

Management of Cervical Myelopathy Using Motion Sparing Techniques

*A systematic review of literature
Essay
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By
Girgis Atia Aziz
(M.B.B.CH)

Under Supervision Of
Prof. Dr. Ahmed El Badrawy
*Assistant Professor of Orthopedic surgery
Faculty of Medicine
Ain Shams University*

DR. Mohamed Zayan
*Lecturer of Orthopedic surgery
Faculty of Medicine
Ain Shams University*

*Faculty of Medicine
Ain Shams University*

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Girgis Atia Aziz

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ABSTRACT

Background: Despite extensive clinical experience with surgical management of cervical myelopathy, the idea of motion preservation remains unclear. The authors sought to comprehensively review the laminoplasty and oblique corpectomy literature spanning from January 1, 2000, to December 31, 2016 while focusing effects of laminoplasty and oblique corpectomy techniques on neurological outcome, spinal deformity and cervical ROM.

AIM OF THE STUDY: is to provide an updated comprehensive review of literature about management of cervical spondylotic myelopathy using motion sparing techniques.

METHODS: The authors conducted a literature survey of the Medline database, in which the terms “laminoplasty,” “laminectomy,” “posterior cervical spine procedures” and “oblique corpectomy” were used as key words spanning from January 1, 2000, to December 31, 2016.

RESULTS: A total of 11 studies for laminoplasty and 4 for oblique corpectomy met our inclusion criteria. These studies described a total of 439 laminoplasty and 431 MOC patients at the period between 2000-2016. The mean follow up period was 68.1 and 48.75 months for laminoplasty and OCC respectively. The mean JOA score improved from being 10.64 ± 2.97 preoperatively to 14.1 ± 2.24 postoperatively for laminoplasty and from 10.4 ± 3.03 preoperatively to 14.85 ± 2.76 postoperatively for OCC. Subaxial laminoplasty prevented postoperative kyphotic deformity with the mean C2-C7 angle decreased only from $15.48 \pm 12^\circ$ preoperatively to $14.77 \pm 11.57^\circ$ postoperatively, for OCC the mean C2-C7 angle decreased from $10.33 \pm 9.8^\circ$ to $8.5 \pm 8.03^\circ$. The mean ROM decreased by 32.724% after surgery for laminoplasty and by 35.5% for OCC.

CONCLUSION

The idea of a motion-sparing technique is the largest benefit when comparing laminoplasty to a laminectomy, and OCC to the anterior transcorporeal approach. A thorough decompression of the spinal canal and mobility is preserved postoperatively close to that of a preoperative spine, reducing the risk for adjacent segment disease.

Keywords: “laminoplasty,” “laminectomy,” “posterior cervical spine procedures” and “oblique corpectomy”

ABBREVIATIONS JOA = Japanese Orthopaedic Association; ROM = range of motion; OCC = Oblique Cervical Corpectomy

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List of Abbreviations

Abb.	Full term
ACDF	Anterior cervical discectomy and fusion
BMP	Bone morphogenic protein
CL	Cervical laminoplasty
CSM.....	Cervical spondylotic myelopathy
CT	Computed tomography
CV.....	Cervical vertebra
EL	Expansive laminoplasty
JOA.....	Japanese Orthopedic Association
LF	Ligamentum Flavum
MRI.....	Magnetic resonance imaging
NSAID	Non steroidal anti-inflammatory drugs
OCC	Oblique cervical corpectomy
OPLL	Ossified posterior longitudinal ligament
PLL	Posterior longitudinal ligament
ROM.....	Range of movement
VA	Vertebral artery

INTRODUCTION

Cervical spondylotic myelopathy (CSM) is a condition in which compression of the spinal cord results from degenerative changes and spine instability. Two main causes of this condition are cervical spondylosis (CS) and ossification of the posterior longitudinal ligament (OPLL).⁽¹⁾

Although typically symptoms appear without obvious predisposing factors and progress slowly, CSM is triggered by trauma and advances rapidly in some cases. Conservative treatment is rarely successful in ameliorating the symptoms or decelerating disease progression, and therefore immediate surgical intervention is of crucial importance.⁽²⁾

After the introduction of laminoplasty by Hirabayashi in 1977, expansive laminoplasty (EL) has become an attractive treatment option for cervical spondylotic myelopathy.⁽³⁾

Thus, EL has been deemed a superior alternative to laminectomy or laminectomy and fusion for patients with cervical myelopathy as it may decrease the incidence of progressive spinal deformity and prevent the need for subsequent spinal stabilization when compared with laminectomy.⁽⁴⁾

The oblique cervical corpectomy (OCC) has slowly emerged as an established method of decompressing the spine in patients with cervical spondylotic myelopathy (CSM).⁽⁵⁾

The reason it is attractive that it allows for a long segment of decompression (up to five levels) without the need for a bone graft or instrumentation as its proponents claim that stability and sagittal alignment are maintained.⁽⁶⁾ Central corpectomy, on the other hand, is destabilizing; and grafting with or without instrumentation is mandatory.⁽⁷⁾

AIM OF THE WORK

To provide an updated comprehensive review of literature about management of cervical spondylotic myelopathy using motion sparing techniques.

ANATOMY OF CERVICAL SPINE AND VERTEBRAL ARTERY

The Cervical Spine:

The first and second cervical vertebrae are atypical in both their structure and function compared to the other cervical vertebrae. Weight bearing between them and the base of the skull is not via the vertebral bodies and intervening disc, like the other vertebrae, but rather via articulations that enable greater movement than other individual motion segments of the spine.⁽⁸⁾

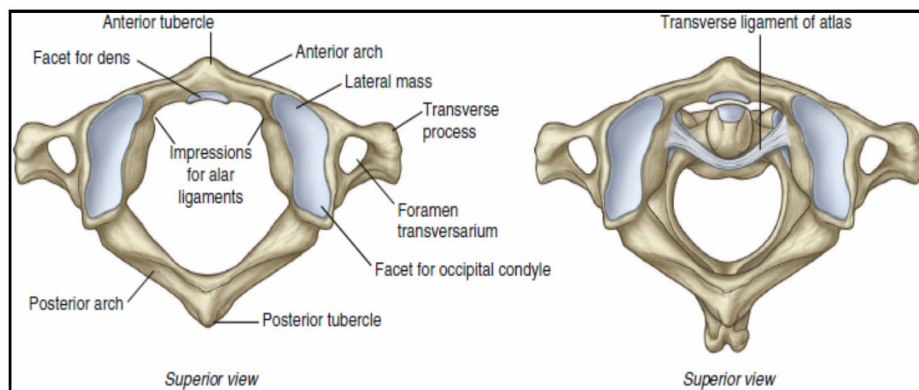


Figure (1): The atlas.⁽¹⁸⁾

Subaxial cervical spine

An image of a typical cervical vertebra is illustrated in (Fig. 2). During development, the costal elements form the anterior tubercle, the costotransverse bar and the tip of the posterior tubercle produce the vertebral foramen. The vertebral

artery typically passes up through the vertebral foramen from C6 to C1, while the vertebral foramen in the lateral mass of C7 contains only the vertebral venous plexus. The vertebral artery passes anterior to the lateral mass of C7. The spinous processes of the typical cervical vertebrae are usually bifid and relatively short. Spinous processes elongate in the lower segments with the C7 level being transitional between the cervical and thoracic region. The spinous process of C7, the vertebra prominens, can be easily palpated posteriorly at the base of the neck and is not typically bifid.^(8,9)

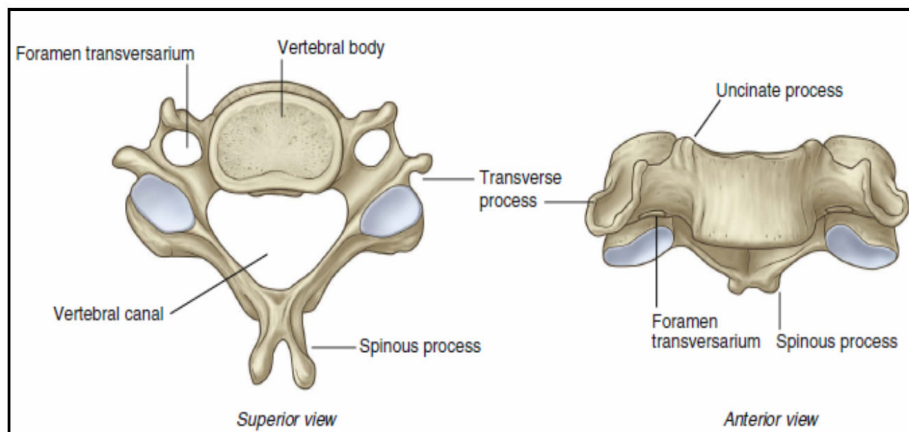


Figure (2): Typical cervical vertebra.⁽¹⁸⁾

Each mobile segment, excluding the articulation between the occiput and C1, and C1 and C2, articulates via a three-joint complex. Anteriorly, there is a fibrous articulation via the intervertebral disc, comprised of an outer tough fibrous *annulus fibrosus* and the central *nucleus pulposus*, and posteriorly two synovial facet or *zygapophyseal* joints.^(8,9,10)

Ligamentous elements are vital in relation to the maintenance of intervertebral stability, the intervertebral disc being the most significant of these structures, but other elements such as the the anterior longitudinal ligament which runs from the occiput to the sacrum and the posterior longitudinal ligament originates from the axis, continuing to the coccyx. The ligamentum flava extends from the lower half of the anterior aspect of one lamina to the upper border of the lamina below and blends laterally with the facet joint capsule. Thus, for the inferior half of the lamina, the ligamentum flavum sits between the lamina and the dura.^(11,12)

The interspinous and supraspinous ligaments are important, along with the posterior longitudinal ligament and facet capsule, in providing a posterior tension band to resist excessive distraction of the posterior elements in flexion. The anterior annulus fibrosus and anterior longitudinal ligament are the principal structures resisting hyperextension. Just about all ligaments act in some way to resist torsion, but it is the annulus and the orientation of the facet joints along with their capsule that are the primary structures resisting this movement.^(10,12)

Muscular elements cannot be ignored when considering both the stability and function of the spine. Suffice to say that without the maintenance of balanced, toned and appropriately coordinated muscle activity, the function and stability of the spine may be significantly compromised.⁽¹¹⁾

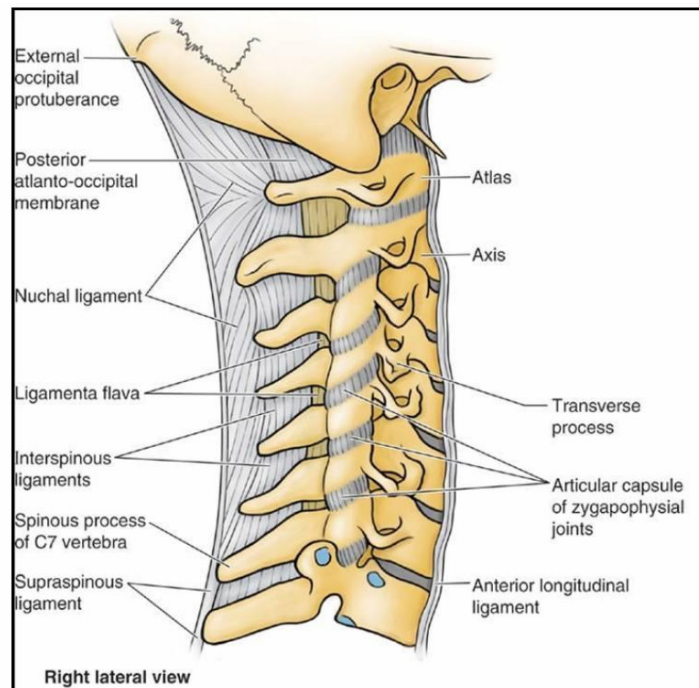


Figure (3): Ligaments of the cervical spine.⁽¹⁹⁾

The Vertebral Artery:

The paired vertebral arteries are the first and largest branches of the subclavian arteries. They arise from the subclavian arteries, usually ascend through the transverse processes of the upper six cervical vertebrae, pass behind the lateral masses of the atlas, entering the spinal canal and pierces the dura and arachnoid mater and inclines medially to the front of the Medulla Oblongata where, at the lower border of the Pons, it unites with the opposite artery to form the basilar artery.⁽¹³⁾