بسم الله الرحمن الرحيم

تم رفع هذه الرسالة بواسطة / سلوي محمود عقل

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات:
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A Comparative study between ultrasound guided four in one block versus femoral nerve block versus adductor canal block in enhanced recovery after knee replacement surgery

Thesis

Submitted in Partial Fulfillment of the M.D. Degree in
Anesthesia, Intensive Care and Pain Management

By

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Ain Shams University
2022

سورة البقرة الآية: ٣٢

Acknowledgment

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

I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Galal Adel Mohamed El Kadi,** *Professor of Anesthesia, Intensive Care and 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 **Assist. Prof. Dr. Sherif George Anis Said,** *Assistant Professor of Anesthesia, Intensive Care and 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 **Assist. Prof. Dr. Mona Ahmed Abdelmotaleb Ammar,** *Assistant Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for her great help, active participation and guidance.*

I wish to introduce my deep respect and thanks to **Dr. Mohamed Mohsen Mohamed,** *Lecturer of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his kindness, supervision and cooperation in this work.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Last but not least my sincere thanks and appreciation to all patients participated in this study.

Islam Mostafa Ibrahim Salem

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List of Abbreviations

Abb.	Full term
AC	*Adductor canal*
ACB	*Adductor canal block*
ACB	*Adductor canal block*
ACLS	*Advanced cardiac life support*
FN	*Femoral nerve*
FNB	*Femoral nerve block*
LAs	*Local anesthetics*
LAST	*Local anesthetic systemic toxicity*
PABA	*Para -aminobenzoic acid*
SaN	*Saphenous nerve*
SFA	*Superficial Femoral Artery*
SLR	*Straight Leg Raise*
SN	*Saphenous nerve*
SNB	*Sciatic nerve block*
TKR	*Total knee replacement*
TUG	*Timed Up-and-Go*
VAM	*Vasto-adductor membrane*
VAS	*Visual Analog Scale*
VM	*Vastus medialis*

INTRODUCTION

Enhanced recoveries after total joint replacements are gaining popularity in orthopedic surgeries. Motor preservation with adequate analgesia has become the optimal postoperative goal enabling earlier physical therapy, faster recovery, and early hospital discharge **(*Sutton et al., 2016*).**

Spinal anesthesia for knee arthroplasty has favorable outcome effects compared with general anesthesia. This is explained by the positive physiological effects of the provided sympathetic blockade with less blood loss, increased leg blood flow, and better initial pain relief. All of which, result in reduced cardiopulmonary and thromboembolic morbidity, but at the potential cost of reduced capability for early postoperative mobilization due to pain occurrence after resolving of spinal anesthesia ***(Memtsoudis et al., 2014).***

An ideal nerve block that targets the sensory nerves and spares the motor function can facilitate early ambulation and rehabilitation, which is a major goal for patients undergoing total knee replacement ***(Memtsoudis et al., 2018).***

Femoral nerve block (FNB) is known to provide superior pain control and shortens the time of functional recovery and the length of hospital stay without associated side effects, in comparison with epidural or intravenous patient-controlled analgesia. However, it reduces quadriceps muscle strength and results in an increased risk of falls ***(Johnson et al., 2013).***

Adductor canal block (ACB) is a new alternative providing pure sensory blockade with minimal effect on quadriceps strength ***(Liu et al., 2014).***

However, patients who undergo TKA and receive Femoral nerve block or Adductor canal block frequently encounter postoperative posterior knee pain requiring supplemental opioid medications ***(Yadeau et al., 2013).***

Femoral nerve block alone has been countered by studies that have found it to be inadequate. The sciatic nerve innervates posterior regions of the knee; thus, performance of both sciatic nerve block (SNB) and FNB may be necessary to improve analgesia after TKA ***(McNamee et al., 2002).***

Adductor canal blocks, just like all other peripheral nerve blocks, cannot provide total analgesia around the knee after TKA, because the knee is innervated by both the lumbar plexus (femoral and obturator nerve) and the sacral plexus (sciatic nerve) ***(Burckett et al., 2016).***

Aim of the Work

The aim of this study is to compare the effect of 4-in-1 block versus femoral nerve block versus adductor canal block in enhanced recovery after knee replacement surgery.

Chapter 1

ANATOMY

Anatomy of Femoral Nerve

Origin

The femoral nerve is the largest nerve of the lumbar plexus. It arises from the ventral rami of the dorsal divisions of the second, third, and fourth lumbar nerves (L_2, L_3, and L_4). It has a role in motor and sensory processing in the lower limbs. It controls the major hip flexor muscles, as well as knee extension muscles. Also it controls sensation over the anterior and medial thigh, as well as medial leg down to the hallux ***(Wong et al., 2019).***

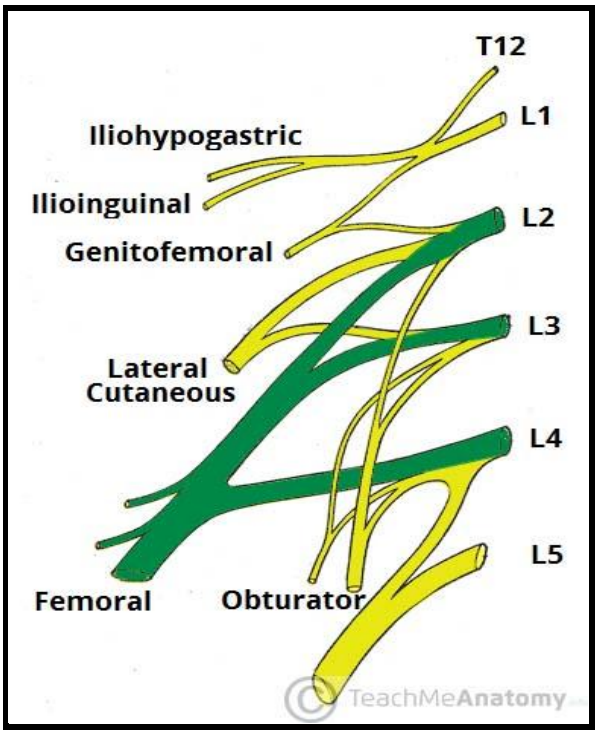

Figure (1): Origin of the femoral nerve from the lumbar plexus. ***(Samani, 2019)***

Course

In the Abdomen

The femoral nerve begins its course in the abdomen, by passing through the psoas major muscle. It then traverses laterally to the distal part of the psoas major muscle, and then finally, it runs "sandwiched" in between the iliacus muscle and the psoas major muscle. The iliacus muscle is inferior to the femoral nerve, and the psoas major muscle is superior to the femoral nerve. At this point two motor branches come off the femoral nerve, one to the psoas major and one to the iliacus muscle. These muscles will flex the hip ***(Refai et al., 2021).***

In the Pelvis

The femoral nerve then enters the thigh through the femoral triangle by running inferior to the inguinal ligament. The femoral triangle is formed by three structures: sartorius (laterally), adductor longus (medially) and the inguinal ligament (superiorly). Inside the femoral triangle exists the femoral nerve, femoral artery, femoral vein, femoral canal, and lymphatic vessels (in order from most lateral to medial). About 4 cm below the inguinal ligament, the femoral nerve then divides into anterior and posterior divisions. The two divisions of the femoral nerve are distinguishable because the lateral circumflex femoral artery splits them ***(Refai et al., 2021).***

a) Anterior Division

The anterior division of the femoral nerve has four terminal branches, two motor and two sensory. The motor branches are nerve to pectineus, nerve to sartorius. These muscles help to flex the hip as well. The sensory branches of the anterior division are the medial cutaneous nerve of the thigh and the intermediate cutaneous nerve. These nerves are responsible for the anteromedial sensory innervation of the thigh ***(Refai et al., 2021).***

b) Posterior Division

The posterior division of the femoral nerve has one sensory nerve, four motor branches and nerves to the hip and knee joints (articular branches). The sensory nerve is called the saphenous nerve and is the largest cutaneous branch of the