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# REGIONAL ANAESTHESIA FOR TOTAL HIP ARTHROPLASTY

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## RIGIONAL ANAESTHESIA FOR HIP SURGERY

### INTRODUCTION

The advancement in health care and shift to increasing life span brings with it a multitude of medical issues. One such medical issue is the increased incidence of degenerative conditions, such as osteoarthritis and osteonecrosis leading to hip fracture. Surgical therapy is offered to patients with advanced disease to prevent further morbidity, restore function and improve quality of life.

The choice of anaesthesia should be aimed at enhancing early mobilization and reducing complications associated with lack thereof. Early mobilization aims to prevent the adverse physiological effects associated with prolonged bed rest such as increased insulin resistance, muscle atrophy, reduced pulmonary function, impaired tissue oxygenation, and increased risk of thromboembolic events.<sup>[1]</sup>

Traditionally, “the gold standard” for surgeons and patients when major hip surgery is being done has been general anaesthetic. Presently the anaesthetist is armed with improved techniques of regional anaesthesia. It is well known that optimal pain management can be one of the factors that shorten the length of hospital stay and allow quicker rehabilitation, however achieving it presents a challenge.<sup>[2]</sup> The consequences of severe post-operative pain are prolonged hospital stay, increased hospital readmission, precipitation in the use of opioids with subsequent increase in post operative nausea and vomiting (PONV) and overall low patient satisfaction.<sup>[2]</sup>

Enhanced recovery after surgery (ERAS) protocols continue to evolve, so do interventional locoregional techniques. Some traditional locoregional techniques are being replaced by more selective techniques to limit unwanted side effects such as haemodynamic instability and unwanted motor block, which may delay early rehabilitation and recovery. A number of ultrasound guided techniques have been described including fascial plane blocks, distal nerve blocks and periarticular injections, hoping to find a balance between efficiency, simplicity, safety and more sensory block than motor blockade.<sup>[3]</sup>

In the consensus statement for perioperative care in total hip replacement and total knee replacement surgery, the ERAS society recommendations strongly recommend against the use of epidural anaesthesia. This is because of potential for adverse effects which may delay recovery.<sup>[1]</sup> Despite the epidural not recommended as part of ERAS protocol in hip surgery, its high analgesic efficacy, moderate negative safety and side effects profile is well acknowledged.<sup>[1]</sup> They further state that local anaesthetic infiltration is recommended for knee surgery and not for hip surgery.<sup>[1]</sup> Nerve blocks are also not an essential element of ERAS, rooting from the unfavourable effect of motor blockade.<sup>[1]</sup> Multimodal analgesic approach is preferable as an effective way of limiting opioids perioperatively, avoiding their unwanted side effect.<sup>[1]</sup>

PROSPECT (procedure specific postoperative pain management) group recommends the use of regional anaesthetic techniques such as fascia iliaca block or local infiltration analgesia, especially if there are contraindications to basic analgesics and in patients with high expected postoperative pain.<sup>[4]</sup> Basic analgesia may be achieved with basic analgesics and regional anaesthesia without intrathecal morphine.<sup>[4]</sup>

This booklet will highlight some of the regional techniques and supporting evidence currently available.

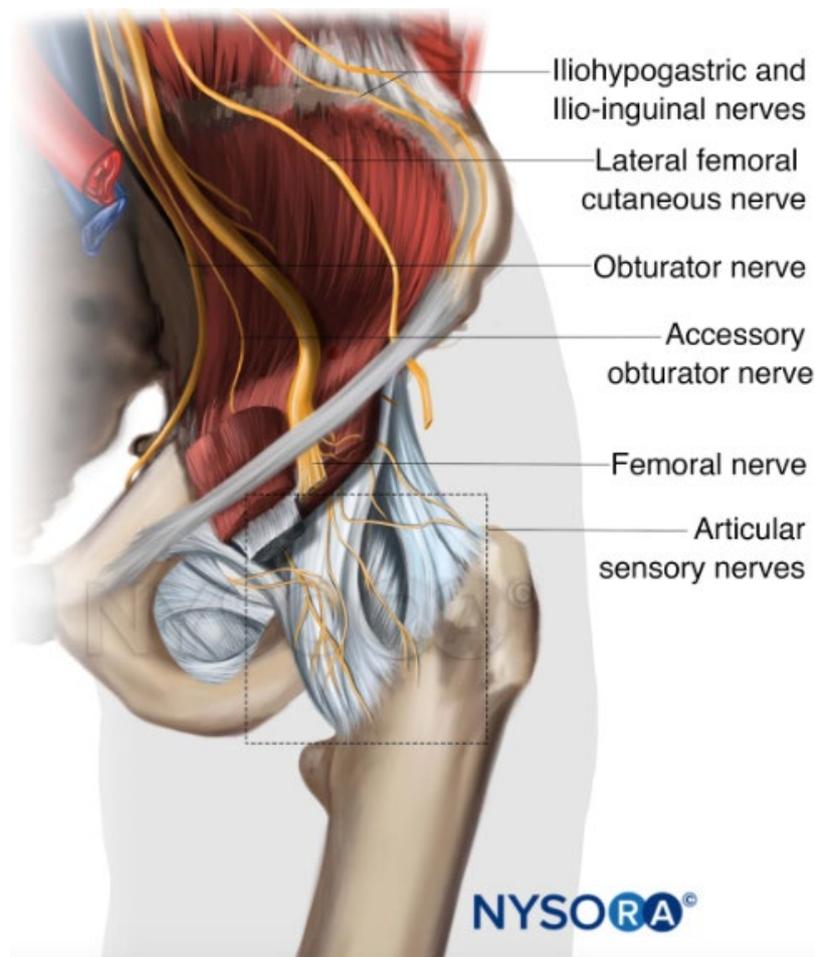
## ESSENTIAL ANATOMY

Pain after hip replacement comes primarily from the anterior hip capsule which is innervated by the terminal nerves of the lumbar plexus:<sup>[5]</sup>

- Femoral nerve: The articular branches from the femoral nerve reach the plane between the iliopsoas muscle and the iliofemoral ligament (iliopsoas plane) and innervate the anterior and lateral aspects of the hip capsule
- Obturator nerve: The articular branches innervate the anterior and medial aspects of the hip capsule.
- Accessory obturator nerve: Contributes to the innervation of the hip in 10%-30% of the patients, and supplies the inferomedial aspect of the hip capsule.
- Lateral femoral cutaneous nerve (LFCN): Supplies cutaneous innervation of the anterolateral thigh. It travels underneath the inguinal ligament, medially to the anterior superior iliac spine (ASIS) and courses distally, superficial to the sartorius muscle.
- The posterior aspect of the hip joint is innervated by the sciatic nerve and branches of the sacral plexus namely:
  - Superior gluteal nerve (SGN)
  - Inferior gluteal nerves (IGN)
  - Articular branch from the quadratus femoris nerve (QF)

Infrequently articular branches to the posterior capsule have been found to emerge directly from the Sciatic Nerve (SN).<sup>[6]</sup> It has been reported that the area innervated by SN overlapped with that innervated by SGN.<sup>[6]</sup>

Figure 1<sup>[5]</sup>



## EVOLVING EVIDENCE OF REGIONAL FOR HIP SURGERY

Guay et al (2017) conducted a Cochrane review of 51 Randomised control trials (RCT) comparing a group receiving peripheral nerve blocks with a no block group.<sup>[7]</sup> The block group included patients who received one of the following: lumbar plexus block, femoral nerve block, fascia iliaca block, obturator nerve block, and femoral lateral cutaneous nerve block.<sup>[7]</sup> The outcomes of this review showed systemic analgesic alone, when compared to peripheral nerve block, provides better pain control and there was no difference between neuraxial and peripheral nerve blocks.<sup>[7]</sup> This study also showed that in the group receiving peripheral nerve block the risk of being confused was decreased, the length of hospital stay was reduced, but there was no difference in the time to first walk after surgery.<sup>[7]</sup>

Recently, Memtsoudis SG et al (2019) who was part of the International Consensus on Anaesthesia Related Outcomes after Surgery group (ICAROS), released a systemic review which included randomised controlled trials (RCT), observational studies comparing neuraxial to general anaesthesia regarding major complications.<sup>[8]</sup> In their study they revealed that neuraxial anaesthesia was associated with lower complication rates, except for urinary retention.<sup>[8]</sup> They recommended neuraxial anaesthesia for primary unilateral total hip replacement when there is no significant contraindication.<sup>[8]</sup> A further study released in 2021 by the same group investigating the impact of peripheral nerve block (PNB) utilization on major complications, showed that PNB was associated with lower odd ratio of developing numerous complications. This study supports the recommendation of the use of PNB, except when they are contraindicated.<sup>[9]</sup>

PROSPECT group reviewed 26 studies related to hip arthroplasty and nerve blocks. This review included 22 RCT and 4 meta-analysis.<sup>[4]</sup> The interventions studied were femoral nerve block, lumbar plexus block, fascia iliaca block, lateral cutaneous nerve block, and anterior quadratus lumborum block.<sup>[4]</sup> This review sort to determine the efficacy of each of these blocks.

Femoral nerve block compared with no block showed that single shot femoral nerve block significantly improved pain scores and reduced analgesic consumption<sup>[4, 10]</sup> In another study patients receiving femoral nerve block met early post-anaesthesia care unit discharge criteria with lower pain scores and analgesic consumption.<sup>[4]</sup> Continuous femoral nerve block was compared with lumbar plexus<sup>[11]</sup> and epidural analgesia<sup>[12]</sup>, similar analgesic requirements were reported.<sup>[4]</sup>

When femoral nerve block was compared with fascia iliaca block, pain scores were slightly higher in the femoral nerve group, but without a clinically significant difference.<sup>[4, 13]</sup>

Recently three meta-analysis all concluded there were lower pain scores, lower morphine consumption, and shorter length of stay when fascia iliaca was used with no greater risk of fall.<sup>[4, 14-16]</sup>

In a study comparing femoral nerve block to local anaesthetic infiltration, femoral nerve block was inferior to local anaesthetic infiltration in respect to postoperative pain scores and morphine consumption, with more motor blockade.<sup>[4, 17]</sup> Neuman MD et al (2021), conducted a pragmatic, randomised control trial to evaluate spinal anaesthesia with general anaesthesia in previously ambulatory patients 50 years and older, undergoing hip surgery.<sup>[18]</sup> The primary outcome was that of death or inability to walk independently at 60 days after randomisation.<sup>[18]</sup> According to this study, spinal anaesthesia was not superior to general anaesthesia with respect to survival and ambulation at 60 days. Incidence of post-operative delirium was similar in both groups.<sup>[18]</sup>

## NERVE BLOCKS

### FASCIA ILIACA COMPARTMENT BLOCK

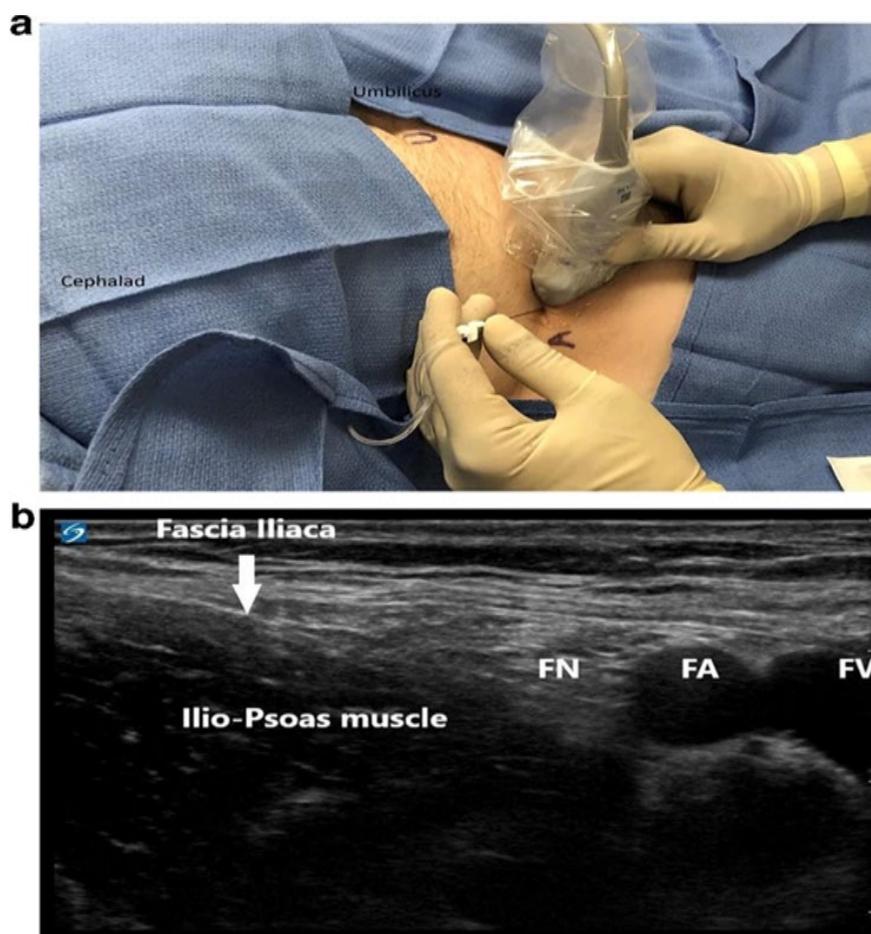
Fascia iliaca compartment block (FICB) is a block where large volume of local anaesthetic is deposited deep to fascia iliaca, covering the anterior surface of iliacus and psoas muscle. It creates a compartment between its attachments to the iliac crest laterally, the psoas fascia medially and the muscles it covers.<sup>[19]</sup> The local anaesthetic (LA) is assumed to spread to the femoral, obturator, lateral cutaneous femoral nerves.<sup>[19]</sup> The femoral artery, femoral vein and Sartorius can be located between the fascia iliaca and fascia lata.<sup>[20]</sup>

#### *Loss of resistance technique*

In this technique a line is drawn from the anterior superior iliac spine to the pubic tubercle. This line is divided into 3 parts and the needle is inserted at the junction of the middle and the lateral thirds. The needle is positioned perpendicular to the skin and advanced till a double pop sensation is felt, corresponding to the needle passing through fascia lata and fascia iliaca respectively.<sup>[19]</sup> This technique is associated with high failure rate and complications compared to the ultrasound technique.<sup>[19]</sup>

#### *Ultrasound technique*

**Figure 2**



**Fascia iliaca block, in-plane ultrasound technique, femoral nerve (FN), Femoral artery (FA), Femoral vein (FV).<sup>[19]</sup>**

The ultrasound guided technique should begin by identifying the femoral artery at the level of the inguinal crease. The probe should be moved medially and laterally to visualise the vessel. The iliopsoas muscle is immediately lateral and deep to the femoral artery and vein and is covered by hyperechoic fascia, which separates the muscle from superficial subcutaneous tissue.<sup>[20]</sup> The femoral nerve is the hyperechoic wedge shaped structure between the iliopsoas muscle and the fascia iliaca and is lateral to the femoral artery. The fascia lata is more superficial and may have more than one layer.<sup>[20]</sup> The lateral cutaneous nerve can be visualised running behind the lateral aspects of the inguinal ligament. The obturator nerve can be seen running through the psoas muscle, although it contributes minimal nociception to the medial leg, it is variable blocked by the FIB.<sup>[20]</sup>

### **3 IN 1 BLOCK**

This block was first described by Winnie et al in 1973. They postulated the entire lumbar plexus can be blocked by perivascular injection slightly distal to the inguinal ligament (location of the femoral nerve in the femoral triangle). They suggest this single injection would result in anaesthesia of the femoral, lateral femoral cutaneous nerve (LFCN) and obturator nerve due to the cephalad spread of local anaesthetic along the fascial layer.<sup>[19]</sup>

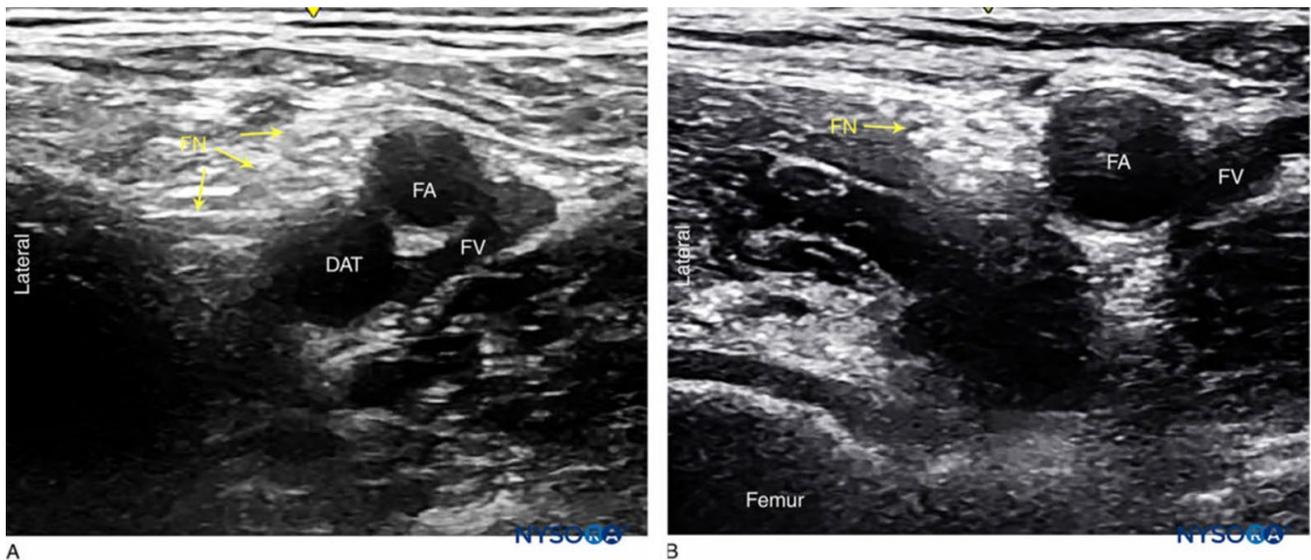
The 3 in 1 block is placed at the same site as the femoral nerve block lateral to the femoral artery but differs by using a large amount of local anaesthetic (LA) and caudal pressure encouraging a more cephalad spread of LA.<sup>[21]</sup> However, this hypothesis was never confirmed. MRI studies have shown a distribution that is more lateral and medial after injection not a cephalad spread.<sup>[19]</sup> This block rarely covers the obturator nerve and has lead to some suggesting it should be termed a “2 in 1 block” instead. Moore CL et al in an article titled “Time to abandon the term 3 in 1 block” states the term “3 in 1 block” is outdated and inaccurate nomenclature.<sup>[21]</sup>

## FEMORAL NERVE BLOCK

The femoral nerve is the largest branch of the lumbar plexus and supplies sensory fibres to the hip joint apart from sensory and motor innervation of the thigh.<sup>[19]</sup> It is formed by the ventral roots of the L2-L4 spinal nerves, above the inguinal ligament femoral nerve is within the psoas muscle but emerges from the muscle at its middle and lower third junction.<sup>[19]</sup> It enters the thigh posterior to the inguinal ligament, and divides into its anterior and posterior branches slightly distal to the inguinal ligament.<sup>[19]</sup> This nerve can be blocked by landmark, nerve stimulator and ultra-sound techniques.<sup>[19]</sup>

### *Ultrasound Technique*

**Figure 3**



***Femoral nerve block, in-plane ultrasound guided, Femoral nerve (FN), Femoral artery (FA), Femoral vein (FV), Deep artery of the thigh (DAT). Note (A) Femoral nerve seen distally and (B) before take-off of Deep artery of the thigh***

A high frequency linear probe is placed at the level of femoral crease with patient lying supine, femoral artery is then identified.<sup>[19]</sup> If profunda femoris artery is also seen, the probe is moved proximally to identify the femoral artery before branching.<sup>[19]</sup> The femoral nerve lies lateral to the femoral artery, and is seen as the hyperechoic triangular or oval structure covered by a hyperechoic fascia iliaca. <sup>[19]</sup>

The needle is inserted in an in-plane technique from lateral to medial direction. An out of plane technique can also be done with the needle perpendicular to the ultrasound probe.<sup>[19]</sup> Using the in-plane technique once the needle is seen above or lateral or below the nerve an injection is made to see the spread of local anaesthetic. Continuous catheter can also be threaded in for prolonged post operative analgesia.<sup>[19]</sup>

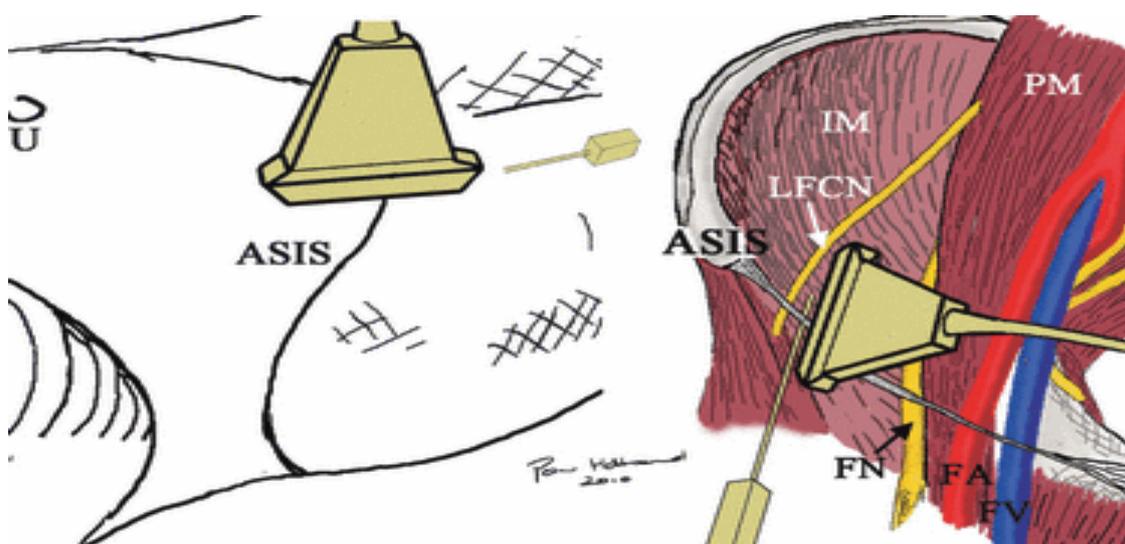
## SUPRA-INGUINAL FASCIA ILIACA BLOCK

Habberd P et al (2011) conducted a study in which they explored the injectate spread and nerve involvement in a cadaveric dye model, using a supra-inguinal ultrasound guided technique that places local anaesthetic directly in the iliac fossa.<sup>[22]</sup> They termed this block the supra-inguinal fascia iliaca block (S-FICB). The study showed that the femoral nerve was stained with dye in all 12 injections, the lateral femoral cutaneous nerve was stained bilaterally in 5 cadavers and the nerve was absent in 6 cadavers, ilio-inguinal nerve passed into the iliac fossae through the iliacus muscle in 8 cadavers (hemi-pelvis) and was stained in seven of these occasions.<sup>[22]</sup>

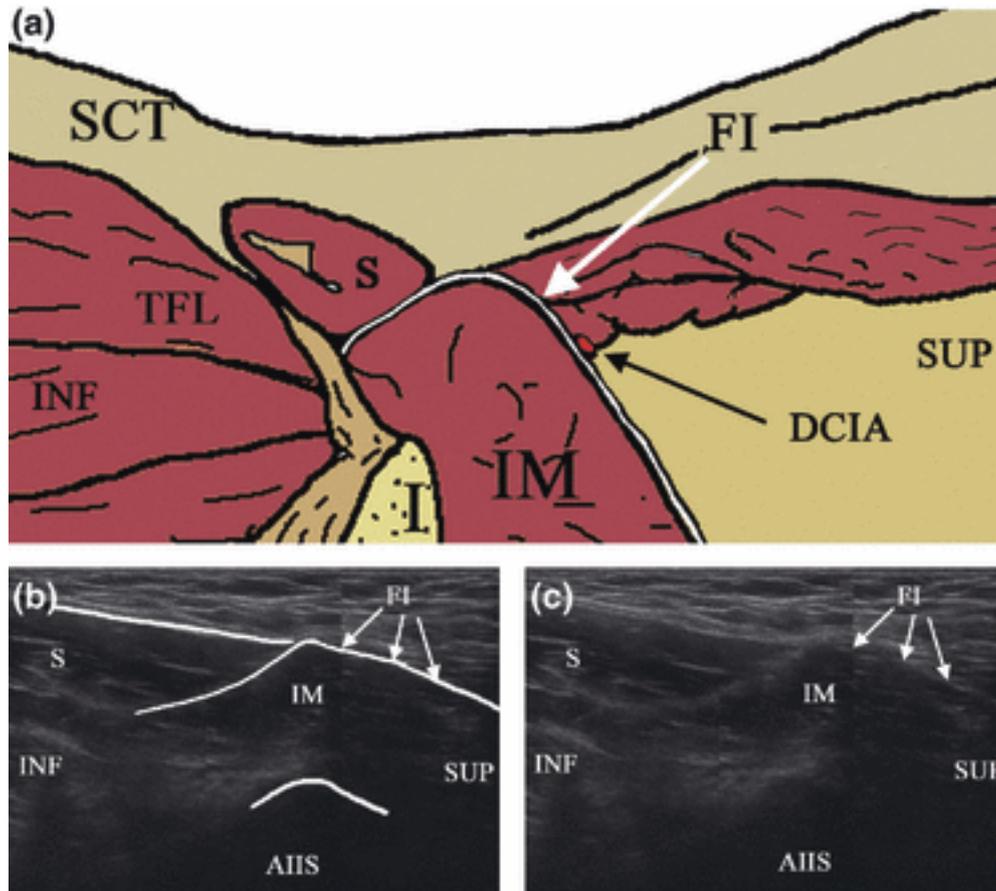
The block is performed with high frequency linear probe or a low frequency curvi-linear probe allowing deeper penetration in obese patients.<sup>[22]</sup> The probe is placed over the inguinal ligament close to the anterior superior iliac spine and orientated in a para-sagittal plane.<sup>[22]</sup>

The thick white line of the ilium and the dark (Echolucent) iliacus muscle with fascia iliaca covering its surface are seen.<sup>[22]</sup> The image of the fascia iliaca is enhanced by tilting the transducer so that the beam is directed more laterally to orientate the fascia more perpendicular to the beam. The probe is then moved more inferior-medially along the line of the inguinal ligament until the femoral artery is seen.<sup>[22]</sup> Moving supero-laterally along the inguinal ligament the anterior inferior iliac spine is imaged.<sup>[22]</sup> The anterior inferior iliac spine forms the attachment for rectus femoris muscle and is identified by the sudden rising of the ilium towards the probe. At this position the probe is lateral to the femoral nerve and this is the starting point for the block.<sup>[22]</sup>

**Figure 1 probe and needle position and diagram of dissected iliac fossae showing the anatomy of the supra-inguinal fascia iliaca block. Iliacus Muscle (IM), Psoas muscle (PM), Femoral nerve (FN), Femoral artery (FA), Femoral vein (FV), Anterior superior iliac spine (ASIS), Umbilicus (U).<sup>[22]</sup>**



**Figure 2. Diagram of anatomical section of the parasagittal plane of the supra-inguinal block (a), and composite sonogram (b and c), Iliacus muscle (IM), fascia iliaca (FI), Psoas muscle (PM), Sartorius muscle (S), Tensor fascia lata muscle (TFL), Ilium (I), Deep circumflex iliac artery (DCIA), Subcutaneous tissue (SCT), Inferior (INF), Superior (SUP), the fascia iliaca, Anterior inferior iliac spine (AIIS), Anterior superior iliac spine (ASIS)[22]**



Zheng T et al (2021) did a case series study with 28 patients undergoing total hip arthroplasty, and who received a modified in plane ultrasound guided supra-inguinal fascia iliaca block as an adjunct to evaluate the analgesic effectiveness and local anaesthetic diffusion with MRI.<sup>[23]</sup>

Modified S-FICB has proved an effective post operative analgesic adjunct after total hip arthroplasty with the satisfactory blockade of Femoral nerve, sciatic nerve and especially the obturator nerve when compared with existing techniques.<sup>[23]</sup>

In this ultrasound technique, they palpated the ASIS and placed the probe in the sagittal plane to obtain the image of the ASIS. They then identified the iliacus muscle by moving the probe medially.<sup>[23]</sup> The probe was then adjusted to identify the ultrasound anatomy, including subcutaneous tissue, internal oblique muscle, sartorius muscle, fascia iliaca, iliacus muscle. A cranial to caudal needle orientation was used to avoid the groin area. After sensory and motor blockade was elicited the patient was evaluated with MRI and the limits of spread of LA were lesser trochanter inferiorly and L2 vertebrae superiorly.<sup>[23]</sup>

FICB is a relatively easy to perform with lower risk at blocking the branches of lumbar plexus, such as spinal, epidural anaesthesia, nerve injury, retroperitoneal haemorrhage.<sup>[23]</sup>

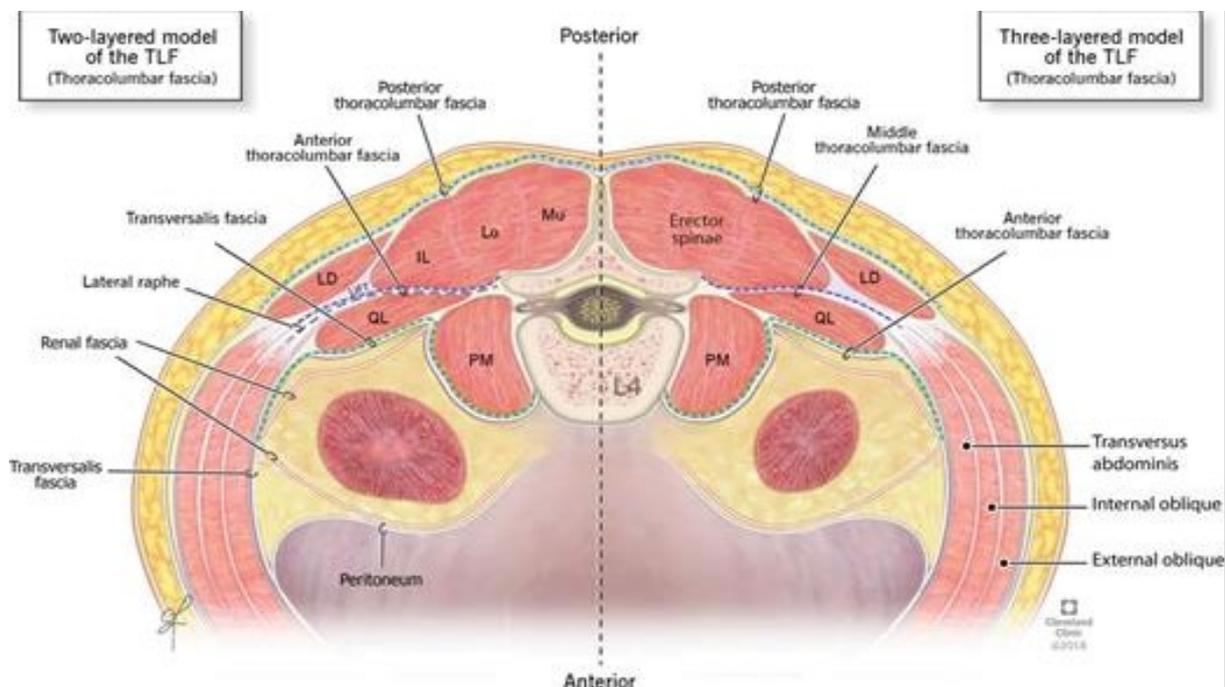
## QUADRATUS LUMBORUM BLOCK (QLB)

Quadratus lumborum block is classified as anterior (Trans muscular), posterior and lateral based on the location of LA in relation with the quadratus lumborum muscle and other abdominal muscles.<sup>[19]</sup> A few case reports on quadratus lumborum block (QLB) and RCT studies on posterior and anterior QLB have shown reduced pain scores, reduced opioid consumption, and improved patient satisfaction for primary total hip arthroplasty.<sup>[19]</sup>

### *Technique QLB*

Patient placed in supine position and a roll under the ischium in order to elevate the hip. Following sterile preparation, a low frequency curvi-linear probe is placed horizontally at the level of umbilicus and moved laterally over the triangle of Petit

**Figure 3.**



**Schematic illustration of cross-section at L4 level showing the quadratus lumborum with different layers of the thoracolumbar fascia.<sup>[24]</sup>**

**Cleveland clinic Centre for medical art and photography (2018)**

It is believed that local anaesthetic injectate anterior to the quadratus lumborum and posterior to the transversalis fascia will spread to the thoracic paravertebral space, posterior to the medial and lateral arcuate ligaments of the diaphragm, along the endothoracic fascia to block the somatic nerve and thoracic sympathetic trunk of the lower levels.<sup>[24]</sup>

LA injected may spread to the thoracic paravertebral space and the vertebrae level of injection will influence the extent of cranial spread.<sup>[24]</sup>

### *Position*

Patient can be positioned supine with a lateral tilt, lateral, sitting or prone. Position is determined by the physician's preference, patient mobility, and the needle trajectory<sup>[24]</sup>

### *Lateral quadratus lumborum*

This block can be performed using an in-plane approach with the needle insertion lateral (anterior) to the probe. The needle should be placed in an anterior to posterior trajectory. LA is deposited at the lateral border of the quadratus lumborum muscle just after the needle has penetrated the transversus abdominis aponeurosis.<sup>[24]</sup>

### *Posterior quadratus lumborum*

This can be done with an in-line technique, either anterior to posterior or posterior to anterior needle trajectory. LA is deposited posterior to the quadratus lumborum muscle and anterior to the erector spinae muscle<sup>[24]</sup>

### *Anterior quadratus lumborum block*

It can be performed using the in-plane technique with the needle medial to the probe, using a posterior to anterior trajectory. The point of LA injection lies in a tissue plane between the quadratus lumborum muscle and the psoas muscle

### *Contraindications*

Include infection to the site of local injection, allergy to LA, known bleeding diathesis as this is a deep block, and relative contraindications include abnormal anatomy, haemodynamic instability.<sup>[24]</sup>

### *Complications*

It may result in local anaesthetic spread to the lumbar plexus and prolonged motor block, delaying mobilisation and hospital discharge, hypotension has also been reported. LA toxicity which may be related to the high dose of LA required and increased vascularity.<sup>[12]</sup>

## **Efficacy of the QLB**

Chang-Hoon et al (2021), Conducted a meta-analysis of studies that evaluated the analgesic effects of QLB compared to that of no block. They included nine studies where outcomes measured were postoperative 24-hour opioid consumption, 12/24-hour Visual analogue scale (VAS) or numeric rating scale (NRS) pain scores, postoperative nausea and vomiting (PONV), and patient satisfaction.<sup>[25]</sup>

In their meta-analysis QLB when compared to no block clinically decreased opioid consumption, reduced PONV and improved participants satisfaction.<sup>[25]</sup>

## PERICAPSULAR NERVE GROUP BLOCK (PENG)

The articular branches of the femoral, obturator, accessory obturator nerve supply the hip joint, and the PENG block is an interfascial plane block aimed at blocking these articular branches.<sup>[19]</sup>

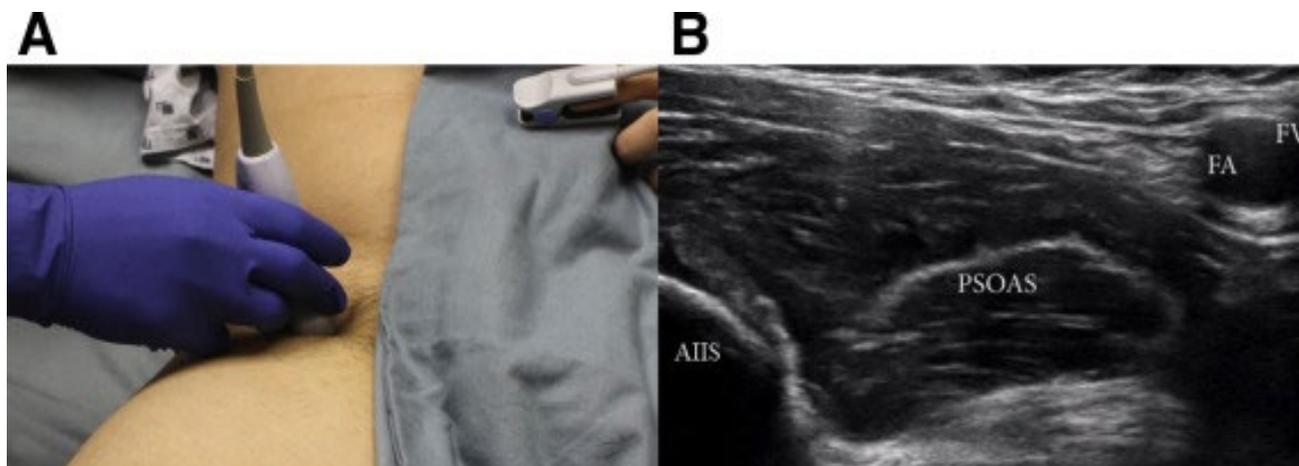
Fernicola et al (2021) described techniques using a high frequency linear probe and positioning the patient supine with a pillow or a blanket under the knee.<sup>[26]</sup> This technique includes marking the bony landmark of the superior anterior iliac spine.<sup>[26]</sup> A linear probe is placed longitudinally and then aligned with pubic ramus by rotating the probe 45 degrees.<sup>[26]</sup> This view allows visualization of the anterior superior iliac spine, ilio-pubic eminence, ilio-psoas muscle, and tendon.<sup>[26]</sup>

The needle is inserted in a lateral to medial direction at an angle of 45 to 60 degrees depending on the size of the patient, in an in-plane approach the needle tip is placed in the musculofascial plane between the psoas muscle anteriorly and pubic ramus posteriorly.<sup>[26]</sup> If the needle is inserted too laterally, it often tracks to the AIIS, making it almost impossible to reach the intended location.<sup>[26]</sup> Conversely starting too medial results in too steep an angle of approach and making needle visualisation more difficult.<sup>[26]</sup>

### *Ultrasound technique*

A low frequency curvi-linear probe is placed in a transverse plane over the anterior inferior iliac spine and moved over inferiorly to visualise the pubic ramus.<sup>[19]</sup>

The femoral artery and the ilio-pubic eminence are then visualised. Using in-plane needle technique from lateral to medial direction, LA is deposited between the psoas tendon anteriorly and the pubic ramus posteriorly.<sup>[19]</sup>



**Figure 3. Fernicola et al (2021) Pericapsular nerve group ultrasound injection position (Fig A). Ultrasound image of the right hip, with the left corresponding to the superolateral pole of the probe. AIIS, Anterior inferior iliac spine, FA, femoral artery, FV femoral vein, psoas , psoas tendon<sup>[26]</sup>**

### *Indications of PENG block*

It has been used in arthroscopic and open hip surgery, hip positioning, acetabular fracture, pelvic fracture, surgery of medial thigh, vein ligation and stripping surgery, in prevention of adductor muscle spasm during TURBT and during treatment of opioid resistant hip Vaso-occlusive crisis.<sup>[27]</sup>

There is lack of good quality data on the efficacy and safety of this block for a specific indication, no consensus can be made on the indication of this block.<sup>[27]</sup> Considering the reported analgesic outcomes in patients with a few specific surgeries, the role of PENG block is worth considering.<sup>[27]</sup>

### ***Complications***

There is an opinion that there is a probability of injury to structures in close proximity to the target area.<sup>[27]</sup> The possibility of injury to the ureter has been mentioned with a more medial needle advancement.<sup>[15] [28]</sup> A hint towards bladder injury itself and a recommendation to take history about last urination and to do an aspiration for urine before injecting.<sup>[27]</sup> Yu et al (2019) reported motor block in the form of quadriceps weakness and proposed use of normal saline or very small volume of local anaesthetic for hydro location to identify the site of needle tip.<sup>[27, 29]</sup>

Intramuscular injection and medial needle placement were suggested to be the possible reasons for the spread to the femoral nerve resulting in motor blockade and it's recommended to rotate the needle while piercing the fascia to prevent intramuscular injection.<sup>[27]</sup>

### ***Efficacy of the PENG block***

Choi YS et al (2022) in a RCT with 58 patients compared the effects of PENG block and supra-inguinal fascia iliaca block on post operative analgesia and quadriceps strength following total hip arthroplasty under general anaesthesia.<sup>[30]</sup> Primary outcome was postoperative pain scores. Pain scores at rest and with movement were assessed postoperatively at the post anaesthetic unit only at rest, and at 6, 12, 24, 36 and 48 hours postoperatively.<sup>[30]</sup> Opioid consumption was also assessed for 48 hours postoperatively. Quadriceps strength measurements were done preoperatively at 6, 24 and 36 hours. There was no difference in pain scores and opioid consumption in the first 48 hours.<sup>[30]</sup>

The change in quadriceps strength measurements in the operative and non-operative leg were not significantly different with slight decrease in both groups on the operative leg.<sup>[30]</sup> Therefore PENG block may have similar analgesic effects to the supra-inguinal FICB.<sup>[30]</sup>

Allard A et al (2021) in a cohort study comparing the femoral nerve block with PENG block on femoral neck fracture.<sup>[31]</sup> The primary outcome was the cumulative morphine consumption in 24 hours.<sup>[31]</sup> No statistically significant differences were found in post operative pain intensity, time to walk, incidence of morphine associated side effects, and length of hospital stay.<sup>[31]</sup> The postoperative muscle strength was greater in the PENG group than the femoral group.<sup>[31]</sup>

Pascarella G et al (2021) In a single centre, observer masked, RCT, patients undergoing total hip arthroplasty received PENG block or no block.<sup>[32]</sup> The maximum pain scores were significantly lower in the PENG group at all time points.<sup>[32]</sup> PENG group also showed a significantly reduced opioid consumption, a better range of hip motion and a shorter time to ambulation.<sup>[32]</sup> No significant difference in the length of hospital stay.<sup>[32]</sup> This shows an improved postoperative functional recovery following total hip arthroplasty.<sup>[32]</sup>

## **LUMBAR PLEXUS BLOCK (Psoas compartment block)**

The lumbar plexus block is a technically difficult and a deep block that requires greater skill and can be time consuming.<sup>[18]</sup> The lumbar paravertebral region is a highly vascular area and difficult to compress hence patients on anticoagulants are at high risk for bleeding complications.<sup>[18]</sup> There is also a high risk of unintentional neuraxial block and inadvertent intravascular injection with local anaesthetic toxicity.<sup>[18]</sup>

Traditionally, it was performed with anatomical landmarks, while its dual performance with dual ultrasound technique and peripheral nerve stimulator can decrease the complications and increase the success rate. However, it has gone out of favour due to the development of easier and safer alternatives.<sup>[18]</sup>

**Table 1 Summary of the peripheral nerve blocks for hip surgery**<sup>[20, 24, 27, 33-35]</sup>

BLOCK	INDICATIONS	CONTRA-INDICATIONS	COMPLICATIONS
<b>Lumbar Plexus block</b>	<ul style="list-style-type: none"> <li>-Used to provide analgesia for injuries or surgery of hip and thigh.</li> <li>-Can be used in chronic pain conditions e.g., herpes zoster.</li> <li>-Does not produce complete anaesthesia for THA, due to sparing of sacral plexus</li> </ul>	<p><b>Absolute:</b></p> <ul style="list-style-type: none"> <li>-patient refusal,</li> <li>-local anaesthetic allergy,</li> <li>-coagulopathy (INR &gt;1.5 or inadequate time since antithrombotic)</li> </ul> <p><b>Relative:</b></p> <ul style="list-style-type: none"> <li>-presence of intrathecal pump or spinal cord stimulator,</li> <li>-major lumbar spine deformity,</li> <li>-prior major spine surgery,</li> <li>-prior neurologic deficit.</li> </ul>	<p>Rare: Local anaesthetic spread to epidural space, possible contralateral spread with associated bilateral muscle weakness, hypotension, urinary retention, intrathecal injection, renal injury (subcapsular haematoma).</p> <p>Local anaesthetic toxicity. Retroperitoneal and psoas haematoma or other vascular complications which are rare. Nerve injury with incidence as low as 0.1%.</p>
<b>Femoral nerve Block</b> <sup>[33]</sup>	<ul style="list-style-type: none"> <li>-Anterior aspects of the thigh surgeries</li> <li>-Can be combined with sciatic nerve block for complete lower extremity coverage below the knee.</li> <li>-Useful for femoral neck fracture, femur fracture and patella injuries<sup>[33]</sup></li> </ul>	<p><b>Absolute:</b></p> <ul style="list-style-type: none"> <li>-Patient refusal</li> <li>-Inability to co-operate</li> <li>-Severe allergy to local anaesthetic agents</li> </ul> <p><b>Relative:</b></p> <ul style="list-style-type: none"> <li>-Infection at the site of injection</li> <li>-Patients on anticoagulants and bleeding disorders</li> <li>-Pre-existing nerve injury (discuss a possibility of further nerve injury for patients at risk)<sup>[33]</sup></li> </ul>	<p>Nerve injury, allergic reaction, Haematoma, infection, Local anaesthetic systemic toxicity. Block failure, a small risk of temporal or permanent nerve injury.</p> <p>Weakness of quadriceps muscle and increased risk of falls<sup>[33]</sup></p>
<b>Fascia iliaca block/ supra-inguinal fascia iliaca block</b>	<p>Lower extremity surgery, after knee, femur shaft, hip surgery</p>	<p><b>Relative:</b></p> <ul style="list-style-type: none"> <li>-coagulopathy,</li> <li>-antithrombotic medication,</li> <li>-infection at the site of injection,</li> <li>-history of femoral bypass surgery,</li> <li>-history of neurologic deficit.</li> </ul> <p>If there is a concern for developing compartment syndrome.</p>	<p>Local anaesthetic toxicity</p> <p>Haematoma of the groin and pain, block failure, quadriceps weakness, peritoneal organ perforation and bladder puncture</p>
<b>Quadratus lumborum block</b>	<ul style="list-style-type: none"> <li>-Caesarean section, laparoscopic gynaecological surgery, lower abdominal surgery (posterior approach).</li> <li>-Proctosigmoidectomy, hip surgery, above knee amputation, abdominal hernia repair, breast reconstruction, colostomy closure, radical nephrectomy, lower extremity vascular surgery, total hip arthroplasty, laparotomy and colectomy</li> </ul>	<p><b>Absolute:</b> Non-specific as applying in all blocks.</p> <p><b>Relative:</b> Anatomical abnormalities, haemodynamic instability, known neurologic disorder</p>	<p>Local anaesthetic distribution to the lumbar plexus, prolonged motor block, delayed mobilisation, and hospital discharge, hypotension. Because of increased vascularity and dose used local anaesthetic toxicity is a potential risk</p>
<b>PENG block</b>	<p>Used in arthroscopic and open hip surgery, hip positioning, acetabular fracture, pelvic fracture, surgery of medial thigh, vein ligation and stripping surgery</p>	<p>It may not be a safe block in patients on anticoagulants</p>	<p>The possibility of injury to the ureter, reported motor block in the form of quadriceps weakness likely due to intra-muscular injection</p>

## **CONCLUSION**

Pain control post hip surgery plays an important role in the recovery pathway and patient satisfaction. There is a need to balance between early mobilisation and pain control by using opioid sparing techniques, including multimodal analgesic approach and peripheral nerve block that is more motor sparing to facilitate early mobilisation as an important element of the ERAS principles in Hip arthroplasty.

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