

ANTERIOR APPROACH PROCEDURES VERSUS POSTERIOR APPROACHES AS A SURGICAL CHOICE IN MANAGEMENT OF CERVICAL SPONDYLOTIC MYELOPATHY

A Systematic Review

*A research protocol submitted in partial fulfillment of the
Requirements for the Degree of Master of Science in
Neurosurgery*

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2015**



I would like to begin by thanking **ALLAH** for his guidance and protection, may this blessing always guide us.

Moreover I would like to express my sincere and profound gratitude to

Prof. Dr. Mohammed Wael Samir, Professor of Neurosurgery, Faculty of medicine, Ain Shams University, for his meticulous supervision, loyal encouragement and valuable advises throughout the work.

I wish to express deep appreciation to ***Assist. Prof. Dr. Ahmad Faisal Toubar***, Assistant Professor of Neurosurgery, Faculty of medicine, Ain Shams University, for his continuous guidance, unique supervision and kind care.

I am also grateful to ***Dr. Ahmed Hassan Abou-Zeid***, Lecturer of Neurosurgery, Faculty of medicine, Ain Shams University, for his kind effort, assistance he offered me throughout the performance of this work.

Dr. Wael M.B. Ashour

Dedications

To my dear **Father** and **Mother**
who supported me in my whole life

 ***Wael M.B. Ashour***



وَأَنْزَلَ اللَّهُ عَلَيْكَ
الْكِتَابَ وَالْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ تَكُنْ
تَعْلَمُ وَكَانَ فَضْلُ اللَّهِ
عَلَيْكَ عَظِيمًا

صدق الله العظيم

سورة النساء الآية
(113)

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List of Abbreviations

<i>Abbreviation</i>	<i>Full meaning</i>
CSM	Cervical spondylotic myelopathy
OPLL	Ossification of posterior longitudinal ligament
ACDF	Anterior cervical discectomy and fusion
ACCF	Anterior cervical corpectomy and fusion
CDR	Cervical disc replacement
SAC	Space available for the cord
MRI	Magnetic resonance imaging
PLL	Posterior longitudinal ligament
PREZ	Posterior root entry zone
AREZ	Anterior root exit zone
CSF	Cerebrospinal fluid
PICA	Posterior inferior cerebellar artery
ALL	Anterior longitudinal ligament
CAA	Clivo-axial angle
DAI	Diffuse axonal injury
UMNL	Upper motor neuron lesion
JOA score	Japanese Orthopedic Association score
mJOA score	Modified Japanese Orthopedic Association
CT	Computed tomography
A-P view	Antero-posterior view
NSAIDs	Non-steroidal anti-inflammatory drugs
COX	Cyclooxygenase

<i>Abbreviation</i>	<i>Full meaning</i>
PEEK	Polyetheretherketone
RLN	Recurrent laryngeal nerve
sACCF	Segmental anterior cervical corpectomy and fusion plus preservation of middle vertebrae
DCF	Discontinuous corpectomy and fusion with reservation of the middle vertebra
PCB system	Plate cage benzech
PLAF	Posterior laminectomy and fixation
CLF	Cervical laminectomy plus fusion
ROM	Range of motion
SD	Sagittal diameter of the dural sac at maximum compression
NDI	Neck disability Index
SF-36	Short Form-36

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I- Introduction:

a) Rationale and justification of the study:

Cervical spondylotic myelopathy (CSM) is a common degenerative disorder results from degeneration of structures of the cervical spinal column leading to narrowing of spinal canal resulting in neurological impairment which leads to reduced patient's independence and quality of life.¹ The exact pathogenesis of CSM remains uncertain however we know that it involves static factors resulting in congenital or acquired stenosis of the cervical canal, and dynamic factors which involve repetitive injury to the cervical spinal cord.²

Static mechanical factors include: Acquired spinal stenosis, spondylosis, disc degeneration, OPLL, ossification or calcification of ligamentum flavum. Congenital stenosis is highly correlated with development of CSM later in life.² Dynamic mechanical factors as in extremes of flexions or extensions would cause narrowing of spinal canal by buckling ligamentum flavum or shingling the lamina.²

The clinical presentation of patients suffering from CSM ranges from subtle findings such as decline in hand dexterity and gait difficulties to severe problems such as incontinence or complete paralysis.³ Most authors will agree that the natural history of CSM is not well known or well predicted but it's found that patients treated conservatively tend to deteriorate over time. However early treatment has been found to alter the prognosis in patients treated within one year of onset of symptoms.⁴

While conservative management could benefit patients with mild symptoms as shown by some studies such as (Oshima et al) and (Sumi et al)⁵ controversy surrounds conservative management for patients with severe compressive myelopathy and ultimately most patients with CSM will eventually undergo surgery.⁶ The Aim of surgery in CSM is to achieve adequate decompression of spinal cord

and nerve roots. In cases of single or multilevel discectomy anterior approach is usually adequate, but if the compression extends behind the posterior aspect of the vertebral body, it's then necessary to perform either a corpectomy (Anterior approach) or a laminectomy (Posterior approach) in order to achieve the optimal decompression. The choice between anterior, posterior, or combined approaches has long been an unresolved controversy. Selection requires taking into account both patient's clinical presentation and radiographs.⁷

Anterior surgical techniques includes: Anterior cervical discectomy and fusion (ACDF), Anterior cervical corpectomy and fusion (ACCF), and Cervical disc replacement (CDR).⁸ Posterior approach is widely thought to be ideally suited for patients with multilevel CSM, patients with preserved cervical lordosis, and those with alkylosed spines.⁹ Posterior surgical techniques includes: Laminectomy w/o fixation and laminoplasty. Laminoplasty was developed to avoid kyphosis and instability associated with conventional laminectomy.⁹

To summarize, there is an old dated controversy regarding the best approach for managing CSM, and the best option is still debated upon, and that gap of knowledge was the motive behind this study. In this systematic review we tried to make an extensive and comprehensive analysis of literature over a 25 years of knowledge accumulation. We sought to identify comparative studies (e.g., randomized controlled trials, cohort studies) comparing anterior with posterior procedures in patients with 3-level or greater cord compression resulting in CSM. We hoped at the end of this review that one may conclude with confidence whether one of these surgical approaches is superior in terms of patient outcomes and/or complication profiles, However, as we will discuss in details, That selection turned out to be extremely challenging and no clear advantage could be shown to be statistically solid in weighting a certain approach over the other.

b) Aim:

To compare between the outcomes of posterior approaches versus anterior approaches in management of multilevel cervical spondylotic myelopathy.

c) Objectives:

A systematic review of the literature was conducted to weigh, analyze, and compare the effectiveness (regarding the neurological and functional outcome) of different modalities of posterior approaches versus the other well known anterior approaches in management of cervical spondylotic myelopathy.

II- Review of literature:

a) History:

In this brief historical overview, we will try to sweep rapidly over the history of spine surgery, starting from the pre-historic era and all along till the present day. We will focus of course on the neck and the cervical spine, more specifically the degenerative rather than the traumatic disorders.

1) Ancient Egypt:

Imhotep (1300 BC) considered by many to be the father of the Egyptian medicine, As he was the most distinguished physician in the ancient Egyptian era; This period of time provided us with the oldest written materials on specific medical and surgical techniques. Among thousands of documents retrieved the most relevant were the three famous papyri, the Ebers, Hearst, and the most well-known; Edwin Smith papyri.¹⁰⁻¹²

Forty-eight cases are presented in the Edwin Smith papyrus, including those dedicated to the disorders of spine and cranium. Each case includes a diagnosis followed by a prognosis. It appears that during that period that the concept of intradural surgery was remote and most surgical techniques was likely extradural, confined to removing bone fragments and other objects compressing the spine.^{13, 14}

2) Ancient India:

The use of spinal traction was reported in the ancient Indian classic *Srimad Bhagwat Mahapuranam*, which is estimated to have been written between 3500 and 1800 B.C. In this epic, one story tells of Lord Krishna correcting the hunchback of one of his followers. This is the earliest known account addressing the correction of spinal deformity.¹⁵

3) **GREEK AND BYZANTINE ERA:**

The Greek medicine can be divided into two periods. The first period, Which we can call the mythological period, began with the Trojan War and lasted until the Hippocratic period, This period was associated with mysticism and belief of certain “gods of health” Not much data can be attributed to this period related to spine surgery. The second period was the scientific period, which began during the time of Hippocrates and ended with Paulus of Aegina.¹⁶ Hippocrates, considered by many to be “The Father of Medicine” was the icon of the scientific period and was able to free the art of medicine from the influence of the “supernatural”.¹⁶

Hippocrates focused on the anatomy and pathology of the spine. He realized that the spine was held together by ligaments, muscles, and the intervertebral discs, and correctly described the normal curvatures of the spine.¹⁷

After Hippocrates by 65 years comes Herophilus of Chalcedone. Studied at the academic center in Alexandria, he was the first to introduce dissections on human subjects. He contributed to the anatomical knowledge of the nerves and nervous system by dividing it into sensory and motor tracts. The next breakthrough was carried out by Galen, the famous physician of the Roman empire. Galen made some important contributions to the anatomy and disorders of the spine, His approach was more experimental and he was more liberal in performing surgeries than his Hippocratic and Alexandrian counterparts. It is noteworthy to point out that it was Galen who coined the words, kyphosis, lordosis, and scoliosis.^{16, 18-20} By the end of the Roman era and at the dawn of the Byzantine period there were already many scholars characterized by the investigative attitude. The most prominent of this epoch was Paulus of Aegina who performed the first laminectomy in recorded history.^{18, 19, 21}