Dexmedetomidine as an Adjuvant to Bupivacaine in Ultrasound-Guided Thoracic Paravertebral Block for Breast Cancer Surgeries.Efficacy of Two Different Doses.

Thesis

Submitted for partial fulfillment of
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Presented by

RamyFawzy Mahmoud

MB.BCH

Supervised by

Professor Dr.Neamat Ibrahim

Professor of Anaesthesiology, Intensive Care and Pain Relief
Kasr El-AinyFaculty of Medicine
Cairo University

Professor Dr.SaharAbdelhalim

Professor of Anaesthesiology, Intensive Care and Pain Relief
National Cancer Institute
Cairo University

Dr.Abeer Ahmed

Lecturer of Anaesthesiology, Intensive Care and Pain Relief
Kasr El-AinyFaculty of Medicine
Cairo University

Faculty of Medicine

Cairo University

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Kasr El-Ainy Faculty of Medicine

Prof. Dr. SaharAbdelhalim

Professor of Anaesthesiology

National Cancer Institute

Dr. Abeer Ahmed

Lecturer of Anaesthesiology

Kasr El-Ainy Faculty of Medicine

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Abstract

This study was conducted on 90 patients divided equally into 3 groups receiving either dexmedetomidine 0.5 μg/kg (groupBD0.5) or dexmedetomidine 1 μg/kg (groupBD1) added to Bupivacaine 0.25% or Bupivacaine 0.25% alone (group B) in TPVB with general anaesthesia in females undergoing MRM. Postoperative pain scores and opioid requirements were significantly lower in the first 24 hours in both groups BD0.5 and group BD1

Keywords

Dexmedetomidine - Ultrasound-Guided - Breast Cancer- *ETCO*

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LIST OF ABBREVIATIONS

ASA American Society of Anaesthesiologists

BMI Body Mass Index

CNS Central Nervous System

CTL Costo-Transverse Ligament

CVS Cardiovascular System

DBP Diastolic Blood Pressure

ECG Electrocardiograph

$ETCO_2$ End-tidal Carbon Dioxide

FDA Food and Drug Administration

GA General Anesthesia

HR Heart Rate

ICU Intensive Care Unit

INR International Normalized Ratio

IV Intravenous

MAC Minimum Alveolar Concentration

MAP Mean Arterial Pressure

mmHg millimeter Mercury

MHz Mega Hertz

NIBP Non-Invasive Blood Presure

OAA/S Modified Observer Assessment of Alertness and Sedation

PONV Post-operative Nausea and Vomiting

PVB Paravertebral Block

SBP Systolic Blood Pressure

SpO_2 Capillary Oxygen Saturation

TOF Train of Four

TPVB Thoracic Paravertebral Block

TPVS Thoracic Paravertebral Space

VAS-M Visual Analog Score at Movement

VAS-R Visual Analog Score at Rest

INTRODUCTION

Nearly 40% of postoperative breast surgery patients experience significant acute postoperative pain, with a pain score above 5, reflecting the inadequacy of conventional pain management. [1] Furthermore, acute postoperative pain is an important risk factor for the development of persistent chronic postoperative pain in women after breast surgery.[1-3] PMPS (Post-Mastectomy Pain Syndrome) was rated as the most troublesome condition leading to disability and psychological distress among breast cancer survivors. [4] As a result, the concept of preventive analgesia with analgesics that exceed the expected duration of action and also attenuate peripheral and central hypersensitivity has evolved over the last few years.[5-7]

Paravertebral Block (PVB) involves injection of local anesthetic in a space immediately lateral to where the spinal nerves emerge from the intervertebral foramina [8]. This technique is being used increasingly for intra-operative and post-operative analgesia in surgeries like thoracotomy [9,10] and also as a sole anesthetic technique for various procedures like breast [11] and abdominal surgeries [12]. The advantages of paravertebral blocks include: unilateral sympathetic segmental block with less hemodynamic instability, decreased stress response to surgery, postoperative analgesia and less side effects compared to epidural block [13].

Dexmedetomidine is a highly selective α2 adreno-receptor agonist with higher affinity to α2 adreno-receptors than clonidine.[14] Dexmedetomidine has been used as an adjuvant to local anesthetics in regional nerve blocks[15] including epidural blocks [16], paravertebral blocks [17-18], caudal anaesthesia [19] and spinal anaesthesia. [20] All have revealed promising results regarding efficacy, duration and safety profile.

Few literatures investigated the efficacy of adding dexmedetomidine as an adjuvant to local anesthetics in PVB. However, it was found that addition of 1 µg/kg Dexmedetomidine prolonged the duration and improved the quality of analgesia with no serious effects [17-18]. The efficacy of using lower dose of dexmedetomidine during PVB has not been assessed yet, and there were no sufficient data about systemic effects of dexmedetomidine in form of delayed recovery from general anesthesia or post-operative sedation effect.

AIM OF WORK

This prospective randomized control trial is designed to compare the perioperative analgesic efficacy of two different doses of dexmedetomidine (1μg/kg and 0.5 μg/kg) added to 0.25% bupivacaine when injected preoperatively in the paravertebral space using ultrasound-guided technique in breast cancer surgeries combined with general anesthesia.

CHAPTER I: PARAVERTEBRAL BLOCK

Introduction:

THORACIC paravertebral block (TPVB) is the technique of injecting local anesthetic adjacent to the thoracic vertebra close to where the spinal nerves emerge from the intervertebral foramina. This results in ipsilateral somatic and sympathetic nerve blockade in multiple contiguous thoracic dermatomes above and below the site of injection. [21-23] Analgesia is obtained either by bolus injection [24] or continuous infusion [6][25] of local anaesthetics with or without adjuvants eg. fentanyl, clonidine or dexmedetomidine. It is effective in treating acute [26-28] and chronic [23][29-30] pain of unilateral origin from the chest and abdomen. Bilateral use of TPVB has also been described.[31-34] Our understanding of the safety and efficacy of TPVB has improved significantly in the last two decades, prompting its use in children [35-37] and neonates [36][38] and for surgical anesthesia.

History:

The concept of Paravertebral Block was pioneered by Hugo Sellheim of Leipzig in 1905 [39-40] who was searching for an alternative to spinal anaesthesia and its associated dangers of hemodynamic and respiratory complications. It was further refined by Lawen (1911) and Kappis (1919). [41]The technique however remained neglected till the late 1970s, when a renewed interest developed in the topic due to efforts from Eason and Wyatt who presented a reappraisal on Thoracic

Paravertebral Block (TPVB).[23]They found it to be an accurate, simple and safe method which carried significant advantages over intercostal and epidural blocks2. In 1997, Weltz et al demonstrated enhanced patient satisfaction and the safety of TPVBs in surgery for breast malignancy, which has become a leading indication for the block.[42].

More recently, there has been renewed interest in this technique for the treatment of acute and chronic pain. Because of the ability to provide long-lasting unilateral anaesthesia, PVB have been successfully used to provide analgesia for multiple thoracic and abdominal procedures in both children and adults.[43]

Anatomy:

The thoracic paravertebral space (TPVS) is a wedge-shaped space that lies on either side of the vertebral column as shown in ***figure (1)***. The boundaries of the space are posteriorly the superior costotransverse ligament; anterolaterally the parietal pleura and medially the vertebral body, the intervertebral disc and the intervertebral foramen. The TPVS contains fatty tissue, within which lies the intercostal (spinal) nerve, the dorsal ramus, the intercostal vessels, the rami communicantes and the sympathetic chain. It communicates medially with the epidural space and laterally with the intercostal space. The inferior limit of this space occurs at the origin of the psoas major muscle and the superior limit extends into the cervical region. [47]

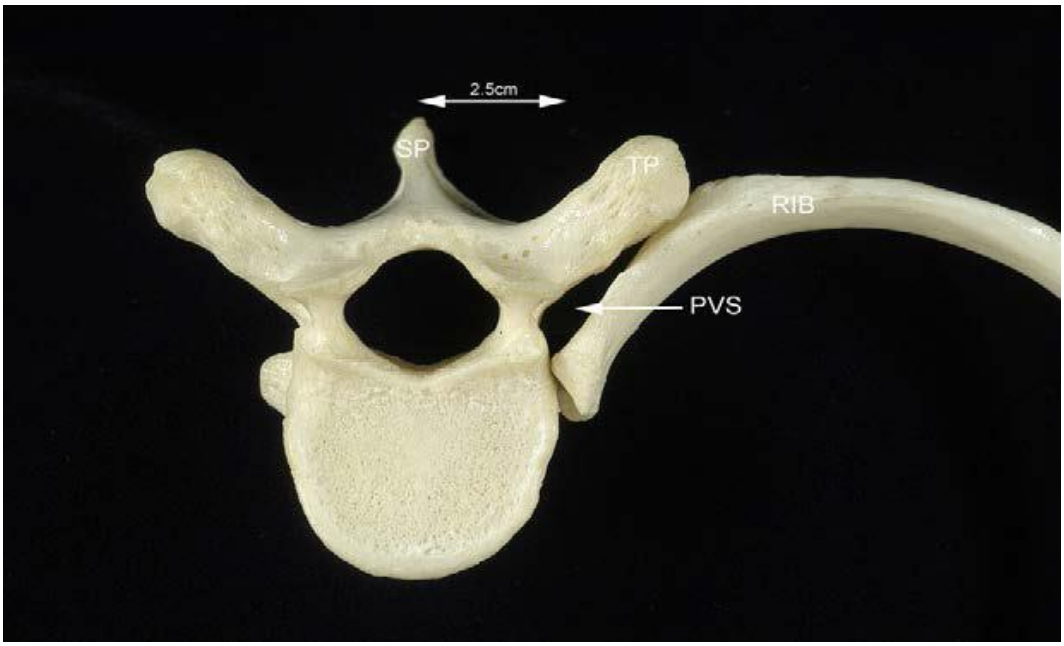

Figure (1) - Bony boundaries of the paravertebral space.

***TP**: Transverse Process **SP**: Spinous Process*

The space, illustrated in ***figure (2),*** is divided into an anterior and posterior compartment by a fibro-elastic membrane, the endothoracic fascia. The endothoracic fascia is the deep investing fascia of the thoracic cavity. It blends medially with the periosteum of the vertebral body; and laterally, is closely applied to the ribs. Caudally, it is continuous with the transversalis fascia of the abdominal cavity and this may explain why solutions injected in the TPVS may spread to the lumbar region. The spinal nerves have been described as running through the compartment posterior to the endothoracic fascia.[442] This however is controversial [44-45] as the precise anatomy of the endothoracic fascia, and its relationship to the spinal nerves in particular, remains ill-defined.

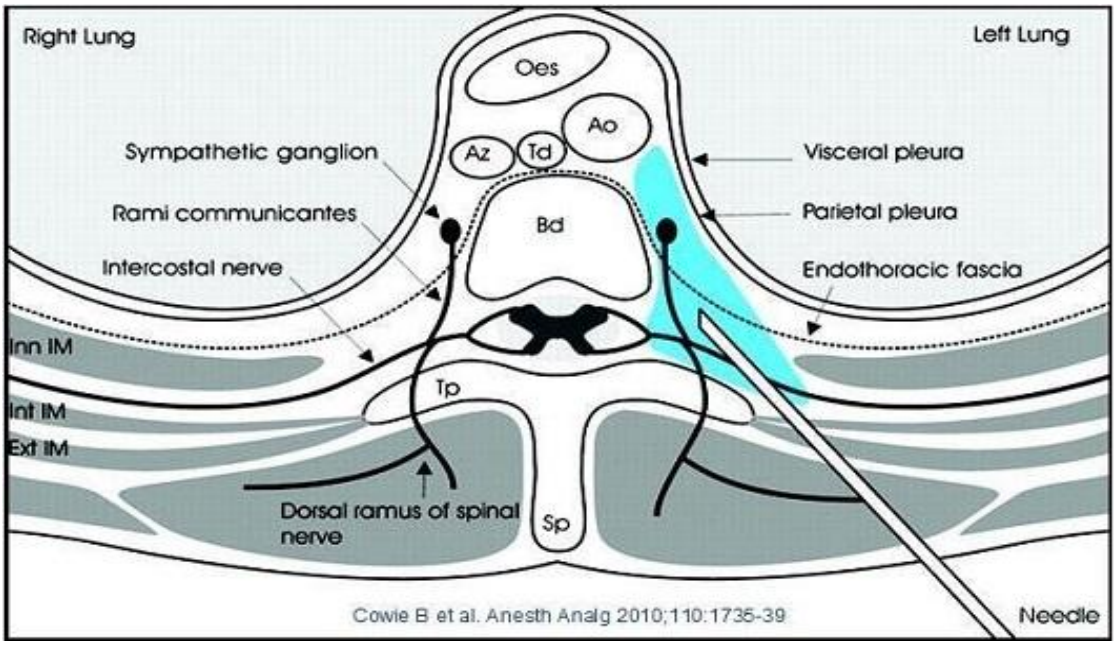

Figure (2) **-** Boundaries of the paravertebral space.

Ao**:** Aorta ***Az****:* Azygous vein ***Td****:* Thoracic duct ***Bd:*** vertebral body ***Tp:***Transverse process ***Sp:***Spinous process ***Oes****:Oesophagus* ***Inn****:*Inner ***Int****:*Internal ***Ext****:* External

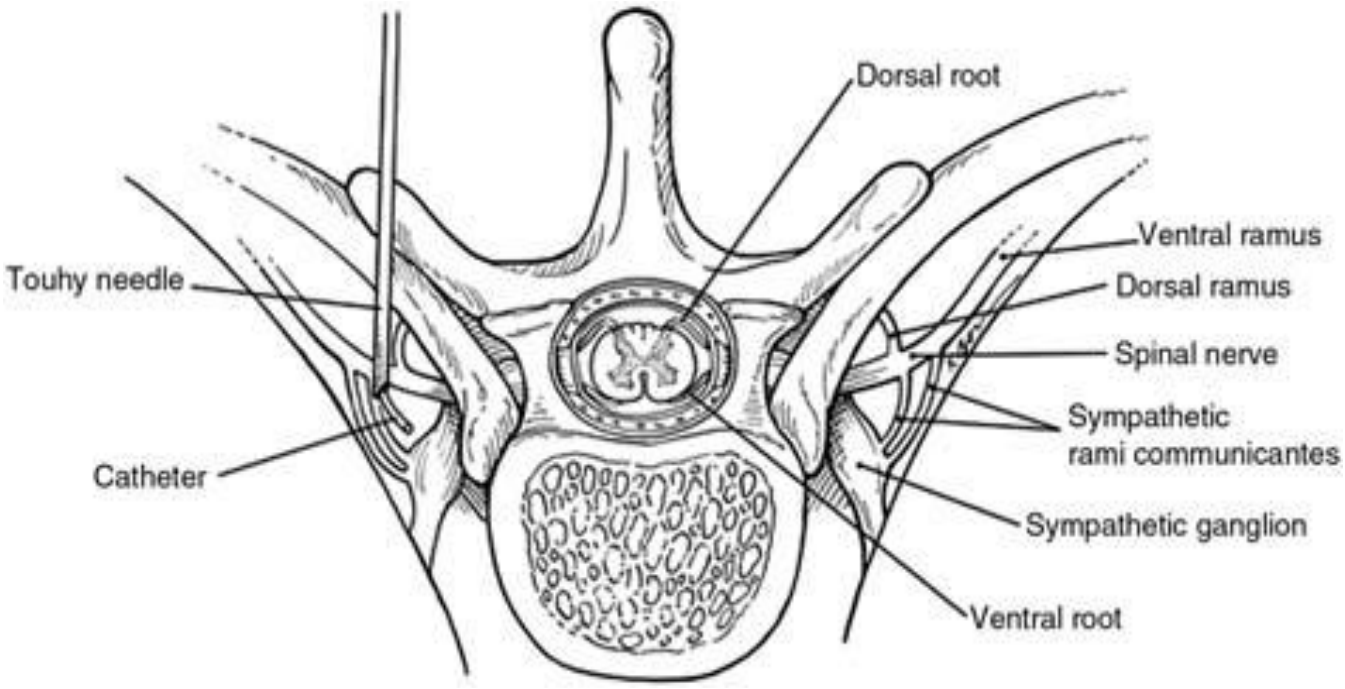

Figure (3) **-** Anatomy of the paravertebral space showing site of needle tip to perform paravertebral block**.**

The spinal nerves in the TPVS are segmented into small bundles lying freely among the fat and devoid of a fascial sheath, which makes them exceptionally susceptible to local anesthetic block.[46] Each spinal nerve emerges from the intervertebral foramina and divides into two rami: a larger anterior ramus, which innervates the muscles and skin over the anterolateral body wall and limbs, and a smaller posterior ramus, which reflects posteriorly and innervates the skin and muscles of the back and neck.[47]