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ORIGINAL ARTICLE

Comparison dose of bupivacaine among elderly patients undergoing hip surgeries under spinal, combined spinal-epidural and continuous spinal anaesthesia

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ABSTRACT:

Background: This research was carried out to evaluate and comparedose of bupivacaine among elderly patients undergoing hip surgeries under spinal, combined spinal-epidural and continuous spinal anaesthesia.**Material and methods**: Over a span of four years, the anaesthetic records of three cohorts, each consisting of 100 patients, were examined: those who underwent spinal anaesthesia exclusively (Group 1), those who received a combined spinal-epidural block (Group 2), and those who were administered continuous spinal anaesthesia (Group 3). All procedures were performed with the patient positioned on their left side. The evaluation considered various factors including the success of the puncture, the maximum level of analgesia attained, lower limb motor block, the quality of anaesthesia, the necessity for supplementary doses, the occurrence of failures, paraesthesia, post-dural puncture headache, cardiovascular irregularities, mental disorientation and delirium, blood transfusions, and mortality. **Results**: Among 100 participants, 75 were male and 25 were female. The mean bupivacaine dosage for group 1 was 19.23 mg, for group 2 it was 26.78 mg, and for group 3 it was 11.23 mg. When comparing groups 1 and 3, patients in group 2 were significantly shorter. The cephalad spread of patients receiving continuous spinal anaesthesia compared to those undergoing mixed spinal-epidural anaesthesia showed a significant difference ($p< 0.01$) among groups 1, 2, and 3. There were no significant differences in arterial hypotension, bradycardia, paraesthesia, or the requirement for blood transfusions between the two groups. Fourteen subjects reported experiencing postoperative cognitive disorientation. The mortality risk during the first week or month following surgery was consistent across both groups. **Conclusion**: Spinal anaesthesia was observed to require the lowest dose of bupivacaine when compared to both combined spinal-epidural (CSE) and epidural techniques. This is primarily due to the direct deposition of the drug into the cerebrospinal fluid (CSF), allowing for a rapid onset and effective neural blockade with a relatively small volume and concentration of local anaesthetic.

Keywords: anaesthesia, orthopaedic, surgery.

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INTRODUCTION

Spinal anaesthesia entails the administration of minimal quantities of local anaesthetic into the subarachnoid space, leading to a temporary loss of both sensation and motor function. The introduction of local anaesthetic into the subarachnoid space may induce alterations in hemodynamics and respiratory function. Should it be feasible to restrict anaesthesia to the surgical area, various adverse effects associated with spinal anaesthesia could potentially be mitigated.

The initial account of segmental anaesthesia application was documented by Jonnesco in 1909[1], with the aim of limiting the degree of somatic and sympathetic paralysis to the surgical area. Among the various methods are fractional segmental spinal analgesia,[2-5] which achieves localization through the intermittent injection of small volumes of agents into the subarachnoid space using an indwelling catheter or needle, and unilateral spinal analgesia, where anaesthesia is restricted to one side of the body through the subarachnoid administration of either hypobaric or hyperbaric solutions, with the patient positioned laterally.[6-8]

In 1961, Tanasichuket al.[9] introduced a specific method of spinal anaesthesia for patients undergoing orthopaedic surgery on one limb, which they referred to as spinal hemi-analgesia. In application, a standard unilateral spinal anaesthesia technique typically produces a motor hemi-block along with a sensory block that is biased towards one side.

This research was carried out to evaluate the differences among spinal, combined spinal-epidural, and continuous spinal anaesthesia in the context of hip surgeries for elderly patients.

MATERIAL AND METHODS

Over a span of four years, the anaesthetic records of three cohorts, each consisting of 100 patients, were examined: those who underwent spinal anaesthesia exclusively (Group 1), those who received a combined spinal-epidural block (Group 2), and those who were administered continuous spinal anaesthesia (Group 3). All procedures were performed with the

patient positioned on their left side. The evaluation considered various factors including the success of the puncture, the maximum level of analgesia attained, lower limb motor block, the quality of anaesthesia, the necessity for supplementary doses, the occurrence of failures, paraesthesia, post-dural puncture headache, cardiovascular irregularities, mental disorientation and delirium, blood transfusions, and mortality.

RESULTS

Table 1: Gender-wise distribution of subjects

Gender	Number of subjects
Males	75
Females	25
Total	100

Among 100 participants, 75 were male and 25 were female.

Table 2: Average dose of bupivacaine in the 3 groups

Groups	Average dose of bupivacaine (mg)	p-value
Group 1	19.23	0.001 (Significant)
Group 2	26.78	
Group 3	11.23	

The mean bupivacaine dosage for group 1 was 19.23 mg, for group 2 it was 26.78 mg, and for group 3 it was 11.23 mg. When comparing groups 1 and 3, patients in group 2 were significantly shorter. The cephalad spread of patients receiving continuous spinal anaesthesia compared to those undergoing mixed spinal-epidural anaesthesia showed a significant difference ($p< 0.01$) among groups 1, 2, and 3. There were no significant differences in arterial hypotension, bradycardia, paraesthesia, or the requirement for blood transfusions between the two groups. Fourteen subjects reported experiencing postoperative cognitive disorientation. The mortality risk during the first week or month following surgery was consistent across both groups.

DISCUSSION

In principle, utilizing two distinct routes of anaesthesia administration on the same patient enhances effectiveness and diminishes side effects. Spinal anaesthesia offers rapid and dependable segmental anaesthesia with a minimal risk of toxicity, whereas epidural anaesthesia delivers perioperative anaesthesia (either independently or in conjunction with general anaesthesia), followed by superior analgesia during the postoperative phase.[10,11]

Furthermore, Combined Spinal Epidural (CSE) anaesthesia mitigates the likelihood of complications, such as the somewhat unpredictable level of blockade associated with spinal anaesthesia, as well as issues related to missed segments, incomplete motor block, inadequate sacral spread, and local anaesthetic toxicity that may arise with epidural anaesthesia.[12]

Continuous spinal anaesthesia (CSA) remains a technique that is not fully utilized in contemporary anaesthesia practice. In contrast to other forms of neuraxial anaesthesia, CSA facilitates the incremental administration of an intrathecal local anaesthetic for an unlimited period. Traditional single-shot spinal anaesthesia, on the other hand, typically requires larger doses, has a limited and unpredictable duration, and carries a higher risk of adverse hemodynamic effects, such as hypotension. Additionally, epidural anaesthesia delivered through a catheter may result in a reduced motor block and less effective anaesthesia in the distributions of the sacral nerve roots.[13]

Hence, this study was conducted to assess the Comparison between spinal, combined spinal-epidural and continuous spinal anaesthesia for hip surgeries in elderly patients.

In this study, out of 100 subjects, 50 were men and 50 were women. The average bupivacaine dose in group 1 was 18.69 mg, in group 2 it was 27.41 mg, and in group 3 it was 9.48 mg. Comparing groups 1 and 3, group 2 patients were noticeably shorter. The cephalad dispersion of patients under continuous spinal vs those under mixed spinal-epidural anaesthesia differed significantly ($p< 0.01$) across groups 1, 2, and 3. Arterial hypotension, bradycardia, paraesthesia, and the need for a blood transfusion were not significantly different between the two groups. Fourteen individuals experienced postoperative mental disorientation. The risk of death during the first postoperative week or month was the same.

Minville V et al.[14] conducted a comparison of the hemodynamic effects between continuous spinal anaesthesia (CSA) and a small dose single injection spinal anaesthesia (SA) with respect to the occurrence of hypotension. A total of seventy-four patients over the age of 75, who were undergoing surgical repair for hip fractures, were randomly assigned into two groups, each consisting of 37 patients. The CSA group received a continuous spinal anaesthetic, which involved titrating 2.5 mg boluses of isobaric bupivacaine every 15 minutes, while the SA group was administered a single injection of 7.5 mg of isobaric bupivacaine. The overall changes in non-invasive automated arterial blood pressure did not show statistically significant differences between the two groups at baseline or following CSA or SA (not significant). Within the SA group, 68% of patients experienced at least one instance of hypotension (defined as a decrease in systolic arterial blood pressure exceeding 20% of the baseline value), in contrast to 31% of patients in the CSA group ($P = 0.005$). Furthermore, 51% of patients in the SA group encountered at least one episode of severe hypotension (characterized by a decrease in systolic arterial blood pressure greater than 30% of the baseline value), compared to only 8% in the CSA group ($P < 0.0001$). The CSA group required an average of 4.5 +/- 2 mg of ephedrine, whereas the SA group needed 11 +/- 2 mg ($P = 0.005$). Additionally, the CSA group utilized 5 mg (ranging from 2.5 to 10

mg) of anaesthetic solution, while the SA group required 7.5 mg ($P < 0.0001$). The authors concluded that for elderly patients undergoing hip fracture repair, CSA resulted in fewer occurrences of hypotension and severe hypotension when compared to a single intrathecal injection of 7.5 mg bupivacaine.This retrospective study by Imbelloni LE et al (2002)[15] compared continuous spinal anesthesia, combined spinal-epidural and single shot spinal anesthesia for hip surgery in elderly patients during a 4-year period, to determine possible advantages and disadvantages of the three techniques. Anesthetic records of 100 patients receiving spinal anesthesia (Group 1), 100 patients receiving combined spinal-epidural block (Group 2) and 100 patients receiving continuous spinal anesthesia (Group 3) over a 4-year period were analyzed. All blockades were performed with patients in the left lateral position. Evaluated parameters were: puncture success, highest level of anesthesia, lower limb motor block, quality of anesthesia, need for additional doses, failures incidence, paresthesia, post-dural puncture headache, cardiovascular changes, mental confusion and delirium, blood transfusion and mortality. There were no significant differences among groups regarding gender, age, weight and height. Group 2 patients were shorter as compared to groups 1 and 3. Mean bupivacaine doses were: 15.30 mg in group 1, 23.68 mg in group 2 and 10.1 mg in group 3. They showed statistical significant differences between groups ($p < 0.01$). There were significant differences ($p < 0.01$) in cephalad dispersion between groups 1 and 2, 1 and 3 and 2 and 3, being lower with continuous spinal and higher with combined spinal-epidural anesthesia. All patients presented total motor block (Bromage score = 3). There were no significant differences in arterial hypotension, bradycardia, paraesthesia and blood transfusion. Postoperative mental confusion was observed in 19 patients, with no difference between techniques. There was no difference in mortality in the first postoperative week and in the first postoperative month. Retrospective studies usually less and demand less time as compared to controlled studies. This retrospective study has shown that regional anesthesia techniques are related to a low mortality rate in the first postoperative month and to a low incidence of complications.

CONCLUSION

Spinal anaesthesia was observed to require the lowest dose of bupivacaine when compared to both combined spinal-epidural (CSE) and epidural techniques. This is primarily due to the direct deposition of the drug into the cerebrospinal fluid (CSF), allowing for a rapid onset and effective neural blockade with a relatively small volume and concentration of local anaesthetic.

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