Updates In Regional Analgesia For Painless Labour

An Essay

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LIST OF ABBREVIATIONS

(ASA): American society of anesthiologist

(CC): closing capacity

(CEI): Continous epidural infusion

(CES): Cauda equina syndrome

(CI-PCEA): Computer intgrated patient controlled epidural analgesia

(CNS): Central nervous system

(CSE): Combined spinal epidural

(CSF): Cerebro spinal fluid

(DD): Demand dose

(EA): Epidural analgesia

(FDA): Food and drug administration

(FRC): Functional residual capacity

(GABA): Gamma amino butyric acid

(GFR): Glomerular filteration rate

(HS): Horner syndrome

(IL): Inter spinous ligament

(IT): Intrathecal

(LA): Local anesthetic

(MAC): Minimal alveolar concentration

(MEAC): Minimal epidural anesthetic concentration

LIST OF ABBREVIATIONS (cont.)

(MLAC): Minimal local anesthetic concentration

(MRI): Magnitic resonant imaging

(Paco2): Partial pressure of cabon dioxide in arterial blood

(PCA): Patient controlled analgesia

(PCEA): Patient controlled epidural analgesia

(PDPH): Post dural puncture headache

(TNS): Transient neurologic syndrome

(TP): Transverse process

(UV/M): The ratio at delivery of the concentration of local anesthetic in blood or plasma from the umbilical vein to the concentration of local anesthetic in maternal blood

(VB): Vertebral body

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INTRODUCTION

Labour is one of the most painful situations a human can experience. It was rated more painful than cancer pain and as painful as amputation of a digit without anesthesia **(Melzack, 1984).**

Pain relief in labour has always been surrounded with myths and controversies. Hence, providing effective and safe analgesia during labour has remained an ongoing challenge. Historically, the era of obstetric anesthesia began with James Young Simpson, when he administered ether to a woman with a deformed pelvis during childbirth. His concept of “etherization of labour” was strongly condemned by critics. The religious debate over the appropriateness of anesthesia for labour continued till 1853, when John Snow administered chloroform to Britain’s Queen Victoria during the birth of her eighth child, Prince Leopold **(Pandya, 2010).**

Several strategies and alternative therapies have been used to provide analgesia for labour pain. These include non-pharmacological approaches such as hypnosis, acupuncture, hydrotherapy and transcutaneous electrical nerve stimulation as well as the administration of nitrous oxide and low-dose sevoflurane and parenteral opioids. Although some of these therapies provide satisfactory pain relief from the mothers’ point of view, there is evidence that neuraxial local anesthetics and opioids yield superior and more reliable analgesia than these forementioned methods **(Loubert et al., 2011).**

Neuraxial labour analgesia is the most complete and effective method of pain relief during childbirth, and the only method that provides complete analgesia without maternal or fetal sedation. Over the past 40 years in the United States, the use of neuraxial analgesia for childbirth has increased dramatically **(Bucklin et al., 2005)**.

Lumbar epidural analgesia has been the mainstay of neuraxial labour analgesia for many years. Placement of an epidural catheter allows maintenance of analgesia until after delivery. Neuraxial anesthesia for emergency cesarean delivery is associated with decreased maternal morbidity and mortality compared to general anesthesia **(Hawkins et al., 1997)**.

The Combined Spinal Epidural (CSE) technique is gaining popularity in obstetric practice to provide optimal analgesia for parturients because it offers the possibility of combining the rapid onset of subarachnoid analgesia with the flexibility of continuous epidural analgesia. The duration of spinal analgesia is between 2 and 3 hours, depending on which agent or agents are chosen. The duration of spinal analgesia, however, was shown to decrease when administered to a woman in advanced labour **(Viscomi et al., 1997).**

Patient Controlled Epidural Analgesia (PCEA) is a novel method of the drug delivery system, providing several advantages, including the ability to reduce the drug dosage. Self-control and self-esteem may be vital for a positive experience in childbirth, and PCEA achieves both. Thus, it is a useful alternative for the maintenance regime**(Pandya, 2010).**

Computer-integrated PCEA: Lim et al. reported another adaptation of the epidural delivery pump technology (2009). Their center has developed a computer-integrated PCEA (CI-PCEA) that controls background infusion rates depending on the previous hour's demand boluses. This randomized trial compared a standard PCEA technique of 0.1% ropivacaine with fentanyl administered as bolus-only by patient demand to the CI-PCEA technique that initiated an infusion algorithm with changing infusion rates depending on the demand boluses. Despite patients with the CI-PCEA technique receiving background infusions, the hourly consumption of ropivacaine was no different from that of the standard group. These studies illustrate that there is room for improvement in administering epidural medication, especially for women with prolonged labours**(Pandya, 2010).**

The availability of newer local anesthetics like ropivacaine and levo bupivacaine have contributed towards the increased maternal safety in terms of being less cardiotoxic after an inadvertent intravenous injection. However, for the dosage used for labour analgesia, cardiotoxicity is not a major issue. The recent study comparing these two drugs with bupivacaine offers no added advantage and is five-times more expensive as compared with that of bupivacaine **(Pandya, 2010).**

Ultrasound imaging is becoming an increasingly popular aid for performing neuraxial blockade. It may help to identify the midline, localize the epidural space, measure the skin-to-epidural space distance and estimate the angle of needle insertion. It is suggested that pre puncture lumbar ultrasound assessment provides the clinician with useful anatomical information, which may facilitate the placement of epidural needles not only in healthy parturients but also in obese pregnant women and patients with scoliosis **(Loubert et al., 2011*)*.**

Anatomy

The spinal cord is continuous cephalad with the brainstem through the foramen magnum and terminates distally in the conusmedullaris. Surrounding the spinal cord in the bony vertebral column are three membranes (from within to the periphery): the pia mater, arachnoid mater, and dura mater. The pia mater is a highly vascular membrane that closely invests the spinal cord and brain. The arachnoid mater is a delicate, nonvascular membrane closely attached to the outermost layer, the dura**(Brown, 2010).**

In the subarachnoid space are the CSF, spinal nerves, and blood vessels that supply the spinal cord **(Figure 1) (Parkinson, 1991).**

The third and outermost membrane in the spinal canal is the dura mater (or theca).This layer is a direct extension of the cranial dura mater and extends as the spinal dura mater from the foramen magnum to S2, where the filumterminaleblends with the periosteum on the coccyx**(Figure 2).** There is a potential space between the dura mater and the subarachnoid, the subdural space **(Brown, 2010).**

Surrounding the dura mater is another space that is often used by anesthesiologists, the epidural space. The spinal epidural space extends from the foramen magnum to the sacral hiatus and surrounds the dura mater anteriorly, laterally, and more usefully, posteriorly. The epidural space is bounded anteriorly by the posterior longitudinal ligaments, laterally by the pedicles and the intervertebral foramina, and posteriorly by the ligamentumflavum which also extends from the foramen magnum to the sacral hiatus. Contents of the epidural space include the nerve roots that traverse it from foramina to peripheral locations, as well as fat, areolar tissue, lymphatics, and blood vessels**(Figure 3) (Brown,2010).**

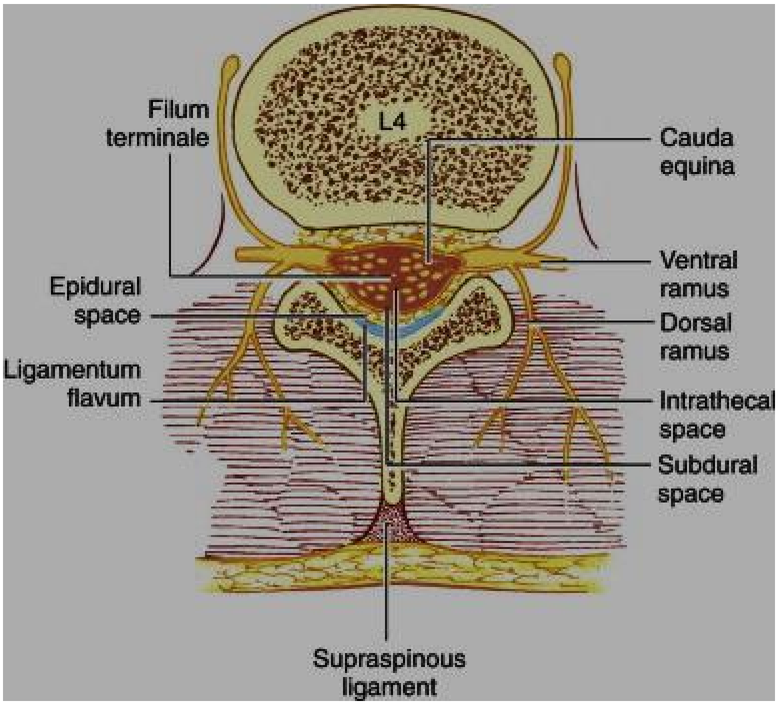

Figure 1 Contents of the dural sac at the level of L4. The caudaequina is contained within a dural sac filled with cerebrospinal fluid **(Brown, 2010)**

Immediately posterior to the ligamentumflavum are the lamina and spinous processes of vertebral bodies or the interspinous ligaments. Extending from the external occipital protuberance to the coccyx posterior to these structures is the supraspinous ligament, which joins the vertebral spines **(Brown, 2010).**

Blombergused fiberoptic technique to demonstrate that the subdural extra-arachnoid space was easily entered in 66% of autopsy attempts in humans**.** Despite this being an infrequent clinical problem with epidural anesthesia, it does allow a visual understanding of subdural complications of epidural anesthesia **(Blomberg, 1987)**.

Traditional thought on epidural anatomy was that it is one continuous space. A more recent thought is the concept of it being a potential space with septations or crevices formed by layering of epidural contents (fat). The anatomic layering and texture of epidural contents create inconsistent paths that ultimately make flow through it less uniform. The idea of these septations or crevices forming variable paths for the flow of a solution is the rationale given for unilateral or partial epidural blockade**(Hogan, 2002).**

Vertebral spinous processes help define the midline. In the lumbar areas they are horizontal. One generally accepted landmark for assessing lumbar level for epidural placement is the superior aspect of the iliac crest. A horizontal line drawn between the superior borders of either iliac crest corresponds to the L4 vertebral body or the L4-5 interspace. The approximate distance from the skin to the epidural