Comparison of ropivacaine vs combination of ropivacaine and dexmedetomidine in adductor canal block for postoperative analgesia after knee surgeries

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ABSTRACT

INTRODUCTION:

Knee surgeries, encompassing a spectrum from arthroscopic procedures to total knee replacement, are commonly performed to address a myriad of conditions such as ligament tears, meniscal injuries, osteoarthritis, and rheumatoid arthritis. [1] Knee surgeries are associated with severe post operative pain. Effective pain management is crucial not only for ensuring patient comfort but also for facilitating early mobilization, minimizing complications, and expediting recovery. In recent years, adductor canal block (ACB) has been introduced as a pure sensory nerve block for postoperative analgesia following knee surgery.[3] but also for facilitating early mobilization, minimizing complications, and expediting recovery. This study seeks to compare the efficacy, safety, and outcomes of using ropivacaine alone versus ropivacaine-dexmedetomidine combination in adductor canal block for postoperative analgesia in knee surgeries. By evaluating parameters such as pain scores, patient satisfaction, and incidence of adverse events, this study aims to provide insights into the relative merits of each analgesic regimen in the context of knee surgeries.

METHODS:

This is a Prospective randomized observational study with a sample size of 80. Patients between age group of 18-65 years of American Society of Anaesthesiologists physical status I and II who are posted for knee surgeries were divided into two groups of 40 each i.e. Ropivacaine group[R] and Ropivacaine and dexmedetomidine[RD] a group . Ropivacaine group(n=40) received ropivacaine [7.5 mg/ml 10ml+ 10ml saline] post operatively by adductor canal block (volume 20ml).Group RD: Ropivacaine Dexmedetomedine group(n=40) received Ropivacaine and Dexmedetomedine 0.5mcg/kg [7.5mg/ml 10ml+ 10ml normal saline+0.5mcg/kg Dexmedetomedine] postoperatively through adductor canal block after knee surgery. The knee surgeries were conducted under spinal anesthesia . Duration of analgesia , pain score, the power of Quadriceps , success of early ambulation, the variability of hemodynamic parameters, the level of patient satisfaction, any undesirable side effects between the two groups were analysed and assessed.

RESULTS:

Both Group R and Group RD Both the groups were comparable and found no significant differences with respect to demographic data (age, gender, weight). The comparison of hemodynamic parameters between the two groups was done using One-Way ANOVA. Both the groups were comparable and found no significant difference with respect to HR, SBP, DBP, MAP at any of the time intervals measured post-operatively. Statistically there was no significant difference in SPO2 at immediate post-op, after 15 min, 45 minutes, 1 hour, 6 hours, 12 hours, 18 hours and 24 hours post-operatively. The duration of analgesia (in hours) was significantly higher in RD group (16.01 ± 0.65) as compared to R group (13.02 ± 0.54) (P <0.0001). Postoperatively, the mean Numeric rating scale scores were significantly lower in Group RD as compared to Group R at 6, 12, 18, and 24 hours (P<0.05**). Pre-operatively**: The quadriceps power in the Ropivacaine group was 1.56±4.51, while in the Ropivacaine + Dexmedetomedine group it

was 1.44±3.47. The p-value for this comparison was 0.894, indicating no significant difference between the two groups before the procedure. **24 hours after the block:** The quadriceps power in the Ropivacaine group was 3.70±2.01, and in the Ropivacaine + Dexmedetomedine group, it was 4.62±2.10. The p value for this comparison was 0.049, which suggests a statistically significant difference, with the Ropivacaine+ Dexmedetomedine group showing greater quadriceps power 24 hours post-block. Patient satisfaction was significantly higher in Group RD (55%) with 35% of the patients reporting better than expected peri-operative experience (p=0.0025). No adverse effects were observed in both the groups.

CONCLUSION:
This study provides a strong evidence that the combined administration of dexmedetomidine and ropivacaine is significantly more effective than ropivacaine alone for postoperative analgesia in patients undergoing knee surgeries. The lower Numeric Rating Scores, extended duration of analgesia, early ambulation and enhanced quadriceps muscle strength observed in the RD[Ropivacaine + Dexmedetomidine]group establishes its potential as a superior pain management technique.

Key Words: Adductor canal block, ropivacaine, dexmedetomidine ,analgesia

INTRODUCTION

Knee surgeries, encompassing a spectrum from arthroscopic procedures to total knee replacement, are commonly performed to address a myriad of conditions such as ligament tears, meniscal injuries, osteoarthritis, and rheumatoid arthritis. Despite advancements in surgical techniques and perioperative care, postoperative pain remains a significant concern for patients undergoing knee surgeries. [1] Knee surgeries are associated with severe post operative pain.

Effective pain management is crucial not only for ensuring patient comfort but also for facilitating early mobilization, minimizing complications, and expediting recovery. Among regional anesthesia techniques, nerve blocks have emerged as a key method due to their ability to provide targeted and prolonged analgesia while preserving motor function . In recent years, adductor canal block (ACB) has been introduced as a pure sensory nerve block for postoperative analgesia following knee surgery.[3] The adductor canal block, in particular, has gained popularity for knee surgeries as it provides effective analgesia for the anterior and medial aspects of the knee while sparing the motor function of the quadriceps muscle, facilitating early mobilization and rehabilitation

This study seeks to compare the efficacy, safety, and outcomes of using ropivacaine alone versus ropivacaine-dexmedetomidine combination in adductor canal block for postoperative analgesia in knee surgeries. By evaluating parameters such as pain scores, patient satisfaction, and incidence of adverse events, this study aims to provide insights into the relative merits of each analgesic regimen in the context of knee surgeries.

MATERIALS AND METHODS

This is a Prospective randomized observational study. The institute ethics committee clearance was obtained before start of study . All subjects were subjected to pre-anaesthetic evaluation and relevant laboratory investigations. Informed written consent was obtained from patients. The study conducted by Rakhee Goyal, Gaurav Mittal, Adductor canal block for post operative analgesia after simultaneous bilateral total knee replacement : A randomized controlled trial to study the effect of the addition of dexmedetomidine to ropivacaine showed that the proportion of satisfactory levels of the patients who received the drug in group RD as 0.83 for 1, 0.479 for 2 and 0.438 for 3 and percentage of satisfaction of patient of Group R [R] as 24.5% for level 1 with 5% significance level, power of 80% and computer generated randomization the caluculated sample size comes to 72 with 36 in each group. However , we considered 80 with 40 in each group. The software used was Winpepi[1] i. j. The study was conducted in 80 patients randomly divided into two groups of 40 each of either sex in age group of 18-65 years posted for knee surgeries i.e Ropivacaine group[R] and Ropivacaine and dexmedetomidine[RD] a group . Group R: Ropivacaine group(n=40) received ropivacaine [7.5 mg/ml 10ml+ 10ml saline] post operatively by adductor canal block (volume 20ml). m. Group RD: Ropivacaine Dexmedetomedine group(n=40)will received Ropivacaine and Dexmedetomedine 0.5mcg/kg [7.5mg/ml 10ml+ 10ml normal saline+0.5mcg/kg Dexmedetomedine] postoperatively through adductor canal block after knee surgery.

All patients were kept nil per oral for at least 6 h prior to surgery. On arrival to the operation theatre, wide bore IV access was secured, standard monitors attached and baseline vital parameters (Heart rate (HR), non-invasive

blood pressure (NIBP), oxygen saturation (SPO2), electrocardiography (ECG) were recorded.

After overnight fasting, patient was taken in the OT and pre-loading was done with 1 liter Ringer Lactate. Under all aseptic precautions in sitting position the patients were given sub arachnoid block for the surgery with 2.5 ml of 0.5% hyperbaric Bupivacaine and 25mcg fentanyl. After the completion of surgery, the patients were shifted to the block-procedure room. The block was performed by an experienced anesthetist.

An independent researcher generated the randomisation code on the basis of a computer-generated randomisation table. Each patient allocation was put in a serially numbered opaque envelop and handed over to the procedure room anaesthesiologist. The anaesthesiologist incharge of the case who performed the block was blinded to the Group allotted. The assessor (Ward Nurse) and the physiotherapist of the ward both were blinded to the study groups. The patient and the surgeon were also blinded to the study Group allocation. Data analysis was done independent of treatment allocation.

The block solution was made in a 20 ml syringe for each group. Group R: [Ropivacaine] (n = 40) received 10ml of 7.5mg/ml Ropvacaine + 10ml Normal Saline. Group RD: [Ropivacaine + Dexmedetomedine] (n =40) received 10ml of 7.5mg /ml Ropivacaine + 5mcg/kg of Dexmedetomedine and Normal Saline was added to make up the volume to 20ml. The patient was positioned with lower limb slightly abducted at the hips and flexed at the knees. After confirming the operated side at the level of mid-thigh, an ultrasound-guided ACB was performed by experienced anesthetist. A linear ultrasound probe covered in a sterile dressing was transversely placed to visualise the adductor canal. These structures were identified on the ultrasound-boat shaped sartorius muscle, femoral artery (pulsatile) and femoral vein (compressible by the probe), the latter two also confirmed on Doppler mode. A 21-gauge 10 cm short bevel needle was used in plane with the transducer, from lateral to medial, with the needle tip targeted anterolateral to the femoral artery and below the sartorius . A bolus of 2 ml of normal saline was used to confirm the location of needle tip. A volume of 20 ml of block solution was injected in 5 ml aliquots through the injection port of the needle after a careful negative aspiration. The spread of the drug between the sartorius and the femoral artery was be seen real time on ultrasound .

The patients were observed by the anaesthesia resident for 60 min in the procedure room. Heart rate (HR), arterial blood pressure (BP) and SpO2 were monitored continuously and noted at 15 min interval for the 1st h after the block, and then 6 hourly for the next 24 h. The vitals will be recorded in the following time . T0- Immediate post operative . T1- 15 minutes following T0 T2- 30 minutes following T0 . T3- 45minutes following T0 .T4- 60minutes following T0 .T5- 6 hours following T0 . T6- 12hours following T0 . T7-18 hours following T0 . T8-24 hours following T0 . Duration of analgesia was observed postoperatively and after 24hours after the block is given. Numeric Rating Scale (1–10, 1 being the least and 10 being the worst pain described by the patient) was used to assess pain at 6, 12, 18 and 24 h during the post-operative period. The quadriceps motor strength was assessed by straight leg raise on a 0–5 scale pre operatively and then at 24 h after the block as per the Medical Research Council Scale[3]

The patients were assisted to ambulate with support by the physiotherapist when motor strength will be ≥ 2 at 24 h. The ward nurse noted the time of ambulation and the number of steps that the patient could walk. Patient satisfaction score at 72 h postoperatively; is noted as 1- not satisfied, 2– satisfied 3 - better than expected. No adverse effects were observed in both the groups.

Data were collected using preformed data collection form and were entered in Microsoft excel . The generative data were expressed in terms of frequency , percentage and continuous variables in terms of mean and SD . Association between two categorical variables was analysed using chi – square test with $p< 0.05$ as statistically significant value at 95%CI. Student “t” test was used to test the significance of mean of 2 groups with $p <0.05$ as statistically significant value at 9

RESULTS:

Group R and RD were comparable and found no significant differences with respect to demographic data (age, gender, weight). The comparison of hemodynamic parameters between the two groups was done using One-Way ANOVA. Both the groups were comparable and found no significant difference with respect to HR, SBP, DBP, MAP at any of the time intervals measured post-operatively. Statistically there was no significant difference in SPO2 at immediate post-op, after 15 min, 45 minutes, 1 hour, 6 hours, 12 hours, 18 hours and 24 hours post-operatively.

The duration of analgesia (in hours) was significantly higher in RD group (16.01 ± 0.65) as compared to R group (13.02 ± 0.54) (P <0.0001).

Comparison of duration of analgesia between the two groups

Duration of analgesia (hr)	Group R	Group RD	P value
Mean	13.02	16.01	<0.0001
SD	0.54	0.65	

p value-< 0.001 the result is statistically significant

Postoperatively, the mean Numeric rating scale scores were significantly lower in Group RD as compared to Group R at 1, 6, 12, 18, and 24 hours (P <0.05)

: Comparison of NRS for pain (h) between the two groups

Time Intervals	Group R	Group RD	P value
T0- Immediate post-op	0.0 ± 0.0	0.0 ± 0.0	-
T1- 15 minutes	0.0 ± 0.0	0.0 ± 0.0	-
T2- 30 minutes	0.0 ± 0.0	0.0 ± 0.0	-
T3- 45 minutes	0.0 ± 0.0	0.0 ± 0.0	-
T4- 1 hour	0.4509 ± 0.50	0.0 ± 0.0	-
T5- 6 hours	0.901 ± 0.30	0.529 ± 0.50	<0.0001
T6- 12 hours	4.235 ± 0.619	2.470 ± 0.504	<0.0001
T7- 18 hours	3.665 ± 0.482	3.011 ± 0.476	<0.0001
T8- 24 hours	3.764 ± 0.42	3.417 ± 0.48	0.001

p value is 0.001(the results are statistically significant)

Pre-operatively: The quadriceps power in the Ropivacaine group was 1.56±4.51, while in the Ropivacaine + Dexmedetomedine group it was 1.44±3.47. The p-value for this comparison was 0.894, indicating no significant difference between the two groups before the procedure. 24 hours after the block: The quadriceps power in the Ropivacaine group was 3.70±2.01, and in the Ropivacaine + Dexmedetomedine group, it was 4.62±2.10. The p value for this comparison was 0.049, which suggests a statistically significant difference, with the Ropivacaine+ Dexmedetomedine group showing greater quadriceps power 24 hours post-block.

Comparison of power of quadriceps between the two groups

Power of Quadriceps	Group R	Group RD	P value
Pre-operatively	1.56±4.51	1.44±3.47	0.894
24 h after the block	3.70±2.01	4.62±2.10	0.049*

p value-0.049. the result is statistically significant

Patient satisfaction was significantly higher in Group RD (55%) with 35% of the patients reporting better than expected peri-operative experience (p=0.0025) when compared to group R where only 10% of the patients reported better than expected peri operative experience.

: Comparison of the level of patient satisfaction between the two groups.

Level of patient satisfaction	Group R	Group RD	P value
S1	**18 (45.0%)**	**04 (10.0%)**	**< 0.00001**
S2	**18 (45.0%)**	**22 (55.0%)**	
S3	**04 (10.0%)**	**14 (35.0%)**	
Total	**40**	**40**	

p value is < 0.00001 the result is statistically significant

DISCUSSION

Knee surgeries are a spectrum of procedures designed to address a wide range of issues affecting the knee joint, from acute injuries to chronic degenerative conditions . [1] Knee surgeries are associated with severe post operative pain. This study demonstrated that the combination of Ropivacaine and Dexmedetomidine in adductor canal blocks provides superior post-operative analgesia compared to Ropivacaine alone for patients undergoing knee surgeries.

The synergistic effects of Dexmedetomidine with local anesthetics like Ropivacaine are attributed to its ability to inhibit the release of norepinephrine and increase the action of inhibitory neurons, leading to prolonged sensory and motor blockade (Esmaoglu et al., 2010). Studies have shown that the addition of Dexmedetomidine to Ropivacaine in nerve blocks can significantly enhance analgesic outcomes, making it a valuable adjuvant in post-operative pain management The primary outcome showed significantly lower pain scores at 24 hours post-operatively in Group RD(Ropivacaine + Dexmedetomidine) compared to Group R (Ropivacaine Alone).

One of the most notable findings was the prolonged duration of analgesia in the combination group. The mean duration of analgesia was significantly longer when dexmedetomidine was added to ropivacaine, which could be attributed to dexmedetomidine's ability to prolong the sensory blockade. Perineural dexmedetomidine confers a significant extension of peripheral nerve block duration when combined with ropivacaine, indicative of its potentiation of local anesthetic effects through intricate pharmacodynamic mechanisms stated in **Marhofer et al** "Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: a volunteer study".This prolonged analgesic effect is beneficial in the context of knee surgeries, where effective pain management is crucial for early mobilization and rehabilitation.

Additionally, Group RD had ,early ambulation and greater power of quadriceps after 24 hours.

Effective pain control is a key determinant of patient satisfaction, influencing their overall experience and perception of care. Higher satisfaction scores in Group RD indicate that the enhanced analgesia provided by the combination therapy positively impacted patients' postoperative experience, contributing to better overall outcomes

In a study conducted **by Goyal R, et al** "Adductor canal block for post-operative analgesia after simultaneous bilateral total knee replacement: A randomised controlled trial" to study the effect of addition of dexmedetomidine to ropivacaine similar to our study concluded that ,the addition of dexmedetomidine to ropivacaine resulted in longer duration of analgesia after adductor canal block for simultaneous bilateral total knee replacement surgery[2]

A study similar to our study was conducted by **Chattopadhyay et al "** Evaluation of postoperative analgesic efficacy of dexmedetomidine as adjuvant with ropivacaine" which was a randomized controlled trial conducted in 3 arm parallel groups where 2 groups received dexmedetomidine and ropivacaine in the adductor canal block in patients undergoing unilateral TKR and one group received only ropivacaine which stated that the incorporation of dexmedetomidine into ropivacaine for adductor canal block significantly extends the duration of analgesia, reduces opioid consumption over a 24- hour period, enhances motor strength, and improves patient satisfaction following unilateral total knee arthroplasty. Importantly, this combination achieves these benefits without precipitating any adverse effects.[4]

Effective analgesia is crucial for early mobilization, which is associated with better functional outcomes and shorter hospital stays. The combination of Ropivacaine and Dexmedetomidine has been shown to provide sufficient pain relief without significant motor blockade, allowing patients to participate in rehabilitation exercises sooner.In a study conducted by **Jæger et a**l" Adductor canal block for postoperative pain treatment after revision knee arthroplasty:a blinded, randomized, placebo-controlled study" where ropivacaine and placebo were compared in adductor canal block for patients who underwent revision knee arthroplasty under general anesthesia which was a randomised controlled study stated that Revision knee arthroplasty is assumed to be even more painful than primary knee arthroplasty and predominantly performed in chronic pain patients, which challenges postoperative pain treatment. They hypothesized that the adductor canal block, effective for pain relief after primary total knee arthroplasty, may reduce pain during knee flexion (primary endpoint: at 4 h) compared with placebo after revision total knee arthroplasty and concluded that ropivacaine is a better analgesic agent and provided early ambulation in patients. These findings were reinforced by our study which showcased similar results . [3]

In a study conducted by **Grevstad U et al** titled ." Effect of adductor canal block versus femoral nerve block on quadriceps strength, mobilization, and pain after total knee arthroplasty: A randomized, blinded study". which is a comprehensive review included all types of study design, including randomized controlled trials (RCTs), retrospective comparative clinical trials, systematic reviews, and meta-analyses investigating the anatomy, infiltration technique, analgesic efficacy, and functional recovery of ACB, as well as comparison of analgesic efficacy and functional recovery between ACB and FNB in patients undergoing TKA . inclusion criteria of the search was publications that presented the anatomy of the adductor canal , mentioned the opioid consumption

,quadriceps power, mobilization ability after adductor canal block was given concluded that ACB provides comparable analgesic efficacy and facilitates earlier mobilization by sparing quadriceps strength compared with FNB .Our study, also consistently found that ACB provided superior analgesia with fewer side effects, promoting faster recovery and improved patient satisfaction.[5]

In a study conducted by **Karthik et al** titled **"** Comparison of postoperative analgesia with two different doses of dexmedetomidine as an adjuvant to ropivacaine in adductor canal block for unilateral total knee replacement surgery: A randomized double-blinded study"a randomized control study was performed comparing two different doses of dexmedetomidine as an adjuvant to ropivacaine in adductor canal block for unilateral total knee replacement surgeries, Postoperative pain, motor blockade, rescue analgesia, hemodynamic parameters, sedation, and adverse effects were recorded and concluded that higher doses of dexmedetomidine like 1microgram per kg provided better analgesia when given in adductor canal block as an infusion with perineural catheter The results of this study align with our study on the efficacy of

dexmedetomidine for postoperative pain management. [6]

Dexmedetomidine, an alpha-2 adrenergic agonist, has been shown to enhance the analgesic effects of local anesthetics when used as an adjuvant, potentially prolonging the duration of analgesia and reducing the need for systemic opioids. In another study conducted by **SS swami et al** titled **"**Comparison of dexmedetomidine and clonidine (α2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study" where one of the two study groups received dexmedetomidine as adjuvant for peripheral nerve block while the other group received clonidine as an adjuvant . duration of sensory ,motor blockade and pain scores were compared in both the groups. The study stated that the onset of sensory and motor blockade was faster with longer duration of analgesia in patients who received dexmedetomidine as adjuvant for the levobupivacaine in the supraclavicular plexus block for upper limb surgeries. The results of this study reinforce our study findings that dexmedetomidine provides superior analgesia in peripheral nerve blocks.[7]

In a study conducted by **Thapa et al** titled **"** Evaluation of analgesic efficacy of dexmedetomidine as adjuvant with ropivacaine in ultrasound-guided adductor canal block in patients following anterior cruciate ligament reconstruction surgeries" where 105 subjects received combination of ropivacaine and dexmedetomidine in adductor canal block. the primary outcome was the requirement of morphine 24 hours after the block while the secondary outcome was the hemodynamic stability. The conclusion was Use of perineural dexmedetomidine with LA for ACB in the postoperative period resulted in significant reduction in total morphine consumption . Our study also recognised that patients who received dexmedetomidine in the ACB as an adjuvant were having prolonged duration of analgesia when compared to the patients who did not receive it. [8]

Magnesium has been studied as an adjuvant to local anesthetics due to its NMDA receptor antagonist properties, which can enhance analgesia and reduce opioid consumption**. Shukla et al. (2012)** titled "Dexmedetomidine and Magnesium Sulfate as Adjuvant to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block" conducted a study comparing the efficacy of Magnesium and Dexmedetomidine as adjuvants to Ropivacaine and found that while both agents improved analgesia, Dexmedetomidine provided superior pain control and patient satisfaction .The results of this study reinforce our study findings that dexmedetomidine provides superior analgesia in peripheral nerve blocks.[9]

A study conducted by **Wang C J et al** titled" Efficacy of perineural dexamethasone with ropivacaine in adductor canal block for post-operative analgesia in patients undergoing total knee arthroplasty" A randomized controlled trial stated that addition of dexamethasone to ropivacaine in adductor canal block for patients undergoing total knee arthroplasty prolongs the duration of block when compared to the receiving ropivacaine alone. Our study's findings on the prolonged duration of analgesia provided by addition of an adjuvant to ropivacaine when compared to plain ropivacaine align with this study. [10]

ACB has gained substantial popularity in the realm of postoperative analgesia, particularly following knee surgeries such as total knee arthroplasty (TKA). This popularity stems from its ability to provide profound pain relief while maintaining quadriceps muscle strength, which is critical for early postoperative mobilization and rehabilitation

A prospective randomized control study was performed by **David H Kim et al** comparing the "efficacy of adductor canal block and femoral nerve block for total knee arthroplasty" and concluded that At 6 to 8 hours after anesthesia, the adductor canal block (ACB) showed better preservation of quadriceps strength compared to the femoral nerve block (FNB).the results of this research aligns with our study[11]

A study conducted by ***Zhao E et al*** titled "Dexmedetomidine Prolongs the Analgesic Effects of Periarticular Infiltration Analgesia following Total Knee Arthroplasty: A Prospective, Double-Blind, Randomized Controlled Trial "in 2023 studied the effect of addition of dexmedetomidine to Peri and Intraarticular Analgesia in increasing the duration of analgesia after TKA and concluded that adding dexmedetomidine increases the duration of analgesia after TKA with minimal adverse effets. The current study builds on this body of evidence by specifically examining the efficacy of addition of dexmedetomidine in patients undergoing knee surgeries we observed consistently lower pain scores in the RD(Ropivacaine +dexmedetomidine) group compared to the R(Ropivacaine) group. [12]

Andersen et al in a study titled "Continuous saphenous nerve block as supplement to single-dose local infiltration analgesia for postoperative pain management after total knee arthroplasty" in 2013 studied the effects of an ultrasound guided continuous peri- neural catheter technique on patients' pain scores after total knee arthroplasty. The authors concluded that pain scores were significantly reduced in the group that received ropivicaine through the adductor canal catheter versus saline. The findings of this study align with our study.[13]

Hanson et al in a study titled. " Ultrasound-guided adductor canal block for arthroscopic medial meniscectomy: a randomized, double-blind trial." In 2013 .illustrated that the adductor canal block with ropivacaine was superior in reducing equivalent resting pain scores than the same block with saline in patient's post- arthroscopic medial meniscectomy. Our study, also consistently found that ACB provided superior analgesia, promoting faster recovery and improved patient satisfaction. [14]

In 2013, in a study titled " The impact of analgesic modality on early ambulation following total knee arthroplasty." a head-to-head, retrospective study comparing the analgesic/ambulatory effects of the adductor canal block to femoral nerve block was published by **Perlas et al.** The authors quantitatively suggested that despite the femoral nerve block showing better analgesia, the strength loss in the quadriceps muscle was approximately 50%. They also demonstrated that an adductor canal block, plus local infiltration following surgery, was associated with earlier ambulation and strength preservation. The findings of this research align with our study.[15]

Jenstrup and colleagues in a study titled ." Effects of adductor-canal-blockade on pain and ambulation after total knee arthroplasty: A randomized study." In 2012 sought to establish a reduction of pain during a 45-degree flexion after knee surgery, reduce morphine consumption, and formally link muscle strength preservation by means of early ambulation. They were successful in all aspects, the most notable of which was the pain reduction at the 2- and 24-hour marks. The results of this study align with our study on the efficacy of ACB for postoperative pain management and early ambulation.

LIMITATIONS OF THIS STUDY

- The study sample was small to extrapolate and draw further conclusive evidence
- Cost effectiveness of the study was not performed
- Only ASA grade I and II patients were included
- Patient with significant co-morbidities were not included
- Patients of age below 18 years and above 65 years were not included in the study

CONCLUSION

This study provides a strong evidence that the combined administration of dexmedetomidine and ropivacaine is significantly more effective than ropivacaine alone for postoperative analgesia in patients undergoing knee surgeries.

The lower Numeric Rating Scores, extended duration of analgesia, early ambulation and enhanced quadriceps muscle strength observed in the RD[Ropivacaine + Dexmedetomidine]group establishes its potential as a superior pain management technique.

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