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Efficacy of Epidural Analgesia versus Ultrasound guided Femoral Nerve Block in Postoperative Pain Relief in case of Total Knee Surgery.

Thesis

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Anaesthesiology*

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List of Abbreviations

Abb.	Full term
ACLS	: Advanced Cardiac Life Support
ASA	: American society of anesthesiologists
CEA	: Continuous epidural analgesia
CFB	: Continuous femoral block
CFI	: Continuous femoral infusion
CNS	: Central nervous system
COX-2	: Cyclooxygenase-2
DPQ	: Dartmouth pain Questionnaire
EA	: Epidural analgesia
FNB	: Femoral nerve block
HR	: Heart rate
ICU	: Intensive care unit
IV	: Intravenous
LA	: Local anesthetic
MAP	: Mean arterial pressure
NSAID	: Non-steroidal anti-inflammatory drugs
OOP	: Out-of-plane
PACU	: Post anesthesia care unit
PCA	: Patient controlled analgesia
PNB	: Peripheral nerve block
PNS	: Peripheral nerve stimulator
PONV	: Postoperative nausea and vomiting
SD	: Standard deviation
TKA	: Total knee arthroplasty
US	: Ultrasound
VAS	: Visual analogue scale

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Introduction

Total knee arthroplasty (TKA) is regarded as an effective treatment for end-stage knee osteoarthritis. The increased life expectancy and better medical care have significantly escalated the number of TKA performed. *(Kuperman et al., 2016)*

In the last decade, TKA replaced coronary artery bypass graft surgery as the most common major surgery performed in the developed world. *(Kuperman et al., 2016)*

In the United States, more than 7, 23, 000 knee replacement surgeries were performed in 2014. Cesarean section is the only surgery done more often than TKA. *(Karkhur et al., 2018)*

TKA has been demonstrated to be a cost-effective procedure for degenerative diseases of the knee joint. It is one of the most common surgeries performed today, even in the Indian subcontinent. *(Karkhur et al., 2018)*

Although different techniques are used, the best technique based on efficacy and safety has not been determined. General anesthesia, neuroaxial blockades, and peripheral nerve blocks represent the techniques used more often *(Morales-Munoz et al., 2017)*.

TKA is associated with severe postoperative pain and effective postoperative analgesia after TKA remains a challenge. *(Grosu et al., 2014)*

The incidence of moderate-to-severe pain after TKA is reported to be about 50%, and it can contribute to immobility-related complications, delay in hospital discharge, and may interfere with functional outcome. **(Grosu et al., 2014)**

Pain is one of the most common symptoms requiring hospital admissions after outpatient surgery. Poorly treated pain can have negative impact on recovery especially owing to disruption in physiotherapy resulting in stiffness of joints and slow progress in mobility. **(Srivastava et al., 2007)**

Early mobilization is a challenge after TKA when a patient has severe pain and is receiving pain treatment. Despite a comprehensive multimodal analgesic regimen, TKA is often associated with intense postoperative pain. **(Sigirci et al., 2017)**

Multiple and multimodal approaches to its relief have been tried, which include neuraxial blockade, systemic opioids, intrathecal opioids, systemic steroid/non-steroidal analgesics, local infiltration analgesia, and peripheral nerve blockade (PNB). **(McIsaac et al., 2017)**

Epidural analgesia being a viable alternative, however, faces a relatively high failure rate and may result in side effects such as urinary retention and motor block, with the latter potentially hindering mobilization. **(Karkhur et al., 2018)**

PNBs are commonly used to relieve pain and to reduce opioid requirements and their adverse effects. PNB for TKA

is associated with significantly lower hospital length of stay and also with a lower risk of re-admission. (*Grosu et al., 2014*)

Femoral nerve block (FNB) is one of the most commonly used nerve blockades and has been shown to be effective in reducing the usage rate of opioid painkiller and shortening hospital stays. (*Grosu et al., 2014*)

Despite the growing interest in the use of ultrasound (US) imaging to guide performance of regional anesthetic procedures such as peripheral nerve blocks, controversy still exists as to whether US is superior to previously developed nerve localization techniques such as the use of a peripheral nerve stimulator (PNS). (*Abrahams et al., 2009*)

Aim of the Work

The aim of the study is to compare the efficacy of epidural analgesia versus ultrasound guided femoral nerve block in postoperative pain relief in case of total knee surgery.

Physiology of Pain

I. Definition of pain:

Pain is defined as “An unpleasant sensory and emotional experience associated with actual or potential tissue damage.” This definition recognizes the interplay between the objective physiologic sensory aspects of pain and its subjective emotional and psychological components (*Christopher and Srinivasa, 2011*).

Pain is divided clinically into acute and chronic pain. Both are primarily due to nociception, while in chronic pain psychological and behavioral factors often play a major role. Postoperative pain is one type of acute pain and can be further differentiated based on the origin and feature into somatic and visceral pain. Somatic pain is due to nociceptive input arising from skin, subcutaneous tissues and mucous membranes. It is characterized by being well-localized and described as sharp, pricking, throbbing or burning sensation (*D'Mello and Dickenson, 2008*).

On the other hand, visceral pain is due to nociceptive input arising from internal organ or one of its coverings. It is usually diffuse dull pain which is frequently associated with abnormal sympathetic or parasympathetic activity causing nausea, vomiting, sweating and /or changes in blood pressure or heart rate (*D'Mello and Dickenson, 2008*).

In order to achieve good quality of postoperative analgesia, careful history should be taken from the patients about any coexisting medical conditions such as substance abuse or withdrawal, anxiety disorder, affective disorder, hepatic or renal impairment and any past history of poor pain management. In addition, preoperative patient education should be done to improve expectations, compliance and ability to effectively interact with pain management techniques (*Chris, 2003*).

II. Neuro-physiology of pain:

Nociceptors:

Sensation is often described as either protopathic (noxious) or epicritic (non-noxious). Epicritic sensation (light touch, pressure, proprioception and temperature discrimination) is received by low-threshold receptors (specialized endorgans on the afferent neurons) (figure 1) and conducted by large myelinated nerve fibers, while protopathic sensation (pain) is subserved by high-threshold receptors (free nerve endings) (*Carr and Goudas, 1999*).

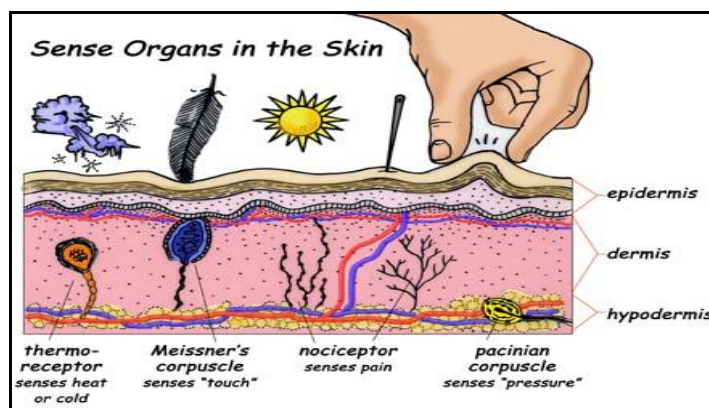


Figure (1): Sense organs in the skin (*Julius and Basbaum, 2001*).

Noxious sensations can often be broken down into two components: a fast, sharp, and well-localized sensation “first pain” which is conducted by A- delta fibers; and a duller, slower onset, and poorly localized sensation “second pain” which is conducted by C fibers (figure 2) (*Julius and Basbaum, 2001*).

This protopathic pain is transmitted mainly by free nerve endings that sense mechanical or chemical tissue damage. Several types of these pain receptors are recognized:

- (1) Mechano-nociceptors, which respond to pinprick.
- (2) Silent nociceptors, which respond only in the presence of inflammation.
- (3) Polymodal mechano-heat receptors which are more prevalent and respond to excessive pressure, extreme of temperature and pain producing substance

(*Richardson and Mustard, 2009*).

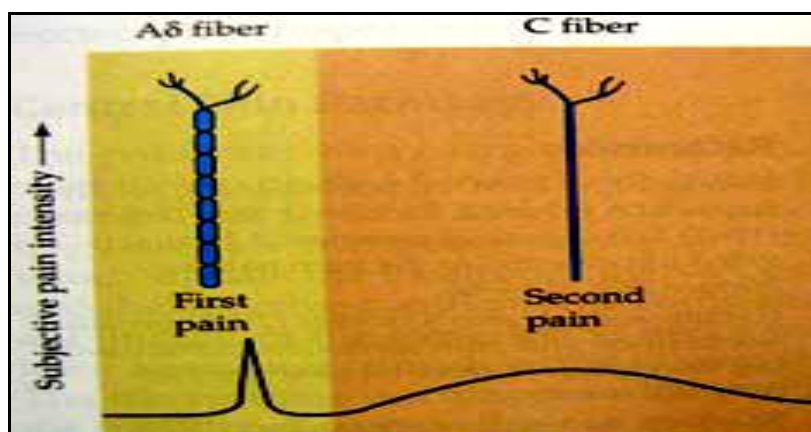


Figure (2):A-delta and C fibers (*Julius and Basbaum, 2001*).

III. Complications of postoperative pain:

Moderate to severe acute pain, regardless of its site, can affect nearly every organ function and may adversely influence postoperative morbidity and mortality. Acute pain is typically associated with neuro-endocrinal stress response that is proportional to pain intensity and it has been hypothesized that a reduction in surgical stress responses (endocrine, metabolic and inflammatory) will lead to a reduced incidence of postoperative organ dysfunction and thereby to an improved outcome (*Richardson and Mustard, 2009*).

1) Cardiovascular effects:

Catecholamine-induced tachycardia, enhanced contractility, increased afterload and increased preload from hypervolemia (caused by enhanced release of arginine vasopressin and aldosterone) are well characterized determinants of increased oxygen demand. Increased oxygen demand, with hypervolemia, may precipitate ischemia and acute cardiac failure, especially in patients with poorly compensated coronary artery or valvular heart disease (*Wartier et al., 2000*).

2) Pulmonary effects:

Pain increases total body oxygen consumption and carbon dioxide production which necessitates an increase in the work of breathing. Patients with poor pain control have inadequate cough, leads to further reduction in the tidal volume and functional residual capacity which in turn can cause