COMPARISON BETWEEN ULTRASOUND GUIDED FEMORAL 3 IN 1 BLOCK VERSUS BLIND FASCIA ILIACA COMPARTMENT BLOCK AS ANALGESIA PRIOR POSITIONING FOR SPINAL ANAESTHESIA

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DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE (ANAESTHESIOLOGY)

UNIVERSITI SAINS MALAYSIA

2016

ACKNOWLEDGEMENT

Firstly, I am grateful to the Almighty God for giving me strength and health to finish this dissertation as partial requirement for my Master of Medicine (Anaesthesiology) programme.

Foremost I would like to express my sincere and greatest gratitude to my supervisor Dr Rhendra Hardy Mohamad Zaini of the Anaesthesiology Department, School of Medical Sciences Universiti Sains Malaysia for his invaluable guidance and support for me in finishing this study. He consistently allowed this paper to be my own work, but steered me in the right direction whenever he thought I needed it.

In this opportunity, I would also like to thank all the consultants/ lecturers of the Anaesthesiology Department, USM who indefatigable in giving moral support and being supportive in any possible way for my convenience.

Getting through my dissertation required more than academic support, and special thanks to my colleagues for listening to and, at times, having to tolerate me over the past few years and have been unwavering in their personal and professional support.

Also, lots of thank to the Ministry of Health (MoH) for the opportunity and scholarship which allows me to pursue my dream of becoming an anaesthetist.

Most importantly, none of this could have happened without my family especially my beloved wife who always stand beside me and offered her encouragement and limitless emotional support for me to finish this dissertation. Every time I was ready to quit, you did not let me and I am forever grateful. This dissertation stands as a testament to your unconditional love and encouragement.

TABLE OF CONTENTS

Biodata Abstrak Penyelidikan

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Introduction: Femur bone fracture may cause considerable amount of pain and peripheral nerve block has been advocated for use in this condition. Many techniques have been described to ease the pain in this kind of patient either prehospital and postoperative setting. However, it remains underutilised and not routinely done. Most of the time, patient either given intravenous analgesic or no analgesic.

Objectives: This study aimed to evaluate the efficacy of ultrasound guided femoral 3 in 1 block versus the blind technique single shot fascia iliaca compartment block as an analgesia method in patients prior positioning for spinal anaesthesia in femur fracture surgery.

Patients and Methods: This study was a prospective, single blinded and randomized controlled trial. A total of 60 patients aged between 18 to 65 years old consisted of ASA I to III were included in this study. Patients were divided into two groups by using computer assisted randomization. Group A received single shot blind fascia iliaca compartment block whereas group B received ultrasound guided femoral 3 in 1 block. The pain score at rest, upon movement and at interval of 5-10 minutes after block performed were recorded using Visual Analog Score (VAS).

Results: Ultrasound guided femoral 3 in 1 block provides faster reduction of VAS at least 5 minutes' post block and significant VAS reduction at 20 minutes' post block. Less intravenous fentanyl required for rescue analgesia in femoral 3 in 1 block group. However, both blocks were comparable in term of reduction of VAS at 30 minutes' post block.

Conclusion: Femoral 3 in 1 block provides significantly faster relief of pain in femoral bone fracture. However, after 30 minutes' total pain reduction in both techniques are similar. Both are equally effective and safe.

Dr Rhendra Hardy Mohamad Zaini: Supervisor

1.0 INTRODUCTION

Demographically there are two main peak of age where fracture shaft of femur more commonly occurred.(1) First in the age group of 15-44 years old because these young people mostly involved in motor vehicle accident as they usually owned a motorbike. In developing country this is being predominated by the male sex group.(2) Secondly, as life expectancy increased, there is also increase in proportion of aging people which presented with fracture shaft of femur due to fall with underlying osteoporotic fragile bone.(3) Whereas increased in proportion of aging population nowadays lead to an increase in incidence of femoral neck fracture which commonly occurred due to fall causing fracture of the fragile osteoporotic bone. This finding was similar worldwide.(4)

Shaft of femur fracture can be significantly painful due to periosteum injury. This is because the periosteum has the lowest pain threshold of the deep somatic structures. Most of patient will experience different degree of pain depending on their pain threshold level. The intensity of pain is most significant upon movement such as being transported from bed to transportation trolley or vice versa and during sitting upright position for regional anaesthesia.

The spinal anaesthesia is the most common technique performed for regional anaesthesia in femur fracture surgery. Regional anaesthesia has become the preferred technique as it carries lower mortality rate compared to general anaesthesia.(5) The mortality rate is reduced by one third when patient is allocated under regional anaesthesia. Apart from that, regional anaesthesia is associated with lower postoperative complication such as deep venous thrombosis, pulmonary embolism,

transfusion requirements, pneumonia, respiratory depression, myocardial infarction, and renal failure.(6)

A good pain management during preoperative period in femur fracture surgery may allow patients to correctly position themselves during preparation for spinal anaesthesia and renders it to be more successfully delivered. Correct position allows maximal separation between the lumbar laminae and the spine, also avoiding rotation and lateral curvature of the whole spine.(7) Adequate and proper positioning may expedite process of induction, improve patient satisfaction prior induction of regional anaesthesia and reduces complication from marked haemodynamic changes due to pain induced sympathetic stimulation. Severe pain intensity may also cause improper position for spinal anaesthesia making the process of giving spinal anaesthesia be quite difficult.

For pain management during positioning for spinal anaesthesia, the intravenous short acting opioid is the most commonly used analgesic of choice, however in the geriatric age group, the opioid can cause the side effect involving respiratory depression. Furthermore, fentanyl which is commonly used only last for a short while and sometimes does not fully covered the pain. In recent years, peripheral nerve block has gain popularity by health care provider to increase quality of health services in providing good pain relief for patients.

Peripheral nerve block is a technique which uses local anaesthetic to be deposited around a target nerve and block the conduction of action potential thus not allowing pain signal to be transmitted to the pain centre in the brain. Peripheral nerve block has evolved over the years in providing pain relief either as analgesia or anaesthesia. The difference between analgesia or anaesthesia with peripheral nerve

block is the dosage of the drug, where a higher dose needed for the latter. However due to complexity of lower limb innervation, central neuraxial blockade or multiple injection of local anaesthetic is used to provide anaesthesia to lower limbs. Thus for one of the peripheral nerve block technique being used to reduce pain score is fascia iliaca compartment block and it has been described useful and recognized for acute pain management in especially in femur fracture.

In the beginning of regional anaesthesia, the lower limb blocks do not gain much popularity and interest when compared to the upper limb block due to complexity of lumbar plexus and for anaesthesia purposes it requires multiple site of injection. The technique has evolved significantly over the years since 1973. Winnie et al described earlier regarding the technique of inguinal paravascular lumbar plexus block.(8) Later Dalens et al described the technique of fascia iliaca block for femoral surgery in paediatric patients.(9)

It also being described useful in paediatric population in lower limb surgery but done under general anaesthesia. It is slightly different from usual peripheral nerve blockade as this technique required to spread a total of volume within the closed compartmental space in the thigh to produce desirable effect. However, the concentration of local anaesthetic used is half than maximum dose as it used for analgesic only. It does not directly target specific nerves. Larger volume is needed and there is risk of local anaesthetic toxicity if maximum dose is exceeded. Thus, familiarity with this technique and pre-calculation of the dose of intended local anaesthetic need to be done before performing the block. Unfamiliarity with this technique may also render it unsuccessful when done incorrectly. Use of ultrasound might improve successful rate as it allows 2-dimensional (2D) visualization of local anaesthetic to spread in intended compartment. However, this technique is more

practical and feasible to do as it does not require sophisticated equipment to do. It also does not need complex training or steep learning curve to perform it.

2.0 LITERATURE REVIEW

2.1 FEMUR FRACTURE

Femur fracture may cause considerable mortality and morbidity especially in geriatric age group as they are often associated with significant comorbidity. The incidence increased from 0.48 to 0.70 per thousand populations from 1981 to 1989 in Malaysia. Elderly population contributed to 38% of the incidence.(2) This could probably due to increase in health care system which increases the life expectancy in our population. In younger age group, femur fracture is most commonly due to traumatic cause such as motor vehicle accident.

Management of femur fracture in adult population most commonly require open reduction and internal fixation despite it being open or closed fracture. Rarely it is not being fixed unless it is deemed not beneficial or harmful to the patient. The surgery can be done either under general or regional anaesthesia. Over recent years, regional anaesthesia has been preferred as sole technique of providing anaesthesia in lower limb surgery as it gives good anaesthesia intraoperatively and good analgesia post operatively. However, it may cause considerable amount of pain to patients especially on movement prior giving regional anaesthesia (central neuraxial blockade). The patient must bear the pain upon movement and positioning before spinal anaesthesia can be given. Pain may be induced during transportation from stretcher to operation table and during sitting or lateral position. It may cause dissatisfaction and even worst haemodynamic changes in susceptible patient with cardiovascular disease.

2.2 PAIN

Based on the International Association for the Study of Pain, pain is described as unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. In can be classified in many ways, one of it by Prof Clifford J. Woolf, a professor of neurology and neurobiology at Harvard Medical School. He classified pain into 3 categories which are nociceptive pain, inflammatory pain which is associated with tissue damage and the infiltration of immune cells, and pathological pain which is a disease state caused by damage to the nervous system or by its abnormal function (e.g. fibromyalgia, irritable bowel syndrome, tension headache, etc.) (10)

Whereas the International Association for the Study of Pain (IASP) has classified pain differently and per specific characteristics region of the body involved (e.g. abdomen, lower limbs), system whose dysfunction may be causing the pain (e.g., nervous, gastrointestinal), duration and pattern of occurrence, intensity and time since onset, and aetiology.

Pain during the acute stage of femur fracture can be excruciating. Based on Hilton's Law as described by John Hilton, he stated that a sensory innervation of a joint is usually supplied by the nerve supplying the overlying muscle and skin. Thus, pain sensory pathway for femoral bone is most likely supplied by the 3 nerves which are femoral, lateral femoral cutaneous and obturator nerve.

Thus, by blocking the propagation of action potential through the above nerves, it is possible to provide good analgesia for patient with femur fracture. Unfortunately to block all the nerves in single shot so far no technique has been proven superior than the other. Pain management in long bone fracture must be

addressed accordingly and not taken lightly as it can cause significant morbidity especially in geriatric population. Increase intensity of pain may stimulate sympathetic reflex and cause coronary event and increase oxygen requirement.

2.3 PAIN PATHWAY IN FEMUR FRACTURE

Following injury/trauma to the femur, there will be destruction of body tissue and inflammatory process begin releasing inflammatory mediators. This will stimulate the nerve ending called nociceptor. Pain induced by injury to body tissue is called nociceptive pain. Pain signal is being transmitted via peripheral nerve towards the spinal cord and then travel up to various part of the brain. Thus, local anaesthetic can be given to block the transmission of action potential from the peripheral nerve to higher centre which is the brain. There are two types of pain nerve fibres which are Aδ fibres and C fibre. The Aδ fibres has faster conduction with the velocity of 6 – 30 meter per second because it is myelinated and larger nerve fibre. The Aδ fibre nociceptors can be divided of two types and respond to mechanical and mechanothermal stimuli. C fibres are unmyelinated, small-diameter less than 2 microns and conduct much slower at the velocity of 0.5 – 2 meters per second. The C-fibre nociceptors respond polymodal to thermal, mechanical, and chemical stimuli. It is well known that the sensation of pain is made up of two categories, an initial fast, sharp pain and a later slow, dull, long lasting pain.

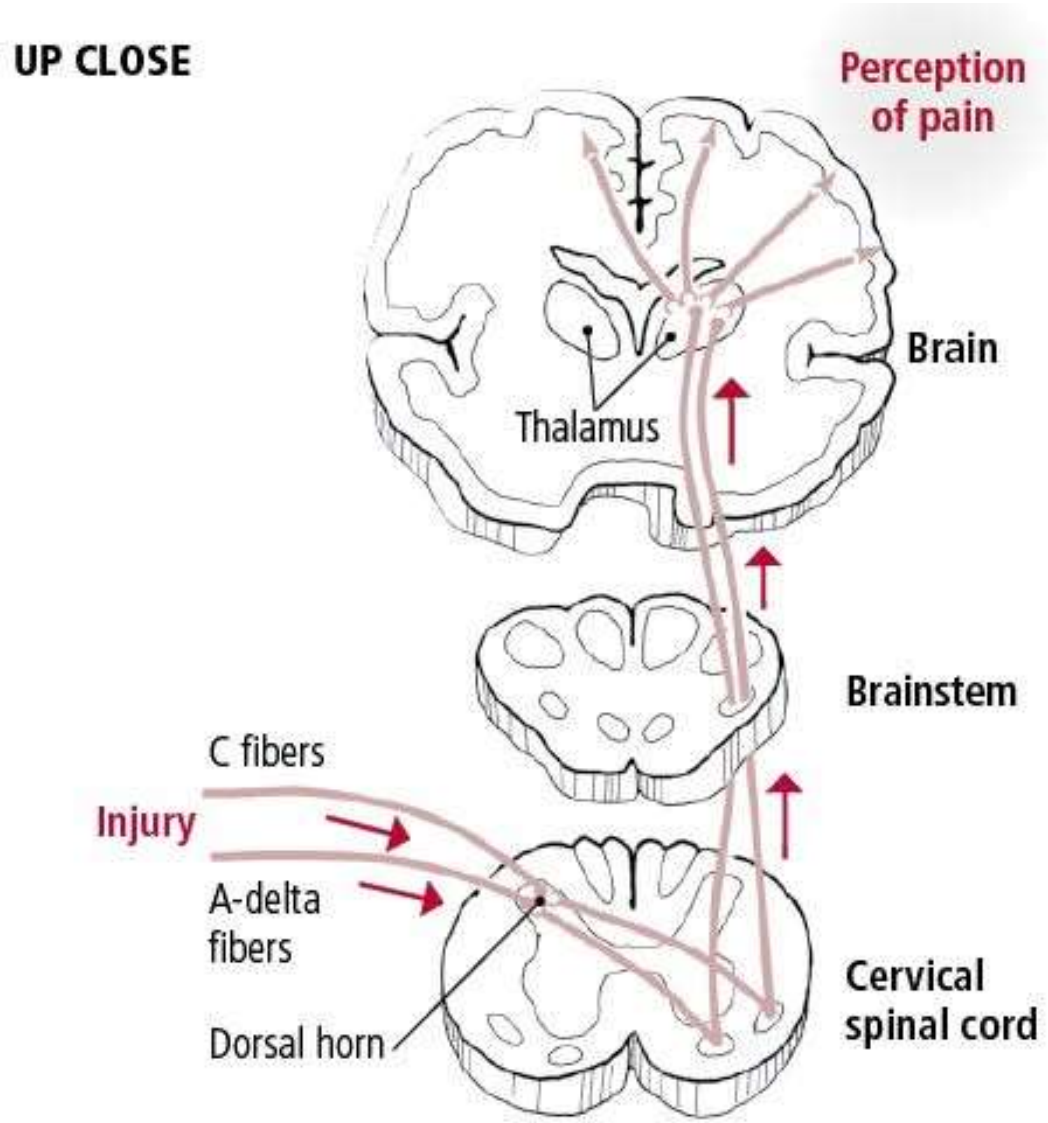

Figure 1 Pain pathway from peripheral to central

2.4 ANALGESIA IN PAIN MANAGEMENT IN FEMUR FRACTURE

Cesare Gregoretti et al. described the role of regional anaesthesia in prehospital, emergency and operating room setting.(11) They advocate the use of regional anaesthesia to reduce posttraumatic stress disorder and reduce the adverse effect of general anaesthesia. Main pain relief method used in traumatic patient in emergency setting includes simple measures such as rewarming; positive

communication; splinting of fractures; and usage of pharmacologic agents administered systemically, regionally, or locally. However, the usage of opioid comes together with undesirable side effect such as respiratory depression thus certain clinician likes to use multimodal approach for pain management as to reduce opioids requirement.(12) Most commonly used opioids is short acting such as fentanyl and prolong use of fentanyl may cause respiratory dysfunction due to second peak in plasma level due to redistribution of drug in circulation.

2.5 VISUAL ANALOG SCALE (VAS)

One way of quantifying pain is by using visual analog scale. It is a psychometric scale used as a measurement instrument for a subjective characteristic such as pain.(13) It is a standardized method of quantifying pain assessment. It uses a rating scale which usually ranging from 0 (indicating no pain) to 10 (worst pain imaginable). It is validated, reliable and can be used for general purposes such as audit. It has good sensitivity and can provide reliable data for statistical analysis.(14)

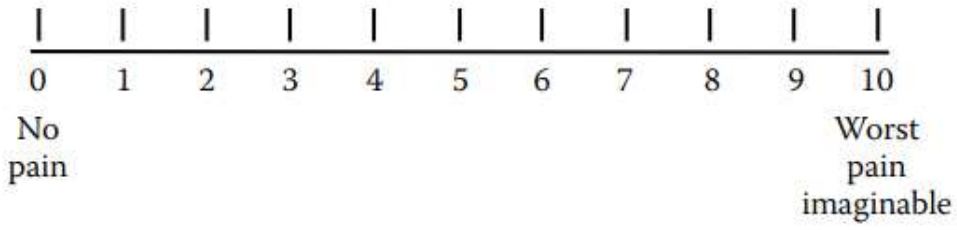

Figure 2 Visual Analog Score used to quantify pain

2.6 LOCAL ANAESTHETIC

Local anaesthetics can be administered for perioperative pain management via different routes either by peripheral nerve blocks or wound infiltration. Peripheral nerve blocks techniques are simple, safe and highly effective approaches to providing perioperative analgesia. The use of long acting local anaesthetics for neural blockage techniques involving the upper and lower extremities can facilitate an early discharge. Extending peripheral nerve blocks using disposable catheter systems to provide continuous peripheral nerve blockage has been shown to reduce pain score post op and requirement for opioid. It also improved patient satisfaction and quality of recovery.(15)

Infiltrating local anaesthetics into the skin and subcutaneous tissue prior to making an incision may be the simplest approach to analgesia. It is a safe procedure with few side effects and low risk for toxicity. When administered before surgery, this simple technique can also decrease anaesthetic and analgesic requirements during surgery, as well as reduce the need for opioid analgesics postoperatively. A study done in patients undergoing total abdominal hysterectomy under general anaesthesia, bilateral block of the abdominal wall with ropivacaine shown less morphine use over the 48 h period after surgery compare to placebo group.(16) Pain scores at rest and with movement were reduced in the ropivacaine group. The incidence of post-operative nausea vomiting did not differ between groups, but the incidence of sedation was reduced in the ropivacaine group.

It is believed that history of local anaesthetic was started from an ancient civilization named Incas in Peru around 1850. The Incas used to chew the leaves of the coca plant for its stimulant properties apart from the local anaesthetic properties.

After the conquest of Peru by Pizzaro, the Austrian von Scherzer who realizes the properties of coca plant, he brought the coca plant to Europe which permits the isolation of cocaine. The first local anaesthetic was known as cocaine then and it was introduced by Freud and Koller in 1884.

Local anaesthetic is a class of drug which causes reversible blockade of neuronal pathway thus preventing transmission of action potential through a neuron.(17) Based in chemical structure it can be divided into two main groups which are amine-ester and amine-amide group. The difference in this group lies in the intermediate alkyl chain which connects the unsaturated aromatic lipophilic portion with the hydrophilic portion usually tertiary amine (Figure 3). The clinical effect of local anaesthetic depends on dosage and volume of drugs used. When applied to a specific nerve with a right concentration it causes muscle paralysis. Examples of ester local anaesthetic are cocaine, procaine, chloroprocaine, tetracaine and benzocaine. Whereas examples of amide anaesthetic are lidocaine, bupivacaine, ropivacaine, levobupivacaine and mepivacaine.

Ester has the commonest association with allergic reaction. It is metabolized rapidly either by plasma or liver cholinesterase or both. The metabolite which is thought to cause the allergic reaction is the para-amino benzoic acid. In condition where plasma cholinesterase level is low, the metabolism of ester local anaesthetic may be prolonged. Such condition can be due to liver disease, pregnancy or atypical enzyme.

Amide has less common association with allergic reaction and most allergic reaction is thought due to preservative in the drugs. It is more stable solution when compared to ester group. The metabolism of amide is by the liver microsomal

enzymes producing amino carboxylic acid through N-dealkylation process and subsequently a cyclic aniline derivative via hydroxylation. Thus, the metabolism is dependent on the liver function and liver blood flow. Most commonly used for peripheral nerve block is from the amide group.

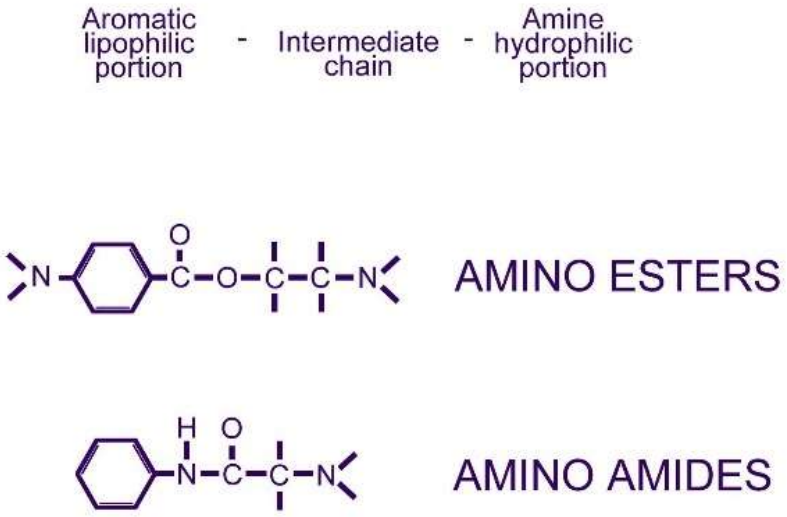

Figure 3 Intermediate link differentiating the ester and amide local anaesthetic

2.6.1 MECHANISM OF ACTION

Although after long history of local anaesthetic use in medical field, the exact site of action at molecular level is still debatable. Local anaesthetic acts as membrane stabilizing agent thus decreasing the rate of depolarization and repolarization of excitable neuron. It that way it prevents transmission of sensorineural. One of the theory is local anaesthetic works by block the inward of voltage gated Na+ ion channel during the depolarization stage which then prevent further propagation of axon action potential. Unfortunately, the exact mechanism is more complex as other ion channels such as calcium, potassium and G protein regulated channel also noted being involved.

2.6.2 ROPIVACAINE

Ropivacaine also known by trade name (Naropin®) is a long acting amide local anaesthetic (Figure 4), pure S enantiomer of the propyl derivative of N-alkyl pipecoloxylidine. (17) After the first cocaine being introduced by Freud and Koller in 1884, the search of less toxic local anaesthetic has led to introduction of Ropivacaine in 1997. Ropivacaine is structurally closely related to bupivacaine with different lies in the propyl group instead of a butyl group linked to the piperidine ring. It is supplied as pure S (–)-enantiomer of propivacaine, with a high pKa and low lipid solubility which blocks nerve fibres via reversible inhibition of sodium ion influx in nerve fibres involved in pain transmission (Aδ and C fibres). The risk of cardiotoxicity of racemix bupivacaine has prompted the development of ropivacaine and it gains popularity due to less cardiotoxicity effect as compared to bupivacaine which was introduced earlier. It is less potent compared to bupivacaine or levobupivacaine due to its lower octanol partition coefficient but it exerts vasoconstrictive effect to offset this lack of potency. At lower doses, the sensory block is suitable for relief of postoperative, labour and other forms of acute pain.

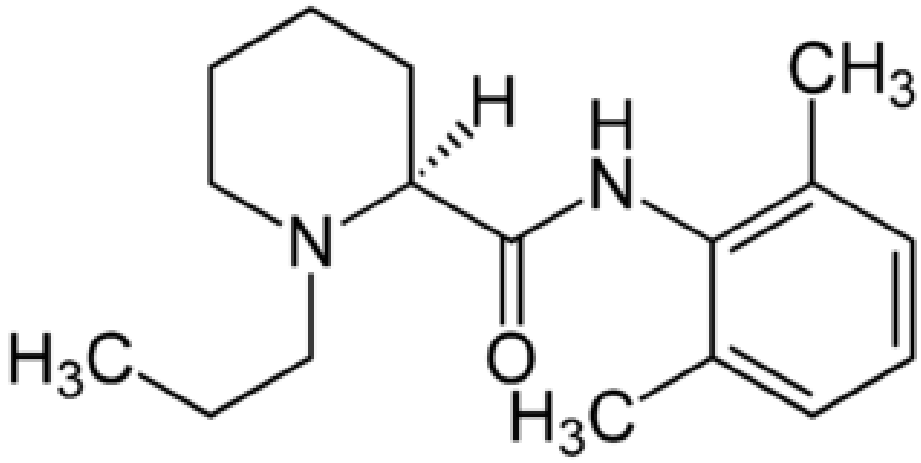

Figure 4 Ropivacaine formula structure

2.6.2.1 PHARMACODYNAMIC

Ropivacaine is a long acting amide local anaesthetic and structurally close in relation with bupivacaine. It has similar pharmacodynamics properties with other local anaesthetic. But combination with adrenaline does not reduce the systemic absorption of ropivacaine. Systemic absorption may cause depression to the central nervous system and cardiovascular system. Even at therapeutic doses, plasma concentration of ropivacaine have been reported to cause cardiac abnormality affecting the conduction, excitability, refractoriness and contractility.

It may cause stimulation or depression or both to the central nervous system. Patient may complaints of dizziness, restlessness, tremors, shivering and may progress to convulsion. Even worse, progress to CNS depression, coma and respiratory arrest.

2.6.2.2 MECHANISM OF ACTION

Like other local anaesthetic it causes nerve block via reversibly inhibition of sodium ion channel of the nerve fibres thus reducing nerve cell membrane permeability to sodium ions. The effect is potentiated by dose-dependent inhibition of potassium ion channel. Nerve fibres are categorised as A, B (both myelinated) or C (unmyelinated) fibres. Pain is being transmitted via Aδ and C fibres; while motor function is controlled by Aα and Aβ fibres. Ropivacaine has a propyl group, whereas bupivacaine has a butyl group, on the amine portion of pipecoloxylidide. Ropivacaine has a high pKa of 8.2, like bupivacaine but less lipid soluble due to different in octanol/buffer partition coefficient 115 vs 346. It is less lipid soluble and less likely to penetrate large myelinated motor nerve fibres. It causes significantly less blockade of motor fibres than equimolar concentrations of bupivacaine. It is

more selective towards pain transmission nerve fibres (Aδ and C fibres) than motor function Aβ fibres.

2.6.2.3 CENTRAL NERVOUS SYSTEM AND CARDIOVASCULAR EFFECT

Like the other local anaesthetic, ropivacaine has the potential to cause central nervous system (CNS) (i.e. seizure) or cardiovascular (CVS) (i.e. arrhythmia or decrease myocardial contractility) effect which usually occurs in high plasma concentration of local anaesthetic following large dose or inadvertent intravascular injection. Clinical signs of CVS toxicity occur at plasma drug concentrations higher than those causing CNS toxicity. CNS toxicity occur in 2 stage processes which are excitatory (lower concentration) and depressant (higher concentration). It ranged from dizziness, visual and hearing disturbances, paraesthesia and generalized seizures. The effect on CVS system can be indirect or direct to the myocardium. Like CNS system, it may cause stimulatory initially then depressive effect later with higher dose. It ranged from arrhythmia, decreased ventricular function and broad QRS complex on sinus rhythm. Due to its lower lipid solubility and stereo selective properties, ropivacaine has a higher threshold level for CNS and CVS toxicity when compared to racemic bupivacaine. The lower lipophilicity of ropivacaine also correlates with less depressant effect on mitochondrial adenosine triphosphate (ATP) synthesis in fast metabolising cells.

2.6.2.4 OTHER EFFECT

At low concentrations and low volume, ropivacaine has vasoconstrictor properties when injected intradermal in humans but does not do so in higher concentration due to biphasic vascular effect.(18) This effect might contribute to long duration of action for ropivacaine as it can stay longer at effect site. It was also noted that ropivacaine case less potent blockade of sodium channel in animal cardiac tissue when compared to bupivacaine.

2.6.2.5 ABSORPTION

A mean maximum plasma concentration (C_{max}) of 1.5 mg/L produced following intravenous infusion of ropivacaine at dose of 50mg over a 15-minute period. In orthopaedic surgery patients, epidural injection of ropivacaine at dose of 100, 150 or 200mg produced C_{max} values of 0.53, 1.07 and 1.53 mg/L, respectively after 96 (100mg) or 40 (150 or 200mg) minutes (t_{max}).(18) Apart from that, there is also systemic absorption of ropivacaine following block performed for intercostal, subclavian or perivascular (for brachial plexus block), peribulbar, intra-articular or local (wound infiltration) administration but the amount is small. So, ropivacaine plasma concentration (Cmax) values remained well below the reported threshold for CNS toxicity (arterial plasma unbound ropivacaine concentrations ≈0.6 mg/L).

2.6.2.6 DISTRIBUTION

Ropivacaine is extensively (90 to 94%) bound to plasma proteins (primarily α1-acid glycoprotein); the level of binding is slightly less than that reported with bupivacaine (96%). During prolonged postoperative epidural infusion of ropivacaine, unbound plasma drug concentrations plateaued or gradually declined despite a progressive increase in total concentrations. The reduction in unbound concentrations was attributed to an increase in plasma α1-acid glycoprotein levels which accompanies the stress response to surgery. Clinical studies have shown that ropivacaine crosses the placenta after epidural administration.

2.6.2.7 METABOLISM AND ELIMINATION

Mean apparent total body clearance (Cl) and terminal elimination half-life ($t_{1/2}$) of ropivacaine after epidural administration have been evaluated in several studies in pregnant women and ranged from 13.4 to 19.8 L/h and 5 to 7h, respectively, regardless of dose. The $t_{1/2}$ after intravenous administration was shorter (≈2h), indicating that the drug undergoes absorption-dependent elimination. Ropivacaine undergoes extensive hepatic metabolism after intravenous administration, with only 1% of the drug eliminated unchanged in the urine. Biotransformation occurs via oxidative metabolism and dealkylation; the major metabolite in urine is 3-hydroxy-ropivacaine (37% of the administered dose). Minor metabolites include 4-hydroxy-ropivacaine, 2-hydroxy-methyl-ropivacaine and N-dealkylated metabolites (PPX) and 3-hydroxy-PPX. An in vitro study in human liver microsomal found that 2 cytochrome P450 (CYP) isoenzymes, CYP1A2 and

CYP3A4, were responsible for the formation of the major and minor metabolites, respectively.

2.7 ANATOMY

2.7.1 LUMBAR PLEXUS

The anterior divisions of the first three lumbar nerves (L1, L2, L3) and part of the fourth lumbar nerve (L4) will formed the lumbar plexus. Often, L1 nerve root joined by a nerve branch from the T12. The lumbar plexus will give rise for the nerve which supply the muscle and skin of the lower extremity, including the iliohypogastric nerve, ilioinguinal nerve, genitofemoral nerve, femoral nerve, lateral femoral cutaneous nerve, and obturator nerve. The lumbar plexus can be found in the posterior third of the psoas muscle, anterior to the lumbar transverse processes, within the psoas major muscle substance.(19)

2.7.2 FEMORAL NERVE

The dorsal divisions of the anterior rami of L2–L4 nerve roots will form the femoral nerve. It is the largest terminal branch of the lumbar plexus. It travels through the psoas muscle, leaving the psoas at its lateral border. It then emerges at the lower border between the psoas and iliacus muscles and descends caudally into the thigh via a groove formed by the psoas and iliacus muscles. It enters the thigh from below the inguinal ligament lateral to the femoral artery and vein. After emerging from the ligament, the femoral nerve divides into an anterior and posterior branch. At this level, it is located lateral and posterior to the femoral artery. It is

covered and separated from the femoral vessel by the fascia iliaca which encloses it laterally and flattens the nerve between itself and iliopsoas muscle.

The anterior branch provides motor innervation to the sartorius and pectineus muscles and sensory innervation to the skin of the anterior and medial thigh. The posterior branch provides motor innervation to the quadriceps muscle (rectus femoris, vastus intermedius, vastus lateralis, and vastus medialis) and sensory innervation to the medial aspect of the lower leg via the saphenous nerve.

The anatomic location of the femoral nerve makes this block one of the easiest to master because the landmarks are usually simply identified (except in cases of morbid obesity), the patient remains supine, and the depth of the nerve is relatively superficial.(20) It supplies motor innervation to the extensors of the knee (quadriceps femoris and sartorius), sensory innervation to the anterior thigh, anteromedial aspect of the knee, medial lower leg and the medial aspect of the ankle and foot (via it's terminal sensory branch, the saphenous nerve) and supplies the periosteum of the femur.

Overlying fascia iliaca, there is fascia lata which runs together with the fascia iliaca laterally, whilst separating from it and overlying the femoral vessels medially. The fascia iliaca compartment within the pelvic brim also contains the lateral cutaneous nerve of the thigh laterally. This nerve supplies sensory supply to the lateral thigh.

2.7.3 LATERAL FEMORAL CUTANEOUS NERVE

Also, known as lateral cutaneous nerve of thigh formed by the L2 and L3 nerve roots. This nerve supplies the sensory innervations of the thigh. It emerges from the lateral border of the psoas major muscle, then it crosses the iliacus muscle and run below or through the inguinal ligament. Then it surfaced up to the thigh through the sartorius muscle.

2.7.4 OBTURATOR NERVE

The anterior divisions of the L2 to L4 nerve roots will forms the obturator nerve. It descends through the psoas muscle and emerges along the medial border of the psoas major muscle. It then goes through the obturator foramen before entering the medial thigh via the obturator canal and divides into anterior and posterior divisions. The anterior division is located between the adductor longus and brevis muscles, and the posterior division is located between the adductor brevis and magnus muscles. This nerve innervates the medial compartment of the thigh. The sensory of medial thigh is supplied by the cutaneous branch of the posterior branch of the obturator nerve.

2.7.5 PERIPHERAL NERVE BLOCK

Peripheral nerve block of the lower limbs done in a variety of surgeries either for analgesic or anaesthetic purposes. However, the lower limbs block is not as popular as the upper limbs block as it more challenging to do. Possibly due to complex lumbar complex as compare to brachial plexus which is more compactly arrange around the subclavian artery. Furthermore, lower limbs block may require

multiple injection if operation to be done above the ankle. One factor which make lower limb block less preferable is the availability of subarachnoid block/ spinal anaesthesia which produce more profound block with single injection. But peripheral nerve block of the lower limbs has becoming more useful in cases of hemodynamic unstable patient where spinal anaesthesia is contraindicated.

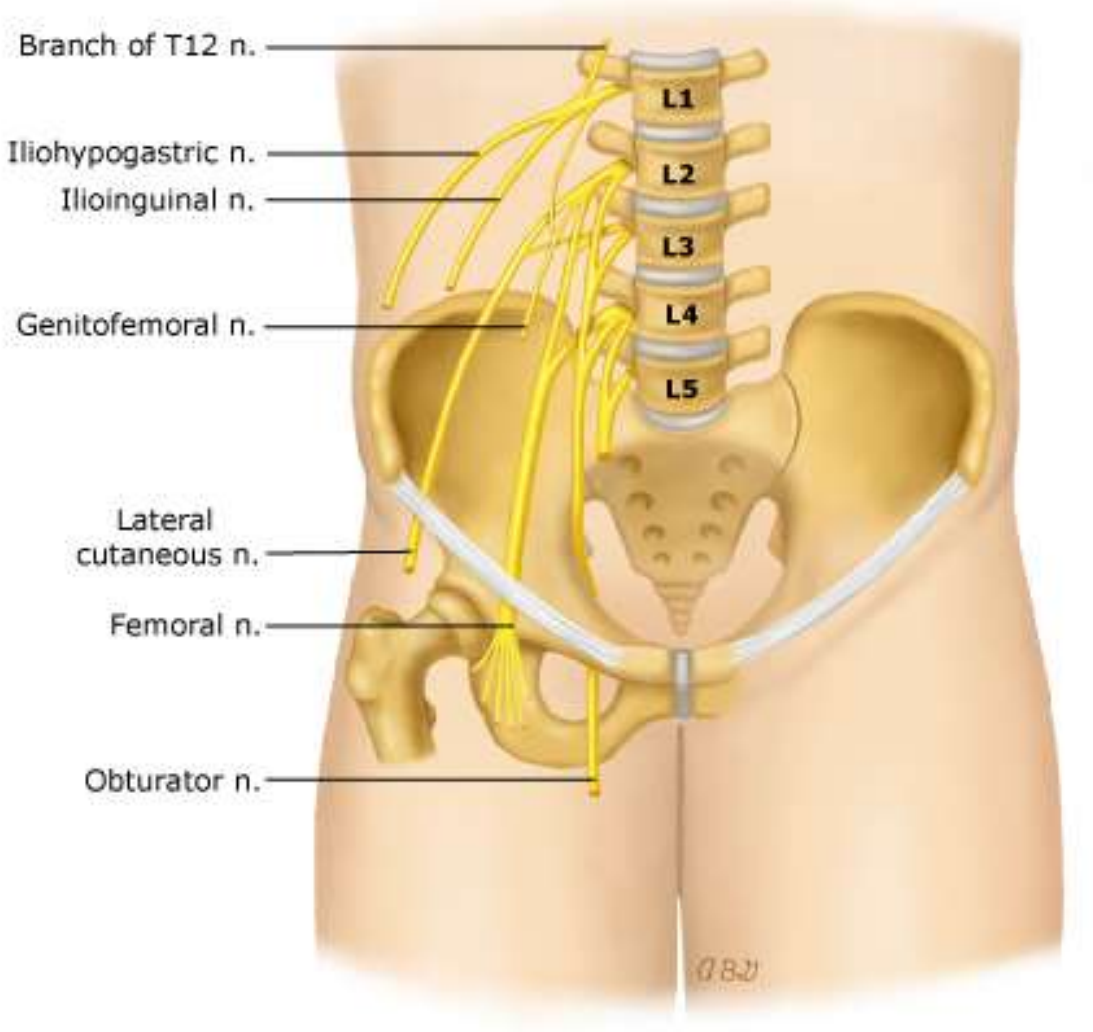

Figure 5 Lumbar plexus formed by the L1 to L3 nerve roots and part of the L4

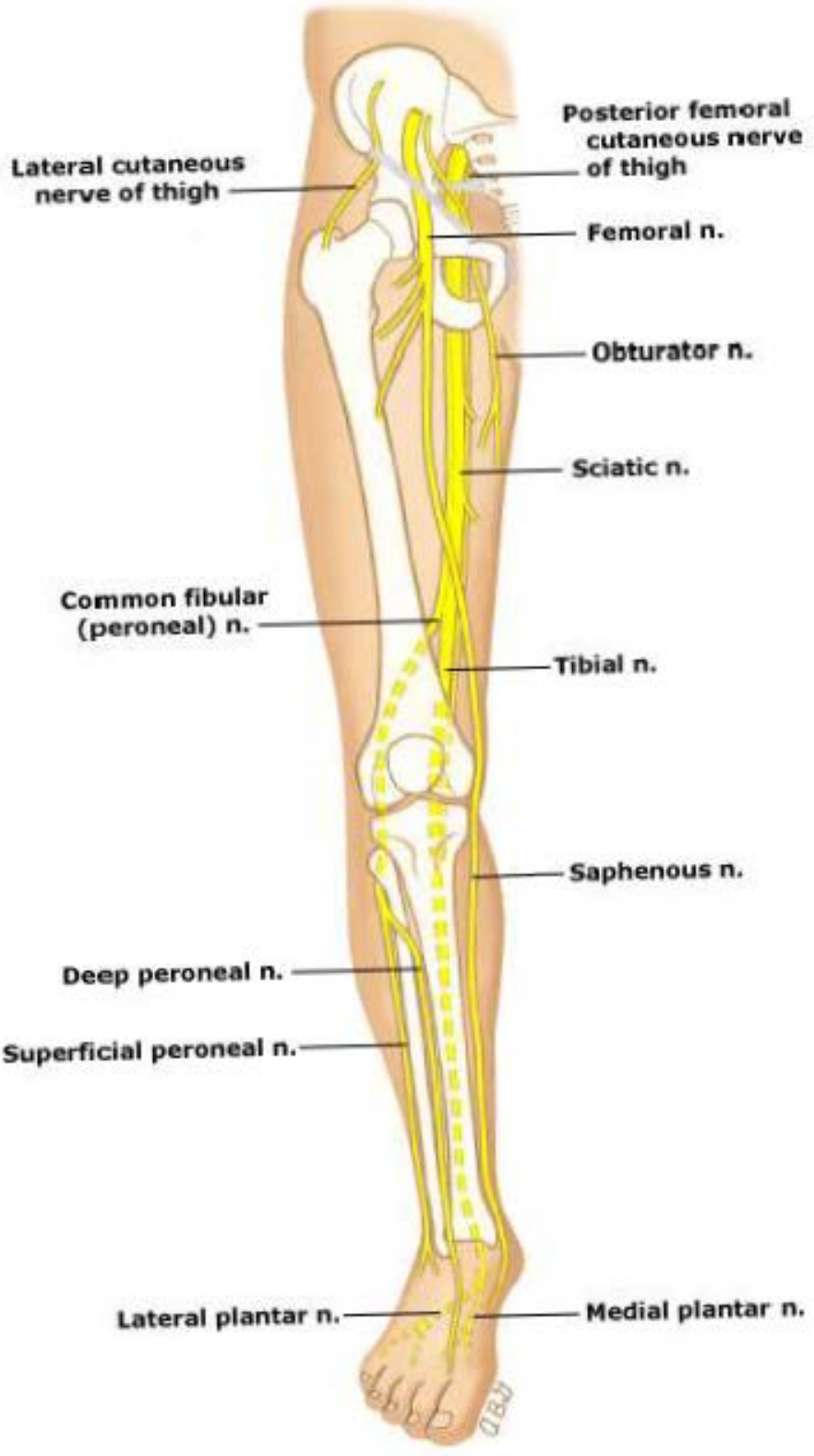

Figure 6 Lateral Femoral Cutaneous, Femoral Nerve, Obturator Nerve and Sciatic Nerve

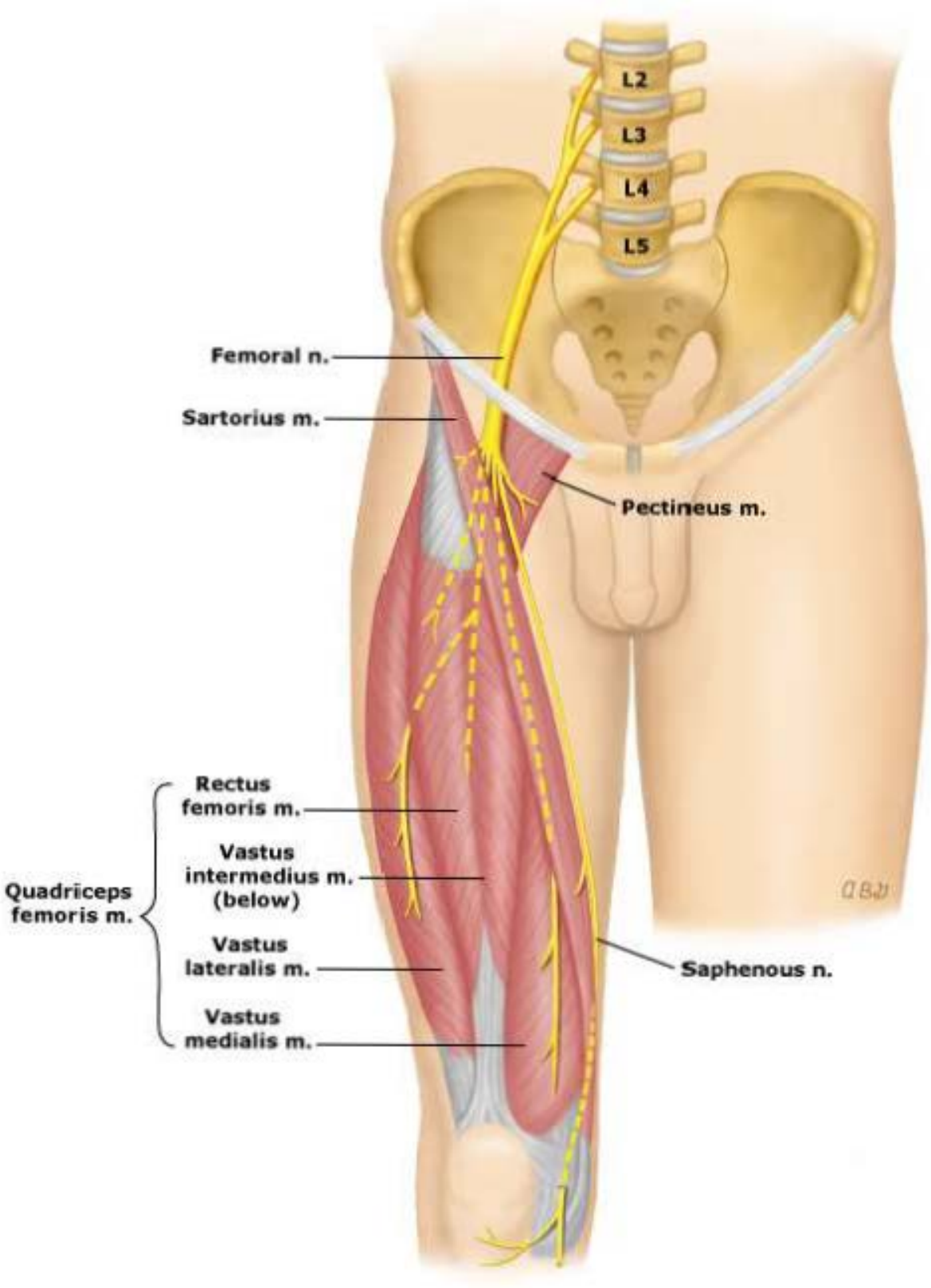

Figure 7 Femoral Nerve Main Innervation

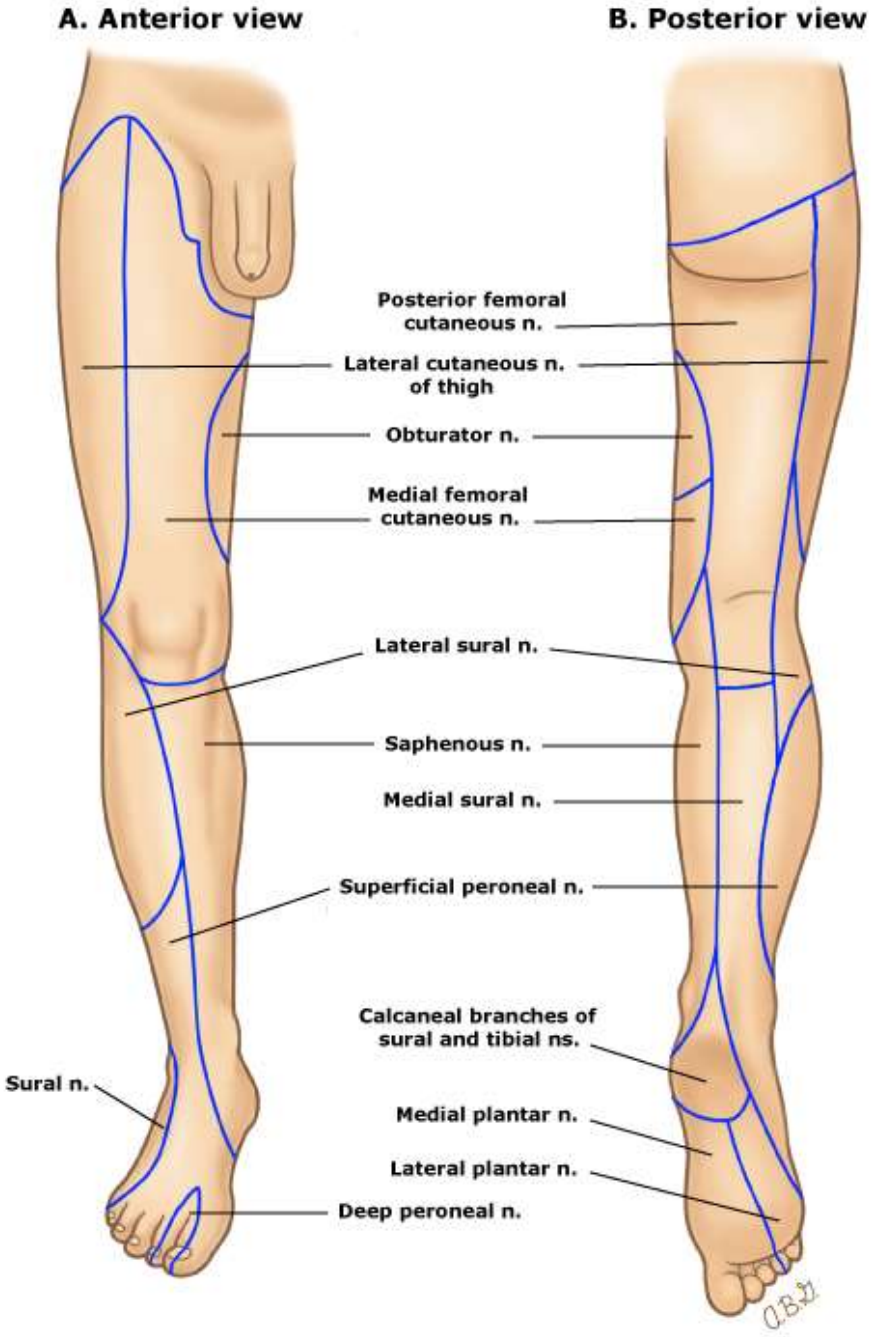

Figure 8 Sensory innervation of lower limbs

2.8 FASCIA ILIACA COMPARTMENT BLOCK

Fascia iliaca compartment block (FICB) has been described initially by Dalens et al as an alternative to femoral 3 in 1 block.(9) It was done in paediatric orthopaedic surgery which includes hip surgery, femoral shaft surgery, knee and quadriceplasty. Nowadays, numerous minor variations in this technique exist since it was introduced in 1989. Dalens et al described it as a single injection technique to block the lateral femoral cutaneous, femoral nerve and obturator nerve. It can be considered as an alternative to the femoral nerve block or a lumbar plexus block but less skilled required without use of ultrasound imaging. Thus, it is a low-tech technique which does not require much of technology for it to be performed. According to Dalens et al. the block is given by injecting local anaesthetic behind the fascia iliaca at the union of lateral with the medial two thirds of inguinal ligament and local anaesthetic is spread upward by forcing it upward with finger compression. It is a compartmental block targeting not specific nerve but rather a compartment where all the target nerves lie. Thus, it requires sufficiently large volume of local anaesthetic to be given so that it can spread within desired compartment subsequently reaching the nerves. He demonstrated a block of the femoral nerve in 100% of cases, whereas the lateral cutaneous nerve 92% and obturator nerve was block in 88%. The indications for this block are similar to femoral nerve block which are:

- Perioperative analgesia for patients with fractured neck or shaft of the femur
- Adjuvant analgesia for hip surgery depending on the surgical approach
- Analgesia for above knee amputation
- Analgesia for plaster applications in children with femoral fracture