



A Comparative Study Between Magnesium Sulfate Versus Morphine Added to Bupivacaine in Ultra-Sound Guided Transversus Abdominis Plane Block for Post-Operative Analgesia after Inguinal Herniorrhaphy

Thesis

***Submitted For Partial Fulfillment Of
Master Degree In Anesthesiology***

By

Hussein Abdel-Naser Hassan Tawfik

M.B.B.CH (2014)

Faculty of Medicine – Ain Shams University

Under Supervision of

Prof. Dr. Ayman Mokhtar Kamaly

Professor Anesthesiology, Intensive Care and Pain Management

Faculty of Medicine - Ain Shams University

Dr. Ahmed Mohamed Khamies

Lecturer of Anesthesiology, Intensive Care and Pain Management

Faculty of Medicine - Ain Shams University

Dr. Rasha Mahmoud Hassan

Lecturer of Anesthesiology, Intensive Care and Pain Management

Faculty of Medicine - Ain Shams University

*Faculty of Medicine
Ain Shams University*

2018

Acknowledgement

First of all, all gratitude is due to Allah almighty for blessing this work, until it has reached its end, as a part of his generous help throughout my life.

Really, I can hardly find the words to express my gratitude to Prof. Dr. Ayman Mokhtar Kamaly, Professor of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his supervision, continuous help, encouragement throughout this work. It is a great honor to work under his guidance and supervision.

I cannot forget the great help of Dr. Ahmed Mohamed Khamies, lecturer of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, for his invaluable efforts, tireless guidance and for his patience and support to get this work into light.

I would like to express special thanks to Dr. Rasha Mahmoud Hassan, Lecturer of Anesthesia, Intensive Care and Pain Management, Faculty in Medicine, Ain Shams University for her faithful supervision, precious help and continuous support throughout this work.

All thanks and gratitude to my precious family for their kindness, love, devotion and continuous support.

Also i have been so lucky for being a member in class 2014 whom became more than only colleagues

Hussein Abdel-Naser Hassan

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

لَسْبَدَانِكَ لَا عِلْمَ لَنَا
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢

List of Contents

Title	Page No.
List of Tables	5
List of Figures	6
List of Abbreviations	8
Introduction	1
Aim of the Work.....	11
Review of Literature	12
Patients and Methods	56
Results	62
Discussion	74
Conclusion.....	80
Summary	81
References	83
Arabic Summary	—

List of Tables

Table No.	Title	Page No.
Table (1):	Verbal rating scale (VRS) for pain intensity.....	53
Table (2):	Comparison among groups according to demographic data.....	62
Table (3):	Comparison between groups according to heart rate (beat/min).	65
Table (4):	Comparison among groups as regard MAP (mmHg).....	67
Table (5):	Comparison among groups as regard postoperative pain manifested as visual analog scale (VAS) at Rest.	69
Table (6):	Comparison among groups as regard time for 1 st time for rescue analgesia.....	71
Table (7):	Comparison among groups as regard side effects.	72

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Anterior Abdominal Muscles.....	14
Figure (2):	A cross-section of the abdominal wall layers.....	14
Figure (3):	Anatomy of the inguinal hernia.....	16
Figure (4):	Anatomy of the inguinal region	17
Figure (5):	Iliohypogastric nerve, Ilioinguinal nerve and Genital branch of the genitofemoral	21
Figure (6):	Cutaneous innervation of the abdominal wall.....	21
Figure (7):	Lumbar triangle of Petit between external oblique muscle and latissimus dorsi.....	23
Figure (8):	Anatomical description of the triangle of Petit (lateral view).....	23
Figure (9):	Ultrasound unit connected to a linear probe.....	25
Figure (10):	An illustration of Linear (A), Sector (B), and Curved (C) probes	27
Figure (11):	Scanner types.....	27
Figure (12):	(A) and (C): The short-axis image of the median nerve in the forearm. Note the circular hyper-echoic structure. (B) and (D): When the transducer is turned 90° (in either direction), the long axis image is generated	29
Figure (13):	Needle insertion techniques.	30
Figure (14):	The patient is in the supine position; a high frequency US probe is placed transverse to the abdominal wall between the costal margin and iliac crest	31
Figure (15):	Image of the abdominal wall	32
Figure (16):	The patient is in the supine position, a USG- TAP block (Th10-Th12).....	33
Figure (17):	LA injection in TAP	33
Figure (18):	Chemical structure of bupivacaine HCl molecule	34
Figure (19):	Action potential conduction in neurons	36

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (20):	Safety guideline for management of LAST	44
Figure (21):	Administration of lipid emulsion therapy guideline for LA toxicity	45
Figure (22):	Activated NMDA receptors	48
Figure (23):	Numerical rating scale (NRS) for pain intensity	54
Figure (24):	Visual analogue scale	55
Figure (25):	Visual Analog Scale (VAS)	60
Figure (26):	Comparison among groups according to age (years)	63
Figure (27):	Comparison among groups as regard sex	63
Figure (28):	Comparison among groups according to ASA.	64
Figure (29):	Comparison among groups as regard heart rate (beat/min)	66
Figure (30):	Comparison among groups as regard MAP (mmHg).	68
Figure (31):	Comparison among the three groups according to postoperative pain (VAS)	70
Figure (32):	Comparison among groups as regard 1st Time for Rescue analgesia.	72
Figure (33):	Comparison among groups as regard Side effects.	73

List of Abbreviations

Abb.	Full term
AAGBI	Association of Anesthetists of Great Britain and Ireland
B.....	Bupivacaine
BMg	Bupivacaine plus Magnesium
BMO.....	Bupivacaine plus Morphine
DNA	De-oxy ribo-Nucleic Acid
EAA.....	Excitatory amino acids
ECG	Electrocardiography
ETCO ₂	End-tidal carbon- dioxide
IP.....	In plane approach
IV	Intravenous
LA	Local anesthetics
LAST.....	Local anesthetics systemic toxicity
M3G	Morphine 3-glucuronide
M6G	Morphine 6-glucuronide
MgSO ₄	Magnesium Sulphate
NIBP.....	Non-invasive blood pressure
NMDA.....	N-methyl-D-aspartate
NRS	Numerical rating scale
OOP	Out of plane approach
PONV.....	Postoperative nausea and /or vomiting
RNA	Ribonucleic Acid
SAO ₂	Oxygen saturation
TAP.....	Transversus Abdominis Plane
US	Ultrasound
VAS.....	Visual analogue scale
VRS.....	Verbal rating scale

INTRODUCTION

The abdominal wall consists of three muscle layers, the external oblique, the internal oblique and the transversus abdominis, and their associated fascial sheaths. This muscular wall is innervated by nerve afferents that course through the transversus abdominis neuro-fascial plane (*Mukhtar and Singh, 2009*).

Transversus Abdominis Plane (TAP) block, first described by Kuppuvelumani (*Kuppuvelumani et al., 1991*) and formally documented by Rafi (*Rafi, 2001*). It is used for the management of surgical abdominal pain by injecting local anesthetic into the plane between the internal oblique and transversus Abdominis muscles (*Rafi, 2001; Aveline et al., 2011*).

Opioids exert a local analgesic effect as based on several observations. Nociceptive afferent nerve fibers contain peripheral opioid receptors which are silent except in the presence of local inflammation. An effective topical opioid analgesic that could be applied to inflamed or open skin lesions would be a useful option for some patients where other options for pain relief have been exhausted (*Elkousy et al., 2013*).

Magnesium is an antagonist of the NMDA receptor, acting as a noncompetitive antagonist, blocking ion channels in a voltage dependent fashion.

This receptor is found in many parts of the body, including the nerve endings, and plays a well-defined role in modulating pain and a number of inflammatory responses (*Barbosa et al., 2010; Bottiger et al., 2014*).

AIM OF THE WORK

This study aimed to compare the analgesic efficacy of Magnesium sulfate versus Morphine added to local anesthetics bupivacaine in ultrasound guided unilateral transversus abdominis plane block for postoperative analgesia after inguinal hernia repair.

REVIEW OF LITERATURE

A) Anatomical consideration of Transversus abdominis plane block (TAP block)

Overview on anterior abdominal wall muscle:-

The abdominal wall is composed of 5 paired muscles: 2 vertical muscles (the rectus abdominis and the pyramidalis) and 3 layered flat muscles (the external abdominal oblique, the internal abdominal oblique, and the transversus abdominis muscles) (**Figure 1, 2**) (*Jankovic et al., 2009*).

The external oblique muscle:

It is the largest and most superficial of the three flat abdominal muscles. It is located in the anterolateral aspect of the abdominal wall. Its fleshy part forms the anterolateral portion and its aponeurosis forms the anterior part (*Skandalakis, 2014*).

Its fibers run inferoanteriorly and medially in the same direction as do the extended digits when they are in one's side pockets. It originates from external surfaces of 5th to 12th ribs and insertion; the fibers pass medially, they become aponeurotic. This aponeurosis ends medially in the linea-alba, pubic tubercle and anterior half of the iliac crest. Innervation is

via the inferior six thoracic nerves and subcostal nerves (**Frank and Netter, 2006**).

Inferiorly, it folds back on itself to form the inguinal ligament between the anterior superior iliac spine and the pubic tubercle. Just superior to the medial part of the inguinal ligament, there is an opening in the aponeurosis called the superficial inguinal ring (**Keith and Anne, 2006**).

The internal abdominal oblique muscle:

*It is the intermediate layer of the 3 paired flat abdominal muscles. It originates broadly from the anterior portion of the iliac crest, lateral half of the inguinal ligament and thoracolumbar fascia. The internal abdominal oblique inserts on the inferior border of the 10th-12th ribs, the linea Alba and the pubic crest via the conjoint tendon. The muscle fibers of the internal abdominal oblique course upward in a superomedial orientation, perpendicular to the muscle fibers of the external abdominal oblique (**Abdallah et al., 2012**).*

The transversus abdominis muscle:

It is the deepest of the 3 paired flat abdominal muscles. It originates on the internal surfaces of the 7th–12th costal cartilages, thoracolumbar fascia, anterior three fourths of the iliac crest and lateral third of the inguinal ligament. As with the other flat muscles, the transversus abdominis forms a broad aponeurosis that helps make up the rectus sheath before it fuses

in the midline to the linea alba. Above the arcuate line the transversus abdominis aponeurosis contributes to the posterior rectus sheath. Below the arcuate line it fuses with the other flat muscles as the anterior rectus sheath (*Finnerty and McDonnell, 2012*).

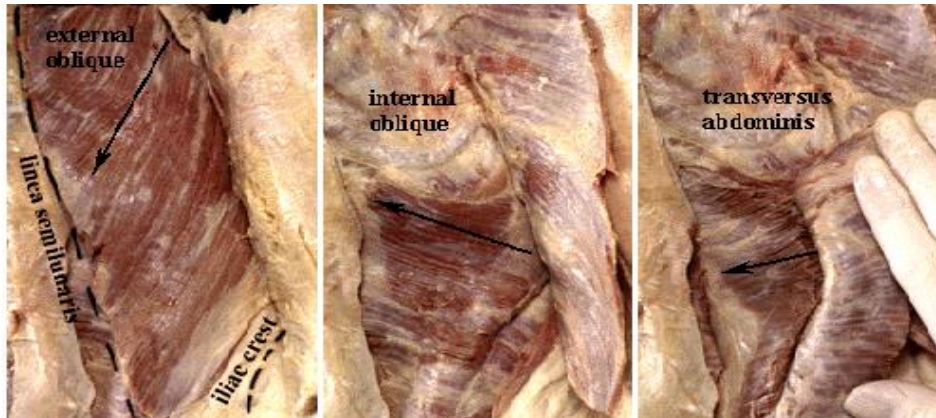


Figure (1): Anterior Abdominal Muscles (*Johannes et al., 2006*).

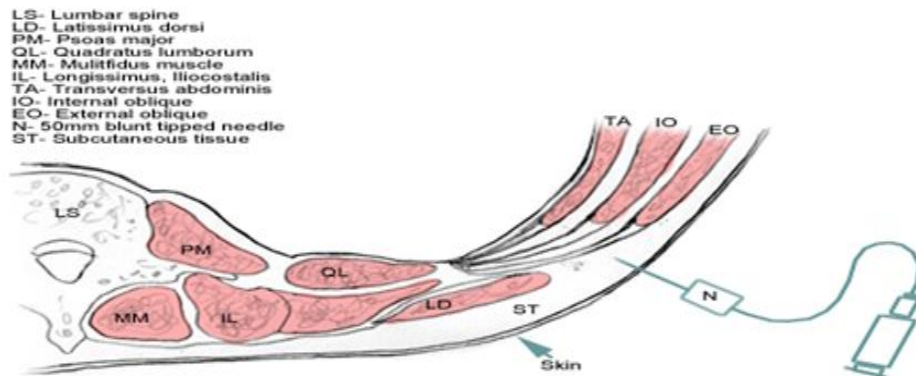


Figure (2): A cross-section of the abdominal wall layers. The TAP block is performed by deposition of local anesthetic between the transversus abdominis muscle and the fascial layer superficial to it (*Rahn et al., 2010*).

Surgical anatomy of the Inguinal Hernia

A useful learning tool for gaining a working knowledge of the inguinal region is to visualize the region as it is surgically approached in the open technique of hernia repair. The inguinal region is part of the anterolateral abdominal wall, which is made up of the following nine layers, from superficial to deep: (*Sabiston and Townsend, 2012*).

- Skin.
- Camper fascia.
- Scarpa fascia.
- External oblique aponeurosis.
- Internal oblique muscle.
- Transversus abdominis.
- Transversalis fascia.
- Pre-peritoneal fat.
- Peritoneum