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EFFICACY OF INTRA-ARTICULAR DEXMEDETOMIDINE FOR POSTOPERATIVE ANALGESIA IN ARTHROSCOPIC KNEE SURGERY

Dr. Rupal B Shah, Dr. Pancham H Mehta, Dr. Kinjal Patel, Dr. Ishita S Thaker, Dr. Helly Mehta

[1]Associate Professor,[2]3rd year resident, [3]3rd year resident,[4]2nd year resident, [5]1st year resident
Department of Anesthesia, AMC MET Medical College and LG Hospital Ahmedabad pin 380008

Abstract

Introduction: *Post-operative pain is very common distressing symptom after any surgical procedure. Different drugs in different routes have been used for controlling post-arthroscopic pain. We have compared the efficacy of analgesic effect of plain ropivacaine versus ropivacaine with dexmedetomidine as an adjuvant when administered through the intra-articular route in arthroscopic knee surgery.* ***Materials and Methods****: from June 2017 to June 2019 sixty patients undergoing elective knee arthroscopy were randomly assigned to two groups (n=30). Group R received 19 ml of 0.50% ropivacaine and 1 ml of isotonic saline (total volume 20 ml) intraarticularly. Group RD received 100 µg (1 ml) of dexmedetomidine added to 19 ml of 0.50% ropivacaine intra-articularly (total 20ml). Pain was assessed using visual analogue scale (VAS) and diclofenac sodium given as rescue analgesia when VAS>4.Time of first analgesia request and total dose of rescue analgesics used in 24 hours were calculated.* ***Results****: VAS score was significantly lower in Group RD, time to first analgesic requirement was significantly greater in Group RD than in Group R and total dose of analgesics used in Group RD patients was significantly less compared to patients in Group R.* ***Conclusion****: Dexmedetomidine, added as adjunct to ropivacaine in patients undergoing arthroscopic knee surgery, improves the quality and duration of postoperative analgesia.*

Keywords: *dexmedetomidine, ropivacaine, arthroscopic knee surgery, intra-articular injection*

INTRODUCTION

Arthroscopic knee surgery is one of the minimal invasive procedures in modern orthopedic setup. It is associated with variable amount of post-operative pain, which is caused by irritation of free nerve endings of synovial tissue, anterior fat pad and joint capsule during surgical excision and resection. Postoperative pain relief is essential for early rehabilitation after arthroscopic knee surgery. Different analgesic agents for day care arthroscopy have been studied. Supposed agent should be active upon cessation of surgery, have a prolonged duration of action, be easy to administer and without serious side effects.

Ropivacaine[2] is a new local amino-amide anesthetic that blocks peripheral afferents from acting on voltage gated Na^+ channels. It has similar pharmacokinetic properties as Bupivacaine but different pharmacodynamics such as their vasodilatory properties and the toxicity[1-5].

Dexmedetomidine[6,7] is a highly selective alpha-2 adrenergic agonist with sedative, anxiolytic, analgesic, sympatholytic and antihypertensive effects. Activation of receptors in the brain and spinal cord level inhibits neuronal firing, thereby causing hypotension, bradycardia, sedation and analgesia. Dexmedetomidine has been used intravenously before initiation of regional anaesthesia and it has shown to provide some analgesic effect after arthroscopic knee surgery but there were some adverse haemodynamic effects. Intra-articular administration of dexmedetomidine may be useful to avoid the adverse haemodynamic effects of intravenous administration while still providing the postoperative analgesia. This double blind, prospective study is designed to assess and compare the postoperative analgesic effects of intra-articular dexmedetomidine
administered as adjuvant with local anaesthetic ropivacaine in patients undergoing arthroscopic knee surgery

METHODS

The study protocol was approved by the Institutional Ethics Committee of AMC MET Medical College, Ahmedabad and informed consent was obtained from every patient in their own language.

Sixty ASA I -II patients of either sex, aged 18-65 years, undergoing elective knee arthroscopy were randomly assigned to one of the two groups, containing thirty patients each. Surgical procedures consisted of synovectomy, articular cartilage procedures and ligament reconstruction.

Exclusion criteria:
Patient refusal
Any known allergy or contraindication to Ropivacaine, Dexmedetomidine
Pregnancy, Lactating mother
Children
Patients having history of cardiovascular, cerebrovascular, and respiratory diseases
Receiving chronic pain treatment

Hypertension treated with α methyldopa, clonidine or β adrenergic blockers[10,11] were excluded from the study. On preoperative rounds, the procedure was explained to patients and they were also taught to interpret the visual analogue scale (VAS) (graded from 0 = no pain to 10 = maximum pain). All patients were investigated for Hb%, TLC, DLC, Platelet count, PT with INR, Blood sugar, Blood urea, Serum creatinine, Liver function test.A 12 lead ECG and chest X-ray were also taken. All patients were kept fasting after midnight. On the operation table, routine monitoring (ECG, pulse oximetry, non-invasive blood pressure) were started and baseline vital parameters like heart rate (HR), blood pressure (systolic, diastolic and mean) and arterial oxygen saturation (SpO2) were recorded. An intravenous line was secured. During the procedure if any patient needed further dose of analgesia, that patient was excluded from the study. The anesthetic technique was standardized was for all patients. Lumbar puncture was done in sitting position at L3-L4 inter-vertebral disc space via median approach with 23G spinal needle, 3 ml of 0.5% Bupivacaine was given in subarachnoid space and the patient was placed in supine position immediately. After confirming the level of block arthroscopic procedure was allowed to start. At the end of the surgery before skin closure, the study drug was administered by the surgeon through the port site in the intraarticular space. Tourniquet was kept inflated for other 20 minutes. Drain put by the surgeon was clamped before administering the study drug and remained clamped for another 20 minutes.
In group R, 19 ml of 0.50% ropivacaine and 1 ml isotonic saline (total volume 20 ml) was administered into the knee joint. Similarly group RD patients received 100μg dexmedetomidine (1 ml) added to 19 ml 0.50% ropivacaine (again making a volume of 20 ml).
HR, NIBP, RR, SPO2, ECG and pain VAS will be recorded at 1st 2nd 4th 6th 12th 24th post-operative hour. Injection Diclofenac Sodium 75mg IM was given as rescue analgesia if the VAS>4. First analgesia request time, total diclofenac used in first 24 hours were recorded. All the date will be collected by the observer who is unaware of patient's group assignment. Patients were transferred to postanaesthesia care unit and intensity of pain and vital parameters were assessed for 24 hours. The patients were monitored for nausea and vomiting, drowsiness, hypotension (defined as systolic blood pressure >20% decrease from baseline) and bradycardia (heart rate <60 beats/min) during this period.

RESULTS

Table1. Pts characteristics of both groups

Variables	Group R(n=30)	Group RD(n=30)	P value
Age(years)	28±8	31±9	0.49
Sex(M/F)	26/4	23/7	
Weight(kg)	62±7	58±5	0.58
Duration(mins)	90±15	91±15	0.98

Table2. Types of surgical procedure undergone by two groups

Procedure	Group R	Group RD
Lateral meniscetomy	5	4
Medial meniscetomy	5	7
Medial collateral ligament repair	3	5
Lateral collateral ligament repair	6	4
Anterior cruciate ligament repair	7	6
Posterior cruciate ligament repair	5	4

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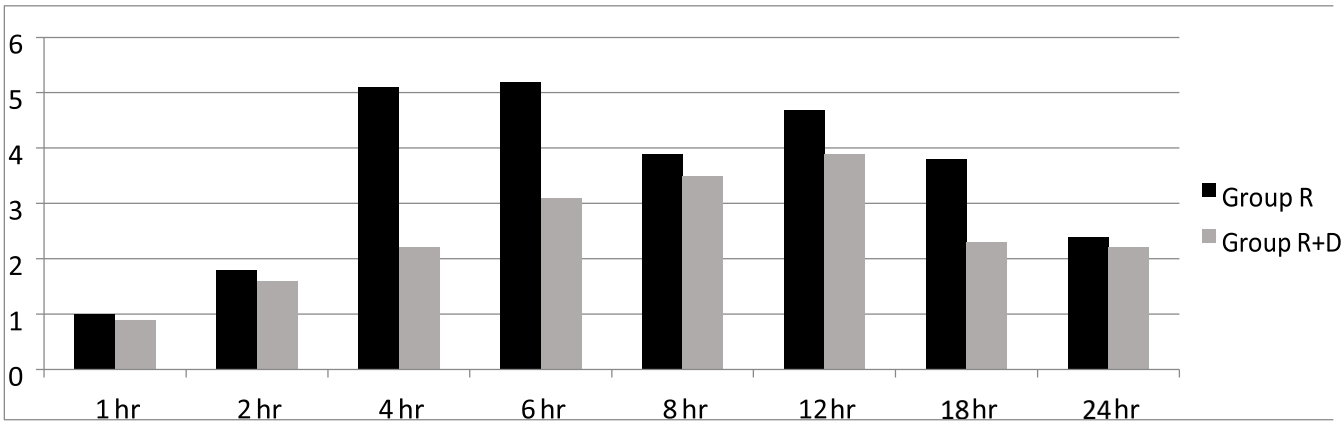
Table3. Intensity of pain in post operative period(VAS)



Intensity of pain was significantly less in Group RD in first 1 hour ($p<0.01$), 2($p<0.05$) hour and 6 hour($p<0.05$) following surgery.

Table4. Duration of analgesia and opioid consumption in both group

	Group R	Group RD	P value
Duration of analgesia(hours)	6.5±1.5	11.5±2.4	0.0001
Diclofenac Sodium consumption in 24 hrs(mgs)	150±25	90±15	0.001

DISCUSSION

In an attempt to improve the recovery and early rehabilitation after arthroscopic knee surgery, research has been directed towards developing newer techniques for
postoperative analgesia. Our study demonstrates a significant increase in postoperative analgesia with dexmedetomidine used with ropivacaine in comparison to ropivacaine alone. Alpha-2 adrenergic agonists produce their analgesic effects through supraspinal, spinal and peripheral actions. The analgesic effect of intra-articular dexmedetomidine[8,9] appears to be mainly due to direct local action. However, a central analgesic effect resulting from systemic absorption cannot be excluded. The mechanism of analgesic effect of intra-articular dexmedetomidine might be similar to that of intra-articular clonidine. Clonidine
produces analgesia mainly through inhibition of the transmission of nociceptive stimulation in the dorsal horn of spinal cord. Clonidine is reported to mimic the effect of noradrenaline release by descending inhibitory control pathways. Topical administration of clonidine may reduce pain intensity in patients with sympathetically maintained pain, suggesting a peripheral site of action. Dexmedetomidine, like clonidine, may provide local anaesthetic effects which inhibit the conduction of nerve signals through C and Aδ fibres and may stimulate the release of encephalin[13]-like substances at peripheral sites.A study evaluating the systemic effects of dexmedetomidine on postoperative analgesia in arthroscopic knee surgery found that buccal dexmedetomidine[15] is better than intramuscular dexmedetomidine in attenuating postoperative pain and reducing diclofenac requirement.In another study dexmedetomidine was used intravenously before epidural anaesthesia. Though dexmedetomidine provided some amount of postoperative analgesia, there were adverse haemodynamic effects like bradycardia and hypotension.When we compare our results with other commonly used intra-articular drugs dexmedetomidine and ropivacaine together provide more prolonged analgesia than most other intra-articular agents. In conclusion dexmedetomidine administered as adjuvant to local anaesthetic ropivacaine improves the quality and duration of postoperative analgesia and reduces the consumption of diclofenac sodium.

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CONFLICTS OF INTEREST: NIL

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