Blocks for procedures of the knee...

ULTRASOUND GUIDED ADDUCTOR CANAL BLOCK

Highlights the essentials for understanding and performance of this block



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ADDUCTOR CANAL BLOCK (ACB)

Controversy arises in the literature whether the initially described technique was in fact, an Adductor Canal Block. Based on current understanding, an 'Adductor Canal' Block AND 'Sub-Sartorial block of the Saphenous nerve at the mid-thigh' or a 'Femoral Triangle Block' are two separate techniques with different clinical effects.

The difference being:

- i) Anatomically the true Adductor Canal is more distal than the described mid-thigh approach. 'Mid-thigh' was described as being 'between ASIS and the base of the patella' while cadaver dissection showed that the Adductor Canal is roughly at the midpoint between 'lower border of Greater Trochanter and the base of the patella'. Therefore the described 'mid-thigh' approach is proximal to the true Adductor Canal.
- ii) At the mid-thigh level only the femoral vessels and saphenous nerve lie within this 'canal' whereas within the true Adductor Canal, saphenous nerve, femoral vessels, nerve to vastus medialis and posterior branch of obturator nerve (this branch may or may not be within the canal) are the structures that lie within this parts.

.... IMPORTANT POINT #1

In spite of these differences, clinically, 'Adductor Canal Block' is found to have statistically significant quadriceps-sparing properties with equivalent analgesia compared to a femoral nerve block. Blocks with clinically significant quadriceps motor involvement is thought to occur due to proximal spread of local anaesthetics beyond the canal to the femoral triangle. (FT)

.... IMPORTANT POINT #2

Structures within/around the canal

i) Sub-sartorial space /Sub-sartorial Compartment

Space **between** Vasto-Adductor Membrane **(VAM)** and **posterior border of Sartorius** muscle; **extends beyond the VAM** distally; contains **'Sub-sartorial plexus'** which is made by anastomoses between:

- a) Posterior branch of the medial femoral cutaneous nerve
- b) Anterior branch of the obturator nerve
- c) Saphenous nerve (distally after penetrating VAM)

Supplies infero-medial thigh **NOT** affected by medial parapatellar arthrotomy

ii) 'True' Adductor Canal

Proximal end begins at the point where the medial border of Sartorius crosses the medial border of Adductor longus deep to VAM. Adductor Canal is roofed by Sartorius muscle anteriorly (and Vasto-adductor aponeurosis of Vastus and adductor muscles), by vastus medialis laterally and adductor longus and magnus postero-medially. Distally it ends at the adductor hiatus, where the femoral vessels diverges away to leave the adductor compartment towards the popliteal fossa, posteriorly.

Injection within this canal (**up to mid-point**) reliably blocks the Saphenous nerve; medial retinacular nerve (terminal branch of nerve to vastus medialis in 10% of cases); and posterior branch of the obturator nerve.

Technique

Trace the femoral vessels down from the inguinal crease (Snowman point) distally until Sartorius muscle is seen crossing over the vessels from lateral to medial. Align further caudad until the medial border of Sartorius crosses the medial border of adductor longus medially (the anterior most of the adductor group of muscles that borders the canal) – this is the proximal end of the 'true' canal. Any block done prior to this point is a FT block (femoral triangle block or sub-sartorial saphenous nerve block).



Figure 1 showing anatomical point where the adductor canal begins (yellow arrow). Note that this point is slightly distal to the mid-point of the thigh (orange line), i.e mid distance between a line drawn between the anterior superior iliac spine (ASIS) to the base of patella (green line). Corresponding image is as shown in *Figure 3*.



Figure 2 showing anatomical point where the adductor canal ends (yellow arrow) at the adductor hiatus. Proximal end of the adductor canal is demarcated by the orange line. The distance between the orange line and the yellow arrow is the 'length of the adductor canal'.

As the transducer is aligned more distally, the femoral vessels will be seen diverging away from the Sartorius muscle and disappears towards the popliteal fossa through Adductor hiatus. The optimal injection point is suggested to be around the 'mid-point' of the canal.

Approach this space in a lateral to medial direction and target the area lateral to the artery. Aim for a peri-vascular local anaesthetic spread within the triangular area bordered by VAM anteriorly, Vastus medialis laterally and adductor muscles postero-medially (refer figure 3). Tip of the block needle must be observed to be beyond the hyperechoic 'double-contoured' VAM. (Sometimes a distinct "pop" will be appreciated but when aliquots of LA is administered, the space anterior to the VAM is distended. This is the 'Sub-sartorial Compartment'. If this is observed, block needle needs to be advanced further).

This is an analgesic block and various volumes have been described from 5 ml to 30 ml.



Figure 3: Note the proximal end/start of the true Adductor Canal- A triangular potential space indicated by the arrow starting from the point where the medial border of Sartorius crosses the medial border of adductor longus. The femoral vessels lie within this canal bordered anteriorly by the Sartorius muscle and Vasto-adductor membrane, laterally by Vastus medialis and medially by adductor longus and magnus



Figure 4 showing sono-anatomy at the distal part of femoral triangle where 'sub-sartorial saphenous block' or a 'Femoral triangle block' (FTB) can be performed (at the level demarcated as the 'orange line' in **Figure 1**). At this point, the medial border of Sartorius crosses the lateral border of Adductor longus as the probe is aligned along the axis of the adductor canal. See illustration as **Figure 8** and the accompanying text under the section **Special Considerations**.



Figure 5 showing sono-anatomy of the proximal end (or the beginning) of 'true' adductor canal (depicted by the yellow arrow in **Figure 1**). This is identified as the point where medial border of the sartorius muscle crosses the medial border of adductor longus. See illustration as **Figure 9** and accompanying text under **Special Considerations**.



Figure 6 showing sono-anatomy of the distal end of adductor canal at the level of adductor hiatus. This point is where the femoral vessels leave the anterior compartment of the thigh to enter the popliteal fossa (depicted by the yellow arrow in **Figure 2**). Femoral vessels can be seen diverging away from Sartorius muscle and slips posteriorly between vastus medialis and adductor magnus.



Figure 7 showing local anaesthetic (LA) spread within the adductor canal.

- a) Spread of LA at proximal end of adductor canal as shown by hypoechoic area surrounding the femoral artery within the margins of the muscles.
- b) Spread of LA at the level of adductor hiatus as shown by hypoechoic regions surrounding the femoral artery. Note that the femoral vessels are diverging away from Sartorius before entering popliteal fossa. This pattern of spread may indicate potential sciatic nerve involvement.

CONCENTRATION AND DOSES

Adductor Canal Block usually requires a maximum of 20 ml of local anaesthetics.

Onset should be within 30 minutes with half concentration of the maximum strength of local anaesthetic (0.375% ropivacaine or 0.25% levo-bupivacaine) as **analgesia**.

SPECIAL CONSIDERATIONS

A block prior to the proximal end of the 'true' canal (Figure 4) may cause significant quadriceps weakness due to close proximity of motor branches to vastus, especially with large volumes. Block at this level is now known NOT as 'adductor canal' block, but as 'FEMORAL TRIANGLE BLOCK' (FTB) which reliably blocks nerve to vastus medialis (that ends as the medial retinacular nerve- in 90% of cases) and the saphenous nerve which are the major contributors to innervation of the knee. (See illustration in *Figure 8*)

Injection within the canal; from the start of 'true' adductor canal (beginning of which, is as illustrated in Figure 5, up to mid-canal point) **reliably blocks the Saphenous nerve**; **medial retinacular nerve** (terminal branch of nerve to vastus medialis in 10% of cases); and **posterior branch of the obturator nerve.** (See illustration in *Figure 9*)

A block too close to the adductor hiatus (as illustrated in Figure 6), may provide block of the posterior group of nerve supplying the knee via potential sciatic spread into the popliteal fossa. If too little volume is injected into the true canal, while being too distal, even a proximal spread covering the saphenous nerve before it penetrates the VAM may not be achieved resulting in complete sparing of saphenous nerve distribution. (See illustration in *Figure 10*)

Clinical proximal spread has been reported with a volume of 10 ml and distal spread to the popliteal fossa has been described with 20 to 30 ml of injectate in cadaveric studies. Different dynamics of spread may be seen with different injection locations and volumes.



Figure 8 showing simplified anatomical illustration of related *SUB-SARTORIAL STRUCTURES IN THE FEMORAL TRIANGLE*, where 'sub-sartorial saphenous block' or a 'femoral triangle block (FTB) can be performed. A block at this or any point proximal to the 'true' adductor canal (sono-anatomically as shown in *Figure 4*) may cause significant quadriceps weakness due to close proximity of motor branches to vastus.



Figure 9 showing simplified anatomical illustration of related structures at the *PROXIMAL END OF 'TRUE' ADDUCTOR CANAL*. A block at this proximal end (sono-anatomically as shown in *Figure 5-* or any point from here up to mid-canal) will reliably block saphenous nerve, but may only provide analgesia to the knee in a small proportion of patients due to variability in location of nerve to vastus medialis; unless a more proximal spread is ensured (by either a more cephalad **site of injection** or injection of a larger **volume of LA**.)

LATERAL



Figure 10 showing simplified anatomical illustration of related structures at the *DISTAL END OF 'TRUE' ADDUCTOR CANAL*. Blue arrows depict changes in location of nerves as they traverse the canal distally from cephalad to caudad. A block too close to adductor hiatus (sono-anatomically as shown in *Figure 6*) may provide potential sciatic spread into the popliteal fossa but may miss saphenous nerve as it pierces VAM and exits the adductor canal at mid-canal point; unless a more proximal spread is ensured (by either a more cephalad **site of injection** or injection of a larger **volume of LA**).

MEDIAL

SUMMARY

IMPORTANT POINT #1

There is a difference between 'block at the mid-thigh' (current description for femoral triangle or FT block) with 'true' adductor canal.

IMPORTANT POINT #2

ACB provides equivalent analgesia compared to a femoral block with added quadriceps motorsparing properties.

IMPORTANT POINT #3

Sub-sartorial plexus are a contribution from 3 main sources and lie in the sub-sartorial compartment anterior to VAM.

IMPORTANT POINT #4

Nerves within the Adductor canal are mainly saphenous, nerve to vastus medialis and posterior branch of the obturator.

IMPORTANT POINT #5

Commonly used volume would be 20 ml of LA for ANALGESIC purposes. Different dynamics of spread may be seen with different injection locations and volumes.

IMPORTANT POINT #6

At the time of writing, it is still not clear whether positive findings from previous studies were from 'perceived' ACB or 'true' ACB, as recent evidences suggest that previous technique described is currently understood to be a 'Femoral Triangle block' or 'Sub-sartorial saphenous nerve block' technique and not a 'true' Adductor Canal Block.

References

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