plating in lower cervical spine caries.

Methodology:

This prospective study was conducted in .....in duration of January 2017 to December 2019. After analysis only 21 patients matched the inclusion criteria of our study. Regarding inclusion criteria of study, we involved patients with contiguous vertebrae between C3 and C7 along with having no history of spinal injuries, without any evidence of neurological injury due to spinal fracture. Patients without evidence of involvement of the axial skeleton in rheumatoid arthritis and also without pathological fractures were part of this research. On the other hand, all the patients with a previous history of cervical corpectomy, central cord syndrome along decompensated spinal canal stenosis were excluded from this research. Patients who suffered

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from neurological impairment before 24 hours of surgery were treated with methylprednisolone. In all patients, we applied skull tongs except those whose neurological status was not determined and whose MRI was not available. We ensured that skull tongs were not applied to patients with skull or brain injury. We observed demographic information in terms of age, sex, mode of trauma, high or low energy trauma, occupational information, and any kind of comorbidities. After that all the selected patients were then classified according to AO subaxial cervical spine classification. The neurological condition of patients was accessed through American Spinal Injury Association (ASIA) impairment scale (AIS). All the patients underwent through radiological assessment. With the help of an X-ray on the cervical spine, we measured parameters including local segmental angle formed between two lines, Ishihara curvature index, the step of distance, and angle of cervical lordosis. To evaluate the disc status, MRI was performed whereas bony structures were evaluated through CT imaging[9].

We further observed operative time, blood loss, and adverse events during surgery. Two surgeons performed surgeries and cases were classified according to the surgeon experience (one junior surgeon with less than 10 year experience, whereas one senior surgeon with more than 10 years experience). For reduction, we used the stepwise method, in first step we used fluoroscopy at the convergent position for open reduction. Whereas at the second stage, local kyphosis was formed with the help of Casper screws at the dislocated segment.

Furthermore, the Smith-Robinson approach was used to performed transverse skin incision. A polyether ether ketone (PEEK) cage with bone graft or bone substitutes was inserted following the discectomy. To stabilize the injured segment, the lock plate was fixed to the proximal and distal vertebra.

A rigid cervical collar was used for the external support for the first 3 weeks after surgery. After these 3 weeks, the soft collar was further used for 3 weeks. To measure the outcomes of the surgery we used neck disability index and visual analog scale. For this study, three follow-up visits were scheduled at 6 weeks, 6 months, and 12 months after surgery. The first visit was conducted after 6 weeks for neurological assessment and X-ray. After 6 months of surgery patients were asked to visit so that we examined the clinical and neurological status. After 12 months of surgery, a CT scan was performed and we measured outcomes according to neck disability index and visual analog scale[9].

We followed all the principles declared in the Helsinki protocol. Patients were well aware of the objectives and written consents were gathered from them before any intervention. For this research, we used SPSS 23.0 version for data analysis. Student t-test was applied to the data and comparison was conducted through the Chi-square formula. We set 0.05 as a statistically significant level of this research.

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Results:

A total of 21 patients was included with a mean age of 39.1 +13.8 years. The age range of the patients was in between 17 to 60 years and 19 of them were male (90.5%). The majority of the patients were labor force of the country and incidents occurred due to traffic accidents. Total 57% of cases of car accidents and 14% of motorbike incidents lead to cervical spine injury. The majority of the patients had single-level surgery with common level C4-5 (47.5%), whereas only 1 patient need double-level injury. Association of disc herniation was reported in six patients. Among these of six one was reported with injury level at C3-4, in 2 cases level was C4-5 and C5-6 reported in 3 patients. In one case longer plate fixation, C4-7 was performed due to injury at C4-5 level associated with C6 fracture. We observed 16.3% as the mean value of the NDI score. We did not find any significant correlation of NDI with kyphotic angle. On the contrary, the mean VAS pain score was reported as 0 with an interquartile range of 0 to 2. Total 11 patients (52.4%) returned to work without any pain, whereas 6 patients (28.6%) failed to return to their index job due to neurological impairment. Total 2 patients observed constraints in their manual duty and 2 of them did not engage in any work before surgery. Out of 21 patients, only one patient reported A2 injury, whereas all other patients reported F4 subtype. Bilateral facet dislocation was observed in 13 patients (61.8%), whereas unilateral facet dislocation was observed in 8 (38.1%) patients. Regarding operative data, we observed 3 days as a median range of hospital admission and surgical intervention. The majority of the patients were operated by junior surgeons whereas only 4 cases were handled by senior surgeons. In two cases (9.5%) we observed neurological complications in form of deterioration. These neurological complications are of 1 or 2 grades of AIS. During late follow up we observed that 2 patients developed radiculopathy and one patient lost reduction at late follow-up. On the other hand, 14.3% of cases of dysphagia were observed at late follow-up.

Variables	Mean + SD
Total Surgery time, min	68.2 + 15.1
Bleeding, ml	436.7 + 82.7
Age years	39.1 +13.8

Table 1: Demographic and Intraoperative findings of recruited Patients[9]

Variables	Before surgery	At 12 month follow up	p-value
Interspinous movement (mm)	-	0.6	-

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Local segmental angle, (degree)	-14 (-12 to -24)	0 (-6 to 8)	<.001
Cervical lordosis (degree)	34 (29-43)	42 (33-51)	0.003
Ishihara curvature index	6.92 (-2.7 to 28.9)	18.7 (- 3.5 to 26.9)	<.001
Step off distance, (cm)	0.9 (0.7-0.95)	0.6 (0.5-0.75)	0.001

Table 2: Pre and Postoperative imaging findings[9]

Late follow up	After surgery	Before surgery
0	0	A
1 C and 1D	2B	B (2 cases)
C	B	C (1 case)
4 E	4 D	D (4 cases)
14 E	1 C 13 E	E (14 cases)

Table 3: Neurological status of patients before surgery, after surgery and late follow up (12 months)[9]

Discussion:

The subaxial cervical spine is more prone to traumatic injuries due to proximity to more rigid thoracic region. Sometimes injuries related to the cervical spine are not properly diagnosed that cause disability[6]. Screening of cervical injuries should be done after the stabilization of patient condition but limited resources of screening may cause delay[10]. Usually anteroposterior and lateral are considered as standard radiographic views to examine the condition of the spine with a more than 70% sensitivity ratio[11]. Computed tomography imaging also plays a vital role to provide detailed information about the cervical spinal carries. It also provides an excellent view of the craniocervical and cervicothoracic junction with an overall 99% sensitivity ratio and 100% specificity rate. With excellent resolution capacity, CT imaging has an edge over other methods to visualize the bone condition[12]. On the other hand, magnetic resonance imaging is widely used to evaluate the discoligamentous complex, soft tissue injuries, and hematomas and assist in surgical planning[12]. In the past, different methods were introduced to classify subaxial cervical spine trauma including Allen and Ferguson classification[13-16]. In this study we used AO classification to describe the injuries.

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Anterior and posterior approaches along with stabilization may help in the operative management of trauma. Anterior approach has less probability of complications and enables decompression, dislocated facet joints reduction, interbody grafting with reconstruction, and provides assistance in the maintenance of lordosis[17-19]. In many cases of post-traumatic prolapsed intervertebral discs decompression can be achieved by using multiple discectomies. These alternative discectomies can be helpful in cases in which degenerative spondylotic changes occur and eventually results in corpectomy spinal canal stenosis with a high fusion rate[18]. On the contrary, the posterior approach may cause injuries that can cause late deformities along with wound infection[20]. We used a left-sided approach in our study to minimize the risk related to the recurrent laryngeal nerve. Within the carotid sheath on the left side nerve enters the thorax and ascends into the neck through the aortic arch. This current study focuses on the patients with C F4 injuries who were treated with only anterior approach.

Observations of the study reported that segmental angle improved at the lateral stage but did not return to the lordotic state[21]. There was no correlation observed between angle restoration and unilateral or bilateral facet dislocation. However, we did not observe any significant variations among the segmental angle improvement at the early and late follow-up periods. Comparing the cervical lordotic angle and Ishihara curvature index, we observed increase restoration at the late postoperative stage than the preoperative data. The median step-off distance was observed as 0.6 cm which indicates that complete reduction never achieved if distance observed more than 0.35 cm.

In current study, we explore that the anterior approach alone was effective worh minimum chance of neurological compliactions. We only observed 7.1% cases of neurological deterioration which were eventually resolved at late follow-up. At the final follow up complete reduction was deducted through CT imaging. In our study, all the patients had low NDI and VAS scores. Restoration of anatomical alignment could not be achieved through the anterior approach alone however a reduction in the dislocated cervical segment was highly observed. Comparing the study results with previous literature we found that the study of Defino et al[4] had better outcomes. At late follow up their local segmental angle was at a range of 7.55+ 5.09 but they loss 5° at late follow up which they already achieved in the early one.

Gao et al[22] observed a 5.2+ 8.6 lordosis range better than our study. Detection of fusion state was observed in 2 measurements. The first was done by CT imaging at late follow up in which we observed the existence of bridging trabecular bone between the endplates. The second was done through ISM on dynamic views and we observed 0.6 cm. A systematic review by Riew et al[23]., demonstrates that the measurement of ISM should be less than 1 cm. So according to this literature, we achieved an excellent fusion state at late follow-up.

To minimize the risk of soft tissue trauma we perform blunt dissection by using fingers. In our study, complications like dysphagia were highly seen in post-surgery duration but resolved within 2-3 days[24]. This complication occurs due to soft tissue inflammation and steroid treatment

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before surgery can be helpful to lessen the ratio of dysphagia severity[25]. The study of Tasiou et al[26]., reported soft tissue hematoma in 2 patients. For our study, we put negative sanction drain for every patient during surgery in order to prevent the hematoma events. With the standard protocol, we did not encounter this complication. The standardization of treatment may not be feasible in the management of subaxial cervical spine trauma, it always depends upon the surgeon's experience, a patient's condition especially comorbidities.

Conclusion

Our study concluded that anterior reduction decompression and fusion with plating is an effective method to manage subaxial cervical trauma injuries. The fusion state and patient feedback were highly satisfactory and considered as one of the successful positive outcomes of the anterior decompression method. Anterior decompression takes less time as compared to the posterior approach. However, this method failed to achieve the full reduction and the injured segment did not return to its normal lordosis.

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