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EPILOR VS CONVENTIONAL LOR TECHNIQUE, IDENTIFICATION OF EPIDURAL SPACE.

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ABSTRACT

Background: The epidural technique is one of the neuraxial techniques widely used for providing anesthesia for surgical operation, postoperative pain control, acute or chronic pain management, and obstetric analgesia. The loss of resistance (LOR) technique is the most commonly used method for identifying the epidural space. Present study was aimed to compare loss of resistance technique between EPILOR syringe and conventional LOR syringe for identifying the epidural space.

Material and Methods: Present study was single-center, prospective, randomised study, conducted in patients of ASA Status I and II, of both sexes, ≥16 years of age, BMI < 25 kg/m^2, coming for elective lower abdominal surgeries. Patients were randomly allocated into two groups, as Group C (received epidural anesthesia by the conventional loss of resistance techniques, n=35) & Group ED (received epidural anesthesia using an EpiLOR syringe, n=35).

Results: In present study, ED group showed a lower failure rate & less incidence of more than 1 attempts as compared to group C, difference was statistically significant ($p < 0.05$). The distance from the skin to the epidural space was not significantly different in both groups. Also epidural depth in L3-L4 interspace & L4-L5 interspace was not significantly different in both groups. Ease score of identification among Operators, Ease score of identification among Observers & Satisfaction score of operators were better in ED group as compared to group C, difference was statistically highly significant ($p < 0.001$).

Conclusion: Using Epilor syringe with a LOR Balloon indicator syringe compared to the conventional LOR technique is an easy, rapid, and reliable method for identifying the epidural space.

Keywords: Epilor syringe, loss of resistance (LOR) technique, epidural space, neuraxial techniques

INTRODUCTION

The epidural technique is one of the neuraxial techniques widely used for providing anesthesia for surgical operation, postoperative pain control, acute or chronic pain management, and obstetric analgesia. [1,2] The loss of resistance (LOR) technique is the most commonly used method for identifying the epidural space. A popular approach of determining the epidural space is the Loss of Resistance (LOR) technique, which is based on the tactile perception of a change in resistance when the needle tip moves from the ligamentum flavum into the epidural space. To help with this identification, this method can make use of air, saline, or local anesthetics such lidocaine [3]. Particularly in labor epidural analgesia, the use of air has been emphasized as a confirmatory adjunct to improve the accuracy of LOR [4]. However, due to the subjective nature of the LOR experience, there is a possibility of false positives due to misinterpretations, particularly among trainees. Furthermore, efficient probing techniques can enhance the identification of the epidural space, thereby lowering problems such unintentional dural punctures, as demonstrated by robotic simulations [5] [6].

However, the ideal technique for the identification of the epidural space is controversial. The conventional LOR technique often depends on inaccurate and subjective measures of the mechanical resistance to an injection of air, saline or both, rather than depending on objective and confirmatory methods. Furthermore, factors such as the anesthesiologist's experience and the spinal anatomy of patients often influence success of the epidural technique. [7,8]

EPILOR is an epidural kit comes with a unique design Tuohy needle with a catheter, catheter holder and 2 variants of Lor syringe. epilor advance-lor balloon indicator syringe that makes the puncture proven visualized and improves the success rate and safety of puncture. When the epidural needle tip penetrates the ligamentum flavum in to the epidural space, the balloon assumes a deflated position due to the decreased intra chamber pressure through the epidural space. Present study was aimed to compare loss of resistance technique between EPILOR syringe and conventional LOR syringe for identifying the epidural space.

MATERIAL AND METHODS

Present study was single-center, prospective, randomised study, conducted in Department of anesthesiology, Saveetha medical college and hospital, Thandalam, Chennai-602105, India. Study duration was of 3 months (October 2023 to December 2023). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of American Society of Anesthesiologists (ASA) physical Status I and II, of both sexes, ≥16 years of age, BMI < 25 kg/m^2, coming for elective lower abdominal surgeries, willing to participate in present study

Exclusion criteria

- Age < 18 and > 50
- BMI > 30
- Epidural site infection
- Coagulopathies
- Patient refusal
- Emergency procedures
- Pregnant patients
- Spinal deformities

Study was explained to patients in local language & written consent was taken for participation & study. All study participants were evaluated thoroughly during pre-anaesthetic check-up and again before surgery. Data collected at the time of patient recruitment, before surgery commencement included demographic data such as age, sex, height and weight of the patient. ASA physical status class, examination of spine by palpation for any deformity was done.

Patients were randomly allocated into two groups, by Simple Random Sampling.

- Group C - received epidural anesthesia by the conventional loss of resistance techniques
- Group ED - received epidural anesthesia using an EpiLOR syringe (ED group).

On arrival in the operating room, standard monitoring devices including an electrocardiogram, pulse oximetry, and a noninvasive blood pressure cuff were applied to the patients. With the patient in the sitting position, local anesthetic was infiltrated in to the subcutaneous tissue or muscle at the L3/4 or L4/5 interspinous space.

In the ER group, the LOR Balloon indicator of an EpiLOR was tested by occluding the exit port and injecting air. In both groups, an 18 gauge Tuohy needle and the needle was advanced until LOR was noted. In the ER group, an EpiLOR syringe was attached between the hub of the Tuohy needle and the syringe was filled with air. Thereafter, the EpiLOR syringe was inflated with 1.5 ml of air, and the Tuohy needle was advanced with both hands until the inflated LOR Balloon indicator became deflated. After deflation of the LOR Balloon indicator, the EpiLOR syringe was disconnected and epidural catheter was inserted in to the epidural space.

Multiple attempts over 1 times were considered as failure. We recorded the number of failures, more than 1 attempts, the occurrence of dural puncture, the time to locate the epidural space. The ease of identifying the epidural space was scored using a five-point score (1= very easy, 2=easy, 3=moderate, 4=difficult & 5=extremely difficult) by both the operator and observer. The satisfaction scores of the procedure were recorded from 1 to 5 points by the operator.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, 70 patients were enrolled into the observational study after obtaining informed consent as 35 patients per group. The patient characteristics such as gender (male/female), age (years), height (cm) & weight (kg) were not significantly different between the two groups.

There were 2 cases of failure, 2 cases of multiple attempts over 1 time & one case of unintentional dural puncture in the C group as compared to 1 case of multiple attempts over 1 time in the ED group. The ED group showed a lower failure rate & less incidence of more than 1 attempts as compared to group C, difference was statistically significant ($p < 0.05$).

The distance from the skin to the epidural space was not significantly different in both groups. Also epidural depth in L3-L4 interspace & L4-L5 interspace was not significantly different in both groups.

Ease score of identification among Operators, Ease score of identification among Observers & Satisfaction score of operators were better in ED group as compared to group C, difference was statistically highly significant ($p < 0.001$).

DISCUSSION

In our study, Epilor syringe guided epiducer offered rapid identification of the epidural space and increased success rates as compared with the conventional LOR technique. The ease and satisfaction scores of the operator performing epidural anesthesia were also better.

One of the concerns with epidural anesthesia is incomplete or failed anesthetic block. The incidence of unsatisfactory block is inconsistent among reports, and it is reported up to 25% in parturients.[9,10] In fact, there are several contributing factors to the etiology of failed epidural anesthesia, and operator experience and technical proficiency are important factors. Studies reveal that anatomical impediments, improperly positioned catheters, and operator inexperience all play a part in the failure rates, which can vary from 8% to 40% based on the criteria and context[11][12]. The operator's capacity to understand the needle's location can be improved with the use of instruments such as the Epilor syringe, which may help to decrease mistakes made by less skilled practitioners[13]. Similar to a manometer, this gadget facilitates improved technique and results by giving visual input that a supervisor can monitor[14]. Furthermore, research has demonstrated that insufficient waiting times, prior epidural history, and younger age are linked to increased failure risks[15]. Consequently, using guided methods such

This study, which compared Epilor syringe to the conventional method for identifying the epidural space, showed the superiority of Epilor syringe. In group C, 2 of 35 cases required more than 1 attempts to locate the epidural space. The multiple attempts in group C were caused by false positive signals related to the subjective detection of the change in resistance by the operator. The cause of the fewer attempts in the ED group compared to the C group is thought to result from visual signals (LOR Balloon indicator syringe) replacing the subjective detection of resistance change by the operator's thumb. In the ED group, only 1 cases had more than 1 attempts, and at that time, the diaphragm of the LOR Balloon indicator was slowly deflated.

Therefore, we suggested that the epidural needle tip was not initially placed at the interspinous ligament, and an air leak of the diaphragm occurred into the patient's tissue, including muscles or tendons, but not in the epidural space.

In the ED group, the operators and observers' ease and satisfaction scores were significantly higher than those in group C. The better ease scores for the operators might have been influenced by placing 2 hands on the needle and the visual endpoint signals. An experienced observer can monitor the visual signals together when placing the epidural needle and detecting the epidural space. [16,17]

Although there was no statistically significant difference in the depth of the epidural space, the time from the interspinous ligament to the epidural space was shorter in the ED group. A continuous pressure in the device and swift visual signal change provide prompt interpretation to an operator and a supervisor; however, false positive signals can occur. This problem could be resolved when the operator correctly places the epidural needle tip into the interspinous ligament, and it is important to know the qualitative differences between slow deflation of the diaphragm caused by air leak into low density tissue and the rapid deflation caused by entry of the needle tip into the epidural space. [18,19]

This study has some limitations. First, ease and satisfaction scores are subjective. However, they were collected by one observer and there was a statistically significant difference between the two groups. Second, our study was not "blinded" for the operators and observers.

CONCLUSION

Using Epilor syringe with a LOR Balloon indicator syringe compared to the conventional LOR technique is an easy, method for identifying the epidural space. Epilor syringe has an advantage of early identification of loss of resistance and lesser complications. This can be easily learned by new trainees and hence , this novel method can be used as a better alternative to conventional LOR syringe.

FIGURES AND TABLES

Table 1 - Demographic data

Characteristics	ED Group (N=35)	C Group (N=35)
Gender (Male/Female)	16/19	14/21
Age (years)	45 ± 11.3	45.4 ± 10.4
Height (cm)	162.1 ± 8.8	162.5 ± 8
Weight (kg)	62.3 ± 10.2	63.5 ± 10.2

Table 2- Epidural characteristics

Characteristics	ED GROUP (n = 35)	C Group (n=35)	p value
Failure (n)	0	2	0.022
More than 2 attempts(n)	1	2	0.002
Dural puncture(n)	0	1	0.155

Table 3 - Epidural depth

Characteristics	ED GROUP (n = 35)	C Group (n=35)	p value
Interspinous ligament-epidural space	18± 8.7	31.5± 16.8	<0.001
Epidural depth			
L3-L4 interspace	5.0±0.6	4.7 ±0.6	0.425
L4-L5 interspace	4.4±0.5	4.4±4.7	0.767

Table 4 - Ease score of identification

Ease score of identification	ED GROUP (n = 35)	C Group (n=35)	p value
Operator	2(2-4)	2(2-5)	<0.001
Observer	2(1-4)	3(2-5)	<0.001
Satisfaction score of operator	2(2-4)	3(2-5)	<0.001

Conflict of Interest:
The authors declare that there is no conflict of interest.

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