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Original Article

Cervicothoracic junction instrumentation: Single center retrospective clinical analysis

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Abstract

Aim: The surgery of lesions involving the cervicothoracic junction was one of the challenging problems in spinal surgery practice. This area is quite unusual, especially since it is a transition zone from hard and relatively stationary thoracic and lumbar vertebrae to the kyphotic and movable cervicothoracic vertebrae. The fact that the cervicothoracic junction differs from the other vertebrae anatomy forces the surgeons to push into more conservative approaches. The instability of this component may cause fatal clinical results and may be necessary to stabilize due to tumor, trauma, infection, or degeneration.

Material and Methods: In this study, we examined 24 patients who underwent cervicothoracic region in our clinic between 2012 and 2017 retrospectively, and their age, gender, pathologies that cause medical need, instability of the vertebrae, howmany vertebrae were included in the pathology, surgical methods and results were evaluated.

Results: According to Frankel scores, neurological examination improved in 4 cases (17%) in the early postoperative period and worsening in 1 patient (4%). In the other 19 patients (79%), Frankel scores were not different in the preoperative and early postoperative examination.

Conclusion: Neurosurgeons should treat the instability of this region discreetly, and they should keep in mind that the surgical procedures involving this area may affect the stability of this region iatrogenically. In patients with cervicothoracic junctional pathologies, motor and sensory loss may occur below the relevant segment, and functional rehabilitation of these patients may be possible with early diagnosis, surgery, and post-rehabilitation applications.

Keywords: Cervicothoracic Junction; Instrumentation; Instability.

INTRODUCTION

The instability between C7-T1 may lead to severe kyphosis and consequent narrowing of the spinal canal and damage to the spinal cord. Instability of C7-T1 may occur due to trauma, tumor, degeneration or iatrogenic (extensive laminectomy). In such cases, it is essential to consider stabilizing spinal canal via posterior or anterior approach. Furthermore, the neurosurgeon should keep in mind that the need for posterior transpedicular stabilization during surgery at the time of when it is necessary for extant laminectomy, facetectomy or pedicure resection in any spinal surgery involving this region (1). The cervicothoracic junction can be a complex anatomical site for fixation and may force the surgeon to stabilize. Posterior rod and screw systems are superior to other anterior or posterior systems used alone when considering their biomechanical strength (2-4). The transition from fluid cervical to rigid thoracic vertebrae makes this region biomechanically different (5). Radiographically, intraoperative visualization of this region is difficult, and it is not possible to stabilize biomechanically with external orthoses. The immobilization method to be used should not contribute to progressive neurological deficits and should help to stabilization by providing bone fusion in the long term (6,7).

The approach to this region is more complicated than the other vertebral column areas due to its major vascular structures, visceral and soft tissue elements. The C7-T4 junction is located at the level of the section with the lower brachial plexus, thoracic outlet, and superior mediastinum. Due to the decrease of the vertebral index from C6 to T1 and changing the formation of the cervicothoracic junction, such as the thoracolumbar region, it causes overload and stress in this region (8).

Furthermore, it may be necessary to use cervicothoracic bridge instruments in posterior rod-screw approaches as a result of narrowing of the vertebral index and changing

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anatomy in the transition from the cervical region to the thoracic region (9).

Approaching this region from the anterior or posterior is possible. According to the location and size of the instability-causing lesion, fusion of the cervicothoracic junction should be decided on the most appropriate technique.

MATERIAL and METHODS

Study Design

This research was a retrospective clinical study. The study approved by the Local Ethics Committee of the Dışkapı Yıldırım Beyazıt Education and Research Hospital (15.10.2018 No:55/33)

In this study, 24 patients who underwent an operation in the neurosurgery clinic of Dışkapı Yıldırım Beyazıt Training and Research Hospital between 2012 and 2017 and who had cervicothoracic junction instability due to trauma, tumor, infection or degeneration were examined retrospectively. Cases with no cervicothoracic junction instrumentation were excluded. Besides, patients that were followed by conservative treatment without stabilization were not included in this study.

These patients were examined according to criteria such as age, gender, location and type of instability, pathology, surgical method, and change in preoperative and postoperative neurological examinations. The neurological examinations of the patients before the operation and the neurological examinations performed immediately after the operation were considered.

Neurological examination of the patients before and after the operation was compared with Frankel score (Table 1).

Table 1. The age, sex, pathology, imaging findings, surgical methods and classification by Frankel score of 24 patients. Ant: Anterior, Post: Posterior, Corp: Corpectomy, Tbc: Tuberculosis

Age	Gender	Pathology	Pathology Type	Preop Examination (Frankel)	Imaging	Treatment	Postop Examination (Frankel)
26	F	Tumor	Metastasis	D	C7-T1 tumor	C5-6-7-T1-2-3 post.	D
53	M	Trauma	in-car traffic accident	D	C7-T1 fracture	C4-5-6-7-T1-2-3 post.	D
33	M	Trauma	in-car traffic accident	A	C6-C7 dislocation	C6-7 Ant / C5-6-7-T1 post.	A
54	F	Degeneration	Degeneration	D	T1 fracture	C7-T2 Ant. Plak	E
51	F	Trauma	off-road traffic accident	D	C5-C6 dislocation	C5-6-7-T1 post.	E
37	M	Trauma	in-car traffic accident	E	C6-C7 dislocation	C5-6-7-T1-2 post.	E
57	M	Tumor	Metastasis	E	C7 tumor	C6-7, C7-T1 Ant.	E
61	M	Tumor	Metastasis	D	C6 tumor	C5-7 Ant, C4-5-6-7-T1-2 post.	D
7	M	Infection	Tbc	D	C7-T1	C3-5-6-T2-3 post.	D
18	M	Tumor	Paraganglioma	D	C7-T1 tumor	C5-6-7-T1-2-3 post.	D
70	F	Trauma	Falling from high	E	T1-T2-T3 fracture	C7-T1-T4-T5 post.	E
54	M	Trauma	in-car traffic accident	E	C7 fracture	C7 corpektomi, C6-T1 Ant.	E
42	F	Tumor	Multiple Myelom	D	T1 fracture	C6-7, T2-T3 post.	D
38	M	Trauma	in-car traffic accident	A	C6-C7 dislocation	C5-6 Ant. / C7-T1 post.	B
49	M	Trauma	in-car traffic accident	A	C6-C7 dislocation	C7 corp, C6-T1 Ant. / C4-5-6-7-T1 post.	A
20	M	Trauma	in-car traffic accident	C	C7 fracture	C6-T1 Ant.	D
62	M	Tumor	Metastasis	E	C5-C7 tumor	C4-T1 Ant. / C4-5-6-T1 post.	E
34	M	Trauma	in-car traffic accident	D	C6-C7 dislocation	C6-7 Ant. / C7-T1-T2 post.	D
50	M	Trauma	in-car traffic accident	D	C7 fracture	C7 corp, C6-T1 Ant.	D
33	M	Tumor	Metastasis	D	T1 fracture	C7 corp, C6-T1 Ant.	D
72	F	Infection	Tbc	E	C7	C7 corp, C6-T1 Ant.	E
61	M	Trauma	in-car traffic accident	C	C6-C7 dislocation	C6-7 Ant / C4-5-6-7-T1 post.	B
40	F	Trauma	in-car traffic accident	A	C6-C7 dislocation	C6-7 Ant / C4-5-6-7-T1 post.	A
62	M	Trauma	in-car traffic accident	E	C6-C7 dislocation	C6-7 Ant / C5-6-7-T1 post.	E

RESULTS

Between 2012 and 2017, 17 of the patients who underwent cervicothoracic junction instrumentation operation were male and 7 of them were female. The mean age of these patients was 45.2 (range 7-72 years). Fourteen patients (58%) were operated after trauma, and among them, in-vehicle traffic accidents were the most common cause with 12 (50%) patients. In one patient, fall from a height, and in another patient, a non-vehicle traffic accident is among the causes of operation.

Seven patients (29%) were operated because of the tumor, five patients (21%) were due to metastasis, and one patient was operated for paraganglioma and one patient for multiple myeloma. Rare causes include one patient with degeneration and two patients with tuberculosis infection.

14 patients (58%) had a pathology involving two adjacent vertebral segments. Nine patients (38%) had a single vertebral segment, and one patient had a preoperative pathology including three vertebrae segments.

When Frankel scores were examined, neurological examination improved in 4 cases (17%) in the early postoperative period and worsening in 1 patient (4%). In the other 19 patients (79%), Frankel scores were not different in the preoperative and early postoperative examination.

When the operation types were examined, eight patients (33%) had posterior rod-screw system alone. Seven patients (29%) were stabilized with corpectomy, plaque or cage systems by anterior approach alone. Nine patients (38%) required stabilization with both anterior and posterior approaches. When both anterior and posterior stabilization patients were examined, it was noted that seven patients (78%) were operated due to trauma.

DISCUSSION

The instability of the cervicothoracic region should be considered carefully, and it should be kept in mind that surgical procedures involving this area may affect the stability of this region iatrogenically. The surgery of the cervicothoracic region varies according to the cases, but there is no standard stabilization technique.

It was observed that high-energy traumas such as in-car or out-of-road traffic accidents alone did not suffice for posterior or anterior stabilization and the cervicothoracic component was stabilized with both anterior and posterior approaches. After the surgery, the majority of the patients did not worsen in the neurological examination, and they became candidates for rehabilitation. Besides, the majority of patients were in the metastatic tumor class, and in other studies, the long-term functional status of these patients was shown to be better in the combination of surgery and radiotherapy than in radiotherapy or chemotherapy alone (10).

CONCLUSION

Anterior or posterior instrumentation alone is not sufficient in some patients. The combined approach may require for both anterior and posterior stabilization of the cervicothoracic junction (11). In these structural pathologies, patients may have a motor and sensory loss below the relevant segment, and functional outcomes of these patients may be possible with early diagnosis, surgery, and post-rehabilitation applications.

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