CASE REPORT

Adductor Canal Block (ACB) as an Adequate Analgesia Post Anterior Cruciate Ligament Repair

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ABSTRACT

Background: Anterior cruriate ligament (ACL) injury is one of the most common cases in knee injury. Inadequate pain management will cause a decrease in quality of life, daily living abilities, increase hospitalization costs, and progressively causing chronic pain. Selection of inappropriate peripheral nerve block (PNB) can reduce range of movement ROM. Abductor canal block (ACB) is expected to facilitate adequate analgetic, improve early mobilization and ambulation, reduce the risk of post operative nausea vomiting (PONV), and needs for other analgetics

Case: A 21-year-old male patient with a diagnosis of ACL rupture knee (S) who will be performed anterior cruriate ligament recontruction (ACLR) procedure with physical status ASA II, premedication ondancentron 4 mg and dexamethasone 5 mg intravenously. Regional anesthesia subarachnoid block, at L3-L4 interspatium with bupivacaine hyperbaric 0.5% 15 mg and fentanyl 25 mcg as the adjuvant for subarachnoid block. Adductor canal block using ultrasound guide using 20 ml levo bupivacaine 0.25%. The outcome assessed using nurmmeric rating score (NRS), PONV, rescue analgetics, and ambulation score which includes: time up to go (TUG) with partial weight bearing, s-CST, 5xSST, 6 WMT straight leg raising (SLR) assessed at more than 48 hours.

Discussion: PNB is proven to be reliable and effective for postoperative pain control, ambulation, rehabilitation and mobilization are also faster, adequate pain control will facilitate early mobilization and prevent side effects related to prolonged immobilization. Adductor canal block is a good modality as an adequate analgetic, the use of ACB can reduce use of rescue analgetic, reduce the incidence of PONV and support early mobilization.

Conclusion: ACB in ACLR can facilitate adequate analgesia, does not require other rescue analgetics, reduce the incidence of PONV, and improve the ambulation as well as avoid other complications.

Keywords: ACB; anterior cruriate ligament; ambulation; PNB; PONV

INTRODUCTION

Anterior cruciate ligament (ACL) injury is one of the most common ligament injury cases in the lower extremity, with 120,000 incidents had shown per year in United States. The incidence of in ACL ruptures in global is estimated to range from 30 to 78 per 100,000 person-years [16], arthroscopic ACL repair (ACLR) is one of the techniques, although arthroscopic (minimally invasive surgery) postoperative pain can still occur especially from the tissue of graft origin.[1]

Adequate pain management will facilitate early mobilization and prevent side effects related to prolonged immobilization.[10] The ideal analgetic post limb surgery is to choose a modality that can reduce the need for other rescue analgesia, promote early mobilization, and facilitate knee range of motion (ROM).[3]

A wide variety of pain management including pharmacological and nonpharmacological have been used. Multimodal analgesia, local anesthesia peripheral nerve block (PNB), intraarticular injection and neuroaxial blockade are used for adequate pain management with their respective negative effects.[2]

Inadequate pain management will cause a decrease in quality of life, daily living abilities, hospitalization costs increase, and progressively cause chronic pain. Inappropriate PNB selection can reduce ROM of quadriceps femoris contractions.[3]

Various studies have shown Intravenous analgesia has effects such as nausea and vomiting, increased length of hospital stay, and inferior to PNB such us femoral nerve block and adductor cannal block in post operative analgesia anterior cruriate ligament repair. Various literatures states that postoperative PNB that can be done in ACLR cases are femoral nerve block (FNB) and adductor canal block (ACB). ACB is a block performed in the mid-lower extremity while maintaining the motor ability of the quadriceps femoris muscle when compared to FNB, the quadriceps femoris muscle is very useful for early mobilization in ACLR recovery.[4]

ACB is a fairly easy to apply and reliable technique, performed by injecting local anesthesic in the adductor canal under the sartorius muscle where there is a saphenous nerve and femoral artery, the saphenous nerve innervates the lower leg, ankle.[5] The selection of ACB in this case as an analgetics modality in ACLR is expected to facilitate adequate analgetics, increase early mobilization and ambulation, reduce the risk of post operative nausea vomitus (PONV), reduce the need for other analgetics, so that it will reduce hospital costs, improve the quality of life of patient.

CASE

A 21-year-old male patient with a diagnosis of ACL knee rupture (S) who will undergo an ACLR procedure with The American Society Of Anesthesiologists (ASA) II physical status. Patient came with complaints of pain in the left knee, no allergies were found, no history of previous illness was found, drug consumption was denied.

Physical examination results obtained, pulse rate 83 times per minute regular, blood pressure 110/70 mmHG, with oxygen saturation 99%. Airway, breathing and circulation are clear, the patient has limited ROM on the left lower extremity, the results of laboratory tests and thorax X-rays are within normal

limits, Genue Ap/Lateral X-rays are within normal limits (Figure 1). Magnetic resonance imaging (MRI) showed mild fluid collection mainly concentrated in the suprapatellar bursa and also intercondylar area, total ACL rupture, bone bruise on the medial condyle of the femur.

After a thorough perioperative examination, the patient is explained about the risks and complications of anesthesia and has been examined by the patient. The patient agrees to anesthesia, the patient is prepared for surgery by doing education, namely fasting for a 6-hour meal, and drinking clear fluid 2 hours before surgery.

Premedication was performed with ondancentron 4 mg and dexamethasone 5 mg intravenously. Anesthesia with regional anesthesic subarachnoid block, puncture was performed in interspatium L3-L4, with spinocain needle size 27, after confirmed with LCS that came out, local agent anesthesic bupivacaine hyperbaric 0.5% 15 mg and adjuvant fentanyl 25 mcg injected into the subarachnoid area. After the block is confirmed successful, positioning is carried out and the operation runs with a duration of 1 hour 30 minutes.

Postoperatively, ACB was performed using ultrasound guidance with a 38 mm 6 MHz linear transducer and a 22G 100 mm regional needle, marker was performed (Figure 3), the patient was positioned supine, legs were flexed and externally rotated, disinfection was performed, the transducer was placed on the anteromedial mid-thigh level side, puncture position plane from lateral-cemedial with femoral artery orientation. When the needle tip appeared on the anterior artery (Figure 4), 1-2 local anesthetics were injected to confirm the accuracy of the injection site. After confirming there was no intravascular injection by aspiration. 20 ml of Levobupivacaine 0.25% was injected (Figure 5). Multimodal analgesia was performed by adding paracetamol 3x1 gram intravenously. The patient was monitored postoperatively in the recovery room for 2 hours and warded for 3 days. During the treatment the effectiveness of adductor canal block was assessed using various parameters. Monitoring the numeric rating score (NRS) at 6, 10, 12, 24, 36, 48, 72 hours postoperatively. The incidence of PONV and other rescue analgetics (Table 1). Ambulation ability was assessed using 5 indicators 48 hours after surgery (Table 2).

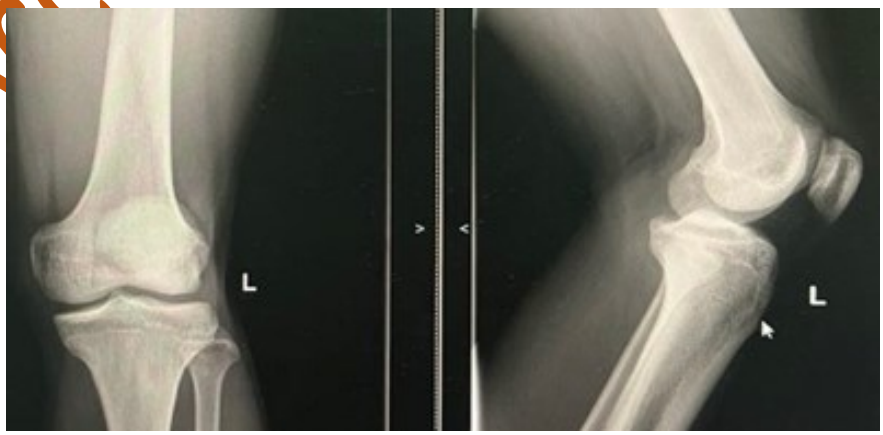

Figure 1. Ro Genue Ap/Lat

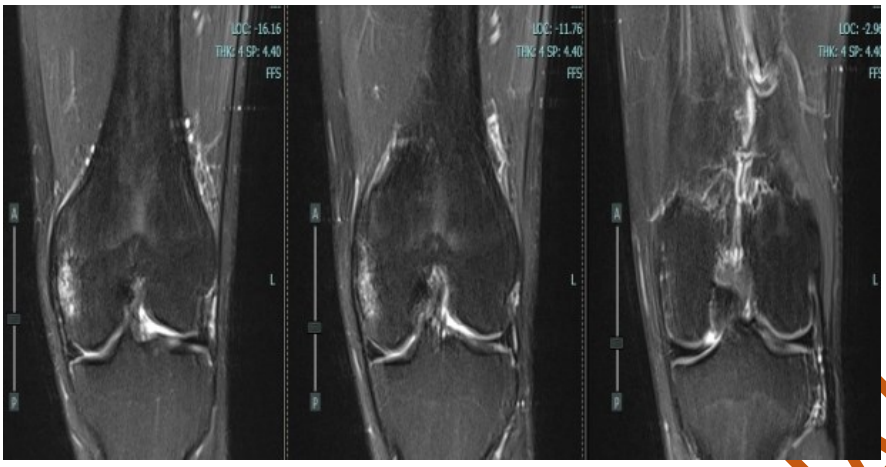

Figure 2. MRI Knee (S)

Figure 3. ACB Marker

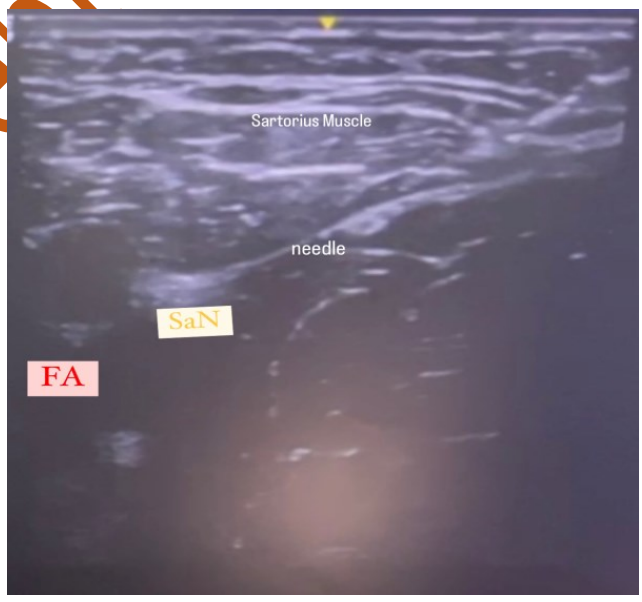

Figure 4. USG ACB Scanning

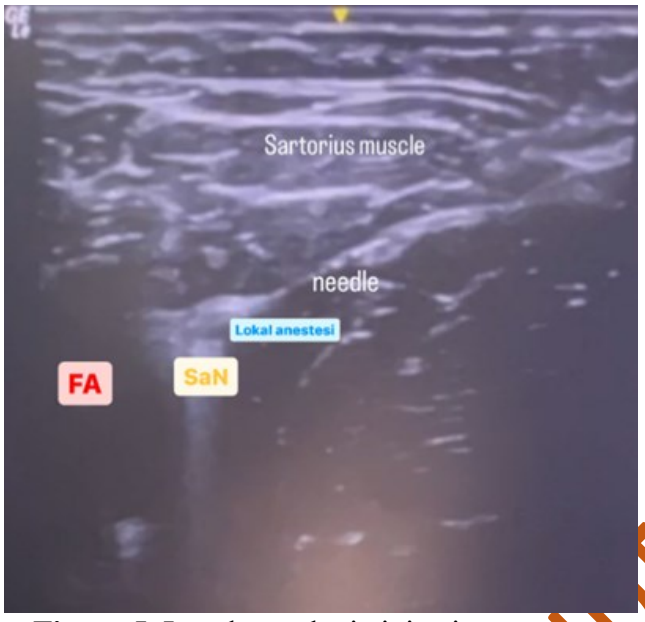

Figure 5. Local anesthetic injection progress

Table 1. NRS, rescue analgesia, ponv output table

Hours	NRS	Rescue Analgesia	PONV
6	2-3	Not performed	Not found
10	2-3	Not performed	Not found
12	2-3	Not performed	Not found
24	2-3	Not performed	Not found
48	2-3	Not performed	Not found
72	1-2	Not performed	Not found

Table 2. Ambulation output table

	48 Hours	72 Hours
TuTG Partial	< 20s Good	<20s Good
Weigh Bearing	Mobility	Mobility
30 s-CST	5 Normal	6 Normal
5x SST	26 s Normal	20 s Normal
6WMT	50 m	74 m
SLR	Negative	Negative

DISCUSSION

PNB in recent years is very popular because it is proven to be reliable and effective for postoperative pain management, ambulation, rehabilitation and faster mobilization.[12] it is very important for patients. Returning to sports activity is also very important for athletes.[13] ACB involves injection of local anesthetic into the adductor canal under the sartorius muscle and is a relatively easy and reliable method to block the saphenous nerve. This technique is useful for postoperative analgetics of the knee, foot or ankle and infrapatellar.[13]

Using a variety of short and long-acting local anesthetics in various concentrations, the duration of action is generally influenced by the concentration of the local anesthetic as well as the volume injected. The duration

of action can also be prolonged with adjuvants such as epinephrine or corticosteroids, such as dexamethasone.[6] For this patient we used levobupivacaine 0.25% 20 cc.

ACB is a good modality as an adequate analgetic.[11] Target both the saphenous nerve and the vastus medialis which contributes to the innervation of the posteromedial aspect of the knee. Local Anesthesia injection interrupt neural conduction by inhibiting the influx of sodium ion throught channles or ionophores within neural membrane.[17] Various studies have shown that using ACB in knee surgery can reduce the use of opioids, other rescue analgetics and reduce the incidence of PONV and support early mobilization.[10]

In line with the above theory, this patient was observed for the presence of PONV symptoms from the 6th hour to 72 hours (Table 1) where the results were not found symptoms in the entire observation.

30% PONV is a side effect of anesthesia and surgery. Spinal anesthetic and the use of opioids as postoperative analgetic modalities cause the risk of PONV if not treated well. And will lead to many postoperative complications such as postoperative bleeding, delayed wound healing, wound dehiscence, and prolonged hospital stays.[13]

PNB in theory can reduce PONV.[14] With PNB, the anesthesiologist can do anesthesia with less or even without opioid as an analgesic agent. As we know, the use of opioid can increase the the incidence of PONV. This case supports the study where no PONV was found due to the success of ACB supporting to decrease the use of opioids, in line with *Jensrup et al.,* that the use of ACB reduces morphine consumption during the course of mobilization.[7] PONV due to neuroaxial risk is anticipated with premedication ondancentron 4 mg, dexamethasone 5 mg, and also hydration.

Postoperative pain was assessed using NRS, starting from hours 6-72 (Table 1), the results were mild pain in all assessments. In line with the theory that ACB is considered as the first choice postoperative pain management in knee surgeries, because it can reduce pain without interfering with motoric skills.[13] This is because ACB only blocks the innervation of several muscle, and with right concentration it will only block the motoric nerve fiber. So that, using ACB as a post-operative analgesia should improve the pain after knee surgery and good for ambulation.

According to *Umut et al.,* ambulation and functional recovery after leg surgery using adductor canal block is assessed with several indicators. First, the timed up and go test (TUG) with partial weight bearing wich measures the time taken by a person to get up from a chair to a chair then walk a distance of 3 meters and return to the chair. Second, the 30s-CST test wich measures how many times in 30 seconds a person can rise from a full sitting position to a standing position. Third, the 5xSST test wich measures the time it takes an individual to rise from a full sitting position to a full standing position 5 times. Fourth, the 6 WMT test wich evaluates the distance that can be traveled in 6 minutes. And the last, straight leg raising (SLR) test wich is assessed in the first 48 hours.[9]

The ACLR mobilization phase according to *Adams et al.,* consists of 6 phases, where anesthesia plays a role in phase 1 immediate post operative (0-2 weeks

post op) which begins with partial weight bearing 15-50% of body weight.[8] If analgesia is inadequate, the mobilization will be hindered. The ability of patient's ambulation measured by 5 indicators. Table 2 describes the patient's ambulation for each indicator showed good ambulation, in line with research conducted by *Umut et al.,* whereas the speed of ambulation is superior to adductor canal block compared to femoral nerve block and intravenous analgetic modalities.[9] Its statements supports the research conducted by *Erdan et al.,* that ACB supports superior ambulation, low pain scores, and high patient satisfaction.[15]

CONCLUSION

In this case, it was found that the use of ACB in ACLR can facilitate adequate analgesia, does not require other rescue analgetics, reduce the incidence of PONV, and improve the ambulation as well as avoid other complications. Further research needs to be done on ACB with outcome indicators as above.

REFERENCES

1. Bollen SR, Scott BW. Rupture of the anterior cruciate ligament – A quiet epidemic? *Injury.* 1996;27:407–9. [PubMed] [Google Scholar]
2. American Society of Anesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in perioperative settings: An updated report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology.* 2012 ;116:248–73.
3. Laksono RM et all, "Adductor canal block is superior to intravenous analgesia for multimodal postoperative pain management in anterior cririate ligament recontruction" Apicare: 2022
4. Faraj W Abdallah, M.D, "Adductor Canal Block Provides Noninferior Analgesia and superior Quadricpes Strenght Conpare with Femoral nerve block in anterior cruriate ligament recontruction" Anesthesiology ASAHQ: 2016
5. Connoly PT, Zittel KW. A coparation of postoperative pain between anterior cruriate ligament recontruction anda repair. Eur J Orthop Surg Traumatol. 2021:31(7):1403-1409
6. Karnawat R, Gupta M and Suthar OP. Adductor Canal Block for Post-Operative Pain Relief in Knee Surgeries: AReview Article. J Anesth Clin Res 2015, 6:10http://dx.doi.org/10.4172/2155-6148.1000578.
7. Enstrup M, Jaeger P, Lund J, et al. Effects of adductor-canal-blockade on pain and ambulation after total knee arthroplasty: a randomized study. Acta Anaesthesiol Scand 2012;56(3):357–64.
8. Adams D, Logerstedt D, et al. Current Concepts for Anterior Cruciate Ligament Reconstruction: A Criterion-Based Rehabilitation Progression. *JOSPT* 2012 42(7): 601-614.
9. Umut Chanbek, Continous Adductor Canal Block for Total knee Replacement, Acta Orthop Turc.2019
10. Heba, Comparative Study between Adductor Canal Block, Femoral Nerve Block and Epidural Analgesia for Management of Post-Operative Pain in Total Knee Replacement: 2010
11. Moahammad, Adductor Canal Block for Knee Surgeries: An Emerging Anlgesic Technique Arch Bone Jt Surg. 2017

12. Calatayud, J.; González, Á. History of the Development and Evolution of Local Anesthesia Since the Coca Leaf. J. Am. Soc. Anesthesiol. 2003, 98, 1503–1508. [Google Scholar] [CrossRef] [PubMed]
13. Bernetti, A.; Mangone, M.; Paolucci, T.; Santillis, V.; Verna, S.; Agostini, F.; Paoloni, M. Evaluation of the efficacy of intra-articular injective treatment with reticular hyaluronic acid (Mo.Re. Technology) in amateur athletes with over-use gonarthrosis. Med. Dello Sport 2020, 73, 127–139. [Google Scholar]
14. Weibel S, Rücker G, Eberhart LH, Pace NL, Hartl HM, Jordan OL, et al. Drugs for preventing postoperative nausea and vomiting in adults after general anaesthesia: a network meta-analysis. Cochrane Database Syst Rev. 2020;10:CD012859. [PMC free article] [PubMed] [Google Scholar]
15. Erdan Kayupov 1, Kamil Okroj 1, Adam C Young 2, Mario Moric 2, Timothy J Luchetti 1, Gilat Zisman 2, Asokumar Buvanendran 2, Tad L Gerlinge. Continuous Adductor Canal Blocks Provide Superior Ambulation and Pain Control Compared to Epidural Analgesia for Primary Knee Arthroplasty: J Arthroplasty doi: 10.1016/j.arth.2017.11.013. Epub 2017 Nov 13.
16. Itai Gans, MD,* Julia S. Retzky, BA,† Lynne C. Jones, PhD,* and Miho J. Tanaka, MD*‡ Epidemiology of Recurrent Anterior Cruciate Ligament Injuries in National Collegiate Athletic Association Sports: The Injury Surveillance Program, 2004-2014 . Orthop J Sports Med. 2018
17. Daniel E becker, DDS. Lokal Anesthetics: Review Of Pharmacological Considerations. Anest Prog 2012