Regional Anesthesia in Breast Surgery

An Essay

Submitted For Partial Fulfillment of Master Degree in Anesthesiology

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2017

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

﴿وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا﴾

صدق الله العظيم

سورة النساء آية (١١٣)

First thanks to **ALLAH** *to whom I relate any success in achieving any work in my life.*

I wish to express my deepest thanks, gratitude and appreciation to ***Prof. Dr. Ahmed Ibrahim Ibrahim,*** *Professor of Anesthesiology, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University for his meticulous supervision, kind guidance, valuable instructions and generous help.*

Special thanks are due to ***Prof. Dr. Sahar Mohammed Kamal Hassanein,*** *Professor of Anesthesiology, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University for his sincere efforts, fruitful encouragement.*

I am deeply thankful to ***Dr. Simon Halim Aramanios,*** *Lecturer of Anesthesiology, Intensive Care and Pain Management Faculty of Medicine- Ain Shams University for his great help, outstanding support, active participation and guidance.*

I am extremely sincere to ***my Family*** *and* ***my Wife*** *who stood beside me throughout this work giving me their support*

Mohamed Mostafa Awida

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List of Abbreviations

Abb.	Full term
ABP	*Arterial blood pressure*
BRILMA	*Blocking the branches of intercostal nerves in the mid-axillary line*
CEA	*Cervical epidural anesthesia*
CO_2	*Carbon dioxide*
ICBN	*Intercostobrachinal nerve*
ICD	*Implantable cardioventer-defibrillartor*
LA	*Local anesthetic*
mA	*Milliampere*
MPVB	*Multiple injections paravertebral block*
MRI	*Magnetic resonance imaging*
NRS	*Numerical rating scale*
$PaCO_2$	*Partial pressure of carbon dioxide in arterial blood*
PaO_2	*partial pressure of oxygen in arterial blood*
PECS I	*Pectoral nerve block*
PECS II	*Modified pectoral nerve block*
PMPS	*Post mastectomy pain syndrome*
PVB	*Paravertebral block*
SaO_2	*Percentage of oxygen saturation in arterial blood*
SPVB	*Single injection paravertebral block*
TPVB	*Thoracic paravertebral block*
U/S	*Ultrasound*

Abstract

Recently, different techniques of regional blocks can be used for this type of surgeries, techniques as epidural anesthesia, paravertebral block and intercostals nerve block depend on landmark identification and easily can be used with almost all patients.

Ultrasound use with paravertebral block and intercostals block improve the outcome.

More recent blocks as PECS I, PECS II, serratus plane block and BRILMA needs expert operator and offer very good analgesia for post-operative period.

Keywords: Implantable cardioventer-defibrillartor - Milliampere- Multiple injections paravertebral block **-** Numerical rating scale- Ultrasound

INTRODUCTION AND AIM OF THE WORK

Breast surgery is an exceedingly common procedure and associated with an increased incidence of acute and chronic postoperative pain. Studies suggest that nearly 60% of breast surgery patients experience severe acute postoperative pain. Chronic pain symptoms in the operated breast and the ipsilateral arm are prevalent for 1 year after breast surgery ***(Karamarie et al., 2009).***

Inadequate pain control can impact patient recovery including impaired pulmonary and immune function with an increased risk of thromboembolism and myocardial infarction ***(Joshi and Ogunnaike 2005).***

Regional anesthesia offers adequate analgesia while minimizing opioid consumption and related side effects. Breast surgery is not an exception to this trend. Regional anesthesia has been associated with improved postoperative pain and decreased side effects following breast surgery ***(Eric et al., 2015).***

In a study performed at Brigham and Women's Hospital in 1993 by surgeon Eberlein, thoracic epidural anesthesia was associated with a statistically significant earlier hospital discharge compared to general anesthesia. For quadrantectomy, axillary node dissection procedures, 51% having thoracic epidural anesthesia were discharged on the operative day versus

22% in the general anesthesia group. Furthermore, 20% in the thoracic epidural group experienced nausea and/or vomiting during their hospital stay versus 56% in the general anesthesia group ***(Eileen et al., 1995).***

The PECS I block is a recently described, easy and reliable superficial block that targets the lateral and median pectoral nerves at an interfascial plane between the pectoralis major and pectoralis minor muscles. It can be used for different breast operations ***(Blanco et al., 2012) a.***

The PECS II block places additional local anesthetic between the pectoralis minor and serratus anterior muscles in order to the anesthetize the lateral branches of intercostal nerves (T2-T6) with the intercostobrachial, thoracodorsal, and the long thoracic nerves ***(Porzionato et al., 2012).***

Thoracic paravertebral block affect ipsilateral somatic and sympathetic nerves including the posterior ramus in multiple contiguous thoracic dermatomes. The spinal nerves in this space are devoid of a fascial sheath, making them exceptionally susceptible to local anesthetics. A block from T1-T6 is required for most breast surgeries ***(Schnabel et al., 2010).***

The aim of this work is to discuss the different techniques of regional anesthesia that can be used in breast surgeries for analgesia during surgery and postoperative period.

PAIN PATHWAY IN BREAST SURGERY

Breast Anatomy:

Female breast lies on the anterior thoracic wall with the base extending from the second to the sixth rib ***(Drew et al., 2007).***

The anatomic boundaries of the breast extend from the level of the second or third rib superiorly to the infra mammary fold inferiorly, and its transverse boundary from the lateral border of the sternum medially to the mid axillary line laterally. About two-thirds of the breast overlies the pectoralis major muscle, and remainder of the breast contacts with the serratus anterior muscle and the upper portion of the abdominal oblique muscle. The breast tissue frequently extends into the axilla as the axillary tail of Spence.

The breast is composed of skin, subcutaneous tissue, and breast tissue ***(Cooper 1840).***

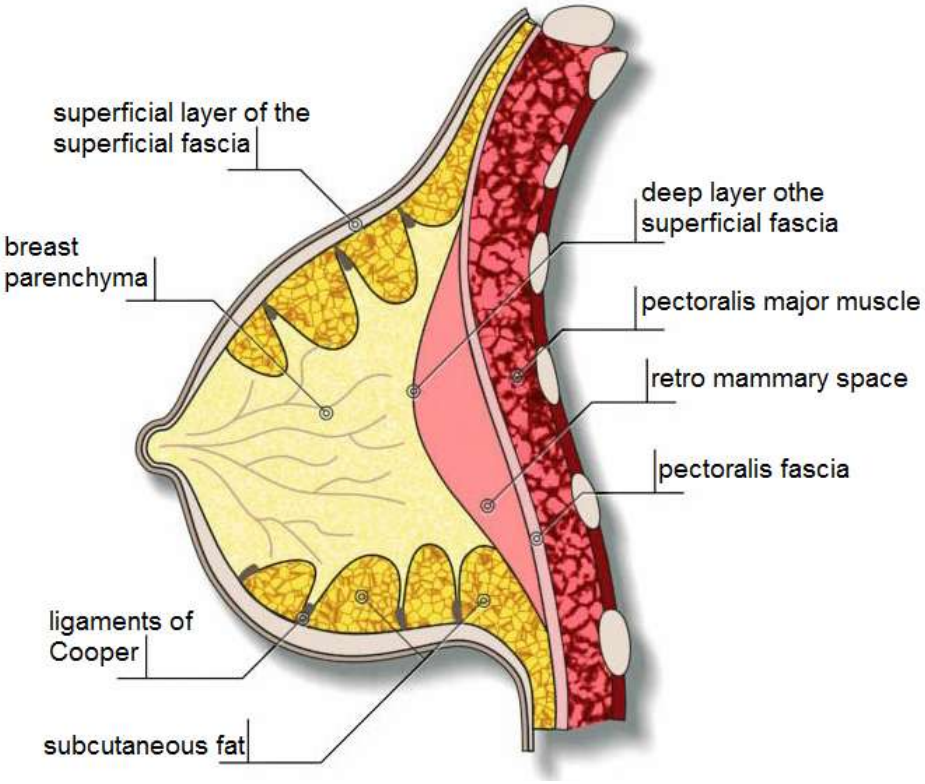

Figure (1): Anatomy of the breast ***(Moustapha et al., 2005).***

There are 2 fascial layers: The superficial fascia lies deep to the dermis and the deep fascia lies anterior to the pectoralis major muscle fascia. The breast tissue lies in the superficial fascia just deep to the dermis as shown in ***(Figure 1) (Bland and Copeland 2009).***

The nipple is located over the fourth intercostal space in a non-pendulous breast and is surrounded by a circular pigmented areola, the areola contains sebaceous glands and apocrine sweat glands ***(Bland and Copeland 2009).***

Blood supply of the breast:

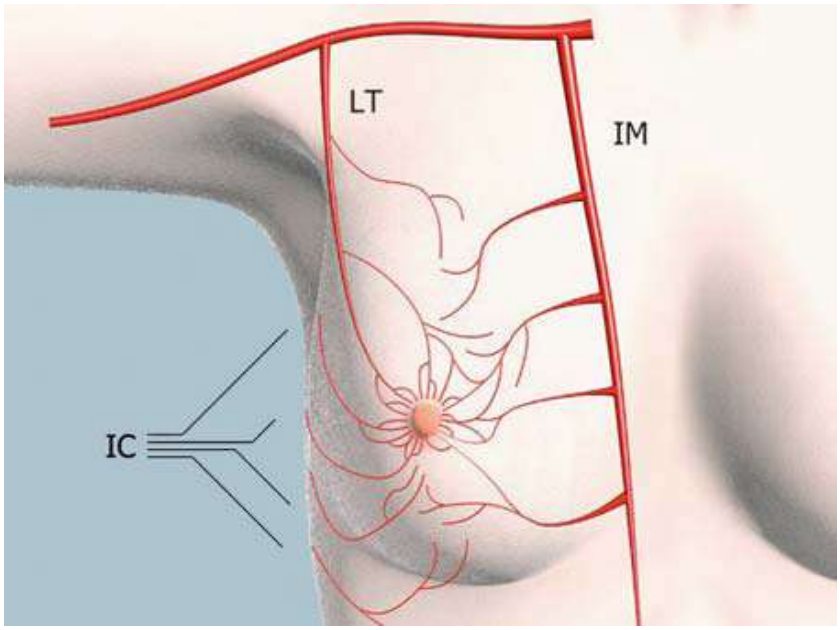

Figure (2): Three main arterial routes supplying the breast: internal mammary artery (IM), lateral thoracic (LT) artery, and intercostal (IC) arteries ***(Moustapha et al., 2005).***

The breast receives its arterial blood supply from 3 major routes: *(Figure 2)*:

1. Medially from anterior perforating intercostal branches, which arise from the ***internal mammary*** artery ***(Bland and Copeland 2009).***

2. Branches of the ***lateral thoracic*** artery originating from the axillary artery, and the pectoral branches of the thoracoacromial artery also branch of the axillary artery ***(Bland and Copeland 2009).***

3. Branches from the posterior ***intercostal arteries (Brunicardi et al., 2004).***

The blood supply to the breast skin depends on the subdermal plexus, which is in communication with the deeper vessels supplying the breast parenchyma. The internal thoracic artery is an important and constant contributor of blood supply to the nipple-areola complex by means of its perforating branches and anterior intercostals branches ***(Van Deventer. 2004).***

The venous drainage of the breast and chest wall runs with arterial supply, but the venous drainage going towards the axilla. The veins form an anastomotic circle, called the circulus venosus around the nipple. The veins from the circle and the gland drain into vessels tributes to the internal thoracic and axillary vein. The 3 main veins are the *perforating branches of the internal thoracic vein* (largest venous plexus to provide drainage of the mammary gland), the *perforating branches of the posterior intercostal veins* and the *tributaries of the axillary vein* ***(Brunicardi et al., 2004) (Bland and Copeland 2009).***

Sensory Innervation of the breast:

The thoracic nerves can be divided into 3 major groups as shown in ***(Figure 3)***: those arising from the superficial cervical plexus, those arising from the brachial plexus, and those extending from the anterior branches of the thoracic nerves. The supraclavicular nerves that innervate the upper pole of the mammary region arise mainly from the superficial cervical plexus (C1-C4). The lateral (C5-C7) and medial (C8-T1) pectoral nerves, the long thoracic or anterior serratus nerve (C5-C7) and the thoracodorsal nerve (C6-C8) arises from the brachial plexus. The intercostal nerves arise from the anterior divisions of the 1^{st} to 11^{th} thoracic nerves. The anterior division of the 12^{th} thoracic nerve is called the subcostal nerve. The 1^{st} to 11^{th} intercostal nerves innervate the sternum, while the breast is innervated by the 2^{nd} to 6^{th} intercostal nerves. The intercostobrachial nerve is a lateral cutaneous branch of the 2^{nd} intercostal nerve that innervates the interior of the upper arm. Acute and even chronic postoperative pain following breast surgery is often caused by damage or even sectioning of this nerve during axillary dissection ***(Diéguez et al., 2016).***