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Outcome of Surgical Fixation to Cervico-Thoracic region: A Systematic Review and meta-analysis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

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INTRODUCTION

Surgical fixation of the cervicothoracic spine is difficult due to the complex anatomy and biomechanical properties of this area. Several important vascular, visceral and soft tissue structures make access to this region challenging and knowledge of these structures is essential for decompression and fixation.

Pathologies at the cervicothoracic junction are relatively uncommon but include infections (bacterial or tuberculous), fractures (trauma, primary bone tumors, meningeal tumors) congenital connective tissue and skeletal disorder and disc herniation ⁽¹⁾.

Up to 80% of the unstable cervicothoracic pathologies can be accompanied with neurological deficit and require surgical treatment. Unfortunately, injuries to this area are often missed on routine radiological studies ⁽²⁾. The goals of surgery are decompression, immediate stabilization, restoration of the spine alignment for early rehabilitation.

Posterior approach is commonly used in many disease of the spine but is inadequate when targeting the anterior spinal elements and thus, it can result in a higher complication rate and can disturb spinal stability ⁽³⁾. For these reasons, different posterolateral and anterior approaches have been developed.

The first posterolateral approach described was the costotransversectomy which gave a good exposure to the middle and lower thoracic spine but was inadequate to approach the upper thoracic region ⁽⁴⁾. In 1976, Larson and colleagues ⁽⁵⁾ developed a lateral extracavitary approach, which provided a better exposure to the middle and lower thoracic spine with less complications and morbidity rate. However, this approach was limited by the shoulder girdle for exposure of the upper thoracic spine. In 1991, a lateral parascapular extrapleural operation was described and provides exposure to the upper thoracic spine up to C7 end plate ⁽⁶⁾.

Anterior, supraclavicular approaches to the cervicothoracic junction, were firstly described by Jonesco and Brunig in 1923 ⁽⁷⁾. However exposure of the thoracic region was restricted by the presence of the clavicle, so the transclavicular and transmanubrial approach was developed by Sundaresan and colleagues ⁽⁸⁾ in 1984 and modified by Birch and colleagues ⁽⁹⁾ in 1990.

AIM OF THE WORK

The aim of this review is to compare these different surgical approaches, indicating pathologies, outcomes and complications.

Chapter 1

SURGICAL ANATOMY

I. Surgical anatomy of posterior subaxial spine and cervico-thoracic junction

a. Surface Anatomy and Bony Landmarks

Several landmarks can be palpated on the posterior aspect of the cervical spine. Superiorly, the external occipital protuberance marks the midline of the occipital region. More laterally, a small bony bridge, the superior nuchal line, can be felt. Inferiorly and more lateral, the mastoid process can be palpated. The tip of the transverse process of the atlas lies just inferior to the tip of the mastoid process. The spinous processes of the cervical spine mark the posterior midline and could be palpated through the ligamentum nuchae. The most superior spinous process is that of the axis vertebra and is quite large and can be easily felt while the spinous processes of C3–C6 are bifid and located slightly more deep. The C7 and T1 spinous processes are more pronounced and not bifurcated. The zygapophysial joints are found about 25 mm lateral from the midline (fig 1).

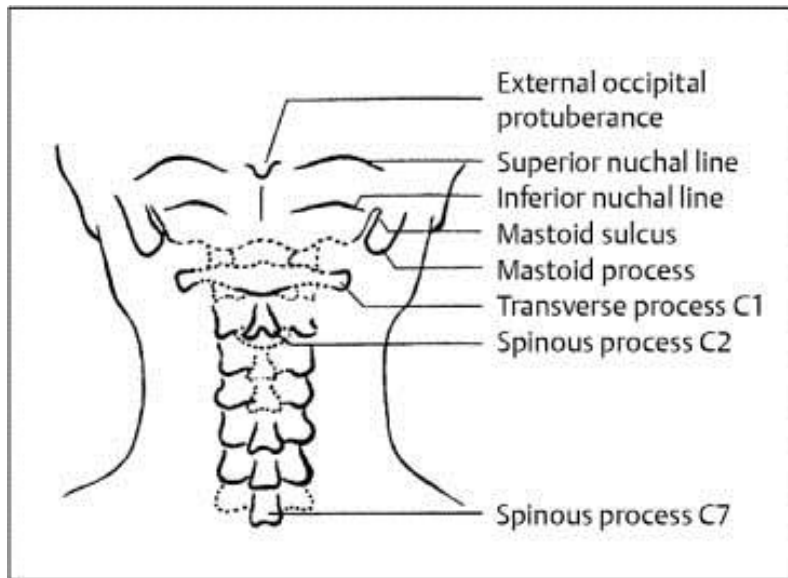


Fig. 1: Bony landmarks of posterior cervical spine

b. Relevant Muscular Anatomy

The posterior aspect of the cervical and the upper thoracic spine are covered by six muscle layers ^(10, 11).

Deep to the skin and the subcutaneous tissue, **the first layer**, is formed by the trapezius and the sternocleidomastoid muscles. They both insert to the occipital bone and are covered by the superior nuchal fascia.

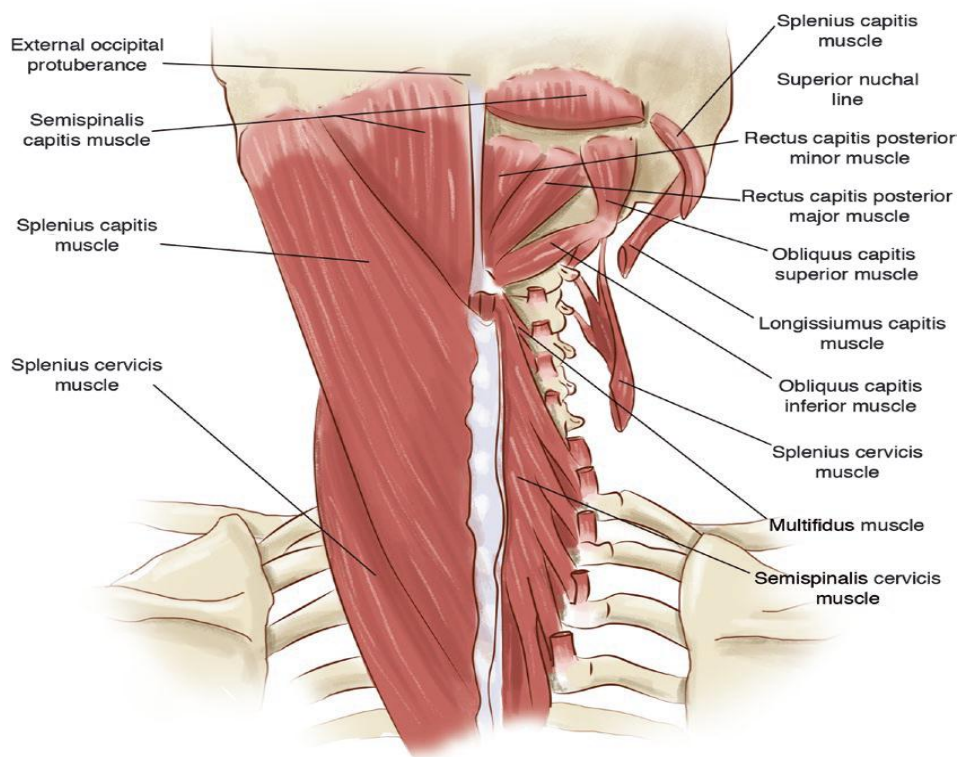


Fig. 2: Picture shows the 4–6th layers of the neck muscles.

The **second layer** includes three muscles: the levator scapulae, the rhomboid minor muscle and the rhomboid major muscle. They lie deep to the trapezius muscle and are inserting on the medial border of the scapula.

The **third layer** is formed by the serratus posterior superior muscle, a thin quadrangular muscle, the **fourth layer** is formed by the splenius capitis muscle, a thin and flat muscle covered by the deep nuchal fascia.

The **fifth layer** is formed by a large group of back muscles called the erector spinae located just deep to the

splenius capitis muscle. They can be divided into three groups of muscles: the group of the iliocostalis, the longissimus and the spinalis muscles (from lateral to medial). Each of them can be divided according to their insertion into three subgroups: thoracis, cervicis, and capitis.

The **sixth layer** contains transversospinalis group of muscle which is the most important segmental stabilizers of the spine. They generally originate from transverse processes and attach to spinous processes. This muscle group is made up of the semispinalis, multifidus, and rotatores muscles (Fig 2).

c. The ligamentum nuchae

The ligamentum nuchae can be compared the supraspinous and interspinous ligaments of the thoracic and lumbar spine (Fig 3).

Its function is to resist flexion of the cervical spine ⁽¹²⁾. It is composed of two parts:

- The superficial part is strong and forms the funicular portion, made of a thick fibroelastic membrane extending between the external occipital protuberance and the spinous process of C7. It joins the superficial and deep cervical fascias and the aponeurosis of the trapezius muscle.
- The deep part, the lamellar portion is made by a double-walled septum separating the multiple layers of the muscles