



## COMPARATIVE EFFICACY AND SAFETY OF UNILATERAL SPINAL ANAESTHESIA WITH SEQUENTIAL COMBINED SPINAL EPIDURAL ANAESTHESIA FOR LOWER LIMB ORTHOPAEDIC SURGERY

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### KEYWORDS :

#### Introduction

Regional anaesthesia is preferred over general anaesthesia for lower limb orthopaedic surgery and spinal anaesthesia is often a choice [1]. Spinal anaesthesia is a simple and quick technique but it has risk of severe hypotension. Even though spinal anaesthesia provides intense and reliable block, it has risk of limited duration of action. Compared to conventional spinal anaesthesia, unilateral Spinal Anaesthesia (unilateral SA) provides more dense and longer lasting block with less hypotension and prolonged analgesia with faster onset of action and lower incidence of failure [2,3]. A more improved method called sequential Combined Spinal Epidural Anaesthesia (sequential CSEA) in which a dose intended to be inadequate for surgery is used in an attempt to reduce hypotension and the block is then deliberately extended to the desired level with the epidural drug. This technique is becoming increasingly popular because of various benefits mainly stable haemodynamic status and feasibility to prolong block for anaesthesia and analgesia [4]. The sequential CSEA is now used in elderly high risk patients for orthopaedic surgeries with encouraging results [5,6].

Thus, to compare their efficacy and safety, we conducted this prospective randomized study between sequential CSEA versus unilateral SA. Our primary outcome were anaesthesia readiness time, characteristics of block, incidences of haemodynamic adverse events, supplementation of general anaesthesia and secondary outcome were bupivacaine dose, duration of analgesia, cost effectiveness.

#### Materials and Methods

This prospective randomized study was conducted on sixty ASA I-III patients aged 18- 65 years undergoing lower limb orthopaedic surgeries of approximately two hours duration. Sequential CSE group received spinal with 5 mg of 0.5 hyperbaric bupivacaine followed by incremental epidural top up of 2 cc of 0.5% isobaric bupivacaine to achieve and maintain T10 level. In unilateral SA group, unilateral spinal anaesthesia was given with 10 mg of 0.5% hyperbaric bupivacaine. Haemodynamic parameter, anaesthesia readiness time and block characteristics were recorded and results were analysed using unpaired Student's t-test.

#### Results

A total of 60 patients randomly divided into two groups of 30 each, were studied. No patient in either group had failed block. Both groups were comparable with regard to age, height, gender ratio, ASA grade physical status and duration of surgery.

**(Table/Fig-1):**

**Block characteristics and total bupivacaine consumption of the groups.**

Variables	Group Unilateral SA	Group Sequential CSEA	p-value
Anaesthesia readiness time (Mean±SD) min	15.93±1.98	19.13 ± 2.87	<0.001
Peak sensory level Median (Max-Min)	T10 {T5 – T10}	T10 {T9 – T10}	0.004
Degree of motor block Grade	0/0/0/3	0/0/0/3	1

Time to regression of sensory block to T12 (Mean±SD) min	137.67±13.50	110.33±6.29	<0.001
Duration of motor block (Mean±SD) min	155.33±17.27	170.83±10.59	<0.001
Duration of analgesia (Mean±SD) min	172.67±22.27	223.67±17.12	<0.001
Supplementation with general anaesthesia N (%)	5 (16.66 %)	0 (0%)	0.02
Total bupivacaine consumption (mg)	10.00±0.00	41.66±6.37	<0.001

**p<0.05- Significant, \*\*p<0.01-Highly significant**

On comparing characteristics of block, all patients in both group achieved sensory level T10 and grade 3 Bromage score in operated limb. In unilateral SA group only one patient achieved T5 peak sensory level while 12 patients achieved T10 level thus, median was T10 with max -min range was T5 to T10 while in sequential CSEA group only six patients achieved T9 level rest 24 patients achieved T10 level thus median was T10 with max -min range was T9 to T10. Thus, the peak sensory level achieved was significantly higher in unilateral SA. Regression of sensory block to T12 was faster in sequential CSEA. Duration of motor block in operated limb and duration of analgesia was longer in sequential CSEA. Total bupivacaine consumption was more in sequential CSEA. On comparing haemodynamics, nine patients (30%) in unilateral SA and one patient (3.3%) in sequential CSEA had episode of clinically significant hypotension (p-value=0.0059). The mean dose of ephedrine required was higher in unilateral SA (1.83±3.07) as compared to sequential CSEA (0.17±0.91 mg) (p=0.0062). One patient (3.3%) in sequential CSEA and 6 (20%) patient in unilateral SA required atropine for bradycardia (p-value=0.040).

**(Table/Fig-2):**

**Incidence of hypotension and bradycardia.**

Variables	Group Unilateral SA (n=30)	Group Sequential CSEA (n=30)	p-value
Number of patients developed clinically significant hypotension Number (percentage)	9(30%)	1(3.3%)	0.0059
Number of patients developed clinically significant bradycardia Number (percentage)	6(20%)	1(3.3%)	0.04
Mean ephedrine requirement (Mean±SD) mg	1.83±3.07	0.17±0.91	0.0062

**p<0.05- Significant, \*\*p<0.01-Highly significant**

#### Discussion

The results from this study indicate that sequential CSEA and unilateral SA both provided good quality block with T10 sensory level and motor block of modified Bromage score 3 for lower limb orthopaedic surgery with no failed block. Sequential CSEA required extra anaesthesia readiness time but had significantly less haemodynamic adverse events and less ephedrine dose requirement and due to its feasibility to extend block, avoided need to supplement

general anaesthesia and provided longer analgesia. There are multiple studies comparing sequential CSEA as well as unilateral SA with conventional spinal anaesthesia and continuous spinal anaesthesia. Both, sequential CSEA as well as unilateral SA have proven to be superior to conventional spinal anaesthesia especially in terms of duration of block and haemodynamic stability [5-8]. Though continuous spinal anaesthesia is a technique with definite end point for successful anaesthesia, technical difficulty in spinal catheters insertion and due to the possibility of complication like Caudal Equina syndrome and Post Dural Puncture Headache (PDPH), it has a very limited use [9,10]. We did not find any randomized studies in the literature comparing sequential CSEA with unilateral SA for lower limb orthopaedic surgery.

Unilateral SA is given with aim to limit distribution of spinal block only to the operated side for operations involving only one lower limb. It is achieved by giving minimal required dose of intrathecal agent so that only nerve roots supplying specific area and only the modalities that require to be anaesthetized are affected. Unilateral SA has low rate of cardiovascular complication due to its low degree of sympathetic block than bilateral spinal anaesthesia [8,11,12]. It has been suggested that a unilateral distribution of spinal anaesthesia can be attempted using the lateral decubitus position with small doses of not isobaric spinal anaesthetic solution, small gauge directional pencil point needles, injecting the drug slowly over long time and maintaining the lateral decubitus position for 15 to 20 minutes [2,3]. An injection of 10 mg (2 ml) hyperbaric bupivacaine 0.5% is recommended to provide block of duration approximately two to three hours for operations above the knee [13,14]. Thus, we used 10 mg of 0.5 % hyperbaric bupivacaine for unilateral SA for the block to last approximately two hour in our study.

As safety of both these techniques is reported in elderly as well as in ASA grade III patients, we included them in our study [5,10]. We were technically able to give the block and could achieve successful surgical anaesthesia in all patient in both group. This may be because unilateral SA is a simple technique with very high success rate and because in sequential CSEA we used double segment CSE technique. Double segment CSE technique has 100% frequency of successful block compared to single segment needle-through-needle CSE technique with similar anaesthetic characteristics and time required to give the block [10]. Double segment CSE technique was also used to avoid delay in giving supine position after injecting spinal drug if there is difficulty in passing epidural catheter to obtain optimal effect of initial low dose spinal drug.

In sequential CSEA with intentional low dose spinal with 5 mg of 0.5% hyperbaric bupivacaine, sensory block up to T11 to L1 level and motor block of Bromage score grade 3 was achieved till the end of ten minutes which was then extended to T10 sensory level with incremental epidural top up with 2 ml of 0.5% isobaric bupivacaine per missed segment. Thus, with this technique advantage of good motor block achieved with spinal is preserved while the disadvantage of inadequate motor block due to epidural is eliminated. As epidural top up was required in all patients to achieve T10 level, anaesthesia readiness time was significantly longer ( $p < 0.001$ ). Result of our studies are comparable to the other studies when comparable dosages of bupivacaine were used for unilateral SA and sequential CSEA [5,6,13,14]. Faster onset and higher level of block are reported in the studies in which higher bupivacaine dosages were used for spinal anaesthesia or when epidural top up were not given in increment [14].

Unilateral SA is cost-effective as sequential CSEA requires extra cost of epidural set and extra drug. Possible limitation of study is that we did not do this study selectively in elderly high risk patients or selectively in major orthopaedic surgeries in elderly patients.

## Result

Unilateral SA is a cost-effective and rapidly performed anaesthetic technique. Unilateral SA and sequential CSEA technique both provide sufficient sensory and motor block for lower limb orthopaedic surgery but sequential CSEA provides significantly more stable haemodynamics with feasibility to prolong anaesthesia thus avoids general anaesthesia. Thus, sequential CSEA should be preferred over unilateral SA in high risk elderly patient for major lower limb orthopaedic surgeries.

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