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A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL STUDY TO STUDY THE DURATION OF POST OPERATIVE ANALGESIA OF A COMBINATION OF LOW DOSE SPINAL ANAESTHESIA AND LUMBAR AND SACRAL PLEXUS BLOCKS IN LOWER LIMB SURGERY

Anaesthesiology

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ABSTRACT

Introduction: Lower limb fractures are a major cause of morbidity and very often require operative management. Post operative pain is nearly ubiquitous after major orthopedic surgery. Poorly controlled post operative pain is associated with significant morbidity including psychological effects, respiratory complications, increased hospital stay, increased opioid use, and impaired quality of life. Therefore providing adequate post-operative analgesia forms an integral part of optimal anaesthesia care. This study aims to compare the duration of post operative analgesia provided by a combination of low dose sub arachnoid block and lumbar and sacral plexus blocks, as compared to a combined spinal epidural technique. **Material And Methods:** Forty patients undergoing surgery for proximal femur fractures, were randomly assigned to two groups of twenty each. One group received a combined spinal epidural technique, while the other received a low dose sub-arachnoid block and lumbar and sacral plexus blocks. Both groups were monitored for haemodynamic, and respiratory parameters and the time to demand analgesia was noted. **Results** : The duration of effect and the duration of post-operative analgesia were longer in the Test group. The effect was highly significant. **Conclusion:** A low dose sub-arachnoid block, in combination with lumbar and sacral plexus blocks can provide prolonged duration of effectiveness, which carries on to the post-operative period as prolonged post operative analgesia, and with minimal adverse effects.

KEYWORDS

Low dose sub-arachnoid block, lumbar and sacral plexus block, post operative analgesia

INTRODUCTION

Lower limb fractures are a major cause of morbidity and very often require operative management.[1] Post operative pain is nearly ubiquitous after major orthopedic surgery. Arefayne et al found 70.5% patients had moderate to severe pain after emergency orthopedic surgery.[2] Edgley et al found the incidence of severe acute pain in the PACU to be 56%.[3] The authors own experience also shows that patients who are inadequately treated have moderate to severe pain and discomfort after major orthopedic surgery.

Poorly controlled post operative pain is associated with significant morbidity including psychological effects, respiratory complications, increased hospital stay, increased opioid use, and impaired quality of life.[4] Effective pain management speeds up recovery and healing and enhances quality of life.[5]Therefore providing adequate post-operative analgesia forms an integral part of optimal anaesthesia care.

Regional anaesthetic techniques are advantageous in lower limb orthopedic surgery as they can provide complete surgical anesthesia, leading to the avoidance of General Anaesthesia all together. They have the further advantage that the effect can persist into the post operative period, and provide persistent post operative analgesia. Regional anaesthetic techniques can afford superior overall pain control and reduce opioid use.[6] They can also reduce cognitive dissonance in the elderly patient by reducing opioid and sedative use.[6]

Regional anaesthetic techniques consist of Central Neuraxis blocks and Peripheral Nerve Blocks. Central Neuraxis Blocks have the advantage of being easy to perform, and can be extended by continuous or intermittent bolus techniques. However, they have the disadvantage of causing sympathetic blockade in addition to sensory and motor blockade. [7] White SM et al found that intraoperative hypotension was significantly associated with adverse effects in patients undergoing orthopedic surgery.[8] Peripheral nerve blocks have the potential to avoid sympathectomy and have minimal haemodynamic effects.[9] Combining peripheral nerve blocks with a low dose subarachnoid block has the potential advantage of fast onset, bilateral effect, minimal sympathetic blockade, long duration and prolonged post operative analgesia. [10] This study aims to compare the duration of post operative analgesia provided by a combination of low dose sub arachnoid block and lumbar and sacral plexus blocks, as compared to a combined spinal epidural technique.

Aims And Objectives

To compare the duration of post operative analgesia obtained by using a combination of a low dose subarachnoid block along with lumbar and sacral plexus blocks, with that of a combined spinal epidural technique.

MATERIAL AND METHODS

Ethics approval was obtained from the Institutional Ethics Committee vide Ref No. VIMS/IEC/C/2024/37, dated 29/05/2024, and the study was carried out following institutional and Helsinki Guidelines.[11]

CTRI registration carried out vide CTRI/2024/12/077717 dated 05 Dec 2024.

Forty patients above the age of eighteen, presenting to the Orthopaedic department of our institute with proximal femur fractures for surgery were randomly assigned to two groups of twenty patients each. Informed consent was obtained from all patients regarding both procedures and random assignment to either group. Patients with fresh trauma, or those with infection at the site of block, as well as those refusing consent, were excluded from the study.

The test group was administered a spinal anaesthetic with 5 mg (1 ml) of 0.5% heavy bupivacaine in the sitting position after aseptic preparation. The patient was made supine for a few minutes while onset of block, and adequacy of level were confirmed. Then the patients were placed in the lateral position with the surgical site on top. Aseptic preparation was again done. A lumbar plexus block was administered by identifying a point 4 cms from the midline, along a line joining the spinous process of the 4th Lumbar vertebra and the Iliac crest. A 100 mm needle was connected to a nerve stimulator and inserted to a depth of 60-80 mm until quadriceps contractions were obtained at a current intensity of 1.5 mA. The current intensity was gradually decreased to 0.5 mA. 25 ml of a solution of 0.5% bupivacaine with 1:100000 adrenaline was instilled.[12] Subsequently, a sacral plexus block was performed in the same position by inserting the same nerve stimulating needle 6 cms along a line joining the Posterior Superior Iliac Spine with the Ischial Tuberosity, to a depth of 60-80 mm. Hamstring or Calf muscle contractions, Plantar or dorsiflexion of the ankle, inversion or eversion of the foot and toes were sought at a current intensity of 1.5 mA, gradually decreasing to 0.5 mA. [13] Subsequently, the patient was positioned for surgery.

The Control group was administered a lumbar spinal anaesthetic with 12.5 or 15 ml (2.5-3 ml) of 0.5 % heavy bupivacaine in the sitting

position after full aseptic preparation, followed by placement of an epidural catheter. Then the patient was placed supine, and adequacy, and level of block confirmed. After confirming the same, the patient was positioned for surgery.

Blinding was achieved by having the patient monitored by a resident who was unaware of the procedure performed. Standard monitoring was done as per our institutional protocols including:

1. Heart Rate
2. Blood Pressure
3. ECG
4. SpO2
5. Blood loss
6. Urine output
7. Symptomatic Complaints
8. Any complications

In addition, the patient was monitored for pain,[14] and was administered analgesia when required. The time from Induction to analgesia administration was recorded, and compared.

Supplementation with General Anaesthesia was kept ready in case of discomfort during surgery. Epidural Top-ups were administered to the control arm patients as and when necessary. Measures were in place to promptly manage any complications.

The results were analysed by Students T Test for significance.[15]

RESULTS

1. There were 20 patients in the control and test arms each. The patient characteristics are as under:

Table 1: Patient Characteristics

Parameter	Test	Control	Significant Difference
Number	20	20	Nil
Age in years (Max,Mean,Min)	91, 68.2, 38	86, 63.8, 29	Nil
Sex (Male, Female)	13, 07,	09, 11	Nil
ASA Grade (Modal Value)	III	III	Nil
Co-morbidities (Most Common)	Geriatric, CAD, HTN, DM	Geriatric, CAD, HTN, DM	Nil
Surgery	Proximal Femur	Proximal Femur	Nil
Duration of surgery in minutes (Max. Mean. Min)	225, 127.5, 60	255, 136, 75	Nil

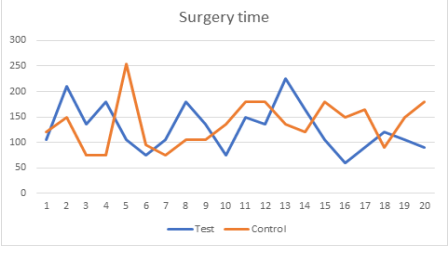

Fig 1. Total Duration Of Surgery

2. Duration Of Effect: All patients successfully underwent the anaesthetic procedure, and there were no dropouts due to conversion to General Anaesthesia. Two patients in the control group were administered epidural top-ups at 90 minutes and 165 minutes of surgery respectively. No patients in the test group required any supplementation.

The mean duration of effect as defined from time of induction, to time when the patient started complaining of pain was 16.89 hours in the test group, and 8.5 hours in the control group. The difference was highly significant.

Table 2: Duration Of Effect.

Duration of effect (hours)	Test	Control	pValue
Mean	17.03	8.82	<<0.01
Maximum	22.5	12.25	
Minimum	8.25	3.25	

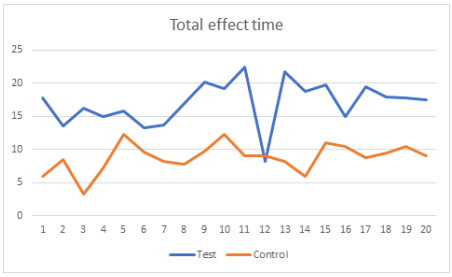

Fig 2. Duration of effect

3. Duration Of Post Operative Analgesia: The duration of post operative analgesia was defined as the time from the end of surgery to the time the patient had a Universal Visual Analogue Scale[9] score of 3. The mean time before the patient had pain and required supplemental analgesia was 14.71 hours in the test group and 6.33 hours in the control group. The difference was highly significant.

Table 3: Duration of Analgesia

Duration of Analgesia (hours)	Test	Control	pValue
Mean	14.9	6.55	<<0.01
Maximum	20	10	
Minimum	6	2	

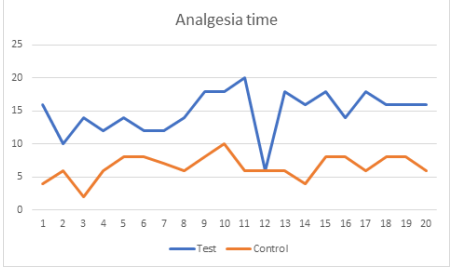

Fig 3: Duration Of Analgesia

4. Haemodynamic Effects And Complications: There was no significant difference in the mean heart rates and arterial pressures. No patient had hypotension or hypertension in either the control or the test group requiring treatment. There were no complications seen in any patient.

DISCUSSION

The study was carried out amongst patients who presented to our institution in a span of 3 months. Proximal femur fractures are common fractures related to age, due to osteoporotic changes[10]. Our patients were also predominantly elderly, with the mean age of 68.2 years in the test group, and 63.8 years in the control group. There was no difference in the demographic characteristics of either group.

The patients in both the groups had one or more co-morbidities, with Type 2 Diabetes Mellitus, Hypertension, and Coronary Artery Disease, being the most common. There was no significant difference in the prevalence of co-morbidities in the two groups. This is line with the epidemiology of proximal femur fractures as seen by other researchers. [16]

The surgeries carried out in the two groups were similar and involved internal fixation of proximal femur fractures, as well has hemiarthroplasties. There was no significant difference in the duration of surgeries in either of the groups, with the mean surgical time being 127.5 and136 minutes and the maximum time being 225 and 255 minutes.

We found a marked difference in the duration of effect and the duration of post operative analgesia in the test group as compared to the control group. The duration of surgical anaesthesia was sufficient to cover the entire operative period in all patients in the test group, and no patient required any supplementation, while 2 patients needed epidural top-ups in the control group. Similarly, there was prolonged post operative analgesia in the test group, with many patients not needing any analgesic till the next morning. We did not assess the total post-operative analgesic requirement, or the economic savings due to

decreased analgesic requirements, as both the groups had underwent regional anaesthesia, but other researchers have found decreased analgesic requirements and significant economic benefits. [17]

There was no significant difference in the haemodynamic, and respiratory parameters. There were no complications seen due to the procedure in either group. We found both the procedures equally safe, and our study procedure had a prolonged duration of effect.

One draw back of our study was that it was difficult to blind it as the procedures in the two groups were so different that the patients could guess which group they were placed in. We ensured that the post graduate resident monitoring the patient did not know which group the patient belonged to, and hence tried to achieve blinding.

CONCLUSION

A low dose sub-arachnoid block, in combination with lumbar and sacral plexus blocks can provide prolonged duration of effect, which carries on to the post-operative period as prolonged post operative analgesia, and with minimal adverse effects. This can lead to potentially decreased requirements of parenteral analgesics, with cost savings, as well as decreased adverse effects of potent analgesic medications.

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