An-Najah National University

Faculty of Graduate Studies

The Effect of Femoral Nerve Block on Opioid Consumption among Patient's who Underwent Total Knee Replacement under Spinal Anesthesia

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Dedication

To my dear parents, wife, lovely son, sisters, brothers,

Teachers, friends and all members of my family with love and respect.

Acknowledgement

I would like to thank all participants in my study for their cooperation and trust.

I would like to express my sincere gratitude to my advisors, Dr. Jamal Qaddumi and Dr Nour aldein Almasry for the continuous support of my master study and related thesis; for their patience, motivation, and immense knowledge. Their guidance continuously helped me in my research and writing of this thesis.

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I would like to thank my family: my parents and especially my wife who supported me all the time

الإقرار

أنا الموقع أدناه، مقدم الرسالة التي تحمل العنوان:

The Effect of Femoral Nerve Block on Opioid Consumption among Patient's who Underwent Total Knee Replacement under Spinal Anesthesia

أقر بأن ما اشتملت عليه هذه الرسالة أنما هو نتاج جهدي الخاص، باستثناء ما تمت الاشاره إليه حيثما ورد، وان هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أيّ درجة أو لقب علميّ لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher`s own work and has not been submitted from anywhere else, for any other degree or qualification.

Student`s name: **اسم الطالب:**

Signature: **التوقيع**

Date: **التاريخ:**

Table of Contents

List of Tables

List of Figures

List of Appendices

The Effect of Femoral Nerve Block on Opioid Consumption among Patient's who Underwent Total Knee Replacement under Spinal Anesthesia

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Abstract

Background

Total knee replacement (TKR) is a common surgical procedure which has become the treatment of choice for people with intractable joint pain and disability. It's a clinically efficacious and cost-effective intervention, with high rates of success in terms of alleviating pain and improving function in patients with advanced arthritis of the knee. The post-operative complications may delay the mobility and discharge. There are many complications such as traumatic to nerves or blood vessels in the leg, dislocation of the prosthesis, allergic to the cement material and pain post operation.

Pain management is an important part of recovery. The multi module post-operative pain management continuous epidural, lumbar plexus, and femoral or sciatic nerve blocks improve postoperative pain management and reduce opioid consumption. Femoral nerve block (FNB) is one of the methods used to decreased opioid consumption. A femoral nerve block can be used to provide anesthesia for the anterior thigh, knee, and a small part of the medial foot. It is typically used in conjunction with other lower

extremity blocks. It may also be used for postoperative pain relief following knee surgery.

Aims

To assess the efficacy of FNB in reducing pain among spinal anesthesia total knee replacement, the efficacy of FNB in reducing post-operative nausea and vomiting (PONV) among spinal anesthesia total knee replacement, and to assess the efficacy of femoral nerve block in reducing opioid consumption post-operative spinal anesthesia total knee replacement.

Methods

A randomized controlled trial (RCT) conducted at Rafidia hospital. The patients participating in the trial were randomly assigned to either group received the femoral nerve block under investigation (intervention group) or to a group did not receive treatment (control group). The sample size based on α 0.05 and affect referred size and power 0.80. The estimated sample size is (100 participants).

Results

Of the 100 subjects who underwent unilateral total knee arthroplasty (TKA) included in this study, 44% (n = 44) of subjects had received a femoral nerve block (FNB) prior to total knee arthroplasty (TKA), while 56% (n = 56) did not receive a femoral nerve block prior to surgery.

The two groups, femoral nerve block vs. non-femoral nerve block, showed differences in the percentage of reported postoperative surgery outcome parameters variables including nausea, vomiting, and drowsiness. Non-femoral nerve block group reported higher percentage of post-operative surgery nausea than femoral nerve block group at all post-operative surgery measured time intervals except at the 4^{th} post-operative hour. The percentage of vomiting by non-femoral nerve block group at the 4th and 24^{th} post-operative hours was lower (26.8% & 3.6%) than the reported percentage of vomiting by femoral nerve block group (27.3% & 4.5%).

The two groups, femoral nerve block vs. non-femoral nerve block, showed no statistically differences in the mean of systolic blood pressure or diastolic blood pressure at pre and all post-operative surgery measured time intervals except at the 12^{th} post-operative hour for systolic and diastolic blood pressure (p value < 0.05) and pre-operative heart rate (p value < 0.05).

The mean of systolic blood pressure and diastolic blood pressure at 12^{th} hour post-operative were 120.5 ± 12.9 mmHg and 70.0 ± 7.1 mmHg for non-femoral nerve block group and were 128.1 ± 9.3 mmHg and 72.7 ± 4.0 mmHg for femoral nerve block group

The two groups, femoral nerve block vs. non-femoral nerve block, showed no statistically differences in the mean of heart rate at all post-operative

surgery measured time intervals except at the pre-operative heart rate (p value < 0.05).

The two groups, femoral nerve block vs. non-femoral nerve block, showed no statistically differences in the mean of O_2 saturation at pre and all post-operative surgery measured time intervals (p value > 0.05).

The overall pain relief among patients' femoral nerve block group following TKR surgery was higher comparing with pain relief among non-femoral nerve block group after the surgery.

There is a significant difference in post-operative surgery analgesia consumption between femoral nerve block and non-femoral nerve block. A Mann-Whitney test indicated that post-operative surgery analgesia consumption was greater for non-femoral nerve block group than femoral nerve block group (U = 66, Z score= -7.85, p = .001).

The overall satisfaction of patients' femoral nerve block group following TKR surgery was higher comparing with overall satisfaction of non-femoral nerve block group.

Conclusion

This study compared post-operative nausea vomiting and drowsiness pain scores, opioid consumption, and patient satisfaction between subjects who received femoral nerve block with non-femoral nerve block in total knee replacement. This study found the overall satisfaction with the function of their operation knee among patients' femoral nerve block group following

total knee replacement surgery was higher comparing with overall satisfaction with the function of their operation knee among non-femoral nerve block group after the surgery. And pain relief among patients' femoral nerve block group following total knee replacement surgery was higher comparing with pain relief among non-femoral nerve block group after the surgery some trends in the data, do suggest efficacy in the use of a femoral nerve block for total knee replacement

Keywords

Total Knee Replacement, Femoral Nerve Block, post-operative nausea and vomiting

Chapter One
Introduction and Theoretical

Introduction

Total knee replacement (TKR) is a common surgical procedure which has become the treatment of choice for people with intractable joint pain and disability.The history of TKR has a line of in the early 1970s John Install designed what has become the prototype for current TKR. This prosthesis is made of three components which resurfaced all three surfaces of the knee (the femur, tibia, and the patella) and is fixed with bone cement. It could be more accurately termed a knee “resurfacing” because only the surface of the bones is actually replaced. Since then, significant improvements have been introduced (Keating, Meding, Faris, & Ritter, 2002).

Total knee arthroplasty (TKA) is a clinically efficacious and cost-effective intervention, with high rates of success in terms of alleviating pain and improving function in patients with advanced arthritis of the knee (Berger et al., 2001; Indelli, Aglietti, Buzzi, &Baldini, 2002; Keating, Meding, Faris, & Ritter, 2002; Quintana, 2008).

However, there has been a steady rise in the volume of revision TKA procedures in the many countries in recent years. The increase in revision TKA procedures is related to a number of factors, including an increase in primary TKA procedure volumes, factors related to modifications in surgical technique, patient selection, implant longevity, and an expansion of the indications to include younger, more active patients (Maloney, 2001;

Saleh et al., 2006). Furthermore, recent estimates suggest the number of revisions TKA procedures is expected to increase substantially over the next several decades (Kurtz et al., 2007).

A TKA is typically composed of a metal shield to the femur, a metal platform to the tibia, a mobile work of hardened plastic that rest on the metal platform, and the patella is often replaced with metal or plastic, these three to four parts are referred to as the arthroplasty. The indication of TKR to release the knee pain that affects walking, climbing stairs, or getting in and out of a chair.

The spinal anesthesia will be used for TKR, and the preparation for spinal anesthesia for patient must be informed of the type and administration of anesthesia along with the more common sensations associated with the procedure including alteration in sense and weakness of legs.

Spinal anesthesia is an invasive anesthetic procedure. A site entails insertion of a spinal needle between lumbar vertebrae (3-4 or 4-5) to inject local anesthetic such as Bupivacaine in to the intrathecal, subarachnoid space. The local anesthetic is used to block sensory and motor nerves from fourth thoracic to fourth sacral dermatomes, which leads to sympathetic block out flow. Its' earliest possible complication is hypotension due to vasodilatation of the vessels, so patients should receive bolus intravenous fluids (mostly crystalloids) at 20 ml/kg before the procedure (Nagelhout, 2010).

Bupivacaine is a mide local anesthetic that has a mechanism of action to block the sodium channel. It is a potent local anesthetic and has a long duration of action (3- 4 hours). Spinal bupivacaine 0.5% 10-15 mg is an adequate dosage (Datta, 2006).

Hypotension is defined as a decrease in blood pressure that leads to inadequate tissue perfusion and oxygenation (Jackson et al., 1995). Blood pressure decrease below 20% of the baseline can lead to organ damage and myocardial ischemia, or a mean arterial pressure of less than 50 mmHg (Heitmiller, 2010).

Ephedrine e improve venous return after sympathetic blockade during the spinal block Ephedrine is a non-catecholamine sympatho-mimetic agent that stimulates alpha and beta adrenergic receptors directly and predominantly indirectly, producing its effects by releasing norepinephrine from nerve endings in the autonomous nervous system, which leads to an increased heart rate, blood pressure, cardiac output, and systemic vascular resistance. It crosses the blood brain barrier and produces central nervous system stimulation (Harvey, 2012).

Ephedrine can be given in increments of 3-6 mg every 3-4 minutes intravenously to treat hypotension produced by sympathetic block during spinal anesthesia and it has a half life of 3-6 hours. The side effects of ephedrine that may occur are nervousness, dizziness, headache, nausea, loss of appetite, and trouble sleeping (Calvey & William, 2008).

Pharmacodynamics of Ephedrine. Ephedrine is indirect sympathomimtic action that resemble those of adrenaline peripherally. stimulate heart rate ,cardiac output, and increases peripheral resistance , so it is usually as a result increase blood pressure, centrally in adults it produces increase alertness, anxiety , tremors, nausea and insomnia. The α-adrenergic receptors of smooth muscle cells in the bladder base stimulation may increase the resistance to the outflow of urine. Activation of ß-adrenergic receptors in the lungs promotes bronchodilation. More over cardiovascular effect from ephedrine is the result of a balance among α-1 adrenoceptor-mediated vasoconstriction, ß-2 adrenoceptor-mediated vasoconstriction, and ß-2 adrenoceptor-mediated vasodilatation. Stimulation of the ß-1 adrenoceptors results in positive inotrope and chronotrope action. Tachyphylaxis to the pressor effects of ephedrine may occur with repeated administration, Pharmacokinetics of ephedrine half time is one hour if administered intravenous. Its onset Immediate of (IV). It is metabolized into norephedrine. (Harvey, 2012).

The post-operative complications may delay the mobility and discharge. There are many complications such as traumatic to nerves or blood vessels in the leg, dislocation of the prosthesis, allergic to the cement material and pain post operation.

Pain management is an important part of your recovery. The multi module post-operative pain management Continuous epidural, lumbar plexus and femoral or sciatic nerve blocks improve postoperative pain management and reduce opioid consumption (Singelyn et al., 1998). Postoperative pain

after TKR affects patients' quality of life. Many studies and hospital records have indicated that severe postoperative pain is associated with an increased risk of complications and that it slows the rehabilitation process, it also delays the improvement of pain states, it prolongs the length of hospital stay, and it raises overall costs (Barrington, Halaszynski, & Sinatra, 2014).

Femoral nerve block (FNB) is one of the methods used to decrease opioid consumption, a femoral nerve block can be used to provide anesthesia for the anterior thigh, knee, and a small part of the medial foot. It is typically used in conjunction with other lower extremity blocks. It may also be used for postoperative pain relief following knee surgery (Butterworth et al., 2013). Continuous femoral nerve block (CFNB) with local anesthetics has been consistently shown to provide superior analgesia and less side-effects compared with systemic opioids, thus facilitating exercises to increase the degree of knee flexion (De Ruyter et al., 2006).

After passing through the psoas compartment, the femoral nerve enters the thigh lateral to the femoral artery just below the inguinal ligament. Distal to this point, motor branches to the quadriceps, sartorius, and pectineus muscles arise as well as numerous sensory branches to the medial and anterior thigh. The nerve is encased in a sheath that extends from the psoas muscle to just below the inguinal ligament (Butterworth et al., 2013).The method of FNBby inguinal ligament should be first identified (by drawing a line connecting the anterior superior iliac spine and the superior-lateral corner of the pubic tubercle). The operator approximates the midpoint

along this line and palpates for the femoral pulse. Once the femoral pulse is identified, the insertion point for the femoral nerve block is located 2 cm lateral to the femoral artery pulse and 2 cm distal to the inguinal ligament line. With the nerve stimulator technique, a 2-in, 22-gauge stimulating needle is advanced seeking a quadriceps twitch or "patellar snap." Once identified, and after reducing the stimulation to < 0.5 mA, witnessing fade of motor activity after injection of 1 mL of local anesthetic and a negative aspiration of blood, 20–30 mL of local anesthetic is delivered (Butterworth et al., 2013).

Problem Statement

Total knee replacement has wide spread over the world, such statistics in United States showed high prevalence of TKR. Some patients have problems post-operative. The most common causes of revision TKA are infection (25.2%), mechanical loosening (16.1%), and implant failure/breakage (9.7%). Infection was the most common indication for arthrotomy/removal of prosthesis (79.1%). Mechanical loosening was the most common reason for all component revision, tibial component revision, femoral component revision, and patellar component revision. Infection was the most common indication for isolated tibial insert revision (Bozic et al., 2010).

There is also an evidence that the prevalence of post-surgical pain is related to the scale used for pain measurement. The prevalence of PPSP is ranging at 6 mo from 16% to 39% and at 12 mo from 13.1% to 23% and even 38% of the patients(Drosos, 2015).

According to Ministry of Health records there is annually increase in patients who admitted to hospitals for KNR, furthermore, many studies indicated that FNB was associated with a significantly reduced postoperative consumption of morphine and a trend to better analgesia, but none of these studies conducted in Palestine. (Barrington, Halaszynski, & Sinatra, 2014).

Aims of Study

- To assess the efficacy of FNB in reducing pain among spinal anesthesia TKR.
- To assess the efficacy of FNB in reducing post-operative nausea and vomiting (PONV) among spinal anesthesia TKR.
- To assess the efficacy of FNB in reducing opioid consumption post-operative spinal anesthesia TKR.
- To assess the efficacy of FNB in reducing post-operative length of stay on hospital among spinal anesthesia TKR.
- To assess the patient satisfaction post-operative spinal anesthesia TKR.

- To assess the efficacy of FNB in reducing drowsy post-operative spinal anesthesia TKR.

Research Questions

- Does FNB affect reducing post-operative pain among TKR?
- Does FNB affect reducing PONV among TKR?
- Does FNB affect reducing opioid consumption post-operative TKR?
- Does FNB affect reducing post-operative length of stay on hospital among TKR?
- Does FNB affect patient satisfaction post-operative TKR?
- Does FNB affectreducing drowsy post-operative TKR?

LIMITATIONS OF THE STUDY

The study was conducted on a sample at a single site. Collecting the sample took a long time, and it was limited to the work of FNB among anesthesiologists in the hospital. On the other hand, the present thesis has lots of strength; experimental design utilizing control and randomization. Furthermore, it is one of the few studies conducting on this topic in Palestine,

Chapter Two
Literature Review and Related Studies

Literature Review

Firstly, Total Knee Replacement (TKR) has commenced in German in 1860 but the results have not been satisfied by then, the techniques were used lead to early failure. However, in 1970, TKR begins to improve to another dimension, for instance surgeries were performed using Condylar design across the world, and this conception has helped to ensure stability of the knee joint. (Williams, 2010)

In the quality of the metal which was used has been also improved over time, in the recent days they use ceramics materials-based prosthesis which have been improved the longevity. According to recent studies over 130,000 knee surgeries are performed in each year in the USA (Palmer, 2014.) Moreover, according to new studies, the number of total knee replacements seem to be increased in Finland, mostly the age between 30 and 59, the main reason they have indicated is knee osteoarthritis. (Paddock, 2012)

After surgery one of the main priorities in the postoperative care is to relieve the patient from pain when awakening from anesthesia. It is obvious that the surgical incision done during the surgery and anesthesia causes patient to feel pain, discomfort and restlessness (Petter 2007.) When pain is adequately managed, it also helps patients to breathe properly and start ambulation as soon as possible. Acute pain begins from mild and develops

into severe phase if pain is not managed well. The acute pain is easier to identify and nursing professionals are more willing to treat acute pain in comparison to chronic pain. After surgery, pain affects the patient overall recovery because uncontrolled pain minimizes the self-care and early mobilization. Pain alone does not only give discomfort to the patient, but also it gives physical and psychological complications such as patient is exhausted, emotionally impaired, not able to receive enough rest, slow wound healing etc. (Petter, 2007)

A peripheral nerve block (PNB) technique which includes femoral block represents the best balance between analgesia and side effects as a choice of postoperative analgesic technique for major knee surgery such as TKR Fowler, Symons, Sabato, & Myles, 2007). Several randomized studies of anesthesia and analgesia for patients undergoing total knee replacement have provided useful information. In one study, patients receiving GA did not gain additional analgesic benefit from a femoral nerve sheath infusion in comparison with a single-injection FNB, although both groups required less postoperative opioid analgesia than did non-blocked controls (Merman, 2015).

This review documents “preventive analgesia” by local anesthetics in a large majority of randomized clinicalstudy. Preventive analgesia is defined as a reduction of postoperative pain that persists for more than 5.5half-lives of a drug which is approximately 8 hours for lidocaine, and 12 to 16 hours for bupivacaine. Mostof the cited studies examined pain scores and/or opioid consumption for at least 24 hours after surgery andlocal anesthetic

administration, thus meeting the criteria for preventive analgesia (Parvataneni et al., 2007).

The study of 72 TKA patients was powered to observe statistically significant differences in pain scores and opioid consumption (Barreveld et al., 2013). Length of hospital stay was similar between the two groups, but the FNB group had a decreased ($p = 0.058$) length of stay. The number of patients who required admission to a rehabilitation center after discharge from the acute care hospital was similar ($p = 0.741$). We observed similar percentages of complications in the twogroups: 56 among the 729 patients (8.2%) who received a FNB and 22 (9.1%) among the 241 patients who did not receive a block. A higher percentage ($p = 0.036$) of the non-FNB patients had arthrofibrosisthan those with FNB (four of 241 versus two of the 729, respectively) (Merman, 2015).

In a randomized, double-blind fashion, 36 patients undergoing TKR received either femoral, sciatic-femoral,or sham nerve blocks after a standardized spinal anesthetic. Further postoperative analgesia was provided by patient-controlled IV morphine and ketorolac. Pain at rest and with physical therapy, morphine use, nausea, pruritus, sedation, and patient satisfaction were assessed. Patients receiving peripheral nerve blocks reported better analgesia at rest for at least 8 h after transfer to the hospital ward ($P < 0.05$) (Allen et al., 1998).

Morphine use wasdecreased by approximately 50% in the peripheral nerve block groups until the second postoperative day (P< 0.02). Side effect profiles and patient satisfaction were similar between groups. We conclude that femoral nerve blocks improve analgesia and decrease morphine use after TKR (Allen et al., 1998).

Femoral nerve block reduces post-operative VAS after TKA (Sundarathiti et al., 2015). On tow group intrathecal morphine group (ITM group) or to the femoral nerve block group (FNB group)Patient characteristics were similar between the 2 groups. We found statistically significant differences in postoperative pain between the two groups: ITM group had the reducedvisual analogic pain score (VAS). Morphine consumption was lower in the ITM group: average consumption within the first 6 hours was 0.9 mg in ITM group compared to 3.1 mg in FNB group; at 12 h 4.2 mg vs. 6.3 mg; at 24 h 6.9 mg vs. 10.3 mg; at 48 h 9.7 mg vs. 13.6 mg. However, the difference in the opioid consumption was not statistically different (p value = 0.06) (Sundarathiti et al., 2015).

The Pain at rest and pain on movement were less for FNB (with or without PCA (patient control analgesia) opioid compared with PCA opioid alone during the first 72 hours post operation. All results demonstrated a moderate effect of FNB for pain at rest at 24 hours (19 RCTs, 1066 participants, SMD -0.72, 95% CI -0.93 to -0.51, moderate-quality evidence) and a moderate to large effect for pain on movement at 24 hours (17 RCTs, 1017 participants, SMD -0.94, 95% CI -1.32 to -0.55, moderate-quality evidence). Pain was also less in each FNB subgroup: single-shot

FNB, continuous FNB and continuous FNB + sciatic block, compared with PCA. FNB also was associated with lower opioid consumption (IV morphine equivalent) at 24 hours (20 RCTs, 1156 participants, MD -14.74 mg, 95% CI -18.68 to -10.81 mg, high-quality evidence) and at 48 hours (MD -14.53 mg, 95% CI -20.03 to -9.02 mg), lower risk of nausea and/or vomiting (RR 0.47, 95% CI 0.33 to 0.68, number needed to treat for an additional harmful outcome (NNTH) four, high-quality evidence), greater knee flexion (11 RCTs, 596 participants, MD 6.48 degrees, 95% CI 4.27 to 8.69 degrees, moderate quality evidence) and greater patient satisfaction (four RCTs, 180 participants, SMD 1.06, 95% CI 0.74 to 1.38, low-quality evidence) compared with PCA (Chan et al., 2014).

Chapter Three

Methodology

Study Design

A randomized controlled trial (RCT) is a type of medical experiment research which aims to reduce bias when testing a new treatment. The people participating in the trial are randomly which to group receiving the treatment under investigation (intervention group) or to a group receiving not given treatment (control group).

Randomization minimizes selection bias and the different comparison groups allow the effects of intervention group and control group. The RCT is often considered the gold standard for a clinical trial. RCTs are often used to test the efficacy or effectiveness of various types of medical intervention and may provide information about adverse effects.

Study Setting

Rafidia hospital was selected because it has a specialty resident orthopedic surgery program, itreceives medical transfers from other hospitals, and it does many cases of TKR annually.

Rafedia hospital makes between 5-7 cases of TKA weakly.

Population and sampling

Population

The population of the study is all patients admitted to orthopedic ward for TKR.

Sampling

The sample was determined randomly for all patients admitted for TKR in Rafidia hospital, after explanation and taking consent form. Each patient was assigned to be involved in the intervention group or control group. The sample size based on:0.05 and affects referred size and power 0.80. The estimated sample size was (100 participants).

Inclusion criteria

- Spinal anesthesia for TKR
- Elective operation TKR
- Unilateral TKR
- All patient on ASA (I-III)
- Controlled hypertension

Exclusioncriteria

- General anesthesia
- History of narcotic use

- Participant to another study
- Bilateral TKR
- Redo TKR
- Uncontrolled hypertension
- Chronic Obstructive Pulmonary Disease (COPD) patient

The Questionnaire

A questionnaire composed of three sections; First section is about demographic dataincluding initial name, gender, age, duration in operation room, date of admission and discharge history of smoking, post-operative nausea and vomiting (PONV), drowsy, femoral nerve block FNB, analgesia used postoperative, opioid used. Second section includes: Vital signs (blood pressure, pulse , blood oxygen saturation) for 24 hours, visual analog scale (VAS) is a unidimensionalmeasure of pain intensity, which has been widely used in diverse adult populations, including those with rheumatic diseases, the scale is most commonly anchored by “no pain” (score of 0) and “pain as bad as it could be” or “worst imaginable pain”. Third section include patient’s satisfaction tool post-operative(Gustke et al., 2014).

Data collection procedure

Femoral nerve block results in anesthesia of the skin and muscles of the anterior thigh and most of the femur and knee joint (Figure 4). The block

also confers anesthesia of the skin on the medial aspect of the leg below the knee joint (saphenousnerve, a superficial terminal extension of the femoral nerve).

Single Injection Femoral Nerve Block

Equipment

A standard regional anesthesia tray is prepared with the following equipment:

Sterile towels and gauze packs One 20-mL syringe containing local anesthetic A 3-mL syringe plus 25-gauge needle with local anesthetic for skin infiltration A 5-cm, 22-gauge short-bevel insulated stimulating needle Peripheral nerve stimulator Sterile gloves; marking pen

Landmarks and Patient Positioning

The patient is in the supine position with both legs extended. In obese patients, a pillow placed underneath the hips can facilitate palpation of the femoral artery and the block performance

After thorough preparation of the area with an antiseptic solution, local anesthetic is infiltrated subcutaneously at the estimated site of needle insertion. The injection for the skin anesthesia should be shallow and, in a line, extending laterally to allow for a more lateral needle reinsertion when necessary. The anesthesiologist should stand at the side of the patient with the palpating hand on the femoral artery. The needle is introduced

immediately at the lateral border of the artery and advanced in sagittal, slightly cephalad plane (Figure 1).

After initial stimulation of the femoral nerve is obtained, the stimulating current is gradually decreased until twitches are still seen or felt at 0.2 to 0.4 mA, which typically occurs at a depth of 2 to 3 cm. After obtaining negative results from an aspiration test for blood, 15 to 20 mL of local anesthetic is injected slowly.

Data analysis

• SPSS Program version 23Was used for data analysis. For descriptive part, the frequency, percentage, mean and standard deviation were used. For inferential part, parametric or non-parametric as appropriate were used.

Ethical Considerations

• Approval from institutional review board (IRB).

• Approval from ministry of health for permission to apply this study.

• Informed consent was obtained from each participating health care professionals after the investigator had explained the nature, purpose, potential risks, and procedures of the study. Anonymity and the confidentiality of the data provided strictly maintained. Participants were assured that their participation was entirely voluntary, and each participant had the right to withdraw or refuse to give information at any time during the study without any penalties.

Chapter Four
Results

Results

Of the 100 subjects who underwent unilateral total knee arthroplasty (TKA) included in this study, 44% (n = 44) of subjects had a femoral nerve block (FNB) prior to total knee arthroplasty (TKA), while 56% (n = 56) did not receive aFNB prior to surgery. The average age for subjects was 63.7 years ± 5.5. However, most of subjects were female (80%). Participants who underwent unilateral total knee arthroplasty (TKA) were grouped either to receive FNB prior to surgery or none femoral nerve block (NFNB). The two groups, FNB vs. NFNB, were similar at baseline in terms of preoperatively baseline variables including operation joint right vs. left (p=0.84), gender (p=0.67), duration of operation (p=0.45), history of smoking (p=0.96), history of surgery (p=0.21), and age (p=0.69). Groups were also comparable in relation to pre-operative variables. (Table 1)

Table 1: Demographics of unilateral total knee arthroplasty participants andcharacteristics of their operation

		Use of FNB			
		NFNB	FNB		
		n (%)	n (%)	X^2	*P* value
TKR	Right	27 (31.8)	20 (23.5)	0.041	0.84
	Left	21 (24.7)	17 (20.0)		
Gender	Male	10 (10.3)	8 (8.2)	0.77	0.67
	Female	44 (45.4)	34 (35.1)		
Duration of operation	2.5 hours	5 (5.0)	6 (6.0)	0.55	0.45
	3 hours	51 (51.0)	38 (38.0)		
Duration of operation	2 hours	31 (31.0)	30 (30.0)	1.70	0.19
	2.5 hours	25 (25.0)	14 (14.0)		
History of smoking	No	46 (46.0)	36 (36.0)	0.002	0.96
	Yes	10 (10.0)	8 (8.0)		
History of surgery	No	17 (17.3)	9 (9.2)	1.5	0.21
	Yes	37 (37.8)	35 (35.7)		
	Mean (SD)	Median	IQR	M-W U	*P* value
Age years	63.7 (5.5)	63	60 - 67	1176	.697

The two groups, FNB vs. NFNB, were similar at baseline in terms of preoperatively hemodynamicparameters variables including systolic blood pressure (p=0.56), diastolic blood pressure (p=0.99), oxygen saturation (p=0.92), and level of pain (VAS) (p=0.92). Groups were also comparable in relation to pre-operative hemodynamic parameters variables except the heart rate that was statistically differ significantly between the two groups; FNB vs. NFNB (p=0.007). The FNB group had higher medium (75bpm) and IQR (71-78.7) of heart rate than NFNB medium (71bpm) and IQR (69.2-77) of heart rate. (Table 2)

Table 2: Pre-operative hemodynamic parameters and level of pain comparison among FNB prior to surgery and NFNB groups

	FNB	Mean (SD)	Median	IQR	M-W U	*P* value
SBP mmHg	No	134.2 (11.2)	132	130-140	1150	.567
	Yes	133.5 (11.4)	130	124.2-142.7		
DBP mmHg	No	76.5 (6.8)	76.5	70-80.7	1230	.991
	Yes	76.2 (7.8)	75	70-85		
HR	No	72.4 (5.0)	71	69.2-77	845	.007
	Yes	75.3 (5.4)	75	71-78.7		
O_2 Sat	No	97.8 (.68)	98	98-98	1222.5	.926
	Yes	97.8 (.32)	98	98-98		
VAS	No	4.7 (.49)	5.0	5-5	1222	.921
	Yes	4.7 (.56)	5.0	5-5		

The two groups, FNB vs. NFNB, were similar at baseline in terms of preoperatively outcome parameters variables including nausea (*p*= NA), vomiting (*p*= NA), and drowsiness (*p*= 0.19). Therefore, the two groups, FNB vs. NFNB, were also comparable in relation to pre-operative outcome parameters variables (Table 3)

Table 3: Pre-operative outcome parameters (nausea, vomiting, and drowsiness) comparison among FNB and NFNB groups

Pre-op outcome		NFNB group n (%)	FNB group n (%)	X^2	*P* value
Nausea	No	56 (56.0)	44 (44.0)	NA	NA†
	Yes	0 (0.0)	0 (0.0)		
Vomiting	No	55 (55.6)	44 (44.4)	NA	NA†
	Yes	0 (0.0)	0 (0.0)		
Drowsiness	No	55 (55.6)	42 (42.4)	2.5	0.19
	Yes	0 (0.0)	2 (2.0)		

†NA: No statistics are computed because Vomiting and Nausea are constant.

As an examination of the findings in Table 4 shows there is a significant difference in post-operative analgesia consumption between FNB and NFNB. A Mann-Whitney test indicated that post-operative analgesia consumption was greater for NFNB group than FNB group (U = 66, Z score= -7.85, p = .001) (Table 4).

Table 4: Results of the Mann Whitney U Test to compare the post-operative analgesia consumption between FNB and NFNB groups

	FNB group	N	Mean Rank	U	Z score	P value
Analgesia consumption	NFNB	56	56.07	66	-7.858	0.001
	FNB	44	19.44			

The two groups, FNB vs. NFNB, showed differences in the percentage of reported postoperative outcome parameters variables including nausea, vomiting, and drowsiness. NFNB group reported higher percentage of post-operative nausea than FNB group at all post-operative measured time intervals except at the 4th post-operative hour. The post-operative reported percentage of nausea by NFNB group at PACU, 1st hour, 6th hours, 12th hours, and 24th hours were 12.5%, 75%, 58.9%, 67%.9%, and 7.1% respectively and by FNB group were 4.5%, 34.1%, 31.8%, 9.3%, and 6.8% respectively. In contrast, the reported percentage of nausea by NFNB group at the 4thpost-operative hour was lower (33.9%) than the reported percentage of nausea by FNB group (50%). (Figure1). Additionally, there were a statistically significant differences between NFNB vs. FNB of post-operative reported nausea at post-operative 1st hour, 6th hour, and 12th hour time intervals (p= 0.001, 0.007, & 0.001 respectively), while on the other hand, there were no statistically significant differences between NFNB vs.

FNB of post-operative reported nausea at PACU, 4th, and 24th hours post operatively (p= 0.16, 0.10, 0.9 respectively). (Figure 1).

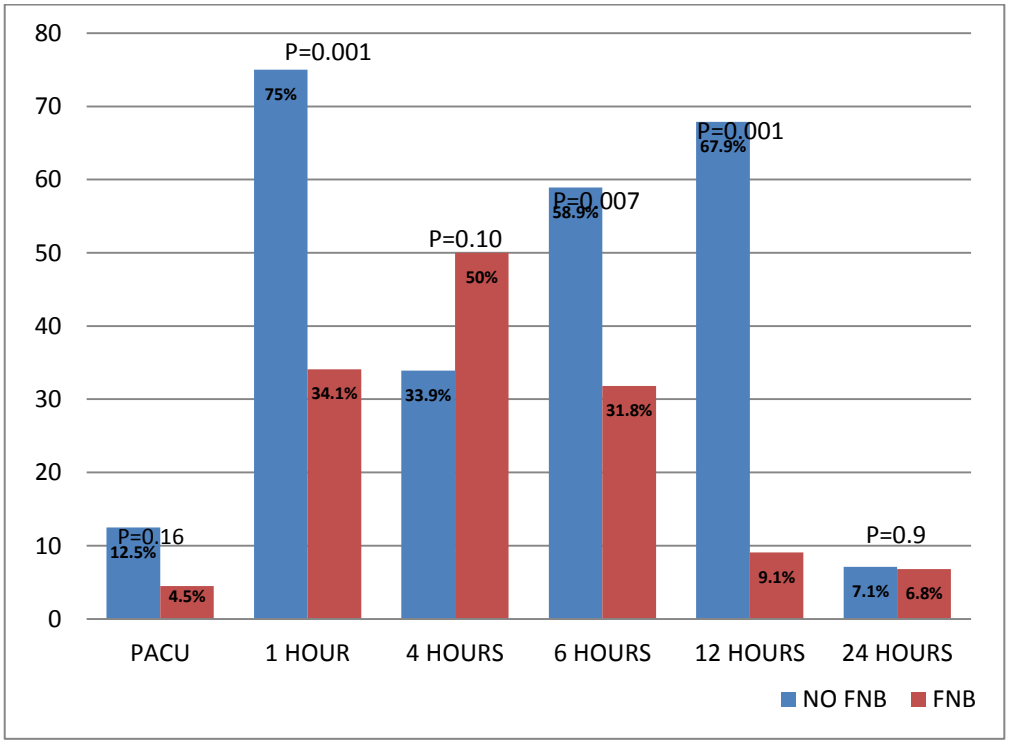


Figure 1: Comparison between percentage of Nausea among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals.

NFNB group had higher percentage of post-operative vomiting than FNB group at all post-operative measured time intervals except at the 4th and 24th post-operative hours. The post-operative percentage of vomiting by NFNB group at PACU, 1hour, 6hours, and 12hours were 8.9%, 41.4%, 51.8%, and 55.4% respectively and by FNB group were 0 %, 18.2%, 18.2%, and 9.1% respectively. In contrast, the percentage of vomiting by NFNB group at the 4th and 24th post-operative hours were lower (26.8% & 3.6%) than the reported percentage of vomiting by FNB group (27.3% & 4.5%). (Figure2). Additionally, there were a statistically significant differences between

NFNB vs. FNB of post-operative vomiting at post-operative PACU, 1st hour, 6th hour, and 12th hour time intervals (p= 0.042, 0.014, 0.001& 0.001 respectively), while on the other hand, there were no statistically significant differences between NFNB vs FNB of post-operative vomiting at, 4th, and 24th hours post operatively (p= 0.95& 0.83, respectively). (Figure 2).

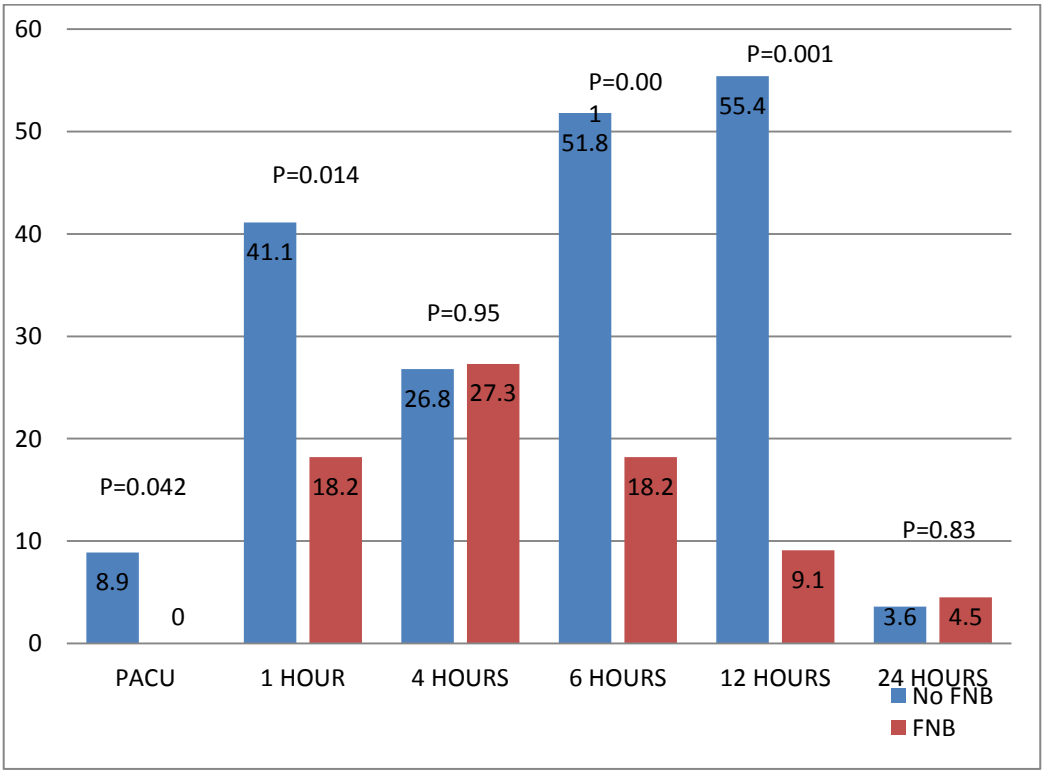


Figure 2: Comparison between percentage of vomiting among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

The percentage episode of post-operative drowsiness among NFNB group was higher than FNB group at all post-operative measured time intervals except at the 4th post-operative hour. The post-operative percentage of drowsiness among NFNB group at PACU, 1st hour, 6th hours, 12th hours, and 24th hours were 51.8%, 17.9%, 53.6%, 60.7%, and 16.1% respectively and among FNB group were 40.9%, 13.6%, 31.8%, 11.4%, and 13.6%

respectively. In contrast, the percentage of drowsiness episode among NFNB group at the 4th post-operative hour was lower (32.1%) than the episode percentage of drowsiness by FNB group (36.4%). (Figure3). Additionally, there were a statistically significant differences between NFNB vs. FNB of post-operative reported episode of drowsiness at post-operative 6th hour, 12th, and 24th hour time intervals (p= 0.030, 0.001, & 0.042 respectively), while on the other hand, there were no statistically significant differences between NFNB vs FNB of post-operative drowsiness episode at PACU, 1th, and 4th hours post operatively (p= 0.27, 0.56, & 0.70 respectively). (Figure 3).

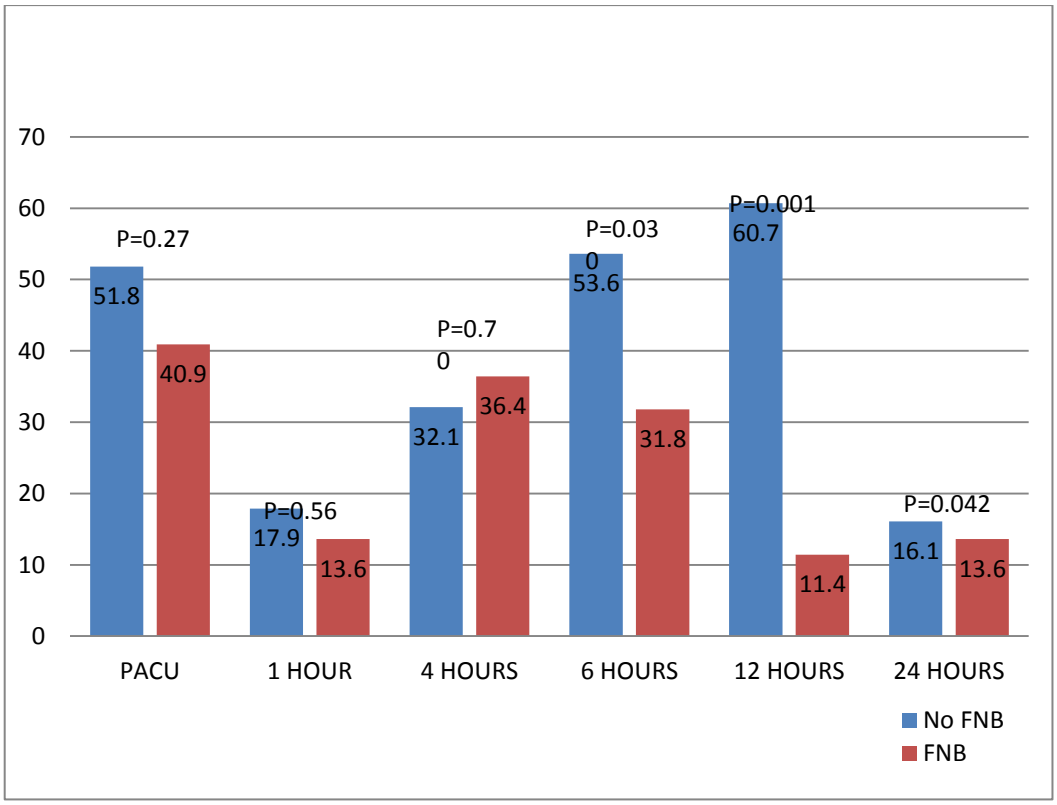


Figure 3: Comparison between percentage of Drowsiness among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

There were statistically significance differences between FNB versus NFNB groups regarding their overall satisfaction with the TKA surgery (P=0.001), overall pain relief after the TKA surgery (P=0.001), and overall satisfaction with the function of their operation knee (P=0.001)

The overall satisfaction of patients' FNB group following TKR surgery was higher comparing with overall satisfaction of NFNB group. Forty three percent of the patients in FNB group were very satisfied, 56.8% were satisfied, and no one reported neutral or dissatisfied response. On contrast, no one in the NFNB group was very satisfied, 94.4% were satisfied, and 3.5% reported neutral response.

The overall pain relief among patients' FNB group following TKR surgery was higher comparing with pain relief among NFNB group after the surgery. Thirty-six point three percent of the patients in FNB group were very satisfied, 61.3% were satisfied, and 2.2% reported neutral response towards their overall pain relief following surgery. On contrast, 7.1% in the NFNB group was very satisfied, 67.8% were satisfied, and 25% reported neutral response towards their overall pain relief following surgery.

The overall satisfaction with the function of their operation knee among patients' FNB group following TKR surgery was higher comparing with overall satisfaction with the function of their operation knee among NFNB group after the surgery. Twenty-nine point five percent of the patients in FNB group were very satisfied, 65.9% were satisfied, and 4.5% reported neutral response towards overall satisfaction with the function of their

operation knee. On contrast, 8.9% in the NFNB group was very satisfied, 48.2% were satisfied, and 41% reported neutral response towards overall satisfaction with the function of their operation knee.

Fifteenpoint nine percent of the patients in FNB group were very satisfied, 77.2% were satisfied, and 6.8% reported neutral response that they can do most things they thought they would be able to do after surgery. On contrast, 1.7% in the NFNB group was very satisfied, 50% were satisfied, and 48.2% reported neutral response that they can do most things they thought they would be able to do after surgery.

Table 5: Comparison between patients' satisfaction following TKR surgery among FNB versus NFNB groups

Patient satisfaction items	NFNB group				FNB group				
	VS	S	N	DS	VS	S	N	DS	*P* value
Overall satisfaction with the surgery	0	54	2	0	19	25	0	0	<0.001
Overall pain relief after the surgery	4	38	14	0	16	27	1	0	<0.001
Overall satisfaction with the function of your operation knee	5	27	23	0	13	29	2	0	<0.001
I can do most things I thought I would be able to do after surgery	1	28	27	0	7	34	3	0	<0.001
	T	MT	ND	MF	T	MT	ND	MF	
My pain relief is as good as I expected following the surgery	1	40	15	0	7	33	4	0	0.006
I am happy with the results of my knee surgery	1	23	31	1	6	34	4	0	<0.001
I would have the same surgery again for the same problem	1	14	36	5	4	28	12	0	<0.001

VS: Very Satisfied S: Satisfied N: Neutral DS: Dissatisfied

T: True MT: Mostly true ND: No difference MF: Mostly false

Hemodynamic parameters among FNB versus NFNB

The two groups, FNB vs. NFNB, showed no statistically differences in the mean of systolic blood pressure or diastolic blood pressure at pre and all post-operative measured time intervals except at the 12th post-operative hour for systolic and diastolic blood pressure (p value < 0.05) and pre-operative heart rate (p value < 0.05). For more details see figure 4 and 5.

The mean of systolic blood pressure and diastolic blood pressure at 12th hour post-operative was 120.5±12.9 mmHg and 70.0±7.1 mmHg for NFNB group and were 128.1±9.3 mmHg and 72.7±4.0 mmHg for FNB group (See figure 4 &5).

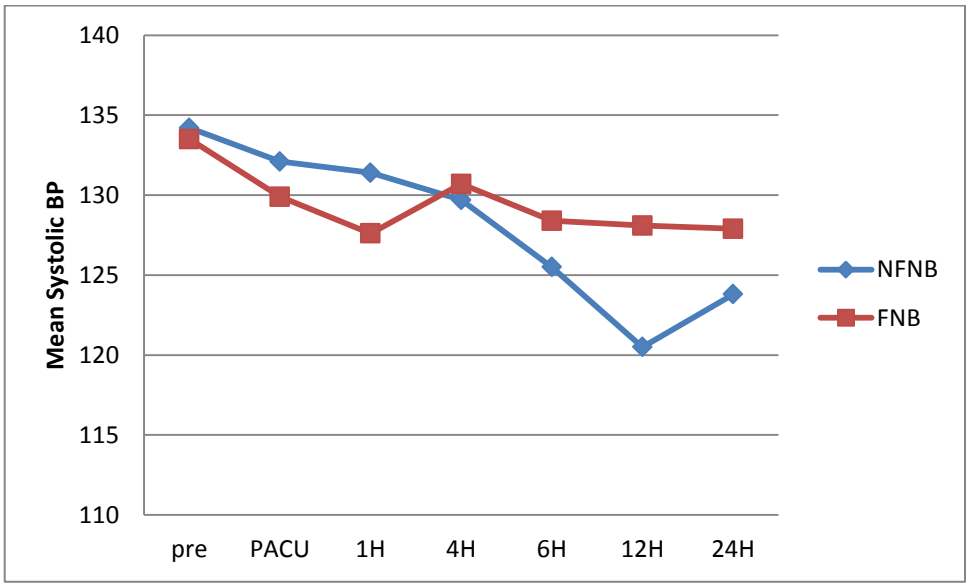


Figure 4: Comparison between mean of systolic blood pressure among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

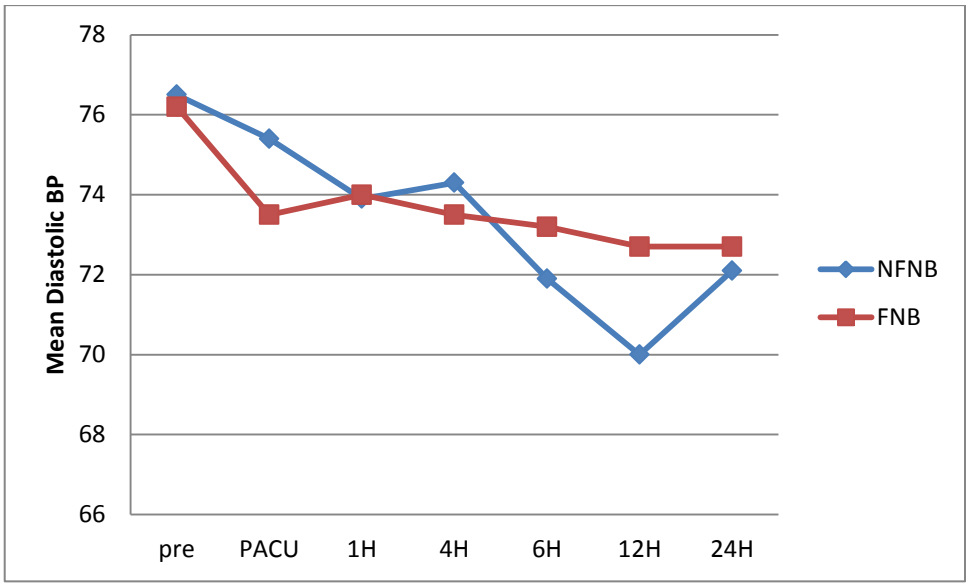


Figure 5: Comparison between mean of diastolic blood pressure among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

The two groups, FNB vs. NFNB, showed no statistically differences in the mean of heart rate at all post-operative measured time intervals except at the pre-operative heart rate (p value < 0.05). For more details see figure 6.

The mean of heart rate at pre-operative was 72.4±5.5 beat/m for NFNB group and was 75.3±5.4beat/m for FNB group (See figure 6).

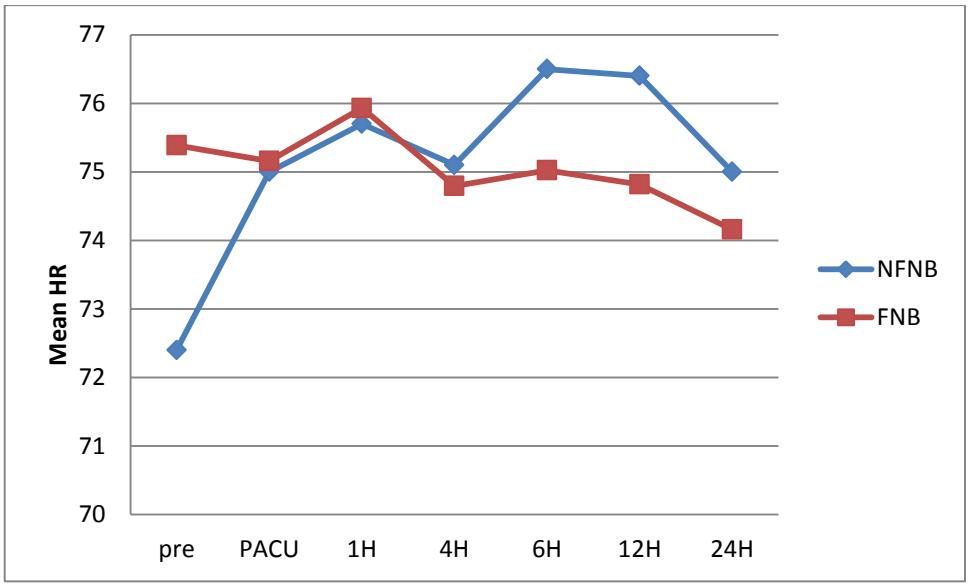


Figure 6: Comparison between mean of heart rate among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

The two groups, FNB vs. NFNB, showed no statistically differences in the mean of O_2 saturation at pre and all post-operative measured time intervals (p value > 0.05). For more details see figure 6.

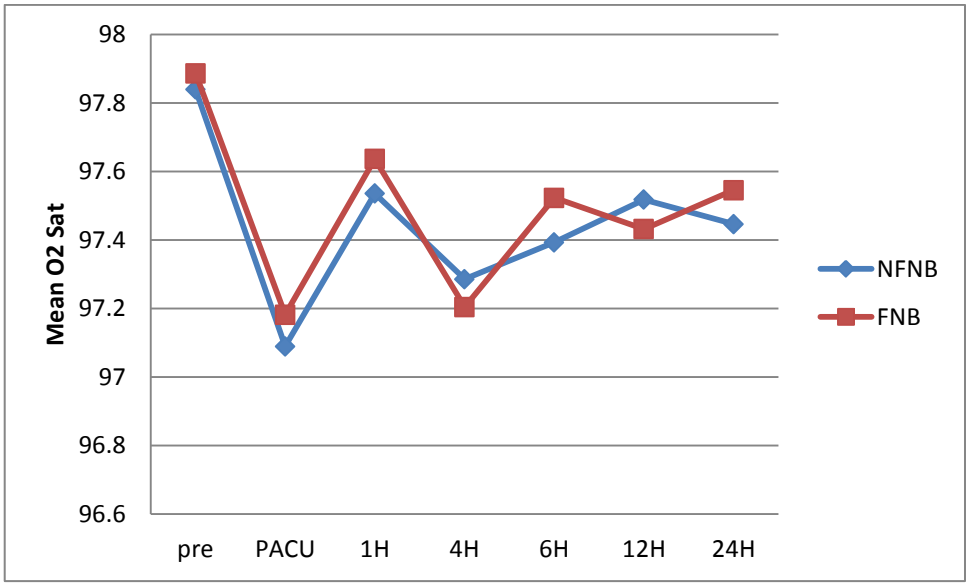


Figure 7: Comparison between mean of O_2 saturation among FNB and NFNB groups at PACU, 1, 4, 6, 12, and 24 hours intervals

The Effect of Femoral Nerve Block on Opioid Consumption among Patient's who Underwent Total Knee Replacement Under Spinal Anesthesia

Demographic data:

Name initials:----------

Data of admission: ---------- Data of discharge----------

Duration in operation room----------

Duration of operation--------

Age:----------Years

Gender (male, female)

History of:

Smoking (yes, no)

Number of cigarette----------.

Medication pre-operation:

History of old surgery (Yes, NO)

Name of surgery: ----------

Use of FNB (YES, NO)

Did you feel of pre or post: Nausea---------- Vomiting----------?

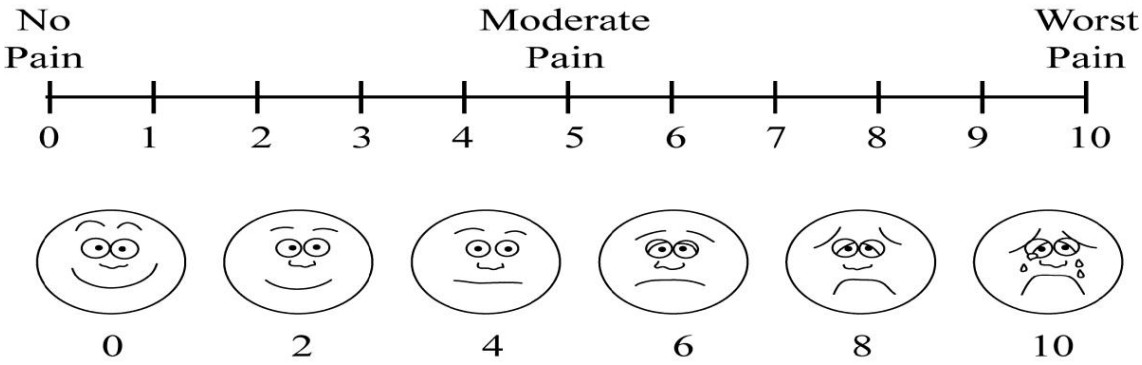
Analgesia used post operation:

Opioid --------- DOSE /WEIGHT Other ---------

Vital signs(Hemodynamic)

TIME	PRE-OP	Post – op on PACU	Post – op 1 hr.	Post – op 4 hr.	Post – op 6 hr.	Post – op 12 hr.	Post – op 24 hr.
Bp							
HR							
O2 SAT							
Pain level							
Nausea							
Vomiting							
Drowsy							

Visual Analogue Scale



Patient Satisfaction Toolpost-operative

The following questions were asked as part of the patient satisfaction survey:

1. **Overall satisfaction with the surgery.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied
2. **Overall pain relief after the surgery.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied
3. **Overall satisfaction with the function of your operative knee.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied
4. **I can do most things I thought I would be able to do after the surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False
5. **My pain relief is as good as I expected following the surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False
6. **I am happy with the results of my knee surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False
7. **I would have the same surgery again for the same problem.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False

Chapter Five
Discussion of the Results

Introduction

In this chapter, the results which obtained to answer the research questions, were discussed in comparison with other studies and rationalized based on either results or theories. So, this study aims to assess the efficacy of femoral nerve block (FNB) in reducing post-operative length of stay on hospital among spinal anesthesia total knee arthroplasty (TKR). Effective analgesia during the post-operative period especially in TKR which considered as one of the most painful surgical procedures is critical to allowing exercise and regain mobility easily that resulted in accelerated healing process thus decrease the patient in hospital stay (Capdevila 1999; Chelly 2001).

Of the 100 subjects who underwent unilateral TKA included in this study, 44% (n = 44) of subjects had aFNB prior to TKA, while 56% (n = 56) did not receive a FNB prior to surgery. The average age in present study subjects was 63.7 ± 5.5 years. However, most of subjects were female (80%) which was consistent with (Affas, et al. 2011; Chan, et al.2012) studies. Bothfound similar age group (69 &67.3 ± 9.4 years) and female gender was much higher among patients underwent TKA compare with male. On the other hand, Moghtadaei, etal (2014) study had higher male patients (nearly 66% were male) but within the same age group (67.4 ± 6.7 years) in comparing with the present study. In contrast with present study,

Fetherston et al.(2011) found that patients underwent TKR consisted of 44.2% (n = 23) male and 55.8% (n = 29) and their age was within with mean of 70 ± 8.6.

Pain among patients underwent TKR

The present study showed ahigher overall mean of pain relief among FNB patients' group following TKR surgery comparing with overall mean pain relief among those with non-femoral nerve block (NFNB) group following TKRsurgery. This, higher overall mean pain relief among FNB group,could be explained as the sensation to the anteromedial aspect of the knee was stopped by FNB blocks, thus reducing pain and muscle spasms (Sinatra 2009).

Compared with a single shot or continuous FNB both can provide a longer duration of postoperative analgesia (Sinatra 2009) which consistent with present study as pain relief was higher among the group of FNB at all time interval especially in PACU up to 24 hours.

Chan etal. (2014) the patient use FNB (any type) resulted in fewer pain at rest and on movement during the first 72 hours after surgery, compared with PCA opioid alone.

Toftdahl etal. (2007) found that pain relief was enhanced when patient underwent the periarticular infiltration technique with femoral block. Moreover,Tariq et al. (2015) found that FNB is effective in pain management and in facilitating rehabilitation course which can affect the

post-operative consequences. In fact,this method (FNB) provided superb analgesia relief with minimal systematic morphine consumption, and thus decreases the systemic opioids side effects, by facilitating an easy adequate postoperative pain management was less morphine consumption.

Analgesia consumption among post-operative TKR patients

In the present study there is a significant difference in post-operative analgesia consumption between FNB and NFNB. A Mann-Whitney test indicated that post-operative analgesia consumption was greater for NFNB group than FNB which is consistent with Carli (2010) who conducted a study contain two groups; periarticular infiltration oflocal anaesthetic (Group I) or continuous femoral nerve block (Group F). Carli found that patients in Group F used less morphine than Group I during the first two post-operative days and there was a trend to less pain at rest in the F group. Also, Chan et al. (2014) found FNB resulted in lower opioid consumption among patients post-operative TKR surgery. Toftdahl(2007) study contrast the periarticular infiltration technique with femoral block showed the superiority of pain relief and less opioid consumption with periarticular infiltration. This is in contrast with present findings there is a significant difference in post-operative analgesia consumption between FNB and NFNB.

Several advantages of application of local anesthetics into the knee at the end of TKA had shown compared to other regional or purely systemic approaches. In a blind study (Bianconi et al. 2003), 37 patients who

underwent total hip or knee arthroplasty were randomized to receive either an intraoperative infiltration with ropivacaine followed by infusion for 55 hours, or saline. Intensity of postoperative pain, consumption of rescue analgesics, and length of hospital stay were significantly reduced in the group that received ropivacaine. Open studies have shown similar results (Rasmussen et al. 2004, Isaac et al. 2005).

Chan et al. (2014) described that femoral nerve block gives better results and less side effects compared to patient-controlled analgesics (PCA). Furthermore, effectiveness of analgesia is greater continuous use of femoral block rather than giving only one dose. In comparison to PCA (patient-controlled analgesics) any kind of femoral block lessens the pain during activities and at rest. On the other hand, patient who uses femoral blocks uses less analgesic.

The Visual Analog Scale (VAS from no pain 0 to 10 extremely painful) is described and very useful in all the research collected because it regularly gives and update knowledge of the pain sensitivity at different and significant time or hospitalization stage. The VAS test can be used for instances after standing up, walking distance, stair climbing, continuous passive motion machine with different loads, knee extension test, at rest, before or after a drugs intake or non-pharmacological treatments, and after the discharge. The results helped to know how the pain evolve and if the treatments are helpful to decrease, control or not the pain. In this situation the nurses communicate the pain scores to one another, to the doctor or

other health professionals involved in the treatment. (Bandholm 2014; Chan 2014; Chen 2013; Holm 2010; Huang 2008; Liu 2012.)

Mac Cartney´s article (2014) introduces the multimodal pain management method to treat post-operative pain in elder TKA patients. Furthermore, the article describes that administrating analgesics before the surgery has minimized the post- operative pain and use of analgesics after surgery, it also indicates that in managing post-operative pain controlling pain before surgery is not enough but also managing opioids related side effects are important thus gabapentin and regional anesthesia has contributed to minimize side effects associated with opioid usage. (McCartney 2014.)Femoralnerve block is also another method which gives greater results than PCA (Fetherston 2011).

Paul(2010) study use single-injection or continuous FNB provided better pain control than PCA after TKA

Patients' satisfaction with the function of their operation knee

The overall mean satisfaction with the function of their operation knee among patients' FNB group following TKR surgery was higher comparing with overall mean satisfaction with the function of their operation knee among NFNB group after the TKR surgery which is consistent with Chan etal. (2014) who found a higher patients' satisfaction among FNB group with their operation knee function compared with those NFNB patients underwent TKR surgery and use patient control analgesia (PCA) opioid. Furthermore, Gustke (2014)found that patients, who have

soft-tissue balance after TKR, as confirmed by sensors intra-operatively,had significantly higher satisfaction than those who do not had, following one-year post-operatively ($p < 0.043$).

Total knee replacement (TKR) are associated with significant postoperative pain(Allen (1998) and single-injection femoral nerve block (FNB) significantly improves postoperative analgesia compared with systemic opioid therapy at least during the first 24 hours after TKR (Wang, 2002) thus as presented above, so de Lima e Souza et al. (2008) found that femoral nerve block using 0.25% ropivacaine or 0.25% bupivacaine is an effective method of postoperative analgesia after TKRand found that a FNB with 0.25% ropivacaine or 0.25% bupivacaine significantly reduced the number of patients who presented with moderate or severe pain at rest or on movement. Thus, FNB with 0.25% ropivacaine or 0.25% bupivacaine increased the number of patients experiencing no pain or mild pain at rest or on movement when compared with the group of patients who did not receive the FNB. This effect was statistically significant up to 10 hours after spinal anesthesia. However, it is noteworthy that patient satisfaction regarding their overall pain management was significantly higher in Groups FNB than Group NFNB for 24 hr.

Baker (2007) found that the satisfaction among patients underwent TKR with FNB was higher especially patients with mean standardized pain score was 0.19 (0 to 1) comparing withpatients with mean standardized pain score 0.63 (0 to 1) who were found to be unsatisfied. This is going parallel with the present study and confirms that when pain mitigated

byusing FNB,theTKR patients' satisfaction with their operation knee function will be boosted post operatively.

Post-operative nausea, vomiting and drowsiness among TKR surgery

In addressing the complication of TKR surgerysuch as nausea, vomiting, and drowsiness in post-operative period, pharmacological and technical approaches such as FNB and theanesthesia staff prior knowledge about what to expect, what complications may occur, how pain is managed, individual risk factors may prepare patients physically and mentally (Chen, 2013) can be prevented or mitigatedthese complications. For example, when certified nurse anesthesia knows how the operation is done and how it impacts the patient on the pain level and use FNB, this leads to effective pain relief that help the patients to mobilize earlier and with greater ease as well as can reduces these complications risks (Walker 2012).

In the present study the two groups, FNB vs. NFNB, showed differences in the percentage of reported postoperative outcome parameters variables including nausea, vomiting, and drowsiness. NFNB group reported higher percentage of post-operative nausea than FNB group at all post-operative measured time intervals except at the 4th post-operative hour

Kim (2014) assured that the incidence of postoperative nausea and vomiting was low in FNB groups. However, the effective postoperative blockade of FNB groups minimized the use of oral opioids and thus limited their notable side effects of nausea and vomiting.

The patients who underwent TKR surgery and had received FNB developless nausea and vomiting comparing with those who had not use FNB. This (post-operative nausea and vomiting) could be decreased due to less opioid consumption thus less opioidsside effect such as constipation,drowsiness, nausea, and vomiting (https://www.webmd.com/pain-management/guide/narcotic-pain-medications).

Chan (2013) finding demonstrated that both single-injection and continuousFNBs provided greater pain relief compared with PCA, during theearly postoperative period. Significantly fewer patients with single injectionand continuous FNBs reported significant pain at 24h postoperativelywhen compared to patients allocated to PCA. The sharp increases in pain observed at 6h at rest, and at 24h when patients commenced walking, were significantly lower in the continuous FNBgroup which can in turn decrease nausea and vomiting that clearly appeared by*Chan* (2013), patients with FNBs had significantly less opioid consumption and fewer reported moderate to severe nausea and vomiting. And demonstrated that the single-injection FNB or the continuous FNB had significantly lessened pain on movement at 24h, lower opioid consumption,and decrease the incidences of nausea and vomiting post operatively.

Hemodynamic parameters among FNB versus NFNB

The two groups, FNB vs. NFNB, showed no statistically differences in the mean of systolic blood pressure or diastolic blood pressure at pre and all post-operative measured time intervals except at the 12^{th} post-operative hour for systolic and diastolic blood pressure (p value < 0.05) and pre-operative heart rate (p value < 0.05). The similar on Shukla et al. (2018) in FNB groups and NFNB There were no statistically significant differences among this groups with respect to the mean MAP value at each time interval and respiratory rates were also recorded at the same time intervals. There was no significant difference

Shukla et al. (2018), the mean arterial pressures increased in the block group, but this difference was not significant. This could be because, as soon as pain increased (VAS>3),

In contrast Bergmann et al. (2013), the hemodynamics effects of peripheral nerve blocks and concluded that they provided more hemodynamic stability than general anaesthesia for ASA III patients.

In contrast Canakci etal. (2017) illustrates changes in perioperative mean arterial pressure (MAP) between the two groups(group USA spinal anaesthesia. and group PCS psoas compartment block and sciatic nerve block). The intraoperative 5th, 10th, 20th, 30th, 60th, and90th and intraoperative 150^{th}minuteMAP values of patients in the PCS group were found to be significantly higher than those of the USA group

Akkaya etal. (2014) the study containstwo groups: group S (spinal group) and group B(block group)the MAP values in the group S were significantly lower.

In the present study two groups, FNB vs. NFNB, showed no statistically differences in the mean of heart rate at all post-operative measured time intervals except at the pre-operative heart rate (p value < 0.05). In contrast Shukla et al. (2018) Heart rates in FNB groups and NFNB similar at all times.

In similar Canakci etal. (2017) explain perioperative heart rates (HR) of groups.The intraoperative 5^{th}, 10^{th}, 20^{th}, 25^{th}, 45^{th}, 60^{th}, 90^{th}, and 150^{th}minute values of patients in the PCS group were significantly higher than those in the USA group.

Canakci etal. (2017), regarding the comparisons of repeated measurements of the hemodynamic parameters between groups mean arterial pressure (MAP), heart rate (HR) values were found to be statistically significant in the USA group compared with that in the PCS group.

Akkaya etal. (2014) the study contains tow group; S (spinal group) and group B(block group) No differences in the respiratory and heart rates were identified.

The two groups, FNB vs. NFNB, showed no statistically differences in the mean of O_2 saturation at pre and all post-operative measured time intervals (p value > 0.05).

In contrast Akkayaetal (2014) the oxygen saturation differed significantly between the groups from 20 to 100 min. The SpO2 tended to be lower in Group B

Akkayaetal (2014) the study contains two groups: group S (spinal group) and group B(block group) The incidence ofnausea was significantly higher in Group S at 110, 115, 120, and 125 min (P = 0.017, 0.006, 0.017, and 0.017, respectively).

No vomiting was observed in any patient. One patient in the block group required 10 mg of IV metoclopramide.

No differences in the respiratory and heart rates were identified.

Although there was no difference in terms of surgical satisfaction, patient satisfaction differed significantly at 75, 80, 85, 90, and 105 min (P = 0.031, 0.06, 0.06, 0.015, and 0.032, respectively). The overall median patient satisfaction values in Group S and Group B were 3 and 2, respectively.

Conclusion

This study compared post-operative nausea, vomiting and drowsiness pain scores, opioid consumption, and patient satisfaction between subjects who received FNB with NFNB in TKA. This study found the overall satisfaction with the function of their operation knee among patients' FNB group following TKR surgery was higher comparing with overall satisfaction with the function of their operation knee among NFNB group after the surgery. And pain relief among patients' FNB group following TKR surgery was higher comparing with pain relief among NFNB group after the surgery Some trends in the data, do suggest efficacy in the use of a FNB for TKA, such as earlier discharge of hospital, decreased pain scores, decreased opioid consumption, decreased length of stay and decreased nausea and vomiting in FNB subjects compared to NFNB subjects. These trends also suggest future research is necessary to establish clinical relevancy.

Recommendations

The findings in this study may support future research in several areas. It may be beneficial for future research to assess length of stay in hospital of time less than 24 hours. Increased accuracy in the measurement of time spent during a subject's stay, may give a more accurate measurable difference between subjects FNB and NFNB. Secondly, conducting a similar study with an increased sample size will add power to the effect size, increasing the ability to find differences in variables. Increasing the

effect size will improve the credibility of the findings. Thirdly, performing a similar study at multiple sites may improve the generalizability of the findings. Analyses at different sites, increases the representation of the general population in the community as well as representation of the different perioperative procedures and post-operative care for subjects who had a TKA. Lastly, future studies may need to develop procedures prior to the initiation of a study, to ensure data (such as pain scores) are recorded or located in the subject's medical record at all times. This practice decreases the opportunity of data omission during data collection.

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54. **Single-injection femoral nerve block with 0.25% ropivacaine or 0.25% bupivacaine for postoperative analgesia after total knee replacement or anterior cruciate ligament reconstruction Rodrigo de Lima e Souza MD, MSc (Staff Anesthesiologist), Cláudio Henrique Correa MD (Staff Anesthesiologist),** Maurício Delage Henriques MD (Staff Anesthesiologist), Christiano Barbosa de Oliveira (Undergraduate Student), Tarcizo Afonso Nunes MD, PhD (Staff Surgeon), Renato Santiago Gomez MD, PhD (Staff Anesthesiologist)

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Appendices

Appendix A

Data Collection Form

Demographic data:

Name initials:----------

Data of admission:---------- Data of discharge----------

Duration in operation room----------

Duration of operation--------

Age:----------Years

Gender (male, female)

History of:

Smoking (yes, no)

Number of cigarette ----------.

Medication pre-operation:

History of old surgery (Yes, No)

Name of surgery: ----------

Use of FNB (YES, No)

Did you feel of pre or post: Nausea ---------- Vomiting ----------?

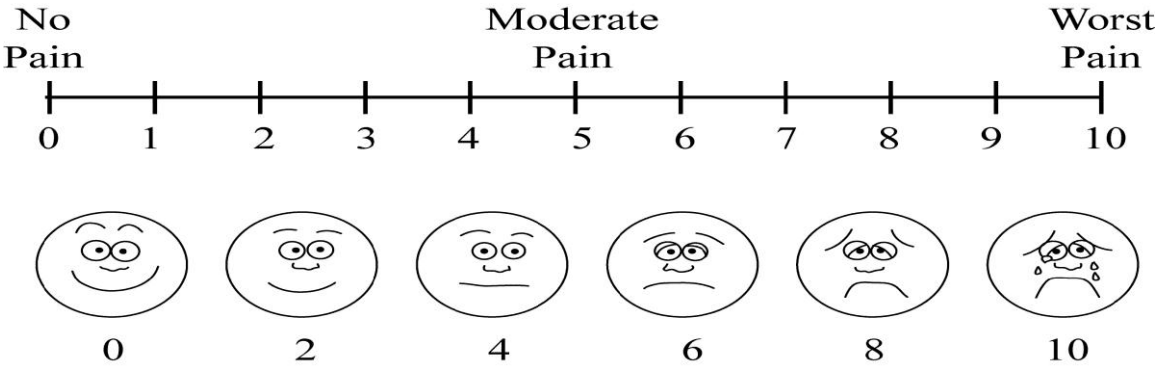
_ Analgesia used post operation:

Opioid --------- DOSE /WEIGHT Other ----------

Vital signs(Hemodynamic)

TIME	PRE-OP	Post – op on PACU	Post – op 1 hr	Post – op 4 hr	Post – op 6 hr	Post – op 12 hr	Post – op 24 hr
Bp							
HR							
O2 SAT							
Pain level							
Nausea							
Vomiting							
Drowsy							

Visual Analogue Scale



Patient Satisfaction Tool post-operative

The following questions were asked as part of the patient satisfaction survey:

1. **Overall satisfaction with the surgery.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied

2. **Overall pain relief after the surgery.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied

3. **Overall satisfaction with the function of your operative knee.**

   ☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied

4. **I can do most things I thought I would be able to do after the surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False

5. **My pain relief is as good as I expected following the surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False

6. **I am happy with the results of my knee surgery.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False

7. **I would have the same surgery again for the same problem.**

   ☐ True ☐ Mostly true ☐ No difference ☐ Mostly false ☐ False

Appendix B

Consent Form

You have been invited, because you recently had surgery to total knee replacement, to participate in a research project being conducted in the Department of Operation, your participation is entirely voluntary. It is up to you to decide whether or not to take part in this study.

Before you decide, it is important for you to understand what the research involves. This consent form will tell you about the study, why the research is being done and the possible benefits, risks and discomforts.

If you wish to participate, you will be asked to sign this form. If you decide to take part in

this study, you are still free to withdraw at any time and without giving any reasons for your

decision.

If you do not wish to participate, you do not have to provide any reason for your

decision. You will not lose the benefit of any medical care to which you are entitled or are

presently receiving.

Please read this form carefully and feel free to discuss it with your family, friends and doctor before you decide.

Benefits:

There will be no direct benefits to you for participating in this study. We hope that the

information gained from this study can be used in the future to benefit other people with a similar

condition.

Risks and discomforts:

There are no physical risks associated with this study.

Costs and reimbursements:

There is no cost to you for participating in this study. You will not be paid for your

participation.

Who to contact for questions about this study:

If you have any questions about this study, you can contact The Principal Investigators,

Sameh Mohammad Kulaib (0598747189)

Consent:

I, _____, have read and

understand the above information and agree to participate in the study entitled:

The Effect of Femoral Nerve Block on Opioid Consumption among Patient's who Underwent Total Knee Replacement Under Spinal Anesthesia

I understand that my participation is voluntary andthat all the information collected will be kept confidential and used only for scientific objectives.

I am not waiving any of my legal rights by signing this consent form. I freely consent to

participate in this study.

Signature_____

Date_____

نموذج موافقة

لقد تمت دعوتك للمشاركة في البحث كونك ستقوم بعملية جراحية لتبديل مفصل الركبه ،بحيث ستكون مشاركتك في البحث الذي سيقام في قسم العمليات الجراحية، وهذه المشاركة تعتبر طواعية ولك الحق في القبول أو الرفض، وقبل أن تقرر المشاركة في البحث يجب أن تدرك مضمون هذا البحث .

نموذج الموافقة هذا سيوضح لك أهمية إجراء البحث وما هي المنافع المنتظرة وهل سيكون هناك خطورة أو أي إزعاج يترتب على مشاركتك .

إذا أحببت المشاركة سيكون أمامك المقدرة على ترك البحث والانسحاب في أي وقت ودون إبداء الأسباب ،وفي حال انسحابك من المشاركة في البحث ، لن تفقد أي رعاية طبية أو اهتمام .

رجاء اقرأ نموذج الموافقة هذا جيدا وبأريحية مطلقة ، وناقش الأمر مع العائلة والأصدقاء أو الطبيب الخاص بك قبل اتخاذ القرار

المنفعة من المشاركة في البحث

ليس هناك منفعة مرتقبة ، وأنا أرجو أن تكون المعلومات المستفادة من البحث بعد إتمامه مفيدة لأشخاص آخرين سيخضعون لمثل هذه العملية الجراحية .

المخاطر

لا يوجد مخاطر أو مضاعفات مرتبطة بهذه الدراسة

التكلفة

لا يوجد تكلفه مترتبة على المشاركة في البحث

جهة الاتصال عند الحاجة

عند وجود أي استفسار أو توضيح بالإمكان الاتصال مباشرة بالباحث الرئيسي في البحث (سامح محمد كليب)

على الرقم 05598747189

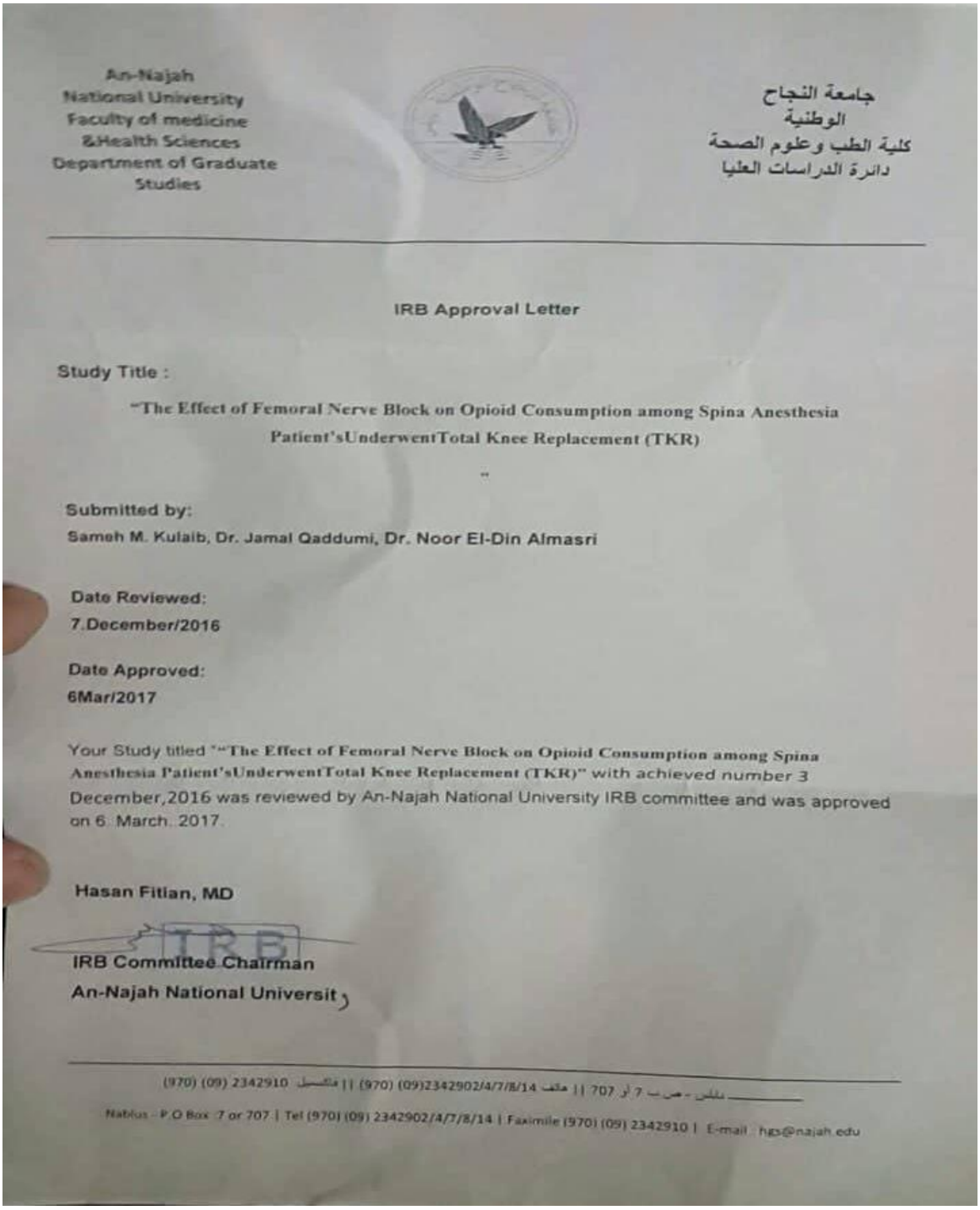
نموذج الموافقة

أنا _____ قرأت وفهمت كل ما جاء من معلومات وأوافق على المشاركة في البحث ، وقد فهمت أن مشاركتي في البحث بإرادتي وجميع المعلومات التي أصرح بها والتي يتم جمعها سيتم الاحتفاظ بسريتها ، واستعمالها للأهداف العلمية فقط ، وعليه أوقع.

توقيع المريض: _____ التاريخ :_____

Appendix C

Approval of IRB



An-Najah
National University
Faculty of medicine
&Health Sciences
Department of Graduate
Studies

جامعة النجاح
الوطنية
كلية الطب وعلوم الصحة
دائرة الدراسات العليا

IRB Approval Letter

Study Title :

"The Effect of Femoral Nerve Block on Opioid Consumption among Spina Anesthesia Patient'sUnderwentTotal Knee Replacement (TKR)

"

Submitted by:
Sameh M. Kulaib, Dr. Jamal Qaddumi, Dr. Noor El-Din Almasri

Date Reviewed:
7.December/2016

Date Approved:
6Mar/2017

Your Study titled "**"The Effect of Femoral Nerve Block on Opioid Consumption among Spina Anesthesia Patient'sUnderwentTotal Knee Replacement (TKR)"** with achieved number 3 December,2016 was reviewed by An-Najah National University IRB committee and was approved on 6 March. 2017.

Hasan Fitian, MD

IRB

IRB Committee Chairman
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جـامــعة الــنجاح الــوطــنية

كليـــة الدراســات العليـا

تأثير كتلة عصب الفخذ على استهلاك الأفيون لدى المريض الذي خضع لاستبدال الركبة الكلي تحت التخدير النخاعي

إعداد

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قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في تمريض التخدير، بكلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس- فلسطين.

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الملخص

الخلفية المرجعية

استبدال الركبة الكلي (TKR) هو إجراء جراحي شائع أصبح العلاج المفضل للأشخاص الذين يعانون من آلام المفاصل والعجز المستعصية. وهو تدخل فعال وفعال من الناحية الاقتصادية، مع معدلات نجاح عالية من حيث تخفيف الألم وتحسين الوظيفة في المرضى الذين يعانون من التهاب المفاصل المتقدم للركبة. قد تؤدي مضاعفات ما بعد الجراحة إلى تأخير الحركة والتفريغ. هناك العديد من المضاعفات مثل الصدمة العصبية أو الأوعية الدموية في الساق، خلع الطرف الاصطناعي ، حساسية للمواد الأسمنتية وعملية إزالة الألم.

تعتبر إدارة الألم جزءًا مهمًا من التعافي. وحدة ما بعد العمليات الجراحية متعددة الأقسام المستمر epidural، الضفيرة القطنية، وكتل الأعصاب الفخذ أو الوركي تحسين إدارة الألم بعد العملية الجراحية وتقليل استهلاك المواد الأفيونية. كتلة الأعصاب الفخذية (FNB) هي واحدة من الطرق المستخدمة لتقليل استهلاك المواد الأفيونية. يمكن استخدام كتلة الأعصاب الفخذية لتوفير التخدير للركبة الأمامية والركبة وجزء صغير من القدم الإنسي. وعادة ما يتم استخدامه بالتزامن مع كتل الطرف السفلي الأخرى. ويمكن أيضا استخدامه لتخفيف الألم بعد العملية الجراحية بعد جراحة في الركبة.

الأهداف

لتقييم فعالية FNB في الحد من الألم بين استبدال التخدير النخاعي الكلي للركبة ، فعالية FNB في الحد من الغثيان والقيء بعد العمليات الجراحية (PONV) بين الاستبدال الكلي للركبة في العمود الفقري، وتقييم فعالية كتلة الأعصاب الفخذية في تقليل الأفيون الاستهلاك بعد الجراحة تخدير العمود الفقري استبدال الركبة الكلي.

الأساليب

أجريت تجربة عشوائية منتظمة (RCT) في مستشفى رفيديا، حيث تم اختيار المرضى الذين شاركوا في التجربة عشوائياً إلى أي من المجموعتين الذين تلقوا كتلة عصب الفخذ قيد التحقيق (مجموعة التدخل) أو إلى مجموعة لم يتلقوا العلاج (مجموعة المراقبة). حجم العينة يعتمد على α 0.05 ويؤثر على الحجم المشار إليه والقدرة 0.80. حجم العينة التقديري هو (100 مشارك.

النتائج

من بين 100 شخص خضعوا لجراحة رأب الركبة من جانب واحد (TKA) في هذه الدراسة، حصل 44٪ (n = 44) من الأشخاص على كتلة عصبية فخذ (FNB) قبل تقويم مفاصل الركبة الكلي (TKA)، في حين أن 56٪ (= 56) لم يتلق كتلة عصبية فخذية قبل الجراحة.

وأظهرت المجموعتان، كتلة عصب الفخذ مقابل كتلة الأعصاب غير الفخذ، الاختلافات في النسبة المئوية من المتغيرات المعلمات نتيجة الجراحة بعد الجراحة المبلغ عنها بما في ذلك الغثيان والقيء والنعاس. أبلغت مجموعة كتلة الأعصاب غير الفخذية عن نسبة أعلى من الغثيان الجراحي بعد الجراحة من مجموعة كتلة الأعصاب الفخذية في جميع العمليات الجراحية بعد العملية قياس فترات زمنية ما عدا في 4 بعد ساعة المنطوق. كانت النسبة المئوية للتقيؤ من قبل مجموعة عصب الأعصاب غير الفخذ في الرابعة والرابعة والعشرين بعد العملية أقل (26.8 ٪ و3.6 ٪) من النسبة المئوية المبلغ عنها من التقيؤ من قبل مجموعة كتلة الأعصاب الفخذية (27.3 ٪ و 4.5 ٪).

لم تظهر المجموعتان ، كتلة عصب الفخذ مقابل كتلة الأعصاب غير الفخذية، أي فروق ذات دلالة إحصائية في متوسط ضغط الدم الانقباضي أو ضغط الدم الانبساطي في الجراحة السابقة والجراحة ما بعد الجراحة قياس فترات زمنية ما عدا الساعة 12 بعد العملية للاضطراب الانقباضي والانبساطي ضغط الدم (قيمة p<0.05) ومعدل ضربات القلب قبل العملية (قيمة p<0.05).

متوسط ضغط الدم الانقباضي وضغط الدم الانبساطي عند 12 ساعة بعد العملية كان 120.5 ± 12.9 مم زئبقي و 70.0 ± 7.1 مم زئبقي لمجموعة كتلة عصبية غير فخذية وكان 128.1 ± 9.3 مم زئبق و 72.7 ± 4.0 ملم زئبقي لمجموعة عصب الفخذ الفخذي.

لم تظهر المجموعتان، كتلة عصب الفخذ مقابل كتلة الأعصاب غير الفخذية، أي اختلافات إحصائية في معدل ضربات القلب في جميع العمليات الجراحية ما بعد الجراحة قياس فترات زمنية ما عدا في معدل ضربات القلب قبل المنطوق (قيمة p<0.05).

لم تظهر المجموعتان، كتلة عصب الفخذ مقابل كتلة الأعصاب غير الفخذية، أي فروق ذات دلالة إحصائية في متوسط تشبع O2 في الجراحة السابقة والجراحة ما بعد العملية قياس فترات زمنية (قيمة p> 0.05).

كان التخفيف العام لتخفيف الآلام بين مجموعة فئران عصب الفخذ لدى المرضى بعد جراحة TKR أعلى مقارنة بتخفيف الألم بين مجموعة كتلة الأعصاب غير الفخذية بعد الجراحة هناك اختلاف كبير في استهلاك تسكين الجراحة ما بعد الجراحة بين كتلة الأعصاب الفخذية وكتلة الأعصاب غير الفخذية. أشار اختبار مان–ويتني إلى أن استهلاك التسكين بعد العمليات الجراحية كان أكبر بالنسبة لمجموعة كتلة الأعصاب غير الفخذية من مجموعة كتلة الأعصاب الفخذية (U = 66، درجة Z = -7.85، p = 0.001

كان الرضا العام لمجموعة مرضى عصب الفخذ لدى المرضى بعد جراحة TKR أعلى مقارنة مع الرضا العام لمجموعة بلوك الأعصاب غير الفخذية.

الاستنتاج

قارنت هذه الدراسة ما بعد العمليات الجراحية من القيء والقيء من علامات النعاس، واستهلاك المواد الأفيونية، ورضا المرضى بين الأشخاص الذين تلقوا كتلة عصبية فخذية مع كتلة عصبية غير فخذية في استبدال الركبة الكلي. وجدت هذه الدراسة أن الرضا العام عن وظيفة الركبة في الركبة بين مجموعة فئران عصب الفخذ لدى المرضى بعد الجراحة الكلية لاستبدال الركبة كانت أعلى مقارنة بالرضا الكلي عن وظيفة الركبة في الركبة لدى مجموعة من العصب غير الفخذي بعد الجراحة. وكان تخفيف الألم بين مجموعة فئران عصب الفخذ لدى المرضى بعد إجراء عملية جراحية لاستبدال الركبة أعلى مقارنةً بتخفيف الألم بين مجموعة عصب الأعصاب غير الفخذية بعد إجراء بعض الاتجاهات في البيانات، وهو ما يشير إلى فعالية في استخدام كتلة الأعصاب الفخذية للركبة الكلية إستبدال.

الكلمات الدالة

استبدال الركبة الكلي، كتلة عصب الفخذ، الغثيان والقيء بعد العمليات الجراحية.