



# Anatomic evaluation to compare the dye spread with ultrasound-guided pericapsular nerve group (PENG) injection with or without an additional suprainguinal fascia iliaca (SIFI) injection in soft embalmed cadavers

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## Abstract

**Background** Novel interfascial plane blocks like PERicapsular Nerve Group (PENG) and SupraInguinal Fascia Iliaca (SIFI) blocks are effective for management of hip fracture pain. We compared the difference in the distribution of the dye injected and nerves stained by the addition of the SIFI block to the PENG block.

**Methods** A total of 24 designated dye injections were performed in eight soft-embalmed cadavers. Under ultrasound guidance 20 ml green ink injected bilaterally in PENG block and 30 ml methylene blue dye was injected in the SIFI block on the right side. The cadavers were dissected 24 h later to assess the extent of dye spread.

**Results** Extensive spread of dyes was seen on both side of iliacus muscle on the right side, but blue dye was not visible medial to the psoas tendon. The subcostal and iliohypogastric nerves were stained green in the infra-inguinal region. On the left side (PENG alone), the anterior division of the obturator, femoral and saphenous nerve (7/8) and iliohypogastric nerves (3/8) were stained in the infrainguinal region. In the suprainguinal region, the femoral nerve (5/8), accessory obturator nerve (3/8), lateral femoral cutaneous (1/8) and nerve to rectus femoris (4/8) were stained. The main obturator nerve trunk was spared with both injections while its anterior branch and accessory obturator nerve were stained with the PENG injection.

**Conclusion** The study findings indicate that combined PENG + SIFI injections lead to an extensive craniocaudal and longitudinal spread along the iliacus muscle. We perceive that the combination of these two injections will have a superior clinical outcome.

**Keywords** Methylene blue · Coloring agents · Ink · Fascia · Cadaver · Ultrasonography

## Introduction

The hip joint is innervated chiefly by the femoral and obturator nerves on its anterior and medial aspect and posteriorly by the sciatic nerve. Opioid analgesics, neuraxial, femoral nerve blocks and the deeper paravertebral or paraspinal blocks have been the mainstay in the management of postoperative pain following hip surgery [1]. However, the recent vogue in the management of postoperative pain after hip surgical procedures is to avoid quadriceps weakness and minimize opioid consumption. Hence, the latest trend is to implement inter-fascial plane blocks in clinical practice since these are considered to be opioid-sparing and motor-sparing [1–3].

Fascia iliaca block has been one of the commonest inter-fascial blocks employed for analgesia following hip surgeries

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[1]. The classical infrainguinal approach has been superseded by the newer suprainguinal approach [2] which was purported to have better proximal spread and more chances of obturator nerve (ON) blockade. The recent introduction of the ultrasound-guided pericapsular nerve group (PENG) block [3] has challenged the supra-inguinal fascia iliaca (SIFI) block in its superiority concerning the involvement of major lumbar plexus nerves.

Anatomically the injection points differ, the PENG being lateral to the psoas tendon at the level of ilio-pubic eminence (IPE) and the SIFI injections being ventral to the fascia iliaca in the supra-inguinal area [4].

As opposed to SIFI, the PENG block claims to possess a greater motor-sparing effect on the quadriceps. The block efficacy of PENG is claimed to be equivalent or superior to the SIFI [5, 6]. Cadaveric studies have proposed that the PENG injection stains the hip articular nerves, while with large-volume SIFI injections, the lateral femoral cutaneous nerve (LFCN), femoral nerve (FN) and ON are soaked [7–9]. However, the anatomical aspects of both these blocks still remain unclear, particularly the involvement of the ON [10].

With ultrasound-guided injections in the PENG and SIFI areas, we explored the relative flow distribution to investigate the extent of dye spread and the specific nerves stained and hypothesized that the injectate would be mainly restricted in their respective interfascial planes and that the ON would not be stained.

## Methodology

The ethical committee JSS, Medical College, Mysuru approved a cadaveric study (ISSMC/IEC /L3042022/4BNCT /2021–2) related to the PENG and SIFI inter-fascial plane blocks. A total of eight soft embalmed cadavers aged between 70 and 84 years without previous history of pelvic pathology or surgical procedure were included for the designated ultrasound-guided interventional procedures. A scout scan of all cadavers depicted normal anatomical landmarks for the PENG and SIFI blocks. The anterior inferior iliac spine (AIIS) was visualized and related to the SIFI and the PENG blocks. The visibility of the femoral vessels, nerve and IPE was ensured in all cadavers for the PENG. The iliacus, sartorius and internal oblique muscles were divulged for the SIFI block.

Ultrasound-guided [Edge 2, Sonosite Fujifilm, USA] injections were performed with a linear probe [7–12 MHz, Sonosite Fujifilm, USA] and 21 G, 100 mm blunt needles [Bbraun, Germany] to inject coloured dyes. Blocks were executed by the primary investigator [SD] with extensive experience in ultrasound-guided regional anesthesia and diffusions were notified by the co-investigators [RT and PP] and dissections were carried out by an anatomist [SS]

unaware of the blocks implemented. A total of 24 injections were executed, with 20 ml of green ink deposited into the PENG block region bilaterally in all cadavers [16/16 specimens] and on the left side [8/16 specimens] 30 ml methylene blue was additionally administered in the SIFI plane.

## Technique

### PENG block

The probe was deployed in the axial plane at the anterior superior iliac spine (ASIS) level and slowly shifted caudally to identify the AIIS. Shifting medial and caudal, the femoral vessels and femoral nerve lying on the iliopsoas muscle reposing on the IPE were divulged. The needle was inserted from lateral to medial and was positioned lateral to the psoas tendon. During injection, the spread was noticed by the co-investigators. During the injection of the dye, diffusion was assessed if the injectate was lifting the psoas tendon, spreading along the IPE, causing swelling of the psoas tendon (PT) and dispersing dorsal and lateral to the iliacus muscle.

### SIFI block

A linear probe was positioned in the para-sagittal plane medial to the ASIS to identify the AIIS. The tapering end of the internal oblique was identified in the supra-inguinal area, and, the needle tip was inserted from the caudal to the cephalad direction, and positioned dorsal to the fascia iliaca. The co-investigators recorded the distribution of the injectate on ultrasound during the injection. During the injection, observations were made to note the diffusion of injectate ventral on the iliacus muscle. The probe was shifted laterally until the ASIS, medially onto the psoas tendon and cephalad till the distal peritoneum and external iliac vessels were identified.

Ultrasound images and videos were saved and downloaded for future evaluation.

Post-block, 24 h later dissections were accomplished in all eight cadavers on both sides. Two co-investigators noted down the findings as the dissection was performed. All pictures were taken with a 1000 D Canon.

### Dissection technique

An oblique incision extending from the ASIS to the pubic tubercle and a vertical incision extending from the pubic tubercle to the middle of the thigh was made. The skin was reflected from the medial to the lateral side.

The superficial fascia of the thigh was dissected by blunt dissection, and it was reflected downwards from the front and lateral sides of the thigh. The deep fascia of the thigh (fascia lata) was identified and traced upwards towards the iliac crest, inguinal ligament and the body of the pubis. Fascia lata was incised and reflected laterally to expose the femoral triangle.

The femoral sheath was cut to expose the femoral vessels. The FN, lying lateral to the femoral sheath in the groove between the iliacus and the psoas major was identified. The connective tissue around it was cleared and it was traced for its divisions and branches. Discolouration of the FN if any was observed. Floor muscles of the femoral triangle like the distal part of the iliacus and psoas major were traced towards their insertion and pectineus and adductor longus muscles were identified.

Sartorius muscle was identified and reflected medially. Tensor fascia lata and parts of the four elements of the quadriceps muscle, while leaving the iliotibial tract were identified. The LFCN was identified and the spread of dye over it and over the origin of rectus femoris was observed. The middle third of the sartorius was reflected laterally and the fascia covering the roof of the adductor canal was identified. The fascia was divided longitudinally and the femoral vessels, saphenous nerve, and nerve to vasus medialis were identified. The pectineus and the adductor longus were reflected downwards from its origin and the anterior aspect of the capsule of the hip joint was observed. The spread of dye was observed. The external oblique, internal oblique and transversus abdominis were cut above the inguinal ligament from the ASIS towards the PSIS, and the flap was retraced medially and upwards to make out the origin of Iliacus and the tendinous part of psoas major. The fascia iliaca overlying these muscles and the FN and LFCN of the thigh traversing beneath the fascia iliaca were identified. The spread of MBD over these structures was observed. The medial border of the psoas major at the pelvic brim was retracted laterally, and the ON was identified and traced downwards towards the obturator canal.

## Results

The 8 cadavers yielded 16 specimens and received ultrasound-guided dye injections in the designated planes. All injections were correctly accomplished and all cadavers underwent dissection whence the spread of both the blue and the green dyes was noted. Anatomical landmarks could be identified in all cadavers. The vascular and bone structures in the PENG and the muscles in the SIFI were

divulged in all cadavers. Ultrasound-guided blocks were correctly executed on both sides (left and right).

## Ultrasound finding

### PENG

The injectate created a hypoechoic oval shape lateral to the psoas tendon. In 4/16 it spread medially over the IPE. Diffusion along the dorsal surface of the iliacus muscle was divulged in 8/16 injections, and in one it reached the ASIS. However, no dye spread was visible around or in the psoas muscle and in the vicinity of the femoral nerve on ultrasound.

### SIFI

Diffusion of the injectate was deciphered along the ventral surface of the iliacus muscle and along the plane dorsal to the fascia iliaca. The injectate spread along the superior surface of the FN in 5/8 specimens and in the vicinity of the AIIS in 4/8 specimens. However, no spread was visible in the psoas muscle and medial to psoas tendon.

## Dissection findings

### Right-sided inguinal dissection [PENG block (green dye)]

Infra-inguinal dissection on the lateral aspect over the tensor fascia lata and the sartorius revealed green discolouration of the branches of the subcostal and the iliohypogastric nerves in 3/8 cadavers. This was the result of the spread of the green dye over the sartorius and the tensor fascia lata (Fig. 1a). The green dye seeped as distal as the apex of the femoral triangle staining the anterior branches of the FN (5/8) (Fig. 1a).

When the iliacus muscle was detached and rolled cephalad and medial, the green dye was visualized to soak the pectineus muscle and the anterior division of the ON in 2/8 specimens (Fig. 1b). The adductor longus was not stained.

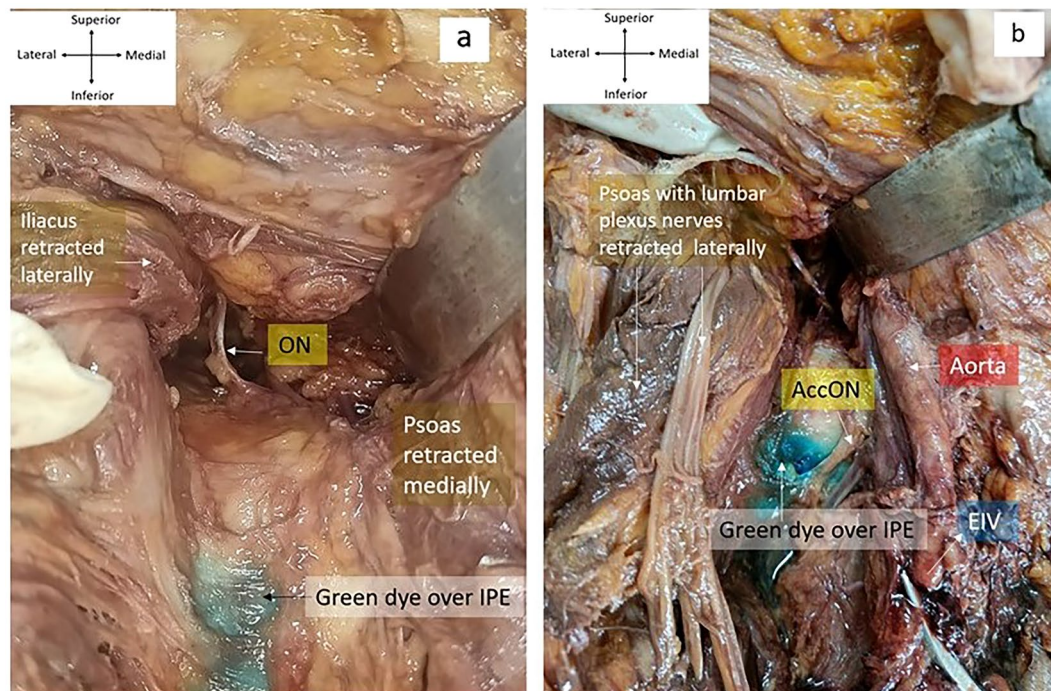
In suprainguinal dissection, the green dye stained the fascia over the IPE in all 8 specimens (Fig. 2a), and peeling the fascia revealed a nerve over the IPE presumably the accessory obturator nerve (AccON) over the IPE stained green in 3/8 cases (Figs. 2b, 3a, b), the soft tissue over AIIS (Fig. 3a, b) and the dorsal aspect of the iliacus muscle (Figs. 1a, b and 3a, b). The dye diffused caudal until the medial aspect of the femur (Figs. 1a, 2a, 3a). The FN and the ON were not stained in any specimen (Fig. 2a, b).

Green dye smeared the fascia over the anterior inferior iliac spine (AIIS) (Fig. 3a), the IPE (Fig. 3a, b) and the fascia over the ASIS (Fig. 3b), and diffused medially in the adductor planes.



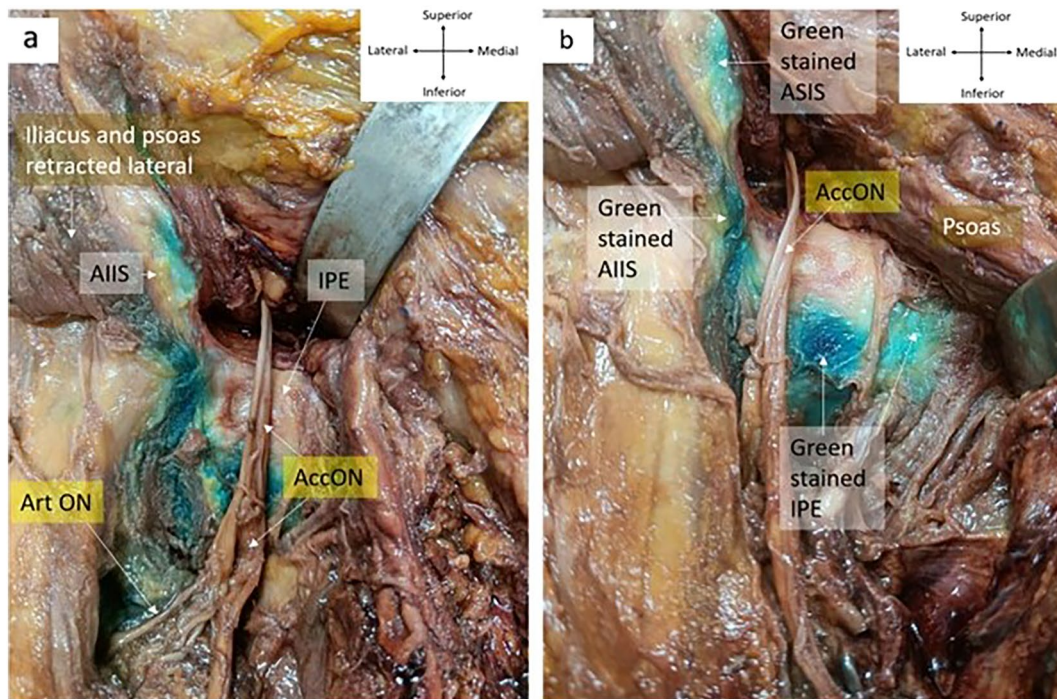
**Fig. 1** **a** Right side infra-inguinal dissection showing green dye staining the following: Sartorius and Tensor fascia Lata (TFL), lateral cutaneous branches of subcostal nerve (LCB-SCN), the ilio-hypogastric nerve (LCB-IHN) and the branches of anterior branches of femo-

ral nerve (b AD-FN). **b** Right side iliacus muscle rolled over depicting dorsal spread of green dye. Right pectineus is stained green with dye partially involving the anterior division of obturator nerve (AD-ON). The adductor longus (ADLo) was unstained



**Fig. 2** **a** Right psoas retracted medial, revealed the unstained obturator nerve (ON). However, the fascia over the ilio-pubic eminence (IPE) was stained green. **b** Deep dissection illustrated the green

stained accessory obturator nerve (AccON) situated over the IPE. The lumbar plexus nerves were not stained



**Fig. 3** **a** Right supra-inguinal dissection showing green dye stains the following from superior to inferior and medial to lateral (1) fascia over the anterior inferior iliac spine (AIIS) (2) fascia over the ilio-pubic eminence (3) the AccON and the articular branch (Art ON) from AccON to hip joint. **b** Right supra-inguinal dissection showing

green dye stains the following from superior to inferior and medial to lateral (1) fascia over the anterior superior iliac spine (ASIS) (2) fascia over the anterior inferior iliac spine (AIIS) fascia over the ilio-pubic eminence (3) spreads medial over the IPE

#### Left-sided inguinal dissection [PENG (green dye) + SIFI block (blue dye)]

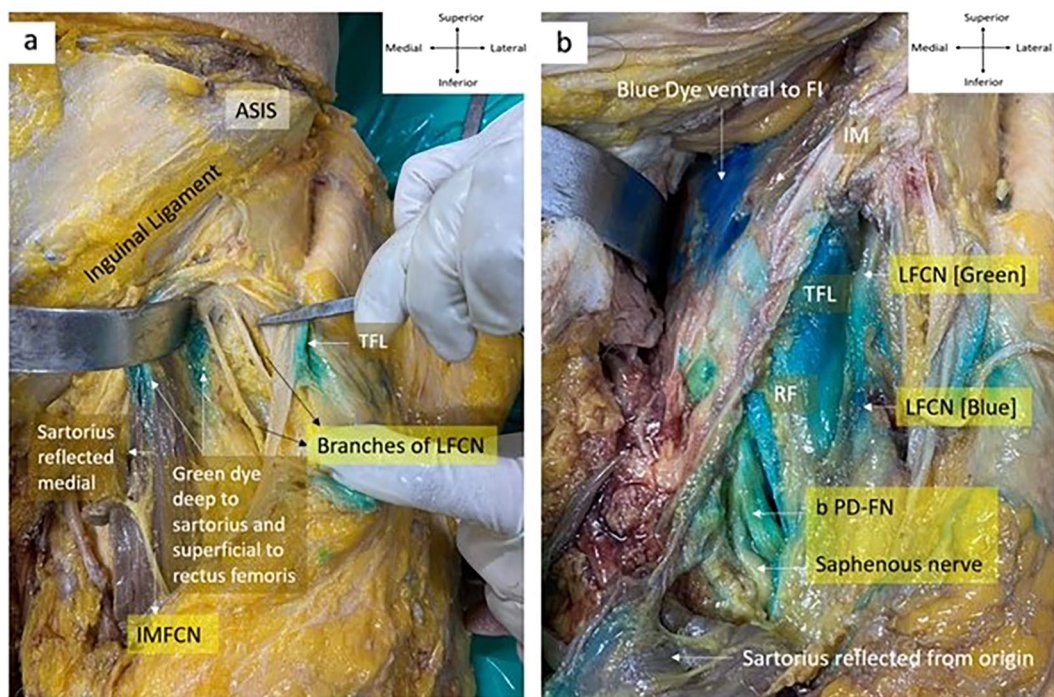
In the infra-inguinal area, the green dye appeared between the sartorius and rectus femoris and medial to the branches of LFCN (Fig. 4a). The tensor fascia lata (TFL) was also stained green which is the possible site for branches of iliohypogastric and subcostal nerves (Fig. 4a). On dissection, the branches of the above nerves were found to be stained green in 3/8 specimens (Fig. 4a). Cephalad dissection revealed that the iliacus muscle beneath the fascia iliaca was discoloured blue and the dye appeared laterally to stain the LFCN in its distal part (Fig. 4b). Thus, the LFCN was stained blue in the proximal and green in the distal region (Fig. 4b). Moreover, the green dye was visible soaking the LFCN branches and diffusing distally to stain the branches of the posterior division of the FN beneath the sartorius (Fig. 4b). Medial and superior retraction of the abdominal wall muscles revealed the medialmost spread of the blue dye over the iliacus muscle, the straight head of the rectus femoris and the tensor fascia Lata (Fig. 4b).

Deep dissection in the infra-inguinal area demonstrates a mix of blue and green dye blemished both the anterior division of the FN (5/8) specimens and the anterior division of ON in (2/8), respectively (Fig. 5a, b). In the supra-inguinal

region, a mix of green and blue dyes was seen both above and below the iliacus muscle which we suppose was due to the percolation of the injectate from the dorsal to the ventral surface and vice-versa (Figs. 5b, 6a, b, c). However, beneath the green stained psoas fascia, the psoas muscle was unstained.

In the supra-inguinal area, the entire ventral side of iliacus muscle was discoloured blue, centrally and spreading from superior to inferior and lateral to medial (Fig. 5a). The green dye bordered the iliacus muscle along its dorsal surface, with maximum stain inferiorly and along the lateral border (Fig. 5b). However, it did spare the psoas muscle (Fig. 5b). Further, medial reflection of the psoas muscle revealed the ON which remained unstained (Fig. 5c). Proximal part of LFCN and FN was stained blue in all 8 specimens. AccON was found to be stained green in only 1/8 specimen over the IPE. Splitting the iliacus muscle clearly discriminated the blue dye ventral to the iliacus and the green dye dorsal to the iliacus (Fig. 6b, c). The ventral surface of the iliacus muscle was also found to be soaked in green (4/8) specimens and the blue dye had seeped into the dorsal surface in all 8 specimens (Fig. 6a, b, c).

Deeper dissection revealed that the lateral border of the psoas tendon was smudged green, which is explained by the needle tip placement next to the tendon during a PENG



**Fig. 4** **a** Left superficial infra-inguinal dissection showing green stained sartorius and rectus femoris and beneath the LFCN. Dye is over the TFL. The intermediate femoral cutaneous nerve (IMFCN) is unstained. **b** Deeper dissection supra and infra-inguinal depicts the (1) blue dye on ventral surface of the fascia iliacus (FI) (2) LFCN

stained green proximal and blue distally (3) branches of posterior division of femoral nerve (b PD-FN) stained green (4) Iliacus muscle (IM), straight head of rectus femoris (RF) and Tensor fascia Lata (TFL) stained blue

block (Fig. 6c). Interestingly, the FN path was stained blue in its proximal part until the midpart of the nerve. Distally, the FN was stained green (Fig. 6c).

Dye distribution after right-side PENG injection and left side PENG and SIFI injections injection have been summarised in Table 1. Further, Fig. 7 illustrate the diffusion of dye in the PENG and SIFI injection respectively.

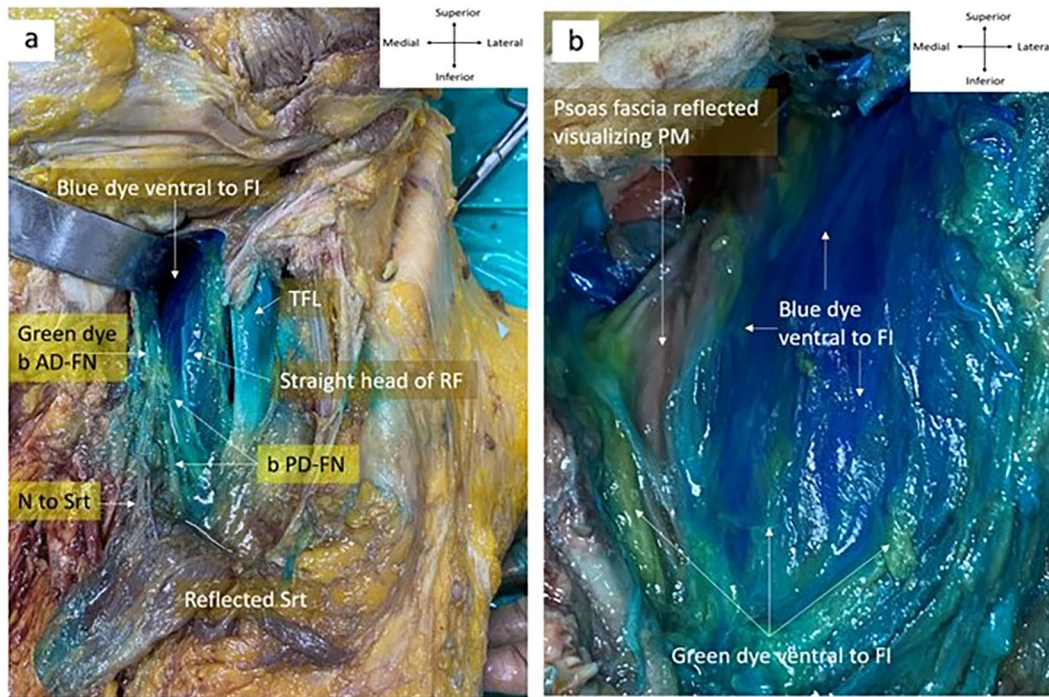
## Discussion

The ultrasound investigation and the cadaveric dissection findings revealed that the green dye spread was mostly limited to the dorsal surface of the iliacus muscle with the PENG approach and the ventral surface was soaked blue with the SIFI approach though there was a visible diffusion of the two dyes on either side. The nerve to rectus femoris, anterior divisions of FN and the ON, the LFCN and AccON were stained green mainly with the PENG injection. However, the proximal part of the FN and LFCN was stained blue with the SIFI approach. The branches of the subcostal and iliohypogastric nerve which provide additional cutaneous innervation to the hip region were additionally stained green, bilaterally in six specimens with the PENG approach.

However, the main trunk of the ON was not involved with any of the techniques.

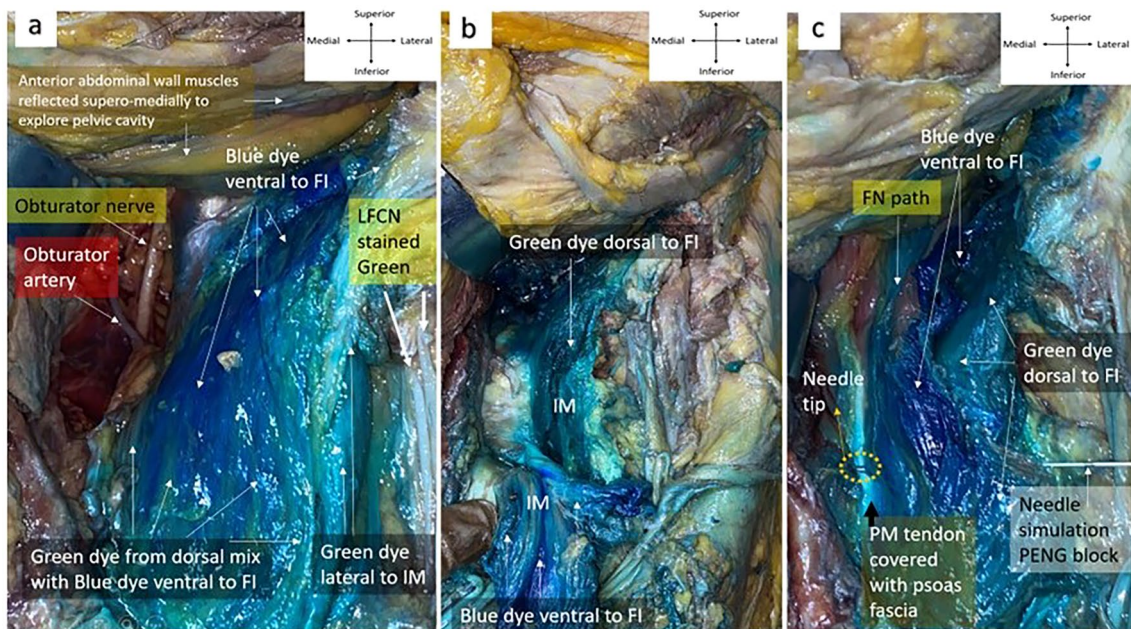
Injections performed above the inguinal ligament deep to the iliacus fascia and superior to the iliacus muscle with injectate diffusing in the iliac fossa soaking the FN and LFCN created a new approach known as the ‘supra-inguinal fascia iliaca block’ [7]. A mean volume of 36 ml providing adequate analgesic effect is reported [7], however, a dose finding cadaveric study [9] determined 62.5 ml injectate that captures all three nerves. Nevertheless, such high volumes are not injected in routine clinical practice. In our study, the SIFI injection soaked the proximal FN and LFCN, however, the branches of the iliohypogastric and the subcostal nerves remained unstained. None of the specimens depicted the proximal ON stain.

Anatomic studies have revealed that the anterior hip capsule is innervated by high articular branches from the FN and the AccON, and, the anteromedial aspect by the ON [11, 12]. Based on this concept, delivery of local anesthetic lateral to the psoas tendon was conceptualized on the premise of blocking these articular nerves, thereby triggering a new approach, the pericapsular nerve group [PENG] block [3]. The study [3] mentions the articular branches of AccON and the FN at the IPE as the main targets, however, in the current cadaveric study the incidence of AccON



**Fig. 5** **a** Left supra and infra-inguinal dissection reveals a mix of blue dye ventral to fascia iliaca (FI) and green dye dorsal to FI. Green dye soaks the branches of anterior division of femoral nerve (b D-FN), nerve to sartorius (n to Srt), the branches of posterior division of femoral nerve (b PD-FN). The RF and TFL were stained with mix of

blue-green. **b** Left supra-inguinal dissection reveals a mix of dominant blue dye ventral to fascia iliaca (FI) and green dye appearing from dorsal to ventral and interspersed with ventral blue dye. Psoas fascia is stained with a mix of blue and green but separating the fascia revealed an unstained psoas muscle (PM)



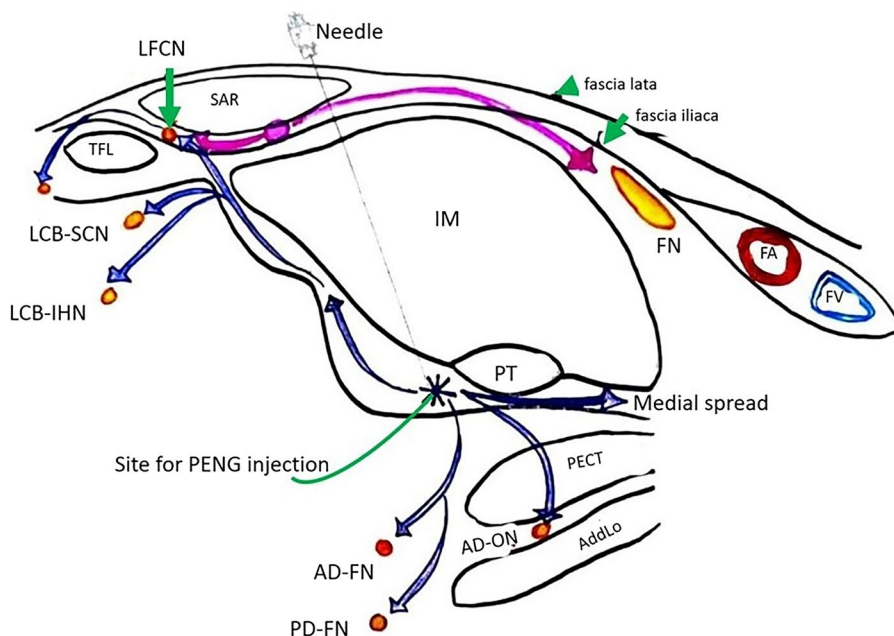
**Fig. 6** **a** Exposing the unstained obturator nerve situated close to the obturator artery. The ventral surface of fascia iliaca (FI) is stained blue with intermittent appearances of green dye, which is visualized more lateral to iliacus muscle (IM) and stains the LFCN. **b** Separating ventral and dorsal iliacus muscle distinctly illustrates the ventral surface of iliacus muscle (IM) stained blue from supra-inguinal fascia iliaca injection and the

dorsal surface of IM stained green with PENG injection. **c** Deeper dissection revealed the green stained (1) psoas tendon, (2) the femoral nerve path stained, and the blue and green dye ventral and dorsal to fascia iliaca (FI). The needle tip is simulated to depict PENG injection

**Table 1** The injection planes and the spread dorsal and ventral to iliacus fascia and specific nerves

Injection Plane	D-FI	V-FI	SCN	LB-IHN	LFCN	AD-FN	AD-ON	PD-FN	PD-ON	ACC-ON
Right PENG	8/8	0/8	3/8	3/8	8/8	5/8	2/8	0/8	0/8	3/8
Left SIFI	8/8	8/8	0/8	0/8	8/8	8/8	0/8	8/8	0/8	0/8
Left PENG	8/8	4/8	3/8	3/8	8/8	5/8	5/8	2/8	0/8	3/8

*PENG* pericapsular nerve, *SIFI* supra-inguinal fascia iliaca, *D-FI* dorsal fascia iliaca, *V-FI* ventral fascia iliaca, *LB-IHN* lateral branch iliohypogastric nerve, *LFCN* lateral femoral cutaneous nerve, *AD-FN* anterior division femoral nerve, *PD-FN* posterior division femoral nerve, *PD-ON* posterior division obturator nerve, *ACC-ON* accessory obturator nerve



**Fig. 7** Site of PENG injection is denoted by (\*). The blue arrows summarize the spread lateral and dorsal to the iliacus muscle towards the LFCN, LCB-SCN, and LCB-IHN. Caudal it spreads towards the AD-FN and PD-FN, and caudal and medial between the pectineus (pect) and adductor longus involves (AddLo) the anterior obturator nerve (AON). The migration of injectate medial to the psoas tendon (PT) is questionable. *IM* Iliacus muscle, *FI* Fascia iliaca, *FN* Femoral nerve, *TFL* Tensor fascia Lata, *IPE* Iliopubic eminence, *AIIS* Ante-

rior inferior iliac spine, *PM* psoas major muscle, *ON* Obturator nerve, *LFCN* Lateral femoral cutaneous nerve, *AccON* Accessory obturator nerve, *ADON* Anterior division of obturator nerve, *b ADFN* branches of Anterior division of femoral nerve, *b PDFN* branches of Posterior division of femoral nerve, *LCB IHN*-lateral cutaneous branch of iliohypogastric nerve, *LCB-SCN* lateral cutaneous branch of subcostal nerve, *EIV* External iliac vein

involvement was 4/16 specimens. A previous cadaveric study reports an incidence between 8 and 29% [13]. The authors [3] quote the presence of an articular branch to the hip capsule arising from the femoral nerve from within the iliacus and travelling deep to the psoas muscle between the AIIS and the IPE [3]. Our cadaver study demonstrated the dorsal iliacus soaked green, which would stain the articular branches of FN and the AccON if present. Though no comments were made about the involvement of ON in the sub-pectineal plane [3], our dissection demonstrates the AD-ON blemished with green dye. Moreover, no observations were expressed regarding the involvement of the LFCN [3]. Interestingly, in a single cadaveric injection, comparing two volumes 10 ml and 20 ml, the authors concluded the PENG

block was a true ‘pericapsular block’ [10]. We illustrated in our study that the green dye injected in the PENG plane reached the LFCN in all specimens and, incriminated the lateral branches of the ilio-hypogastric nerve (6/16) and the subcostal nerves (6/16), and wonder whether the PENG is a true pericapsular block considering its extensive spread. In a further letter, the authors mentioned that a high-volume injectate may potentially spread to the main trunk of the obturator nerve, femoral or LFCN along the intermuscular septum between pectineus and psoas muscle or beneath the iliacus, psoas and pectineus muscles [14]. The same mechanisms may have operated in our dye study. The authors however did not report the staining of femoral or LFCN as was seen in our study with the same volume. The reason may be

differing injection pressure, dye concentration or cadaveric preparation.

An unusual phenomenon, unreported earlier was observed in the present study. Reflecting the iliacus muscle from the iliac bone divulged the green dye staining the entire dorsal surface of the iliacus muscle, and, mixing with the blue dye injected deep into the fascia iliaca. Correspondingly, the blue dye was perceptible at the dorsal surface of the iliacus muscle. Thus, these two planes are communicable, probably through the connective tissue channels in the iliacus muscle. Common to both injections in PENG and SIFI planes is the involvement of the nerve to the rectus femoris, responsible for the emergence of articular nerves in the anterior hip capsule. However, the proximal part of the ON was not involved in any specimens.

Prior to embarking upon a clinical trial, we thought of conducting a similar dual block (PENG and the SIFI) with different coloured dyes to understand the spread. As noted, the SIFI spread ventral to the iliacus muscle engulfing the FN and the LFCN but did not affect the proximal ON in any of the specimens. The PENG distribution was along the dorsal surface of the iliacus muscle, reached the LFCN in all specimens, the AccON at the IPE, and the AON in the sub-pectineal plane (Fig. 7). Moreover, an unusual spread to involve the branches of the subcostal and iliohypogastric was noted with the PENG injection. Notably, these branches are likely to contribute to analgesia with the proximal incision for hip surgery [15]. Perhaps, this is a plausible mechanism through its extensive diffusion the PENG provides a clinical analgesic benefit but unfortunately would be a non-motor sparing block (Fig. 7).

Our dye study has certain limitations. Firstly, our study involved a small sample size of cadavers. Moreover, cadaveric injections cannot be directly extrapolated to clinical settings. However, the strength of the study lies in discovering the PENG injections discolouring the branches of the LFCN, the subcostal and the iliohypogastric nerves, accessory ON and the anterior branch of ON and the FN. The proximal FN and the LFCN nerves were involved by the SIFI and distally by the PENG injections. All these nerves have an important role in the innervation of the hip joint and are variably covered by either block alone and a combination may prove advantageous. The study findings could provide the direction for future research for clinical studies.

## Conclusion

Our study indicates that the PENG has a predictable dorsal spread under the iliacus muscle, but it also communicates with the ventral surface of the iliacus muscle. We propose an alternative name and would like to call it a ‘dorsal fascia iliaca block!’. Similarly, the SIFI plane injection, apart

from the consistent extensive spread on the ventral surface of the iliacus muscle, percolated onto the dorsal surface of the iliacus muscle. Apart from the overlapping territories both injections independently covered crucial innervations to the hip joint. We perceive that to have a superior clinical outcome, probably the two injections need to be combined.

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**Data availability** The data supporting the results reported in our paper can be provided on reasonable personal request to the corresponding author.

## Declarations

**Conflict of interest** There is no financial or any other conflict of interest.

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