



## Four Important Blocks of The Last Decade

J Balavenkatasubramanian<sup>1</sup>, Gurumoorthi Palanichamy<sup>1</sup>, Senthil Kumar Balasubramanian<sup>1</sup>, Madhanmohan Chandramohan<sup>1</sup>,  
Vinoth Kumar Subramanian<sup>1</sup>, Satish Raja Selvam Parameswaran<sup>1</sup>

<sup>1</sup>Department of Anaesthesia, Ganga Hospital, Coimbatore, Tamil Nadu, India.

### Introduction

Ultrasonography (USG) guided regional anaesthesia has become the standard practice due to its improved success rate and decreased complications. With the advent of USG regional anaesthesia has flourished in a way that every surgery can be supplemented with a regional block as a part of multimodal analgesia. USG guided regional anaesthesia became rampant in the last decade with many newer inter-fascial plane blocks involving the paraspinal, chest wall and abdominal wall being introduced. Also new approaches for the plexus blocks are being established with improved safety and success. Here in this educational article, we are discussing the intricacies of the USG guided Costoclavicular approach of brachial plexus block, PEricapsular Nerve Group (PENG) block, Serratus Plane block (SPB) and Supra inguinal Fascia Iliaca Block (SIFICB). The costoclavicular approach for brachial plexus block is phrenic nerve sparing and still consistently block all the nerves arising from the cords, making it a safer option in certain population of patient with respiratory compromise. PENG block was introduced in the last decade for providing analgesia for the hip orthopedic procedures and advantage of this block is that there is no motor involvement without any major complications. The SPB is a one of chest wall block used for providing analgesia to the anterolateral chest especially for breast surgery and pain management in rib fractures. Being superficial and technically easier using USG, SPB has been included in the standard pain management for chest trauma. USG guided SIFICB introduced was introduced in 2011 as a novel approach to block the major nerves of lumbar plexus anteriorly but it gained popularity in the recent past for its ability to block femoral nerve, lateral femoral cutaneous nerve and possibly obturator nerve. With this block the above mentioned nerves can be blocked easily without any complications of classical approach for lumbar plexus block.

Address of Correspondence: Dr. Gurumoorthi Palanichamy, Ganga Hospital, Coimbatore, Tamil Nadu, India.

E-mail: drpgurumoorthi@gmail.com

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## Costoclavicular Brachial Plexus Block– A Phrenic Nerve Sparing Novel Block

### Introduction:

Costoclavicular brachial plexus block is a new approach for infraclavicular brachial plexus block, targeting the cords of brachial plexus. At the costoclavicular space (CCS), and in contrast to that at the Lateral Infra Clavicular (LIC) space, all the cords of the brachial plexus are clustered together lateral to the first part of axillary artery and share a consistent relation to one another and to the axillary artery. In costoclavicular brachial plexus block, the cords are located superficially when compared to classical infraclavicular brachial plexus block.

### Scanning Technique:

Patient being in supine position with ipsilateral arm abducted to 90 degree and the head turned slightly to the contralateral side of the brachial plexus block. A high frequency linear array transducer (8–13 MHz) is positioned initially above the midpoint of the clavicle in the transverse orientation, with its orientation marker

directed laterally. Then the transducer is gently moved caudally until it slipped off the inferior border of the clavicle and the axillary artery (first part) and vein are visualized. With the transducer being in the same position, a gentle cephalad tilt is given to direct the ultrasound beam towards the CCS, the space between the posterior surface of the clavicle and the second rib [1]. The ultrasound image is optimized, until all three cords of the brachial plexus are clearly visualized lateral to axillary artery (Fig. 1–5).

### Needling Technique:

Under all aseptic precautions, a 22G echogenic needle is inserted either in-plane (lateral to medial or medial to lateral) or out of plane approach to reach the centre of three cords [2] (Fig. 6 & 7). Care must be taken to avoid needle insertion with the cephalic vein or thoracoacromial artery in view, as this would indicate needle insertion distal to the CCS. For the same reason, it is imperative that the subclavius muscle is visualized at all times during the needle insertion. A total volume of 20ml of local anaesthetic is injected in small aliquots and at a single site over 2 to 3 minutes [3].



Figure 1: USG Probe Position and with abducted arm

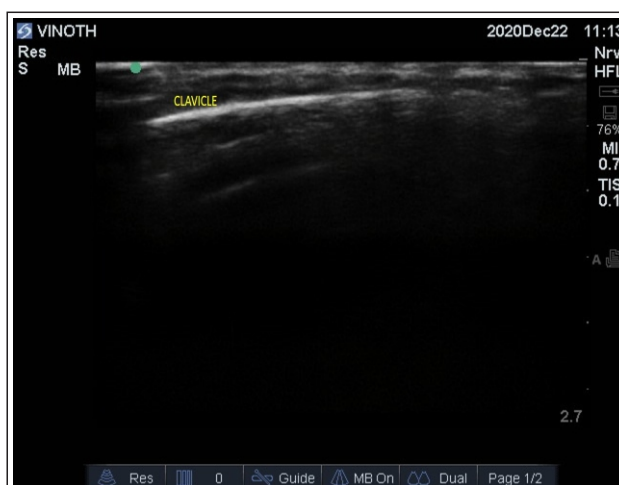


Figure 2: Sonogram with probe over clavicle

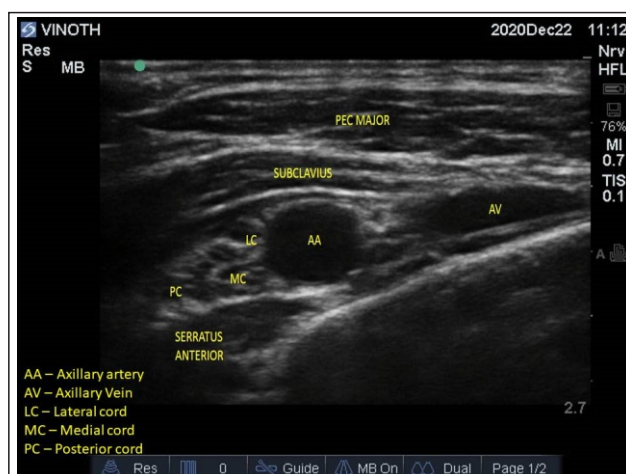


Figure 3 A: An optimized image of costoclavicular space depicts the three cords

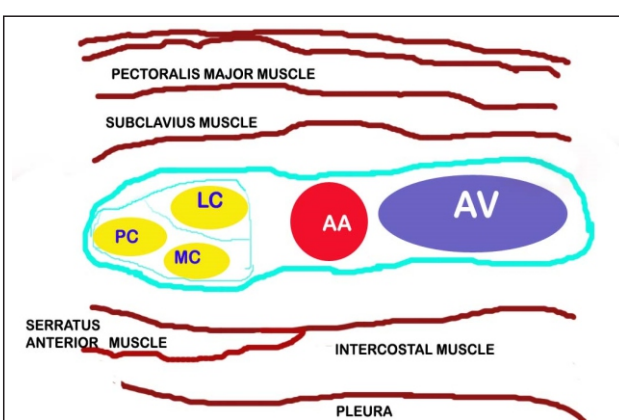


Figure 3 B: Schematic diagram of costoclavicular space with the cord arrangement

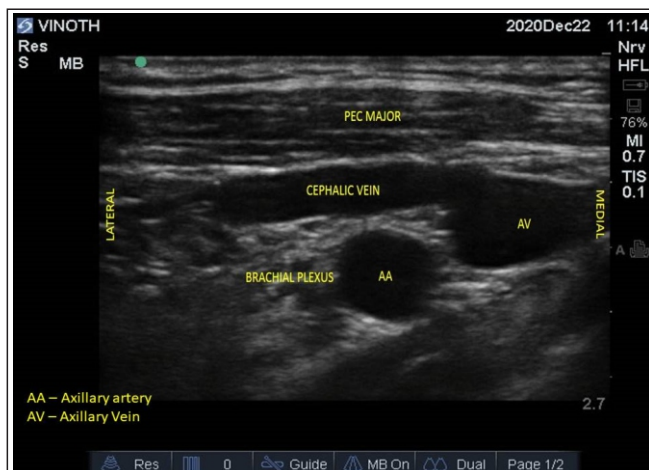


Figure 4: Sonogram showing the cephalic veins arching over cords

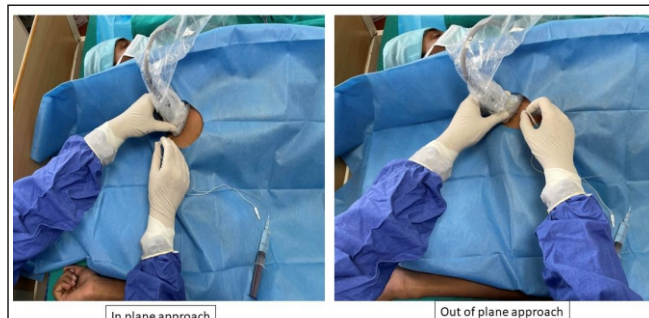


Figure 6: CCB with in-plane and out of plane approach

### Drugs spread:

A cadaveric study in Five cadavers demonstrates that ultrasound guided injection with 20ml Of 0.1% methylene blue in the costoclavicular space spreads cephalad to the brachial plexus in the supraclavicular space, consistently reaching the suprascapular nerve and all the trunks and cords of brachial plexus, while sparing the phrenic nerve [4].

### Advantages:

- The incidence of hemidiaphragmatic paralysis is significantly lower with costoclavicular than with supraclavicular brachial plexus block [5].
- Less incidence of pneumothorax
- The cords are densely packed which can reduce the LA volume/dose [3].
- Ultrasound guided single shot costoclavicular block with low volume of LA can provide reliable and safe anaesthesia for single stage bilateral upper limb surgeries.

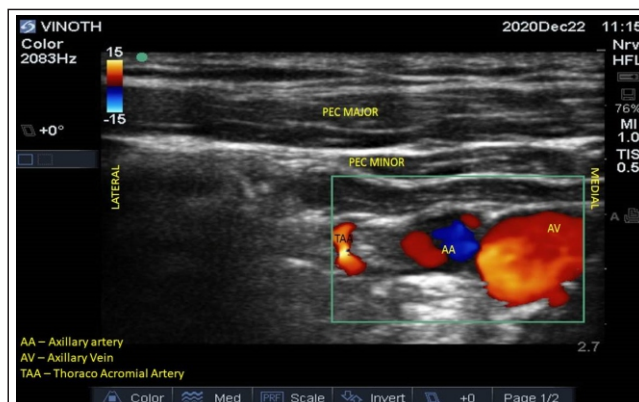


Figure 5: Doppler sonogram showing origin of thoracoacromial artery

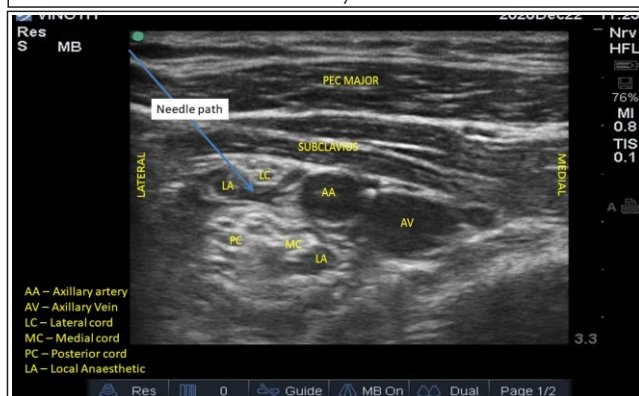


Figure 7: Spread of local anaesthetic

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## Serratus Plane Block

### Introduction

Providing adequate perioperative analgesia for chest wall surgeries or rib fractures poses significant challenge to anaesthesiologist everyday. Breast surgeries are associated with persistent postoperative pain in 30-55% of the patients, mostly progressing to chronic pain. Serratus plane block (SPB) has emerged over the years as a novel technique for analgesia of the anterolateral chest wall [1].

### Anatomy

Chest wall is predominantly innervated by the cutaneous branches of the intercostal nerve. The lateral cutaneous branches of the T3-T9 thoracic intercostal nerves pierce internal intercostal muscle, external intercostal muscle (EIM) and serratus anterior muscle (SAM) to supply lateral chest wall (Fig. 1). Thoracodorsal nerve (TDN) and Long thoracic nerve (LTN) lie in the plane between latissimus dorsi muscle (LDM) and serratus anterior muscle and innervate lateral chest musculature.

Two variations of SPB have been described in the literature [2].

**1) Superficial SPB:** LA is injected between LDM and SAM.

**2) Deep SPB:** LA is injected between SAM and rib or EIM.

Both superficial and deep SPB provides ipsilateral sensory block in T2-T9 dermatomes. In addition, superficial SPB also blocks LTN and TDN which might lead to intraoperative anatomical distortion and surgical interference. Greater dermatomal spread is expected in deep SPB, because respiratory movements allow LA to disperse along the space due to capillary action [3]. Cadaveric studies with methylene blue dye have demonstrated a spread of

10cm and 13 cm antero-posterior and cephalo-caudal direction respectively [4].

### Indications

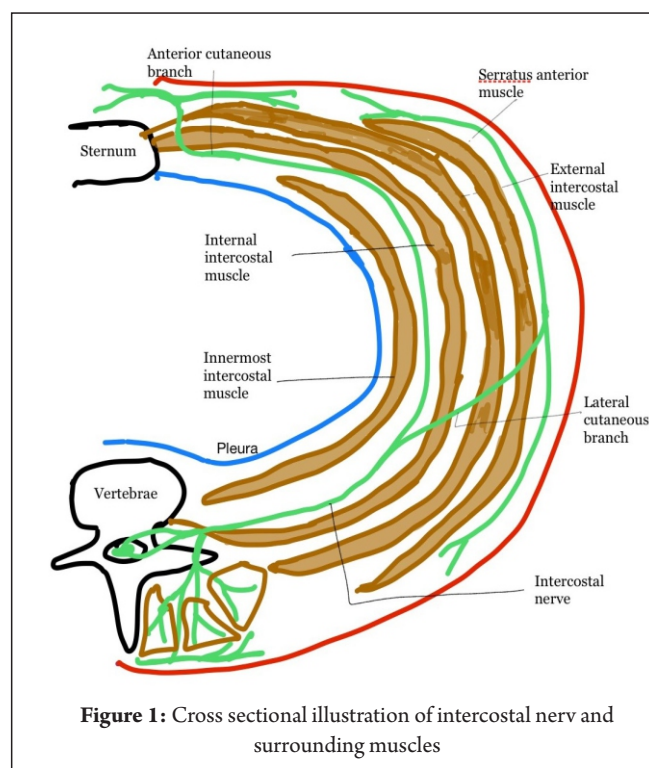
1) Breast surgery, 2) Rib fractures, 3) Thoracoscopy, 4) Thoracotomy, 5) Chronic pain after mastectomy 6) Post herpetic neuralgia

### Contraindications

1) Patient refusal 2) Allergic to local anaesthetics 3) Subcutaneous emphysema 4) Presence of chest tubes 5) Prior thoracotomy or Latissimus dorsi flap surgery

### Technique:

Place the patient in supine position with the abduction of ipsilateral arm (Fig. 2). A high frequency linear ultrasound transducer is placed over the deltopectoral groove and moved inferolaterally in parasagittal oblique plane until the 5th rib, LDM superficially and SAM deeper are visualized (Fig. 3) The Thoracodorsal artery (TDA) runs between these two muscles and helps to delineate the plane between them. A 22G 5 cm short bevel needle is introduced via in-plane technique from anterior to posterior direction in the midaxillary line. In superficial SPB, the needle tip is placed in the fascial plane between two muscles [5] (Fig. 4). Hydrolocalisation helps to delineate the two muscles. In deep SPB, needle tip is placed between SAM and 5th rib. A volume of 0.4ml/kg LA (0.25% BUPIVACAINE/0.2% ROPIVACAINE) with Dexamethasone 4mg provides analgesia for 18-24 hour duration. Increasing the volume of LA from 20 to 40 ml will cover to more dermatomes. Continuous catheters [6] can be inserted with LA infusions at 6-8 ml/hr.

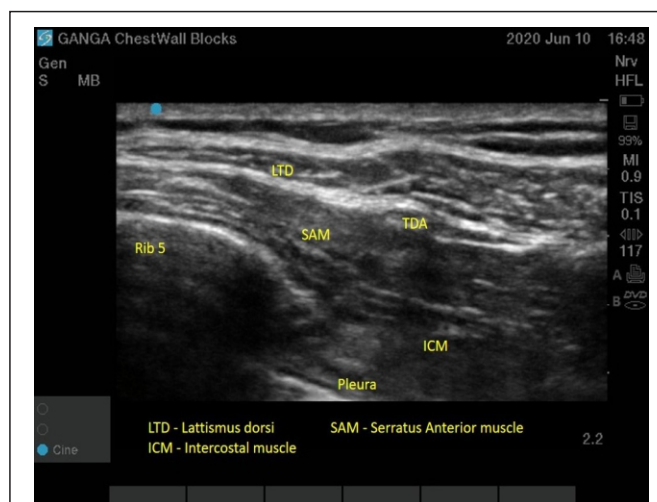


## Complications

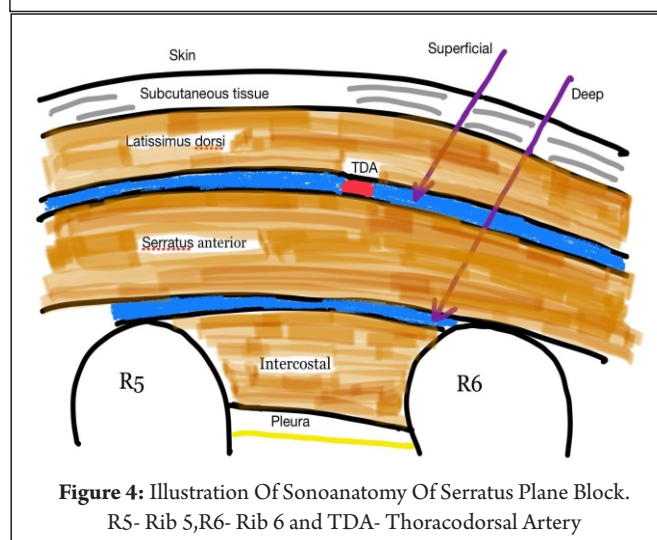
1) Local anaesthetic systemic toxicity 2) Vascular injury 3) Pleural puncture

## Conclusion:

Serratus plane block can be used as a novel technique or a component of multimodal analgesia of chest wall in perioperative or trauma care settings with decreased opioid consumption [7].



**Figure 3:** Ultrasound Image Demonstrating Serratus Plane Between Latissimus Dorsi And Serratus Anterior Containing Thoracodorsal Artery At The Level Of 5<sup>th</sup> Rib; TDA- Thoracodorsal Artery



**Figure 4:** Illustration Of Sonoanatomy Of Serratus Plane Block. R5- Rib 5, R6- Rib 6 and TDA- Thoracodorsal Artery

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## PENG [PERicapsular Nerve Group] Block

### Introduction

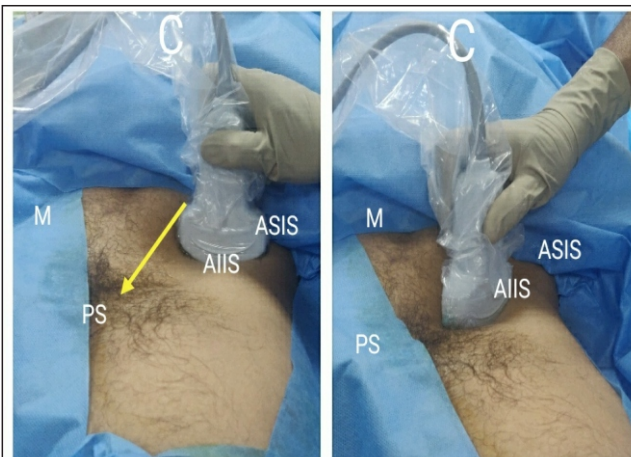
Nociceptive fibers are predominantly concentrated in the anterior hip capsule and the posterior capsule has predominantly mechanoreceptors [1]. Anterior capsule is innervated by articular branches from femoral nerve, obturator nerve and accessory obturator nerve [2]. The high articular branches of femoral (FN) and accessory obturator (AON) nerves are found to be consistently present in the musculofascial plane between psoas muscle and the pubic ramus between iliopubic eminence (IPE) and anterior inferior iliac spine (AIIS), and the obturator (ON) nerve along with its articular branches are found a little further medially in the plane between pectineus and obturator externus [2, 3]. LA deposited in this musculofascial plane would involve articular branches of FN, AON and spread medially in the subpectineal plane to involve articular branches of ON [4].

Patient is supine, curvilinear low frequency (2-5 MHz) ultrasound is placed transversely on AIIS and then aligned with pubic ramus by rotating the farther end of the probe towards pubic ramus by approximately 45 degrees (Figure 1). The iliopsoas muscle and tendon would be seen on the pubic ramus, the medial and lateral boundaries being IPE and AIIS. A 10 cm, 22 G needle is inserted in an in-plane approach from lateral to medial to bring the tip in the myofascial plane between psoas and pubic ramus (Figure 2). 20 ml of LA deposited here has been found to produce satisfactory analgesia [4] (Figure 3).

PENG block provides pain relief in intra-hip capsule pathologies and procedures, with no associated quadriceps weakness [4, 5, 6]. Patient discomfort due to longer needle path, difficulty visualizing the needle, inadvertent motor weakness, potential for injury to femoral nerve and vessels or the ureter, large abdomen pannus obscuring sonoanatomy are some of the difficulties associated with PENG block [7, 8, 9, 10].

Pericapsular nerve group (PENG) block is a novel regional analgesia technique. Current evidence as to its efficacy in hip pain is mainly from case reports and case series, where it has been seen to provide sufficient analgesia with minimal reported side effects [11]. PENG block can be considered as an analgesic technique for hip pathologies, that is alternative to lumbar plexus block, femoral nerve block or fascia iliaca blocks, particularly when motor weakness has to be avoided [11].

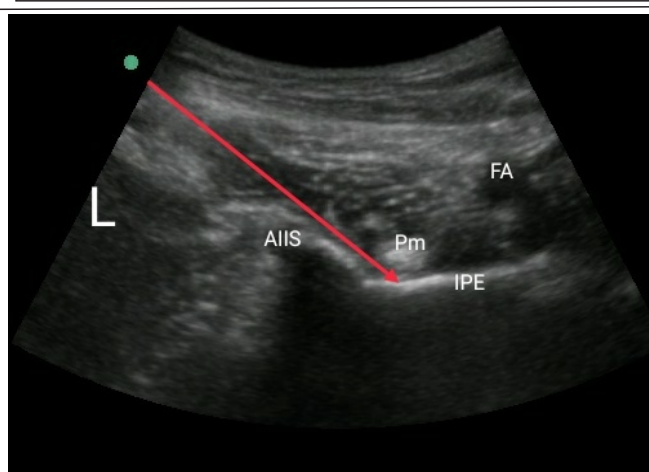
**Figure 3:** Image Depicting The Sonogram During Placement Of A Peng Block. AIIS- Anterior Inferior Iliac Spine; IPE- Iliopubic Eminence; Pm- Psoas Tendon; FA- Femoral Artery; L- Lateral; Red Arrow Indicates Needle Path



**Figure 1:** Ultrasound Probe Orientation During Peng Block. Image On The Left Shows Initial Placement Of The Probe Transversely On The ASIS. Image On The Right Shows Final Position Of The Ultrasound Probe Aligning With AIIS And PS. ASIS, Anterior Superior Iliac Spine; AIIS Anterior Inferior Iliac Spine; PS- Pubic Symphysis; M- Medial; C- Cranial End; Yellow Arrow Indicates Rotation Of The Medial End Of The Ultrasound Probe Towards The Pelvis



**Figure 2:** Image On The Left Shows Needle Insertion In An In-Plane, Lateral To Medial Technique During Placement Of Peng Block. Image On The Right Shows Corresponding Sonogram. ASIS, Anterior Superior Iliac Spine; AIIS, Anterior Inferior Iliac Spine; Ps- Pubic Symphysis; M- Medial; L- Lateral



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## Suprainguinal Fascia Iliaca Block– Is It The True 3 In 1 Block?

### Introduction

The fascia iliaca compartment is a potential space lying between the fascia iliaca anteriorly and the iliacus and psoas muscles (iliopsoas) posteriorly. Fascia iliaca block (FICB) is a peripheral compartment block, traditionally given below the inguinal ligament between the fascia iliaca and iliopsoas muscle, thereby blocking the femoral nerve (FN) and sometimes lateral femoral cutaneous nerve (LFCN). Before the advent of ultrasound the block was performed using landmark with “double pop” technique infra inguinally [1] and later by a modified suprainguinal approach [2]. The block was mainly performed for analgesia of the hip surgery. With the introduction of USG to RA, FICB block success rate has increased and it blocks the femoral nerve consistently; whereas the LFCN which is lying superficial to the fascia iliaca and underneath the fascia lata explains the reason behind its sparing in infrainguinal FICB. The branches of the lumbar plexus namely the obturator nerve (ON), FN, LFCN formed in the substance of the psoas muscles and they emerge out of the muscle. FN and LFCN course in the anterior surface of iliopsoas underneath the fascia iliaca till the inguinal ligament level and distal to that they branch and remain in different fascial planes. The LFCN pierces the fascia iliaca at the level of inguinal ligament to lie in the plane between fascia iliaca and fascia lata where it gives sensory branches anterior and lateral divisions supplying the lateral thigh. The common ON emerges medial to the psoas muscle and lateral to sacroiliac joint before leaving pelvis via obturator canal. The FN and LFCN lie in the fascia iliaca compartment supra inguinally and the ON runs in the medial side of the psoas muscle. Suprainguinal FICB should block FN and LFCN consistently and possibly ON when adequate volume of local anaesthetic (LA) is injected. Kris Vermeylen et al [3] suggested based on combining CT and dissection findings that the volume to reach the FN, ON, and LFCN with a supra inguinal FICB was 40 ml.

**Indications:** Proximal hip fracture and femur shaft fracture for perioperative analgesia.

**Contraindications:** Inguinal swellings (lymph nodes, hernia, varicocele), Hernioplasty.



Figure 1: USG Probe Position

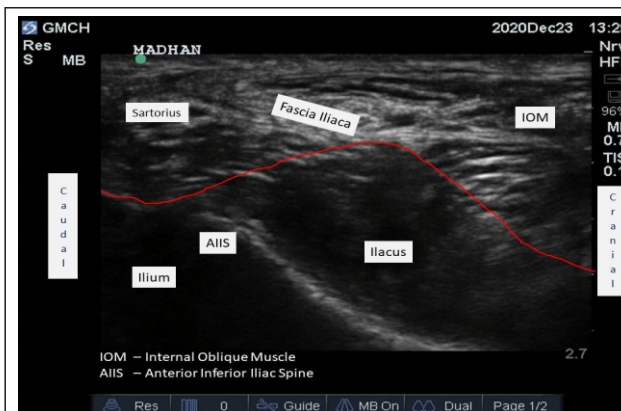


Figure 2: Sonogram Showing The Optimized Image For Suprainguinal FICB

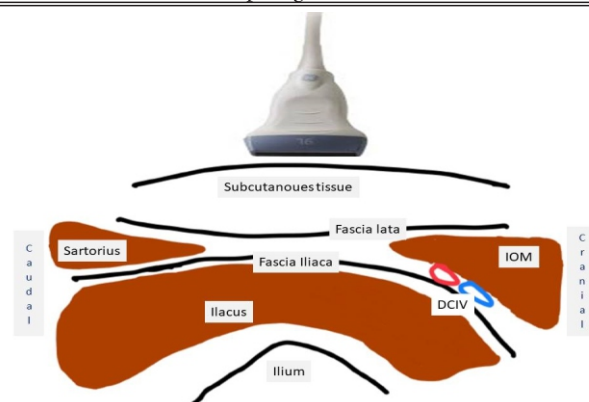


Figure 3: Schematic Diagram Showing The Suprainguinal FICB Anatomy

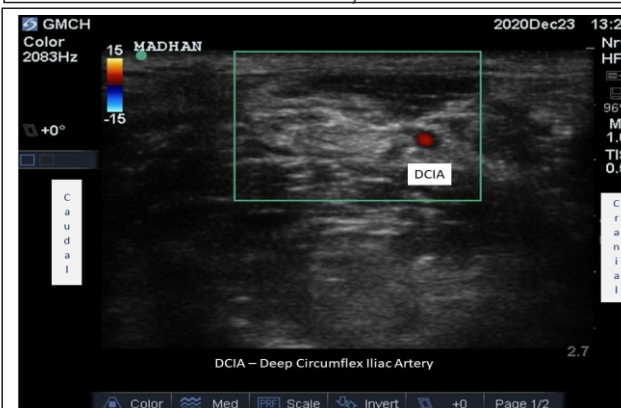


Figure 4: Sonogram Showing Deep Circumflex Iliac Artery Over The Suprainguinal Fascia Iliaca

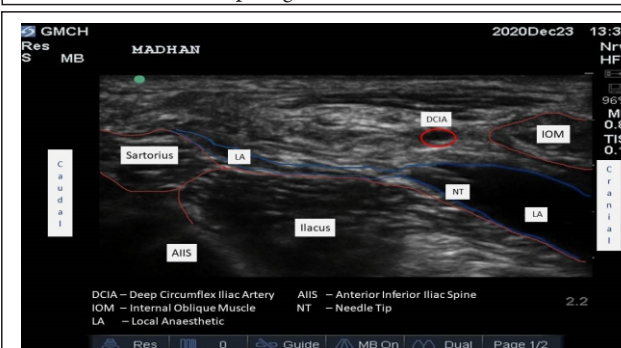


Figure 5: Supra Inguinal FICB Showing Local Anaesthetic Spread



**Advantage:** When compared to infrainguinal FICB, suprainguinal FICB blocks LFCN consistently and with larger volume ON can also be blocked.

**Block Description:** Ultrasound guided suprainguinal FICB was first demonstrated by Hebbard [4] in a cadaver study. The block is performed with the patient lying supine and a linear high frequency probe (6-13 MHz) is placed longitudinally parallel to the anterior superior iliac spine (ASIS). The probe is further moved medially till the anterior inferior iliac spine (AIIS) is reached and the fascia iliaca, sartorius, iliopsoas, and internal oblique muscles are identified (Fig. 1, 2 & 3). The deep circumflex artery can be found lying superficial to the fascia iliaca [Fig 4]. At this frame the 'hour glass pattern'/'bowtie sign' formed by the iliacus muscle can be appreciated [5]. A 100 mm block needle is introduced caudad to cephalad direction using an in-plane approach and the needle tip is positioned beneath the fascia iliaca. Using hydro-dissection the fascia iliaca is separated from the iliacus muscle. The advised LA volume for this block is 30–40 ml. The block success depends upon the cephalic spread of LA between the iliacus muscle and the fascia where the 3 nerves lie underneath the internal oblique muscle (Fig. 5). Supra inguinal FICB can be the true 3 in 1 block as with large volume of about 40 ml should block FN, ON and LFCN.

**Complications:** Though it is a superficial and safer block, complications like vascular injury, intramuscular/intraperitoneal injection and local anaesthetic systemic toxicity can occur.

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**Table:** Block Features

Block	Advantage	limitation	Remarks
CCB	Phrenic nerve sparing	Blood vessels lying in the needle path	Excellent block for procedures from mid arm and below
SPB	Superficial block and can be performed with the patient supine	It is not useful for posterolateral rib fractures and sternal fractures.	Safe regional analgesic option for chest trauma pain management
PENG	Motor sparing analgesia for hip joint with consistently blocking accessory obturator nerve	Deeper block so pain during needle manipulation	Can be used as an on arrival block for hip fractures. Lacks large randomized trials as of now
SIFICB	Blocks LFCN consistently than infrainguinal approach and also proximal branches of FN	More volume of LA is needed	Useful for blocking FN, LFCN and possibly ON for anaesthesia as well as analgesia