Original Article

ADDUCTOR CANAL BLOCK AND LOWER (INTERMUSCULAR) SAPHENOUS NERVE BLOCK IN ANTERIOR CRUCIATE LIGAMENT REPAIR UNDER GENERAL ANAESTHESIA: A PILOT RESEARCH

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Abstract

Background: Postoperative pain persists from graft anchoring into the anterior cruciate ligament (ACL). Adductor canal block (ACB), on the contrary hand, is a motorsparing block, and the introduction of ultrasound guidance has boosted its success by facilitating the imaging of the adductor canal (AC). The aim of this work was to evaluate the efficacy of the combined ACB and saphenous nerve block (SNB) in pain relief following knee arthroscopic ACL repair.

Methods: This pilot research was on15 cases aged from 19 to 50 years old, scheduled for elective ACL repair under general anesthesia. Ultrasound (US) guided ACB was done by injecting of 20 ml lidocaine 2%, along with US guided SNB at the upper boundary of the popliteal fossa in the intermuscular (IM) space between Vastus Medialis (VM) and Sartorius (Sr) by injecting of 10ml bupivacaine 0.5%.

Results: 11 (73.33%) of cases had loss of sensation. Time to first analgesic request had (mean ± SD) of 9.07±2.02 h. Total morphine consumption showed (mean ± SD) of 5.33 ± 2.48 mg. AC bolus were of (mean ± SD) 0.87 ± 0.64 ml. Only 2(13.33%) of cases suffered of complications.

Conclusions: Presurgical combined US guided ACB and US guided SNB produced adequate analgesia with minimal incidence of complications following knee arthroscopic ACL repair.

Keywords: Adductor Canal Block, Saphenous Nerve Block, Anterior Cruciate Ligament Repair, Post-operative analgesia

Introduction

The anterior cruciate ligament (ACL) is the most often damaged knee ligament [1]. ACL reconstruction (ACLR) is the surgical procedure of choice. Pain remains postoperatively due to graft anchoring into the ACL [2]. Systemic and numerous nonsystemic methods, such as local anaesthetic infiltration, peripheral nerve block, intraarticular injecting, and neuraxial blockade, are employed for analgesia [3]. Maximum pain relief is provided with peripheral nerve blocks, but the associated motor paresis becomes the limiting factor. We require a local anaesthetic that specifically works on sensory fibres in order to achieve our objective of a a patient without agony with adequate

motor function [4]. However, such a treatment does not exist in our arsenal at this time, and thus the quest for motorsparing drugs continues.

The femoral nerve block (SNB) is a routinely utilised nerve block in knee surgery cases. Nevertheless, SNB induces quadriceps muscular weakness, which hinders early walking and may increase the likelihood of falling. [5]. Adductor canal block (ACB), on the other hand, is a motorsparing block, and the introduction of ultrasonography has improved its efficacy [6]. ACB mostly obstructs the saphenous nerve and the vastus medialis (VM) nerve as they go through the adductor canal (AC) [7].

The objective of this research was to assess the effectiveness of the combined ACB and SNB at the upper boundaryof the popliteal fossa in the IM space between the Vastus Medialis (VM) and Sartorius s (Sr) for pain control following arthroscopic ACL repair of the knee.

Patients and Methods:

This pilot research was done on 15 cases aged from 19 to 50 years old, both sexes, with BMI <30 kg/m^2 scheduled for elective knee orthopaedic (ACL repair) surgery recruited in the research. An informed written consent was obtained from the cases. The ethics board approved our research at Al-Kasr Alainy Hospital.

Cases involving patients < 18 or > 60 years, hypersensitivity to anaesthesia, coagulation problems, Glasgow Coma Scale less than 15, conception, and neurologic impairments are excluded.

All cases were subjected to history taking, clinical examination and routine laboratory investigation.

Intra-operative: Standard monitoring was applied to the patient (pulse oximetry, electrocardiography, capnography and non-invasive arterial blood pressure), peripheral cannula (20G) was inserted. And the patient was pre-medicated with intravenous midazolam (0.02 mg/kg). Induction of general anaesthesia was done by propofol 1-2 mg/kg, fentanyl 100micg and laryngeal mask were inserted. Maintanace of anaesthesia was performed by sevoflurane 2-3%.

US-guided ACB was accomplished by injecting 20 ml of bupivacaine, in conjunction with US-guided SNB in the upper boundaryof the popliteal fossa in the IM space between VM and Sr by injecting 10 ml of bupivacaine 0.5%.

US Guided Adductor Canal Block

At the level of the midthigh, almost halfway between the anterior superior iliac spine and the patella, a linear US probe was utilised. The femoral artery, vein, and saphenous nerve (SN) were discovered beneath the Sr . From the lateral side of the transducer, a 10-cm, 18-gauge Tuohy needle was inserted into space via the Sartorius . To expand the AC, 20 ml of a local anaesthetic solution was injected immediately under the vasto-adductor membrane, lateral to the artery and SN, with the tip of the Tuohy needle positioned exactly beneath the vasto-adductor membrane.

US Guided Saphenous Nerve Block

In the lower region of the thigh, the procedure was conducted in the IM space between the Sr and VM s. The US probe was positioned on the front of the lower leg just above the patella in order to view both the patella (hyperechoic curving line) and VM in front of it (closer to skin). The probe was then advanced medially till the end of the VM and an IM space between it and the Sr could be observed. Then, a 20-gauge spinal needle was inserted in an in-space orientation into the substance of the VM , continuing until it faced the IM space between the VM and the Sr. Once the needle tip was positioned in close proximity to the target structures, 20 cc of local anaesthetic was given after gentle aspiration.

All cases underwent elective arthroscopic knee surgery (ACL repair) under tourniquet control. Reversal of anaesthesia was performed.

The postoperative VAS at rest and motion were assessed. In case of postoperative pain (VAS > 3)10 mL (5ml bupivacaine 0.5%+5ml lidocaine 2%) in ACB were injected as rescue analgesia and if pain persisted for more than 15 minutes 2 mg intravenous morphine were given until VAS < 3. Time to first analgesic request, 24 Post operative opioid consumption, number of boluses in the AC and the incidence of complications. Measurements were at immediately and 2, 4, 8, and 24 post-operatively

Statistical analysis

SPSS v25 performed the statistical analysis (IBM Inc., Chicago, IL, USA). The same group's quantitative data were given as mean and standard deviation (SD) and compared using the paired Student's t-test. The frequency and percentage (%) of qualitative characteristics were displayed. Non-parametric variables were represented in terms of the median and interquartile range (IQR). A two-tailed P value 0.05 was deemed statistically significant.

Results

Table 1 shows the characteristics of the studied cases.

Table 1: Demographic data of the studied cases

		N = 15
Age (years)		37.4 ± 8.37
Sex	**Male**	13(86.67%)
	Female	11(73.33%)
ASA physical status	**I**	11(73.33%)
	II	4(26.67%)
BMI (kg/m^2)		25.95 ± 1.97

Data are presented as mean ± SD or frequency (%), ASA: American Society of Anaesthesiologists, BMI: body mass index.

Visual analogue scale (VAS) at rest and at movement (figure 1, 2) respectively.

Figure 1:Visual analogue scale (VAS) at rest

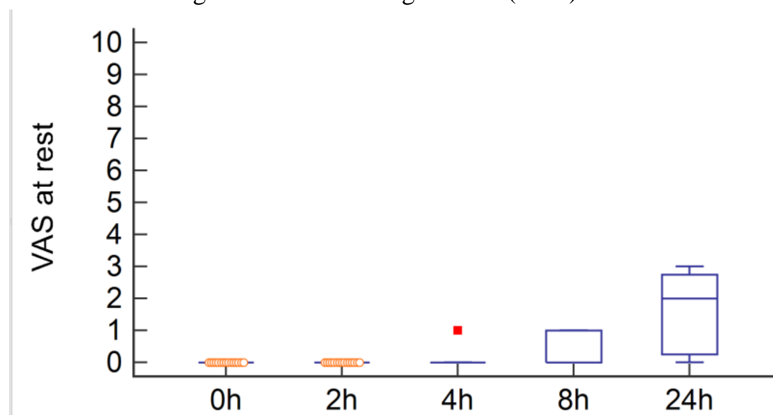
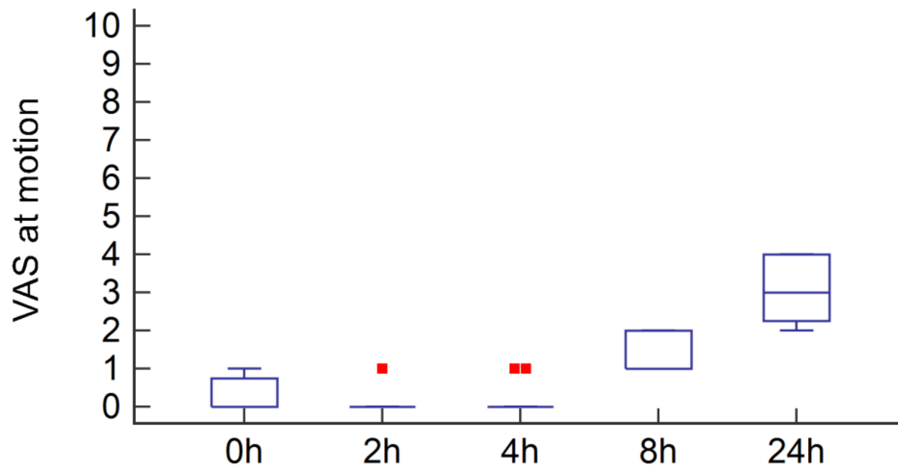


Figure 2: Visual analogue scale (VAS) at motion.



Intraoperative HR and MAP declined below the baseline readings in the studied cases ($p < 0.001$). Postoperative HR and MAP were insignificantly different compared to baseline readings in the studied cases ($p > 0.05$). (Figure 3 and 4)

Figure 3: Base line, intraoperative and postoperative heart rate (HR) in the studied cases

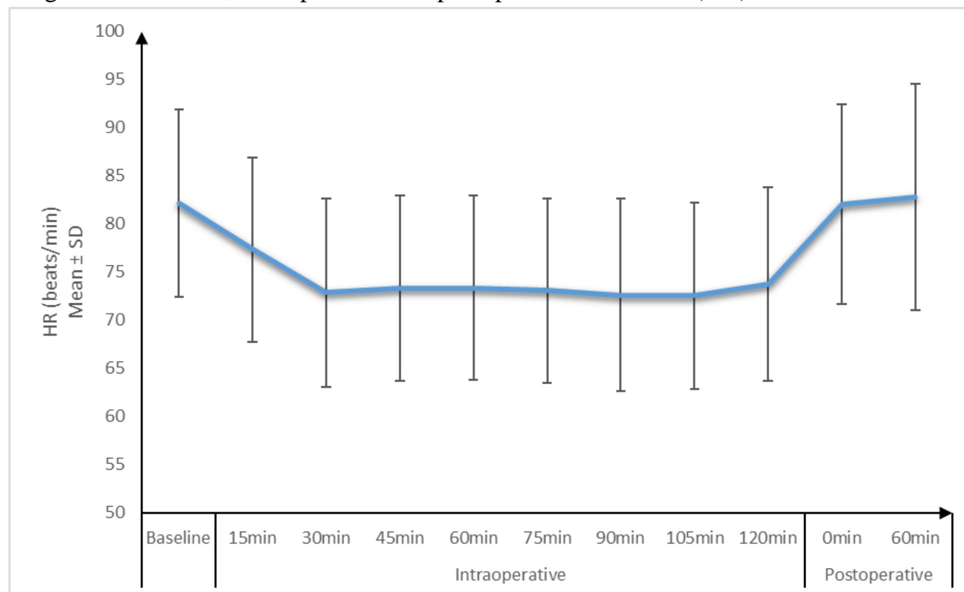


Figure 4: Base line, intraoperative and postoperative mean arterial blood pressure (MAP) in the studied cases

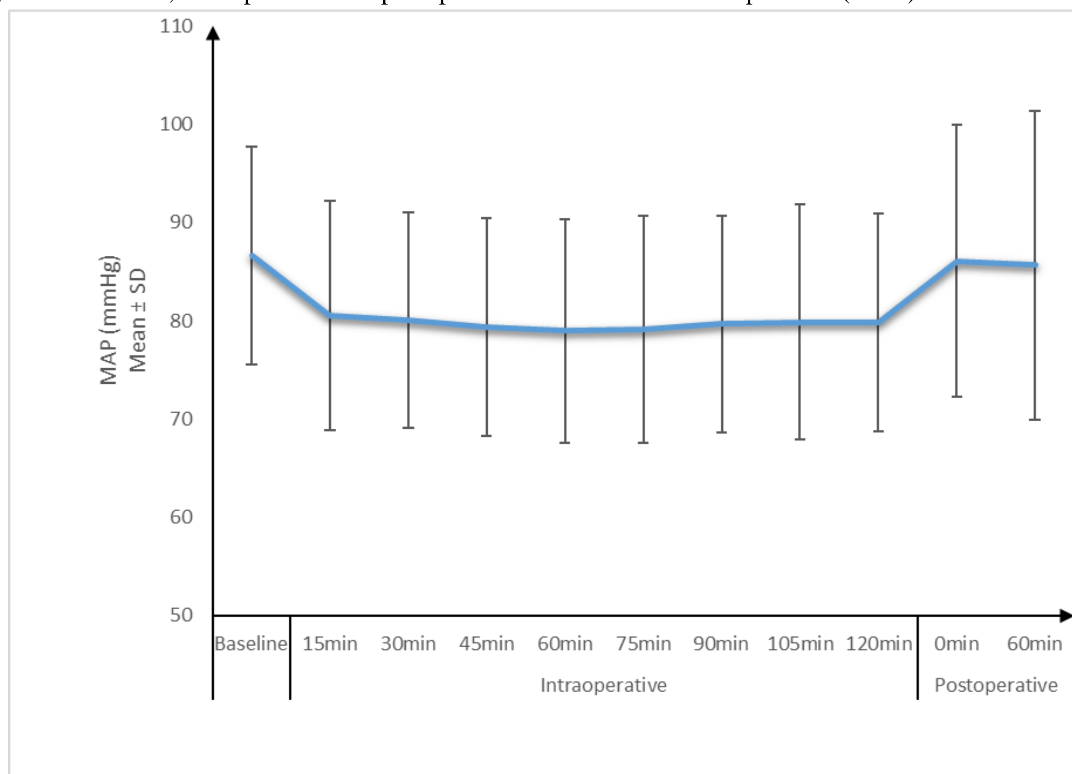


Table 2 shows that 11 (73.33%) of cases had loss of sensation. The mean (± SD) time to first analgesic request was 9.07 (±2.02) h. The mean (± SD) total morphine consumption was 5.33 (± 2.48) mg. The mean (± SD) AC bolus was 0.87 (± 0.64) ml. Only 2(13.33%) of cases suffered of complications.

Table 2: Point scale for sensory block, additional analgesia in 24hs and complications of the studied cases

		N= 15
Point scale for sensory block	Loss of sensation to light touch	11 (73.33%)
	Full sensation	4 (26.67%)
Time to first analgesic request (h)		9.07±2.02
Total morphine consumption (mg)		5.33 ± 2.48
Adductor canal bolus (ml)		0.87 ± 0.64
Complications		2(13.33%)

Data are presented as mean ± SD or frequency (%)

Discussion

ACL tears continue to be a prevalent The occurrence of musculoskeletal injury is 68.6 per hundred thousand person a year [8]. The restoration of the anterior cruciate ligament (ACL) is now a worldwide standard, with outpatient procedures being the norm [9, 10]. The next day, cases who underwent outpatient ACL restoration slept more soundly, got up more frequently, and walked more frequently than the day before [9].

Our results revealed that pain score of all cases was lower that 4 at different time intervals.

Kejriwal et. [11] documented that the SNB had a significantly lower VAS score at 4 hours post-surgery compared to control group (no SNB) in anterior cruciate ligament reconstruction with hamstring autograft.

However, in contrast with our finding Ogura et al [12] reported that cases who underwent anatomical double-bundle ACL repair randomly assigned to preoperative ACB or SNB. They found no significant variations in both groups in postoperative VAS scores till 48 hr. Our new approach provided sustained analgesia till 24 h as multiple clinical studies on total knee arthroplasty [13-15] ACB has been shown to preserve quadriceps muscular strength, improve ambulation, and expedite equivalent functional recovery with equivalent analgesia effects and morphine dose versus SNB.

Our results showed that 11 (73.33%) of cases had loss of sensation while 4 (26.67%) had full sensation to light touch according to point scale for sensory block.

Our results are supported by Sonawane et al [16] Who tested the analgesic effectiveness of the two distinct volumes in Dual sub-sartorial block (DSB) performed as First Injecting (Lower FTB) where hyperechoic saphenous nerve (SN) was identified. Second Injecting (ACB) with just 10 ml in group B while 20 ml in Group A. They found that dynamic VAS was lower in group used large volume. Als, Kapoor et al [17] demonstrated that US-guided SNBs within and lower to the AC have shown success and safe region in preventing motor blockade when performing ACB as spare nerve to VM and achieve effective sensory block.

In our research, time to first analgesic request had (mean ± SD) of 9.07±2.02 h. Total morphine consumption showed (mean ± SD) of 5.33 ± 2.48 mg.

Our observations agreed with ElShawady et al.[18] who stated that time to first analgesic request was 14.42 ± 5.47 h in ACB, and the total morphine needed in the first 24 h was 5.55± 2.39. Similarly, Ghodki et al.[4] reported that 60% of cases required analgesia in the first 24 h postoperative in ADB and these results were similar to SNB, Consequently, SNB might not be the choice method for knee arthroscopes performed in an outpatient setting.

Despite claims that ACB is a pure sensory block, it can occasionally result in partial motor impairment. This is due to a nerve blockage in the AC that supplies the VM. However, the odds of blocking the nerve to VM depend on the injecting place; that is, paresis is more likely if the ACB is administered close to the AC's hiatus [19].

Our results demonstrated that only 2(13.33%) of cases suffered of complications. Jaeger et al. [20] and Kim et al.[21] revealed comparable outcomes. Jaeger et al. [20] determined that SNB diminishes motor strength by 49% but ACB decreases it by just 8%, which was not functionally additive.

Sinha et al.[22] found that ACB retains quadriceps strength and offers comparable postoperative analgesia following ACLR. Our findings are consistent with these two research. In another trial, Kuang et al. [23] found that ACB preserved quadriceps muscular strength better than SNB.

Limitations: It was a pilot research with relatively small sample size. The research was in a single centre. Therefore, a larger scale studies with multicentre collaborations are needed to validate our conclusions.

Conclusions:

Presurgical combined US guided ACB and US guided SNB at the lower third of thigh in the IM space between Vastus Medialis and Sartorius s produced adequate analgesia with minimal incidence of complications following knee arthroscopic ACL repair.

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Nil

Conflict of Interest:

Nil

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