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Original Research Article

THE CLINICAL EFFECTS OF SEQUENTIAL COMBINED EPIDURAL SPINAL VERSUS SPINAL ANAESTHESIA UNDERGOING LOWER ABDOMINAL SURGERY

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ABSTRACT

Background: The combined spinal-epidural (CSE) technique involves the injection of medication into the subarachnoid space while simultaneously placing a catheter into the epidural space during the same procedure. This study aims to compare the effectiveness of combined spinal epidural anaesthesia with spinal anaesthesia in patients undergoing lower abdominal surgery.

Material and Methods: In this prospective, randomised, comparative, case control study Total 60 patients of either gender between age groups of 20 to 60 years, having ASA -I and ASA II physical status undergoing lower abdominal surgery were randomly divided into two groups of 30 patients each. Group C- Patients received sequential combined spinal epidural anaesthesia. The patients in group S, Spinal needle 23 G is introduced into the subarachnoid space at L3-L4 interspace and 3cc of Bupivacaine heavy 0.5% injected after aspiration of free flow of cerebrospinal fluid. The onset of sensory analgesia at T10 level, Maximum sensory level achieved, time required to achieve maximum sensory level, Time of onset of motor block, Duration of motor block, duration of analgesia, Inadequate spinal effect/prolonged surgery supplement by top up dose, no of patients requiring rescue analgesia in 1st 24 hour and side effects were observed.

Results: The average duration of surgery showed no significant difference. The duration of surgery was similar for both groups. In Group C, the highest sensory level reached was T4 in one patient, accounting for 3.33%, while 21 patients achieved a sensory level of T6. In Group S, the highest sensory level recorded was T4 in one patient. In group S, 43.33% of participants required rescue analgesic three times, while in group C (combined spinal epidural), this was the case for 10 patients, accounting for 33.33%. The requirement for postoperative analgesic doses is lower in Group C compared to Group S. There was a significant difference between the two groups regarding the need for rescue analgesics in the first 24 hours.

Conclusion: Combined spinal epidural anaesthesia using the single shot spinal epidural technique in patients who are undergoing lower abdominal surgeries provides effective prolong postoperative analgesia, prolong duration of analgesia, and achieved the required level of anaesthesia by using local anaesthetic in conjunction with an epidural catheter without causing any adverse effects.

Key Words: Epidural Anaesthesia, Lower Abdominal Surgery, Spinal Anaesthesia, Spinal-Epidural (CSE) Technique.

INTRODUCTION

The International Society for the Study of Pain defines pain as an unpleasant subjective experience that arises from noxious stimuli, which may be linked to actual or potential tissue damage, or described in relation to such damage. Various regional anaesthesias, including subarachnoid block, epidural, or a combination of both, have been utilised for all lower abdominal surgeries. Each method presents its own set of advantages and disadvantages. Some significant drawbacks of neuraxial block include the potential for sudden hypotension and challenges in managing the level of analgesia effectively.[1,2]

The epidural block with catheter technique effectively manages pain levels and is beneficial for postoperative pain relief. However, there are some disadvantages to consider, such as a slower onset of action, inconsistent effects, the need for large doses of local anaesthetics, and potential risks of cardiovascular and neurotoxicity.[3,4]

The combined spinal-epidural (CSE) technique involves the injection of medication into the subarachnoid space while simultaneously placing a catheter into the epidural space during the same procedure. The CSE technique consists of administering a small dose of subarachnoid local anaesthetic, followed by the extension of the block through an epidural catheter. This approach combines the benefits of a spinal block with the flexibility of an indwelling epidural catheter, allowing for an extended duration of analgesia during the postoperative period. In 1937, Soresi introduced the method known as the "single needle-single interspace technique."[5,6]

Major surgeries below the umbilicus necessitate improved surgical conditions and extended effective postoperative analgesia. Combined spinal epidural anaesthesia has been suggested as an alternative technique to spinal anaesthesia. The SE technique offers superior surgical conditions compared to using an epidural block alone. CSE anaesthesia integrates two techniques that offer enhanced potency and cost-effectiveness. This technique offers significant benefits by merging the speed, density, and reliability of a subarachnoid block with the adaptability of a continuous epidural block. It allows for adjustments to the sensory level, varying the intensity of the block, controlling the duration of anaesthesia, and providing effective postoperative analgesia.[7,8]

There are various approaches to managing pain during and after surgery, including both medication and regional anaesthesia techniques. The administration of high doses of pain medication poses risks to vital organs, including the kidneys and liver, and can also lead to increased overall anaesthesia costs. The implementation of advanced techniques like lumbar blocks, coeliac blocks, and paracervical blocks presents significant challenges. Additionally, the integration of higher imaging techniques for anatomical identification can be particularly difficult in various settings, especially in our country. Therefore, it is essential to study the CSE technique in Indian patients to gain a comprehensive understanding of its effectiveness in various surgeries and patient populations. This motivated us to conduct a study comparing CSE with Subarachnoid block alone, focussing on the onset and duration of surgical analgesia.[9]

The combined spinal epidural technique offers the benefits of a spinal block while allowing for the flexibility of an indwelling epidural catheter, which can prolong analgesia into the post-operative period. As a result, it has become increasingly favoured among patients who are undergoing various significant surgical procedures below the umbilical level. The procedures encompass orthopaedic surgeries, lower abdominal gynaecological surgeries, general surgical interventions, and lower extremity procedures, among others. This technique is widely utilised in the field of obstetric anaesthesia and analgesia. This study aims to compare the effectiveness of combined spinal epidural anaesthesia with spinal anaesthesia in patients undergoing lower abdominal surgery.

MATERIALS AND METHODS

The present prospective, randomized clinical study was done at Shardaben General Hospital for the period of one year. The study was conducted on 60 adult patients of either sex between age group 20 to 60 years of ASA-I and ASA-II undergoing lower abdominal surgery were divided into two groups of 30 patients each randomly as per inclusion and exclusion criteria. The patients in group C were administered combined spinal epidural and in group E only subarachnoid block given. After Institutional Ethical & Scientific Committee Board approval and informed written consent was obtained after explaining the procedure to the patients.

Inclusion Criteria

The patients with ASA I &II, age 20 to 60 years, scheduled to undergoing elective lower abdominal surgeries and those who gave informed written consent were included in the study.

Exclusion Criteria

The patients with ASA III and ASA IV, history of cardiac or renal disease, chronic pain syndrome, previous spine surgery, allergy to study drug, presence of infection at the site of injection, presence of spinal abnormalities, neurological disorders, Coagulation disorders and those who did not signed the consent were excluded from the study.

A thorough pre-anesthetic assessment was done prior to the day of surgery which included past history of chronic illness and medication, drug therapy, drug sensitivity and past anesthetic experience along with routine investigations like

CBC, blood sugar, blood urea, serum creatinine, along with coagulation profile carried out for all patients.

All patients had been kept NBM for 6 hours before surgery. In operation theatre intravenous access with 18G cannula and patients pre-hydrated with Ringer Lactate solution 10 ml/kg. ECG, NIBP, Sp02 monitors attached and baseline parameters observed. Vitals were recorded throughout surgery. All patients were premeditated with IV Injection glycopyrrolate 0.2 mg IV, Injection Emset 4 mg IV and injection midazolam 0.5 mg IV 10 minutes before surgery

Patients included in group C received sequential combined spinal epidural Anaesthesia. 27 G spinal Needle was introduced through 18G Epidural Needle & 3 ml(15mg) Hyperbaric Bupivacaine was given for spinal block. The spinal needle was withdrawn 20 G epidural catheter was inserted & secured, if block did not reach the desired level top up 10 ml of 0.25%. After 2 ½ hour 10 ml 0.25% Sensoricaine given by catheter after aspiration and continuously Pulse and Blood Pressure noted and when patients feels pain same procedure done.

The patients in group S, Spinal needle 23 G is introduced into the subarachnoid space at L3-L4 interspace and 3cc of Bupivacaine heavy 0.5% injected after aspiration of free flow of cerebrospinal fluid. Spinal needle is withdrawn and drug is allowed to fix.

Measured by pin prick in mid clavicular line on both sides with 24G needle every minute until no pain to pin prick was felt at T6 dermatome. Thereafter the level was assessed every 2 minutes, till the attainment of maximum level of block. Onset of sensory blockade was defined as time from the completion of injection of study drug to time when patient did not feel pin prick at T10 level.

Duration of analgesia was given by time from onset of sensory block to time when patient requires first dose of rescue analgesic, i.e Diclofenac 75mg IV for postoperative pain of VAS≥4 in patient with spinal anaesthesia and Inj Tramadol 50mg by epidural route in pt with CSE.

Quality of motor blockade in lower limb was graded using Modified Bromage Scale

After giving the spinal anaesthesia and placement of epidural catheter if the desired level is not achieved, patient complain of pain and there is increased in heartrate and Blood pressure during surgery then top up dose of 10 ml 0.25% Sensoricaine was given through epidural catheter after aspiration and adequate level is achieved. Heart rate and Blood pressure were recorded.

If the Surgery is prolonged of 150-180 minutes like Tuboplasty, Incisional hernioplasty, Hysterectomy we top up the dose at 2 ½ hour of 10 ml 0.25% Sensoricaine through epidural catheter as a analgesia given and make patient comfort.

In Group S (Spinal anesthesia): After giving spinal anaesthesia, wait for 10-15 minutes for adequate level of sensory and motor block, if adequate level was not achieved after that then General anaesthesia was given in such patients.

If the surgery was prolonged of 2.5-3 hours like abdominal hysterectomy, tuboplasty or prostate surgery, if the spinal effect was worn off and patient complains of pains, there is increased in heart rate and Blood pressure then General anaesthesia was given.

General Anaesthesia

Pre-Medication: Inj Glycopyrrolate 0.004 mg/kg IV, Inj Emset 0.15mg/kg IV and Injection Fentanyl 1 mcg/kg IV

Pre-Medication: with 100% O2 for 3 minutes. Induction: done with Inj Propofol 2.5mg/kg IV, Inj Succinylcholine 2 mg/kg IV

Intubation: Intubation was done with oral cuffed Endotracheal tube of appropriate size.After confirmation of bilateral equal air entry, cuff was inflated and tube fixed.

Maintenance: O2 + Sevoflurane

Neuromuscular block was achieved with Inj Atracurium 0.5 mg/kg bolus IV and then subsequently 0.01 mg/kg IV for maintenance.

Reversal: At the end of surgery, patients were reversed by Inj glycopyrrolate, 0.08 IV mg/kg and Inj Neostigmine 0.05 mg/kg IV.

Extubation: done after spontaneous respiration thorough oral suction done, cuff deflated, tube removed in deep inspiration after good muscle tone power and all protective reflexes achieved.

Number of Rescue Analgesia Required in 24 hour:

Postoperative patients were observed every 30 minutes till 2 hour then every two hourly for 24 hour.

Visual Analogue Scale (VAS) 10 points was used to assess post-operative analgesia.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2019) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution. Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

RESULTS

The study included a total of 60 patients. The participants were evenly split into two groups, comprising 30 patients in each group. The study included a total of 29 males and 31 females. In group C, there were 14 males and 16 females, while group S had 15 males and 15 females. The variation in sex between the two groups was not statistically significant.

The study involved patients scheduled for a range of surgical procedures, including Abdominal Hysterectomy, Myomectomy, Vaginoplasty,

Umbilical Hernioplasty, Incisional Hernioplasty, Stoma Closure, Percutaneous Nephrolithotomy, Tuboplasty, Transurethral Resection of the Prostate, and Vaginal Hysterectomy. The surgery duration for group C was recorded at 152.5 minutes, with a standard deviation of 17.63 minutes. The average duration of surgery in group B was 154 minutes, with a standard deviation of 17.14 minutes. The average duration of surgery showed no significant difference. The duration of surgery was similar for both groups.

The onset time for analgesia at the T10 level was recorded as 3.76 ± 1.14 minutes in group C. The onset time for analgesia at the T10 level was recorded as 3.56 ± 1.28 minutes in group S. The analysis revealed no notable difference between the two groups regarding the onset time of sensory analgesia at the T10 level. In Group C, the highest sensory level reached was T4 in one patient, accounting for 3.33%, while 21 patients achieved a sensory level of T6. In Group S, the highest sensory level recorded was T4 in one patient. The mean time to achieve maximum sensory block in Group C was 9.4 ± 2.42, while in Group S it was 9.28 ± 2.29.

The analysis of the time of onset of motor block at a Bromage score of 1 revealed no significant difference between the two groups (p=0.14). The average time for the onset of motor bromage 1 was 3.18 ±1.06 minutes in group C and 3.48 ±1.08 minutes in group S. The time required to achieve complete motor block in group C is 7.25 ± 2.2 minutes, while in group S, it is 8.33 ± 2.77 minutes. The analysis indicates that there is no significant difference between the two groups, with a p-value of less than 0.05.

In group S, 43.33% of participants required rescue analgesic three times, while in group C (combined spinal epidural), this was the case for 10 patients, accounting for 33.33%. The requirement for postoperative analgesic doses is lower in Group C compared to Group S. There was a significant difference between the two groups regarding the need for rescue analgesics in the first 24 hours. The analysis revealed no statistically significant difference between the two groups (p>0.05) regarding oxygen supplementation, respiratory rate, mean arterial pressure, haemodynamic parameters, and mean pulse rate.

The Visual Analogue Scale (VAS) Score in both groups at various postoperative time intervals—30 minutes, 1 hour, 2 hours, and 4 hours—demonstrates a statistically significant difference. After 6 hours, there was no meaningful difference observed between the groups in terms of the VAS score.

Table 1: Maximum level of sensory block attained

Maximum sensory level achieved	Group C	Group S	P value
T10	1	4	0.92
T8	1	1	
T6	21	17	
T4	7	1	
TOTAL	30	30	

Table 2: Time required achieving maximum sensory block

Group	No. of patients	MEAN ± SD	P value
Group C	30	9.4 ±2.42	0.42
Group S	30	9.28 ±2.29	

Table 3: Time of onset of motor (bromage 1) block

Group	No. of patients	MEAN ± SD	P value
Group C	30	3.18 ±1.06	0.14
Group S	30	3.48 ±1.08	

DISCUSSION

The combined spinal epidural technique has become increasingly popular among patients undergoing major surgery below the umbilical level, as it provides prolonged and effective postoperative pain relief. The combined spinal epidural technique consists of a deliberate subarachnoid blockade along with the placement of an epidural catheter, all performed in a single procedure. CSE facilitates a quick initiation of neuraxial blockade, which can then be extended or adjusted as needed. The technique employed for implementing the CSE block is the single space needle through needle method. In 1937, Soresi introduced this concept. Subsequently, various modifications and different methods were introduced, each offering unique advantages over the others.[5,10]

Our research focused on examining the onset timing of sensory analgesia at the T10 level. The onset time for analgesia in group C at the T10 level was recorded at 3.76±1.14 minutes. The onset time for analgesia in group S at the T10 level was recorded as 3.56±1.28 minutes. The difference in the time for the onset of sensory analgesia at the T10 level was not found to be statistically significant, with a p-value of 0.26.

The highest sensory dermatome level observed after 30 minutes following the administration of the drug in the epidural space. In Group C, the highest sensory level reached was T4 in one patient, accounting for 3.33%. The most frequently observed maximum sensory level in Group C was T6, which was noted in 19 patients, representing 63.33%. In comparison, Group S had 14 patients, or 46.66%, achieving the same maximum sensory level of T6. The highest sensory level reached did not exceed T4 in any of the groups studied. The observed difference did not reach statistical significance ($p>0.05$).

The analysis revealed no statistically significant difference between the two groups regarding the time taken to reach maximum sensory block, with a p-value greater than 0.05. The average time to achieve maximum sensory block was 9.4±2.42 minutes for Group C and 9.28±2.29 minutes for Group S. In 2015, Dr. Nagaraju Talikota,[11] and colleagues conducted a randomised controlled trial to evaluate the efficacy and safety of sequential combined spinal epidural compared to spinal block for lower abdominal surgeries. Fifty patients were randomly assigned to one of the two groups. A patient from Group A underwent spinal anaesthesia using a 24 G needle at the L3-L4 interspace, with an injection of 3 cc of heavy bupivacaine. The time taken for the onset of anaesthesia was 5.48 minutes in the spinal anaesthesia group, while it was 7.40 minutes in the CSEA group, resulting in a mean difference of 1.92 minutes (95% CI: 0.78-3.05, p-value 0.001). The duration of analgesia was 115.6 minutes in spinal anaesthesia, compared to 124.5 minutes in combined spinal-epidural (CSE) anaesthesia, resulting in a mean difference of 8.92 minutes (95% CI: 0.87-18.71, P-value 0.07).

Both groups demonstrated a quick onset of action, providing effective pain relief and a satisfactory level of motor block. Group A demonstrated a notably lower incidence of hypotension ($p<0.01$) while also providing extended analgesia in comparison to Group B. Shah Akif Mutahar et al (2019),[12] assess the alterations in haemodynamic parameters associated with the use of sequential combined spinal epidural block and spinal anaesthesia for lower limb surgeries. A total of 60 patients classified as ASA 1 and 2 physical status participated in the study, all of whom underwent procedures involving the lower limbs. The participants were evenly allocated into two groups: group 1, which received spinal anaesthesia, and group 2, which underwent sequential combined spinal epidural anaesthesia. The number of patients who reached the T6 and T10 levels showed a statistically significant difference ($p<0.05$). Patients who reached T8 showed similar outcomes in both groups. The haemodynamic parameters were observed in both groups. Between the 2-minute and 20-minute marks, group 1 exhibited a statistically significant increase in pulse rate, accompanied by a decrease in blood pressure (p value <0.05).

In our study, the dosage of 0.5% hyperbaric Bupivacaine administered in Group C - Combined spinal epidural anaesthesia and Group S - spinal anaesthesia was 3ml (15 mg). In the three studies conducted by Nagaraju Talikota, Vengamamba Tummala, and Shah Akif Mutahar, the dosage and techniques used in both groups varied. Therefore, our study presents a contradiction to these previous findings.

In terms of the duration of motor block with a Bromage score of 1, the comparison between the two groups showed no significant difference ($p= 0.14$). The average time for the onset of motor bromage 1 was 3.18 ± minutes in Group C and 3.48 ± 1.08 minutes in Group S. The duration from the spinal injection to the point at which the maximum motor bromage score is reached. The time required to achieve a complete motor block in Group C was 7.25±2.2 minutes, while in Group S, it was 8.33±2.77 minutes. Both groups demonstrated a quick onset of action, providing effective pain relief and a satisfactory level of motor block.

Sharmin Ara Begum,[13] and colleagues conducted a study on 70 geriatric cases that underwent surgeries on the lower extremities. Participants were randomly assigned to two groups: 35 individuals in group A (CSEA) and 35 individuals in group B (SAB). The various outcome variables among groups, such as the duration of anaesthesia, respiratory rate (RR), oxygen saturation (SpO2), end tidal CO2 (EtCO2), peak expiratory flow rate (PEFR), breath holding test (BHT), perioperative side effects of anaesthesia, and postoperative visual analogue score (VAS), were analysed and compared using statistical tests. The average duration of anaesthesia, the average time to reach the target level of sensory block, and the average time to achieve complete motor block were all significantly greater in group A ($p<0.001$).

In our study, the dosage of 0.5% hyperbaric Bupivacaine administered in Group C, which received combined spinal epidural anaesthesia, and Group S, which underwent spinal anaesthesia, was 3ml (15 mg). In the three studies conducted by Vengamamba Tummala, Sharmin Ara Begum, and P V S Lavanya, the doses and techniques used in both groups varied. Therefore, our study presents a contradiction to the findings of these three studies.

In group C patients, out of 30 individuals, 3 did not achieve an adequate sensory level (T6). For those requiring prolonged surgery, an additional 10 ml of 0.25% plain Bupivacaine was administered through the epidural catheter. Heart rate, blood pressure, and oxygen saturation were assessed every 5 minutes for a duration of 30 minutes following the administration of the top-up dose. In Group S patients, among the 30 individuals, 5 did not achieve the adequate level (T6). For these patients, General Anaesthesia was administered.

A greater number of patients in group S needed a higher amount of rescue analgesia during the first 24 hours. In group S, 13 patients, representing 43.33%,

required rescue analgesic, while in group C, 10 patients, or 33.33%, needed the same intervention. In group S, 7 patients, representing 23.33%, needed rescue analgesic four times; in contrast to group C.
Our study found that there were no notable changes in intraoperative haemodynamic parameters in either group. The average heart rate, average blood pressure, and SP02 levels showed similar results in both groups. All patients were carefully observed for any complications during the surgical procedure and for a duration of 24 hours following the operation. No side effects were observed in either group during the intraoperative or postoperative period of 24 hours.

CONCLUSION

This study comes to the conclusion that combined spinal epidural anaesthesia using the single shot spinal epidural technique in patients who are undergoing lower abdominal surgeries provides effective prolong postoperative analgesia, prolong duration of analgesia, and achieved the required level of anaesthesia by using local anaesthetic in conjunction with an epidural catheter without causing any adverse effects.

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