Intrathecal Heavy Bupivacaine Versus Pethidine Versus Their Combination in Spinal Anesthesia for Intraoperative Anesthesia & Postoperative Analgesia in Lower Limb Surgery

Thesis

Submitted for Partial Fulfillment of M.D Degree in Anesthesia

By

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2017

Abstract

Background: Spinal anesthesia has a clear tendency to be used more often than epidural or peripheral nerve blocks. It is safe, easy to perform, effective, has a low failure rate, has no systemic local anesthetic toxicity, is inexpensive and has a high rate of patient satisfaction.

Aims: The aim of this study is to evaluate the analgesic, hemodynamic effects & side effects of pethidine as a sole intrathecal agent in spinal anesthesia in lower extremity surgeries *(intra- and post-operatively)* and compare this with the standard heavy bupivacaine alone or heavy bupivacaine plus small dose pethidine.

Methodology: This prospective, randomized (via sealed envelope), double blind study was carried out on sixty six adult patients, presenting to Ain Shams University Hospitals (from August 2014 till February 2016) for elective lower limb surgery after approval of the research ethics committee of Ain Shams University and obtaining an informed consent from each patient.

Results: Patients were randomly allocated into three equal groups (22 patients each) A, B and C. *Group A:* Patients in this group received an intrathecal injection of preservative free pethidine(5%) 1mg/kg with dextrose 10% to reach the desired volume (3-3.5 ml). *Group B:* Patients in this group received an intrathecal injection of pethidine 25 mg (0.5 ml) plus hyperbaric bupivacaine (0.5 %) (2.5 – 3 ml). *Group C:* Patients in this group received intrathecal injection of hyperbaric bupivacaine (0.5 %) (3 – 3.5 ml) as needed

Conclusion: *As a conclusion*, this study has supported the findings of other's previous work that intrathecal pethidine prolongs the postoperative analgesia as evidenced by a significantly longer time to first rescue analgesia, lower VAS scores and decreased total amount of rescue analgesia needed, with minimal acceptable side effects.

Keywords: Intrathecal Heavy Bupivacaine, Pethidine, Spinal Anesthesia, Intraoperative Anesthesia, Postoperative Analgesia, Lower Limb Surgery

Thank you Allah the most Gracious, the most Merciful.

Words do fail me when I come to express my indebtedness and profound gratitude to my ***Professor Dr. Zakaria Abd El Aziz Mostafa,*** *Professor of anesthesia and intensive care, Faculty of Medicine, Ain Shams University, who guided this work and whenever I was in need. His patience, close supervision and constant encouragement throughout this work are beyond my words of thanks.*

Special thanks to ***Professor Dr. Sahar Kamal Hasanen,*** *Professor of anesthesia and intensive care, Faculty of Medicine, Ain Shams University, for dedicating so much of her precious time and effort to complete this work.*

Special thanks and deepest gratitude to ***Dr. Mohammed Mohammed Abd El Fattah,*** *lecturer of anesthesia and intensive care, Faculty of Medicine, Ain Shams University, for his support and guidance. Without his generous encouragement and witty supervision, this work would never have been in our hands.*

Special thanks and deepest gratitude to ***Dr. Raham Hasan,*** *Lecturer of anesthesia and intensive care, Faculty of Medicine, Ain Shams University, for her help, remarkable efforts, continuous support and guidance all the time.*

Last but not least, I would like to thank my ***family*** *for their continuous and devoted support responsible for every success in my life. Many thanks to all my* ***friends*** *who helped and encouraged me throughout this work.*

Paula Micheel

Contents

List of Abbreviations

Abbrev.	Meaning
AAGBI	Association of anesthetists of great Britain
ASA	American society of anesthesiologists
BMI	Body mass index
BP	Blood pressure
CNS	Central nervous system
CSF	Cerebrospinal fluid
DVT	Deep venous thrombosis
ECG	Electro-cardiography
GCS	Glasgow coma scale
HR	Heart rate
IM	Intra-muscular
INR	International normalized ratio
IV	Intra-venous
L.A	Local anesthetic
LMWH	Low molecular weight heparin
MAOIs	Mono-amine- oxidase inhibitors
MAP	Mean arterial blood pressure
MIN	Minute
MRI	Magnetic resonance imaging
NSAIDs	Non-steroidal anti-inflammatory drugs
PABA	Para-amino benzoic acid
PAN	Pethidine associated neurotoxicity
PCA	Patient controlled analgesia

PDPH	Post-dural puncture headache
PNS	Parasympathetic nervous system
PT	Prothrombin time
PTT	Partial thromboplastin time
RR	Respiratory rate
S.C	Subcutaneous
SD	Standard deviation
SNS	Sympathetic nervous system
SPO2	Arterial oxygen saturation
SPSS	Statistical package for social science
TNS	Transient neurological syndrome
TURP	Trans-uretheral resection of the prostate
VAS	Visual analogue score

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INTRODUCTION

Spinal anesthesia has a clear tendency to be used more often than epidural or peripheral nerve blocks. It is safe, easy to perform, effective, has a low failure rate, has no systemic local anesthetic toxicity, is inexpensive and has a high rate of patient satisfaction ***(Dharmalingam and Ahmad Zainuddin, 2013).***

Pethidine is a phenylpiperidine derivative with agonist activity at mu and kappa opioid receptors. It blocks sodium channels in a similar way to local anesthetics. It also shares structural features with atropine, but does not appear to have significant anticholinergic actions ***(Latta et al., 2005).***

Intrathecal opioids bind to opioid receptors localized in the spinal dorsal horn reducing nociceptive transmission. Opioids with high lipid solubility and low pKa results in an extremely potent analgesic effect when added to local anesthetics ***(Hindle, 2008).***

Due to dual local anesthetic and opioid agonist properties, a potential advantage of intrathecal pethidine compared with local anesthetic is a longer period of postoperative analgesia. Studies using pethidine as a sole agent reported a duration of at least six to eight hours before

further analgesia was required. So in recent years, interest has been directed towards use of pethidine as a sole anesthetic agent intrathecally ***(Shrestha et al., 2007).***

AIM OF THE WORK

The aim of this study is to evaluate the analgesic, hemodynamic effects & side effects of pethidine as a sole intrathecal agent in spinal anesthesia in lower extremity surgeries *(intra- and post-operatively)* and compare this with the standard heavy bupivacaine alone or heavy bupivacaine plus small dose pethidine.

SPINAL ANESTHESIA

⇒Anatomical Considerations:

The Vertebral Column:

The spine is composed of the vertebral bones and fibrocartilaginous intervertebral discs (**Figure 1**). There are 7 cervical, 12 thoracic, and 5 lumbar vertebra. The sacrum is a fusion of 5 sacral vertebra, and there are small rudimentary coccygeal vertebra. At each vertebral level, paired spinal nerves exit the central nervous system ***(Tricoci et al., 2009).***

The spinal canal contains the spinal cord with its coverings (the meninges), fatty tissue, and a venous plexus. The meninges are composed of three layers: the pia mater, the arachnoid mater, and the dura mater; all are contiguous with their cranial counterparts. The pia mater is closely adherent to the spinal cord, whereas the arachnoid mater is usually closely adherent to the thicker and denser dura mater ***(Brown, 2005).***

Cerebrospinal fluid (CSF):

CSF is an isotonic, aqueous medium with a constitution similar to interstitial fluid. CSF is contained between the pia and arachnoid matters in the subarachnoid space ***(Kleinman and Mikhail, 2006).***

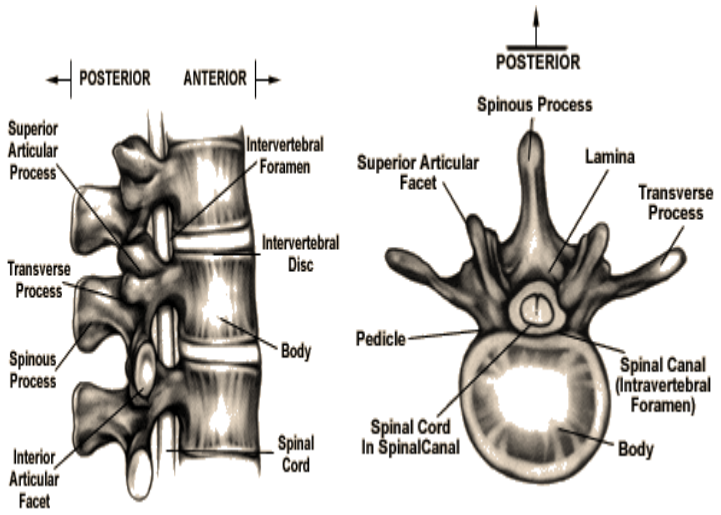

Figure (1): This is a detailed lateral & top views of lumbar vertebrae ***(Kleinman and Mikhail, 2006).***

The Spinal cord:

The spinal cord normally extends from the foramen magnum to the level of L_1 in adults. The anterior and posterior nerve roots at each spinal level join one another and exit the intervertebral foramina forming spinal nerves from C_1 to S_5. At the cervical level, the nerves arise above their respective vertebrae, but starting at T_1 they exit below their vertebrae. Because the spinal cord normally ends at L_1 with 30% of people having a cord that ends at T12 and 10% at L3, lower nerve roots course some distance before exiting the intervertebral foramina. These lower spinal nerves form the cauda equina ("horse tail"). Therefore, performing a lumbar (subarachnoid) puncture below L_1 in an adult avoids potential needle trauma to the cord; damage to the cauda equina is unlikely as these nerve roots float in

the dural sac below L_1 and tend to be pushed away (rather than pierced) by an advancing needle ***(Brown, 2005).***

The blood supply to the spinal cord and nerve roots is derived from a single anterior spinal artery and paired posterior spinal arteries. The anterior spinal artery is formed from the vertebral artery at the base of the skull and courses down along the anterior surface of the cord. The anterior spinal artery supplies the anterior two-thirds of the cord, whereas the two posterior spinal arteries supply the posterior one-third. The posterior spinal arteries arise from the posterior inferior cerebellar arteries and course down along the dorsal surface of the cord medial to the dorsal nerve roots ***(Horlocker et al., 2010).***

When performing a spinal anesthetic using the midline approach, the layers of anatomy that are traversed (from posterior to anterior) are skin, subcutaneous fat, supraspinous ligament, interspinous ligament, ligamentum flavum, dura mater, subdural space, arachnoid mater, and finally the subarachnoid space. When the paramedian technique is applied, the spinal needle should traverse the skin, subcutaneous fat, ligamentum flavum, dura mater, subdural space, arachnoid mater, and then pass into the subarachnoid space ***(Bromage, 1996).***