



A Comparative Study between Intrathecal Fentanyl and Dexmedetomidine as Adjuvants to Hyperbaric Levobupivacaine 0.5% in Patients Undergoing Infra Umbilical Surgeries

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سُبْحَانَكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

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Last but not least, I dedicate this work to my family and my beloved fiancée, whom without their sincere emotional support, pushing me forward this work would not have ever been completed.

Loay Ashraf Taha Mohammed

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List of Abbreviations

Abb.	Full term
$\mu\text{g} / \text{kg}$	<i>Microgram / kilogram</i>
<i>k</i>	<i>Kappa</i>
<i>L</i>	<i>First lumbar vertebra</i>
<i>Las</i>	<i>Local anesthetics</i>
<i>m / s</i>	<i>Milli-second</i>
<i>MAP</i>	<i>Mean Arterial Pressure</i>
<i>Meq</i>	<i>Milli-equivalent</i>
<i>METs</i>	<i>Metabolic Equivalent</i>
<i>Mg</i>	<i>Milligram</i>
<i>Mg⁺⁺</i>	<i>Magnesium</i>
<i>Min</i>	<i>Minute</i>
<i>ml</i>	<i>Milliliter</i>
<i>mmHg</i>	<i>Millimeter mercury</i>
<i>Mmole</i>	<i>Milli-mole</i>
<i>NE</i>	<i>Nor-epinephrine</i>
<i>NGF</i>	<i>Nerve Growth Factor</i>
<i>NMDA</i>	<i>N-Methyl-D-Aspartate</i>
<i>NO</i>	<i>Nitric Oxide</i>
<i>NS</i>	<i>Nociceptive Specific neurons</i>
<i>NT</i>	<i>Neurotransmitter</i>
<i>ORIF</i>	<i>Open reduction and internal fixation</i>
<i>PCA</i>	<i>Patient Controlled Analgesia</i>
<i>PGE</i>	<i>Prostaglandin E</i>
<i>PMN</i>	<i>Polymorphonuclear</i>

List of Abbreviations cont...

Abb.	Full term
<i>POCD</i>	<i>Postoperative Cognitive Dysfunction</i>
<i>PTH</i>	<i>Parathyroid Hormone</i>
<i>R-</i>	<i>Rectus-</i>
<i>S</i>	<i>Sacral vertebra</i>
<i>S-</i>	<i>Senister-</i>
<i>SD</i>	<i>Standard Deviation</i>
<i>ST</i>	<i>Spinothalamic Tract</i>
<i>T</i>	<i>Thoracic vertebra</i>
<i>TENS</i>	<i>Transcutaneous Electrical Stimulation</i>
<i>TNF</i>	<i>Tumour Necrosis Factor</i>
<i>VAS</i>	<i>Visual Analogue Scale</i>
<i>WDR</i>	<i>Wide Dynamic Range neurons</i>
<i>α</i>	<i>Alpha</i>

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INTRODUCTION

Despite availability of many new additives for central neuraxial blockade, there is a constant search for better additives to increase duration of analgesia with minimum side effects. Levobupivacaine which is the pure S - enantiomer of racemic bupivacaine that has a beneficial ratio of sensory to motor block in neuraxial anesthesia. Preclinical animal and volunteer studies showed less cardiac toxicity and neurotoxicity than bupivacaine. It seems to be an alternative local anesthetic agent in epidural anesthesia (*Dubé and Granry, 2013*).

Fentanyl is a potent, short-acting, highly lipophilic, synthetic opioid analgesic. It has been commonly used as an adjuvant for post operative analgesia (*Bernards, 2002*).

Dexmedetomidine a selective Alpha 2 agonist, provides stable hemodynamic conditions and good quality of intra operative and prolonged post operative analgesia with minimal side effects (*Grewal, 2011*).

75 Patients, undergoing infraumbilical surgeries eg; inguinal hernia, varicocele and hydrocele were randomly allocated into one of three groups to compare the onset, duration of sensory and motor block, duration of post operative analgesia and possible side effects in patients undergoing infra umbilical surgeries. Perioperative hemodynamics, post-operative pain score, onset of the block and post-operative complications were the parameters of the study.

AIM OF THE WORK

This study is designed to assess and compare the effect of intrathecal Fentanyl and Dexmedetomidine as adjuvants to hyperbaric Levobupivacaine 0.5% regarding the onset, duration of sensory and motor block, duration of post operative analgesia and possible side effects in patients undergoing infra umbilical surgeries. The comparison was regarding intra operative hemodynamics, pain measured by the visual analogue scale (VAS), and post-operative complications.

REVIEW OF LITERATURE

Anatomical Considerations

A thorough appreciation for the anatomy of the spinal structures is necessary for appropriate technique, patient selection, and management of neuroaxial anesthesia.

I- Anatomy of the vertebral column

A. Surface landmarks:

Surface landmarks are generally used to locate a particular vertebral level. The inferior margin of the 12th rib lies at the level of the L₁ vertebra, Tuffier's line (the line connecting the iliac crests) crosses the vertebral column at the level of the L4 vertebra, while the posterior superior iliac spine lies at level with S₂ (Figure 1) (Priebe, 2010).

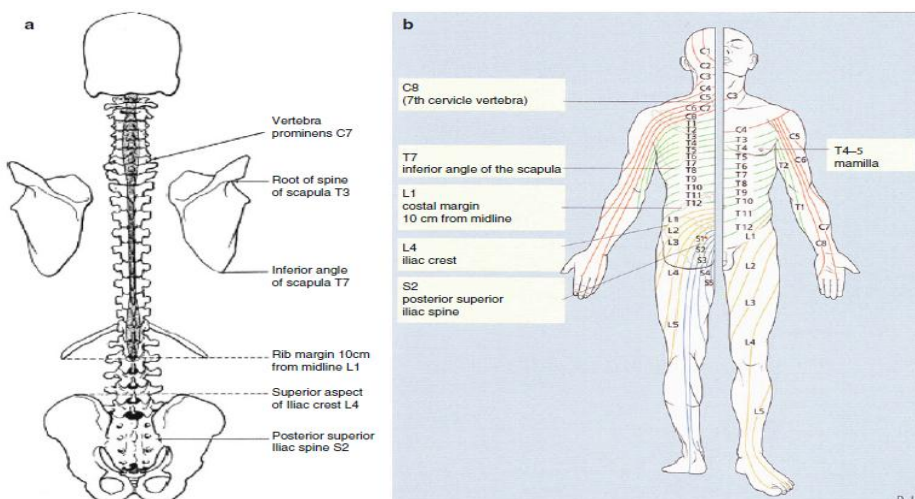


Figure (1): The common surface landmarks of the vertebral column (Kumra, 2008).

B. Ligaments of the Vertebral Column:

Adjacent vertebrae are united by ligaments that run the length of the vertebral column along both its posterior and anterior aspects (**Figure 2**). These serve to resist excess forward or backward bending movements of the vertebral column, respectively. The anterior longitudinal ligament runs down the anterior side of the entire vertebral column, uniting the vertebral bodies. It serves to resist excess backward bending of the vertebral column. The supraspinous ligament is located on the posterior side of the vertebral column, where it interconnects the spinous processes of the thoracic and lumbar vertebrae. This strong ligament supports the vertebral column during forward bending motions.

The posterior longitudinal ligament is found anterior to the spinal cord, where it is attached to the posterior sides of the vertebral bodies. The ligamentum flavum “yellow ligament” is found posterior to the spinal cord. That consists of a series of short, paired ligaments (Right and Left), each of which interconnects the lamina regions of adjacent vertebrae (**Krechel et al., 2009**).

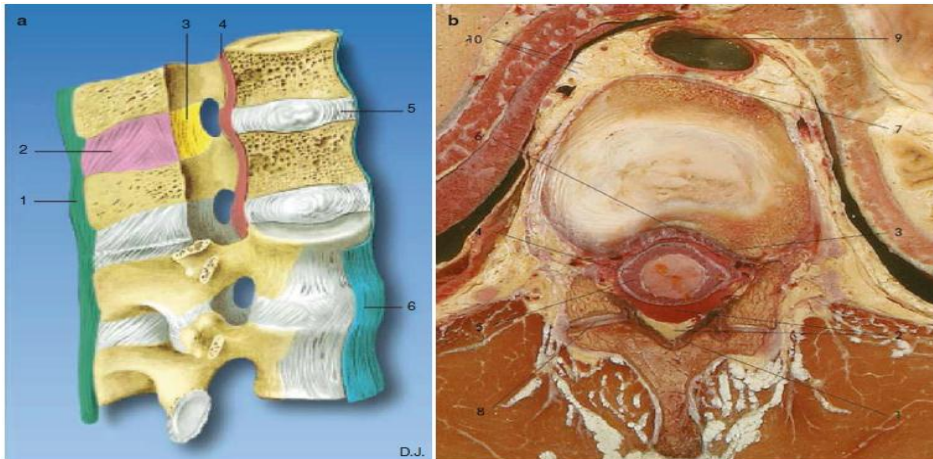


Figure (2): (a) Sagittal section of the vertebral column illustrating the ligaments of the vertebral column.(1) Supraspinous ligament, (2) interspinous ligament, (3) ligamentum flavum, (4) posterior longitudinal ligament, (5) intervertebral disc, and (6) anterior longitudinal ligament. (b) Transverse dissection at the level of T9(1) Ligamentum flavum, (2) posterior epidural space with fat, (3) anterior epidural space with veins, (4) spinal duramater, (5) subarachnoid space with spinal cord, (6) posterior longitudinal ligament, (7) anterior longitudinal ligament, (8) zygapophysial joint, (9) aorta, and (10) sympathetic ganglion (**Kumra, 2008**).

II- Anatomy of The spinal cord:

The spinal cord is about 46 cm long and is the caudal continuation of the medulla oblongata, which extends from the atlas to the conus medullaris (the lower edge of the first lumbar vertebra). The length of the spinal cord varies with age, in adults, the conus ends at the level of L₁-L₂. Spinal anesthetics must therefore be performed at the L₂ -L₃ intervertebral space or lower to avoid the risk of spinal cord injury (**Figure 3**) (**Al-Alami et al., 2009**).

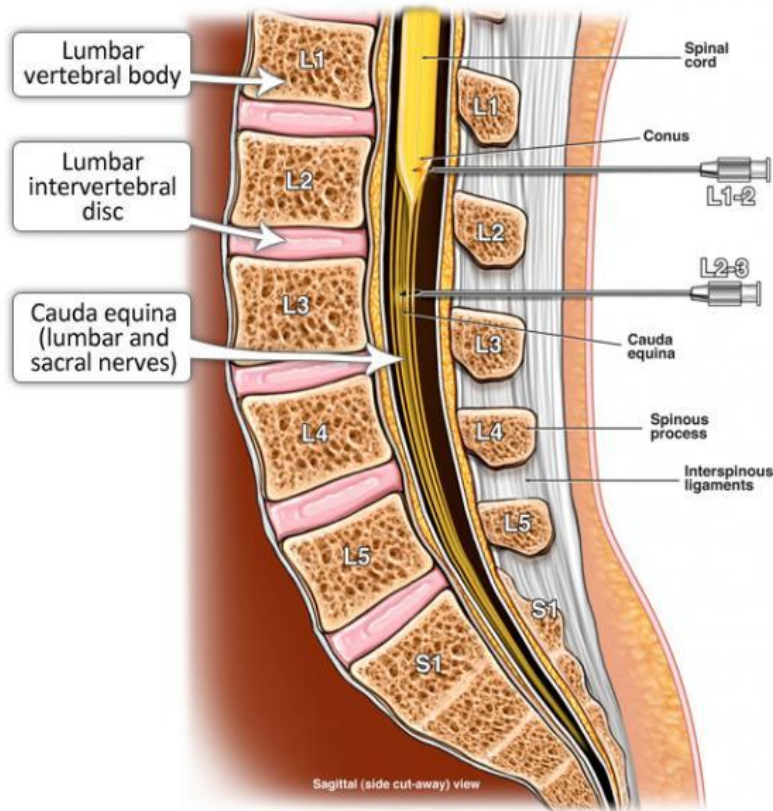


Figure (3): The termination of the spinal cord (*Chodorowski et al., 2003*).

III- Spinal dermatomes:

Via its branching spinal nerves, each segment of the spinal cord provides the sensory supply for a specific area of skin, known as the dermatome. These areas of skin, which often overlap, are very important for checking and verifying the spread of anesthesia (*Kumra, 2008*).

The subarachnoid Space

The subarachnoid space is the interval between the arachnoid membrane and the pia mater. It is occupied by

delicate connective tissue trabeculae and intercommunicating channels containing cerebrospinal fluid (CSF) (**figure 4**)

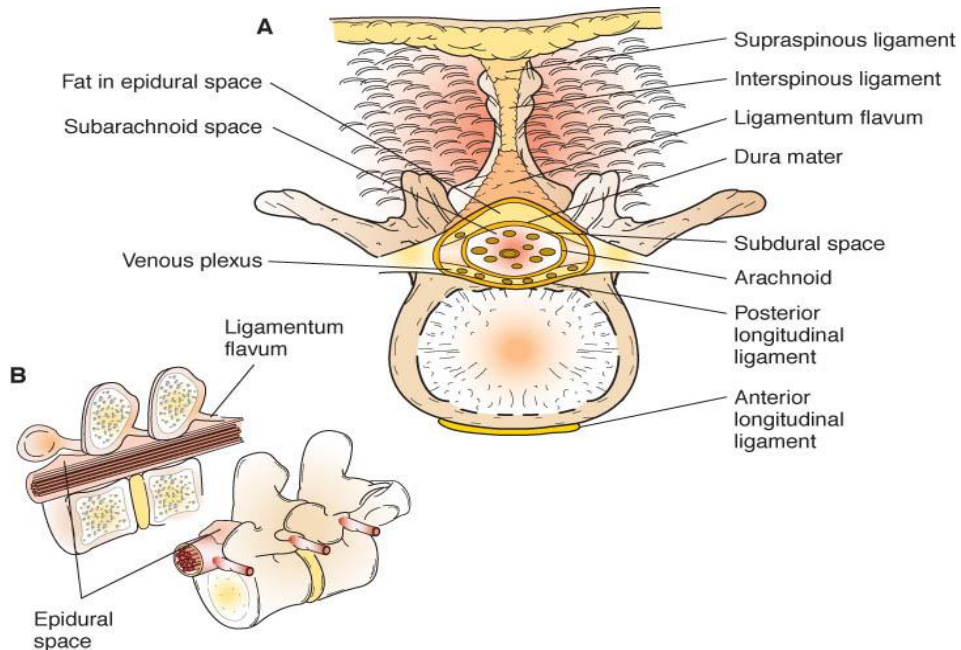


Figure (4): (a) Cross-sectional view of the lumbar region depicting the location of the epidural space and subarachnoid space associated with neuraxial procedures (*Al-alamy et al., 2009*).

Physiology of Pain

Definition of pain:

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.

Stress response to surgery and pain

The stress response is the name given to the hormonal and metabolic changes which follow injury or trauma. This is