Department of Anesthesiology,
Intensive Care
and Pain Management

# Comparative Study between Ultrasound-Guided and Conventional Method of Epidural Anesthesia

## Thesis

Submitted for partial fulfillment of MD Degree
in Anesthesia

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بسم الله الرحمن الرحيم

# قالوا

## سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

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***Kotb Mohamed Kotb***

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# List of Abbreviations

| Abbrev. | Full-term |
|---|---|
| **AP** | : Articular processes |
| **BMI** | : Body mass index |
| **°C** | : Degree Celsius |
| **ECG** | : Electrocardiography |
| **f** | : Frequency |
| **HR** | : Heart rate |
| **i.v.** | : Intra-venous |
| **IP** | : In-plane |
| **$L_1$** | : First lumbar vertebra |
| **$L_3$** | : Third lumbar vertebra |
| **LOR** | : Loss of resistance |
| **MHz** | : Mega Hertz |
| **MRI** | : Magnetic resonance imaging |
| **PS** | : Paramedian sagittal |
| **PZT** | : Piezoelectric material |
| **RCT** | : Randomized Controlled Clinical Trial |
| **$S_1$** | : First sacral vertebra |
| **$S_2$** | : Second sacral vertebra |

**$S_4$** : Fourth sacral vertebra

**SD** : Standard deviation

**SPSS** : Statistical Package of Social Science

**$T_{12}$** : Twelfth thoracic vertebra

**TP** : Transverse processes

**U/S** : Ultrasound

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# Introduction

Epidural anesthesia or analgesia is frequently used during the peri-operative period. Success of the technique depends on ability to accurately locate the epidural space. Traditionally, one has to rely on surface anatomical landmarks and ‘loss-of-resistance’ (LOR) technique. Although anatomical landmarks are useful, they are surrogate markers, difficult to palpate in the obese and those with edema in the back, do not consider anatomical variations, and frequently lead to incorrect identification of a given lumbar inter space ***(Broadbent et al., 2000).***

‘Loss-of-resistance’ technique, the gold standard for identifying the epidural space, is a blind technique. Also, one cannot predict technical difficulties or accuracy of needle placement before skin puncture with landmark based techniques. This may lead to multiple attempts of epidural needle placement, pain and patient discomfort, failed block, complications, frustration for the Anesthesiologist, and patient un-satisfaction. So, any alternative technique that can overcome some of these drawbacks and facilitate identification of epidural space is desirable ***(Broadbent et al., 2000).***

It is suggested that, as in case of vascular access insertion and peripheral nerve blocks, the use of ultrasound may increase success rate and decrease incidence of complication of epidural catheterization ***(Liu et al., 2009).*** Ultrasound can be used in 2 different ways. One way (pre-puncture ultrasound) is to use ultrasound to identify the target inter vertebral space, the midline of the spine, the optimal puncture point, the optimal angle for needle insertion, and the depth to the spinal canal. The second way is to use real-time ultrasound imaging to follow passage of the needle into the epidural space ***(Tran et al., 2010).***

# Aim of the Work

The aim of this study was to determine whether ultrasound imaging can reduce the risk of failed epidural catheterizations, when compared with standard identification methods, and whether ultrasound imaging can reduce traumatic procedures, insertion attempts, and other complications.

# REVIEW of LITERATURE

## I. Anatomy of the Spine

A typical vertebra has two components: the body and the arch. The vertebral arch is composed of pedicles, lamina, transverse processes, spinous process, and superior and inferior articular processes (fig. 1). Adjacent vertebrae articulate at the facet joints between superior and inferior articular processes and at the intervertebral discs between vertebral bodies ***(Cramer, 2005).***

The vertebral canal is formed by the spinous process and lamina posteriorly, the pedicles laterally, and the vertebral body anteriorly. The posterior longitudinal ligament runs along the anterior wall of the vertebral canal. The only openings into the vertebral canal are (a) the interlaminar spaces on its posterior wall (b) the intervertebral foramina along its lateral wall, from where the spinal nerve roots emerge. The ligamentum flavum is a dense connective tissue that bridges the interlaminar spaces. It is arch-like in cross-section and is thickest in the midline. The ligamentum flavum attaches to the anterior surface of the lamina above but splits to attach to both the posterior surface (superficial component) and anterior surface (deep component) of the lamina below. The spinous processes are connected at their tips by the supraspinous ligament, which is a strong fibrous cord, and along their length by the interspinous ligament, which is thin and membranous ***(Cramer, 2005).***

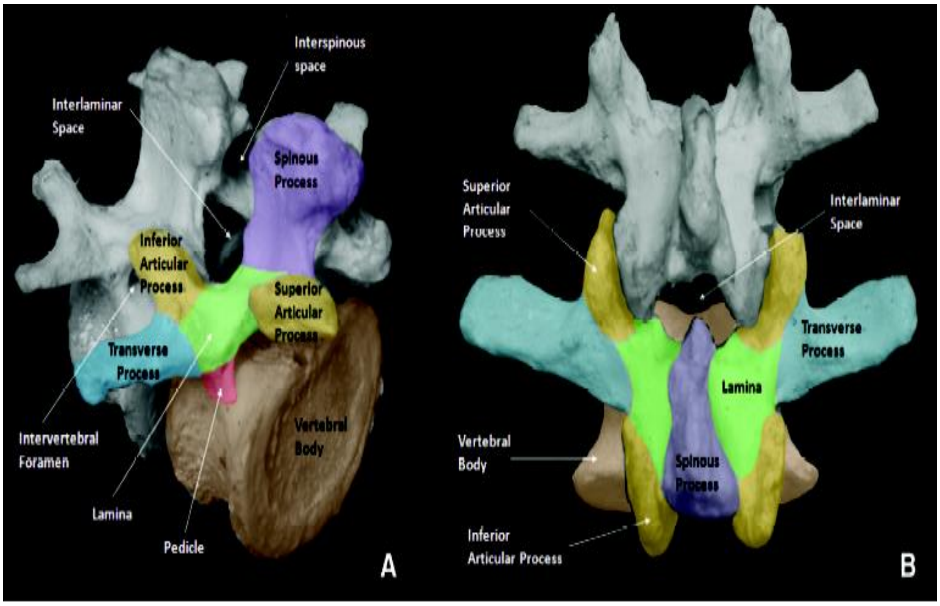


**Figure (1):** Three-quarter oblique view (A) and posterior view (B) of adjacent lumbar vertebrae. The interlaminar space is located posteriorly and is bounded by the bases of the spinous processes, the laminae, and the inferior articular processes. It is roofed over by the ligamentum flavum. The interspinous space lies in the midline and is filled by the supraspinous and interspinous ligaments. The intervertebral foramina are located laterally and bounded by the pedicles, vertebral body, laminae, and superior and inferior articular processes and contain spinal nerve roots and their accompanying blood vessels ***(Cramer, 2005).***

Within the vertebral canal lie the thecal sac and its contents. The vertebral canal is formed by the dura mater and arachnoid mater. It contains spinal cord, cauda equina, and cerebrospinal fluid. The epidural space is divided into anterior, lateral, and posterior spaces with respect to the thecal sac, with the posterior epidural space being of most