An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I and II

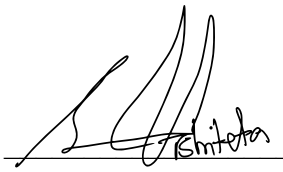
Pablo Samuel Tshiteta

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Anaesthesiology.

Johannesburg, 2024

Declaration

I, Pablo Samuel Tshiteta, declare that this research report is my own unaided work. It is being submitted for the Degree of Master of Medicine in the branch of Anaesthesiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



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Abstract

Background

Poorly managed perioperative mastectomy pain increases the incidence of chronic pain. The postoperative risk factor for developing chronic pain identified was severe acute postoperative pain. This presents the perioperative team with a variable that can be modified with regional anaesthesia to improve outcomes. The aim of this study is to determine the analgesic efficacy of PEC I & II blocks versus the administration of local anaesthesia via a surgical drain in post-mastectomy patients. These techniques were compared with regards to postoperative pain scores, satisfaction, time to first request for systemic opioid postoperatively, opioid consumption, the incidence of postoperative nausea and vomiting (PONV) and complications.

Methods

A prospective, contextual, cohort, observational, single centre study with 30 female participants who were recruited via convenience sampling. Participants were assigned to PEC blocks (Group P, n=15) or local anaesthesia via surgical drain (Group S, n=15). The general anaesthesia was standardized between the groups. Group S received the standard of care which was administration of 2mg/kg of 0.5% bupivacaine with adrenaline (1:200,000) via the surgical drain. Group P received 0.2ml/kg of 0.5% bupivacaine plus adrenaline (1:200,000) in each fascial plane.

Results

There were no significant differences in participants' characteristics in the groups. The study showed no statistically significant difference between the pain scores of the groups at 30 minutes, 3, 6, and 24 hours postoperatively (p=0.660, p=0.160, p=0.894, p=0.931). The differences in patient satisfaction scores and morphine consumption were statistically insignificant. No complications were noted in either of the groups. No statistically significant relationship with the occurrence of vomiting and nausea and the specific technique.

Conclusion

The techniques evaluated in this study demonstrate a similar efficacy in the management of postoperative pain in mastectomy patients. The techniques can be considered safe as there is a low incidence of the described complications including the incidence of PONV.

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Abbreviations

ASA	American society of anaesthesiology
ASIC3	Acid-sensing ion channel 3
CHBAH	Chris Hani Baragwanath Academic Hospital
ERAS	Enhanced recovery after surgery
ESP	Erector spinae plane
FPS-R	Faces Pain Scale-Revised
HREC	Human Research Ethics Committee
IASP	International Association for the Study of Pain
IL	Interleukin
MMP	Metalloproteinases
mTOR	Mammalian target of rapamycin
MTP	Mid-point transverse process to pleura
NK	Natural killer
NRS	Numerical rating scale
NSAIDS	Non-steroidal anti-inflammatory drugs
PEC	Pectoral nerve block
PIFB	Pecto-intercostal fascial block
PMM	Pectoralis major
PmM	Pectoralis minor
PONV	Postoperative nausea and vomiting
QoR	Quality of Recovery

RISS	Rhomboid intercostal and subserratus
SAJAA	Southern African Journal of Anaesthesia and Analgesia
SAM	Serratus anterior muscle
SAP	Serratus anterior plane
SIFB	Serratus intercostal fascial block
SPSS	Statistical Package for Social Science
TRPV1	Transient receptor potential cation channel subfamily V member 1
UPAT	Universal Pain Assessment Tool
VAS	Visual Analog Scale
VRS	Verbal Rating Scale

Statement

The Research Report consists of a literature review, draft article, study proposal and appendices. The study proposal is included for background reference and is not for examination.

The formatting of this Research Report complies with the University of the Witwatersrand's Style Guide for Theses, Dissertations and Research Reports. The formatting of the draft article is in keeping with the rest of the Research Report thus may not comply with the author guidelines of the South African Journal of Anaesthesia and Analgesia, the journal to which it is intended to be submitted.

Section 1: Review of the literature

1.1 Introduction

The most prevalent cancer amongst women worldwide is breast cancer with about 1.7 million estimated diagnoses yearly. It is common for these patients to undergo either total mastectomies with axillary lymph node biopsies, or breast conserving surgery. Both treatment modalities present the anaesthetic practice with several short and long-term challenges. The challenges include the optimal management of intraoperative and postoperative pain, the development of chronic post-surgical pain, and breast cancer recurrence (1). Reviewing the literature and conducting clinical studies are the basis by which evidence-based medicine can be practiced for these patients. Thus, this literature review will examine the physiology, anatomy, guidelines, challenges, and research relevant to managing postoperative pain in mastectomy patients.

The revised definition of pain as of 2020 by the International Association for the Study of Pain (IASP), is "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." The IASP has further emphasised on the experience of pain being subject to biological, psychological, and social factors. The IASP also noted that pain and nociception are different phenomena because pain cannot only be explained by activity in the sensory neurons (2). Pain can further be classified as acute or chronic (3) in which chronic pain is defined as "pain that lasts or recurs for longer than 3 months" and acute pain lasts less than 3 months (4, 5).

Post mastectomy patients experience a significant amount of pain, and current evidence suggests that these patients are at a higher risk for chronic pain syndrome (6). A Turkish study conducted by Turan et al in 2014 reported a 41.8% incidence of chronic pain in breast surgery patients that experienced severe postoperative pain (7) which is prevalent in about 30-50% of these patients (1). Several perioperative risk factors have been identified in the development of chronic pain after breast surgery. In the preoperative period, risk factors such as depression, anxiety, young age, and genetics were identified. The intraoperative risk factors for chronic pain included lymph node dissection and intercostobrachial nerve injury. The postoperative risk factor for developing chronic pain was identified as severe acute postoperative pain (8, 9). This presents the perioperative team with a factor that can be modified with regional anaesthesia to improve outcomes. Regional anaesthesia is a pain

management strategy where local anaesthetic is used to provide analgesia to specific areas of the body; therefore, targeting the innervation of that area.

The breast has a complicated innervation which can be classified as cutaneous and subcutaneous arising from thoracic intercostal nerves 3-5 (T3-T5). The thoracic spinal nerves exiting from the intervertebral foramen divide into the ventral and dorsal rami. The dorsal rami nerves innervate the posterior chest wall. The ventral rami nerves run between the innermost and internal intercostal muscle fascial plane and is referred to as an intercostal nerve. A branch of the intercostal nerve called the lateral cutaneous nerve exits and perforates the fascial plane, internal intercostal muscle, external intercostal and the serratus anterior muscle at the mid-axillary point to innervate the lateral chest skin. The anterior cutaneous branch exits next to the sternum and innervates the medial chest and sternum. The superior portion of the breast's innervation originates from supraclavicular nerves. The axilla's innervation is from the lateral cutaneous branch which is derived from the ventral rami of T2. The pectoral muscles innervation is derived from the brachial plexus. The pectoralis major is innervated by the lateral pectoral nerve (C5-7). The pectoralis minor is innervated by the medial pectoral nerve (C7-T1). The medial and lateral pectoral nerves run between the clavipectoral fascia and the pectoral fascia with the thoracoacromial artery. The long thoracic nerve (C5-7) runs along the serratus anterior muscle which it innervates (1).

The pathophysiology of mastectomy pain, peripheral sensitisation and central sensitisation is complex but provides insight into the management strategies to mitigate these adverse effects. The proposed physiology of postoperative pain is that it consists of 2 components. Firstly, the degree of nociceptive insult from the surgery and subsequently, the mechanisms of peripheral and central sensitisation (9). The nociception pain can be divided into 4 basic processes namely, transduction, transmission, perception, and modulation. Transduction is the detection of mechanical, thermal, or chemical damage by the nociceptive receptors. Transmission is the generation of a nervous impulse to the spinal cord and then brain. Perception is the experience of pain by the individual. Modulation is the mitigation, inhibition or exacerbation of the pain impulse (3). The nociceptive inputs due to surgical incision, cause the release of nerve growth factor and cytokines in the sensory neurons of the dorsal ganglia which leads to the increased activity of several receptors (ASISC3, TRPV1, mTOR). The increased glutaminergic discharge will be responsible for the peripheral sensitisation. These changes and their persistence will later influence the spinal neuronal

activity that cause central sensitisation. The process of central sensitisation can be described as “pain memory” due to neuroplastic adaptive changes that amplify the pain signalling systems long term and leads to chronic pain (9).

The objective assessment and quantification of pain can be performed with the utilisation of pain score scales. The 4 commonly used scales include the Numerical Rating Scale (NRS), the Verbal Rating Scale (VRS), the Visual Analog Scale (VAS) and the Faces Pain Scale-Revised (FPS-R) (10). These 4 scales have been validated (11). A systematic review of the currently employed pain rating scales in clinical practice, concluded that the pain rating scales can be used by patients to communicate pain intensity. The VAS, NRS and the VRS have been deemed reliable in clinical practice (12). These scales do present some challenges for the users. The particular challenge in this regard stems from the literacy levels of the user (10). A study focused on determining whether the NRS, VRS, VAS, and FPS-R are viable pain rating scales in a population with low literacy rates was conducted in Nepal. The results of the study suggested that the FPS-R and the VRS were first and second respectively in terms of preference amongst the younger and older participants irrespective of education level. The VAS and the NRS were reported to have the greatest number of errors or incorrect responses. It is possible that these results are affected by cultural factors. An important note to make is that these pain rating scales have often been validated in clinical trials performed in western nations with higher levels of literacy (10). A study conducted in Mexico to validate the VRS and the VAS found that participants with more than 6 years of education preferred the VAS (13). Due to the varied literacy level of the participants involved in the proposed study, the Universal Pain Assessment Tool (UPAT) which has been validated for use in children (14) and patients with intellectual disabilities (15) will be utilised to mitigate errors or incorrect responses.

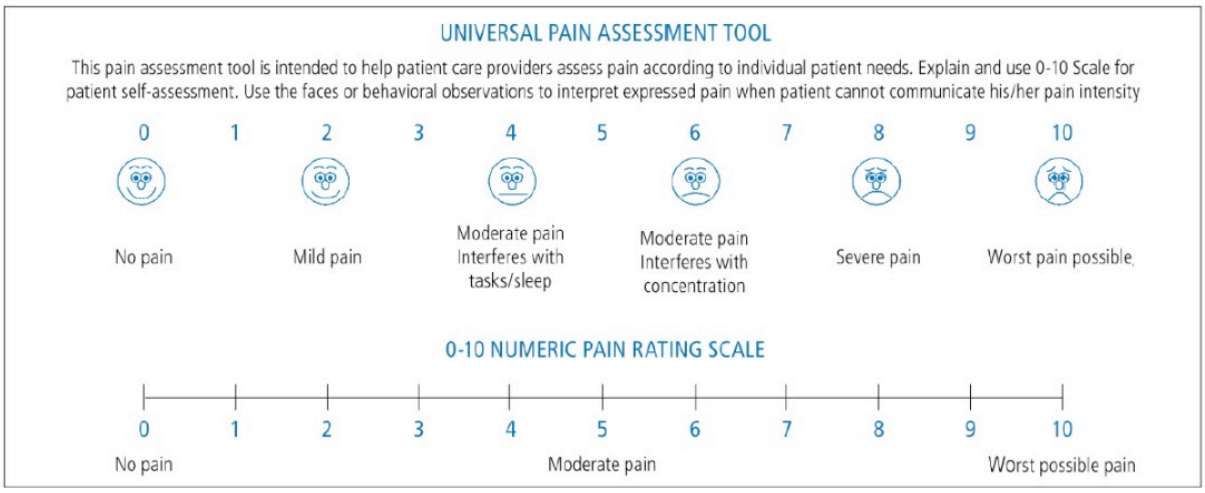

Figure 1. The Universal Pain Assessment Tool (14)

One of the major consequences of inadequately treated postoperative pain which is chronic pain has been mentioned and a proposed management has been stated. Current evidence from a Cochrane review of randomised controlled trials of regional anaesthesia versus conventional anaesthesia for thoracotomy and breast surgery suggested that regional anaesthesia may reduce the incidence of chronic pain. The literature seems to support the use of regional techniques in the anaesthetic management of all these breast surgery patients (6). Cancer recurrence may be another consequence. An Irish study conducted by Deegan et al in 2010 on 32 breast cancer patients that underwent mastectomies in which preoperative and postoperative (24hrs) interleukin (IL) and metalloproteinases (MMP) levels were measured in a propofol/paravertebral group and sevoflurane/opioid group. The results showed a decrease in measured IL-1B in patients that received a regional block anaesthetic as opposed to those who had an anaesthetic with an opioid (regional = -26% vs opioid = -4%; p = 0.003). This finding supports the proposed hypothesis of the immunomodulatory effects of opioids. Further evidence to support the hypothesis is that IL-10 which inhibits proinflammatory cytokines was increased in the regional anaesthesia group (regional = 10% vs opioid = -15%; p = 0.001). A reduction in the elevation of the metalloproteinases 3 (regional = 2% vs opioid = 29%; p = 0.011) and 9 (regional = 26% vs opioid = 74%; p = 0.02) was also noted in the regional anaesthesia group. This supports the hypothesis as well because the known function of these MMPs is proteolytic degradation of basement membranes and extracellular matrices which would allow for the propagation of cell invasion, metastasis, and angiogenesis. The study results demonstrated that pro-tumorigenic cytokines and matrix metalloproteinases were reduced, and anti-inflammatory cytokines were increased in patients that had a regional anaesthetic technique after undergoing a mastectomy (16). Other studies suggest that regional

anaesthesia in the perioperative period may reduce metastases in breast cancer patients via a different mechanism. The finding in 2014 was that breast cancer patients undergoing breast surgery with a regional anaesthetic technique had an increased serum level of Natural Killer (NK) cell cytotoxic activity as compared to the opioid general anaesthetic group (1, 17, 18). This is in keeping with a more recent study that found less immunosuppression and inflammation in the regional anaesthetic technique (19).

Thus, the management of mastectomy pain is an important factor to consider in the anaesthetic plan of the patient. Enhanced recovery after surgery (ERAS) represents perioperative guidelines and practices that are evidenced based and intended to reduce the length of stay, morbidity and mortality originally describe for colorectal surgery. These recommendations have now been expanded to other types of surgery including breast surgery. The ERAS recommendations are numerous for breast surgery but the ones of concern pertaining to this study are for preoperative, intraoperative, and postoperative analgesia. The first recommendation concerning analgesia is that the patient should receive a multimodal analgesic strategy. The drugs specifically mentioned include the gabapentinoids preoperatively. They further suggest the use of systemic magnesium, venlafaxine, and clonidine as effective analgesics if given preoperatively. Nonsteroidal anti-inflammatory drugs provide effective analgesia intraoperatively, reduce chronic breast pain and do not increase bleeding complications according to the recommendations. The infiltration of the surgical site with a local anaesthetic like bupivacaine decreases the use of opioids and pain intensity postoperatively. The ERAS society discusses the standard anaesthetic protocol and notes that the combination of general anaesthetic with a regional technique decreased the recurrence rate of breast cancer which is supported by previously mentioned studies (1, 16, 20). The ERAS recommendations for postoperative analgesia are that a multimodal pain management plan be instituted with the goal of being opioid sparing. The tools to achieve this goal include the use of paracetamol in combination with non-steroidal anti-inflammatory drugs (NSAIDS), preoperative and postoperative gabapentin and regional anaesthetic techniques (20).

The ERAS society recommendations for opioid sparing techniques of anaesthesia are supported by many studies that have demonstrated several benefits. There’s evidence that indicates that regional anaesthetic techniques reduce morphine consumption in the perioperative period (21) There is a review article that shows one study with increased in

opioid consumption and one with no difference. The rest of the reviewed studies all demonstrated a statistically significant decrease in the opioid consumption among the regional technique groups (21). The second benefit associated with an opioid sparring technique is the prolongation of time to first request for systemic opioid. A meta-analysis looked at 6 studies that reported an increase by 296.69 minutes ($p = 0.001$) (22). An study be Hamed et al. which compared two regional techniques had increased time to first request for systemic opioid in both groups (23). Another study reported similar results comparing opioid sparring anaesthesia versus non-opioid sparring anaesthesia at extubation and 6 hours ($p=0.043$; $p=0.006$) (24). The third benefit of note is the decreased incidence of PONV. Bin Ghali et al. demonstrated this in there 2023 meta-analysis. This is further supported by a review from Jin et al. that had similar findings and proposed that the decrease incidence of PONV is associated with the decreased opioid use (25). All this benefits are in keeping with the desired outcomes expressed by the ERAS society (20).

To provide some degree of uniformity when studying the different opioids available in the acute management of pain a morphine equivalent dose is used. Several points need to be noted when utilising morphine equivalents. First point is that the data used to create the equivalents is from chronic pain management literature, expert opinion, and small case series. Secondly, the pharmacogenetic differences, drug interactions, and hepatic or renal effects have not been taken into consideration. Nonetheless, morphine equivalents provide a useful metric to study opioid consumption (26).

Numerous regional anaesthetic techniques are available for mastectomies and have been shown to reduce the postoperative pain scores. However, some regional techniques are preferred over other techniques due to the potential complication profiles. Thoracic epidurals are a described technique of regional anaesthesia, but the associated potential complications have made this technique's use decline in popularity. The thoracic epidurals have been associated with complications such as dural puncture, high or total spinals, and an elevated failure rate despite the use of ultrasonography to improve needle placement accuracy. The thoracic paravertebral block is another technique that was first described in 1905 and has evolved with multiple approaches and techniques described in literature. Nonetheless, the associated complications of perioperative hypotension, pneumothorax and symptomatic bradycardia remain a concern. It should be noted that the incidence of some of these complications have reduced with the use of ultrasonography. (1)

Several other regional techniques have since been described namely, the serratus anterior plane block (SAP), the pecto-intercostal fascial block (PIFB), serratus intercostal fascial block (SIFB), rhomboid intercostal and subserratus plane block (RISS), erector spinae plane (ESP) block, retrolaminar block and the mid-point transverse process to pleura (MTP) block.(1)

The regional anaesthetic technique of interest in this literature review is the pectoral nerve block known as the PEC I and PEC II blocks. The PEC I block was initially described in 2011 as a technique in which local anaesthesia was injected in between the pectoralis major and minor muscles to block the medial and lateral pectoral nerves. In 2012, the PEC II block was described as requiring the injection of local anaesthesia in between the pectoralis major and minor muscles as well as between the pectoralis minor and serratus muscle with the intention to block the intercostobrachial, 3-4 intercostal and long thoracic nerves (1). The indications for these regional anaesthetic techniques include breast surgery for which it was originally intended but has expanded to thoracotomies and insertion of cardiac resynchronisation devices according case reports. The medial and lateral pectoral nerves which innervate the pectoral major and minor muscles run between the clavipectoral fascia and the pectoral fascia. These nerves arise from C5-7 and C8-T1 respectively of the brachial plexus. The PEC I block requires the deposit of a local anaesthetic volume of 0.2-0.4 ml/kg in that inter-fascial plane. The PEC II block requires the deposition of 0.2-0.4 ml/kg of local anaesthetic in between the clavipectoral fascia and the superior border of the serratus anterior muscle. The PEC blocks are ultrasound guided regional anaesthetic technique as the fascial planes must be identified for the administration of the local anaesthetic into the planes (27).

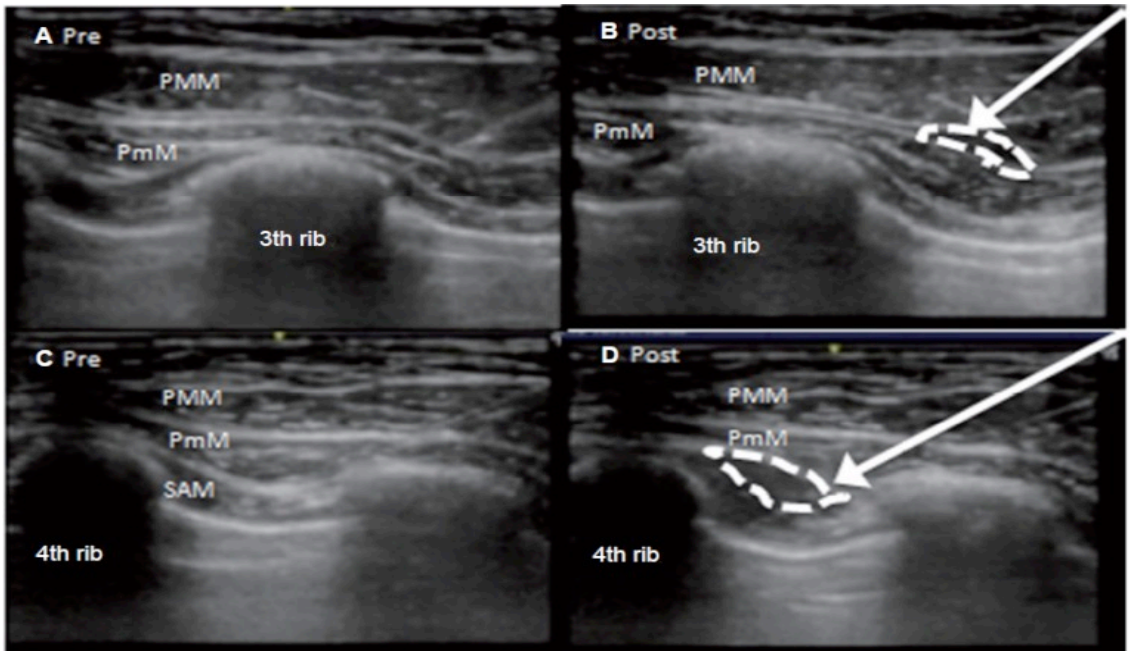

Figure 2. Sonoanatomy of the PEC I block (A&B) & PEC II block (C&D) pre and post injection of local anaesthetic. Pectoralis major (PMM), pectoralis minor (PmM), serratus anterior muscle (SAM). (28)

The complications associated with the PEC I & II blocks include potentially local anaesthetic systemic toxicity due the large volume, arterial puncture of the thoracoacromial artery, hematoma formation (28) and pneumothorax (1). There are reports of intraoperative hypotension with PEC blocks. There is scare literature that reports of other complications with ultrasound guided PEC blocks (1).

The PEC I & II block demonstrated better analgesic efficacy when compared to a control group that received a standard general anaesthetic for a modified radical mastectomy at 3, 6, 12 and 24 hours postoperatively. This study consisted of 50 participants equally divided into the 2 study arms. Pain severity was assessed utilising the VAS. The VAS score increased in severity from 3, 6, to 12 hours postoperatively in the PEC block group (0.7, 1.0, 1.5 respectively; $p = 0.001$) while it decreased in the control group over the same hours (2.8, 2.7, 1.9; $p = 0.001$), it was still significantly higher (7). This study demonstrated that PEC blocks provide superior analgesia when compared to opioids. Comparative studies between PEC blocks and other regional techniques have been conducted to determine superior analgesic efficacy. A study conducted in Egypt demonstrated that PEC I & II blocks provided superior analgesia at 2 specific times in mastectomy patients versus the thoracic paravertebral regional

technique in a randomised clinical trial. The randomised controlled trial conducted involved 30 female patients divided into two intervention arms namely the paravertebral block group and the PEC block group. Postoperative analgesic efficacy was then quantified utilizing the VAS. The results suggested superior analgesia from the PEC blocks at 1 hour (paravertebral VAS = 1 vs PEC VAS = 0; p = 0.018) and 4 hours (paravertebral VAS = 2 vs PEC VAS = 1; p = 0.05) postoperatively. The difference in VAS scores were non-significant 2, 6, 8, 12, 18, and 24 hours (23). Thus, the PEC block exhibited some superiority and equivalency in comparison to the paravertebral which was previously considered the ideal regional anaesthetic technique for breast surgery (1). Another study compared the PEC I & II blocks to SIFB and to a control group with standard general anaesthetic. In this study they looked at the severity of postoperative static and dynamic pain. Static pain was defined as pain at rest and dynamic pain as pain on movement. The results indicated that the PEC block group reported the least static and dynamic pain at 12 hrs (static pain NRS: SIFB = 1.9 vs PEC 1.7 vs no bock = 3.3; p = 0.047) (dynamic pain NRS: SIFB =2.9 vs PEC = 2.5 vs no block = 4.5; p = 0.037) but failed to demonstrate superior efficacy at 24 hours (29). There is a study published in 2023 that compared PEC I& II blocks to the ESP block and placebo. Their results showed decreased pain scores at 6, 12, and 24 hours in the regional anaesthetic groups. The PEC block group had lower pain scores when compared to the ESP block group(30).

A parameter often investigated in pain studies is the satisfaction score. The validity of this parameter has been studied by McNeill et al. They utilised a questionnaire that assessed pain characteristics, beliefs about pain, overall patient satisfaction and pain intensity and wait time before administration of pain medicine. The interesting finding was the patients that were overall either satisfied or dissatisfied reported similar high pain intensity (satisfied = 8.1 vs dissatisfied = 9.2; p = 0.003). This suggests that they were other factors that determine the overall satisfaction such as cognitive, behavioural factors from the health care professionals and from the patients. This indicates that satisfaction scores need to be interpreted with the above caveat (31).

The administration of a local anaesthetic via the surgical drain in mastectomy patients has also been investigated. A 2004 study by Talbot et al. found that the pain scores and morphine consumption in mastectomy patients that received local anaesthetic via the surgical drain versus a placebo as bolus dose every four hours in over 24 hours was statistically

insignificant (p = 0.16) (32). However, a randomised clinical trial that compared continuous infusion of a local anaesthetic versus a placebo and found a decrease in VAS scores in the first 24 hours postoperatively in the infusion group (p = 0.039). The mean morphine consumption was between the groups was marginally insignificant (p = 0.56) (33). Khpal et al. studied the pain scores in postoperative mastectomy patients that received local anaesthetic via the surgical drain compared to skin infiltration with a local anaesthetic at 3, 12, and 24 hours. The findings demonstrated a significant decrease in pain scores at the 3- and 12-hour intervals and insignificant at 24 hours with the local anaesthetic via the drain (p = 0.031; p = 0.008; p = 0.085 respectively). The morphine consumption difference was not statistically significant (p = 0.561) (34). Barrington et al. compared PEC II blocks and subcutaneous and cutaneous infiltration and found no difference (p = 0.60) (35). Thus, there seems to be some evidence that supports the administration of a local anaesthetic via the surgical drain. Nonetheless, at the time of writing this literature review, there were no comparative studies between the PEC blocks and the administration of local anaesthetic via the surgical drain which is of interest for this proposed study.

Numerous analgesic techniques are available for mastectomy patients in the perioperative periods to reduce the risk of developing chronic pain (36), avoid opioid-induced immunosuppression (17) and improve postoperative pain scores but the best techniques remain to be determined. The justification for conducting this study is that the current literature suggests that regional anaesthesia is a superior technique for the management of the mastectomy patient's postoperative pain and associated effects of possibly reduced perioperative immunosuppression (17) and incidence of chronic pain (36). The studies that demonstrate the benefits and superiority of the regional anaesthesia techniques, also demonstrate a decreased incidence of complications with the use of ultrasonography (1) which are pertinent reasons to support these interventions in mastectomy patients. Several studies have compared techniques with different outcomes (23, 29). However, the PEC blocks performed well in comparison to the other regional techniques but has not been compared to local anaesthetic administration via the surgical drain method. Therefore, the aim of my study is to determine the analgesic efficacy of PEC I & II blocks versus the administration of local anaesthesia via a surgical drain in post-mastectomy patients.

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Southern African Journal of Anaesthesia and Analgesia (SAJAA)

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Acknowledgements

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Section 3: Draft article

An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I and II

Pablo Samuel Tshiteta[1], MBChB, DA (SA)

pstshiteta@live.co.za

https://orcid.org/0009-0001-9769-2319

Toms Lushiku[1], MBChB, DA (SA), FCA (SA), MMed (Anaes)

lushiku_toms@yahoo.fr

https://orcid.org/0000-0002-8492-861X

Mathabe Sehlapelo[1], MBChB, DA (SA), FCA (SA), MMed (Anaes), DTM&H, DipHIVMan (SA)

mmathabe@yahoo.com

https://orcid.org/0009-0001-5351-5396

[1]Department of Anaesthesia, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand

Corresponding Author

PS Tshiteta

Declaration of conflict of interest

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Human Research Ethics Committee (Medical) Clearance certificate number: M220856

Key words: breast cancer, chronic pain, mastectomy, pain, pectoralis nerve block, surgical drain.

Abstract

Background

Poorly managed perioperative mastectomy pain increases the incidence of chronic pain. The postoperative risk factor for developing chronic pain identified was severe acute postoperative pain. This presents the perioperative team with a variable that can be modified with regional anaesthesia to improve outcomes. The aim of this study is to determine the analgesic efficacy of PEC I & II blocks versus the administration of local anaesthesia via a surgical drain in post-mastectomy patients. These techniques were compared with regards to postoperative pain scores, satisfaction, time to first request for systemic opioid postoperatively, opioid consumption, the incidence of postoperative nausea and vomiting (PONV) and complications.

Methods

A prospective, contextual, cohort, observational, single centre study with 30 female participants who were recruited via convenience sampling. Participants were assigned to PEC blocks (Group P, n=15) or local anaesthesia via surgical drain (Group S, n=15). The general anaesthesia was standardized between the groups. Group S received the standard of care which was administration of 2mg/kg of 0.5% bupivacaine with adrenaline (1:200,000) via the surgical drain. Group P received 0.2ml/kg of 0.5% bupivacaine plus adrenaline (1:200,000) in each fascial plane.

Results

There were no significant differences in participants' characteristics in the groups. The study showed no statistically significant difference between the pain scores of the groups at 30 minutes, 3, 6, and 24 hours postoperatively (p=0.660, p=0.160, p=0.894, p=0.931). The differences in patient satisfaction scores and morphine consumption were statistically insignificant. No complications were noted in either of the groups. No statistically significant relationship with the occurrence of vomiting and nausea and the specific technique.

Conclusion

The techniques evaluated in this study demonstrate a similar efficacy in the management of postoperative pain in mastectomy patients. The techniques can be considered safe as there is a low incidence of the described complications including the incidence of PONV.

Introduction

The most prevalent cancer amongst women worldwide is breast cancer with 1.7 million estimated diagnoses yearly. These patients undergo either a wide local excision, total mastectomy (unilateral or bilateral), or oncoplastic breast reduction with or without axillary lymph node dissections.[1]

Post mastectomy patients experience a significant amount of acute pain, and the evidence suggests that these patients are at a higher risk for chronic pain syndrome.[2] Senapathi et al. in 2014 reported a 41.8% incidence of chronic pain in breast surgery patients that experienced severe postoperative pain.[3] Fitzgerald et al reported a prevalence of 30-50% severe postoperative pain in mastectomies.[1] Several perioperative risk factors have been identified in the development of chronic pain after breast surgery. The postoperative risk factor for developing chronic pain identified was severe acute postoperative pain.[4-6] This presents the perioperative team with a variable that can be modified with regional anaesthesia to improve outcomes. The recommendation by the Enhanced Recovery After Surgery (ERAS) Society guidelines for breast surgery advocates for the use of a multimodal analgesic strategy including local anaesthetics to alleviate the pain intensity and reduce opioid consumption as supported by the current evidence.[7]

Regional anaesthetic techniques have been shown to reduce the incidence of chronic post-surgical pain and may mitigate one of the factors involved in cancer recurrence.[1, 8, 9] Several regional techniques for breast surgery have since been described namely, the serratus anterior plane block, the pecto-intercostal fascial block, serratus intercostal fascial block, rhomboid intercostal and sub-serratus plane block, erector spinae plane block, retrolaminar block, the mid-point transverse process to pleura block and the pectoralis nerve block (PEC).[1]

The pectoralis nerve I (PEC I) block was initially described by Blanco et al. in 2011 as a technique in which local anaesthesia was injected in between the pectoralis major and minor muscles to block the medial and lateral pectoral nerves.[10, 11] The pectoralis nerve II (PEC II) block also described by Blanco et al. in 2012 as requiring the injection of local anaesthesia in between the pectoralis major and minor muscles as well as between the pectoralis minor and serratus muscle with the intention to block the intercostobrachial, three to four intercostal and long thoracic nerves.[10, 12] The medial and lateral pectoral nerves which innervate the pectoral major and minor muscles run between the clavipectoral fascia and the pectoral fascia. These

nerves arise from C5-7 and C8-T1 respectively of the brachial plexus. The PEC I block requires the deposition of a local anaesthetic volume of 0.2-0.4 ml/kg in that inter-fascial plane. The PEC II block requires the deposition of 0.2-0.4 ml/kg of local anaesthetic in between the clavipectoral fascia and the superior border of the serratus anterior muscle. The PEC blocks are ultrasound guided regional anaesthetic techniques as the fascial planes must be identified for the administration of the local anaesthetic into the planes.[10]

The complications associated with the PEC blocks include potential local anaesthetic systemic toxicity due to the large volume, arterial puncture of the thoracoacromial artery, hematoma formation and pneumothorax.[1, 6] Though, there are reports of intraoperative hypotension with PEC blocks. There is scarce literature that reports of other complications with ultrasound guided PEC blocks.[6]

The administration of a local anaesthetic via the surgical drain in mastectomy patients has also been investigated. Talbot et al. found that the difference in pain scores and morphine consumption was not significant.[13] Beguinot et al. found a decrease in visual analogue scale (VAS) scores in the local anaesthetic group.[14] Khpal et al. demonstrated a statistically significant decrease in pain scores, but the morphine consumption difference was not statistically significant.[15] None of these studies suggest a distinct mechanism for the demonstrated analgesic efficacy.[13-15] The authors proposes that the mechanism is the local anaesthetic effect on the cutaneous branches of the intercostal nerves in the region.

Inadequate management of the post-mastectomy pain results in several short and long-term sequelae. Breast cancer's 5-year survival after surgery is at 85% and thus the associated sequelae need to be recognised and managed.[1] Poorly managed perioperative mastectomy pain increases the incidence of chronic pain. Achieving effective perioperative pain management is the recommended strategy. This can be accomplished with regional anaesthetic techniques.[2] PEC blocks are a regional technique with a favourable risk profile, demonstrated good efficacy and uncomplicated administration technique.[1] PEC blocks confer numerous benefits aligned to enhanced recovery after surgery (ERAS) for post mastectomy pain management guidelines.[7] The current practice at Chris Hani Baragwanath Academic Hospital (CHBAH) as part of analgesia is the administration of local anaesthesia via a surgical drain as standard care.

At CHBAH it is not known whether PEC blocks analgesic efficacy outweighs standard care in post mastectomy patients. The aim of this study was to determine the analgesic efficacy of PEC blocks versus the administration of local anaesthesia via a surgical drain in post-mastectomy patients. The primary objective of this study was to compare post-operative pain utilizing the Universal Pain Assessment Tool (UPAT) questionnaire between the two groups at 30 minutes, 3, 6, and 24 hours. The secondary objectives of the study were to compare patient satisfaction using a numerical rating scale, compare the time to first request for systemic opioid post-operatively, compare the systemic opioid consumption in morphine equivalents at 24 hours, describe complications of PEC blocks and compare the incidence of nausea and vomiting postoperatively.

Methods

Approval was obtained from the Human Research Ethics Committee, the Post Graduate Committee (Medical) of the University of the Witwatersrand and other relevant authorities. A prospective, contextual, cohort, observational, single centre research design was followed.

The study was conducted from 01 February 2023 to 28 February 2024. The study population consisted of female participants that were above the age of 18, ASA I-III, undergoing elective one-sided radical mastectomy between 07h00 and 13h00 on weekdays at CHBAH. Participants that declined to participate, had any allergy to local anaesthetics and opioids, a previous diagnosis of chronic pain syndromes, previous breast surgery on the same side, any contraindication to regional anaesthesia and male patients were excluded from the study.

Stata statistical software was utilised for the calculation of the sample size. Based on a median pain score of 1.3 (± 0.5 as SD) at 3 hours postoperatively obtained from a previous study [3] in which PEC blocks were administered to mastectomy patients, a decrease of 60% pain score is needed to detect a significant difference in the PEC group. Thus, according to these parameters, a sample size of 30 patients (15 per group) was required at an alpha of 5% and power of 80%.

A convenience sampling method was utilised. Eligible patients booked for a radical unilateral mastectomy were identified at the preoperative visit the day before surgery and invited to participate in the study. The participants were offered the different regional anaesthetic modalities by the primary anaesthetic team for breast surgery commonly used in current

practice and the standard of care at CHBAH. The participants were then allocated into study groups based on the anaesthetic regional technique they selected preoperatively. If the participant selected a PEC block, they were allocated to the PEC group (Group P) and if they selected the local anaesthesia via the surgical drain, they were allocated to the standard of care group (Group S). Participants that selected any of the other described anaesthetic regional techniques for breast surgery were excluded from the study.

All participants were transferred to the theatre table and monitored intraoperatively as per ASA standards. Participants were blunted with 1-3ug/kg fentanyl, induced with 1-2.5mg/kg propofol and paralysed with 0.6-1.2mg/kg rocuronium intravenously. The airway was secured with an appropriate-sized endotracheal tube. General anaesthesia was maintained with oxygen, air, and sevoflurane. They received 20mg/kg paracetamol, and 4-8mg dexamethasone. Morphine 0.05-0.1 mg/kg was administered as rescue analgesia when necessary. The attending anaesthetist managed any subsequent intraoperative analgesic requirements per their discretion. The additional morphine administered was taken into consideration for the data analysis.

Group P: The PEC block was placed according to the South African Society of Anaesthesiologists Guidelines for Regional Anaesthesia.[16] Either a Fujifilm Sonosite, Sonoscape or GE ultrasound machines with comparable efficacies were used to do the PEC blocks with a linear transducer (±5.0-15 MHz). The probe was placed at the midclavicular line in the sagittal plane and the thoracoacromial artery was identified. The probe was then moved laterally till the pectoralis major, pectoralis minor and serratus anterior were visible. The needle was then advanced into the inter-fascial plane between the pectoralis minor and the serratus anterior muscles in which 0.2ml/kg of 0.5% bupivacaine plus adrenaline (1:200,000) was administered (PEC II).The needle was then retracted into the inter-fascial plane between the pectoralis major and the pectoralis minor in which 0.2ml/kg of 0.5% bupivacaine plus adrenaline (1:200,000) was administered (PEC I). A toxic dose of 2mg/kg was calculated and not exceeded.[10] The principal researcher's technique for PEC blocks was taught and validated by a senior anaesthesiologist that has a post graduate diploma in regional anaesthesia from the University of Montpellier.

Group S: Participants received the standard of care which was administration of 2mg/kg of 0.5% bupivacaine with adrenaline (1:200,000) via the surgical drain. The clamp on the

surgical drain was removed in the post anaesthetic care unit 30 minutes after the instillation of the local anaesthetic.

The following time intervals were used in this study:

Time 0 (T0): 30 minutes postoperatively in the post anaesthetic care unit.

Time 1 (T1): 3 hours postoperatively.

Time 2 (T2): 6 hours postoperatively.

Time 3 (T3): 24 hours postoperatively.

The pain severity was assessed with the UPAT in all participants at all time intervals. Complications and total systemic opioid analgesic requirements post a PEC block or anaesthetic via drain were determined in morphine equivalent doses at T3. Overall patient satisfaction using a numerical rating scale was noted at T3.

The data collected was entered into the Statistical Package for Social Science (SPSS) software. The qualitive data was subsequently presented in frequency tables and comparisons done with Chi-square tests and Fisher exact tests. A z-test was applied for normality test using skewness and kurtosis. The quantitative data comparisons were performed with the independent t-test. The confidence interval was 95%, the margin of error accepted was set to 5% and a p value of < 0.05 was considered significant.

Results

Thirty participants were recruited and allocated to Group P or Group S with 15 participants per group. The participants characteristics are demonstrated in Tables I and II. The data indicates that there was no significant difference between the groups. Most participants had an ASA classification of two and demonstrated no significant difference (p =0.682).

Table I. Patient Characteristics

Patient Characteristics	Group S Mean (SD)	Group P Mean (SD)	*p* value
Age (years)	53.47 (10.288)	58.80 (15.694)	.280*
Weight (kg)	77.27 (16.757)	80.47 (12.609)	.559*

** Independent samples t-test*

Table II. Surgical duration

	Category	Group S	Group P	p value
Duration of surgery- n (%)	<2 hr	13 (46.4%)	15 (53.6%)	.483†
	2-3 hr	2 (100%)	0	

† *Fisher's exact test*

Participants' post-operative pain scores utilising the UPAT at different time intervals is shown in Table III and figure 1. The significance level of 5% demonstrates that the differences are not statistically significant. The 3-hour pain scores showed a slight increase among the Group P participants but was statistically insignificant.

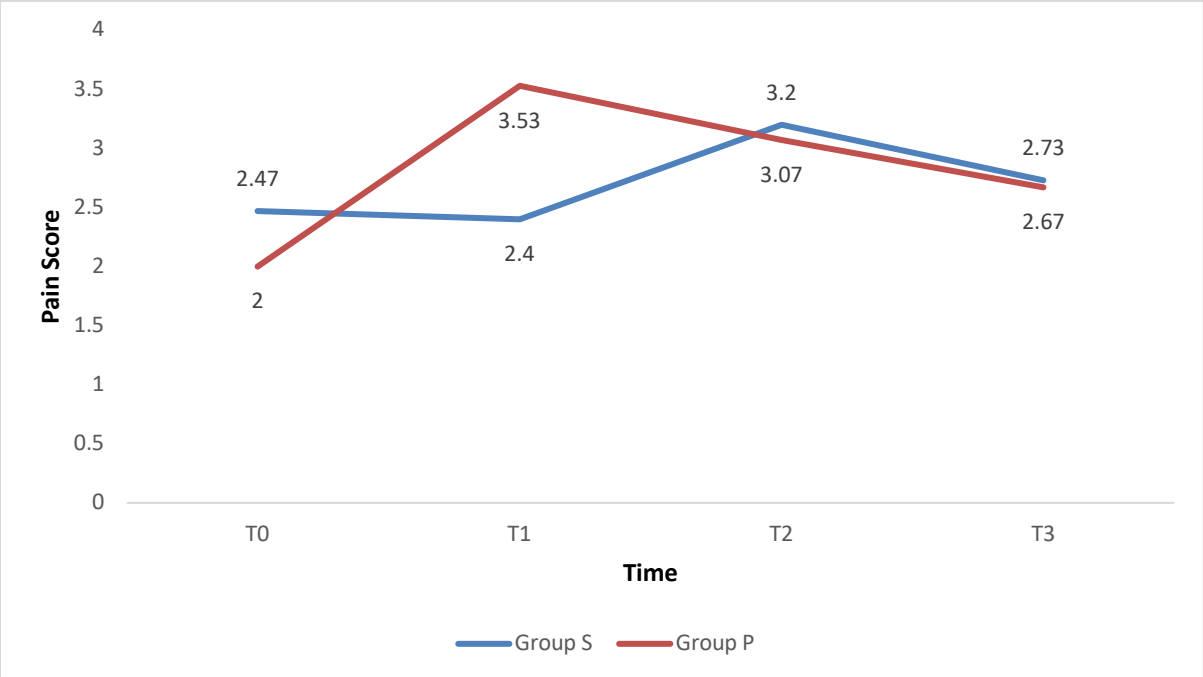

Figure 1. Pain Scores

Table III. Pain scores

Time	**Group P** **Mean ± SD**	**Group S** **Mean ± SD**	***p* value**
T0	2.00± 2.952	2.47 ± 2.800	.660*
T1	3.53 ± 2.200	2.40 ± 2.098	.160*
T2	3.07 ± 2.685	3.20 ± 2.731	.894*
T3	2.67 ± 2.440	2.73 ± 1.668	.931*

** Independent samples t-test; significance level 5%*

Table IV compares the participants overall satisfaction score with their pain management.

Table IV. Satisfaction score

	Group P **Mean ± SD**	**Group S** **Mean ± SD**	***p* value**
Numerical rating scale	7.33 ± 1.589	8.13 ± 1.727	.197*

** Independent samples t-test; significance level 5%*

Time to first request for systemic opioid postoperatively was not assessed as the data was not collected.

Table V. Morphine consumption

	Group P **Mean ± SD**	**Group S** **Mean ± SD**	***p* value**
Morphine consumption (mg)	23.33 ± 7.237	21.33 ± 5.164	.392*

** Independent samples t-test; significance level 5%*

Table V compares the two groups morphine consumption postoperatively and notes that both groups received a similar amount.

No complications were noted in either of the groups. No statistically significant relationship with the occurrence of vomiting and nausea and the specific technique. Fisher's exact test demonstrated this lack of association with a p value = 1.000.

Discussion

The participants in this study demonstrated similar characteristics between the two groups including the duration of the surgery. This provided a homogenous group of study subjects for comparisons to be made even though the data was collected over one year. The results of the study demonstrated that the participants in Group P and Group S reported similar postoperative pain scores at all the time intervals. The greatest difference between the reported pain scores noted was at T1, however the difference remained statistically insignificant. A recent review article looked at 15 different PEC block studies that were compared to placebos or other regional techniques and demonstrated better analgesic efficacy in 13 of the studies. Local anaesthetic via the surgical drain has also been compared to placebos and showed analgesic superiority.[6, 17] However, no studies have evaluated and compared specifically PEC blocks and local anaesthetic via the drain after extensive literature review. A study by Barrington et al. compared PEC II blocks to local anaesthetic infiltration into the subcutaneous and cutaneous tissue at the completion of surgery by the surgeon. This study is the closest in similarity to our study that can be used to compare. They demonstrated no statistically significant difference in the quality of recovery (QoR) questionnaire between

the techniques. It is worth noting that the pain scores in the QoR were also statistically insignificant [18] which seems to support our study's results.

The satisfaction score between the groups assessed with a numerical rating scale was similar between the groups. This suggests that the two techniques have similar efficacy. It should be noted that the satisfaction score may be influenced by other aspects of the participants overall care as noted by McNeill et al. such as cognitive and behavioural factors.[19]

This study did not demonstrate any difference in time to first request for systemic opioid administration as no data was collected and thus no comment can be made regarding this objective. However, a meta-analysis of PEC blocks demonstrated significant prolongation in the time to first request of postoperative analgesia by 296.69 minutes.[6]

Morphine consumption in this study was the same between the groups which is in keeping with a previous study by Khpal et al. that compared local anaesthetic via a surgical drain and direct infiltration [15] This was further supported by a similar study by Beguinot et al. that noted that the morphine consumption difference was almost statistically significant postoperatively.[14] However, a review by Bin Ghali et al. comparing PEC blocks to other regional anaesthetic techniques or placebos showed a statistically significant decrease in the postoperative opioid consumption in the PEC block group except for two studies.[17] It should be noted that this study cumulative opioid consumption was confounded by the protocolised postoperative analgesic regimen of the institution.

No complications were reported in this study which is consistent with other studies.[1, 6, 20] The reported complications in the other studies appeared to arise not from the PEC blocks or local anaesthetic via the drain techniques but rather paravertebral blocks or thoracic epidurals.[1, 21] A meta-analysis of PEC block studies reported hematoma formation in one study however no other complications related to the PEC block technique.[6]

This study had one participant report the experience of postoperative nausea. The 2023 Bin Ghali et al. meta-analysis supports the results from this study. This meta-analysis showed 5 studies that demonstrated a statistically significant decrease in the incidence of postoperative nausea and vomiting (PONV) in post mastectomy participants that received a regional anaesthetic techniques.[17] The proposed reduction in PONV is most likely due to the opioid sparring effects of these regional techniques.[22]

This study however has several limitations that may have affected the results. The inherent disadvantages of an observational study design. These disadvantages include the potential presence of confounding factors, the presence of bias and the inability to control variables. Convenience sampling method may have introduced selection bias. The study's contextual nature needs to be considered when extrapolating the results and applying them at different sites. Thus, the results of the study may not translate to other breast surgery units at different sites. The different participants' cancer stages were not considered and may have affected the pain scores. A further confounding factor of the study was the protocolised nature of systemic opioid administration postoperatively to the participants in the ward at the institution.

In light of these limitations, the author recommends that further research in the form of randomised controlled trials with larger sample sizes is necessary. Involvement of the institution's ward to avoid a regimented postoperative analgesic plan. The inclusion of an opioid only control group to compare with the regional anaesthetic groups. Comparisons of local anaesthetic via the surgical drain and other regional techniques like the erector spinae plain block may elucidate further knowledge that would improve our understanding and management of postoperative pain in breast surgery.

Conclusion

The techniques evaluated in this study demonstrate a similar efficacy in the management of postoperative pain in mastectomy patients. Patients' similar overall satisfaction and postoperative opioid consumption may be because of the equivalent pain scores across the two techniques. The techniques can be considered safe as there is a low incidence of the describe complications including the incidence of PONV.

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Section 4: Proposal

An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I and II

Pablo Samuel Tshiteta

2499754

Supervisor: Dr Mathabe Sehlapelo

Chris Hani Baragwanath Academic Hospital

Department of Anaesthesiology

Co-supervisor: Dr Toms Lushiku

Chris Hani Baragwanath Academic Hospital

Department of Anaesthesiology

4.1. Introduction

The most prevalent cancer amongst women worldwide is breast cancer with 1.7 million estimated diagnoses yearly. These patients undergo either a wide local excision, total mastectomy (unilateral or bilateral), or oncoplastic breast reduction with or without axillary lymph node dissections.(1)

Post mastectomy patients experience a significant amount of acute pain, and the evidence suggests that these patients are at a higher risk for chronic pain syndrome.(2) Senapathi et al. in 2014 reported a 41.8% incidence of chronic pain in breast surgery patients that experienced severe postoperative pain.(3) Fitzgerald et al reported a prevalence of 30-50% severe postoperative pain in mastectomies.(1) Several perioperative risk factors have been identified in the development of chronic pain after breast surgery. The postoperative risk factor for developing chronic pain identified was severe acute postoperative pain.(4-6) This presents the perioperative team with a variable that can be modified with regional anaesthesia to improve outcomes. The recommendation by the Enhanced Recovery After Surgery (ERAS) Society guidelines for breast surgery advocates for the use of a multimodal analgesic strategy including local anaesthetics to alleviate the pain intensity and reduce opioid consumption as supported by the current evidence.(7)

Regional anaesthetic techniques have been shown to reduce the incidence of chronic post-surgical pain and may mitigate cancer recurrence.(1, 8, 9) Several regional techniques for breast surgery have since been described namely, the serratus anterior plane block, the pecto-intercostal fascial block, serratus intercostal fascial block, rhomboid intercostal and sub-serratus plane block, erector spinae plane block, retrolaminar block, the mid-point transverse process to pleura block and the pectoralis nerve block (PEC).(1)

The pectoralis nerve I (PEC I) block was initially described by Blanco et al. in 2011 as a technique in which local anaesthesia was injected in between the pectoralis major and minor muscles to block the medial and lateral pectoral nerves.(10, 11) The pectoralis nerve II (PEC II) block also described by Blanco et al. in 2012 as requiring the injection of local anaesthesia in between the pectoralis major and minor muscles as well as between the pectoralis minor and serratus muscle with the intention to block the intercostobrachial, three to four intercostal and long thoracic nerves.(10, 12) The medial and lateral pectoral nerves which innervate the pectoral major and minor muscles run between the clavipectoral fascia and the pectoral

fascia. These nerves arise from C5-7 and C8-T1 respectively of the brachial plexus. The PEC I block requires the deposition of a local anaesthetic volume of 0.2-0.4 ml/kg in that inter-fascial plane. The PEC II block requires the deposition of 0.2-0.4 ml/kg of local anaesthetic in between the clavipectoral fascia and the superior border of the serratus anterior muscle. The PEC blocks are ultrasound guided regional anaesthetic techniques as the fascial planes must be identified for the administration of the local anaesthetic into the planes.(10)

The complications associated with the PEC blocks include potential local anaesthetic systemic toxicity due to the large volume, arterial puncture of the thoracoacromial artery, hematoma formation and pneumothorax.(1, 6) Though, there are reports of intraoperative hypotension with PEC blocks. There is scarce literature that reports of other complications with ultrasound guided PEC blocks.(6)

The administration of a local anaesthetic via the surgical drain in mastectomy patients has also been investigated. Talbot et al. found that the difference in pain scores and morphine consumption was not significant.(13) Beguinot et al. found a decrease in VAS scores in the local anaesthetic group.(14) Khpal et al. demonstrated a statistically significant decrease in pain scores, but the morphine consumption difference was not statistically significant.(15) None of these studies suggest a distinct mechanism for the demonstrated analgesic efficacy.(13-15) The authors proposes that the mechanism is the local anaesthetic effect on the cutaneous branches of the intercostal nerves in the region. This study should reveal some information that will assist with our understanding of postoperative analgesia management in mastectomy patients.

4.2. Problem statement

Inadequate management of the post-mastectomy pain results in several short and long-term sequelae. Breast cancer's 5-year survival after surgery is at 85% and thus the associated sequelae need to be addressed and managed (1). Poorly managed perioperative mastectomy pain increases the incidence of chronic pain. Achieving effective perioperative pain management is the recommended strategy. This can be accomplished with regional anaesthetic techniques (2). Numerous regional anaesthetic techniques are available for mastectomies and have been shown to reduce the postoperative pain scores. However, some regional techniques are preferred over other techniques due to the potential complication profiles.

The current practice at Chris Hani Baragwanath Academic Hospital (CHBAH) as part of analgesia is the administration of local anaesthesia (i.e., bupivacaine 0.5% with adrenaline 1: 200,000) via a surgical drain. This does not provide predictable analgesic efficacy. PEC I & II blocks confers numerous benefits aligned to ERAS for post mastectomy pain management guidelines (7).

At CHBAH it is not known whether PEC I & II blocks analgesic efficacy outweighs standard care in post mastectomy patients.

4.3. Aim

The aim of this study is to assess the analgesic efficacy of the PEC I & II blocks compared to the standard care in patients presenting for mastectomy at CHBAH.

4.4. Objectives

The primary objective of this study is to:

- compare post-operative pain utilizing the Universal Pain Assessment Tool questionnaire between the two groups at 30 minutes, 3, 6, and 24 hours.

The secondary objectives of the study are to:

- compare patient satisfaction using a numerical rating scale
- compare the time to first request for systemic opioid post-operatively
- compare the systemic opioid consumption in morphine equivalents at 24 hours
- describe complications of PEC blocks
- compare the incidence of nausea and vomiting postoperatively.

4.5. Research assumptions

Standard care: Administration of 2mg/kg of 0.5% bupivacaine with adrenaline (1:200,000) via the surgical drain. Total volume administered through the surgical drain will be at the discretion of the surgical team. The clamp on the surgical drain will be removed in the post anaesthetic care unit 30 minutes after the instillation of the local anaesthetic.

Time 0 (T0): 30 minutes postoperatively in the post anaesthetic care unit.

Time 1 (T1): 3 hours postoperatively.

Time 2 (T2): 6 hours postoperatively.

Time 3 (T3): 24 hours postoperatively.

Complications of PEC blocks: Pneumothorax, arterial injury, hematoma, and local anaesthetic systemic toxicity.

Registrar: A qualified medical doctor undergoing training in anaesthesiology.

Consultant: A specialist anaesthesiologist.

4.6. Demarcation of study field

The study will be conducted in the theatre complex of CHBAH affiliated to the Department of Anaesthesiology at the University of the Witwatersrand. CHBAH is a 2888 beds central hospital. The hospital has 25 theatres of which 2 are for breast surgery on Tuesdays and Thursdays. The 25 theatres perform an average of 65 000 cases annually of which approximately 280 are mastectomies in the two theatres.

4.7. Ethical considerations

Approval to conduct the study will be obtained from the Human Research Ethics Committee (HREC) (Medical) and the Graduate Studies Committee of the University of the Witwatersrand. Permission to conduct the study at CHBAH will be obtained from Chairman of the Medical Advisory Committee prior to commencement of the study (Appendix A), the Head of the surgical breast unit (Appendix B) and the Head of Department of Anaesthesiology (Appendix C) at CHBAH.

Patient consent

The focus of this study is assessing postoperative analgesic efficacy of PEC blocks in mastectomy patients with the use of pain scores. Patients will be identified at the preoperative visit in the wards and will be invited to participate in the study. The study will be explained to the patient with the use of the information sheet (Appendix D). Should the patient agree to

participate in the study they will be asked to sign written consent forms (Appendix E) prior to their inclusion in the study and will keep the information sheet.

Anonymity and confidentiality

Patients will be assigned to one of the study groups with a study number based on the anaesthetic management observed. The patients study number, study group and data from the data collection document (Appendix F) will be stored in a database. Should the patient request their data it will be made available to them. The patient will be able to withdraw from the study at any point without any consequences and the data will be excluded.

The study number assigned to the patient will be used to maintain anonymity and confidentiality. The study number will be used on the data collection sheet.

Other ethical considerations

Electronic data will be stored securely in a password protected database for six years after the completion of the study. The paper-based data will be secured in a locked cupboard for six years after completion of the study. The data will only be accessible to the principal researcher and the supervisors.

Any potential complications as described in the literature stemming from the study will be managed appropriately and patient informed. Necessary medical intervention will always be instituted.

The principles of the Declaration of Helsinki (16) as well the South African Guidelines for Good Clinical Practice (17) will be adhered to. The study will be registered with the National Health Research Database.

4.8. Research Methodology

4.8.1 Research design

A prospective, observational, cohort, contextual single site study will be followed.

A prospective study design is when the recognition of the existence or absence of a determinant of interest is documented before the commencement of the proposed study. The

incidence or non-occurrence of the condition is then assessed over a period following recruitment (18, 19). This is a prospective study because patients will be assigned to a study group and data will be collected in an anterograde fashion over a period until the study is completed.

An observational study is when the researcher observes the outcomes of different study groups without implementing a specific intervention nor a control group. This is an observational study because the patients postoperative outcomes will be observed without actively intervening in their perioperative management (19).

A cohort study samples patients with similar characteristics and observes them over a period of time and collects cross sectional data at different intervals (19). This is a cohort study as the patients will be breast cancer patients undergoing a one-sided radical mastectomy and data about postoperative analgesia will be gathered at specific times in the disease management.

A contextual study recognizes that it may be influenced by social, environmental, and individual factors. Contextual study results will only be applicable to the demarcated study field (19). This is a contextual study as it is being conducted in a single centre that may be influenced by numerous factors that are not present in other health institutes.

4.8.2 Study population

The study population will be consisting of patients presenting for one sided radical mastectomy surgery under general anaesthesia at CHBAH theatres.

4.8.3 Study sample

Sample size

Stata statistical software will be utilised for the calculation of the sample size. Based on a median pain score of 1.3 (± 0.5 as SD) at 3 hours postoperatively obtained from a previous study (3) in which PEC blocks were administered to mastectomy patients. A decrease of 60% pain score is needed to detect a significant difference in the PEC group. Thus, according to these parameters, a sample size of 30 patients (15 per group) was required at an alpha of 5% and power of 80%.

Sampling method

Convenience sampling method will be utilised. Eligible patients booked for a radical mastectomy will be identified at the preoperative visit the day before surgery and invited to participate in the study. The patients will be offered different regional anaesthetic modalities by the primary anaesthetic team for breast surgery commonly used as is the current practice. The patients will be allocated into study groups based on the anaesthetic management they select preoperatively. If the patient selects a PEC I&II block they will be allocated to the PEC group and if they select the standard management, they will be allocated to the standard group. Patients that select the other described anaesthetic regional techniques for breast surgery will be excluded from the study.

Inclusion and exclusion criteria

Eligibility Criteria:

The inclusion criteria for this study are:

- ASA I-III
- elective one-sided radical mastectomy patients
- patients 18 years and older
- patients that consent to the study
- patients undergoing mastectomy between 07h00 and 13h00 on weekdays

The exclusion criteria for this study are:

- allergy to local anaesthetics and opioids
- previous diagnosis of chronic pain syndromes
- previous breast surgery on the same side
- contraindication to regional anaesthesia
- male patients

- patients that choose an analgesic modality other than the PEC block or the standard management

4.8.4 Data collection

Once relevant approvals have been received, eligible patients will be identified from theatre booking lists in the CHBAH theatres on the day before surgery. Patients fulfilling the inclusion criteria will be approached to participate in the study. The study will be explained and those patients agreeing to participate will be given an information letter (Appendix D) and asked to provide written consent (Appendix E). Patients will be added to the study via convenience sampling. The patients will then be allocated to one of the two groups. The PEC blocks will be performed by a single operator which will be the principal researcher. Patients receiving the PEC block will be allocated to Group P and those receiving standard care (administration 2mg/kg of 0.5% bupivacaine with adrenaline (1:200,000) via the surgical drain. Total volume administered through the surgical drain will be at the discretion of the surgical team. The clamp on the surgical drain will be removed in the post anaesthetic care unit 30 minutes after the instillation of the local anaesthetic) to Group S. Patients will be transferred to theatre, intraoperative monitoring as per ASA standards will done for both groups. Patients will be induced with 1-3ug/kg fentanyl, 1-2.5mg/kg propofol and 0.6-1.2mg/kg rocuronium intravenously. Airway will be secured with an appropriate-sized endotracheal tube. Participants will be maintained under general anaesthesia with oxygen, air, and sevoflurane. Patients will receive 20mg/kg paracetamol and 4-8mg dexamethasone. Morphine 0.05-0.1 mg/kg may be administered if rescue analgesia is necessary. The additional morphine administered will be taken into consideration during data analysis. The attending anaesthetist will then manage subsequent intraoperative analgesic requirements per their discretion.

Group P: The PEC block will be placed according to the South African Society of Anaesthesiologists Guidelines for Regional Anaesthesia (20). An ultrasound machine with a linear transducer (5.0-15 MHz) will be used to do the PEC blocks. The probe will be place at the midclavicular line in the sagittal plane and the thoracoacromial artery will be identified. The probe will then be moved laterally till the pectoralis major, pectoralis minor and serratus anterior are visible. The needle will then be introduced and advanced to the inter-fascial plane between the pectoralis major and the pectoralis minor in which 0.2ml/kg of 0.5% bupivacaine

plus adrenaline (1:200,000) will be administered (PEC I). The needle will be then advance into the inter-fascial plane between the pectoralis minor and the serratus anterior muscles in which 0.2ml/kg of 0.5% bupivacaine plus adrenaline (1:200,000) will be administered (PEC II). A toxic dose of 2mg/kg will be calculated and not exceeded (20).

Pain severity will be assessed with the Universal Pain Assessment Tool questionnaire in all patients at T0 in the post anaesthetic care unit.

All patients will be reviewed in the ward at T1, T2 and T3 to assess pain severity with the Universal Pain Assessment Tool questionnaire by the principal researcher. Time to first systemic analgesic requirement will be noted. Complications and total systemic analgesic requirements within 24 hours post block or standard care will be determined in morphine equivalent doses. At T3, patient satisfaction using a numerical rating scale will be noted. All data collected will be captured on a data collection sheet (Appendix F).

4.8.5 Data analysis

Objective	Variable	Statistical Analysis Plan
compare post-operative pain utilizing the Universal Pain Assessment Tool questionnaire between the two groups at 30 minutes, 3, 6, and 24 hours.	Universal pain assessment tool (i.e., pain scores)- Continuous	To summarise the pain scores of the Universal Assessment Pain Tool, means and standard deviations will be used if the data are normally distributed. Comparison of the mean scores between groups will be assessed via the independent t-test. Non-normal distributed data will be summarised as medians and interquartile ranges and comparison between groups will be done with the Mann Whitney test. Normality will be assessed with histogram

		plots, P-P plots, Q-Q plots in addition to the Shapiro-Wilk test.
compare patient satisfaction using a numerical rating scale	Numerical rating scale- Continuous	To summarise the patient satisfaction scores from the numerical rating scale, means and standard deviations will be used if the data are normally distributed. Comparison of the mean scores between groups will be assessed via the independent t-test. Non-normal distributed data will be summarised as medians and interquartile ranges and comparison between groups will be done with the Mann Whitney test. Normality will be assessed with histogram plots, P-P plots, Q-Q plots in addition to the Shapiro-Wilk test.
compare the time to first request for systemic opioid post-operatively	Time scale- Continuous	To summarise the time scales, means and standard deviations will be used if the data are normally distributed. Comparison of the mean scores between groups will be assessed via the independent t-test. Non-normal distributed data will be summarised as medians

		and interquartile ranges and comparison between groups will be done with the Mann Whitney test. Normality will be assessed with histogram plots, P-P plots, Q-Q plots in addition to the Shapiro-Wilk test.
compare the systemic opioid consumption in morphine equivalents at 24 hours	Total amount of drug in milligrams administered in 24 hours- Continuous	To summarise the total amount of opioid administered in 24 hours, means and standard deviations will be used if the data are normally distributed. Comparison of the mean scores between groups will be assessed via the independent t-test. Non-normal distributed data will be summarised as medians and interquartile ranges and comparison between groups will be done with the Mann Whitney test. Normality will be assessed with histogram plots, P-P plots, Q-Q plots in addition to the Shapiro-Wilk test.
describe complications of PEC blocks	4 describe complications in the literature- Categorical • haematoma • arterial injury • pneumothorax	Frequencies and percentages (proportions) will be reported for the complications.

	• Local anaesthetic toxicity	
compare the incidence of nausea and vomiting postoperatively.	Self-reported presence or absence of nausea or vomiting- Categorical	Frequencies and percentages (proportions) will be reported for the incidence of vomiting and nausea and differences between the proportions between the two groups will be done using the Chi-square test.

4.8.6 Significance of the study

There have been numerous comparative studies of PEC blocks versus other regional anaesthesia techniques that have shown that the PEC blocks are e an efficacious option. Studies have demonstrated that acute postoperative pain is a modifiable predisposing factor in the development of chronic pain in mastectomy patients (2, 4, 5). By determining the efficacy of PEC blocks in mastectomy patients we may be adding useful data for the current management of postoperative pain. Identifying which technique is superior and its utilisation may improve postoperative pain management and reduce the incidence of the associated adverse effects in the future (1, 2, 21). This will support the principles of ERAS management for mastectomy.

4.9. Validity and reliability of the study

The validity of an instrument determines the extent to which it reflects or can measure the construct being examined. Validity indicates whether the inferences made from the study are justified based on the design and interpretation of the data. The reliability of an instrument denotes the consistency of the measures obtained of an attribute, item, or situation in a study or clinical practice (19).

Validity and reliability will be ensured by the following:

- applying an appropriate study design
- using a standardised data collection sheet

- ensuring an appropriate sample size as guided by a biostatistician
- performing ultrasound guided PEC I & II blocks by the researcher who will be validated by a trained sonographer from the Department of Radiology affiliated with the University of the Witwatersrand
- clear explanation of the universal pain assessment tool to the trial patients
- ensuring data is collected by the researcher
- utilising a Sonosite or GE ultrasound machines which is standardised to depict the required images
- appropriate data analysis with the guidance of a biostatistician.

4.10. Potential limitations of the study

Limitations are uncontrollable restrictions or problems in a study that may decrease the generalisability of the findings (19).

This study is a contextual study that will be conducted at CHBAH and thus its results may not be extrapolated to other hospitals. The study will utilize convenience sampling which may be homogenous and vulnerable to selection biases (19). The study will be collecting data at different times which may be affected by logistical factors.

This study will be assessing and measuring a subjective parameter and will then be conducting conclusions based on this data. Thus, the results of the study may not translate to other breast surgery units at different sites as numerous factors are involved in the subjective perception of pain.

Further limitations to the study are the inherent disadvantages of an observational study design. These disadvantages include the potential presence of confounding factors, the presence of bias and the inability to control variables.

4.11. Project outline

4.11.1 Time frame

Activity	Apr 2022	May 2022	June 2022	July 2022	Aug 2022	Sept 2022	Feb 2023	Mar 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024
Proposal												
Postgraduate approval												
Ethics approval												
Data collection												
Data analysis												
Draft article												
Submission												

4.11.2 Financial plan

The Department of Anaesthesiology will bear the cost of printing and paper for the postgraduate documents. The prices are inclusive of VAT. CHBAH will bear no cost for this research, proposal, postgraduate forms, or binding of documents.

Description	**Price per page**	**Number of pages**	**Copies**	**Total**
Proposal	1	40	10	R400
Post graduate form	1	2	6	R12
Complete report	1	100	4	R400
Binding of report			3	R750
Grand total				R1562

4.12. References

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Section 5: Appendices

Appendix A: Letter of permission from the Medical Advisory Committee

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 8th September 2022

TITLE OF PROJECT:

An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I & II at an academic hospital.

UNIVERSITY: Witwatersrand

Principal Investigator: Dr P S Tshiteta

Department: Anaesthesiology

Supervisor : Dr M Sehlapelo

Permission Head Department (where research conducted): Yes

NHRD No. GP_202208_073

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- **Permission having been granted by the Committee for Research on Human Subjects of the University of Witwatersrand.**
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

.....
Recommended
(On behalf of the MAC)
Date: 08/09/2022

.....
Approved/~~Not Approved~~
Hospital Management
Date: 14/09/2022

Appendix B: Letter of permission from the Head of Breast Surgery Unit, CHBAH

Prof H Cubasch
FCS (SA)
Practice number 0222240

breast practice

☎ +27 11 484 7376 ✉ hcubasch@gmail.com

Chris Hani Baragwanath Academic Hospital Private Bag X 01 Pimville 1808	Suite 147 Postnet X2600 Houghton 2041	Ahmed Kathrada Private Hospital K43, Klipspruit West, Lenasia 1821 ☎+27 11 854 1899

12.7.2022

Re: Dr PS Tshiteta, permission to conduct research in the Breast Unit

This letter serves to confirm that I give Dr PS Tshiteta permission to go ahead with his observational study "An observational study evaluating the perioperative efficacy of the pectoralis nerve blocks I and II" and I am very happy to support his research work.

Yours sincerely

H Cubasch
Head of Breast Unit
Principal Specialist
Associate Professor
Department of Surgery

Appendix C: Letter of permission from the Head of Department of Anaesthesiology, CHBAH

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

WITS
UNIVERSITY

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL
DIRECTORATE - ANAESTHESIA
Tel. number: (011) 933-9334/5
Fax number: 086 553 2529
Email: Palesa.Mogane@wits.ac.za

27th June 2022

Medical Advisory Committee
Chris Hani Baragwanath Academic Hospital
PO Bertsham
2013

To whom it may concern

RE: PERMISSION TO CONDUCT RESEARCH

This serves to confirm that I, Dr Palesa Mogane in the capacity of Chief Specialist and Head of Department at Chris Hani Baragwanath Academic Hospital hereby grant permission for research to be performed with the department. Dr Pablo Tshiteta, identity number 8709236646186 and persal number 9274265 to conduct research for his MMed research titled:
"AN OBSERVATIONAL STUDY EVALUATING THE PERIOPERATIVE EFFICACY OF THE PECTORALIS NERVE BLOCKS I &II".

I wish him all the best with this endeavour.

Kind regards.

Dr Palesa Mogane
Chief Specialist and Head of Department
Department of Anaesthesiology
Chris Hani Baragwanath Academic Hospital
University of Witwatersrand
Email: Palesa.Mogane@wits.ac.za

Appendix D: Information letter

Good day

Introduction

My name is Pablo Samuel Tshiteta. I am a registrar in the Department of Anaesthesiology at Chris Hani Baragwanath Academic Hospital. I would like to invite you to participate in this research study titled: **An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I and II**. This study will be submitted towards my Master's in Medicine degree with the University of the Witwatersrand. Whether or not you agree to participate will not affect your access to normal hospital care.

Research is a way that healthcare providers try to answer questions that exist about different treatments and procedures. It helps health care providers to give better care to the community. The work done for this study is part of research.

Breast removal surgery can be very painful especially after the procedure. When you come to theatre for the breast surgery, the doctors will put you to sleep (general anaesthesia) and can treat your pain in many ways.

Study Procedure

This study may provide answers regarding an injection of a local anaesthetic (PEC I & II blocks) that can help improve pain from breast removal surgery after the operation in the ward. The injection is given after the general anaesthetic. Similar studies, in other parts of the world, have shown that injection of the PEC I&II blocks after a general anaesthetic decreases the pain after the surgery. This study will compare the pain experienced by patients receiving the PEC I&II block injection to those patients who receive a local anaesthetic through the surgical drain which is the usual treatment. Both groups of patients will be having breast removal surgery under general anaesthesia. They are other options available for the treatment of pain that the participants will be told about by the primary anaesthetic doctor. However, we are not researching these specific options in this study. The results of this study will help us improve the quality of care provided to our community.

Participants in this study will be asked to measure the pain they experience from the breast removal surgery at different times during the study period, using a simple tool (Universal Pain Assessment Tool) that will be provided and explained. They may receive the injection being investigated called a PEC I&II block after the general anaesthetic or the local anaesthetic via through the surgical drain. The choice will be up to the participant who will be told about all different options by their primary anaesthetic doctor.

If you agree to participate in the study, you will be allocated a study number. The study number will be assigned to a group, depending on whether you chose to get a PEC I&II block and general anaesthetic or a general anaesthetic with local anaesthetic through the surgical drain. You will still have your pain treated regardless of which group you are allocated to. You are welcome to refuse participation in the study and this will not negatively impact your planned treatment in any manner. Your operation will proceed as planned by your doctors in theatre.

If you agree to participate in the study, I will first need to measure how much pain you have after the operation at several different times. If you chose to receive the PEC I&II block injection, I will use an ultrasound machine to help me inject the local anaesthetic in the right space. You will then have the breast removal surgery. I will then measure your level of pain 30 minutes after the operation. I will see you again in the ward 3, 6 and 24 hours after the PEC I&II block injection was done and review how

much other medication you needed for pain after the operation. I will also assess if there are any complications following the PEC I&II block injection and the anaesthetic.

If you chose to receive the general anaesthetic and local anaesthetic through the drain, you will have the breast removal surgery. I will then also measure how much pain you have 30 minutes after the operation. I will see you again in the ward 3, 6 and 24 hours after the general anaesthetic was done and review how much other medication you needed for pain after the operation. I will also assess if there are any complications following the anaesthetic.

Risks

The PEC I& II block injection is safe with a low risk of side effects. The side effects of the PEC I&II block injection at the breast may include infection, bleeding, injury to the lung, dysfunction of the nerves of the same breast and toxic effects of the local anaesthetic in the rest of the body. The PEC I&II block is performed under sterile conditions minimising the risk of infection. An ultrasound machine is used with the correct sized needle showing exactly where the tip of the needle is at the site of injection within the breast thus blood vessel, lung and nerve damage is minimised. The dose of the local anaesthetic injected is within the safe level for adult patients thus toxicity is minimised. Local anaesthetic through the surgical drain is safe with a low risk of side effects such as the toxic effects mentioned earlier.

Benefits

The benefits of the PEC I&II block include relief of breast pain after the surgery to remove the breast. This improves the ability to move, sleep, and use your arms after breast removal surgery. Patients receiving the PEC I&II block injection are reported to have less pain and move sooner in the ward after the operation. This reduces the number of complications after an operation and improves patient satisfaction.

Costs

There is neither cost nor payment involved in participating in the study.

Withdrawal

You can withdraw your consent at any point of the study, without having to give a reason. If that happens, any data collected about you will be destroyed, unless you specifically consent to its retention.

More information

You are welcome to ask any questions at any time that you may have regarding this study. Contact details: Principal Investigator: Dr Pablo Samuel Tshiteta, tel.no. 0785764171, e-mail pstshiteta@live.co.za. Supervisor: Dr Mathabe Sehlapelo, tel. no. 011 933 0349, e-mail mmathabe@yahoo.com. Co-supervisor: Dr Toms Lushiku, tel. no. 011 9333 0349, email lushiku_toms@yahoo.fr

Confidentiality

Only I and two study supervisors will have access to your information regarding this study. Your name will not appear in any report or publication arising out of this study.

Results

I will be pleased to provide a free results summary to any participant who requests it.

Consent

If you agree to participate, I will ask you to sign a consent form to record the fact. You will be given a copy of this Information Sheet and the signed Consent Form, should you agree to participate.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

Thank you for your time and consideration.

Regards,

Dr Pablo Samuel Tshiteta

Appendix E: Consent form for participant

PATIENT CONSENT FORM

I _____ agree to participate in the study titled: **An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I & II.**

- The study has been explained to me in a language that I understand.
- The complications of both the PEC block and local anaesthetic have been explained to me and I understand them.
- All my questions at present have been answered and I understand that I am free to make further enquiries at any point during the study, which will be answered.
- I am agreeing to participate of my own free will and understand that I may withdraw from the study at any point.
- I understand that if I withdraw from the study, I will still receive the standard of care for my condition.

Signed:

Patient name:

Date:

Signature or Fingerprint:

Witness name:

Date:

Signature:

Appendix F: Data Collection Sheet

https://docs.google.com/forms/d/e/1FAIpQLSch47QA_Z0nSAezP8CXwR940HnZMMoteDU6TLj51tP50_D72A/viewform

An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I & II at an academic hospital

Participant Study Number:

*Required

To be filled by patient preoperatively

1. How old are you? *

2. Have you received radiotherapy? *

Mark only one oval.

- Yes
- No

3. Have received neoadjuvant chemotherapy? *

Mark only one oval.

- Yes
- No

4. Are you on treatment for a chronic pain syndrome? *

Mark only one oval.

- Yes
- No

5. Are you allergic to local anaesthetics? *

Mark only one oval.

- Yes
- No

6. Do you have any other allergies? Please specify *

_____

7. Weight? *

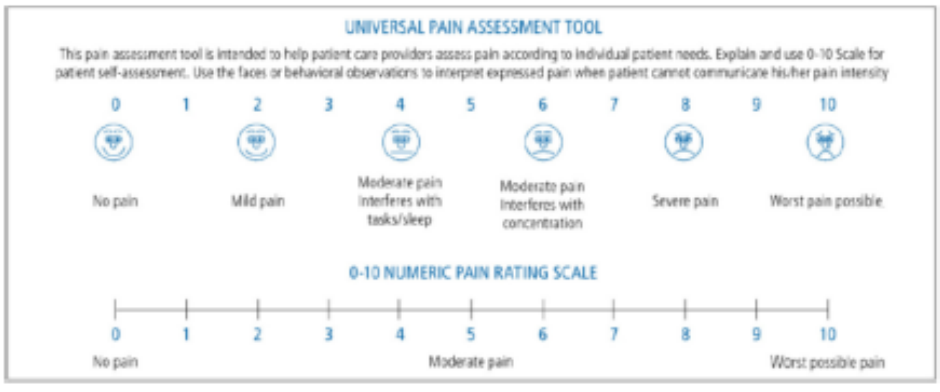
_____

8. Height? *

_____

To be filled by patient postoperatively

Universal pain assessment tool

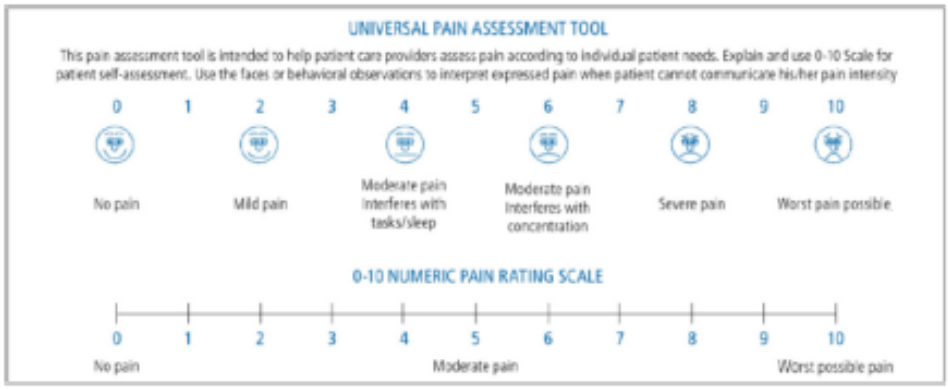


9. How severe is your pain 30 minutes after the operation? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
No Pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Worst Pin

Universal pain assessment tool

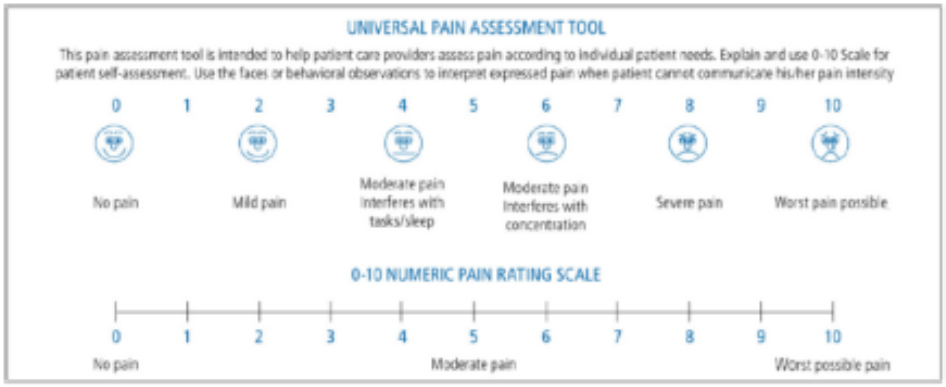


10. How severe is your pain 3 hours after the operation? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
No Pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Worst Pain

Universal pain assessment tool

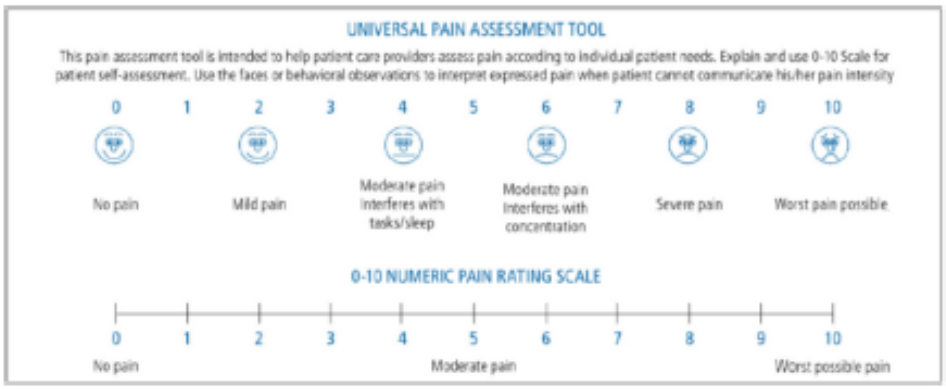


11. How severe is your pain 6 hours after the operation? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
No Pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Worst Pain

Universal pain assessment tool



12. How severe is your pain 24 hours after the operation? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
No Pain	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Worst Pain

13. Did you require extra pain medication during the first 24 hours after the operation? *

Mark only one oval.

◯ Yes
◯ No

14. Did you experience any nausea or vomiting after the operation? *

Mark only one oval.

◯ Yes
◯ No

15. How satisfied were you with the treatment of your pain after the operation? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not satisfied	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very statisfied

To be filled by clinician

16. ASA Grading *

Mark only one oval.

- 1
- 2
- 3
- 4
- 5

17. Duration of surgery? *

Mark only one oval.

- Less than 2 hours
- 2-3 hours
- 3-4 hours
- More than 4 hours

18. Regional Anaesthetic Technique *

Mark only one oval.

- Local anaesthesia via surgical drain
- PEC block

19. Total volume of local anaesthetic administered? *

_____

20. Total dose of local anaesthetic administered? *

_____

21. Any complications related to the regional anaesthetic? Please describe *

Tick all that apply.

- [ ] Pneumothorax
- [ ] Arterial injury
- [ ] Hematoma
- [ ] Local anaesthetic systemic toxicity

22. Any complications non-related to the regional anaesthetic? Please describe *

23. Time to first request of systemic opoid postoperativley? *

24. Consumption of opiods in morphine milligram equivalents over 24 hours postoperatively? *

Section 5: Annexures

5.1 Ethics approval

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Dr PS Tshiteta

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M220856

NAME: (Principal Investigator)	Dr PS Tshiteta
DEPARTMENT:	School of Clinical Medicine Department of Anaesthesia Medical School University
PROJECT TITLE:	*An observational study evaluating the perioperative efficacy of the pectoralis nerve block1 and 2*
DATE CONSIDERED:	2022/08/26
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Drs M Sehlabelo and T Lushiku
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/11/16

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **August** and therefore reports and re-certification will be due in the month of **August** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator — Date: 26/11/2022

5.2 Graduate studies approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

17 June 2022
Person No: 2499754
PAG

Dr PS Tshiteta
101 Underberg, 67 Hoover Street
Berario
Northcliff
2195
South Africa

Dear Dr Pablo Tshiteta

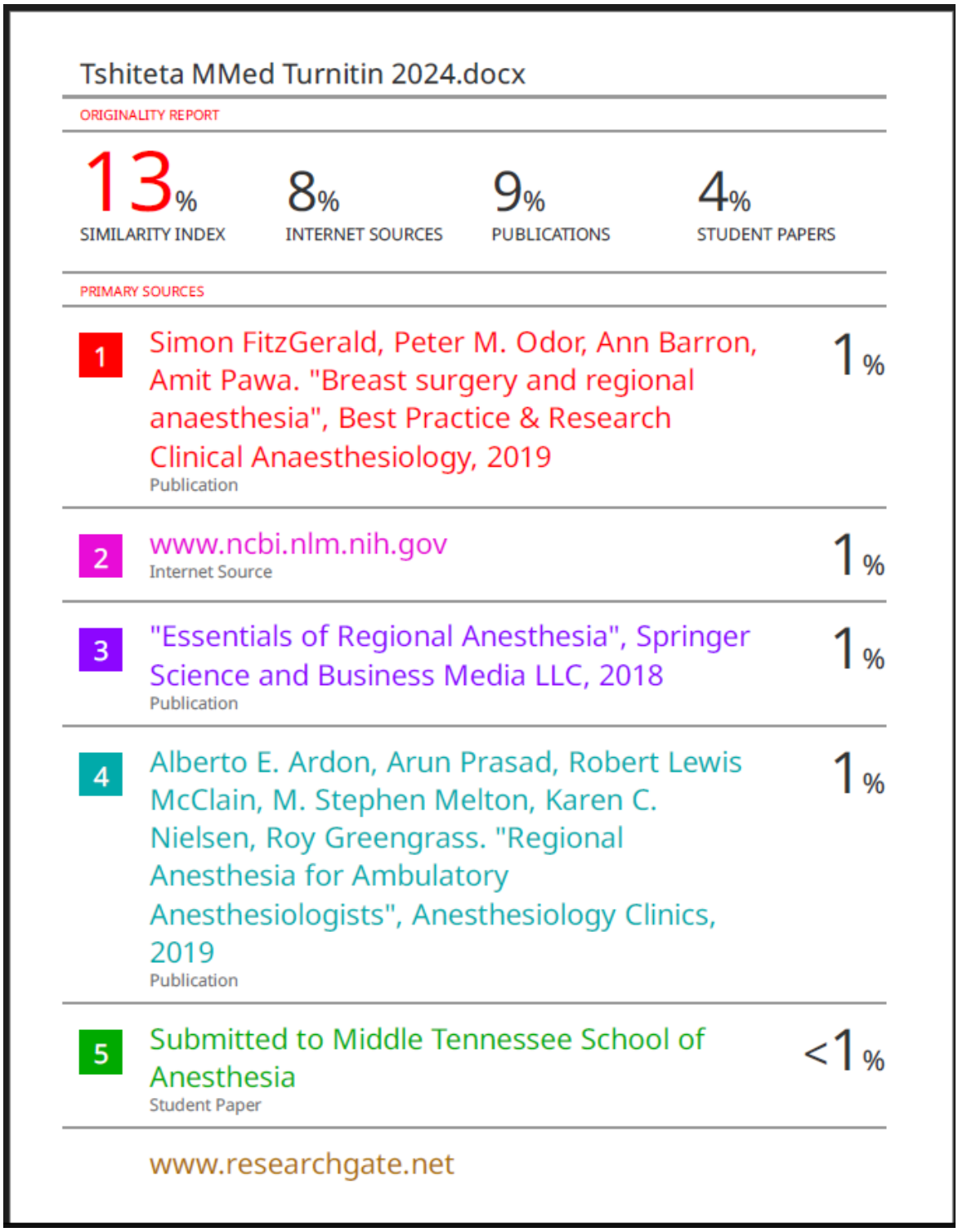
Master of Medicine in Anaesthesia: Approval of Title

We have pleasure in advising that your proposal entitled *An observational study evaluating the perioperative efficacy of the pectoralis nerve block I and II* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

5.3 Turnitin report



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5.4 Turnitin supervisor's report

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

24 May 2024

The Chairperson

Graduate Studies Committee

Faculty of Health Sciences

University of the Witwatersrand

Dear Madam,

RE: M Med: **An observational study evaluating the perioperative efficacy of the Pectoralis nerve blocks I & II at an academic hospital**

Dr Pablo Samuel Tshiteta, student number: 2499754, has submitted his research report to Turnitin which revealed a similarity index of 13%. These similarities appear not to be plagiarism but mainly the use of common terminology and phrases specific to the topic of the research.

Yours sincerely,

Mathabe Sehlapelo

Supervisor