

COMPARATIVE STUDY OF EFFECTS OF ADMINISTRATION OF LOCAL ANAESTHETICS THROUGH EPIDURAL NEEDLE BEFORE AND AFTER EPIDURAL CATHETER INSERTIONUmesh L. Ramtani¹, A. S. Tarkase², Soma Cham³**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: Epidural catheter placement offers flexibility in block management. However, during epidural catheter insertion, complications such as paresthesias, venous and subarachnoid cannulation, suboptimal catheter placement and coiling of catheter can affect the quality of anesthesia. A prospective randomized controlled study was conducted to assess the effect of priming of epidural space with a single-injection dose of local anesthetic solution (10mL 2% lidocaine+adrenaline and 10ml 0.5% bupivacaine) before catheter insertion. We randomized 100 patients into 2 equal groups and measured the quality of anesthesia and incidence of catheter related complications. **METHODS:** A group of 100 patients was randomized and divided in two groups. In Group A [needle group] (n = 50), local anaesthetic solution was administered through epidural needle before epidural catheter insertion. In Group B [catheter group] (n = 50), the catheter was inserted immediately after identification of the epidural space. Local anesthetic solution was then injected via the catheter. We noted the occurrence of paresthesia, inability to advance the catheter, or IV or subarachnoid catheter placement, number of attempts to insert catheter. Sensory and motor block were assessed 20 min after the injection of local anesthetic solution. Surgery was initiated when adequate sensory loss was confirmed. Infraumbilical, pelvic general surgeries, hysterectomies and lower limb orthopedic surgeries were included in study. **RESULTS:** All observations were noted and statistical test of significance was applied. In the catheter group, the incidence of paresthesia during catheter placement was 16% compared with 4% in the needle group ($\chi^2=4.0$, $P<0.05$). Intravascular catheter placement occurred in 8% versus 0% of patients in the catheter and needle groups, respectively ($\chi^2= 5.34$, $P<0.05$). The number of attempts to pass catheter was more than one in catheter group as compared to needle group. ($\chi^2=4.33$, $P<0.05$) More patients in the needle group had excellent quality of surgical conditions than the catheter group (94% versus 35%) ($\chi^2=9.75$, $P<0.05$). **CONCLUSION:** We conclude that priming of epidural space with a single injection local anaesthetic dose via the epidural needle before catheter placement improves the quality of anesthetic blockade and reduces catheter-related complications.

KEYWORDS: Epidural needle, Epidural catheter, Quality of anaesthesia, Catheter related complications, Priming of epidural space, Local anaesthetic solution.

INTRODUCTION: Epidural anesthesia is popular for many surgical, obstetric, and analgesic procedures because placement of a catheter offers flexibility to extend, intensify, and maintain block. However, during epidural catheter insertion, complications such as paresthesia and inadvertent venous and subarachnoid cannulation may occur; these, in turn, may lead to transient or permanent paralysis, other neurological complications and postdural-puncture headache.^(1,2) Furthermore, suboptimal catheter placement within the epidural space affects the spread and quality of anesthesia,⁽¹⁻⁴⁾ leading to failure of anesthetic blockade and the need for general anesthesia.

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The review of literature suggests that the incidence of catheter related complications and failures may be reduced by injecting a “priming” dose of local anesthetic or saline through the epidural needle before catheter insertion.⁽⁵⁻⁷⁾ Some studies contradicted,^(8,9) but in studies showing a lack of effect, either a small and possibly inadequate volume of local anesthetic or normal saline, which would dilute local anesthetic subsequently injected, was given. The use of a large priming dose of local anesthetic has not been studied. The aim of this prospective, randomized study was to assess the effect of priming of epidural space with single-injection of local anesthetic solution through the needle before insertion of the catheter on incidence of catheter related complications and quality of anesthetic blockade.

METHODS: After obtaining institutional ethics committee approval and informed consent, 100 ASA class I-II consecutive adult patients undergoing elective surgery with epidural anesthesia were included in this prospective, randomized study. Patients belonging to ASA III-IV, or having contraindications to epidural and spinal block, pregnant patients and patients with spinal column disorders were excluded. Patients were randomly divided in two equal groups. In Group A [needle group] (n=50), local anaesthetic solution (10mL 2% lidocaine+adrenaline and 10ml 0.5% bupivacaine) was administered through epidural needle before epidural catheter insertion. In Group B [catheter group] (n=50), the catheter was inserted immediately after identification of the epidural space. Local anesthetic solution was then injected via the catheter. On arrival in the operating room, blood pressure monitoring, electrocardiograph and pulse oximetry were monitored, and 10–15mL/kg of Ringer’s lactate solution was infused before the procedure. Baseline demographic data and vital signs were recorded before surgery. All emergency drugs and airway equipments were kept ready. With the patient in left lateral position, lumbar epidural punctures were performed at the L2-3 or L3-4 interspace using a midline approach with 18-gauge Tuohy needle and epidural space was confirmed by loss of- resistance technique with glass syringe. In the needle group, after identification of epidural space and a negative aspiration test for blood or cerebrospinal fluid, 3mL of 2% lidocaine with adrenaline (1:2lacs) was injected through the needle as a test dose.

The patients were also observed for any increase in heart rate that would indicate an intravascular injection of adrenaline and were questioned about dizziness, tinnitus, a metallic taste in the mouth, or sudden warmth or numbness in the legs. If these responses were negative after 3 min, the remainder of the full 20 mL of local anesthetic was injected slowly. A 20-gauge multiorifice epidural catheter (Minipack; Portex Ltd.) was inserted 4cm into the epidural space through the cranially directed tip of the epidural needle. After removal of the Tuohy needle, the catheter was fixed to the skin, and the patients were turned to supine position. In catheter group, identification of the epidural space, aspiration test, test dose were performed as above, except that local anesthetic solution was injected after catheter placement through epidural catheter. Observations were recorded. Hemodynamic variations in terms of pulse rate, blood pressure and oxygen saturation if any were noted. Catheter related complications such as paresthesia during insertion of the catheter, inability to advance the catheter, IV and subarachnoid cannulation and number of attempts to insert catheter were noted by the attending anesthesiologist.

Intravenous or subarachnoid placement was detected by aspiration of frank blood or cerebrospinal fluid through the catheter. It was planned that if intravascular or subarachnoid cannulation occurred, reinsertion in another space will be tried and if again unsuccessful, procedure will be abandoned and general anesthesia will be given. These patients will be excluded from the

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analysis. The minutes required for sensory and motor block were noted. Twenty minutes after the main dose, peak sensory block levels and the degree of motor block were assessed. Sensory block was assessed with objective fine touch method and motor block by the Bromage scale (0 _ no block, 1 _ hip movement block, 2 _ hip and knee block, and 3 _ complete block in hip, knee, and ankle). Complete loss of touch sensation to T6 on both sides was regarded as sufficient for surgery.

Quality of surgical anaesthesia was divided in three categories Vz excellent, fair and poor. If patient had no discomfort throughout the operative course and didn't require epidural top ups then it was considered excellent anesthetic blockade. If patient complained of discomfort, epidural top up was given with 2.5ml 2% lignocaine with adrenaline +2.5ml 0.5% bupivacaine and anesthetic blockade was labeled as fair. Inj. Midazolam 0.03-0.05mg/kg was given as and when required. The term "failed epidural" was used for situations in which either it was impossible to insert the catheter or there was no sensory block after injection of the local anesthetic. Unilateral block, unblocked sacral segments, low level and unblocked segments, or a patchy block were regarded as "incomplete block" and labeled as poor quality of anesthesia. Arterial blood pressure, heart rate, and oxygen saturation were measured and recorded every 5 min for the duration of the surgical procedure. Hypotension (systolic blood pressure <70% baseline), bradycardia, (heart rate <50bpm), and desaturation (Spo2<90%) were recorded.

Hypotension was treated with IV ephedrine 5–15mg and bradycardia with 0.6 mg of IV atropine; desaturation was treated with oxygen via a face mask. The type and duration of surgical procedures and amount of perioperative IV fluid given were documented. Other observations such as postoperative complications i.e. nausea, vomiting, backache, headache, retention of urine and neurological sequelae etc were recorded. Statistical analysis was performed by SPSS for Windows (version 10.0) statistical package (SPSS Inc., Chicago, IL). Patient characteristics were analyzed using the t-test for independent group. Quantitative analysis was done using Z test. If Z value was more than 1.96, p value was less than 0.05, it was considered statistically significant. Qualitative data was compared using chi square (χ^2) test. If χ^2 value was more than 3.84 then p value was less than 0.05 and it was considered statistically significant.

RESULTS: There were no significant differences in demographic or surgical data, epidural block characteristics, or incidence of perioperative complications between the groups (Table 1, Table 2, Table 3, Table 4A, 4B and Table 5). There were no failed or incomplete blocks. The incidence of catheter-related complications is shown in Table 6 (Fig. 1)

It was observed that paraesthesias occurred during catheter insertion in 4% patients in needle group vs 16% in catheter group ($\chi^2 = 4.0$ i.e. >3.84 , $p < 0.05$). IV placement of catheter was in 8% patients in catheter group vs 0% in needle group ($\chi^2 = 5.34$ i.e. >3.84 , $p < 0.05$). There was no case of intra thecal catheter placement and in none of case, there was inability to advance catheter. The number of attempts to pass catheter was noted as shown in Table 7 (Fig. 2). The number of attempts to insert catheter was one in 94% patients, two in 4% patients and more than two in 2% patients in group A vs 80%, 16% and 4% patients in group B respectively ($\chi^2 = 4.33$ i.e. >3.84 , $p < 0.05$). The quality of surgical anaesthesia, as shown in Table 8 (figure: 3), was found to be excellent in 94% patients, fair in 6% patients and poor in 0% patients in group A vs 70%, 24% and 6% patients in group B respectively ($\chi^2 = 9.75$ i.e. >3.84 , $p < 0.05$). There were no significant intra or post-operative complications in any of the group.

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DISCUSSION: Epidural anaesthesia provides many advantages over spinal anaesthesia, some of them being segmental blockade, slow controlled hypotension, extended postoperative analgesia and no chance of postdural puncture headache. But epidural catheter placement is associated with catheter related complications.⁽⁵⁾ Gadalla et al.⁽⁶⁾ Mannion et al.,⁽⁷⁾ all noted a significant reduction in the incidence of extradural vein cannulation by routinely injecting 10 mL of saline priming fluid into the epidural space before catheter insertion. Saline, however, dilutes the local anesthetic injected; in this study, we therefore administered a single-injection dose of local anesthetic (20mL) as a priming solution as done by Cesur et al.⁽⁵⁾

This study also demonstrated improved surgical conditions with the administration of a single-injection dose through an epidural needle before epidural catheter placement.⁽⁵⁾ However, Rolbin et al.⁽⁸⁾ and Scott and Beilby⁽⁹⁾ reported no advantage in injecting fluid into the epidural space before catheter insertion, but they administered much smaller volumes of fluid (3 and 5mL, respectively) for priming. However, Paresthesia during epidural catheter insertion has been reported in up to 60% of parturients,⁽¹⁰⁾ and the frequency of venous and subarachnoid cannulation has been studied and there complications were reported.^(11,12,13) Paresthesia may be associated with transient or permanent neurological injury and may be unpleasant for the patient. Unnoticed venous and subarachnoid cannulation may lead to convulsions, total spinal anesthesia, or postdural puncture headache.

Expansion of the epidural space by priming it with local anesthetic before advancement of the catheter may reduce the likelihood of both paresthesia and inadvertent venous or subarachnoid cannulation.⁽¹⁴⁾ Moreover, when priming solution is injected directly in epidural space through needle, the intra epidural spread of solution also affects quality of anesthetic blockade and can be confirmed radiologically for eg. Myelographically.⁽¹⁵⁾ We used a multi-port epidural catheter inserted only 4 cm in the epidural space; these catheters give better anesthesia and require less manipulation than uniport ones^(4,5) and insertion to no more than 3–4 cm into the epidural space minimizes complications and the incidence of inadequate anesthesia, even in obstetric patients.⁽¹⁶⁾ Our single-injection dose via epidural needle before catheter placement led to fewer cases of catheter replacement and inadequate anesthesia.

Despite a correct technique, some segments may remain unblocked because of inadequate spread of local anesthetic within the epidural space. This may be related to variations in epidural anatomy,^(17,18) although a transforaminal or anterior catheter positioning is a more likely explanation.^(8,16) Suboptimal positioning of the epidural catheter is common. Both the type of catheter and needle⁽¹⁹⁾ and its optimal depth of insertion have been questioned. Lim et al.⁽²⁰⁾ found that the catheter tip could be advanced without coiling for 4cm or less in only 13% of cases. Hogan⁽²¹⁾ found that lateral catheter deviation is a more common cause of asymmetric block than anatomic barriers to the spread of the local anesthetic solution. Using radiography, Sanchez et al.⁽²²⁾ showed that the intended catheter placement was often not achieved. When epidural anesthesia is incomplete, additional injections or catheter manipulation may provide reliable surgical anesthesia, suggesting suboptimal positioning of the catheter.

CONCLUSION: Priming of epidural space with single-injection administration before catheter insertion offers the advantages of a single injection technique plus the flexibility of epidural catheterization. The requirement of relatively large volumes of local anesthetic as priming solution in

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the single-injection/catheter technique may be a disadvantage, and the direct catheter technique is preferable if it is essential to restrict dose and level block in special patients.

In summary, we report that the administration of local anesthetics through the epidural needle before epidural catheter placement improves the quality of epidural anesthesia and decreases the risk of catheter related complications.

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Groups	Number of Patients					
	20-30 yrs	21(42%)	29(58%)	51-60YRS	Males	Females
A	2(4%)	7 (14%)	43(86%)	15(30%)	21(42%)	29(58%)
B	5(10%)	28	72	13(26%)	7 (14%)	43(86%)
Total	7	33	32	28	28	72

Table 1: Showing age and sex distribution of patients

Groups	Number of Patients				
	Height (cm)			Weight(kg)	
	145-155	45-55	56-65	45-55	56-65
A	20(40%)	34(64%)	16(32%)	34(64%)	16(32%)
B	29 (58%)	38(76%)	12(24%)	38(76%)	12(24%)
Total	49	36	15	72	28

Table 2: Showing distribution of patients as per height and weight

GROUPS	Number of Patients		
	Type of surgery		
	Lower limb orthopaedic surgery	Hystectomies (total abdominal, vaginal)	Lower abdominal and pelvic surgery
A	5	25	20
B	11	33	6
Total	16	58	26

Table 3: Showing surgical data

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PRE-OPERATIVE	GROUPS		p value
	A	B	
Mean Pulse Rate (S.D)(per min)	89.4 (9.18)	91.28 (7.65)	>0.05
Mean Systolic Blood Pressure (S.D) (mm of Hg)	125.4 (8.11)	122.5 (8.01)	>0.05
Mean Respiratory Rate(S.D)(per min)	16.2 (0.47)	16.16 (0.54)	>0.05

Table 4A: Showing preoperative hemodynamic parameters

(Z < 1.96, p> 0.05 i.e. non-significant).

INTRAOPERATIVE	GROUPS		p value
	A	B	
Mean Pulse Rate (S.D) (per min)	81.28 (7.93)	82.12 (8.55)	>0.05
Mean Systolic Blood Pressure (S.D)(mm of Hg)	112.28 (8.69)	109.8 (9.58)	>0.05

Table 4b: Showing intraoperative hemodynamic parameters

(Z < 1.96, p> 0.05 i.e. non-significant).

Observations	Group A	Group B	Z value
Time required for onset of sensory analgesia in minutes	4.32 (1.53)	4.46 (0.93)	0.25
Time required for onset of motor block in minutes	8.14 (1.95)	8.9 (1.5)	0.35
Peak dermatomal level at 20 minutes	T6(T4 - T8)	T8(T4 -T8)	
Time for two segment regression in minutes	139.83 (20.4)	136.73 (26.7)	1.26

Table 5: Showing characteristics of epidural block

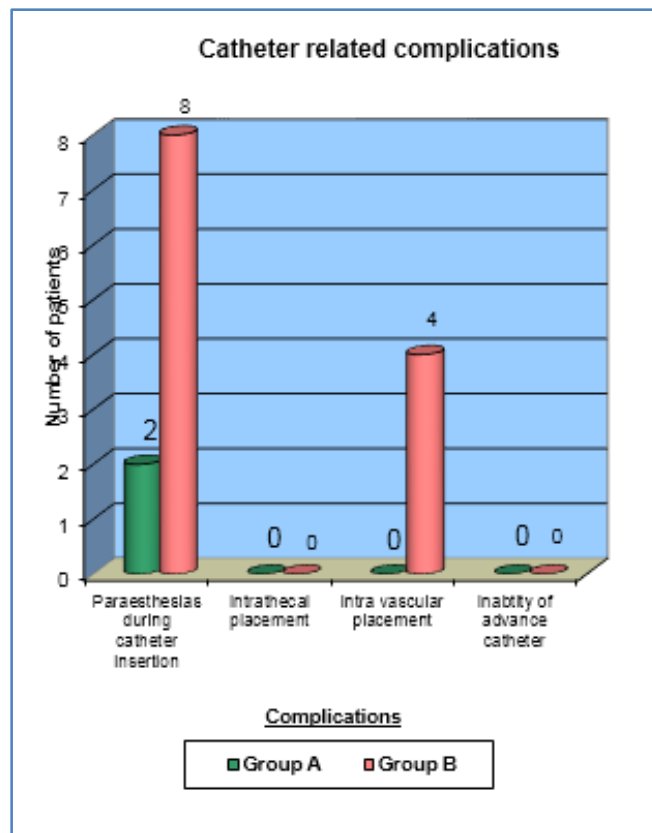
(Z < 1.96, p> 0.05 i.e. non-significant)

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Catheter related complications	Number of patients		x ² test
	Group A	Group B	
Paraesthesias during catheter insertion	2 (4%)	8 (16%)	4.0
Intrathecal placement	0	0	-
Intravascular placement	0	4 (8%)	5.34
Inability to advance catheter	0	0	-

Table 6: Showing catheter related complications

($x^2 > 3.84$, $p < 0.05$, i.e. Significant).



Number of attempts to pass catheter	Number of Patients		x ² test
	Group A	Group B	
One	47 (94%)	40 (80%)	4.33
Two	2 (4%)	8 (16%)	
More than two	1 (2%)	2 (4%)	

Table 7: Showing number of attempts to pass catheter

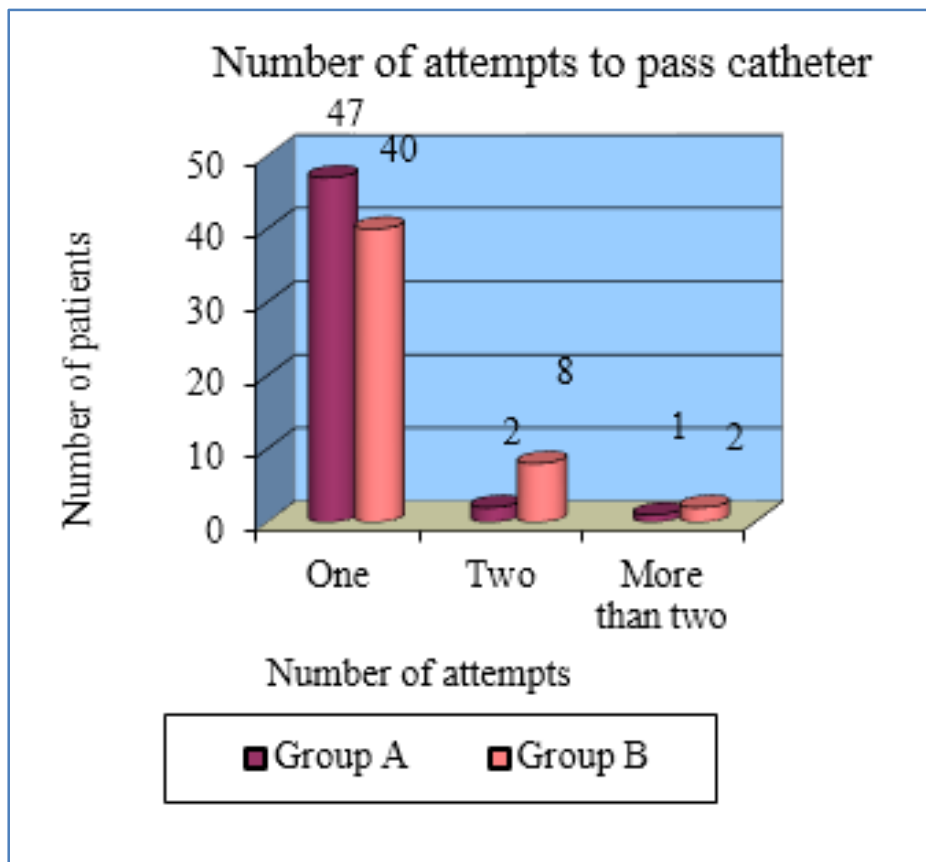
($x^2 > 3.84$, $P < 0.05$, i.e. Significant).

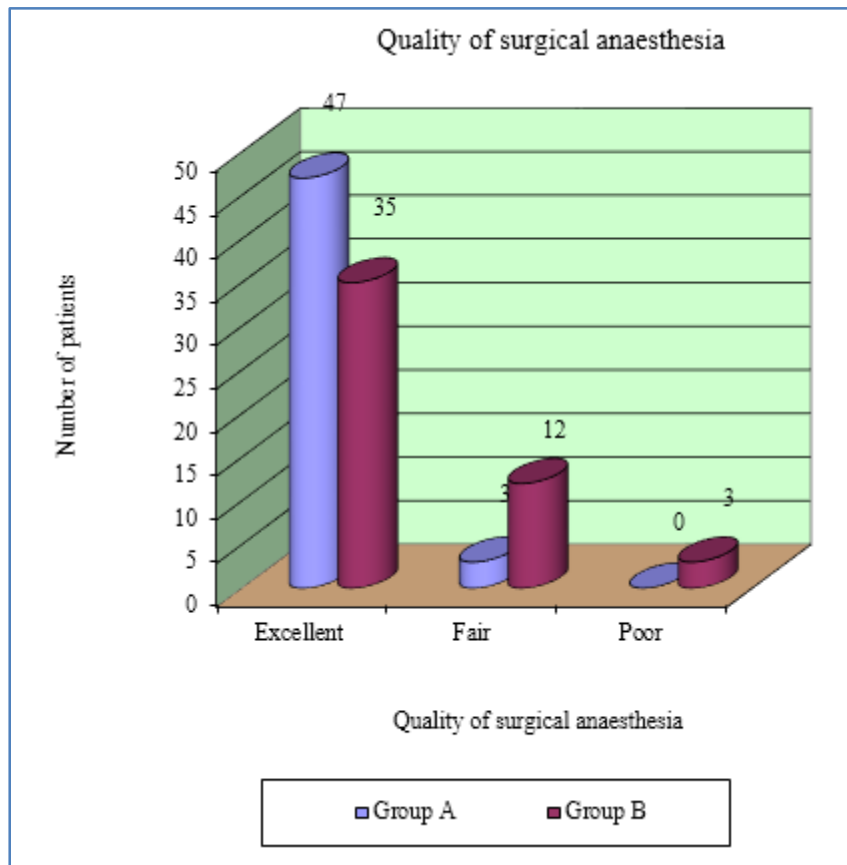
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Quality of Surgical Anaesthesia	Number of Patients		x ² test
	Group A	Group B	
Excellent	47 (94%)	35 (70%)	9.75
Fair	3 (6%)	12 (24%)	
Poor	0	3 (6%)	

Table 8: Showing quality of surgical anaesthesia

($x^2 > 3.84$, $p < 0.05$, i.e. Significant).



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