

Lumbar Epidural Space Depth has Better Relations to the Weight than Height of the Patient

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This study was carried out on one hundred and fifty male patients undergoing TURP and Cystoscopy under lumbar epidural anaesthesia in urology department mayo hospital with age between 30years to 100years with mean 64.29years, weight :37kg to96kg with mean 59.21kg and height between 140cm to187cm with mean 165.34cm. All patients were administered single .shot–lumbar epidural anesthesia with tuohy needle no 16 with bupivacain 0.5%?volume ranging 15cc to 20cc at level of L3-4 or L4-5 level. Two patients developed lumbar puncture and managed conservatively. The lumbar epidural space ranged between 3.5cm to 6.5cm with mean depth 4.38±0.563. It was concluded statistically that lumbar epidural space depth had better relation to the weight of patients than height.

Key words: Lumbar epidural space. Weight Height

Tuohy's subarachnoid needle was adapted for the continuous extra dural technique using a ureteric catheter. In the 1950, lumbar epidural anaesthesia was used first for obstetric pain relief and became more widely used during surgery and for post-operative pain relief.

Curelaru described combined single-shot subarachnoid and extra dural catheter technique in 1979. Subarachnoid and epidural anaesthesia are now established as a safe techniques of anaesthesia. Popularity of epidural anaesthesia technique is partly due to both ease of catheter insertion and subsequent maintenance of block for wide variety of surgical, obstetrical and analgesic procedures¹. Epidural anaesthesia can be performed at different levels of spinal cord and with varying concentration of local anaesthetics. An epidural anaesthesia must be performed in an area adequately equipped for treating all sorts of complications including infection, headache after dural tap and unintentional subarachnoid injection leading to high spinal².

Key feature of performing the epidural block is combining appropriate technique with tactile appreciation of anatomy³. The ligamentum flavum thickness and skin to dura matter distance vary with level of vertebral canal in the same patient and also vary from patient to patient leading to difference in distance from skin to lumbar epidural space. The studies have been done to find correlation between physical parameters of patients and distance from skin to lumbar epidural space so that epidural space depth can be predicted. They found variable relationship between patient height, weight and epidural space depth⁴. This study was conducted to determine the range of lumbar epidural space depth in our adult male population and to find any correlation between patient's weight, height and epidural space depth.

Materials and methods

After approval from the Hospital Ethical Committee, this study was carried out in Anaesthesia Department, Mayo Hospital, Lahore. It is a descriptive/correlation study and was carried out on 150 patients. Preoperative assessment

of patient was carried out a day before surgery. The whole procedure was explained to the patient and informed consent including possibility of a headache was taken. Weight was measured in kilograms using a standard balance with patient wearing light clothes and without shoes. Same weighing balance was used for all patients. Height was measured in centimeters in standing position.

In the operation theatre after recording baseline pulse and blood pressure, I/V line was maintained with Hartman's solution. SpO₂ and ECG were also monitored during the operation in addition to pulse and blood pressure. Epidural anaesthesia was administered in sitting position in the lumbar region at a point on the line crossing the highest point of the iliac crest using midline approach. Patients were made to sit on the operating table with feet resting on the stool and an assistant supported the patient. Epidural anaesthesia was given using a graduated Tuohy needle No. 16. Under aseptic technique, 3ml of 2% Lignocaine was infiltrated in the site of insertion of Tuohy needle throughout the tract. The epidural space was identified by loss of resistance technique using air. Distance from skin to epidural space was measured with the tip of the Tuohy needle was in the epidural space. The distance from the skin to the hub was noted and this distance was subtracted from the entire length (10cm) of the needle to give the distance from skin to epidural space. The measurements were included only if the epidural block was success.

Inclusion Criteria: Only adult male patients between the ages of 30-100 years of ASA I to III undergoing general surgical, urological or orthopaedic surgical procedures were included in the study.

Exclusion Criteria: Patient's refusal and patients having compromised cardiovascular status, any bleeding tendencies or on anticoagulant therapy, having local skin lesions or a systemic infection, patients with complaints of backache were excluded from the study.

Statistical analysis: The range of distance from skin to lumbar epidural space at the level of the highest point of

iliac crest was estimated and mean, lowest and highest figures were noted.

Linear regression analysis was done to see any correlation between patient weight & height and distance from skin to lumbar epidural space. Pearson Correlation Coefficient was determined. Regression equation was also found.

Results

The recorded parameters of the patients are shown in the table. The mean age was estimated to be 64.29 ± 12.90 (range 30-100 years). The mean weight was found to be 59.25 ± 9.81 kg (range was 37 to 96kg). The mean height was found to be 165.34 ± 7.28 cm (range was 140 to 187cm). The mean depth to epidural space was 4.38 ± 0.56 cm (range was 3.50 to 6.5cm).

After collecting the data, the correlational techniques were used on these data to see relationship between the patient's weight, height and epidural space depth. The correlation coefficient (Pearson coefficient $\{r\}$) was determined to see the strength and direction of relationship between patient's weight, height and epidural space depth. The correlation coefficient $\{r\}$ between patient's weight and distance from skin to epidural space was found to be ($r = 0.543$, $r^2 = 0.30$, $p < 0.01$) The correlation coefficient for relationship between patient's height and distance from epidural space was $r = 0.374$, $r^2 = 0.14$, $p < 0.01$). Single linear regression analysis was done on the collected data to get regression equation in order to predict value of the distance of skin to epidural space from the value of patient's weight and height. Single linear regression revealed a significant relationship between the distance from skin to epidural space and patient's weight but relationship between depth of epidural space and patient's height was weak. The regression equation was expressed as :

$$\begin{aligned} \text{Epidural space depth} &= 2.53 + 0.03 \text{ weight} \\ &= 0.43 + 0.03 \text{ height} \end{aligned}$$

Parameter	Units	Minimum	Maximum	Mean	Standard Deviation
Age	Years	30.00	100.00	64.29	12.90
Weight	Kg	37.00	96.00	59.21	9.81
Height	Cm	140.00	187.00	165.34	7.28
Epidural space depth	CM	3.5	6.5	4.38	0.563

Discussion

In 1940 and 1950 interest developed in neural blockade techniques but epidural anaesthesia did not play an important role in clinical usage at that time. Because of increased understanding of pharmacokinetics of local anaesthetic drugs used for epidural anaesthesia, they are better studied now a days⁵. Epidural anaesthesia is a complex in term of its anatomy, sight of action, physiology and pharmacology. A skillful hand and alert mind are the

most important factor in prevention of complications. If dura is punctured with 16 to 18 gauge epidural needle, the incidence of headache is high (70% to 80%)⁶ so the identification of epidural space is important. It is also very important to have an idea about depth of epidural space especially for the trainee. The mid lumbar area is the most commonly chosen space for epidural block because the epidural space is the widest in this area and spinal cord also terminates above this area. The structures that a needle passes on its way to the epidural space are skin, subcutaneous tissue, supraspinous ligament, interspinous ligament and ligamentum flavum. The subcutaneous tissue is the most variable of these structure.

In this study the mean value of the depth from skin to epidural space is 4.38 ± 0.563 cm (range 3.5 to 6.5cm) this is similar to previous studies. Currie studied the depth of epidural space depth by means of ultra sound scanning and direct measurement. The mean value for the depth to the epidural space was 4.13cm (range 2.9 to 7.2cm) and 4.35cm (range 3.2 to 7.1cm) respectively⁷.

Blomberg studied the depth to the epidural space with aid of epiduroscope in the 14 autopsy subjects. The distance from the skin to the point of loss of resistance was 4.86cm (range 4.2 to 5.2cm)⁸. Hirbayashi et al measured the distance from skin to epidural space in mid lumbar area in 221 patients showing that most patients had a distance to epidural space of 3 to 5cm. Similarly the study done by Hon-Pin Lau in Chinese patients population showed that the epidural space was at a depth of 3 to 7 cm with mean value of 4.62cm .

Harrison G R demonstrated in his study that the distance from the skin to epidural space was 4.7 cm but this varied with lumbar inter space at which it was measured, being greatest at L3-4 vertebral interspace (4.93cm) and least at L1-2 interspace (4.23cm)⁹.

As the range is 3.5to 6.5cm in our study, it is suggested therefore that after insertion by the mid line approach at a distance of 3cm, continuous and careful testing of loss of resistance is necessary. The Lee modification of the Tuohy needle is thus commonly used for epidural block because the needle has 1cm marking and the depth of epidural space can be easily calculated.

The Linear regression analysis in our study revealed significant direct correlation between body weight and skin to epidural space depth $r = 0.543$ but weak correlation between body height and skin to epidural space depth $r = 0.374$.This is supported by previous work which also confirms the strong correlation with patient weight and weak correlation with patient height.

Palmer et al studied distance from the skin to the epidural space in obstetric patients showing significant relationship between patient's weight and the depth of epidural space¹⁰.

Rosenberg et al studied the distance from skin to epidural space in nonobstetric patients and demonstrated that the best correlation was patient's weight and depth,

the coefficient was 0.55; the correlation was not significant between epidural space depth and patient's height, the coefficient was 0.13¹¹.

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