Evaluation of Ultrasound guided thoracic paravertebral block in perioperative pain management in patients undergoing modified radical mastectomy

Protocol

Submitted for partial fulfillment of

Master Degree in Anesthesiology

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2015

The undersigned have examined the dissertation entitled ‘Evaluation of Ultrasound guided thoracic paravertebral block in perioperative pain management in patients undergoing modified radical mastectomy’ presented by *Neveen Nazmy Nazir Gerges Metias*, a candidate for the degree of Master Degree in Anesthesiology and hereby certify that it is worthy of acceptance.

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ABSTRACT

Key words: PVB, US, MRM, LA, Perioperative pain

This study demonstrate that, ultrasound guided thoracic paravertebral block (TPVB) is an effective intraoperative and postoperative technique for surgical anaesthesia and analgesia for breast surgery (e.g. MRM). It offers a long-lasting effective analgesia with a significant decrease in anaesthetic and analgesic consumption, and with a high degree of patient satisfaction, decrease the incidence of PONV and shorten length of hospital stay. Ultrasound guidance helps identifying the paravertebral space (PVS), needle placement, and to real time monitor the spread of the local anesthetic around nerves which increase the efficacy of the block and minimize the risk of complications.

Acknowledgements

At the very outset, I would like to thank God, the Almighty, for having made everything possible and letting me through all the difficulties by giving me blessings, strength and courage to do this work.

It gives me immense pleasure to express my sincere gratitude, indebtedness and deepest appreciation to my advisor Professor Dr. **Inas Mohamed El Shazly**, *Professor of anaesthesiology, faculty of medicine, Cairo University*, whose help and continued guidance were fruitful in shaping this work to the present form. It was a great honor to work under her supervision.

I express my sense of gratitude to Dr. **Mohamad Ahmed Mansour,** *Lecturer of anaesthesiology, Faculty of medicine, Cairo University,* and Dr. **Amany Hassan Saleh,** *Lecturer of anaesthesiology, Faculty of medicine, Cairo University,* for providing constructive guidance and valuable scholarly advices which have encouraged me to accomplish this work.

I acknowledge my family and friends. A special thanks to my beloved husband and my father. Words cannot express how grateful I am for all of the sacrifices that you both have made on my behalf. Your prayer for me was what sustained me thus far.

Finally, I would also like express my sincere gratitude to all those who have helped and supported me in the completion of this humble effort.

Neveen Metias

2015

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List of Abbreviations

The following table describes the significance of various abbreviations and acronyms used throughout the thesis. The page on which each one is defined or first used is also given.

Abbreviation	Meaning
5-HT3	5-Hydroxytryptamine3
AAA	abdominal aortic aneurysm
AAG	albumins and alpha-1-acid glycoprotein
ADH	anti-diuretic hormone
AMI	acute myocardial infarction
A-mode	amplitude modulation
AMPA	2-amino-3-hydroxy-5-methyl-4-isoxazole-propionic acid
ARAS	ascending reticular activating system
ASA	American Society of Anesthesiologists
ASRA	American Society of Regional Anesthesia and Pain Medicine
ATP	adenosine triphosphate
BMI	body mass index
B-mode	brightness modulation
CGRP	calcitonin gene-related peptide
CNS	central nervous system
COX-2	cyclooxygenase-2
CPR	cardiopulmonary resuscitation
CPVB	Continuous Paravertebral Block
CTL	costo transverse ligament
CVS	cardiovascular System
DBP	diastolic blood pressure
DVT	deep venous thrombosis

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Abbreviation	Meaning
EAAs	excitatory amino acids
ECG	Electrocardiogram
EEG	Electroencephalogram
EICM	external intercostal muscle
GA	general anesthesia
GABA	gamma-aminobutyric acid
HR	heart rate
HT	high-threshold
IASP	International Association for the Study of Pain
IICM	internal intercostal membrane
INR	international normalized ratio
IV	intravenous
LA	local anesthetic
LR	low-threshold
MHz	Megahertz
MRM	multiple reaction monitoring
NGF	Nerve Growth Factor
NIBP	non-invasive blood pressure
NMDA	N-methyl-D-aspartate
NRM	nucleus raphe magnus
NS	nociceptive specific
NSAID	nonsteroidal anti-inflammatory drugs
PACU	post anesthesia care unit
PAG	periaqueductal gray
PCA	patient-controlled analgesia
PCEA	patient-controlled epidural analgesia
PCINA	patient-controlled intranasal analgesia
PCRA	patient-controlled regional anesthesia

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Abbreviation	Meaning
PCSA	patient controlled sublingual analgesia
PCTA	patient controlled transdermal analgesia
PEG-2	prostaglandin E2
PIM	posterior intercostal membrane
Pka	Protein kinase.
Pl	Pleura
PONV	Postoperative nausea and vomiting.
PVB	Paravertebral block
PVS	paravertebral space
RA	regional anesthesia
SBP	systolic blood pressure
SNS	sympathetic nervous system
sP	substance P
SP	spinous process
TENS	transcutaneous electrical nerve stimulation
TM-mode	time motion modulation
TPs	Transverse processes
TPVB	Thoracic Paravertebral Block
TPVS	thoracic paravertebral space
US	Ultra-Sound
VAS	Visual analogue score
VATS	video assisted thoracic surgery
VIP	vasoactive intestinal polypeptide
VMM	ventromedian medulla
WDR	wide dynamic range

Introduction

Paravertebral blocks (PVBs) were first performed in 1905[1] and became a popular technique for the provision of analgesia in the early part of the twentieth century. However, their use declined over the years until a publication by Eason and Wyatt[2] in 1979 began a renaissance. Since then, a considerable number of good quality studies have been published on and it is now an established regional anaesthetic technique.[3]

Paravertebral block is a technique creating unilateral somatic and sympathetic nerve block as a result of local anesthetic solution injection close to the spinal nerves along the columna vereblalis. Paravertebral block may be used for 4 region: Cervical, Thoracic (T1-T10), Thoraco-lumbar (T11-L2), Lumbar or psoas compartment (L2-L5).[4]

The thoracic paravertebral space begins at T1and extends caudally to terminate at T12. Although PVBs can be performed in the cervical and lumbar regions, there is no direct communication between adjacent levels in these areas. Most PVBs are therefore performed at the thoracic level.[3]

Many practitioners, however, remained hesitant to perform thoracic paravertebral blocks secondary to the associated risk of pneumothorax, reported to be 0.5%-2% in addition to the risk of dural puncture with some of the older medially directed landmark approaches. The growth of ultrasound technology increase the ability to visualize the nerve roots, pleura and spread of local anesthetic in the paravertebral space lead to increased interest in performing thoracic paravertebral blocks.[5]

PVB can provide control of acute and chronic pain (e.g. rib fracture, cancer pain), PVB can also be used as a regional anesthetic technique either alone or combined with general anesthesia for unilateral or bilateral thoraco abdominal surgeries (e.g. Breast surgery with and without axillary discussion, Inguinal and umbilical hernia repair, thoracotomy, major abdominal cases such as partial hepatectomy, nephrectomy, and colectomy as it provides dense block for both somatic and sympathetic nerves).[6]

Breast surgery is one of the indications of Paravertebral block. Breast cancer accounts for 29% of Egypt national cancer institute cases; it is one of the most common causes of cancer death in females. In USA, around 180000 women are diagnosed with breast cancer.[7] Modified radical mastectomy is one of the most common surgical procedures for treatment of breast cancer during which surgeons remove the breast with the accessible axillary lymph nodes, due to this dissection patients usually suffer from sever post-operative pain, Nausea and vomiting, painful restrictive shoulder movement, increase the need for analgesia intra and post-operative, so the use of regional anesthesia (e.g. TPVB may help in decreasing the need for analgesia and provide better pain control and early hospital discharge).[6,8]

Aim of work

The aim of this study is to evaluate the efficacy of US guided paravertebral block compared to systemic opioid, Identify the effect of US-guided paravertebral block on analgesic requirement needed to control post-operative pain and shortening length of hospital stay and to assess surgeon and patient satisfaction.

Literature Review

Chapter1 Physiology of Pain

DEFINITION OF PAIN

In 1996 the International Association for the Study of Pain (IASP) defined *pain* as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage'.[9]

Scientists recognize that stimuli that cause pain are likely to be damaging to a tissue.[9] Although we tend to think of pain as a homogeneous sensory entity, several distinct types exist: nociceptive, inflammatory, neuropathic, and functional.[10]

MECHANISM AND PATHOPHYSIOLOGY OF PAIN

Multiple mechanisms that can produce pain have been identified; they include nociception, peripheral sensitization and central sensitization.[10]

Nociception

Nociception is the sole mechanism that causes nociceptive pain and comprises the processes of transduction, conduction, transmission, and perception.

- *Transduction* is the conversion of a noxious thermal, mechanical, or chemical stimulus into electrical activity in the peripheral terminals of nociceptor sensory fibers.[10]

- *Conduction* is the passage of action potentials from the peripheral terminal along[1] axons to the central terminal of nociceptors in the central nervous system.[10]

- *Transmission* is the synaptic transfer and modulation of input from one neuron to another.[10]