Adductor Canal Block is Superior to Femoral Nerve Block for Early Postoperative Pain Relief after Single Bundle Anterior Cruciate Ligament Reconstruction with Hamstring Autograft

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FINANCIAL DISCLOSURE

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The authors declare no conflict of interest for this study.

Background:

Postoperative pain control is a key to improving patient satisfaction and outcomes and reducing the cost of healthcare.

Objective:

The purpose of this study was to compare the combination of a lateral femoral cutaneous nerve (LFCN) block with a femoral nerve block (FNB) and an adductor canal block (ACB) for postoperative pain control in patients undergoing anterior cruciate ligament (ACL) reconstruction with hamstring autograft.

Study design:

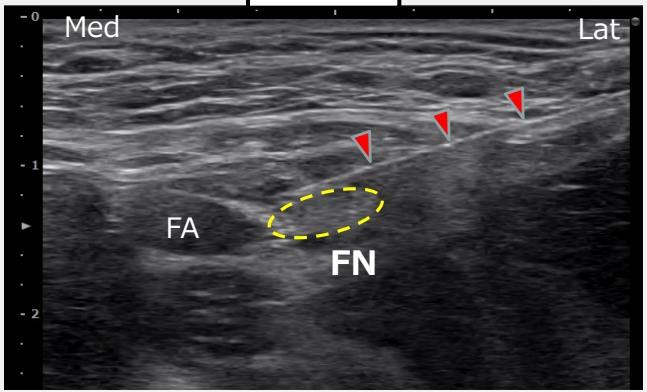
- A non-randomized, prospective, controlled clinical trial
- The patients who received an FNB with LFCN block were assigned as the FNB group and those receiving an ACB with LFCN block as the ACB group. The FNB and ACB groups included 41 and 40 patients, respectively.

Variables	FNB group (N=41)	ACB group (N=40)	p value
Age (years)	22.4 ± 12.2	25.5 ± 13.7	n.s.
Sex	M 18, F 23	M 18, F 22	n.s.
Height (cm)	163.9 ± 7.9	165.0 ± 8.6	n.s.
Weight (kg)	63.0 ± 14.3	63.6 ± 12.5	n.s.
BMI (kg/m^2)	23.3 ± 4.3	23.3 ± 3.5	n.s.

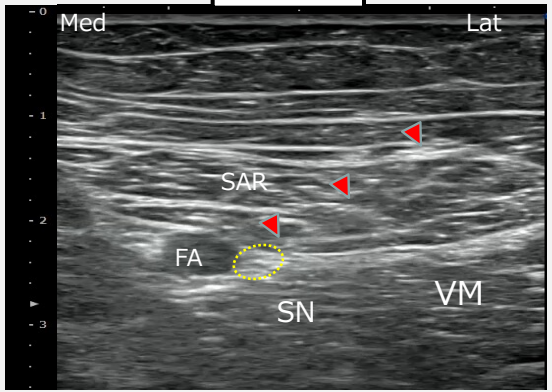
Nerve block procedure

- A high-frequency linear-array ultrasound transducer
- A 25-gauge needle was inserted lateral to medial using an in-plane technique
- FNB and ACB : 10 mL 0.75% ropivacaine
- LFCN block : 5 mL 0.75% ropivacaine

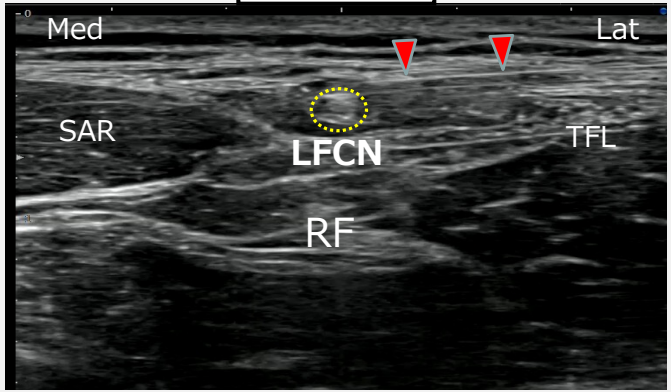
FNB



ACB



LFCNB



FA: Femoral artery, SAR: Sartorius, RF: Rectus femoris, TFL: Tensor fascia Lata, SN: Saphenous nerve, VM: Vastus medialis, Arrow head: needle

Data collection

- Duration of surgery
- Pain management during surgery
  - total amount (in μg/kg) of fentanyl used
  - remifentanil
  - intravenous acetaminophen
  - diclofenac suppositories
- 0- to 10-point pain numerical rating scale (NRS) was recorded 30 min, and 4, 8, 12, 24, 48, and 72 h after returning to the room.
- The administration and use of analgesic suppositories (50 mg diclofenac sodium or 300 mg acetaminophen) were assessed.

Statistical Analysis

- Pain levels and average suppository use were compared between two groups.
- The endpoint was defined as pain relief when the NRS<2.
- These endpoints were analyzed as time-to-event outcomes using Kaplan-Meier estimation.
- Using the Cox proportional hazard model, factors for pain relief (NRS<2) were evaluated, including block type, age, sex, body mass index (BMI), and suppository use. All survival estimates and hazard ratios (HRs) were reported with 95% CIs.

RESULTS

There were no significant differences in pain management during the surgery

Variables	FNB group (N=41)	ACB group (N=40)	p value
Duration of surgery (min)	107.2 ± 22.4	104.9 ± 22.7	n.s.
Total amount of fentanyl (μg/kg)	2.8 ± 1.0	2.4 ± 1.4	n.s.
Remifentanil (n)	40	39	n.s.
Intravenous acetaminophen (n)	38	34	n.s.
Diclofenac suppositories (n)	3	8	n.s.

Tab.1 The duration of the surgery and pain management during the surgery

RESULTS

- There was no significant difference in the number of suppositories used.
- Pain scores were significantly lower in the ACB group than in the FNB group at 30 min, 4 h, 24 h, and 48 h. However, there was no significant difference at 72 h after surgery (Tab. 3).

Time	FNB group (N=41)	ACB group (N=40)	p value
30 min	5 (2)	2 (0)	0.034
4 h	4 (3)	2.5 (2)	0.030
8 h	3 (2)	3 (2)	0.424
12 h	3 (2)	3 (2)	0.803
24 h	3 (2)	3 (0)	0.018
48 h	2 (1)	1 (0)	0.005
72 h	0 (0)	0 (0)	0.897

Tab.3 NRS scores represented as medians and lower quartiles

RESULTS

- In the FNB and ACB groups, the probabilities of NRS>1 were 83% (95% CI: 68%-92%) and 53% (95% CI: 36%-67%) at 30 min, 61% (95% CI: 44%-74%) and 30% (95% CI: 17%-44%) at 12 h, 44% (95% CI: 29%-58%) and 15% (95% CI: 6%-28%) at 48 h, respectively. (Fig.)
- Cox hazard proportional hazard model reveals a significant difference between the two groups (p=0.03) (Tab.4).

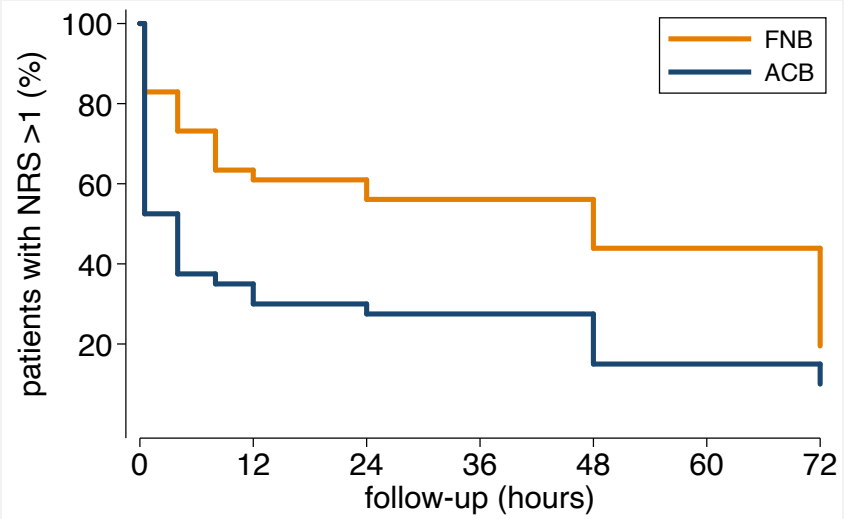


Fig. Kaplan-Meier survival estimates, pain relief (NRS<2) as the endpoint

Factor	p value	Hazard Ratio (95% CI)
ACB	0.030	1.77 (1.05-2.89)
Age	0.547	1.01 (0.99-1.03)
BMI	0.329	1.03 (0.97-1.10)
Sex (male)	0.453	0.83 (0.50-1.36)
Suppository use	0.801	0.96 (0.71-1.31)

Tab.4 Cox Proportional Hazard Ratio of each factor for pain relief (NRS<2)

DISCUSSION

- Combination of ACB with an LFCN block may have contributed to our results.

  - Previous studies have typically evaluated ACB or FNB alone. [1-3]
  - Analgesia of the lateral side provided by the LFCN significantly reduces postoperative pain after ACL reconstruction with a hamstring graft. [4]

- Anatomical differences between the femoral nerve and the adductor canal.

  - The adductor canal has a thick connective tissue membrane that may allow for more efficient spreading of analgesia compared to the loose sheath surrounding the femoral nerve. [5-10]

CONCLUSION

- The combination of ACB and an LFCN block significantly reduced postoperative pain in the early phase compared to FNB with an LFCN block.

- This association was not affected by sex, age, BMI, or suppository use. ACB could be recommended not only to avoid muscle weakness but also for superior pain management in the early postoperative phase.

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