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A Comparative Study on Safety of Combined Spinal and Epidural Anesthesia verses Epidural Anesthesia for Orthopedic and Gynecological Surgery

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Abstract

Background: In major surgeries, anesthesia plan requires modification as per patient's need for safe outcome. Orthopedic and gynecological surgeries require excellent surgical conditions and prolonged and effective postoperative analgesia. *Objective:* To compare the safety measures of combined spinal epidural anesthesia verses epidural anesthesia. *Materials and Methods:* The randomized prospective study was conducted on 20 to 60 years old ASA grade (I and II) patients posted for orthopedic and gynecological surgeries. Sixty patients were divided into two groups of 30 each such as group A (combined spinal epidural) and group B (epidural anesthesia). Various parameters were studied to compare safety parameters of combined spinal epidural anesthesia and epidural anesthesia in terms of quality of analgesia, hemodynamic changes and opinion feedback (patient's opinion regarding comfort and acceptance of technique, surgeon's opinion regarding quality of relaxation and preference of technique). Data was analyzed using unpaired t test and chi square test with the help of MS Excel and SPSS software. *Results:* The quality of analgesia was excellent in group A (CSE) as compared to group B (EA). Hemodynamic changes during anesthesia and surgery were comparable in both the groups. Surgeon's opinion regarding motor blockade and preference of technique was in favor of group A compared to group B. Patient's acceptance revealed equivocal in both groups. *Conclusion:* Our study concludes that CSE anesthesia is more safe technique over EA for patients as well as surgeons.

Keywords: Epidural Block; Combined Spinal Epidural Block; Analgesia; Hemodynamics.

Introduction

Conventional spinal anesthesia is safe, cost-effective and reliable form of anesthesia. It is superior to epidural, because of better quality of anesthesia produced, less toxic as the volume of drug and dose is comparatively less, less time consuming. But the disadvantages include precipitous hypotension, PDPH (postdural puncture headache), difficulty in controlling the level of analgesia and not possible to extend the duration of analgesia [1]. In recent times, the use of regional anesthesia in major surgeries is increasing worldwide. Spinal anesthesia (SA) and epidural anesthesia (EA) are still the two most popular regional anesthetic techniques, with proven efficacy in a variety of surgical procedures across the globe [2]. However, EA has advantages in the form of a better control of analgesia, can be extended for long duration surgeries as well as postoperative pain relief. But, the drawbacks include delayed onset of anesthesia, patchy anesthesia, inadequate motor blockade large volumes and dose of drug requirement leading to more chances of side effects and complications not common with spinal anesthesia [3,4]. The combined spinal and epidural (CSE) anesthesia provides benefits of spinal block along with flexibility of an epidural catheter so as to modify and prolong the block for a longer period. In CSE, two anesthetic techniques, each with a different mode of action has to be considered. A

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local anesthetic injected into the subarachnoid space is immediately in close contact with spinal nerves and spinal cord causing neural blockade in a relatively short time span [5,6]. Therefore, CSE is a sort of balanced anesthesia, which uses combination of techniques instead of drugs to accomplish the ideal kind of anesthesia for almost all patients of any age. Later, many modifications and different methods came with some advantages over the other. CSE block can be used for a variety of surgeries [7] and also for relief of labor [8] and postoperative pain [9]. Thus, to compare safety, we conducted this prospective randomized study between combined spinal epidural anesthesia verses epidural anesthesia for orthopedic and gynecological surgery in terms of quality of analgesia, hemodynamic changes and opinion feedback (patient's opinion regarding comfort and acceptance of technique, surgeon's opinion regarding quality of relaxation and preference of technique).

Materials and Methods

Study Design

This prospective study was completed in two years after the approval from the Institutional Ethical Committee. Informed consent was obtained from each patient. Sixty patients with ASA (American Society of Anesthesiologists) physical status I and II aged 20 to 60 years posted for elective surgery were randomized in two groups of 30 each, after thorough clinical and routine laboratory examinations.

Inclusion Criteria

Patients with age group 20 to 60 years, under ASA I and II and posted for various elective surgical procedures of lower abdomen where regional anesthesia was indicated included for the study.

Exclusion Criteria

Patient's refusal, anticoagulant therapy, bleeding diathesis, infection on the back, spinal deformities, history of peripheral neuropathy, neurological disorders, allergic to local anesthetics, blockade is more than T_8 level were excluded from the study

Methods

The patient was positioned in sitting or lateral position with the help of an assistant. Under all aseptic conditions the back was prepared with 5% povidine iodine solution, spirit and area was draped. The L_{3-4} interspace was identified; skin was infiltrated with 2mL of 2% Xylocaine.

Group A: Combined Spinal and Epidural (CSE) Anesthesia

After infiltration of local anesthetic, by using needle through needle single interspace technique, with a 18 gauge 'Weiss' needle via L_{3-4} interspace, epidural space was identified with loss of resistance technique. A long 27g 'Whitacre' spinal needle was inserted through the epidural needle until the tip was felt to penetrate the duramater and cerebrospinal fluid back flow, 3 mL of 0.5% hyperbaric bupivacaine injected with intent of achieving T_8 level block. The spinal needle was then withdrawn. A 20G epidural catheter was inserted into the epidural space via the Weiss needle. After negative aspiration for blood or cerebrospinal fluid a test dose of 3mL ligonocaine 2% adrenaline 1:200000 was given. After positioning the patient in supine position the level of sensory blockade was checked by loss of sensation to pin prick. Once the motor blockade was established by paralysis and the maximum level of sensory analgesia confirmed and the patient was put in required position and surgery was started.

Group B: Epidural Anesthesia (EA)

After infiltration of local anesthetic at L_{3-4} space a 18g 'Tuohy' needle was introduced, epidural space was identified with loss of resistance technique. An 20G catheter was threaded through the epidural needle into the epidural space in cephalad direction, the epidural needle was slowly pulled out without disturbing the catheter and the epidural catheter is kept up 4 to 5 cm in epidural space. After negative aspiration for blood or cerebrospinal fluid a test dose of 3mL lignocaine 2% with adrenaline 1:200000 was given. In all the patients 0.5% bupivacaine was given through the epidural catheter to achieve T_8 level blockade in fractionated doses. This would amount to about 12 to 16 mL and was deposited through the epidural catheter. Once T_8 level of analgesia and adequate blockade was established, the patient was suitably placed and surgery was commenced.

Outcome Parameters

• *Quality of Analgesia: It was compared in both study groups with the following criteria:*

During surgery, patients were given IV sedation midazolam (0.02mg/kg) and supplementary IV

analgesic fentanyl (1 mcg/kg). A criterion for giving sedation was when the patient reported discomfort. The criterion for giving analgesics was when the patient complained of pain.

Excellent: When no sedatives/analgesic was required

Good: When only sedatives was required

Fair: When both sedative and analgesic were required

Poor: When general anesthesia with oral endotracheal tube was required

Hemodynamic Changes: It was noted down and compared in both study groups as follows:

Systolic blood pressure and pulse pressure before administrating anesthesia and throughout intraoperative period. Hypotension (defined as 30% decrease of systolic blood pressure [SBP] controlled with preoperative control level) was treated with intravenous fluid and IV Mephentramine (6mg/kg). Clinically significant bradycardia was defined as a heart rate less than 50 beats/min and was treated with IV atropine (0.5mg/kg). Incidences of clinically significant hypotension and bradycardia were noted as incidence of hemodynamic adverse event. All the patients were monitored in post anesthesia care unit till they were shifted to general ward after they fulfilled PACU (post-anesthesia care unit) discharge criteria.

Opinion Feedback: Postoperatively patient's and surgeon's opinion were taken and analyzed in both the study groups as follows:

Patient: Analgesic comfort during procedure and would he opt for the same technique, if needed in future.

Surgeon: Quality of relaxation and his preference to epidural or CSE.

Statistical Analysis

All clinical data were presented as mean ± standard deviations. Statistical analysis was carried out using MS Excel and SPSS software. The unpaired two tailed student's t test and chi square test was used wherever appropriate. A p value of <0.05% was considered statistically significant.

Results

Demographic Data

Sixty patients (30 in each group) with ASA (American Society of Anesthesiologists) physical status I and II were studied. Patients were in between 20 to 60 years.

Group A (CSE) and group B (EA) both were comparable in terms of age, weight, height and nature of surgery as shown in Table 1. The p value for all parameters was statistically not significant (p>0.05).

Quality of Analgesia

The quality of surgical analgesia was excellent in group A as compared to group B, as shown in Table 2. The p value was highly significant (p<0.001).

Hemodynamic Changes

Hemodynamic changes during anesthesia and surgery were comparable in both the groups.

Table 1: Demographic data in both study groups

Parameters	Group A (CSE)	Group B (EA)	P value	Significance
No of patients	30	30	1.000	Not significant
Age (years)	47.37 ± 9.75	48.66 ± 8.75	0.589	Not significant
Height (cm)	158.76 ± 4.62	156.93 ± 4.22	0.115	Not significant
Weight (kg)	55.00 ± 5.43	55.53 ± 5.09	0.697	Not significant
Surgery (Orthopedic/Gynecology)	16/14	14/16	0.606	Not significant

CSE: combined spinal and epidural anesthesia, EA: epidural anesthesia. The values quoted as the Mean ± Standard deviation. Unpaired t-test was used to compare the results between two groups. The *p* value of <0.05 was considered statistically significant difference

Table 2: Quality rating of analgesia in both study groups

Quality Rating	Group A (CSE)	Group B (EA)	p value	Significance
Excellent	12 (40%)	3 (10%)	< 0.001	Significant
Good	16 (53%)	13 (43%)		
Fair	2 (7%)	12 (40%)		
Poor	0 (0%)	2 (7%)		

CSE: combined spinal and epidural anesthesia, EA: epidural anesthesia. Chi square-test was used to compare the results between two groups. The *p* value of <0.05 was considered statistically significant difference

Maximum number of patients in both were fall of < 30% in heart rate and systolic blood pressure as shown in Table 3 and Table 4.

Heart rate raised above 30% in an only 1 (3%) patient of CSE group; whereas all EA group patients showed no increase in heart rate above 30% (Table 3).

Systolic blood pressure increased above 30% in 3 (10%) patients of CSE group; whereas 2 (7%) patients in EA group showed increase in systolic blood pressure above 30% (Table 4).

The p value for heart rate and systolic blood pressure in both study groups was not significant i.e. p = 0.122 and p = 0.589 respectively.

Patient and Surgeon Opinion Feedback

Surgeon's opinion regarding quality of relaxation (motor blockade) and preference of technique was in favor of group A when compared with group B. The patient's acceptance (analgesic comfort during procedure) revealed equivocal in both groups, as shown in Table 5. The p value for surgeon's opinion is 0.001 highly significant and p value for patient's opinion is 0.150 not significant.

Discussion

Regional anesthesia (RA) is preferred over general anesthesia for lower limb orthopedic surgery and spinal anesthesia is often a choice [2,10]. Spinal anesthesia is a simple and quick technique but it has risk of severe hypotension. New drugs, new needle designs, and developments in catheter technology have contributed to improving the quality and safety of regional anesthesia. Epidural and spinal blocks are major techniques with long history of effective use for various surgeries and pain relief. Nevertheless, both techniques have their drawbacks. Major disadvantage of subarachnoid blockade is precipitous hypotension and inability to obtain desired level. Epidural blockade with catheter *in-situ* provides better control of analgesia and postoperative care. Although it has its own demerits like slower onset, large dose of local anesthetic drug requirement, patchy anesthesia.

Table 3: Percentage fall heart rate in both study groups

% Fall in heart rate	Group A (CSE)	Group B (EA)	p value	Significance
<10%	14 (47%)	17 (57%)	0.122	Not significant
10-20%	12 (40%)	9 (30%)		
20-30%	3 (10%)	4 (13%)		
>30%	1 (3%)	0		

CSE: combined spinal and epidural anesthesia, EA: epidural anesthesia, %: Percentage. Chi square-test was used to compare the results between two groups. The *p* value of <0.05 was considered statistically significant difference

Table 4: Percentage fall systolic blood pressure in both study groups

% Fall in Systolic BP	Group A (CSE)	Group B (EA)	p value	Significance
<10%	1 (3%)	6 (20%)	0.589	Not significant
10-20%	8 (27%)	14 (47%)		
20-30%	18 (60%)	8 (27%)		
>30%	3 (10%)	2 (7%)		

CSE: combined spinal and epidural anesthesia, EA: epidural anesthesia, %: Percentage, BP: Blood pressure. Chi square-test was used to compare the results between two groups. The *p* value of <0.05 was considered statistically significant difference.

Table 5: Comparison of opinion feedback in both study groups

Opinion feedback	Group A (CSE)		Group B (Epidural)		p value	Significance
	Excellent	Good	Excellent	Good		
Surgeon's opinion	23 (76.70%)	7 (23.30%)	2 (7%)	26 (92.70%)	< 0.001	Significant
Patient's opinion	30 (100%)	0 (0%)	28 (93.30%)	0 (0%)	0.150	Not significant

CSE: combined spinal and epidural anesthesia, EA: epidural anesthesia, %: Percentage. Chi square-test was used to compare the results between two groups. The *p* value of <0.05 was considered statistically significant difference.

Combined spinal epidural (CSE) techniques combine both features of subarachnoid block and continuous epidural anesthesia. CSE is an effective method to reduce the drug dosage used for anesthesia, and choice of medication is based on concept of anti-nociceptive synergy [11]. The subarachnoid injection allows rapid onset of analgesia with minimal dosage, flexibility to extend the block depending upon the surgical incision required [5,6]. The safety of CSE is enhanced by keeping a catheter *in-situ*, thereby avoiding overshooting with regard to duration of spinal anesthesia. Many studies confirm that low dose local anesthetic and low dose opioid confer sufficient analgesia without any motor or proprioceptive impairment [12-14]. This selective block render patient to bear weight and return to their casual routine even after any moderate to major surgery. In another words it hastens the recovery of surgical patients postoperatively.

In present study, majority of the patients who were given CSE had good quality of analgesia when compared to epidural route alone. The need for supplementary sedatives and analgesics were significantly higher in epidural group patients. The higher incidence of supplementation and failure rate in patients receiving epidural block has been reported by many authors.

Hemodynamic changes were assessed by using heart rate and systolic blood pressure. Hemodynamically the incidence of hypotension and bradycardia was almost similar in both the groups. The majority of the CSE group patients had a fall of 20-30%, majority of EA group had a fall of 10-20% in heart rate and systolic blood pressure only 1 patient of CSE group and none of EA group had fall of >30% in heart rate which responded to atropine. Hypotension of >30% was seen in 3 patients of CSE group and 2 patients of EA group which were treated with mephentaramine. In CSE, although spinal block is given initially, significant hemodynamic changes are not observed because of less extensive spinal block (T_8). Nikhil Swarnkar et al.[15] in their study of CSE in comparison to EA for total abdominal hysterectomies found out that there is no significant change in the hemodynamic parameters observed in both the groups. The explanation given by them for this finding is, in CSE although spinal block is given initially, significant hemodynamic changes are not observed because of less extensive spinal block (T_{7-8}) due to sequential CSE technique combined with slower onset of epidural block allowing time for compensatory mechanism to occur. The absence of hemodynamic changes in CSE group in our study is comparable with the above study and may be explained by the relatively low dose of bupivacaine used in the spinal phase of CSE, and by the gradual administration of local anesthetics in the EA group and also due to preloading with IV fluids.

Postoperative questionnaire revealed equivocal patient acceptance of the CSE and EA technique reflecting the patients comfort and adequate analgesia in the preoperative period. On the other hand surgeon's response weighed heavily in favor of CSE, which they attributed to early commencement of surgery and better relaxation in abdominal operations. In this study we did not come across complications like cardiorespiratory and neurological catastrophes, total spinal, inadvertent dural puncture, etc. none of the patients complained of post dural puncture headaches. The use of 27g spinal needle may have contributated to the absence of headache in our study. We have used the single segment block technique in CSE, which appears to be safer, time saving and less traumatic.

Conclusion

Both anesthetic techniques provide good quality analgesia and stable hemodynamics but CSE provides significantly more comfort with feasibility to prolong block. Thus, CSE should be preferred over epidural anesthesia in high risk patients especially for orthopedic and gynecological surgeries.

Conflicting Interest: None Decleared

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