# International consensus on anatomical structures to identify on ultrasound for the performance of basic blocks in ultrasound-guided regional anesthesia

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## ABSTRACT

There is no universally agreed set of anatomical structures that must be identified on ultrasound for the performance of ultrasound-guided regional anesthesia (UGRA) techniques. This study aimed to produce standardized recommendations for core (minimum) structures to identify during seven basic blocks. An international consensus was sought through a modified Delphi process. A long-list of anatomical structures was refined through serial review by key opinion leaders in UGRA. All rounds were conducted remotely and anonymously to facilitate equal contribution of each participant. Blocks were considered twice in each round: for "orientation scanning" (the dynamic process of acquiring the final view) and for the "block view" (which visualizes the block site and is maintained for needle insertion/injection). Strong recommendations for inclusion were made if ≥75% of participants rated a structure as "definitely include" in any round. Weak recommendations were made if >50% of participants rated a structure as "definitely include" or "probably include" for all rounds (but the criterion for "strong recommendation" was never met). Thirty-six participants (94.7%) completed all rounds. 128 structures were reviewed; a "strong recommendation" is made for 35 structures on orientation scanning and 28 for the block view. A "weak recommendation" is made for 36 and 20 structures, respectively. This study provides recommendations on the core (minimum) set of anatomical structures to identify during ultrasound scanning for seven basic blocks in UGRA. They are intended to support consistent practice, empower non-experts using basic UGRA techniques, and standardize teaching and research.

## INTRODUCTION

The use of ultrasound to assess anatomy in relation to regional anesthesia was first described by Ting and Sivagnanaratnam in 1989.[1] It has since progressed to become the predominant method of practice in modern regional anesthesia.[2] Image interpretation and visualization of anatomical structures are well recognized as essential components of ultrasound-guided regional anesthesia (UGRA).[3 4] However, there is a lack of consistency in the anatomical descriptions of UGRA techniques.[5] Despite the importance of robust guidelines and training methods,[6] there is no universal agreement on recommended anatomical structures to visualize and identify on ultrasound for each technique.

Recent publications have highlighted the need to standardize elements of UGRA.[5 7 8] One approach, proposed by Turbitt *et al*, is the concept of "Plan A blocks."[7] In this editorial, the authors propose seven "high value" nerve blocks to be widely adopted. Regional Anaesthesia UK (RA-UK) supports this approach, which aims to encourage uptake among non-experts. The Plan A blocks comprise:

- Interscalene level brachial plexus block (ISB).
- Axillary level brachial plexus block (AxBP).
- Thoracic level erector spinae plane block (ESP).
- Rectus sheath plane block (RSB).
- Femoral nerve block (FNB).
- Adductor canal block (ACB).
- Popliteal level sciatic nerve block (SNB).

As part of this approach, Turbitt *et al* recommend that "standardised ultrasound-guided approaches should be established for all basic block techniques."[7] As ultrasound scanning precedes needle insertion, it is logical to first standardize the ultrasound scanning goals. The aim of this study was to generate consensus on a series of anatomical structures to identify on ultrasound for the performance of Plan A blocks in UGRA. A modified Delphi process was used to achieve consensus among a group of international experts for both "orientation scanning" and the "block view" as discrete elements of ultrasound scanning for each Plan A block.

## METHODS

The recommendations contained herein do not define standard of care. They are not intended to replace clinical judgment. In the imperfect setting of heterogeneity of the data, limited data, controversial topics, and bias inherent to expert opinion, compliance with the recommendations may not result in improved outcomes compared with alternative approaches consistent with personalized medicine.

### Organizations represented

This study was conducted by RA-UK and is endorsed by the American Society of Regional Anesthesia and Pain Medicine (ASRA) and the European Society of Regional Anaesthesia & Pain Therapy (ESRA).

### Long-list

An initial list of anatomical structures, relevant to each Plan A block, was generated and shared by the Ultrasound Regional Anaesthesia Interpretation Skill Evaluation study team (URAISE; Imperial College, London, work unpublished). This team undertook a scoping review of the literature in November 2020, using PubMed. The search terms used were "ultrasound-guided" AND "sono-anatomy" AND "block" (the Plan A block in question, from the list above). The team identified English language publications of original research, review articles, case, and series presentations. The data were extracted by a different researcher to those undertaking the literature search.

This list of structures for each Plan A block was reviewed by the study steering group (BB, JSB, AJRM, AP, LT). Additional anatomical structures or clarifying terminology were added if deemed to be potentially relevant. The completed long-list contained 118 structures (29 for ISB, 22 AxBP, 11 ESP, 17 RSB, 14 FNB, 14 ACB, 11 SNB; see online supplemental file A).

### Orientation scanning and block view

In accordance with the assessment checklist for UGRA devised by Cheung *et al*,[9] there are two component phases of ultrasound scanning during UGRA. In the first, the anesthesiologist must orient themself to the patient's anatomy and trace the sono-anatomical structures to confirm their identity. We have termed this dynamic process of acquiring the final view "orientation scanning." The second phase represents the end point of the first; the view maintained during needle insertion and injection, to observe safe passage of the needle and appropriate deposition of local anesthetic. We have termed this the "block view." In reality, "orientation scanning" and the "block view" are two phases of a single, continuous process. However, as there is potential to encounter different anatomical structures during each phase, they have been considered separately in this study.

### Participants

Akins *et al* demonstrated the suitability of relatively small numbers of experts for a Delphi technique if they have similar training and a general understanding of the field.[10] In accordance with this, 27 UK-based key opinion leaders in the field of UGRA were invited to take part. They were identified based on recognition of their experience in performing, teaching, or research in the field of UGRA. They included the steering group (but not the principal investigator; JSB), the RA-UK board members, and anesthesiologists to provide broad geographic and ethnographic representation throughout the UK. To achieve international consensus, five board members from ASRA and six board members from ESRA were also invited. In total, 38 participants were invited to take part.

All participants accepted the invitation to take part in this study. This was followed by specific invitation emails for each round. Participants were only invited to take part in each subsequent round if they had completed the one prior. The study aimed for a minimum 70% response rate (and a minimum of 15 participants) in each round.

### Modified Delphi technique

A modified Delphi technique was employed, based on that of Oikonomou *et al*.[11] Rating rounds were conducted remotely and anonymously, using Google Forms. This aimed to facilitate widespread geographical input, social distancing requirements of the current SARS-CoV-2 pandemic, and support independent, unbiased input for each participant. No in-person or virtual/teleconference was held to discuss individual structures.

Participants were asked to review the long-list of anatomical structures for each Plan A block. For each block, participants were asked to rate whether items on the list should be included as a core (minimum) structure that is essential to identify on orientation scanning by a non-expert. The same list was then reviewed again, with the experts this time rating whether each structure should be included for the block view. The order in which structures were presented on each list was randomized to avoid any perceived difference in importance. Rating was performed on the following 4-point Likert scale:

- Definitely include.
- Probably include.
- Probably exclude.
- Definitely exclude.

A 4-point Likert scale was chosen, based on precedent set by Oikonomou *et al*,[11] to remove the option of equipoise and ensure participants decide on either inclusion or exclusion for each structure. To be consistent with the recent ASRA-ESRA regional anesthesia nomenclature study,[5] a threshold of ≥75% agreement was set as a consensus for inclusion. Therefore, structures rated as "definitely include" by ≥75% experts were accepted for inclusion (and not rated again in further rounds). Structures that did not meet this criterion but rated as either "definitely include" or "probably include" by more than half (50%) of experts were retained for the next round. Structures that did not meet either of these criteria were excluded. During each round, participants were presented with the opportunity to suggest alternative terminology and/or additional structures (for both orientation scanning and block view).

After each round, overall rating results for that round were shared with all participants. This included a graphical representation of rating patterns for each structure and the overall outcome for each one (included/retained for the next round/excluded). In the following round, they were then asked to rate the remaining structures (with the same system applied). Any new structures/terminology, suggested in the previous round, were added to the relevant list. Three rating rounds were held.

Following three rounds, the structures which had met the criteria for inclusion were put forward as "strong recommendations." Structures that did not meet the criteria for inclusion in previous rounds (≥75% definitely include), but >50% of participants had rated 1/definitely include or 2/probably include over all three rounds, were put forward as "weak recommendations." This final list of structures was shared with all Delphi participants (who had completed all three rounds) to provide feedback.

This feedback was reviewed by the study steering group and considered in the manuscript discussion.

## RESULTS

Thirty-seven out of 38 participants (97.4%) completed the first rating round for 118 structures (for both phases of scanning). Thirty-four and 25 structures were included for orientation scanning and the block view, respectively. Forty-three and 29 structures were retained for the next round, while 41 and 64 were excluded. Feedback identified 10 new structures to be added for rating in the second round. Some participants asked for clarity on the anatomical level of each block; a definition was provided which attempted to avoid leading participants' subsequent ratings. The rating outcomes of round one and definitions for each block can be seen in online supplemental file B.

In round 2, 36 out of 37 invited participants (97.3%) completed the rating. This increased the included structures to 35 and 28 for orientation scanning and the block view, respectively. Thirty-eight and 21 were retained for the next round, while 55 and 79 had been excluded. No new structures were added for rating in the next round. Further detail for the outcome of round 2 can be seen in online supplemental file C.

In round 3, 36 out of 36 invited participants (100%) completed the rating. From a total of 128 structures rated, 35 and 28 reached strong consensus for inclusion on orientation scanning and the block view respectively. Weak consensus for inclusion was reached on 36 and 20 structures, respectively, while 57 and 80 structures respectively were excluded. No new structures were added. Further detail for the outcome of round 3 can be seen in online supplemental file D.

An overall summary of the number of structures allocated to "included," "retained," and "excluded" after each rating round can be seen in online supplemental file E. Table 1 shows the final "strong recommendations" and "weak recommendations."

## DISCUSSION

A wide variety of anatomical structures are mentioned in the literature for each Plan A block. One hundred and twenty-eight structures were reviewed for both orientation scanning and the block view. Three successive rounds of voting were held among 36 key opinion leaders from France, Germany, Greece, Portugal, Spain, the UK, and the USA (from 38 originally invited; 94.7%). Strong consensus was reached on 92/128 (71.9%) structures for inclusion or exclusion on orientation scanning. Thirty-five structures were considered as a core (minimum) structure that is essential to identify by ≥75% of participants. For the block view, 108/128 (84.4%) of structures gained strong consensus for inclusion or exclusion. Twenty-eight were considered as a core (minimum) structure that is essential to identify by ≥75% of participants. A list of the relevant structures for each block can be seen in table 1; structures reaching a strong consensus for inclusion have been termed "strong recommendations." Thirty-six structures did not reach a strong consensus as a core (minimum) structure to identify on orientation scanning and 20 for the block view. However, they were rated as either 1/definitely include or 2/probably include by >50% experts in each of three rating rounds. They have therefore been included as "weak recommendations." Figure 1 shows the "strong recommendation" structures for the block view of each Plan A Block.

Standardization of practice can support a consistently high level of care being delivered to patients. It can also empower individuals to adopt standards of care and facilitate good practice. A successful example of this is the Difficult Airway Society

**Table 1** Minimum anatomical structures to identify on ultrasound for the performance of Plan A blocks in ultrasound-guided regional anesthesia

| Strong recommendations | Weak recommendations |
|---|---|
| *Interscalene level brachial plexus block (orientation scanning)* | |
| Anterior scalene muscle | Common carotid artery |
| Middle scalene muscle | Internal jugular vein |
| C5 nerve root | Subclavian artery |
| C6 nerve root | Transverse process of C5 |
| Upper trunk of brachial plexus | Transverse process of C6 |
| | Sternocleidomastoid |
| | C7 nerve root |
| | Middle trunk of brachial plexus |
| *Interscalene level brachial plexus block (block view)* | |
| Anterior scalene muscle | Sternocleidomastoid |
| Middle scalene muscle | C7 nerve root |
| C5 nerve root | Upper trunk of brachial plexus |
| C6 nerve root | |
| *Axillary level brachial plexus block (orientation scanning)* | |
| Axillary artery | Brachial artery |
| Axillary vein(s) | Humerus |
| Conjoint (common) tendon of latissimus dorsi/teres major | Biceps brachii (short head) |
| Median nerve | Coracobrachialis |
| Musculocutaneous nerve | Fascia overlying conjoint (common) tendon of latissimus dorsi/teres major |
| Radial nerve | |
| Ulnar nerve | |
| *Axillary level brachial plexus block (block view)* | |
| Axillary artery | Biceps brachii (short head) |
| Axillary vein(s) | Coracobrachialis |
| Conjoint (common) tendon of latissimus dorsi/teres major | Fascia overlying conjoint (common) tendon of latissimus dorsi/teres major |
| Median nerve | |
| Musculocutaneous nerve | |
| Radial nerve | |
| Ulnar nerve | |
| *Thoracic level erector spinae plane block (orientation scanning)* | |
| Rib (head/neck) | Laminae (thoracic vertebrae) |
| Transverse process (thoracic vertebrae) | Trapezius |
| Erector spinae muscle group | Rhomboid major |
| Pleura | Spinous process (thoracic vertebrae) |
| *Thoracic level erector spinae plane block (block view)* | |
| Transverse process (thoracic vertebrae) | Trapezius |
| Erector spinae muscle group | Rhomboid major |
| | Pleura |
| *Rectus sheath plane block (orientation scanning)* | |
| Rectus abdominis | External oblique |
| Rectus sheath (anterior layer) | Internal oblique |
| Rectus sheath (posterior layer) | Transversus abdominis |
| Linea alba | Linea semilunaris |
| Peritoneum | Transversalis fascia |
| | Intra-peritoneal contents |
| *Rectus sheath plane block (block view)* | |
| Rectus abdominis | Transversalis fascia |
| Rectus sheath (anterior layer) | Intra-peritoneal contents |
| Rectus sheath (posterior layer) | |
| Peritoneum | |
| *Femoral nerve block (orientation scanning)* | |

Continued

**Table 1** Continued

| Strong recommendations | Weak recommendations |
|---|---|
| Femoral artery (common femoral artery) | Profunda femoris (deep femoral artery) |
| Femoral vein (common femoral vein) | Fascia lata |
| Iliacus/iliopsoas | |
| Femoral nerve | |
| Fascia iliaca | |
| *Femoral nerve block (block view)* | |
| Femoral artery (common femoral artery) | Femoral vein (common femoral vein) |
| Iliacus/iliopsoas | Fascia lata |
| Femoral nerve | |
| Fascia iliaca | |
| *Adductor canal block (orientation scanning)* | |
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) |
| Sartorius | Femur |
| Vastus medialis | Adductor longus |
| Saphenous nerve/nerve complex | Adductor magnus |
| | Nerve to vastus medialis |
| | Vastoadductor membrane |
| *Adductor canal block (block view)* | |
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) |
| Sartorius | Adductor longus |
| Saphenous nerve/nerve complex | Vastus medialis |
| | Vastoadductor membrane |
| *Popliteal level sciatic nerve block (orientation scanning)* | |
| Popliteal artery | Popliteal vein |
| Sciatic nerve | Femur (popliteal surface) |
| Sciatic nerve where elements diverge | Biceps femoris |
| Tibial nerve | Semimembranosus |
| Common peroneal (fibular) nerve | Semitendinosus |
| *Popliteal level sciatic nerve block (block view)* | |
| Sciatic nerve | Popliteal artery |
| Sciatic nerve where elements diverge | Popliteal vein |
| Tibial nerve | Biceps femoris |
| Common peroneal (fibular) nerve | |

2015 Guidelines on Management of the Unanticipated Difficult Airway.[12] These guidelines, for the first time, provided a standardized management approach that unified anesthesiologists in the pursuit of high-quality airway management. In regional anesthesia, a joint AAGBI/OAA/RA-UK guideline on regional anesthesia,[13] anticoagulants, and abnormalities of coagulation have been successful in supporting clinicians in making informed decisions around procedures in such patients.

This study reflects the approach of El-Boghdadly *et al* to move toward consistent and anatomically standardized practice in UGRA.[5] Uncertainty and inconsistency can impede training, practice and research, and limit adoption of UGRA techniques (particularly by non-experts).[5 7] The authors appreciate that experts may have strong opinions on specific practices within any given UGRA procedure. By definition, experts will have extensive knowledge and experience to bring to bear on their practice and teaching. Furthermore, as mentioned in the free text feedback, over-simplification can compromise safety (and potentially efficacy). Therefore, these recommendations are designed to standardize and guide non-expert learning and performance of UGRA scanning for Plan A blocks. Non-experts (and experts) may feel able to readily identify more structures than those listed here and those not named are not excluded because they are unimportant. The structures listed in this consensus study should be viewed as a minimum standard (not a maximum) for a non-expert to identify prior to inserting the block needle.

While some structures have not been included in these lists by name, it is logical to carefully scrutinize the acquired ultrasound images to ensure the block site and needle trajectory avoid traumatizing blood vessels, nerves, or serosal tissue. This has been mentioned in the free text feedback (see online supplemental files), such as the dorsal scapular nerve for the ISB. A common practice, and suggestion in the free text feedback, is to use color Doppler to survey ultrasound images for potential blood vessels. Similarly, compression of venous structures is commonly practiced to avoid puncturing veins and any associated bleeding or intravascular injection. While veins are only named on the "strong recommendation" list for two blocks, that does not mean that they are not of clinical significance or only present in those two regions.

Feedback raised the question of whether structures (particularly in the case of muscles) should be named or simply recognized. It is true that images can be interpreted through pattern recognition as the operator becomes increasingly familiar with any given technique. However, the authors feel that knowledge of the structure name is required as it is part of a full understanding of the underlying anatomy and for effective communication between clinicians during teaching, clinical practice, and in academic publications.

Free text responses also suggested the prospect of classifying structures identified in the image on the basis of their relevance (eg, to promote success or increase safety). While there is some overlap in this description, ISB, AxBP, FNB, ACB, and SNB can be considered blocks that target a specific nerve(s), while ESP and RSB are fascial plane blocks. In the former category, nerves are the target structures (also relevant for safety), while bone and muscle/fascia can be thought of as landmark structures. Vascular structures can be viewed as both landmark and safety structures. In the latter, it is the bone, muscle, and fascia which are the target structures, while the blood vessels and nerves can be considered as safety structures. Again, there are exceptions and limitations to this approach—the proposal is purely intended as a descriptive classification to aid understanding for the aims of UGRA techniques.

The number of structures that did not reach a strong consensus for either inclusion or exclusion is surprising given that this study seeks to define the core (minimum) structures that should be identified by non-experts during ultrasound scanning for basic (Plan A) blocks. This may reflect the degree of variation in individual practice. For example, the subclavian artery is often the starting point for scanning during ISB, as nerves of the brachial plexus are followed up the axial level of C6 (identified by the prominent anterior tubercle of C6). Equally, the profunda femoris is often identified during orientation scanning, aiming for a block view proximal to this point to ensure deposition of local anesthetic before the femoral nerve divides. However, it is recognized that this may not be universal practice (eg, orientation scanning for the ISB starting at the cricoid cartilage in the midline, moving laterally, and viewing the carotid artery/internal jugular vein en route). This may represent a limitation of the present study: that the scanning technique was not defined in advance of structure rating. Also, a different methodology could have ensured a binary outcome for all structures (of definitely include/exclude). However, this approach was avoided to ensure the representative opinion of all participants.

The authors note that three levels of the nerve(s) are included for the popliteal level sciatic nerve block: sciatic nerve, sciatic nerve where elements divide, and the tibial/common peroneal

# Block View for the Plan A Blocks

## Anatomical Structures meeting criteria for Strong Recommendation

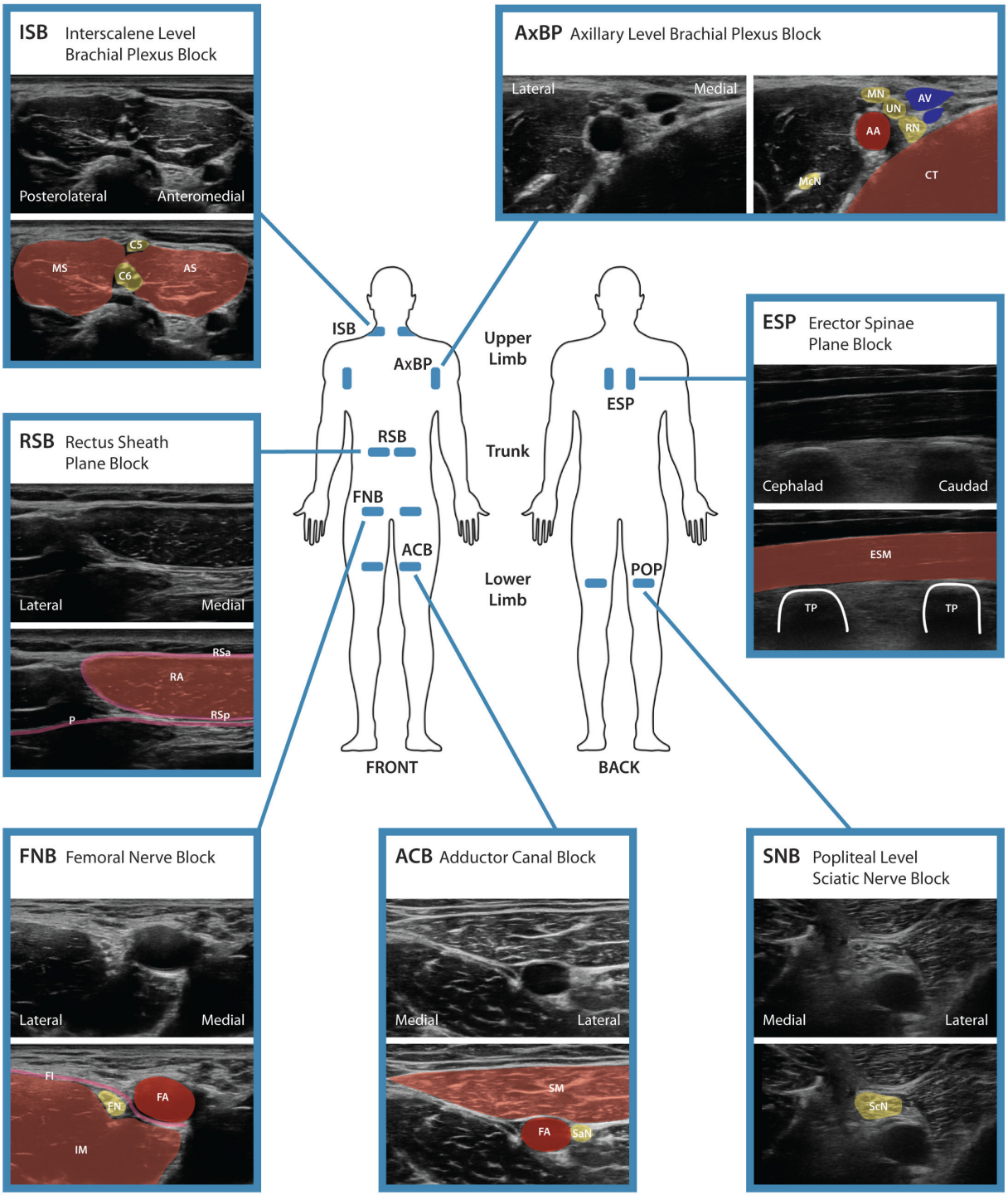


**Figure 1** Anatomical structures meeting the strong recommendation criteria for inclusion on the block view for each Plan A block. *ISB*: AS, anterior scalene; C5, C5 nerve root; C6, C6 nerve root; MS, middle scalene. *AxBP*: AA, axillary artery; AV, axillary vein; CT, conjoint (common) tendon of latissimus dorsi/teres major; McN, musculocutaneous nerve; MN, median nerve; RN, radial nerve; UN, ulnar nerve. *ESP*: ESM, erector spinae muscle group; TP, transverse process. RSB: P, peritoneum; RA, rectus abdominis; RSa, rectus sheath (anterior layer); RSp, rectus sheath (posterior layer). FNB: FA, femoral artery; FI, fascia iliaca; FN, femoral nerve; IM, iliacus/iliopsoas muscle. *ACB*: FA, femoral artery; SaN, saphenous nerve; SM, sartorius muscle. *SNB*: ScN, sciatic nerve.

(fibular) nerves. While this is logical in orientation scanning, to identify the level at which is the nerve is best visualized and safely accessed, it is clearly not possible in a single block view. Therefore, any of the three levels are deemed appropriate for the block view—while remembering that blocking the tibial and common peroneal (fibular) nerves individually is not a "sciatic nerve block."

As described in the methodology, this study used a 4-point Likert scale to quantify the subjective opinion of individuals contributing to this study, as opposed to the common 5-point or 7-point scales. An even number of potential responses was intentionally chosen to remove the option of equipoise—requiring participants to decide on inclusion or exclusion of each structure. Four points (rather than two) were including to ensure that ranking decisions were not binary.

Many Delphi studies hold an in-person or virtual/teleconference to discuss individual structures. This was not included in the present study as it is the experience of the steering group that these forums provide an opportunity for a limited number of participants to give a disproportionate representation of their viewpoint. Furthermore, given the difficulties of a large number of participants all being available simultaneously, the steering group aimed to avoid elements of the study which did not enable all study participants to contribute equally.

Given the rapid evolution of UGRA[5] and lack of strong consensus for all structures, it would be logical to review this Delphi process after a suitable time interval. Involvement of other key opinion leaders in the field will provide validation of the current conclusions. A robust methodology to reach a firm conclusion on the structures which lacked a strong consensus may also be desirable, to reach a definitive end point. Further work is in progress to expand this methodology to the Plan BCD (advanced) blocks defined by Turbitt *et al*.[7] In common with El-Boghdadly *et al*,[5] reviewing these conclusions periodically will ensure guidance remains valid.

## CONCLUSION

In conclusion, this study used a modified Delphi process to produce recommendations on the structures that should be identified on ultrasound scanning for seven basic (Plan A) blocks. This information is intended to support consistent practice and empower the non-expert to facilitate the approach of using a "small number of 'high value' nerve blocks, attaining and maintaining widespread competency in these skills."[7] The authors hope that a standardized minimum set of structures to identify on ultrasound for a core set of UGRA procedures may aid improved and consistent communication, teaching and research in the field.

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# International Consensus on Anatomical Structures to Identify on Ultrasound for the Performance of Basic Blocks in Ultrasound-Guided Regional Anesthesia: A Regional Anaesthesia UK Delphi Study

## Supplementary File A – Anatomical Structures Long-List

| Interscalene Level Brachial Plexus Block | |
|---|---|
| **Blood vessel** | Common carotid artery<br>External jugular vein<br>Internal jugular vein<br>Subclavian artery<br>Suprascapular artery<br>Transverse cervical artery<br>Vertebral artery |
| **Bone** | First rib<br>Transverse process of C5<br>Transverse process of C6<br>Transverse process of C7 |
| **Muscle** | Anterior scalene<br>Inferior belly of omohyoid<br>*Middle scalene<br>Sternocleidomastoid<br>Trapezius |
| **Nerve** | C5 nerve root<br>C6 nerve root<br>C7 nerve root<br>Dorsal scapular nerve<br>Long thoracic nerve<br>Lower trunk of brachial plexus<br>Middle trunk of brachial plexus<br>Phrenic nerve<br>Superficial cervical plexus nerves (lesser occipital, great auricular, transverse cervical, supraclavicular)<br>Upper trunk of brachial plexus |
| **Other** | Dome of pleura<br>Prevertebral fascia<br>Thyroid gland |

***The posterior scalene muscle is a slip of the middle scalene muscle which attaches to the second rib (and hence is not considered as a separate sono-anatomical structure in this study)**

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| Axillary Level Brachial Plexus Block | |
|---|---|
| **Blood vessel** | Anterior circumflex humeral artery<br>Axillary artery<br>Axillary vein(s)<br>Basilic vein<br>Brachial artery<br>Posterior circumflex humeral artery<br>Profunda brachii artery<br>Venae commitantes of the brachial artery (brachial vein) |
| **Bone** | Humerus |
| **Muscle** | Biceps brachii (short head)<br>Coracobrachialis<br>Conjoint tendon of latissimus dorsi/teres major<br>Medial head of triceps |
| **Nerve** | Intercostobrachial nerve<br>Medial cutaneous nerve of arm<br>Medial cutaneous nerve of forearm<br>Median nerve<br>Musculocutaneous nerve<br>Radial nerve<br>Ulnar nerve |
| **Other** | Deep investing fascia of the arm (deep brachial fascia)<br>Fascia overlying the conjoint tendon of latissimus dorsi/teres major |

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| Erector Spinae Plane Block (Thoracic Region) | |
|---|---|
| **Blood vessel** | Intercostal neurovascular bundle |
| **Bone** | Laminae (thoracic vertebrae)<br>Rib (head/neck)<br>Transverse processes (thoracic vertebrae) |
| **Muscle** | Intercostal muscles<br>Trapezius<br>Rhomboid major<br>Erector spinae muscle group |
| **Nerve** | |
| **Other** | Pleura<br>Posterior intercostal membrane<br>Superior costotransverse ligament |

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| Rectus Sheath Plane Block | |
|---|---|
| **Blood vessel** | Deep inferior epigastric artery<br>Deep inferior epigastric vein(s)<br>Superficial inferior epigastric artery<br>Superficial inferior epigastric vein |
| **Bone** | |
| **Muscle** | External oblique<br>Internal oblique<br>Pyramidalis<br>Rectus abdominis<br>Transversus abdominis |
| **Nerve** | |
| **Other** | Intra-peritoneal contents<br>Linea alba<br>Linea semilunaris<br>Peritoneum<br>Pre-peritoneal fat<br>Rectus sheath (anterior layer)<br>Rectus sheath (posterior layer)<br>Transversalis fascia |

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| Femoral Nerve Block | |
|---|---|
| **Blood vessel** | *Femoral artery<br>*Femoral vein<br>Lateral circumflex femoral artery<br>Medial circumflex femoral artery<br>Profunda femoris artery<br>Superficial circumflex iliac artery |
| **Bone** | Femur |
| **Muscle** | Iliacus/iliopsoas<br>Pectineus<br>Sartorius<br>Tensor fascia lata |
| **Nerve** | Femoral nerve |
| **Other** | Fascia iliaca<br>Fascia lata |

***Vascular surgeons refer to this portion of the femoral artery/vein as the common femoral artery/vein (prior to branching of the profunda femoris; distal to this point the term superficial femoral artery/vein is used). Anatomists do not use this terminology, only referring to the vessel as the femoral artery (between the inguinal ligament and adductor hiatus/medial border of femur).**

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| Adductor Canal Block (Distal Femoral Triangle Block) | |
|---|---|
| **Blood vessel** | *Femoral artery<br>*Femoral vein |
| **Bone** | Femur |
| **Muscle** | Adductor longus<br>Adductor magnus<br>Sartorius<br>Vastus medialis |
| **Nerve** | Anterior division of obturator nerve<br>Medial cutaneous nerve of thigh<br>Medial retinacular nerve<br>Nerve to vastus medialis<br>Posterior division of obturator nerve<br>**Saphenous nerve/nerve complex |
| **Other** | ***Vastoadductor membrane |

***Vascular surgeons refer to this portion of the femoral artery/vein as the superficial femoral artery/vein (distal to branching of the profunda femoris, until the adductor hiatus/medial border of femur). Anatomists do not use this terminology, only referring to the vessel as the femoral artery (between the inguinal ligament and adductor hiatus/medial border of the femur).**

****The saphenous nerve is often regarded as a subsartorial nerve complex (incorporating elements of the nerve to vastus medialis and/or obturator nerve)**

*****Fascia running between vastus medialis and adductor magnus (this is terminology predominantly used by clinicians, its use is less commonly replicated in anatomical descriptions)**

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| Popliteal Level Sciatic Nerve Block | |
|---|---|
| **Blood vessel** | Popliteal artery<br>Popliteal vein |
| **Bone** | Femur (popliteal surface) |
| **Muscle** | Biceps femoris<br>Semimembranosus<br>Semitendinosus |
| **Nerve** | Common peroneal (fibular) nerve<br>Sciatic nerve<br>Sciatic nerve where elements (tibial and common peroneal (fibular)) diverge<br>Tibial nerve |
| **Other** | Fascia lata |

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## Supplementary File B – First Round Results

A graphical representation of results can be found here: https://docs.google.com/forms/d/1OkCKV1qMpaY1yRPsanH9Fef5RDJQNV85PusUtCFrzOk/viewanalytics

### Anatomical level of Blocks

Some participants have asked for clarification on the anatomical level of specific blocks. We appreciate the need for clarity but wish to avoid undue influence on scoring through naming specific anatomical structures when describing the block site. Therefore, we have provided a description of each block (including anatomical level) below, whilst trying to avoid a leading explanation. Where specific terminology has been used in the block name (e.g., a nerve/muscle is mentioned by name), that has been used in the description.

When you rate each anatomical structure, please do so in the context of this information and what you believe to be the correct block level/target given the names of the blocks considered. Please also assume the block is done on a subject with what you understand to be 'normal' anatomy, with an optimal view for the ideal structure(s).

### Interscalene level brachial plexus block

- Deposition of local anaesthetic around the elements of the brachial plexus emerging through the interscalene groove (around the level of an axial plane through the sixth cervical vertebra)

### Axillary level brachial plexus block

- Deposition of local anaesthetic around axillary elements of the brachial plexus in the proximal, medial arm (around the level of the intersection of biceps brachii and pectoralis major)

### Erector spinae plane block (thoracic)

- Deposition of local anaesthetic in the 'erector spinae interfascial plane' in the upper/mid-thoracic region of the spine e.g., the level of the fifth thoracic vertebra (using a longitudinal/parasagittal probe orientation)

### Rectus sheath block

- Deposition of local anaesthetic in the posterior fascial/tissue plane within the rectus sheath (using a transverse/axial probe orientation)

### Femoral nerve block

- Deposition of local anaesthetic around the femoral nerve in the proximal, anterior thigh (just below the inguinal ligament)

### Adductor canal block

- Deposition of local anaesthetic in the adductor canal, between its commencement in the antero-medial thigh and its end at the adductor hiatus

### Popliteal level sciatic nerve block

- Deposition of local anaesthetic around the sciatic nerve at the level of the popliteal fossa (assuming an equal quality of view for the neural structures at all levels)

### Criteria for Inclusion, Retaining Structures for Voting in Next Round & Exclusion

- Included: ≥75% 'definitely include' (i.e., Response 1)
- Retained for Next Round: >50% 'definitely include' or 'probably include' (i.e., Response 1 or 2)
- Excluded: does not meet either of the above criteria
- * = added after first round (based on free text feedback)

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## Interscalene - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Anterior scalene | Common carotid artery | External jugular vein |
| Middle scalene | Internal jugular vein | Suprascapular artery |
| C5 nerve root | Subclavian artery | Transverse cervical artery |
| C6 nerve root | Vertebral artery | First rib |
| | Transverse process of C5 | Inferior belly of omohyoid |
| | Transverse process of C6 | Trapezius |
| | Transverse process of C7 | Dorsal scapular nerve |
| | Sternocleidomastoid | Long thoracic nerve |
| | C7 nerve root | Lower trunk of brachial plexus |
| | Middle trunk of brachial plexus | Phrenic nerve |
| | Upper trunk of brachial plexus | Superficial cervical plexus nerves |
| | Dome of pleura | Thyroid gland |
| | Prevertebral fascia | |
| | | |
| | *Vagus nerve (CN 10) | |
| | *Deep investing fascia of the neck | |
| | *Pretracheal fascia | |
| | *Carotid sheath | |
| | *Trachea | |
| | *Cricoid | |
| | *Accessory nerve (CN 11) | |
| | *Great auricular nerve | |

## Interscalene - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Anterior scalene | Sternocleidomastoid | Common carotid artery |
| Middle scalene | C7 nerve root | External jugular vein |
| C5 nerve root | Phrenic nerve | Internal jugular vein |
| C6 nerve root | Upper trunk of brachial plexus | Subclavian artery |
| | Prevertebral fascia | Suprascapular artery |
| | | Transverse cervical artery |
| | *Vagus nerve (CN 10) | Vertebral artery |
| | *Deep investing fascia of the neck | First rib |
| | *Pretracheal fascia | Transverse process of C5 |
| | *Carotid sheath | Transverse process of C6 |
| | *Trachea | Transverse process of C7 |
| | *Cricoid | Inferior belly of omohyoid |
| | *Accessory nerve (CN 11) | Trapezius |
| | *Great auricular nerve | Dorsal scapular nerve |
| | | Long thoracic nerve |
| | | Lower trunk of brachial plexus |
| | | Middle trunk of brachial plexus |
| | | Superficial cervical plexus nerves |
| | | Dome of pleura |
| | | Thyroid gland |

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## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

- Vagus nerve (CN 10)
- All four layers of fascia in the neck to be included:
    - Deep investing fascia of the neck (surrounds neck like a collar, splits to invest sternocleidomastoid – comparable to deep fascia that underlies the subcutaneous fat of the limbs)
    - Prevertebral fascia (lies deep to the deep investigation fascia of the neck, in front of the prevertebral muscles, scalenus anterior/medius and levator scapulae)
    - Pretracheal fascia (thin fascia surrounding thyroid gland, lies anterior to trachea and deep to the strap muscles of neck)
    - Carotid sheath (tissue surrounding common and internal carotid artery, internal jugular vein, vagus nerve and some deep cervical lymph nodes)
- Trachea
- Cricoid
- Accessory nerve (CN 11) – from “any other feedback” section
- Great auricular nerve – from “any other feedback” section

Note is made of two responses that ‘superficial cervical plexus’ is incorrect terminology (and should be referred to as ‘superficial branches of cervical plexus’). The point is accepted. However, as the consensus opinion of round one is that these structures as to be excluded from the final list, this terminology will not be included in subsequent rounds (but may feature in the resulting publication).

## Free text feedback

| Interscalene Level Brachial Plexus Block |
|---|
| I don't think one needs to see/specifically seek out the suprascapular or transverse cervical artery as such on either view as a core structure but as a general principle the operator needs to ensure no vessels in the path of needle. So I said not essential in that I don't think we need to be specific, rather just ensure no vessel on screen. |
| In 2007, in a letter to JCA I described Teaching ultrasound-guided interscalene blocks: description of a simple and effective technique, which is how I've been teaching ISB for well over a decade. Only landmarks are carotid artery, first rib/pleura, nerve roots and muscles. doi:10.1016/j.jclinane.2007.02.001 |
| Some crossover I suppose between what practitioners may describe as upper trunk or C5/6 roots |
| 1. Prevertebral fascia: answered as if stated "Investing Layer Deep Cervical Fascia" as Prevertebral Fascia is deep layer of DCF and not needed for this block. 2. Supraclavicular nerves are only nerves of cervical plexus that need visualising; no need to scan all branches of cervical plexus; there is no deep and no superficial cervical plexus... only approaches described in these terms! 3. Essential to view Sup Scap and Trans Cerv Arteries during ourientation but must NOT have them visibke during Block view: esential to exclude them from view but dont know how to describe that in better way! |
| Investing layer of deep cervical fascia. In order to avoid confusion, I believe it is necessary to use the international anatomical nomenclature, which refers to the muscular fascia of the neck as "deep cervical fascia". It is made up of 4 layers, the pretracheal and carotid layers, and those of really interest at the level of the interscalene block: the investing and prevertebral layers. |
| Vagus nerve within the carotid sheath |
| Trachea- scanning view |
| Orientation scanning dependant if its from (1) Supraclavicular fossa or from (2) midline cricoid laterally |
| interscalene view can be variable along the path of the brachial plexus. I made my comments based on what i think is the classic interscalene view. some structure maybe in the picture but the operator may or may not care to name it (preveterbral fascia) so i downgraded those to (2) although they will be there in the picture |

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| |
|---|
| Would expect use of doppler to identify vessels prior to needle insertion but not necessarily exact anatomical identification of those vessels |
| 1. vagus nerve. 2. There is no superficial and deep cervical plexus. It should be named as superficial branches of cervical plexus.3. ISB is not a block that can be done by non expert without understanding the structures as it is very close to neuraxial structures. So minimum skill level should be obtained before starting ISB/STB. |

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## Axillary - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Axillary artery | Brachial artery | Anterior circumflex humeral art |
| Axillary vein(s) | Humerus | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Biceps brachii (short head) | Posterior circumflex humeral art |
| Median nerve | Coracobrachialis | Profunda brachii artery |
| Musculocutaneous nerve | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Venae commitantes of the brachial artery (brachial vein) |
| Radial nerve | | Medial head of triceps |
| Ulnar nerve | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |

## Axillary - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Axillary artery | Humerus | Anterior circumflex humeral art |
| Axillary vein(s) | Biceps brachii (short head) | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Coracobrachialis | Brachial artery |
| Median nerve | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Posterior circumflex humeral art |
| Musculocutaneous nerve | | Profunda brachii artery |
| Radial nerve | | Venae commitantes of the brachial artery (brachial vein) |
| Ulnar nerve | | Medial head of triceps |
| | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |

### Structures added to the Second Round Survey (from Free Text Responses in Round 1)

No additional structures were suggested for inclusion for this block.

Note is made of the responses that 'conjoint tendon of latissimus dorsi/teres major' is incorrect terminology (and should be referred to as the 'common tendon' or 'conjoined fascia'). The point is accepted. Future iterations of the survey will include the terminology 'conjoint (common) tendon' (or the fascia overlying).

They study steering group hope that, despite the tendons inserting onto the humerus independently (latissimus dorsi into the floor of the intertubercular sulcus and teres major


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into the medial lip), this terminology is readily recognisable to the experts involved in this study.

## Free text feedback

| Axillary Level Brachial Plexus Block |
|---|
| For block view I clicked 1 for axillary vein but I would compress it with probe so technically it would not be on screen - but I think we need to be aware of it obviously. |
| Keeping it SIMPLE. |
| Not sure if it's relevant, but it's important for non-experts to trace back the 4 nerves to help correctly identify each nerve. |
| For Block view need to ensure conjoint tendon in view: everything lies above it when this high enough. |
| Need to consider if Intecostobrachial and Median nerve of the arm are defined as part of an Axillary BP block |
| 1. The conjoint tendon is a wrong usage. It should be common tendon or conjoined fascia. The true conjoined tendon is inguinal aponeurotic falx. 2. For axillary brachial plexus the most important structures to have in the final view are the conjoined fascia that is continuous and the 4 nerves ( MN, RN, UN,MCN) above the facia. If the fascia is broken it means the radial nerve is already gone in to the posterior compartment.The ICBN may or may not be visible at that point. |
| Radial nerve can be tricky to find especially for the non-expert. I don't think it is absolutely essential to have on screen during the block (albiet the person blocking should know or strongly suspect where it is) |

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## ESP (Thoracic) - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Rib (head/neck) | Laminae (thoracic vertebrae) | Intercostal neurovascular bundle |
| Transverse process (thoracic vertebrae) | Intercostal muscles | Posterior intercostal membrane |
| Erector spinae muscle group | Trapezius | Superior costotransverse ligament |
| Pleura | Rhomboid major | |
| | | |
| | *Spinous process (thoracic vertebrae) | |

## ESP (Thoracic) - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Transverse process (thoracic vertebrae) | Trapezius | Intercostal neurovascular bundle |
| Erector spinae muscle group | Rhomboid major | Laminae (thoracic vertebrae) |
| | Pleura | Rib (head/neck) |
| | | Intercostal muscles |
| | *Spinous process (thoracic vertebrae) | Posterior intercostal membrane |
| | | Superior costotransverse ligament |

## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

- Spinous process (thoracic vertebrae)

Note is made of the response to include cervical muscle groups in the list of potential structures. As this study focuses on the thoracic region for this block, muscles of that region have been prioritised for inclusion. However, if the respondent wishes to suggest more specifically which muscle(s) to include for review, this structure(s) could be considered for inclusion in the third round.

## Free text feedback

| Erector Spinae Plane Block |
|---|
| Block view needs to be as simple as possible |
| In an axial axis approach: "transversospinalis muscles" (semispinalis, multifidus and rotatores muscles), "spinous process" and "costotransverse articulation for ORIENTATION SCANNING. "transversospinalis muscles" in BLOCK VIEW. |
| spinous process in the orientation |
| The structures that must see are transverse process, erector spinae group of muscles. Depending up on the site of injection the other muscles vary.Eg, lower thoracic level the trapezius and Rhomboids may be absent. Upper thoracic region the ES group of muscles separates outor covered by part of cervical muscle groups. The rib may be visible along with lamina if lateral to medical approach is done similar to PVB |

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## Rectus Sheath - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Rectus abdominis | Deep inferior epigastric artery | Deep inferior epigastric vein |
| Linea alba | External oblique | Superficial inferior epigastric artery |
| Peritoneum | Internal oblique | Superficial inferior epigastric vein |
| Rectus sheath (anterior layer) | Transversus abdominis | Pyramidalis |
| Rectus sheath (posterior layer) | Intra-peritoneal contents | Pre-peritoneal fat |
| | Linea semilunaris | |
| | Transversalis fascia | |

## Rectus Sheath - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Rectus abdominis | Deep inferior epigastric artery | Deep inferior epigastric vein |
| Peritoneum | Intra-peritoneal contents | Superficial inferior epigastric artery |
| Rectus sheath (anterior layer) | Pre-peritoneal fat | Superficial inferior epigastric vein |
| Rectus sheath (posterior layer) | Transversalis fascia | External oblique |
| | | Internal oblique |
| | | Pyramidalis |
| | | Transversus abdominis |
| | | Linea alba |
| | | Linea semilunaris |

## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

N/A

## Free text feedback

| Rectus Sheath Plane Block |
|---|
| Need to include arteries for orientation but ensure not present in block view |
| Tranversalis fascia should be known as a concept but to be viewed is not something I have every looked for or been taught to look for |
| Identifying vessels in the needle path is important - naming them less so for the non-expert |
| Views can be dependant on approach from medial to lateral or Cranial/Caudal to Cranial/Caudal |
| Would expect use of doppler to identify vessels rather than specific anatomical identification of vessels |
| I perform and teach rectus sheath with the rectus muscles in long axis (not as per plan a poster) - hence oblique muscles not visible. I find this more suitable for catheter placement. |
| For rectus sheath block the structures you see depends up on above the umbilical level or below the umbilical level. It also depends up on needle entry from medial to lateral or lateral to medial. Below the arcuate ligament you will see only one layer of posterior rectus sheath. Second layer is peritoneum. In elderly people and women after child birth the transversalis facia is not clearly seen always. The scarring around the rectus abdominal muscle after surgery makes the superficial vessels very difficult to see( even deep vessals) The LA should be betwe en the posterior part of rectus muscle and posterior layer of rectus sheath as a standard so that it doesn't cause damage to intraperitoneal structures even when you do 4 quadrant rectus sheath block and catheter placement. . |
| Important to identify any vessels on orientation view to then avoid on block view |

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## Femoral - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Profunda femoris artery (deep femoral artery) | Lateral circumflex femoral artery |
| Femoral vein (common femoral vein) | Sartorius | Medial circumflex femoral artery |
| Iliacus/iliopsoas | Fascia lata | Superficial circumflex iliac artery |
| Femoral nerve | | Femur |
| Fascia iliaca | | Pectineus |
| | | Tensor fascia lata |

## Femoral - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Femoral vein (common femoral vein) | Lateral circumflex femoral artery |
| Iliacus/iliopsoas | Fascia lata | Medial circumflex femoral artery |
| Femoral nerve | | Profunda femoris artery (deep femoral artery) |
| Fascia iliaca | | Superficial circumflex iliac artery |
| | | Femur |
| | | Pectineus |
| | | Sartorius |
| | | Tensor fascia lata |

## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

No other structures/nomenclature have been suggested by participants in the study. However, the study team have added the term "(deep femoral artery)" to the term profunda femoris artery, for clarity.

## Free text feedback

| Femoral Nerve Block |
|---|
| Nedd to identify arteries potentially at risk of puncture in orientation scan but exclude from field in block view |
| Non-expert should be aware that vessels may in needle path & so should scan for them - but naming them less important |
| Femoral vessals, the fascia over the top of iliopsoas muscle enclosing the femoral nerve above the division of profunda femoris artery ( to avoid missing branches of femoral nerve). Other structures depnds on lateral to medial approach or caudal to cranial approach. |

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## Adductor Canal - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Anterior division of obturator nerve |
| Sartorius | Femur | Posterior division of obturator nerve |
| Vastus medialis | Adductor longus | Medial cutaneous nerve of the thigh |
| Saphenous nerve/nerve complex | Adductor magnus | Medial retinacular nerve |
| | Nerve to vastus medialis | |
| | Vastoadductor membrane | |
| | | |
| | *Anterior cutaneous nerve of the thigh | |

## Adductor Canal - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Femur |
| Sartorius | Adductor longus | Adductor magnus |
| Saphenous nerve/nerve complex | Vastus medialis | Anterior division of obturator nerve |
| | Nerve to vastus medialis | Posterior division of obturator nerve |
| | Vastoadductor membrane | Medial cutaneous nerve of the thigh |
| | | Medial retinacular nerve |
| | *Anterior cutaneous nerve of the thigh | |

## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

- Anterior cutaneous nerve of thigh

## Free text feedback

| Adductor Canal Block |
|---|
| Keep block simple with only three muscles in listed block view; perivascular injection for beginners rarher than nerve block (dont get het up on identifying nerves!) |
| Concept of vast adductor but not needed to be viewed as is a pretty tricky call |
| Non expert should be aware that hyper echoic structures beneath the vasoadductor membrane will represent NVM and saph - but wont be able to always identify - so should realise that careful needle insertion is important |
| The structures depends up on which level of the adductor canal is the injection performed. The nerve to vastus medialis is medial branch at the lower part of the canal and lateral and medial branches in the upper part. The sapenous nerve might have already left the canal before it reaches the adductor hiatus level |
| Like radial nerve the nerve to vastus medialis and saphenous nerve can be tricky to find especially for non-expert. Whilst every attmept should be made to try and find them sometimes they only become 100% appraent when local has been injected. In terms of terminology i would go with anterior cutaneous nerve of the thigh as this covers both intermediate and medial cutaneous nerves of the thigh (which are branches). |

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## Popliteal - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Popliteal artery | Popliteal vein | Fascia lata |
| Common peroneal (fibular) nerve | Femur (popliteal surface) | |
| Sciatic nerve | Biceps femoris | |
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Semimembranosus | |
| Tibial nerve | Semitendinosus | |

## Popliteal - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Popliteal artery | Femur (popliteal surface) |
| | Popliteal vein | Semimembranosus |
| | Biceps femoris | Semitendinosus |
| | Common peroneal (fibular) nerve | Fascia lata |
| | Sciatic nerve | |
| | Tibial nerve | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## Structures added to the Second Round Survey (from Free Text Responses in Round 1)

N/A

## Free text feedback

| Popliteal Level Sciatic Nerve Block |
|---|
| Block view designed to avoid vascular structures so not essential to include in this 'part' of block. |
| Naming muscles not important - only for orientation med to lat |
| Need to define level of politeal block as this may vary from practitioner to practitioner |
| Would perform block at level where nerve/s best identified either as sciatic or at point of divergence - depends on ultrasound images |
| Ideally I perform just after the nerve has split (divergence point) but is still within the paraneural sheath, but if view is better a little further distally then would recommend that entry point. So, sciatic, divergent sciatic, or Tib/com fib nerves could all be essential. |
| In some individuals the components of sciatic nerves are never together. So identifying both components and scanning upwards to see them being together or not is critical to make sure they are blocked. Tibial component alone can be misinterpreted as popliteal sciatic nerve especially in thin individuals. |
| I think the surrouding structures are important for orientation but once you trace the nerve(s) proximally and have your target the only structures important are the nerves. I have maked sciatic, divergence and the nerves as essential as the actual location of the block can vary depending on the anatomy of the patient (some patients may have a nice superficial sciatic. Others will have a deep sciatic and the best image is tibial and peroneal distally. |

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## Other free text feedback

| Any Other Feedback |
|---|
| One can consider dividing structure that need to be visualized in to those promoting success (e.gnerves) and those increasing safety (e.g vessels) |
| improve anatomical description of various anatomical structures mentioned in survey |
| think conceptually understanding where certain anatomy is rather than visualising is important such as vertebral artery or vast-adductor but this is different to view and identify by ultrasound. Excellent work thank you for asking me to be part of the project |
| A very useful study which could be basis for the competencies of Plan A blocks. |
| I have tried to identify, on the one hand, the structures that I consider necessary to identify during the scan. On the other hand, I have also tried to identify the structures that need to be identified during the block. In some approaches, I am afraid I am a bit confused. For example: at the interscalene level, I consider that it is important to identify numerous adjacent structures, such as the dorsal scapular and long thoracic nerves through the middle scalene muscle, the supraclavicular nerve of the superficial cervical plexus between the investing and prevertebral layers just above the middle scalene muscle, the phrenic nerve over the anterior scalene muscle, or identify the cranial nerve XI during in-plane insertion of a catheter tunnelled from the posterior neck, or the greater auricular nerve in out-of-plane approaches if tunnelled from cephalad. But all these nerves are small and often very difficult to identify even for experts. I consider it more important to instil concepts such as: do not perform an in-plane approach from anterior because there is a risk of injury to the phrenic nerve overlying the anterior scalene muscle, beware of "white" images within the middle scalene, which may correspond to the dorsal nerve of the scapula or the long thoracic nerve, etc. In the definition of essential structures for the adductor canal block, I have pointed out those corresponding to the adductor canal from a strictly anatomical point of view. There is too much confusion in the literature between the different levels of the adductor canal, which often correspond anatomically to approaches at different levels of the femoral triangle. |
| Popliteal block question is very confusing |
| A number of the structures are important to know exist, so you don't needle them, but aren't necessarily vital to see in your orientation / block view |
| 1. Please specify the exact anatomical level/ location of performing the block as the structures seen will be different. Eg- ESP, adductor canal, popliteal.2. Consider the chronic pain situations as well. These blocks are performed in chronic pain or post surgical patients for acute surgery where the anatomy is varied. So structures like fascia and some superficial vessels and nerves may not be visible.3. Include the bare minimum structures needed to be identified to do a block SAFELY at a specific anatomical location before needle is inserted and block performed. |

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## Supplementary File C – Second Round Results

A graphical representation of results can be found here:
https://docs.google.com/forms/d/1UM6nd_MMtj0RRuFfX4YuGnpbBX7b3LAytpvYOWY2OnU/viewanalytics

### Anatomical level of Blocks

Some participants have asked for clarification on the anatomical level of specific blocks. We appreciate the need for clarity but wish to avoid undue influence on scoring through naming specific anatomical structures when describing the block site. Therefore, we have provided a description of each block (including anatomical level) below, whilst trying to avoid a leading explanation. Where specific terminology has been used in the block name (e.g., a nerve/muscle is mentioned by name), that has been used in the description.

When you rate each anatomical structure, please do so in the context of this information and what you believe to be the correct block level/target given the names of the blocks considered. Please also assume the block is done on a subject with what you understand to be 'normal' anatomy, with an optimal view for the ideal structure(s).

### Interscalene level brachial plexus block

- Deposition of local anaesthetic around the elements of the brachial plexus emerging through the interscalene groove (around the level of an axial plane through the sixth cervical vertebra)

### Axillary level brachial plexus block

- Deposition of local anaesthetic around axillary elements of the brachial plexus in the proximal, medial arm (around the level of the intersection of biceps brachii and pectoralis major)

### Erector spinae plane block (thoracic)

- Deposition of local anaesthetic in the 'erector spinae interfascial plane' in the upper/mid-thoracic region of the spine e.g., the level of the fifth thoracic vertebra (using a longitudinal/parasagittal probe orientation)

### Rectus sheath block

- Deposition of local anaesthetic in the posterior fascial/tissue plane within the rectus sheath (using a transverse/axial probe orientation)

### Femoral nerve block

- Deposition of local anaesthetic around the femoral nerve in the proximal, anterior thigh (just below the inguinal ligament)

### Adductor canal block

- Deposition of local anaesthetic in the adductor canal, between its commencement in the antero-medial thigh and its end at the adductor hiatus

### Popliteal level sciatic nerve block

- Deposition of local anaesthetic around the sciatic nerve at the level of the popliteal fossa (assuming an equal quality of view for the neural structures at all levels)

### Criteria for Inclusion, Retaining Structures for Voting in Next Round & Exclusion

- Included: ≥75% 'definitely include' (i.e., Response 1)
- Retained for Next Round: >50% 'definitely include' or 'probably include' (i.e., Response 1 or 2)
- Excluded: does not meet either of the above criteria
- * = added after first round (based on free text feedback)

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## Interscalene - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Anterior scalene | Common carotid artery | External jugular vein |
| Middle scalene | Internal jugular vein | Suprascapular artery |
| C5 nerve root | Subclavian artery | Transverse cervical artery |
| C6 nerve root | Vertebral artery | First rib |
| Upper trunk of brachial plexus | Transverse process of C5 | Inferior belly of omohyoid |
| | Transverse process of C6 | Trapezius |
| | Transverse process of C7 | Dorsal scapular nerve |
| | Sternocleidomastoid | Long thoracic nerve |
| | C7 nerve root | Lower trunk of brachial plexus |
| | Middle trunk of brachial plexus | Phrenic nerve |
| | | Superficial cervical plexus nerves |
| | | Thyroid gland |
| | | Dome of pleura |
| | | Prevertebral fascia |
| | | Vagus nerve (CN 10) |
| | | Deep investing fascia of the neck |
| | | Pretracheal fascia |
| | | Carotid sheath |
| | | Trachea |
| | | Cricoid |
| | | Accessory nerve (CN 11) |
| | | Great auricular nerve |

## Interscalene - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Anterior scalene | Sternocleidomastoid | Common carotid artery |
| Middle scalene | C7 nerve root | External jugular vein |
| C5 nerve root | Upper trunk of brachial plexus | Internal jugular vein |
| C6 nerve root | | Subclavian artery |
| | | Suprascapular artery |
| | | Transverse cervical artery |
| | | Vertebral artery |
| | | First rib |
| | | Transverse process of C5 |
| | | Transverse process of C6 |
| | | Transverse process of C7 |
| | | Inferior belly of omohyoid |
| | | Trapezius |
| | | Dorsal scapular nerve |
| | | Long thoracic nerve |
| | | Lower trunk of brachial plexus |
| | | Middle trunk of brachial plexus |
| | | Superficial cervical plexus nerves |
| | | Dome of pleura |
| | | Thyroid gland |
| | | Phrenic nerve |
| | | Prevertebral fascia |
| | | Vagus nerve (CN 10) |

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| | | |
|---|---|---|
| | | Deep investing fascia of the neck |
| | | Pretracheal fascia |
| | | Carotid sheath |
| | | Trachea |
| | | Cricoid |
| | | Accessory nerve (CN 11) |
| | | Great auricular nerve |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note is made of response that states the correct anatomical terminology is 'investing layer of deep cervical fascia'. The point is accepted. As the consensus opinion of round one is that this structure is to be excluded from the final list, this terminology will not be included in subsequent rounds but may feature in any resulting publication.

Note is also made of the request to be more specific with the end point of the block – please refer to the block descriptions above. Similarly, one participant commented on the need to include the 'two scalene muscles' – these have already been accepted for inclusion for both orientation scanning for the block view.

## Free text feedback

| Interscalene Level Brachial Plexus Block |
|---|
| I would like to suggest, not a structure, but a required core action, before needling: doppler scanning looking for blood vessels in the potential needle trajectory and close to the nerve target |
| I still have a problem separating scanning and block view and consider them a continuous activity for the purpose of describing the activity to a non-expert. Same for all blocks... |
| Might want to be more specific about block end-point: upper trunk versus C5/6/7 nerve roots. |
| Non-expert should be able to identify C5/C6/trunks but not necessarily differentiate between them - i.e. know they are the target nerves |
| Cannot understand why plane of Dorsal Scapula Nerve (not necessarily nerve itself) is excluded: this is the one structure most likely to be injured in this block and it must be avoided. Excluding it from the anatomical setup menas it will be ingnored and pootentially injured. Also anatomists teach "Investing layer of deep cervical fascia" as a term not the more simplified term, but I understadn why that might be favoured... |
| C5 identification correctly is key to success of ISBP block. If C5 is missed( high riding C5)the block will be insufficient for shoulder. |
| we did not include the two scalene muscles which i think should be included in the final view of the interscalene |

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## Axillary - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Axillary artery | Brachial artery | Anterior circumflex humeral art |
| Axillary vein(s) | Humerus | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Biceps brachii (short head) | Posterior circumflex humeral art |
| Median nerve | Coracobrachialis | Profunda brachii artery |
| Musculocutaneous nerve | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Venae commitantes of the brachial artery (brachial vein) |
| Radial nerve | | Medial head of triceps |
| Ulnar nerve | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |

## Axillary - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Axillary artery | Humerus | Anterior circumflex humeral art |
| Axillary vein(s) | Biceps brachii (short head) | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Coracobrachialis | Brachial artery |
| Median nerve | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Posterior circumflex humeral art |
| Musculocutaneous nerve | | Profunda brachii artery |
| Radial nerve | | Venae commitantes of the brachial artery (brachial vein) |
| Ulnar nerve | | Medial head of triceps |
| | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note is made of the response that querying "I am assuming we do not mean the axillary artery when we say brachial artery…" This is correct: the axillary artery has already been accepted for inclusion in orientation scanning and the block view. The remaining structure referred to is specifically the brachial artery.

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## Free text feedback

| Axillary Level Brachial Plexus Block |
|---|
| Identifying the muscles by name not important, identifying conjoint tendon is important. Identifying artery by name less important |
| View of humerus depends on depth of image for block view. Usually not in an optimised image as too deep. |
| Including Brachila artery in Orienttation ensures dynamic approach to sonoanatomical appreciation during block planning: must move donw arm a little or will not appreciate nerves! Block view should ensure conjoint tendon visible, then there is no need to include any structure that lies deep to this! |
| I am assuming we do not mean the axillary artery when we say brachial artery, correct? |

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## ESP (Thoracic) - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Rib (head/neck) | Laminae (thoracic vertebrae) | Intercostal neurovascular bundle |
| Transverse process (thoracic vertebrae) | Trapezius | Posterior intercostal membrane |
| Erector spinae muscle group | Rhomboid major | Superior costotransverse ligament |
| Pleura | Spinous process (thoracic vertebrae) | Intercostal muscles |

## ESP (Thoracic) - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Transverse process (thoracic vertebrae) | Trapezius | Intercostal neurovascular bundle |
| Erector spinae muscle group | Rhomboid major | Laminae (thoracic vertebrae) |
| | Pleura | Rib (head/neck) |
| | | Intercostal muscles |
| | | Posterior intercostal membrane |
| | | Superior costotransverse ligament |
| | | Spinous process (thoracic vertebrae) |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note is made of the responses that query the level of the block (with respect to rhomboid major) and orientation of the ultrasound probe. Please refer to the block description which the study group believes addresses these points.

## Free text feedback

| Erector Spinae Plane Block |
|---|
| Identifying & naming muscles less important than identifying bony end point |
| I thought it would be useful to identify the transition between ribs and transverse process during the orientation scanning ( appreciate the ribs have been excluded in the 1st round |
| Surely rhomboids are dependant on level - if low thoracic will not be present |
| Level of thoracic ESP need to be mentioned (high/mid thoracic) as lower down the rhomboids may not be particularly well seen and sagittal/transverse view to be mentioned, as a few structures will be seen in the transverse view (e.g. Spinous process) |
| In the thoracic level the spinous process and corresponding vertebral level can be very confusing |

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## Rectus Sheath - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Rectus abdominis | External oblique | Deep inferior epigastric vein |
| Linea alba | Internal oblique | Superficial inferior epigastric artery |
| Peritoneum | Transversus abdominis | Superficial inferior epigastric vein |
| Rectus sheath (anterior layer) | Intra-peritoneal contents | Pyramidalis |
| Rectus sheath (posterior layer) | Linea semilunaris | Pre-peritoneal fat |
| | Transversalis fascia | Deep inferior epigastric artery |
| | | |

## Rectus Sheath - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Rectus abdominis | Intra-peritoneal contents | Deep inferior epigastric vein |
| Peritoneum | Transversalis fascia | Superficial inferior epigastric artery |
| Rectus sheath (anterior layer) | | Superficial inferior epigastric vein |
| Rectus sheath (posterior layer) | | External oblique |
| | | Internal oblique |
| | | Pyramidalis |
| | | Transversus abdominis |
| | | Linea alba |
| | | Linea semilunaris |
| | | Deep inferior epigastric artery |
| | | Pre-peritoneal fat |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note that the deep inferior epigastric artery has been excluded from both stages of scanning. This structure scored exactly 50% for definitely/probably include. The criteria for retaining the structure is >50% 'definitely include' or 'probably include' (but not scoring ≥75% 'definitely include').

## Free text feedback

| Rectus Sheath Plane Block |
|---|
| The second and deeper line of the tramline consists in the fusion of the transversalis fascia (thicker, especially below the umbilicus) and the peritoneum.Although it is not essential when performing a block, I think it is useful to know the concept. |
| Naming abdo wall muscles not important but defining the rectus in relation to them is important |
| As for all blocks, Orientation should concentrate on anaatomy for block and anatommy that must be avoided! Block view should concentrate on target anatomy only... |
| Identification of abdominal muscles is important if lateral to medical approach is done. |

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## Femoral - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Profunda femoris artery (deep femoral artery) | Lateral circumflex femoral artery |
| Femoral vein (common femoral vein) | Fascia lata | Medial circumflex femoral artery |
| Iliacus/iliopsoas | | Superficial circumflex iliac artery |
| Femoral nerve | | Femur |
| Fascia iliaca | | Pectineus |
| | | Tensor fascia lata |
| | | Sartorius |

## Femoral - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Femoral vein (common femoral vein) | Lateral circumflex femoral artery |
| Iliacus/iliopsoas | Fascia lata | Medial circumflex femoral artery |
| Femoral nerve | | Profunda femoris artery (deep femoral artery) |
| Fascia iliaca | | Superficial circumflex iliac artery |
| | | Femur |
| | | Pectineus |
| | | Sartorius |
| | | Tensor fascia lata |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note that sartorius has now been excluded from both stages of scanning. This structure scored exactly 50% for definitely/probably include in the orientation scanning phase in round 2. The criteria for retaining the structure is >50% 'definitely include' or 'probably include' (but not scoring ≥75% 'definitely include').

## Free text feedback

| Femoral Nerve Block |
|---|
| During the scan I consider it essential to identify the deep femoral artery in order to identify the appropriate level of the femoral block, just above the fusion of the deep femoral artery with the common femoral artery. |
| Naming deep femoral artery not important; appreciating the division of the artery to position block level is important |
| Often pushing hard so can't see vein |

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## Adductor Canal - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Anterior division of obturator nerve |
| Sartorius | Femur | Posterior division of obturator nerve |
| Vastus medialis | Adductor longus | Medial cutaneous nerve of the thigh |
| Saphenous nerve/nerve complex | Adductor magnus | Medial retinacular nerve |
| | Nerve to vastus medialis | Anterior cutaneous nerve of the thigh |
| | Vastoadductor membrane | |

## Adductor Canal - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Femur |
| Sartorius | Adductor longus | Adductor magnus |
| Saphenous nerve/nerve complex | Vastus medialis | Anterior division of obturator nerve |
| | Vastoadductor membrane | Posterior division of obturator nerve |
| | | Medial cutaneous nerve of the thigh |
| | | Medial retinacular nerve |
| | | Nerve to vastus medialis |
| | | Anterior cutaneous nerve of the thigh |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

Note that the nerve to vastus medialise has now been excluded from the block view stage. This structure scored exactly 50% for definitely/probably include in the block view phase in round 2. The criteria for retaining the structure is >50% 'definitely include' or 'probably include' (but not scoring ≥75% 'definitely include').

## Free text feedback

| Adductor Canal Block |
|---|
| A non expert does not need to differentiate between the adductor muscles, but should identify the adductor muscle bulk for orientation and block view |
| Naming/recognising muscles except sartorius not important. Recognising N to VM is probably not important but recognising and avoiding hyperechoic structures in the needle path and using careful hydrodissection is important |
| May be useful to say proximal Adductor canal block (though appreciate nomenclature contentious) |

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## Sciatic (Popliteal) - ORIENTATION

| Included | Retained for next round | Excluded |
|---|---|---|
| Popliteal artery | Popliteal vein | Fascia lata |
| Common peroneal (fibular) nerve | Femur (popliteal surface) | |
| Sciatic nerve | Biceps femoris | |
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Semimembranosus | |
| Tibial nerve | Semitendinosus | |

## Sciatic (Popliteal) - BLOCK

| Included | Retained for next round | Excluded |
|---|---|---|
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Popliteal artery | Femur (popliteal surface) |
| Common peroneal (fibular) nerve | Popliteal vein | Semimembranosus |
| Sciatic nerve | Biceps femoris | Semitendinosus |
| Tibial nerve | | Fascia lata |

## Structures added to the Third Round Survey (from Free Text Responses in Round 2)

No additional structures were suggested for consideration.

## Free text feedback

| Popliteal Level Sciatic Nerve Block |
|---|
| Identifying and naming muscles less important; however appreciating that common peroneal n will travel laterally towards biceps femoris m is useful |
| I would suggest active scanning of all 3 points for both orientation and then during performance of block (sciatic, divergence & individual nerves) |
| Block will usually be either both nerves together (sciatic) or separate. Usually compromise between view and how for cephalic you go |

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## Other free text feedback

| Any Other Feedback |
|---|
| Features of the block view should all be present on orientation scanning. It may be helpful for future similar work to conclu de an orientation scanning Delphi prior to commencing a block view Delphi (e.g. for plan B,C&D blocks). |
| Good luck this is a great idea |
| It's great going. Thanks for this comprehensive study. |
| Over simplification of blocks may compromise safety of block. So minimum structures should be identified. DSN is an example while doing ISB |
| thank you for taking on this effort |

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## Supplementary File C – Third Round Results

A graphical representation of results can be found here:
https://docs.google.com/forms/d/1o5pTwaL9BkuaTHxg5JcfP8EXkl3k4lCUfdw1D7NYdEw/viewanalytics

### Anatomical level of Blocks

Some participants have asked for clarification on the anatomical level of specific blocks. We appreciate the need for clarity but wish to avoid undue influence on scoring through naming specific anatomical structures when describing the block site. Therefore, we have provided a description of each block (including anatomical level) below, whilst trying to avoid a leading explanation. Where specific terminology has been used in the block name (e.g., a nerve/muscle is mentioned by name), that has been used in the description.

When you rate each anatomical structure, please do so in the context of this information and what you believe to be the correct block level/target given the names of the blocks considered. Please also assume the block is done on a subject with what you understand to be 'normal' anatomy, with an optimal view for the ideal structure(s).

### Interscalene level brachial plexus block

- Deposition of local anaesthetic around the elements of the brachial plexus emerging through the interscalene groove (around the level of an axial plane through the sixth cervical vertebra)

### Axillary level brachial plexus block

- Deposition of local anaesthetic around axillary elements of the brachial plexus in the proximal, medial arm (around the level of the intersection of biceps brachii and pectoralis major)

### Erector spinae plane block (thoracic)

- Deposition of local anaesthetic in the 'erector spinae interfascial plane' in the upper/mid-thoracic region of the spine e.g., the level of the fifth thoracic vertebra (using a longitudinal/parasagittal probe orientation)

### Rectus sheath block

- Deposition of local anaesthetic in the posterior fascial/tissue plane within the rectus sheath (using a transverse/axial probe orientation)

### Femoral nerve block

- Deposition of local anaesthetic around the femoral nerve in the proximal, anterior thigh (just below the inguinal ligament)

### Adductor canal block

- Deposition of local anaesthetic in the adductor canal, between its commencement in the antero-medial thigh and its end at the adductor hiatus

### Popliteal level sciatic nerve block

- Deposition of local anaesthetic around the sciatic nerve at the level of the popliteal fossa (assuming an equal quality of view for the neural structures at all levels)

### Criteria for Inclusion, Retaining Structures for Voting in Next Round & Exclusion

- Included: ≥75% 'definitely include' (i.e., Response 1)
- Retained for Next Round: >50% 'definitely include' or 'probably include' (i.e., Response 1 or 2)
- Excluded: does not meet either of the above criteria
- * = added after first round (based on free text feedback)

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## Interscalene - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Anterior scalene | Common carotid artery | External jugular vein |
| Middle scalene | Internal jugular vein | Suprascapular artery |
| C5 nerve root | Subclavian artery | Transverse cervical artery |
| C6 nerve root | Transverse process of C5 | First rib |
| Upper trunk of brachial plexus | Transverse process of C6 | Inferior belly of omohyoid |
| | Sternocleidomastoid | Trapezius |
| | C7 nerve root | Dorsal scapular nerve |
| | Middle trunk of brachial plexus | Long thoracic nerve |
| | | Lower trunk of brachial plexus |
| | | Phrenic nerve |
| | | Superficial cervical plexus nerves |
| | | Thyroid gland |
| | | Dome of pleura |
| | | Prevertebral fascia |
| | | Vagus nerve (CN 10) |
| | | Deep investing fascia of the neck |
| | | Pretracheal fascia |
| | | Carotid sheath |
| | | Trachea |
| | | Cricoid |
| | | Accessory nerve (CN 11) |
| | | Great auricular nerve |
| | | Vertebral artery |
| | | Transverse process of C7 |

## Interscalene - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Anterior scalene | Sternocleidomastoid | Common carotid artery |
| Middle scalene | C7 nerve root | External jugular vein |
| C5 nerve root | Upper trunk of brachial plexus | Internal jugular vein |
| C6 nerve root | | Subclavian artery |
| | | Suprascapular artery |
| | | Transverse cervical artery |
| | | Vertebral artery |
| | | First rib |
| | | Transverse process of C5 |
| | | Transverse process of C6 |
| | | Transverse process of C7 |
| | | Inferior belly of omohyoid |
| | | Trapezius |
| | | Dorsal scapular nerve |
| | | Long thoracic nerve |
| | | Lower trunk of brachial plexus |
| | | Middle trunk of brachial plexus |
| | | Superficial cervical plexus nerves |
| | | Dome of pleura |
| | | Thyroid gland |
| | | Phrenic nerve |

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| | | |
|---|---|---|
| | | Prevertebral fascia |
| | | Vagus nerve (CN 10) |
| | | Deep investing fascia of the neck |
| | | Pretracheal fascia |
| | | Carotid sheath |
| | | Trachea |
| | | Cricoid |
| | | Accessory nerve (CN 11) |
| | | Great auricular nerve |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Interscalene Level Brachial Plexus Block |
|---|
| It is logical to exclude C7 root from the inter scalene block view, as the level has been defined as C6 |
| I think the C5,,6,7 nerve roots and interscalene muscles are the most useful landmarks practical terms. |
| Whether the trunks need to be specifically visualised depends on whether an upper trunk block or a more classical interscalene block is being performed. Identifying individual nerve roots and their corresponding TPs vital for cases where anatomy is not typical - a common scenario. |
| We need to include anterior scalene muscle, middle scalene muscle and dorsal scapular nerve. External jugular vein is not that important for in plane approach, but should be visualised before the out of plane approach. We should also specify the spread of LA - lateral (posterolateral) to C5/C6 roots |
| 1-for the block view, how do you define the upper trunk. 2- for the SCM, does it matter if we are referring to the body of the muscle or the pos border? |
| I still feel the DSN and LTN identification/awareness is important before needling. |

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## Axillary - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Axillary artery | Brachial artery | Anterior circumflex humeral art |
| Axillary vein(s) | Humerus | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Biceps brachii (short head) | Posterior circumflex humeral art |
| Median nerve | Coracobrachialis | Profunda brachii artery |
| Musculocutaneous nerve | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Venae commitantes of the brachial artery (brachial vein) |
| Radial nerve | | Medial head of triceps |
| Ulnar nerve | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |

## Axillary - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Axillary artery | Biceps brachii (short head) | Anterior circumflex humeral art |
| Axillary vein(s) | Coracobrachialis | Basilic vein |
| Conjoint (common) tendon of latissimus dorsi/teres major | Fascia overlying the conjoint (common) tendon of latissimus dorsi/teres major | Brachial artery |
| Median nerve | | Posterior circumflex humeral art |
| Musculocutaneous nerve | | Profunda brachii artery |
| Radial nerve | | Venae commitantes of the brachial artery (brachial vein) |
| Ulnar nerve | | Medial head of triceps |
| | | Intercostobrachial nerve |
| | | Medial cutaneous nerve of arm |
| | | Medial cutaneous nerve of forearm |
| | | Deep investing fascia of the arm (deep brachial fascia) |
| | | Humerus |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Axillary Level Brachial Plexus Block |
|---|
| I don't think identifying CB and SHoB is difficult and is really helpful for identifying MCN and common variations in its course. |
| humerus should only be visible on pre block scanning. After that, depth should be decreased in order to have artery, conjoint tendon, biceps/coracobrachialis and nerves on the screen during the block performance. Probe should be slightly lifted to identify vein(s) especially when approaching ulnar nerve |
| Including SH Biceps and CoracoBrach in both orientation and block ensures MusculoCut Nerve is addressed adequately: failed block without... |
| As all the structures are in the anterior compartment, humerus visualisation should not be a must before injecting |

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## ESP (Thoracic) - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Rib (head/neck) | Laminae (thoracic vertebrae) | Intercostal neurovascular bundle |
| Transverse process (thoracic vertebrae) | Trapezius | Posterior intercostal membrane |
| Erector spinae muscle group | Rhomboid major | Superior costotransverse ligament |
| Pleura | Spinous process (thoracic vertebrae) | Intercostal muscles |

## ESP (Thoracic) - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Transverse process (thoracic vertebrae) | Trapezius | Intercostal neurovascular bundle |
| Erector spinae muscle group | Rhomboid major | Laminae (thoracic vertebrae) |
| | Pleura | Rib (head/neck) |
| | | Intercostal muscles |
| | | Posterior intercostal membrane |
| | | Superior costotransverse ligament |
| | | Spinous process (thoracic vertebrae) |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Erector Spinae Plane Block |
|---|
| Naming muscles is for the entertainment of an expert alone |
| Pleura visualisation important for pressman, but not for actual block performance. Rhomboid muscle important only for upper thoracic ESP block down to T5 level. |
| Pleura and non-TP anatomy important for orientation but block should concentrate on TP (edge) and muscles above/below target site. |
| Should be able to identify that a muscle is above the transverse process, but does not have to name it as Rhomboid or trapezius, just know what muscle looks like on ultrasound |

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## Rectus Sheath - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Rectus abdominis | External oblique | Deep inferior epigastric vein |
| Linea alba | Internal oblique | Superficial inferior epigastric artery |
| Peritoneum | Transversus abdominis | Superficial inferior epigastric vein |
| Rectus sheath (anterior layer) | Intra-peritoneal contents | Pyramidalis |
| Rectus sheath (posterior layer) | Linea semilunaris | Pre-peritoneal fat |
| | Transversalis fascia | Deep inferior epigastric artery |
| | | |

## Rectus Sheath - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Rectus abdominis | Intra-peritoneal contents | Deep inferior epigastric vein |
| Peritoneum | Transversalis fascia | Superficial inferior epigastric artery |
| Rectus sheath (anterior layer) | | Superficial inferior epigastric vein |
| Rectus sheath (posterior layer) | | External oblique |
| | | Internal oblique |
| | | Pyramidalis |
| | | Transversus abdominis |
| | | Linea alba |
| | | Linea semilunaris |
| | | Deep inferior epigastric artery |
| | | Pre-peritoneal fat |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Rectus Sheath Plane Block |
|---|
| I think that, especially for a non-expert the identification of the muscles lateral to the RS provides a useful method to add a check of depths scale to the posterior rectus sheath. Simply putting the probe adjacent to the midline and injecting superficial to a a hyper echoic line may lead to error. Also, the deep fascia of the RS is the important marker, deeper lines may represent TF or peritoneum - TF is not consistently seen in my experience. |
| For block performance transversals fascia important and not intraperitoneal content (pressman yes, block performance no). Anything deep to posterior sheath should be avoided anyway, no need to distract the operator during the block. |
| once orientated where bowel content is, often reduce the depth and the bowel content is not on the screen for the actual block performance |

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## Femoral - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Profunda femoris artery (deep femoral artery) | Lateral circumflex femoral artery |
| Femoral vein (common femoral vein) | Fascia lata | Medial circumflex femoral artery |
| Iliacus/iliopsoas | | Superficial circumflex iliac artery |
| Femoral nerve | | Femur |
| Fascia iliaca | | Pectineus |
| | | Tensor fascia lata |
| | | Sartorius |

## Femoral - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Femoral artery (common femoral artery) | Femoral vein (common femoral vein) | Lateral circumflex femoral artery |
| Iliacus/iliopsoas | Fascia lata | Medial circumflex femoral artery |
| Femoral nerve | | Profunda femoris artery (deep femoral artery) |
| Fascia iliaca | | Superficial circumflex iliac artery |
| | | Femur |
| | | Pectineus |
| | | Sartorius |
| | | Tensor fascia lata |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Femoral Nerve Block |
|---|
| Identifyng the split of CFA into SFA and PF is a very useful marker - below which the femoral nerve has usually split and is harder to visualise/block. |
| during the block performance femoral vein not important. Bifurcation of femoral artery to deep&superficial absolutely necessary |
| femoral vein may or may not be visible on the US screen when performing block |

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## Adductor Canal - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Anterior division of obturator nerve |
| Sartorius | Femur | Posterior division of obturator nerve |
| Vastus medialis | Adductor longus | Medial cutaneous nerve of the thigh |
| Saphenous nerve/nerve complex | Adductor magnus | Medial retinacular nerve |
| | Nerve to vastus medialis | Anterior cutaneous nerve of the thigh |
| | Vastoadductor membrane | |

## Adductor Canal - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Femoral artery (superficial femoral artery) | Femoral vein (superficial femoral vein) | Femur |
| Sartorius | Adductor longus | Adductor magnus |
| Saphenous nerve/nerve complex | Vastus medialis | Anterior division of obturator nerve |
| | Vastoadductor membrane | Posterior division of obturator nerve |
| | | Medial cutaneous nerve of the thigh |
| | | Medial retinacular nerve |
| | | Nerve to vastus medialis |
| | | Anterior cutaneous nerve of the thigh |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Adductor Canal Block |
|---|
| I don't think it is helpful for non-experts to differentiate between adductor longus and magnus |
| For block performance, adductor longus lies on opposite site of the artery and I don't think its necessary to keep an eye on it during the block (pressman yes - in order to find the injection points the tip of femoral triangle/ beginning of adductor canal). |
| Again the practitioner should know that there is a muscle medially but does not have to distinguish between different add uctors |

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## Sciatic (Popliteal) - ORIENTATION

| Included | Consensus not reached | Excluded |
|---|---|---|
| Popliteal artery | Popliteal vein | Fascia lata |
| Common peroneal (fibular) nerve | Femur (popliteal surface) | |
| Sciatic nerve | Biceps femoris | |
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Semimembranosus | |
| Tibial nerve | Semitendinosus | |

## Sciatic (Popliteal) - BLOCK

| Included | Consensus not reached | Excluded |
|---|---|---|
| Sciatic nerve where elements (tibial and common peroneal/fibular) diverge | Popliteal artery | Femur (popliteal surface) |
| Common peroneal (fibular) nerve | Popliteal vein | Semimembranosus |
| Sciatic nerve | Biceps femoris | Semitendinosus |
| Tibial nerve | | Fascia lata |

## Structures added

No additional structures were suggested for consideration.

## Free text feedback

| Popliteal Level Sciatic Nerve Block |
|---|
| As sciatic nerve where elements diverge is included in the block view, it does not make sense to include the sciatic nerve, the tibial nerve or the common peroneal nerve. |
| Vessels important in orientation but not in actual block performance: should be avoiding by then! |

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## Other Free Text Feedback

| Any Other Feedback |
|---|
| As per our conversation…I was hoping to show that the novice learner need not worry about specific muscles for anything but plane blocks, and just rely on vascular structures, but my colleagues don't all seem to agree…very interesting. |
| In addition to the core minimum structures which must be identified, it would be having a list of essential structures that the anaesthetist should be aware of due to risk of damage, for example dorsal scapular nerve in interscalene block, epigastric vessels in rectus blocks. These structures although not essential to performing the blocks, lie close to the potential needle path and would cause complications if damaged. |
| LA spread and needle tip must be identified during all blocks |
| Thank you for including me |
| Broadly agree with comment about separating Orientation from Block: narrative needs to explain that appreciation of anatomy is continuous but that focussing on block target is but one aspect of safe practice. "USGRA is a dynamic technique of safely guiding a needle to a selected target"? |
| Include tips and tricks as a part- eg caudal tilt for popliteal nerve block. |

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## Supplementary File E - Summary of Structure Allocation after each Rating Round

| Rating Stage (Total Structures) | Block (Total Structures) | Orientation Scanning (Included; Retained; Excluded) | Block View (Included; Retained; Excluded) |
|---|---|---|---|
| **Round 1 (118)** | **ISB (29)** | 4; 13; 12 (8 added for next round) | 4; 5; 20 (8 added for next round) |
| | **AxBP (22)** | 7; 5; 10 | 7; 4; 11 |
| | **ESP (11)** | 4; 4; 3 (1 added for next round) | 2; 3; 6 (1 added for next round) |
| | **RSB (17)** | 5; 7; 5 | 4; 4; 9 |
| | **FNB (14)** | 5; 3; 6 | 4; 2; 8 |
| | **ACB (14)** | 4; 6; 4 (1 added for next round) | 3; 5; 6 (1 added for next round) |
| | **SNB (11)** | 5; 5; 1 | 1; 6; 4 |
| | **Total (118)** | **34; 43; 41 (10 added)** | **25; 29; 64 (10 added)** |
| **Round 2 (128)** | **ISB (37)** | 5; 10; 22 | 4; 3; 30 |
| | **AxBP (22)** | 7; 5; 10 | 7; 4; 11 |
| | **ESP (12)** | 4; 4; 4 | 2; 3; 7 |
| | **RSB (17)** | 5; 6; 6 | 4; 2; 11 |
| | **FNB (14)** | 5; 2; 7 | 4; 2; 8 |
| | **ACB (15)** | 4; 6; 5 | 3; 4; 8 |
| | **SNB (11)** | 5; 5; 1 | 4; 3; 4 |
| | **Total (128)** | **35; 38; 55** | **28; 21; 79** |
| **Round 3 (128)** | **ISB (37)** | 5; 8; 24 | 4; 3; 30 |
| | **AxBP (22)** | 7; 5; 10 | 7; 3; 12 |
| | **ESP (12)** | 4; 4; 4 | 2; 3; 7 |
| | **RSB (17)** | 5; 6; 6 | 4; 2; 11 |
| | **FNB (14)** | 5; 2; 7 | 4; 2; 8 |
| | **ACB (15)** | 4; 6; 5 | 3; 4; 8 |
| | **SNB (11)** | 5; 5; 1 | 4; 3; 4 |
| | **Total (128)** | **35; 36; 57** | **28; 20; 80** |