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Comparison of Analgesic Effect of a Single Dose of PerineuralRopivacaine With and Without Dexamethasone on Ultrasound-Guided Femoral Nerve Block After Total Knee Arthroplasty.

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Abstract

Background:
Postoperative pain after total knee replacement surgery is an unpleasant memory for the patients. Different techniques have been tried to elevate the post-operative pain. A femoral nerve block with local anaesthetics is considered to bethe gold standard for postoperative pain.But the pain-free period after the femoral nerve block lasts for a few hours only.Several adjuvants have been triedwith local anaestheticsto prolong analgesics' duration and avoid the adverse effects of NSAIDsandopioid use.

Objective:
In this study, we have used dexamethasone as an adjuvant withropivacaine to prolong the duration of analgesia effect, in a single dose of perineural femoral nerve block after total knee arthroplasty.

Methods:
It was a prospective, randomized, controlled study, sixty patients were randomly assigned to one of two groups:Group R or Group RD. In Group R, 40 mL of 0.375% ropivacaine was used, and in Group RD 8 mg of dexamethasone was used as an adjuvant to 40 mL of 0.375% ropivacaine.The primary endpoint was to check the duration of analgesia after the femoral nerve block and the secondary endpoint was to check the amount of rescue analgesic consumed in the first 24 hours, postoperatively.A visualanalogue scale (VAS) score was used to access the pain with 1 being the least pain and 10 being the highest. The adverse reactions to the drugs were also noted in both groups.

Results:
The duration of Analgesia for Group R was 10.16 ± 2.08 hours (Mean ± SD) as compared to Group RD 18.14 ± 2.52 hours and was statistically significant (P-value < 0.05). The amount of

rescue analgesia requirement was also significantly low in Group RD (75.8 ± 28.71 mg) than in Group R (150.78 ±14.09 mg).

Conclusion:

Dexamethasone prolongs the effect of ropivacaine in a single dosefemoral nerve block. Quality of analgesia and patient satisfaction werealso better compared to patients who did not get dexamethasone as an adjuvant to ropivacaine.

Keywords:postoperative analgesia, total knee arthroplasty, ropivacaine, dexamethasone,femoral nerve block

1. INTRODUCTION

Postoperative pain is the combination of unpleasant sensory, emotional and mental experience after surgical trauma. Effective postoperative pain control is essential for every surgical procedure.After a total knee replacement(TKR), postoperative pain is moderate to serve. This requires a multimodal analgesia regimen that can help in early mobilization, shorteningthe hospital stay, and increase overall patient satisfaction.The armamentarium of post-operative analgesia has many options like epidural analgesia, intravenous infusion of opioids and non-opioids, perineural block, etc. Ultrasound-guided single dose perineuralfemoral nerve block provides effective postoperative analgesia after TKR.[1]A limitation to the use of postoperative analgesia is that the analgesic effect lastsonly a few hours after which moderate to severe pain at the surgical site may result in the need for alternative analgesic therapy. Several adjuvants (epinephrine[2], dexamethasone[3], dexmeditomidine[4], midazolam, opioids[5]) have been used to prolong the analgesic duration of peripheral nerve block and reduce the dose-dependent adverse effects of local anaesthetics. This study has used dexamethasone as an adjuvant to ropivacaine and compared its efficacy with ropivacaine as a single agent.

2. METHODS AND MATERIALS

After obtaining Ethical committee approval and written informed consent 60 patients were randomized into the study. The key inclusion criteria were male or female patients aged between 40 and 75 years, met theAmerican Society of Anesthesiologists (ASA) physical status I and II, undergoing elective unilateral total knee arthroplastywere selected for the study. Patients with a neuromuscular disorder, neuropathies, ASA III, ASA IV, not cooperative for the procedure, or hypersensitive to ropivacainewere excluded from the study. Patients were randomly divided into Group R or RD by sealed envelope technique, with 30 patients in each.Patients in GroupReceived 40 mL of 0.375%ropivacaine and patients inGroup RD received 8 mg of dexamethasone as an adjuvant to40 mL of 0.375%ropivacaine.It was a prospective randomized control study.

Patients have fasted forsix hours before surgery. On the day of surgery, baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and oxygen saturation (SpO2) was recorded and monitored throughout surgery.A balanced crystalloid fluid was started at 20mL/kg of body weight after placing an18G cannula.A subarachnoid block was given in L3-L4 space with a 25G Quinckeneedleusing3mL of 0.5% hyperbaric bupivacaine in a sitting position.

No analgesics or sedatives were given during surgery. All the patients were given intra-articular ketorolac with adrenaline by the operating surgeon, after the surgery. Immediately after the application of dressing,an ultrasound-guided femoral nerve block was given with a blinded drug.A portable ultrasound device with a linear transducer probe (SonoSite M-Turbo, Fujifilm USA)was usedfor femoral nerve block. The probe was placed transversely one centimeter below the inguinal crease. Thesonoanatomy landmark of thefemoral nerve appears as a hypoechoic wedge nerve bundle, medial to the nerve is a pulsating femoral artery, and medial to the artery is collapsing femoral vein. A 100mm stimuplex needle was inserted by usingan in-plane approach. The selected drugs were injected after confirmation of negative aspiration and hydro-dissection.The painwas assessed by the Visual Analog Scale (VAS)of 0-10.Heart rate, Blood pressure, oxygen saturation, VAS score, and adverse reaction were recorded at 1st, 2nd, 4th, 8th, 12th, and 24th hours postoperatively.Rescue analgesia was administered when the VAS score was more than 4(injection of Diclofenac 75mg in 100mLnormal saline as slow intra-venous). In case of nausea and vomiting, ondansetron 4mg was given intravenously. The time interval between the end of FNB performance and the first demand by the patient for rescue analgesia was taken as the duration of the drug used for nerve block. The total amount of rescue analgesia used in the first 24 hours was taken as the total amount of rescue analgesia used.

Statistical Analysis

Statistical Analysis was performed usingSPSS Version 2.1.0. Data were presented as mean ±standard deviation (SD). Comparison between groups was made using an independent t-test.Categorial Variables were assessed using the Chi-Square test.

3. RESULTS

A total of 60 patients were randomized and analyzed in this study, 30 in each group.There was no significant difference between the two groups concerning demographic profile andbaseline hemodynamic data (**Table 1**).The duration of Analgesia for Group R was 10.16 ± 2.08 hours (Mean ± SD) as compared to Group RD 18.14 ±2.52 hours and was statistically significant (P-value< 0.05). The amount of rescueanalgesia requirement was also significantly low in Group RD (75.8± 28.71 mg)thanin Group R (150.78 ±14.09 mg) (P=0.03).Both groups had no pain in the first 4 hours post-surgery.However, at8th and 12th-hour post-surgery, a statistically significant ($p<0.05$) pain was noted in Group R (VAS scores 4 and 5) compare to Group RD (VAS scores 1 and 2). At the 24th hour post-surgery, both groups had comparable pain (VAS scores 4 and 3 respectively) andwere not statistically significant (**Table**). In group R, the incidence of nausea and vomitingwas 26.6% at 8 hours, 20% at 12 hours, and 16.6% at 24 hours which was highercompared to group RD at 6.6% at 8 hours, 3.3% at 12 hours, and 3.3% at 24 hours. However, no statistical significance was noted.

Table 1: Patient Demographics and Baseline Characteristics

Demographics and Baseline Characteristics	**Group R**	**Group RD**	**P-value***
Age	61 (57–64)	63 (60–66)	0.58
Sex(M: F)	14:16	13:17	0.82
Height (cm)	165 (159–168)	166 (158–168)	0.67
Weight (kg)	70.64 ± 4.41	71.08± 5.54	0.055

BMI	29.94± 1.14	30.13 ±1.16	0.039
Baseline HR	79.09 ± 3.27	79.89 ± 3.43	0.261
Baseline SBP	123 ± 5.78	126 ± 3.76	0.237
Baseline DBP	72 ± 4.20	71 ± 4.36	0.433
Baseline SpO2	99.33 ± 0.83	99.20 ± 0.79	0.435
Duration of surgery	54.82±8.36	55.66 ± 12.23	0.201

*P<0.05, statistically significant

Table 2: Outcome Parameters

	Group R	**Group RD**	**P-value***
Duration of Analgesia (hour) (mean±SD)	10.16 ± 2	18 ± 2	0.02
Rescue analgesianeeded (mg) (mean±SD)	150.71 ±14.09	75.88±28.71	0.03
VAS at 4 hours	No pain	No pain	
VAS at 8 hours Mean (range)	4 (3-5)	1 (0-1)	0.02
VAS at 12 hours Mean (range)	5 (4-6)	2 (1-3)	0.03
VAS at 24 hours Mean (range)	5 (4-6)	4 (3-5)	0.17
Nausea& vomiting in 4 hours	nil	nil	
Nausea & vomiting in 8 hoursN (%)	8(26.6%)	2(6.6%)	0.21
Nausea & vomiting in 12 hoursN (%)	6(20.0%)	1(3.3%)	0.26
Nausea & vomiting at 24 hoursN(%)	5(16.6%)	1(3.3%)	0.36

*P<0.05, statistically significant

4. DISCUSSION

Postoperative Analgesia was initially centeredaroundopioids and NSAIDs. After the introduction of ultrasound in anesthesia practice,peripheral nerve blocks became accurate, and the use of newer local anesthetics made the procedure safe. Ropivacaine is an amide group of a local anesthetic drug,which is a pure enantiomer long-acting, less cardio-toxic, and neurotoxic.Ropivacaine seems to have the greatest margin of safety of all long-acting local anesthetics at present[6.] Paul et al (2010) performed a meta-analysis of 23 studies and demonstrated that a single-shot femoral nerve block improves analgesia and reduces morphine dose compared with intravenous patient-controlled analgesia.[7] Other studies have also shown that single-shot femoral nerve block is comparable to continuous femoral nerve block[8,9.] Ropivacaineis as effective as bupivacaine when used for single-shot femoral nerve block[10,11].KeAnet al (2015)found that perineural dexamethasone added to local anesthetic not only prolongs the duration of the block but also preventsreversible neurotoxicity and short-term "rebound hyperalgesia" after the resolution of nerve block[12.] In the current study, a statistically significant prolongation of the duration of analgesia was observedwhen dexamethasone was used as an adjuvant. The duration of Analgesia for Group R was 10.16 ± 2.08 hours (Mean ± SD) as compared to Group RD 18.14 ± 2.52 hours and was statistically significant (P-value< 0.05).Results indicate that the use of rescue analgesics wasreduced significantly in Group RD (75.8 ± 28.71 mg) comparedto group R (150.78 ±14.09 mg).Gupta et al (2019) statedthat the use of dexamethasone along with 0.375% ropivacaine prolongs the analgesic duration of TAP block in patients undergoing LSCS and has added benefits of opioid-sparing and anti-emetic effects, therebyresulting in better postoperative recovery and improved maternal satisfaction[13.] It was

also found that in the first 4 hoursboth groups had no pain although there was significant patient satisfaction and a pain-free period was observed in the dexamethasone group.The VAS score (group R4-5, group RD1-2)for pain at 8 and 12 hours post-operativeperiod was statistically significant ($p<0.05$).

CONCLUSION

It can be concluded that a single dose of perineuralropivacaine on ultrasound-guided femoral nerve block isan effective and safe modality for postoperative analgesia inthe first 24 hours after total knee arthroplasty.Ropivacaine(0.375%) with adjuvant dexamethasone provides an extended duration of analgesiaas compared to plainRopivacaine (0.375%).The requirement for rescue analgesics is also reduced with the addition of dexamethasone.

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