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ORIGINAL ARTICLE

Comparison Effectiveness of Epidural Catheter by using Two Techniques Air Versus Saline as Pre-emptive Analgesia in Obstetric Patients

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ABSTRACT

Background: In obstetric patients, epidural anaesthesia (EA) and combined spinal epidural anaesthesia (CSEA) is commonly preferred techniques due to their efficacy and acceptable safety profile with minimal adverse effects.

Objective: To evaluate and compare the efficacy of epidural catheterization techniques involving the use of air versus saline for pre-emptive analgesia in obstetric patients.

Methodology: A prospective study was conducted at the Department of Gynecology and Obstetrics of the Hospital from January 2023 to July 2023. A total of 132 patients over 18 years and younger than 38 years undergoing vaginal deliveries were selected. Patients were consecutively allocated into two distinct groups, namely Group A (LOR with air) and Group B (LOR with saline).

Results: Nine patients in Group A suffered from hypotension (13.6%) and 13 patients in Group B suffered from hypotension (19.7%). Two patients in Group A developed a dural puncture and 5 patients in Group B had a dural puncture. Three patients in Group A developed PDPH and 2 patients in Group B developed PDPH which was managed conservatively. There is no significant difference in both groups regarding procedural complications.

Conclusion: Epidural catheterization via loss of resistance with air (ALOR) and loss of resistance with saline (SLOR) for providing preemptive analgesia in obstetric patients show comparable analgesic effects in terms of efficacy and complications with different success rate of epidural catheter placement which was higher in the ALOR group.

Keywords: Anesthesia, Catheter, Epidural, Pregnancy.

INTRODUCTION

Sicard and Cathelin, who were developing epidural anesthesia in France in 1901, are credited with popularizing the caudal technique.[1] Since then, the technique has undergone a number of modifications and enhancements to more precisely localize the epidural space. It is a blind technique with a 1.5% failure rate since it is difficult to precisely locate the epidural area. The most often utilized procedure is manually detected reduction of resistance to air or saline infusion. Because of their effectiveness and acceptable safety profile with few adverse effects, combined spinal epidural anaesthesia (CSEA) and epidural anaesthesia (EA) are routinely used procedures in obstetric patients.[2]

Pain in the nerve roots is a possible side effect of having an epidural catheter placed. When a catheter is inserted into a patient without first injecting fluid into the epidural space, the patient may suffer from temporary paralysis in as many as 49 percent of cases.[3] Needle-based administration of air or fluid can affect the prevalence of these issues. It has been proven that paraesthesia can be reduced by using an epidural catheter if 10 ml of air is inserted into the needle beforehand.[4] A spinal infusion of 3 ml fluid prior to catheter implantation did not improve outcomes.[5] Catheter insertion was not made simpler by the use of local anaesthetics or saline, and there was no reduction in the incidence of paraesthesia or blood vessel trauma.

Studies have indicated that a reduction in air resistance is related to an increase in the risk of problems such as difficulty in inserting the catheter, intravascular catheter placement, paresthesia, partial block, post-dural puncture headache (PDPH), and inadvertent dural puncture.[6] According to the findings, the LOR in air was 52.6%, whereas it was only 47.4% in saline. In both the saline and the air groups, the patient's characteristics, the analgesic techniques used, and the percentage of successful blocks were all identical. Operators who had a preference for one medium were less likely to try another (1.3±0.7 vs 1.6±0.8) and were less likely to accidentally puncture the dura mater (1% vs 4.4%, odds ratio =0.25).

In Singha et al, the saline group had the highest first-try success rate for epidural space localization (100%).[7] The saline group had the shortest mean time for epidural space localization, which was statistically significant when compared to the air group. Although the majority of patients in the saline group had a higher success rate with the block and required fewer attempts to localize the space, the outcome was found to be statistically insignificant.

Literature shows that air loss of resistance (ALOR) was associated with an increased risk of unfavorable consequences; hence, saline loss of resistance (SLOR) was selected as the way to utilize in the process of identifying the epidural space.[8] When comparing SLOR with ALOR, more recent meta-analyses that were based on these trials were unable to generate conclusive results.[9]

The objective of this study is to evaluate and compare the efficacy of epidural catheterization techniques involving the use of air versus saline for pre-emptive analgesia in obstetric patients.

MATERIAL & METHODS

A prospective study was conducted at the Department of Gynecology and Obstetrics of the Hospital from January 2023 to July 2023. A total of 132 patients over 18 years and younger than 38 years undergoing vaginal deliveries were selected by consecutive sampling. The sample size was calculated by RaoSoft software keeping a 7% margin of error, 95% Confidence Interval, 400 population size, and 50% response distribution. Patients with morbid obesity, severe hypovolemia, infection at the injection site, sepsis, coagulopathy or another bleeding diathesis, neurological defects, major blood loss, demyelinating deficits, complication during surgery, severe spinal deformity, prolonged surgery time, stenotic valvular heart lesions, prior back surgery at the site of injection or if blood or CSF aspirated from the needle or epidural catheter during placement were excluded.

The present investigation was undertaken subsequent to obtaining the necessary ethical clearance from the Institutional Review Board (IRB) of Shaikh Zayed Medical Complex. Following the successful fulfillment of the predetermined inclusion criteria, the patients residing in the obstetric ward were approached to obtain their written informed consent. Patients were consecutively allocated into two distinct groups, namely Group A (LOR with air) and Group B (LOR with saline). Upon the arrival of patients in the operation theatre, it was observed that two intravenous lines were promptly established using an 18-gauge cannula. The application of basic monitoring techniques, such as non-invasive blood pressure measurement, electrocardiography (ECG), and pulse

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oximetry, was implemented. The parturient subjects were administered a preloaded dose of lactated ringer solution at a rate of 10 milliliters per kilogramme of body weight. In a controlled clinical setting, individuals were positioned in a seated posture while maintaining a sterile environment. A specialized needle, specifically an 18-gauge tuohy needle, was carefully inserted at either the L3-L4 or L4-L5 intervertebral space. The localization of the epidural space was performed using the loss of resistance technique, employing a plastic syringe. Two groups were included in the study: Group A, which received 3ml of air, and Group B, which received 3ml of saline solution.

Upon achieving the desired needle placement, a multi-orifice epidural catheter was meticulously threaded in accordance with the precise depth of the Tuohy needle. The epidural catheter was securely affixed to the posterior region of the patient using a waterproof adhesive tape. The patients were positioned in a supine posture with left uterine displacement for 5 minutes. In the absence of any indications of blood or cerebrospinal fluid aspiration through the epidural catheter, a 3ml injection of 2% lidocaine was administered. The efficacy of the intervention was evaluated using the Visual Analogue Scale (VAS) scoring system. A proforma documented the presence of complications such as hypotension, dural puncture, patchy analgesia, and post-dural puncture headaches. The various complications were effectively addressed in accordance with established protocols.

Data was entered and analyzed on SPSS version 25. Quantitative variables like age and number of attempts were presented as mean ± SD if normally distributed. Qualitative variables like pain relief, PDPH, and hypotension were represented as frequency and percentages. Age and number of attempts were compared between the two groups by using an independent sample t-test and Mann-Whitney U-test depending on the normality of the data. P value < 0.05 was considered as significant.

RESULTS

A total of 132 patients participated in the study. They were divided into two groups. In Group A, Loss of Resistance with Air (ALOR) was used to identify epidural space. In Group B, Loss of Resistance with Saline (SLOR) was used to identify epidural space. The mean age was 26.08 ± 4.01. In Group A (ALOR) mean age of patients is 26.61 ± 4.03 and in Group B (SLOR) mean age of patients is 25.55 ± 3.95 years (Table I). All patients were ASA 2 because pregnant patients are considered ASA 2.

The epidural catheter was passed to 111 patients in the first attempt, 20 patients in the second attempt, and one patient in the third attempt. In group A, the ALOR epidural catheter was passed to 59 patients in the first attempt, and 7 patients in the second attempt. In group B, the SLOR epidural catheter was passed to 52 patients in the first attempt, 13 patients in the second attempt, and 1 patient in the third attempt. The difference between groups was not significant (p= 0.198) (Table II).

In group A, Pain was relieved in 63 out of 66 patients. In group B, pain was relieved in 64 patients (Table III). Adequate level of analgesia was achieved in 59 patients of each group (89.4%). Four patients in Group A suffered from patchy analgesia (6.1%) and 5 patients in Group B (SLOR) suffered from patchy analgesia (7.6%).

Table I: Distribution of participants by age

	N	Mean ± SD
Age of the participant	132	26.08 ± 4.01
ALOR	66	26.61 ± 4.03
SLOR	66	25.55 ± 3.95

Nine patients in Group A suffered from hypotension (13.6%) and 13 patients in Group B suffered from hypotension (19.7%). Hypotension was corrected in the patients by giving ringer lactate 10ml/kg bolus. Two patients in Group A developed a dural puncture and 5 patients in Group B had a dural puncture. Three patients in Group A developed PDPH and 2 patients in Group B developed PDPH which was managed conservatively. There is no significant difference in both groups regarding procedural complications (Table IV).

Table II: Number of attempts for the epidural catheter in study groups

No. of attempts	ALOR Group	SLOR Group	P value
First	59 (89.4%)	52 (78.8%)	0.198
Second	7 (10.6%)	13 (19.7%)	
Third	0	1 (1.5%)	

Table III: Pain relief in study patients

Pain relief	ALOR Group	SLOR Group	P value
Yes	63 (95.5%)	64 (97%)	0.208
No	3 (4.5%)	2 (3%)	

Table IV: Complications Of Epidural Anesthesia

Complication	ALOR Group	SLOR Group	P value
Hypotension	9 (13.6%)	13 (19.7%)	0.873
Dural puncture	2 (3%)	5 (7.6%)	0.244
PDPH	3 (4.5%)	2 (3%)	0.208

DISCUSSION

When compared to other approaches to labor pain management, epidural analgesia is universally recognized as the method that is both the most effective and the gold standard. In the present study, an epidural catheter was successfully inserted into 57 patients on the very first try, and 9 patients in the ALOR group required a second attempt. Complete analgesia was reached in 63 patients, and in the SLOR group, an epidural catheter was successfully inserted into 52 patients during the first attempt, 13 patients during the second attempt, and one patient during the third attempt. However, complete analgesia was reached in 64 patients overall. The number of attempts was lower in group A, but there was no significant difference between the groups in terms of the analgesic effect. There was no statistical difference between the two groups in terms of the occurrence of procedural complications.

The success rate of placing an epidural catheter in the saline group was 100%, according to research that was carried out by Duniecet al.[10] The majority of patients in the saline group had a higher number of successful space localization attempts and a higher success rate with the block, but the difference between the two groups was found to be statistically insignificant. There was no discernible difference between the ALOR group and the SLOR group in the research that was carried out by Ahmed et al.[11]

Studies show that dural puncture is more common in the air group than it is in the saline group when it comes to complications associated with epidurals.[12,13,14] As the epidural space is reached, the saline which flows with continuous pressure pushes the dura away, thereby minimizing the incidence of dural puncture.[15] Studies using saline report an incidence of 0.3-0.5%, whereas studies using air report an incidence of up to 2%.[16,17,18] The explanation for this is that as the epidural space is reached, the saline which flows with continuous pressure pushes the dura away. In current research, the incidence of a dural puncture was 3% in the ALOR group and 7.6% in the SLOR group; however, there was no statistically significant difference between the two groups. Pain was relieved by epidural in 96% by both techniques. Imani et al and Ashagrie et al showed similar results.[19,20]

The findings of our research indicate that although the success rate of passing an epidural catheter is higher in the ALOR group, the analgesic effect of both groups is the same. Furthermore, there is no statistical difference between the two groups in terms of efficacy or other complications; consequently, we recommend the use of both air and saline loss of resistance techniques in locating the epidural space in order to provide preemptive analgesia in obstetric patients.

CONCLUSION

Epidural catheterization via loss of resistance with air (ALOR) and loss of resistance with saline (SLOR) for providing preemptive

analgesia in obstetric patients show comparable analgesic effects in terms of efficacy and complications with different success rate of epidural catheter placement which was higher in the ALOR group.

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