

SURGICAL OUTCOME OF CORPECTOMY, BONE GRAFTING AND CASPAR PLATING IN NON-TRAUMATIC CERVICAL SPINE DISEASES

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ABSTRACT

Objective: To determine the neurological outcome in non-traumatic cervical spine diseases after corpectomy, bone grafting and Caspar plating.

Methods: Patients presenting with cervical spine diseases were included in this descriptive study. Patients' demographic profiles, symptoms, signs and imaging findings were recorded. The corpectomy was performed through anterior approach. The bone graft was taken from iliac crest. The graft was shaped according to the size and fixed in position with Caspar and screws. Post op. check x-rays were carried out to confirm the position of graft and hardware. Eighty one patients were studied during 3 years.

Results: Out of 81 patients, 53 were male while 28 were female; age ranged from 18 to 60 years with mean age of 43.44 ± 12.52 years. 35(43.2%) patients had cervical spine stenosis secondary to osteophyte and hard disc, 15(18.5%) patients had cervical stenosis with soft discs at multiple levels, 10(12.3%) patients had ossified posterior longitudinal ligaments, 10(12.3%) patients had collapsed vertebra secondary to metastasis, 7(8.6%) patients had collapsed vertebra secondary to plasmacytoma and 4(4.9%) patients had collapsed vertebra secondary to old carries spine. Ninety percent of patients presented with neck pain, brachialgia, quadripareisis and urinary retention. Pain was relieved in all patients (100%). Motor deficit recovered in 70 patients (86.41%).

Conclusion: In our study corpectomy, bone grafting and fixation with Caspar plating had a good neurological outcome in non-traumatic diseases of lower cervical spine.

Key words: Cervical spine, Corpectomy, Bone graft, Caspar plating, Neck pain

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INTRODUCTION

Cervical spine is made up of seven vertebrae. The initial two (C1 and C2) are exceptionally specific and named as atlas and axis respectively. The remaining vertebrae (C3-C7) are having a body, pedicles, laminae, spinous processes and facet joints^{1,2}. Cervical spondylosis is a common condition, occurring as a result of age-related wear and tear. After the age of 60 years, it affects >85% of the people. It may be asymptomatic but usually presents with neck pain, radiculopathy, myelopathy, or a combination of these³. The neckache experienced with cervical spondylosis is frequently associated with stiffness and radiation into the shoulders. Cervical radiculopathy is not usually associated with myelopathy. Sixth and seventh nerve roots are mostly involved due to compression at C5-C6 and C6-C7 disc levels. The vast majority of these patients present with and without

a precipitating cause. Usually, the pain is more frequent in the upper limbs than in the neck⁴. Cervical spondylotic myelopathy is the most common cause of non-traumatic paraparesis and tetraparesis. Sphincter loss (fecal and urinary incontinence or retention) are less common. However, quality of life of the patients is usually affected⁵. Myelopathy is either caused by developmental canal stenosis or occurs as result of opacification of the posterior longitudinal ligament (OPLL), central disc herniation, osteophytes and listhesis³ (figure 1).

Systemic tumors metastasize to the spine in 5-10% of cases^{6,7}. Metastases to cervical spine are seen in 10%, lumbar spine 20% and thoracic spine in 70% of cases⁸. Metastatic spread to the spine is most frequently observed in cancers of breast, prostate, lung and kidneys. Similarly, other malignancies like lymphoma, myeloma and carcinomas of gastrointestinal tract can involve and destroy the vertebral bodies or their pedicles⁷⁻⁹. As

Figure 1: MRI Cervical Spine showing opacification of the posterior longitudinal ligament (OPLL) and developmental cervical stenosis



vertebral bodies are most commonly affected by the metastatic spread, therefore anterior cervical corpectomy is considered to be the most valuable and direct approach. Its advantages include excision or removal of tumor and neurological decompression. Furthermore, vertebral column can be efficiently reconstructed with this neurosurgical approach¹⁰⁻¹¹.

Spinal tuberculosis (TB) is a common disease especially in underdeveloped nations. Spinal TB can lead to destruction of vertebral bodies and the adjoining intervertebral disc space, breakdown of the spinal components, and anterior wedging resulting in gibbous formation¹².

Hardening or ossification of posterior longitudinal ligament (OPLL) occurs to prevent the spreading of infection to the spinal cord. 10% of Japanese and Chinese Men at 60 years often develop OPLL. It is classified as segmental, continuous, isolated and mixed types. It typically present with weakness in the presence of congenital canal stenosis³.

Decompression and stabilization of spine can be achieved by corpectomy and fusion. A graft is placed to maintain anatomic orientation and vertebral height as well as encouraging stability. To enhance the stability and decrease the chances of graft dislodgment, a plate is placed over the graft and it is screwed into the adjoining vertebral bodies¹³⁻¹⁷.

The aim of this study was to determine the neurological outcome in non-traumatic cervical spine diseases

after corpectomy, bone grafting and Caspar plating. We did this study in patients with spinal cord compression and destabilized spine secondary to degenerative changes, metastases, plasmacytoma, spinal TB and ossified posterior longitudinal ligament.

METHODOLOGY

This study was carried out in patients presenting with non-traumatic cervical spine diseases to the Department of Neurosurgery at Pakistan Institute of Medical Sciences, Sheheed Zulfiqar Ali Bhutto Medical University Islamabad.

All patients of 18-60 years of age who had cervical spine diseases such as cervical spondylosis, metastatic tumors of spine, spinal tuberculosis, ossified posterior longitudinal ligaments and plasmacytoma were included in this descriptive study. These cervical spine diseases were diagnosed on the basis of relevant history, detailed neurological examination and appropriate neuro-imaging techniques. An informed consent was taken from all the patients. Sample size was calculated according to WHO sample size calculator. Eighty one patients were studied during a period of 3 years. All patients with history of trauma, those who had associated co-morbidities and those with redo-surgeries were excluded from the study.

The corpectomy was performed through anterior approach. The bone graft was taken from iliac crest. The graft was shaped according to the size and fixed in position with Caspar and screws. Post op. check X-rays

were carried out to confirm the position of graft and hardware. Surgical outcome was defined as neurological improvement in terms of relief of pain and motor deficits.

Data was collected through structured proforma. SPSS version 16 was used for analysis of data. Descriptive statistics were calculated for the observed data. Frequencies or percentages were computed for categorical data while means and standard deviation were computed for numerical data.

RESULTS

Out of 81 patients, 53 were male while 28 were female; age ranged from 18 to 60 years with mean age of 43.44 ± 12.52 years.

35 patients had cervical spine stenosis secondary to osteophyte and hard disc. The relative frequencies of other cervical pathologies are shown in table 1.

73(90%) of patients presented with neck pain (with or without neck movement), brachialgia, quadriaparesis and urinary retention. Surgical outcome in terms of neurological improvement as relief of pain and motor deficits is shown in table 2. In 11 patients (13.58%) motor deficit did not improve. All of them had signal changes in the cord on MRI and they developed long standing quadriplegia.

DISCUSSION

Surgical decision making is guided by a number of factors including the expected fusion rate. After resection of vertebral body, reconstruction and stabilization of spine is achieved by various methods¹. Titanium mesh inter-body cage, coaxial double-lumen poly-methyl-methacrylate (PMMA) reconstruction, and Endoscopic plate spacer is utilized for stabilization after corpectomy¹⁸⁻²¹. In majority of cases, the vertebral body's

deformity is treated surgically with bone autograft or allograft, silastic tubes, PMMA, titanium inter-body spacers and confines or a combination of these²²⁻²⁸. Stability is then accomplished with anterior cervical plating. Surgical intervention is considered for spinal metastasis with intractable pain, compression of spinal cord and the need for stabilization.

In this study all pathology was anterior so in all cases anterior lateral approach was used. In current study we used the bone graft which was taken from iliac crest for reconstruction which was fixed with Caspar plating after vertebral body resection (figure 2).

Thirty patients with tumors of cervical spine who were treated with anterior cervical plate after corpectomy were studied by Caspar et al¹⁸. It was reported that relief of pain and neurological symptoms was achieved in a significant number of patients (29/30, 96.6%) and rate of construct failure was dramatically reduced.

After corpectomy, cervical spine fusion and stability can be carried out by different approaches, each with its merits and demerits. Patients with cervical spine fractures who underwent anterior cervical plating have better bone fusion and diminished rate of development of complications^{18-21,29-30}.

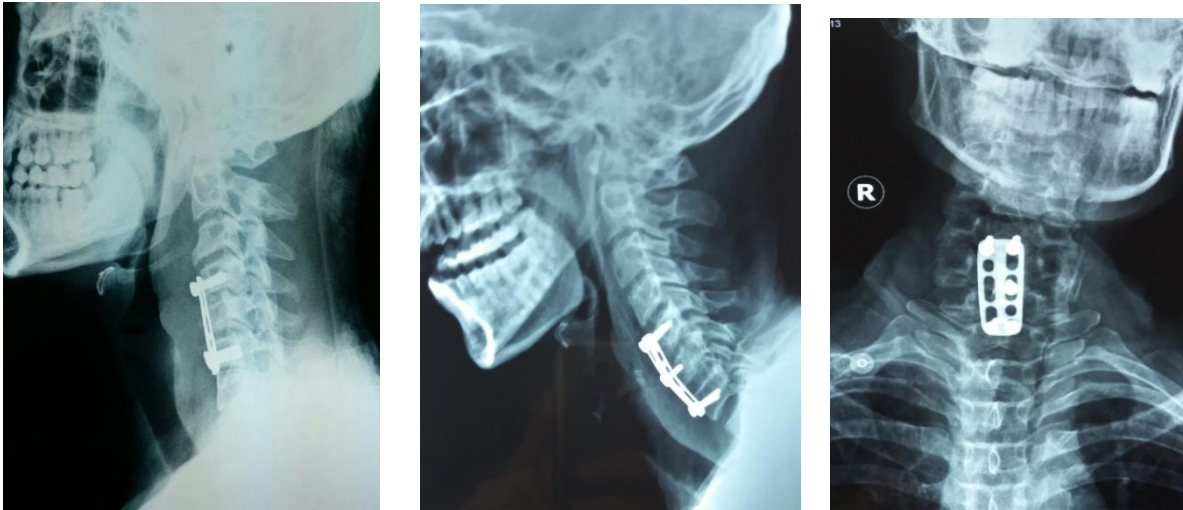
Utilization of PMMA-assisted reconstruction is a reasonable alternative option to bone grafting²¹. Sundaresan et al³¹ performed fusion with PMMA and Steinmann pins in 101 patients with vertebral metastasis. After the corpectomy, Steinmann pins are put into the VBs above and beneath the level of the resection and PMMA is filled in the resection cavity. In 85% of patients pain relief was observed. Postoperatively there was significant increase (from 55 to 78%) in the overall mobility. The reported complications include dislodgment of pins resulting in damage to esophagus and the spinal cord^{32,33}.

Table 1: Frequencies of cervical spine diseases

S. No.	Cervical spine disease	Number of patients (n=81)
1	Cervical spine stenosis secondary to osteophyte and hard disc	35 (43.2%)
2	Cervical stenosis with soft discs at multiple levels	15 (18.5%)
3	Ossified posterior longitudinal ligaments	10 (12.3%)
4	Collapsed vertebra secondary to metastasis	10 (12.3%)
5	Collapsed vertebra secondary to plasmacytoma	7 (8.6%)
6	Collapsed vertebra secondary to old carries	4 (4.9%)

Table 2: Surgical outcome

Clinical Presentation	Improvement after Surgery
Pain	81 (100%)
Motor Deficit	70 (86.41%)

Figure 2: Post-operative x-rays

The neurologic outcome in these patients is not only determined by the adequacy of decompression procedure but also on the duration and severity of symptomatology before surgery. However, the treatment aim in these cases is not curative. Instead these neurosurgical interventions are directed to enhance the quality of life through pain control, protection of neurological function and restoration of stability. Consequently, early mobility may be achieved³⁴⁻³⁵. Some surgeons suggest conservative treatment for solitary metastasis; however a combined anterior and posterior approach for multiple cervical spondylectomy might be warranted¹. Posterior stabilization is especially critical for lesions at the cervico-thoracic junction on the grounds that there is a higher danger of dynamic kyphosis and instability.

A meta-analysis by Fraser et al³⁶ showed that fusion was significantly improved with the use of anterior plates. Based on the involvement of 02 discs versus 03 discs levels, the fusion rates differed between corpectomy alone and corpectomy with plate placement (89.8% vs. 96.2%, $p = 0.0001$, for a 03 disc level disease).

Anterior cervical plate stabilization in conjunction with PMMA is considered an important procedure regarding correction of spine. Perrin and McBroom⁷ devised a strategy to fill the corpectomy defect with PMMA. A U-shaped stainless steel plate with 2-mm guide openings is molded to fit the corpectomy defect. Ono and coworkers³⁷ described the utilization of a ceramic prosthesis utilized in conjunction with PMMA to increase fixation. In a study, 18 patients underwent this procedure and showed pain relief in 94.1% cases. Improvement was observed in 91.7% of those patients who had preoperative motor deficit while 87.5% achieved mobility after surgery.

CONCLUSION

In our study corpectomy, bone grafting and fixation with Caspar plating had a good neurological outcome in non-traumatic diseases of lower cervical spine. Individualization of the patients for corpectomy, bone grafting and Caspar plating is important for desired success rate of the procedure.

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CONTRIBUTORS

MK conceived the idea, planned the study, and drafted the manuscript. UF helped acquisition of data. EA, SK and KUZ did statistical analysis and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.