Antiischemic Effects of High Thoracic Epidural Anesthesia in Patients with Coronary Artery Disease Undergoing Elective Non-Cardiac Surgery

Thesis

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List of Abbreviations

ACS	Acute coronary syndrome
CAD	Coronary artery disease
CK-MB	Creatine kinase iso-enzyme MB
cTnT	Cardiac troponin T
DBP	Diastolic blood pressure
ECG	Electrocardiogram
EF%	Ejection fraction %
HR	Heart rate
HTEA	High thoracic epidural anesthesia
PCI	Pecutaneous coronary intervention
PMI	Perioperative myocardial infarction
PTCA	Pecutaneous transluminal coronary angioplasty
SBP	Systolic blood pressure
TRI	Transient radicular irritation

INTRODUCTION

Perioperative myocardial infarction is an important cause of serious morbidity and mortality associated with anaesthesia and major surgery ***(National Center for Healthy Statistics, ١٩٨٨)***.

Prevention of perioperative myocardial ischemia is essential to avoid potentially fatal metabolic, electrophysiological, and mechanical dysfunction of the heart ***(Berendes et al., ٢٠٠٣).***

The entire perioperative period is stressful characterized by autonomic and physiological changes ***(Marty et al., ١٩٩٠)***.

The response to surgical stress and pain is characterized by increased catabolism and sympathetic activity ***(Moller et al., ١٩٨٠)***.

The latter is linked to myocardial ischemia and infarction and probably related to changes in myocardial O_2 supply and demand ***(Rocco et al., ١٩٨٧)***.

Coronary blood flow is regulated primarily by local metabolic factors; those factors, however, may be competitively or complementarily modified by cardiac neural control ***(Feigl , ١٩٩٨).***

In patients with coronary atherosclerosis and endothelial dysfunction, an abnormally augmented response to coronary α-adrenergic activation has been shown to result in a reduced coronary blood flow response during sympathetic stimulation ***(Heusch et al. , ٢٠٠٠).***This phenomenon is believed to reflect a disturbance of the balance between coronary endothelial vasodilatory function and vasoconstrictor effects of myocardial sympathetic tone ***(Vita et al., ١٩٩٢).*** Inhibition of the cardiac sympathetic nerve innervation in such patients might therefore alleviate abnormalities of coronary function ***(Nygård et al., ٢٠٠٥).***

Inhibition of the sympathetic nervous outflow to the heart may be achieved by high thoracic epidural analgesia (TEA). During TEA, cardiac noradrenaline spillover decreases and thoracic cutaneous blood flow increases consistently with regional inhibition of the sympathetic tone ***(Nygård et al., ٢٠٠٢).***

In patients with ischemic heart disease, TEA has been evaluated as an adjunctive treatment for refractory chest pain during stable and unstable angina pectoris***(Olausson et al., ١٩٩٧)*** and for improving postsurgical recovery after CABG ***(Scott et al., ٢٠٠٣)***. On the other hand, it remains unclear to what extent these apparently beneficial effects of TEA are mediated by changes in myocardial blood flow or whether they are merely the result of improved pain relief ***(Nygård et al., ٢٠٠٥).***

AIM OF THE WORK

The aim of this work is to evaluate anti-anginal and anti-ischemic effect of high thoracic epidural anesthesia in perioperative period in patients with coronary artery disease undergoing elective non-cardiac surgery.

ANATOMICAL ASPECTS

١) Vertebrae:

The spine consists of ٣٣ vertebrae (٧ cervical, ١٢ thoracic, ٥ lumbar, ٥ fused sacral, and ٤ fused coccygeal). With the exception of C١, the cervical, thoracic, and lumbar vertebrae consist of a body anteriorly, two pedicles that project posteriorly from the body, and two laminae that connect the pedicles. These structures form the vertebral canal, which contains the spinal cord, spinal nerves, and epidural space. The laminae give rise to the transverse processes that project laterally and the spinous process that project posteriorly. ***(Bernards, ٢٠٠٦)***.

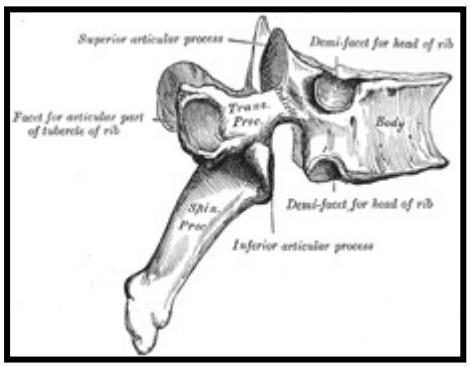

Figure ١: A thoracic vertebra
(Scott, ١٩٨٩)

The spinous processes of the thoracic vertebrae vary considerably in their angulation . The ١st , ٢nd ,١٠th ,١١th and ١٢th are , like the lumbar vertebrae, almost horizontal in the sagittal plane and allow a needle to be inserted at or near ٩٠° to the skin. The other thoracic spinous processes are angled downwards to a greater or lesser extent and this required a different technique to ensure entrance into the epidural space (Figure ١) ***(Scott, ١٩٨٩).***

٢) Ligaments:

The vertebral bodies are stabilized by five ligaments that increase in size between the cervical and lumbar vertebrae. The supraspinous ligament, the interspinous ligament, the ligamentum flavum, the anterior and posterior longitudinal ligaments ***(Hogan, ١٩٩١)***

٣) Epidural Space:

The epidural space is the space that lies between the spinal meninges and the sides of the vertebral canal. It is bounded cranially by the foramen magnum, caudally by the sacrococcygeal ligament covering the sacral hiatus, anteriorly by the posterior longitudinal ligament, laterally by the vertebral pedicles, and posteriorly by both the ligamentum flavum and vertebral lamina (Figure ٢).

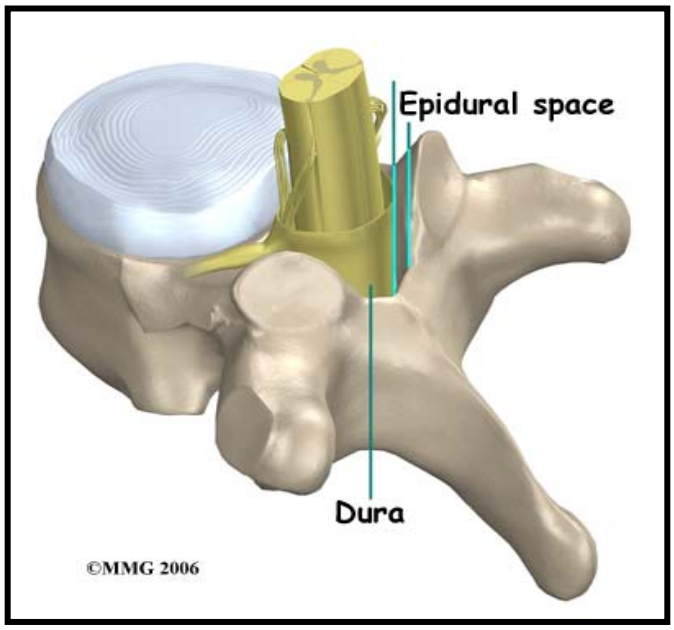

Figure ٢: Epidural space *(www.eorthopod.com)*.

The contents of the epidural space are fat, a rich network of valveless veins (Batson's plexus), lymphatics and segmental arteries running between the aorta and the spinal cord ***(Bernards, ٢٠٠٦)***.

٤) Meninges:

The spinal meninges consist of three protective membranes (dura mater, arachnoid mater, and pia mater) that are continuous with the cranial meninges.

⊙ ***Dura Mater:***

The dura mater is the outermost and thickest meningeal tissue. The spinal dura mater begins at the foramen magnum, where it fuses with the periosteum of the skull, forming the cephalad border of the epidural space. Caudally, the dura mater ends at approximately S٢ where it fuses with the filum terminale ***(Hogan, ١٩٩٩)***..

⊙ ***Arachnoid Mater***

The arachnoid mater is a delicate, avascular membrane composed of overlapping layers of flattened cells with connective tissue fibers running between the cellular layers (***Bernards and Hill, ١٩٩١)***.

⊙ ***Pia Mater***

The spinal pia mater is adherent to the spinal cord and is composed of a thin layer of connective tissue cells interspersed with collagen.

٥) Spinal Cord:

In the first-trimester fetus, the spinal cord extends from the foramen magnum to the end of the spinal column. Thereafter, the vertebral column lengthens more than the spinal cord so that at birth the spinal cord ends at approximately the level of the third lumbar vertebra. In the adult, the caudad tip of the spinal cord typically lies at the level of the first lumbar vertebra. The spinal cord gives rise to ٣١ pairs of spinal nerves, each composed of an anterior motor root and a posterior sensory root. The skin area innervated by a given spinal nerve and its corresponding cord segment is called a dermatome ***(Bernards, ٢٠٠٦)*** .