Spinal Anesthesia Versus Popliteal and Adductor Canal Blocks for Ambulation After Pott's Fracture Surgery

Thesis

Submitted for Partial Fulfillment of Master Degree In Anesthesiology

By

Madonna Mounir Salama

M.B., B.Ch. Ain Shams University

Under supervision of

Prof. Dr. Mohamed Anwar El-Shafie

Professor of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Dr. Hany Victor Zaki

Lecturer of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Dr. Reham Mustafa Hashim

Lecturer of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Faculty of Medicine
Ain Shams University
2019

Acknowledgment

First and foremost, I feel always indebted to ***God,*** *the Most Kind and Most Merciful.*

I'd like to express my respectful thanks and profound gratitude to ***Prof. Dr. Mohamed Anwar El-Shafie,*** *Professor of Anesthesiology, Intensive Care & Pain Management Faculty of Medicine – Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to ***Dr. Hany Victor Zaki,*** *Lecturer of Anesthesiology, Intensive Care & Pain Management Faculty of Medicine – Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I am deeply thankful to ***Dr. Reham Mustafa Hashim,*** *Lecturer of Anesthesiology, Intensive Care & Pain Management Faculty of Medicine – Ain Shams University, for her great help, active participation and guidance.*

Madonna Mounir Salama

List of Contents

Title	Page No.

List of Tables

Table No.	Title	Page No.

List of Figures

List of Figures Cont...

Fig. No.	Title	Page No.

List of Abbreviations

Abb.	Full term
ASA	American Society of Anesthesiologists
BMI	Body mass index
COX I	Cyclooxygenase I
COX II	Cyclooxygenase II
CSF	Cerebrospinal fluid
CT	Computed tomography
DNA	Deoxyribonucleic acid
DST	Dexamethasone suppression test
HPA axis	Hypothalamus pituitary adrenal axis
HR	Heart rate
IL-1	Interleukin 1
IL-6	Interleukin 6
IQR	Inter quartile range
IV	Intravenous
K+	Potassium
LAs	Local anaesthetics
LCN	Lateral cutaneous nerve
MRI	Magnetic resonance imaging
Na+	Sodium
OR	Operating rooms
PDPH	Post-dural puncture headache
PF	Preservative-free
PNBs	Peripheral nerve blocks
PTN	Posterior tibial
SN	Sciatic Nerve
SPSS	Statistical Package for Social Science
TNF	Tumor necrosis factor
VAS	Visual analogue scale

INTRODUCTION

Peripheral nerve blocks (PNBs) have been extensively used in patients with poly-trauma posted for emergency surgeries and for patients with critical co-morbidities who cannot tolerate even the slightest alteration of hemodynamic status. Recently several developments have led to an increased interest in lower extremity PNBs, including recognition of transient neurological symptoms associated with spinal anesthesia and evidence of improved rehabilitation outcome with lower limb PNBs.

Complications to spinal and epidural anesthesia also include hypotension due to the vasodilatory effect of the sympathetic blockade, in addition to the rare but potentially serious risk of compressive neuraxial hematoma ***(Pitkänen et al., 2013).***

It is desirable to provide effective anesthesia, rapid and an uneventful recovery, persistent postoperative analgesia and early ambulation to patients. Also they are ideally suited for lower limb surgeries because of the peripheral location of the surgical site and the potential to block pain pathways at multiple levels ***(Palkhiwala and Bhatt, 2015).***

With the development of ultrasonographic imaging and neurostimulation technology, more and more anesthesiologists have tended to select PNBs for lower limb surgery ***(Jun et al., 2014).***

A review of multiple studies concerning early mobilization protocols, involving hospitalized medical/surgical patients, indicates getting out of bed “early” (e.g. out of bed the day of surgery or the first postoperative day or soon thereafter reduces perioperative morbidities and length of stay ***(Epstein, 2014).***

Risks of perioperative complications (morbidity/ mortality) increase with the number of attendant comorbid factors including; hypertension, diabetes, obesity/elevated body mass index, hypothyroidism, osteoporosis, chronic obstructive pulmonary disease, coronary artery disease and other factors. If early mobilization protocols are effective, then the incidence of various perioperative/postoperative complications should be reduced (e.g. deep venous thrombosis, pulmonary embolism, pneumonia, atelectasis, urinary tract infections, sepsis, myocardial infarction, stroke, and others) ***(Epstein, 2014).***

Aim of the Work

The aim of this work was to compare the effect of Spinal Anesthesia versus popliteal and adductor canal blocks for ambulation after pott's fracture surgery.

Chapter 1

REGIONAL ANESTHESIA

I- Anatomical Considerations:

The Vertebral Column:

The spine is composed of the vertebral bones and fibrocartilaginous intervertebral disks. There are 7 cervical, 12 thoracic, and 5 lumbar vertebrae. The sacrum is a fusion of 5 sacral vertebrae, and there are small rudimentary coccygeal vertebrae. The spine as a whole provides structural support for the body and protection for the spinal cord and nerves, and allows a degree of mobility in several spatial planes. At each vertebral level, paired spinal nerves exit the central nervous system ***(Kleinman and Mikhail, 2006).***

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).***

The Spinal cord:

The spinal cord normally extends from the foramen magnum to the level of L1 in adults. The anterior and posterior nerve roots at each spinal level join one another and exit the intervertebral foramina forming spinal nerves from C1 to S5. At the cervical level, the nerves arise above their respective vertebrae, but starting at T1 they exit below their vertebrae. Because the spinal cord normally ends at L1, lower nerve roots course some distance before exiting the intervertebral foramina. These lower spinal nerves form the caudaequina "horse tail". Therefore, performing a lumbar (subarachnoid) puncture below L1 in an adult avoids potential needle trauma to the cord, damage to the caudaequina is unlikely as these nerve roots float in the dural sac below L1 and tend to be pushed away (rather than pierced) by an advancing needle ***(Brown, 2005).***

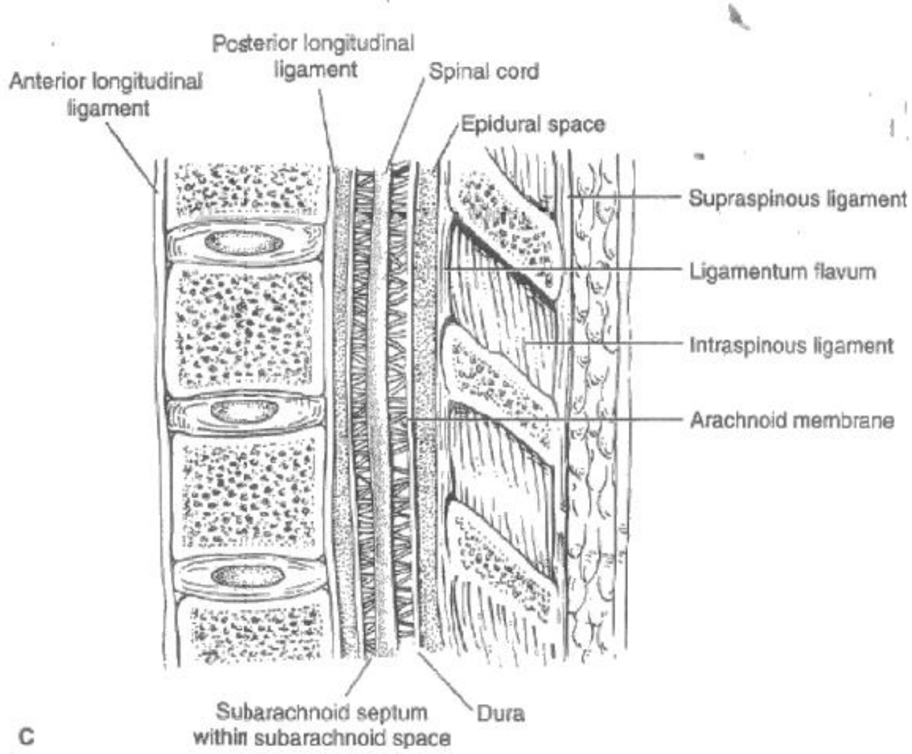

Figure (1): Sagital section through lumbar vertebrae ***(Kleinman and Mikhail, 2006).***

When performing spinal anesthesia using the midline approach, the layers of anatomy that are traversed (from posterior to anterior) are skin, subcutaneous fat, supraspinous ligament, interspinous ligament, ligamentumflavum, dura mater, subdural space, arachnoid mater, and finally the subarachnoid space (Figure 1). When the paramedian technique is applied, the spinal needle should traverse the skin, subcutaneous fat, ligamentumflavum, dura mater, subdural space, arachnoid mater, and then pass into the subarachnoid space ***(Klienman and Mickhail, 2006).***

II- Physiological considerations:

The physiologic response to central block is determined by the effects of interrupting the afferent and efferent innervations of somatic and visceral structures. Somatic structures are traditionally related with sensory and motor innervations, while the visceral structures are more related to the autonomic nervous system ***(Klienman and Mickhail, 2006).***

A- <u>Somatic blockade:</u>

Prevention of pain and skeletal muscle relaxation are classic objectives of central blockade. Nerve fibers are not homogenous. There are three main types of nerve fibers designated A, B and C. The A group has four sub-groups alpha, beta, gamma and delta (Table 1). The minimum concentration of local anesthetic required to stop transmission varies depending upon fiber size ***(Casey, 2000).***

Table (1): Nerve fibers classification ***(Casey, 2000)***.

Class	Action	Myelin	Size
Aα	Motor	Yes	++++
Aβ	Light, touch, pressure pain	Yes	+++
Aɣ	Proprioception	Yes	+++
Aƺ	Pain, temperature	Yes	++
B	Preganglionic sympathetic fibers	Yes	++
C	Pain, pressure	No	+

B- <u>Visceral blockade:</u>

Most of the visceral effects of central blockade are mediated by interruption of autonomic impulses to various organ systems.

1- Cardiovascular effect:

Sympathetic blockade results in cardiovascular changes of hemodynamic consequence in proportion to the degree of sympathectomy. The sympathetic chain originates from the lumbar and thoracic spinal cord. The fibres involved in smooth muscle tone of the arterial and venous circulation arise from T5 and L1. Arteries retain most of their tone despite sympathectomy because of local mediators and there is no arteriolar vasoplegia, but the venous circulation does not. The consequence of total sympathectomy is an increase in the volume of the capacitance vessels, specially in the splanchnic circulation, decreasing the venous return to the heart and hypotension occurs ***(Spiegel and Hess, 2007).***

The cardiac accelerator fibers are sympathetic efferents, which increase heart rate when stimulated. When blocked by high central blockade, unopposed vagal action leads to bradycardia ***(Brown, 2005).***

Prophylactic administration of pharmacologic agents may be more effective than prehydration to prevent hypotension***. α-*** adrenergic agents (e.g., phenylephrine) reliably