

ANESTHETIC CONSIDERATIONS FOR CERVICAL SPINE SURGERY

Thesis

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Anesthesia

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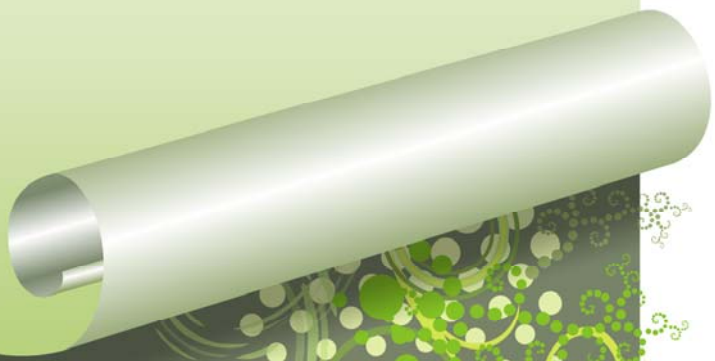
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Dedication

To ...

The soul of my great Father



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INTRODUCTION

The spectrum of spinal surgery in adult life is considerable. Anaesthesia for major spinal surgery, such as spinal stabilization following trauma or neoplastic disease, or for correction of scoliosis, presents a number of challenges. Patients commonly have preoperative co-morbid conditions such as serious cardiovascular and respiratory impairment. Airway management may be difficult.

Surgery imposes further stresses of significant blood loss, prolonged anaesthesia, and problematical postoperative pain management. The advent of techniques to monitor spinal cord function has reduced postoperative neurological morbidity in these patients. The anaesthetist has an important role in facilitating these methods of monitoring (*Raw et al., 2003*).

Both adult and paediatric patients present for spinal surgery, which may be elective or urgent. They mainly present with one of five pathologies: trauma, infection, malignancy, congenital, or degenerative disease.

The challenge to the anaesthetist is to provide optimal surgical conditions whilst ensuring adequate

oxygenation to the brain and spinal cord, and facilitating the use of intraoperative spinal cord monitoring techniques if appropriate. Also to decrease postoperative complications (*Raw et al, 2003*).

AIM OF THE WORK

The aim of this essay to highlight significant anesthetic considerations in patients undergoing cervical spine surgeries.

CERVICAL SPINE ANATOMY

The cervical spine is made up of the first seven vertebrae in the vertebral column (Fig. 1). It starts just below the skull and ends at the top of the thoracic spine. The cervical spine has a backward "C" shape (lordotic curve) and is much more mobile than either of the thoracic or lumbar region (*Michael, 2001*).

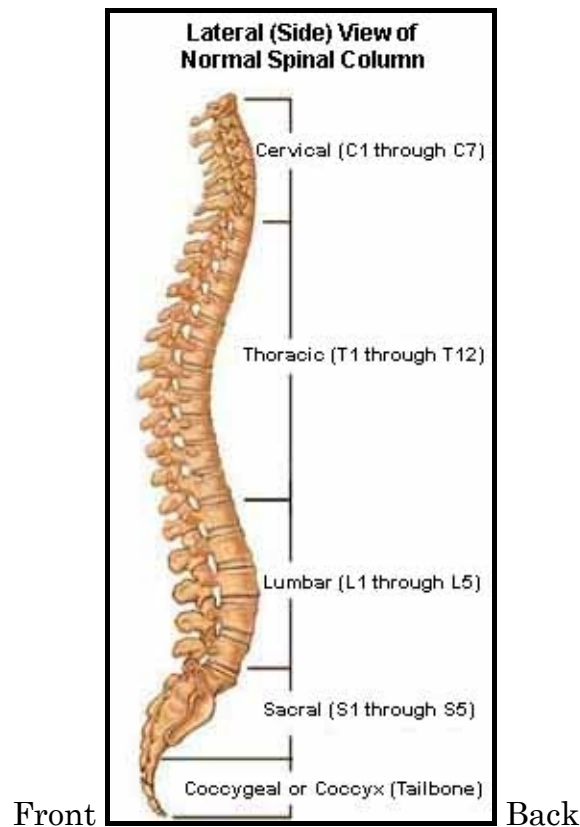


Fig. (1): Lateral (side) view of normal spinal column (*Michael, 2001*).

The first two vertebral bodies in the cervical spine are called the atlas and the axis (Fig.2). The atlas and axis vertebrae in the cervical spine differ from all other vertebrae because they are designed primarily for rotation. The atlas has a thick forward (anterior) arch and a thin back (posterior) arch, with two prominent masses (*Stewart, 2006*).

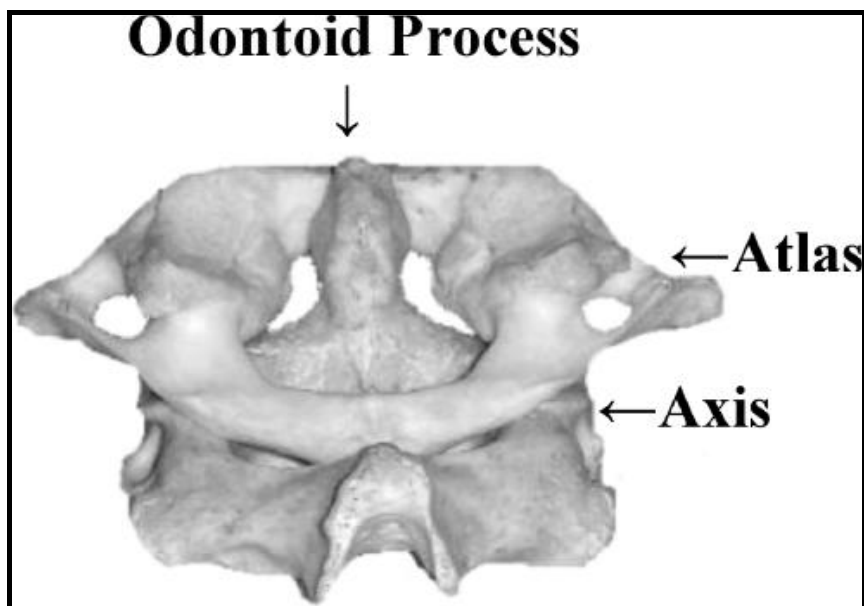


Fig. (2): Posterior view for C1 (atlas) and C2 (axis) (*Raw et al., 2003*).

The axis sits underneath the atlas and has a bony knob called the odontoid process that sticks up through the hole in the atlas and this mechanism that allows the head to turn from side to side. It is conceptually easiest to divide the neck into two portions: 1) the subaxial spine (below the "axis" of C2)

and the upper (or atlanto -axial) portions spine (which includes the skull base). Subaxial vertebrae are similar to normal vertebrae, having a vertebral body, lamina, spinous processes, transverse elements etc... The vertebrae of the atlanto-axial spine are quite different. Between each vertebra in the cervical spine are discs which act as cushions or shock absorbers and also permit some movement between the vertebral bodies. In addition to the intervertebral discs, special joints between each of the vertebral bodies, called facet joints, allow the individual bones of the spine to move and rotate with respect to each other (*Michael, 2001*).

C1 (the atlas): C1 is a ring, with large superior and inferior articular surfaces, which interact with the skull base above and C2 below, respectively. It has no vertebral body and no spinous process.

C2 (the axis): A very unusual structure. Its most unusual feature is the dens or odontoid process, a thumb-like extension of the vertebral body, which extends upward to pass through the arch of C1. The odontoid process (OD) is located just behind the anterior arch of C1.

The typical cervical vertebrae are C3-6 (Fig. 3). Each of these has a small flattened body and a triangular relatively large vertebral foramen.

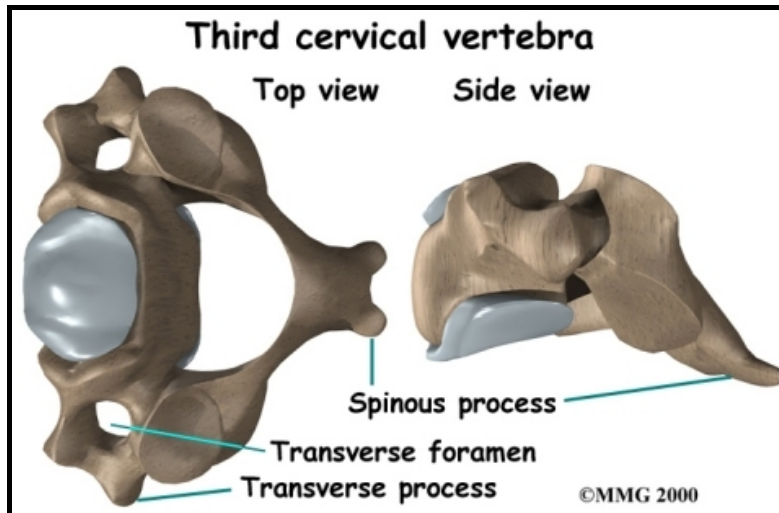


Fig. (3): Third cervical vertebra (*Michael, 2001*).

Ligaments of Cervical vertebrae:

The individual vertebrae are linked to each other by a complicated system of intervertebral facets and ligaments. The upper cervical ligament system is especially important in stabilizing the upper cervical spine from the skull to C2. Although the cervical vertebrae are the smallest, the neck has the greatest range of motion. A complex series of ligaments binds the occiput, atlas and axis as follows:

Occipitoatlantal Ligament Complex (Atlas):

These four ligaments run between the Occiput and the Atlas:

- Anterior Occipitoatlantal Ligament
- Posterior Occipitoatlantal Ligament
- Lateral Occipitoatlantal Ligaments (2)

Occipitoaxial Ligament Complex (Axis)

These four ligaments connect the Occiput to the Axis:

- Occipitoaxial Ligament
- Alar Ligaments (2)
- Apical Ligament

Atlantoaxial Ligament Complex (Axis)

These four ligaments extend from the Atlas to the Axis:

- Anterior Atlantoaxial Ligament
- Posterior Atlantoaxial Ligament
- Lateral Ligaments (2)

Cruciate Ligament Complex

These ligaments help to stabilize the Atlantoaxial (Axis) complex:

- Transverse Ligaments
- Superior Longitudinal Fascicles
- Inferior Longitudinal Fascicles

Beside the above the above mentioned ligaments, there are other so called primary spinal ligaments, summarized in table-1.

Ligaments**Table (1): Primary Spinal Ligaments**

Ligament	Spinal Region	Limits
Alar	Axis-skull	Head rotation and lateral flexion
Anterior Atlantoaxial	Axis and Atlas	Extension
Posterior Atlantoaxial	Axis and Atlas	Flexion
Ligamentum Nuchae	Cervical	Flexion
Anterior Longitudinal	Axis-Sacrum	Extension and reinforces front of annulus fibrosis
Posterior Longitudinal	Axis-Sacrum	Flexion and reinforces back of annulus fibrosis
Ligamentum Flavum	Axis-Sacrum	Flexion