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Identification of Epidural Space Using Modified Drip Method and Loss of Resistance Syringe Technique: A Comparative Study

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Abstract

Background: Epidural anesthesia has become an integral part of today's anesthesia practice. There are various techniques to identify epidural space like, LOR (Loss of resistance) with saline or air, Hanging drop method, MDM (Modified running drip method) and balloon method. *Aims and objectives:* To compare time taken to locate epidural space and ease of epidural catheter insertion among LOR with saline and MDM. *Methods:* 60 healthy patients of either sex, ASA-I or II physical status, between aged 20 to 60 years, scheduled to undergo lower abdominal and lower limb surgeries were randomly assigned to one of the two groups. (30 each). In LOR group (Group A): the lumbar epidural space was identified by using the LOR technique with saline. MDM Group (Group B): the lumbar epidural space was identified by using the modified drip method (MDM). Time taken to locate epidural space (T1), time taken to thread epidural catheter (T2) and quality of block were recorded. *Results:* The mean time taken to localize the epidural space was less in MDM than LOR but the difference was found statistically insignificant. (p=0.59).) Mean time taken to thread epidural catheter T2 was more in LOR than MDM which is also statistically not significant (p=0.76). Accidental dural puncture was seen in one patient in MDM and four patients in LOR. 3 cases of incomplete block were found in LOR while 1 case in MDM group which is not statistically significant. *Conclusion*: We believe that MDM is one of the most accurate visual method of identifying epidural space and useful for teaching the epidural blockade to students and residents.

Keywords: Epidural space identification; MDM; LOR.

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Introduction

Epidural anesthesia has been a part of anaesthetic practice since 1901, when Sicard and Cathelin of France popularized the caudal approach [1]. This technique has since undergone modifications as a improvement in needle, syringe, catheter and as a result of advance in pharmacology of local anesthetics and adjuvant medications. However correct localization of epidural space still remains the major determinant of successful epidural block. Epidural is not widely employed due to the perceived difficulty in locating the epidural space. The other disadvantages are the fear of inadvertent dural puncture resulting in a total spinal block.

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Newer techniques for localization of epidural space can be broadly classified into techniques that (1) guide the needle to the epidural space, (2) identify needle entry into the epidural space, and (3) confirm catheter location in epidural space. An ideal method should be easy to learn and perform, easily reproducible with high sensitivity and specificity, identifies inadvertent intra-thecal and intravascular catheter placements with ease, feasible in perioperative setting and have a cost-benefit advantage [2].

Various techniques are there to identify epidural space like LOR with air or saline, hanging drop method and balloon method, MDM (Modified running drip method), ultrasound and fluoroscopy guided detection of epidural space. Baraka (1972) described a loss of resistance technique using gravitational hydraulic forces rather than a manually generated pressure [3]. This technique was modified and introduced into clinical practice by Michel and Lawes, and is known as modified drip method [4].

In this study we have compared and evaluated the success rate of the modified drip method with loss of resistance with saline technique in locating the lumbar epidural space.

Materials and Methods

The study was approved by Hospital Ethical Committee and informed consent from all the patients was obtained. Randomized, prospective and controlled study was done in 60 patients of either sex, ASA-I or II physical status, between aged 20 to 60 years, scheduled to undergo lower abdominal and lower limb surgery. The patients with local infection, vertebral column abnormalities, previous spine surgery, congenital or acquired coagulation disorders, were excluded from the study.

All the patients were randomly assigned to one of the two groups. LOR group (Group A):, the lumbar epidural space was identified by using the loss of resistance (LOR) technique with saline. MDM Group (Group B), In this group, the lumbar epidural space was identified by using the modified drip method (MDM)

Preoperative anaesthesia check-up of all the patients were done in detail by general physical and systemic examination. All routine investigations were done. Patients were kept nil by mouth for at least 6 hours. In the operation theatre, after the establishment of intravenous line, standard monitors (non-invasive blood pressure, electrocardiography and pulse-oxymetry), were attached and basic vitals were noted. After explaining procedure to the patients, epidural blocks were given to the patients in sitting position, under all aseptic precautions, using 18G Tuohy epidural needle in L3-L4 space by the two fixed anesthesiologists. Epidural space localization was attempted with either of the two techniques and maximum two attempts were taken to locate epidural space. In all cases an epidural catheter was introduced after identifying the epidural space.

Modified Drip Method

In MDM after introducing 18G Tuohy needle into skin and subcutaneous tissue, stylet was removed and a sterile intravenous set connected to 100 ml normal saline was attached to hub. The bottle was hung one meter above the level of vertebral column. The male end of the intravenous set was connected to hub of the epidural needle and drip. Epidural needle was advanced slowly using both hands while constantly watching drip. As soon as the drip started to flow freely, that indicate entry into epidural space then stop drip to prevent saline from entering into space.

LOR Method

In LOR with saline technique applied continuous or intermittent pressure on the syringe plunger, when the needle entered into epidural space, pressure applied to the syringe plunger allows solution to flow without resistance into the epidural space. If not in epidural space piston bounced back.

In both the techniques time taken to locate epidural space in seconds (T1) and time taken to thread epidural catheter (T2) were noted. A Maximum two attempts were taken for epidural space localization by the given technique. The establishment of complete epidural anesthesia after the injection of a bolus dose of local anesthetic through the epidural catheter was taken as successful end point to identify epidural space.

Patient's demographic data like age, sex, weight were noted. T_1 and T_2 quality of the block were also recorded during the study. Sensory block was assessed by pinprick method and motor block by asking patient to raise lower limbs without bending the knees.

Level of blocked dermatome was recorded and achieved level was graded as:

1. Good: Satisfactory block achieved without any unblocked segment in between
2. Incomplete/failure: Patchy effect or no effect.

Incidence of complication such as dural puncture, bloody tap and root irritation were recorded among two techniques. At the end of this study, the data collected during the study period was compiled and analyzed statistically by using ANOVA *f*-test for quantitative data and Chi-square test for qualitative data.

Results

All the 60 patients were randomly assigned to one of the two groups (LOR or MDM) resulting in each group comprising of 30 patients each. The mean age, sex, and weight of the subjects were comparable in both groups

Table 1:

Group	Sex Male:Female	Age (years) (mean ± SD)	Weight (kg) (mea ± nSD)
LOR	15:15	36.3 ± 7.21	51.9 7 ± .8
MDM	16:14	37.3 ± 7.58	54.47 ± 9.74
p Value		0.60	>0.5

Accidental dural puncture was seen in one and four patient of MDM group and LOR respectively and the difference was found statistically non-significant (p=0.18). Such patients we had not taken in study. Even more than 2 attempts were not considered in study. The mean time taken to identify the epidural space (T_1) and the mean duration of time taken to thread the epidural catheter (T_2) was recorded for both groups which are also not significant.

Table 2:

Group	Time taken to identify lumbar epidural space TI (Seconds)	Time taken to thread Epidural catheter T2 (seconds)
LOR	41.96 ± 12.67	18 ± 4.86
MDM	39.2 ± 24.87	17.46 ± 6.16
P value	p =0.590 (NS)	p=0.76 (NS)

Table 3 showing rate of success by two techniques. In LOR 3 cases of incomplete block while 1 case in MDM group was found which is not statistically significant.

Table 3:

Group	Successful block	Incomplete/failure block
LOR (30)	27 (90%)	3 (10%)
MDM (30)	29 (96.66%)	1 (3.33%)

Discussion

Accurate identification of the epidural space is the most important requisite for the success of epidural anesthesia. Several methods to identify the epidural space depend on either existence of a negative pressure within the space or the manual loss of resistance (LOR) to the injection of air or saline as the needle pierces the ligamentum flavum and enters the epidural space [4].

We choose 2 ml of saline rather than air in syringe in LOR method as saline has certain advantages over air, as liquid is incompressible, so transition from complete resistance to LOR is immediate and convincing but excess of saline may dilute local anesthetic solution and results in inadequate block [1,7,8].

Air has disadvantages of being compressible, so that detection of epidural space is more difficult and false positives are possible. In addition there are also possibility of venous air embolism, more unblocked segments and subcutaneous emphysema if large volumes of air injected into extradural space. [1,6,7,12]. LOR syringe technique has the advantage of great simplicity as no special apparatus is required, but it may be clumsy as the anesthetist must divide attention between exerting pressure and introducing needle [8]. MDM is also objective method as dripping on the entry of the epidural space is obvious to everyone. Furthermore, in this technique anesthetist can advance the needle with both hands, thus making the grip more sensitive. This technique also has certain disadvantages like slow dripping is sometimes observed even when the tip of the needle is in the loose inter-spinous ligaments. But false dripping is distinguished from true dripping by its slow dripping rate [3,4]. Hence, every technique is having certain advantages and disadvantages.

In our study, we compared MDM with LOR technique for time taken to locate epidural space (T1) and time taken to thread epidural catheter (T2) and obtaining successful epidural anesthesia and complication.

We studied that mean time taken to localize the epidural space was less in MDM (39.2 ± 24.87) than LOR (41.96 ± 12.67) but the difference was found statistically insignificant. (p=0.59). Michel and Lawes (1991) studied Modified the original drip method with 95% success rate in less than 1 minute which is same as in our study that was 39.2 ± 24 sec [4]. Mean time taken to thread epidural catheter T2 was more in LOR (18 ± 4.86) than MDM (17.46

± 6.16) which is also statistically not significant. In LOR method sometimes due to septa difficulty may be there in passing catheter while in MDM free flow of drip that means less or no chances of septa so easy to guide epidural catheter.

Baraka (1972) first used the drip method to identify the epidural space with a 100% success rate [3]. and there were no unintentional dural punctures [4]. In the same year Yamashita and Tsuji used the drip method with a success rate of 97% [10]. Kumagai and Yamashita (1995) did another study using the drip method with an overall success rate of 96% [11]. In our study 90% successful block was found in LOR method (27/30) while 96.6% in MDM (29/30). However the difference between the two groups did not show statistical significance. Balloon technique has certain advantages like the method is objective because inflation or deflation of the balloon is obvious to anyone regardless of experience and ability to sense changes in resistance. However, it is also possible to obtain false positives results, since the balloon can collapse if the tip of the needle is inserted into the loose para-vertebral tissue. Another disadvantage of the balloons technique is that they are fragile and cannot be autoclaved [15,16].

Accidental dural puncture was seen in one patient in MDM and four patients in LOR. This higher incidence of accidental dural puncture in the LOR group could be due to the fact that epidural location of the needle tip is checked intermittently after advancing the needle, making direct dural puncture a distinct possibility. In contrast, the entry of the epidural needle is being checked throughout the period of advancement of the needle in MDM group so making accidental dural puncture less common. Michel and Lawes documented no untoward dural puncture when modified drip infusion method [4]. Si YOUNG OK et al. concluded that combined LOR with drip infusion method is an efficacious method for the confirmation of the cervical epidural space [17]. That shows MDM is one of the good confirmatory method for epidural space localization.

Conclusion

We believe that MDM is one of the most accurate visual method of identifying epidural space and useful for teaching the epidural blockade to students and residents.

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