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CASE REPORT

Adductor Canal Block (ACB) provides Adequate Postoperative Analgesia in Patients Undergoing Total Knee Arthroplasty (TKA): Case Report : Postoperative Analgesia using ACB in TKA

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Abstract:

Background:

Effective postoperative multimodal analgesia facilitates early physical rehabilitation to maximize the postoperative range of motion and prevent joint adhesions following total knee arthroplasty (TKA). Adductor canal block has been reported as a supplement to multimodal analgesia protocols in patients undergoing TKA. The use of ultrasound (US) guidance has improved the success rates of the blocks compared with blind approaches.

Case Presentation:

This report described two elderly patients undergoing TKA with ACB as postoperative pain management, resulting in adequate pain control during the postoperative period.

Conclusion:

Adductor canal block can be used to optimize multimodal analgesia by reducing opioid requirements and enhancing recovery after TKA.

Keywords: Adductor canal block, Analgesia, Bupivacaine, Peripheral nerve block, Total knee arthroplasty, Osteoarthritis.

Article History

Received: February 1, 2022

Revised: March 8, 2022

Accepted: April 1, 2022

1. BACKGROUND

Osteoarthritis (OA) of the knee is one of the leading causes of disability among adults older than 65 years. End-stage arthritis of the knee is best managed with total knee arthroplasty (TKA) [1]. Pain is typically more severe after total knee replacement. Effective postoperative multimodal analgesia facilitates early physical rehabilitation to maximize the postoperative range of motion and prevent joint adhesions following knee replacement. It is important to balance pain control with the need for an alert and cooperative patient during physical therapy [2]. The approach to anesthetize the saphenous nerve within the adductor canal has been long entertained to provide analgesia to the medial aspect of the ankle and foot. However, the concept of using this block for TKA is a fairly recent innovation [3]. A saphenous nerve block

has been reported as a supplement to multimodal analgesia protocols in knee replacement surgery patients. A more proximal (mid-thigh) approach and a larger volume of local anesthetic are used for this adductor canal block. The use of ultrasound (US) guidance has improved the success rates of saphenous blocks compared with field blocks below the knee and blind trans-sartorial approaches [4].

2. CASE

2.1. Case 1

A 70-year-old woman (160 cm, 65 kg) was diagnosed with left knee osteoarthritis and was scheduled to undergo left knee replacement under spinal anesthesia and left adductor canal block postoperatively. Physical examination was normal except for pain in the left knee joint when walking and laboratory findings were within the normal limits. The procedure was performed after the consent was obtained. The spinal anesthesia was performed with 15 mg (3 ml) of 0.5%

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hyperbaric bupivacaine without adjuvant. The duration of the surgery was 180 minutes. After surgery, the procedure was performed under ultrasonography (USG) guidance using a 38 mm 6 MHz linear transducer and a 22G 100 mm regional block needle. The patient was positioned supine, with the thigh abducted and externally rotated. The skin is disinfected and the transducer is placed anteromedially around the mid-thigh level. The needle is inserted in the plane in a lateral-to-medial orientation and advanced to the femoral artery. Once the needle tip is visualized anterior to the artery, 1–2 mL of local anesthetic is injected to confirm the proper injection site. After confirming no intravascular injection by aspiration, 20 ml of 0.25% isobaric bupivacaine was injected. Doses of 750 mg intravenous metamizole, and 500 mg oral paracetamol, and 75 mg oral gabapentin were administered every 8 hours as postoperative analgesia for 48 hours. The patient was monitored postoperatively for 2 hours in the recovery room and the next 48 hours in the medical ward. The patient did not report any breakthrough pain during the monitoring period, with VAS 0/10. The patient was noted to have good strength in the operative limb and was able to ambulate early. On the third day, the patient began to report mild pain with VAS 1/10 when moving but still did not report pain at rest. No adverse event was found.

2.2. Case 2

A 66-year-old man (167 cm, 60 kg) was diagnosed with bilateral osteoarthritis and was scheduled to undergo left knee replacement under spinal anesthesia and left adductor canal block for postoperative analgesia. The patient was with comorbidities of controlled hypertension (BP = 140/80 mmHg) uses 10 mg oral amlodipine once daily and controlled diabetes mellitus (RBG = 110 mg/dl) using 5 IU premeal rapid-acting insulin every 8 hours and 10 IU long-acting insulin at night. The consent was obtained, and spinal anesthesia was performed with 15 mg (3 ml) of 0.5% hyperbaric bupivacaine without adjuvant. The surgery was finished within 160 minutes. After surgery, the procedure of adductor canal block was performed similarly with the patient in Case 1. The patient was administered similar postoperative analgesia to the patient in Case 1. The patient also did not report any breakthrough pain during the monitoring period until the first pain with VAS 2/10 when moving was reported after 48 hours. No adverse event was found. The patient was also noted to have the good postoperative muscle strength and met all physical therapy goals.

3. DISCUSSION

Following the introduction of Enhanced Recovery After Surgery (ERAS) by Henrik Kehlet in 1997, postoperative analgesia aims at facilitating early mobilization and rehabilitation, thereby enhancing recovery and minimizing postoperative morbidity [5]. The adductor canal block (ACB), also known as a saphenous nerve block, is predominantly a sensory block with only the motor nerve to the vastus medialis of the quadriceps muscle traverses the adductor canal [6]. The theoretical advantage of preserving quadriceps muscle strength provides better ambulation ability than traditional neuraxial or femoral nerve blocks (FNB), making it an alternative modality

for postoperative analgesia in TKA [7 - 9]. A recent systematic review also suggested that ACB decreases opioid requirements when compared to placebo [7]. As the number of patients aged over 80 years undergoing TKA has been on the rise, decreasing opioid and other NSAIDs requirements by using ACB will be beneficial in reducing complications caused by these medications in the elderly [10].

ACB aims to have local anesthetic spread lateral to the femoral artery and deep to the sartorius muscle or more distal below the knee, adjacent to the saphenous vein [4]. The target is the two largest sensory contributors of the femoral nerve to the knee, the saphenous nerve and the branch of the vastus medialis, but also the terminal end of the posterior branch of the obturator nerve as it enters the distal part of the adductor canal [6]. The saphenous nerve is a terminal sensory branch of the femoral nerve. It supplies innervation to the medial aspect of the leg down to the ankle and foot. It also sends infrapatellar branches to the knee joint. The ACB results in anesthesia of the skin on the medial leg and foot [4].

Several studies have compared the effectiveness between ACB and FNB in the setting of TKA, and found that ACB is superior to FNB regarding sparing of quadriceps strength and faster knee function recovery, albeit not inferior to FNB regarding pain control or opioid consumption [11, 12]. However, Lim *et al.* found no statistically significant differences in analgesic effects, quadriceps strength, or functional recovery postoperatively between ACB and FNB [13]. This may be because of the fact that although the saphenous nerve block is a sensory block, an injection of a large volume of local anesthetic into the subsartorial space can result in a partial motor block of the vastus medialis due to the block of the femoral nerve branch to this muscle, often contained in the canal [4].

Nevertheless, no single regional anesthesia technique can provide ideal analgesia, especially without any motor weakness after TKA [14]. Some patients will not achieve adequate posterior knee analgesia as ACB pain relief is primarily limited to the anterior capsule of the knee [6, 14]. Infiltration between the Popliteal Artery and Capsule of the posterior Knee (IPACK) and genicular nerve block (GNB) combined with ACB has been studied to cover this problem with promising results [14, 15]. Combined ACB and local infiltration analgesia (LIA) also showed enhanced early ambulation with reduced and delayed rescue analgesia after TKA [16]. Both patients did not report any postoperative posterior knee pain for up to 48 hours in this report.

In ACB, the saphenous nerve can be blocked by up to 30-mL volume of a local anesthetic to provide moderate postoperative pain relief after knee surgery [17]. In general, the duration of action is affected by the concentration of the local anesthetic and the volume injected. Duration of action can also be prolonged with additives. However, there is still no unified agreement on choosing the best agents for ACB [18]. Nader *et al.* reported effective pain management in the postoperative period after TKA using 10 mL of bupivacaine 0.25% with epinephrine 1:300,000 [19]. Grevstad *et al.* reported that using 30 mL of ropivacaine 0.2% for ACB resulted in a mean VAS reduction of 32 mm during active flexion of the knee [6]. These

findings were in line with this case report, where 20 ml of bupivacaine 0,25% provided adequate pain relief in both patients.

Regarding the optimal timing for ACB in TKA, Poonet *al.* compared the outcome between performing ACB at the post-anesthesia recovery unit (PACU) and before inducing general anesthesia. Despite no differences in opioid consumption, the latter resulted in a better intraoperative hemodynamic state [20]. In this report, ACB in TKA provided adequate postoperative analgesia.

CONCLUSION

Adductor canal block can be used to optimize multimodal analgesia by reducing opioid requirements and enhanced recovery after TKA. Further study about the use of ACB in TKA is needed to establish the effectiveness of this technique.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Written informed consent has been obtained from all individuals included in the publication of the case report.

STANDARDS OF REPORTING

CARE guidelines were followed in this study.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

- [1] Feng JE, Novikov D, Anoushiravani AA, Schwarzkopf R. Total knee arthroplasty: Improving outcomes with a multidisciplinary approach. *J Multidiscip Healthc* 2018; 11: 63-73. [http://dx.doi.org/10.2147/JMDH.S140550] [PMID: 29416347]
- [2] Butterworth JF, Mackey D, Wasnick JD. *The practice of anesthesiology*. 2019.
- [3] Yuan SA, Hanson NV, Salinas F. Adductor canal block for total knee arthroplasty: A review of the current evidence. *J Anesth Surg* 2016; 3(6): 1-9. [http://dx.doi.org/10.15436/2377-1364.16.053]
- [4] Bendtsen TF, Lopez AM, Clark TB. Ultrasound-guided saphenous (Subsartorius/Adductor Canal) nerve block. *Hadzic's Textbook of Regional Anesthesia and Acute Pain Management*. 2nd ed. New York: Mc Graw-Hill 2017; pp. 615-9.
- [5] Ljungqvist O, Hubner M. Enhanced recovery after surgery-ERAS-principles, practice and feasibility in the elderly. *Aging Clin Exp Res* 2018; 30(3): 249-52. [http://dx.doi.org/10.1007/s40520-018-0905-1] [PMID: 29453605]
- [6] Grevstad U, Mathiesen O, Lind T, Dahl JB. Effect of adductor canal block on pain in patients with severe pain after total knee arthroplasty: A randomized study with individual patient analysis. *Br J Anaesth* 2014; 112(5): 912-9. [http://dx.doi.org/10.1093/bja/aet441] [PMID: 24401802]
- [7] Hoogma DF, Rex S, Van De Velde M, Coppens S. Efficacy of adductor canal block in total knee arthroplasty: A systematic review. *Acta Anaesthesiol Belg* 2017; 68(2): 63-71.
- [8] Kuang MJ, Ma JX, Fu L, He WW, Zhao J, Ma XL. Is adductor canal block better than femoral nerve block in primary total knee arthroplasty? A GRADE analysis of the evidence through a systematic review and meta-analysis. *J Arthroplasty* 2017; 32(10): 3238-3248.e3. [http://dx.doi.org/10.1016/j.arth.2017.05.015] [PMID: 28606458]
- [9] Kwofie MK, Shastri UD, Gadsden JC, *et al.* The effects of ultrasound-guided adductor canal block versus femoral nerve block on quadriceps strength and fall risk: A blinded, randomized trial of volunteers. *Reg Anesth Pain Med* 2013; 38(4): 321-5. [http://dx.doi.org/10.1097/AAP.0b013e318295df80] [PMID: 23788068]
- [10] Cheung A, Fu H, Cheung MH, Chan WKV, Chan PK, Yan CH, *et al.* How well do elderly patients do after total knee arthroplasty in the era of fast-track surgery? *Arthroplasty* 2020; 2(1): 0-5.
- [11] Wang D, Yang Y, Li Q, *et al.* Adductor canal block versus femoral nerve block for total knee arthroplasty: A meta-analysis of randomized controlled trials. *Sci Rep* 2017; 7(1): 40721. [http://dx.doi.org/10.1038/srep40721] [PMID: 28079176]
- [12] Jæger P, Zaric D, Fomsgaard JS, *et al.* Adductor canal block versus femoral nerve block for analgesia after total knee arthroplasty: A randomized, double-blind study. *Reg Anesth Pain Med* 2013; 38(6): 526-32. [http://dx.doi.org/10.1097/AAP.000000000000015] [PMID: 24121608]
- [13] Lim YC, Quek HYK, Phoo WHJ, Mah CL, Tan S. A randomised controlled trial comparing adductor canal block and femoral nerve block for knee arthroplasty. *Singapore Med J* 2019; 60(3): 145-9. [http://dx.doi.org/10.11622/smedj.2018082] [PMID: 30009316]
- [14] Kukreja P, Venter A, Mason L, *et al.* Comparison of Genicular Nerve Block in Combination With Adductor Canal Block in Both Primary and Revision Total Knee Arthroplasty: A Retrospective Case Series. *Cureus* 2021; 13(7):e16712 [http://dx.doi.org/10.7759/cureus.16712] [PMID: 34471571]
- [15] Zheng F-Y, Liu Y-B, Huang H, Xu S, Ma X-J, Liu Y-Z, *et al.* The impact of IPACK combined with adductor canal block under ultrasound guidance on early motor function after total knee arthroplasty. *Braz J Anesthesiol* 2021; 21: 1-13. [PMID: 33915199]
- [16] Kampitak W, Tanavalee A, Ngarmukos S, Amarase C, Apihansakorn R, Vorapalux P. Does adductor canal block have a synergistic effect with local infiltration analgesia for enhancing ambulation and improving analgesia after total knee arthroplasty? *Knee Surg Relat Res* 2018; 30(2): 133-41. [http://dx.doi.org/10.5792/ksrr.17.088] [PMID: 29843199]
- [17] Tao Y, Zheng SQ, Xu T, *et al.* Median effective volume of ropivacaine 0.5% for ultrasound-guided adductor canal block. *J Int Med Res* 2018; 46(10): 4207-13. [http://dx.doi.org/10.1177/0300060518791685] [PMID: 30124351]
- [18] El-Rab NAG, Saad AH, Said HG, Aly MG. Review article: Ultrasound-guided adductor canal block for post-operative analgesia in knee arthroscopy. *Med J Cairo Univ* 2018; 86(9): 2141-8. [http://dx.doi.org/10.21608/mjcu.2018.57492]
- [19] Nader A, Kendall MC, Manning DW, *et al.* Single-dose adductor canal block with local infiltrative analgesia compared with local infiltrate analgesia after total knee arthroplasty: A randomized, double-blind, placebo-controlled trial. *Reg Anesth Pain Med* 2016; 41(6): 678-84. [http://dx.doi.org/10.1097/AAP.0000000000000494] [PMID: 27776098]
- [20] Poon YY, Yang JCS, Chou WY, *et al.* Is there an optimal timing of adductor canal block for total knee arthroplasty?—A retrospective cohort study. *J Pers Med* 2021; 11(7): 1-8. [http://dx.doi.org/10.3390/jpm11070622] [PMID: 34209054]