



STUDY OF TIME TO REACH THE EPIDURAL SPACE AND FAILED EPIDURAL ANALGESIA

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Abstract-

Background- Adequate pain relief during the perioperative period is the main part of balanced anaesthesia. Thoracic epidural anaesthesia has been a cornerstone in the perioperative care after thoracic and major abdominal surgery providing most effective analgesia.

Aims- the main aim of our study is "To compare the efficacy of" Episure" AutoDetect syringe and Glass syringe using loss of resistance technique with "Air" for identification of lower thoracic epidural space".

Methods and materials- This prospective, randomized, parallel group double-blinded study conducted in the Department of Anaesthesiology, Chengalpattu Government Medical College and Hospital, Chengalpattu for period of one year from April 2019 to April 2020.

The study population has been chosen from patients admitted for surgery in the Department of General Surgery and from the Department of Orthopedics. Sample size is 82, each group consists of 41 participants. After ethical committee approval and informed written consent among the study population, they were allocated randomly into two groups by picking odd or even numbers. Group A [n=41] epidural space identified using Episure Auto Detect Syringe, Group B [n=41] epidural space identified using Glass Syringe. The categorical variables of them were described in terms of percentages and compared between them by an appropriate non parametric test namely χ^2 (Chi-square) test. The above said activities were carried by the statistical package namely IBM SPSS Statistics-20. The P-values less than or equal to 0.05 ($p \leq 0.05$) were considered as statistically significant.

Results- males of both groups were 68.3% and the females of both groups were 31.7%. Males forms a higher percentage of participation in both groups than female. Mean height and mean weight was not statically significant. The mean depth to Epidural space of Group A was 4.3 ± 0.5 cm and Group B was 4.4 ± 0.5 cm. the incidence of successful epidural space identification in first attempt was more (39 patients) with Group A [Episure syringe] when compared to the Group B [Glass syringe] (31 patients) and two groups were statistically significant in respect of number of attempts ($P < 0.05$). the mean time to reach epidural space for Group A was 27.4 ± 8.6 seconds and Group B was 40.6 ± 15.4 secs. The difference between the two groups was statistically significant ($P < 0.001$). Hence the time

to reach the epidural space was found to be significantly lesser in Group A [Episure AutoDetect Syringe]. No incidence of failed epidural analgesia in Group A (Episure Auto Detect syringe). There were 6 case of failed analgesia present in Group B (Glass syringe) and the result is found to be statistically significant.

Conclusion- The spring-loaded syringe provides both subjective and objective confirmation of epidural space by the depression of plunger. This objective confirmation of epidural space prevents the overshooting and thereby decreases the incidence of accidental dural puncture by the beginners. Episure Auto Detect syringe allows reliable and quicker identification of the epidural space in lower thoracic epidural technique as compared to use of glass syringe. There was no incidence of inadvertent dural puncture or failed analgesia with the Episure Auto Detect syringe technique.

Keywords- episure, epidural space, balanced anaesthesia.

Introduction- Pain is a fundamental protective biological phenomenon. The Revised International Association for the Study of Pain 2020 has defined pain as “An unpleasant sensory and emotional experience associated with or resembling that associated with, actual or potential tissue damage”^[1]. Adequate pain relief during the perioperative period is the main part of balanced anaesthesia. Thoracic epidural anaesthesia has been a cornerstone in the perioperative care after thoracic and major abdominal surgery providing most effective analgesia ^[2,3]. Apart from its excellent analgesic properties, thoracic epidural anaesthesia has significant favourable effects on postoperative neuro-humoral stress response, cardiovascular pathophysiology and intestinal functions ^[4]. The thoracic block not only blocks the noxious afferent stimuli from the surgical site, but also imparts a bilateral selective thoracic sympathectomy. Epidural analgesia can also positively contribute to recovery by facilitating early mobilization and recovery of gut function. It markedly reduces the pulmonary, cardiovascular, thromboembolic and gastrointestinal complications occurring after major abdominal surgery.

Aims- the main aim of our study is “To compare the efficacy of” Episure” AutoDetect syringe and Glass syringe using loss of resistance technique with “Air “for identification of lower thoracic epidural space”.

Methods and materials-

Study design- This prospective, randomized, parallel group double-blinded study conducted in the Department of Anaesthesiology, Chengalpattu Government Medical College and Hospital, Chengalpattu for period of one year *year from April 2019 to April 2020*.

The study population has been chosen from patients admitted for surgery in the Department of General Surgery and from the Department of Orthopedics in Chengalpattu Government Medical College, Chengalpattu.

Sample size- sample size is 82, each group consists of 41 participants.

Randomization- After ethical committee approval and informed written consent among the study population, they were allocated randomly into two groups by picking odd or even numbers. Randomization of two groups will be done by draw of Lots.

Group A [n=41] epidural space identified using Episure Auto Detect Syringe.

Group B [n=41] epidural space identified using Glass Syringe.

Inclusion criteria-

- Age 18 – 60 yrs of both sexes
- Weight 50 – 100 kg
- Height 150 – 200 cm
- BMI – 20 – 35
- ASA grade I – III patients
- Patients requiring abdominal & lower limb surgeries

- Patients requiring post-operative analgesia

Exclusion criteria-

- Patient refusal
- ASA grade IV and V patients
- Patients with infection at site of injection
- Patients with known contra-indication to regional anaesthesia – Known or suspected coagulopathy
- Patients with neurological diseases & abnormalities of spinal column
- Patients with H/O allergy or hypersensitivity to local anesthetics.

Statistical analysis-

All parameters collected were recorded in Master Chart using Microsoft Excel Sheet. The study subjects were described according to their demographic profiles and compared in respect of continuous variables by independent “t” test. The categorical variables of them were described in terms of percentages and compared between them by an appropriate non parametric test namely χ^2 (Chi-square) test. The above said activities were carried by the statistical package namely IBM SPSS Statistics-20. The P-values less than or equal to 0.05 ($p \leq 0.05$) were considered as statistically significant.

Observation and results-

- the mean age of group A was 42.9 ± 9.7 years. The mean age of Group B was 43.6 ± 10.0 years. The difference between the mean ages was not statistically significant ($P > 0.05$).
- males of both groups were 68.3% and the females of both groups were 31.7%. The difference of gender between the two groups was not statistically significant ($P > 0.05$). Males forms a higher percentage of participation in both groups than female.
- mean height of the Group A was 159.4 ± 4.8 cm. The mean height of the Group B was 159.4 ± 6.5 cm. The difference between the two groups in respect of their height was not statistically significant ($P > 0.05$).
- mean weight of Group A was 62.2 ± 8.9 Kg. The mean weight of the Group B was 58.8 ± 9.1 Kg. The difference between the mean weights of both groups was not statistically significant ($P > 0.05$).
- the mean depth to Epidural space of Group A was 4.3 ± 0.5 cm. The mean depth to Epidural space of Group B was 4.4 ± 0.5 cm. The difference between the means was not statistically significant ($P > 0.05$).
- the incidence of successful epidural space identification in first attempt was more (39 patients) with Group A [Episure syringe] when compared to the Group B [Glass syringe] (31 patients) and two groups were **statistically significant** in respect of number of attempts (**$P < 0.05$**).
- the mean time to reach epidural space for Group A was **27.4 ± 8.6 seconds**. The mean time to reach epidural space of Group B was **40.6 ± 15.4 secs**. The difference between the two groups was **statistically significant ($P < 0.001$)**. Hence the time to reach the epidural space was found to be significantly **lesser in Group A** [Episure AutoDetect Syringe].
- there were 8 cases of Inadvertent dural puncture in Group B (Glass syringe) and only one case of Inadvertent dural puncture in Group A (Episure syringe). Hence the incidence of Inadvertent dural puncture was very less in Group A [Episure Auto Detect syringe].
- no incidence of failed epidural analgesia in Group A (Episure Auto Detect syringe). There were 6 case of failed analgesia present in Group B (Glass syringe) and the result is found to be **statistically significant**.

Discussion-

Adequate pain relief during the perioperative period is the main part of balanced anaesthesia The Revised International Association for the Study of Pain 2020 has defined pain as “An unpleasant sensory and emotional experience associated with or resembling that associated with, actual or potential tissue damage”^[1]. Epidural analgesia and anaesthesia are commonly used as a labour

analgesia, for chronic back pain treatment or as a sole anaesthetic technique during specific surgery and for postoperative analgesia. Identification of epidural space is a blind procedure. The failure of epidural analgesia usually results from inability to identify the epidural space correctly. During an epidural needle insertion, the operator tries to perceive feeling the resistances on the needle while the tip of needle entering the tissues. This is a process known as „haptic“ feedback.

The Loss of Resistance technique is the most widely used for identification of the epidural space. This technique uses both air and saline, but the debate is going still which medium is superior. Air becomes the popular medium with some reasons. First is historical, as until the 70's, syringes were made from glass and were non-disposable. Disadvantages of using air are possibility of causing pneumocephalus^[15,16], headache^[16], cervical emphysema^[18], patchy block and air embolism^[18]. With the availability of plastic syringes fluid gained popularity as it eliminates most of the problems of air as a medium. The main disadvantages of using saline are dilution of local anaesthetic agent affecting sensory blockade and confusion of saline with cerebrospinal fluid if accidental dural puncture occurs. The LOR is a subjective feeling, so most of the failure rates occurs with inexperienced hands^[19]. Baraka A reported „saline infusion technique“ in which the saline from the infusion set enters the epidural space as there is negative pressure in the epidural space^[20]. The main advantage of this technique is ,it uses both hands to hold the needle .The learning curve for begginers was easy and has got high success rate. Based on this principle, a new spring-loaded AutoDetect syringe Episire™ was designed by Indigo- Orb, Inc., Santa Clara, USA. A constant pressure applied may confers for correct epidural space identification in Episire Auto Detect syringe.. Visual observation of Loss of Resistance technique provides both subjective and objective conformation of epidural space identification and hence offers a more precise end-point compared with the standard Glass syringe^[11]

A total of 100 were evaluated for this study. Of which 12 patients were excluded as they did not meet the inclusion criteria. 6 patients refused to give informed consent; hence, we randomized 82 patients in two groups of 41 each. All the parameters collected were entered in a table and analysed statistically.

In our study, we compared the efficacy of Episire Auto Detect syringe with Glass syringe for identifying epidural space in lower thoracic epidurals using Loss of resistance technique with Air.

The demographic parameters such as age, height and weight were found to be insignificant in both the groups. There is relatively quicker identification of the epidural space with the spring-loaded syringe (27.4 ± 8.6 s) as compared to Glass Syringe (40.6 ± 15.4 s) ($p < 0.001$). It is mainly due to the difference between using continuous pressure to advance the needle in the spring loaded syringe group compared with intermittent advancement in the Glass syringe group. It is similar to that of Habib et al., who noted that the median elapsed time with the spring loaded syringe versus a conventional Glass syringe was 20 secs (11–28 secs) and 40 secs (25–58secs) respectively ($P < 0.001$) with epidural analgesia in parturient^[11].

Johnson et al conducted similar study on lower thoracic epidural space identification on patients undergoing lower abdominal surgery and found that the quicker identification of the epidural space was with Episire AutoDetect syringe (31.63 ± 9.4 s) than with Glass syringe (39.0 ± 14.3 s) and its due to the difference in using a continuous pressure in needle advancement using Episire syringe group compared with intermittent advancement in the Glass syringe group and the time to reach epidural space was quicker with Episire AutoDetect syringe ($P = 0.0012$)^[8].

In our study, there were 6 cases of inadvertent dural puncture in Glass Syringe while one case with that of Episire Auto Detect syringe.

Successful identification of epidural space in the first attempt using Episire Auto Detect syringe was seen in 39 patients whereas for the Glass Syringe it was 31 patients. Second attempt was required for 2 patients in Group Episire AutoDetect while it was required for 9 patients in Glass syringe group. There were no incidences of third attempt in Episire syringe group whereas one patient required third attempt in Glass syringe group. In Habib et al. study, it is one with the range of 1–3 attempts for spring-loaded syringes while it is one with the range of 1–6 attempts ($P=0.01$) for Glass Syringes with epidural analgesia in a parturient^[11].

The failed epidural analgesia was reported in 6 cases was found to be in Glass syringe group, whereas no incidence of failed epidural analgesia in Group Episure syringe. This finding is similar to that of Habib et al., noted that the incidence of failed analgesia in Episure Auto Detect spring loaded syringe versus a conventional Glass syringe was nil and 5 cases respectively ($P=0.03$) with epidural analgesia in parturient^[13]. Johnson et al conducted a similar study and noted there were 5 failed blocks in the Glass syringe group and none in the Episure syringe group ($P = 0.0287$). The overall success in performing epidural analgesia with spring loaded syringe is mainly due to both hands-free technique, application of constant pressure on the plunger and the visual observation of loss-of-resistance^[8,11].

Conclusion-

The spring-loaded syringe provides both subjective and objective confirmation of epidural space by the depression of plunger. This objective confirmation of epidural space prevents the overshooting and thereby decreases the incidence of accidental dural puncture by the beginners. Hence serves as a useful tool for the beginners. It provides the ease of using both the hands in holding the needle and has better control over the needle advancement thereby increases the chances of correct epidural space identification compared to the conventional Glass Syringe. Episure Auto Detect syringe allows reliable and quicker identification of the epidural space in lower thoracic epidural technique as compared to use of glass syringe. There was no incidence of inadvertent dural puncture or failed analgesia with the Episure Auto Detect syringe technique.

References-

1. Raja, Srinivasa N.a,*; Carr, Daniel B.b; Cohen, Miltonc; Finnerup, Nanna B.d,e; Flor, Hertaf; Gibson, Stepheng; Keefe, Francis J.h; Mogil, Jeffrey S.i; Ringkamp, Matthiasj; Sluka, Kathleen A.k; Song, Xue-Junl; Stevens, Bonniem; Sullivan, Mark D.n; Tutelman, Perri R.o; Ushida, Takahiroq; Vader, Kyleq The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises, PAIN: September 2020 - Volume 161 - Issue 9 - p 1976-1982 doi: 10.1097/j.pain.0000000000001939
2. Popping DM, Zahn PK, Van Aken HK, Dasch B, Boche R, Pogatzki-Zahn EM. Effectiveness and safety of postoperative pain management: a survey of 18 925 consecutive patients between 1998 and 2006 (2nd revision): a database analysis of prospectively raised data. *Br J Anaesth* 2008; 101: 832–40
3. Royse C, Royse A, Soeding P, Blake D, Pang J. Prospective randomized trial of high thoracic epidural analgesia for coronary artery bypass surgery. *Ann Thorac Surg* 2003; 75: 93–100
4. Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomized trials. *Br Med J* 2000;321: 1493
5. Waurick K, Waurick R. Epidural anästhesie - Geschichte und Technik der Epidural anästhesie [History and Technique of Epidural Anaesthesia]. *Anesthesiol Intensivmed Notfallmed Schmerzther.* 2015 Jul;50(7-8):476- 82; quiz 483. German. doi: 10.1055/s-0041-100845. Epub 2015 Jul 31. PMID: 26230893.
6. Franco A, Diz JC: The history of the epidural block, *Current Anaesthesia Critical Care* 11(5):274-276, 2000.
7. Antibas PL, do Nascimento Junior P, Braz LG, Vitor Pereira Doles J, Módolo NS, El Dib R. Air versus saline in the loss of resistance technique for identification of the epidural space. *Cochrane Database Syst Rev.* 2014 Jul 18;2014(7):CD008938. doi:10.1002/14651858.CD008938.pub2. PMID: 25033878; PMCID: PMC7167505.
8. Joseph EJ, Pachaimuthu E, Arokyamuthu V, Muthukrishnan M, Kannan DK, Dhanalakshmi B. Comparative study of Episure™ AutoDetect™ syringe versus glass syringe for identification of epidural space in lower thoracic epidural. *Indian J Anaesth* 2015;59:406-10.
9. Carabuena JM, Mitani AM, Liu X, Kodali BS, Tsen LC. The learning curve associated with the epidural technique using the Episure™ AutoDetect™ versus conventional glass syringe: An

- open-label, randomized, controlled, crossover trial of experienced anesthesiologists in obstetric patients. *Anesth Analg* 2013;116:145-54.
10. Schier, Robert MD, PhD*; Guerra, Diana MD†; Aguilar, Jorge MD†; Pratt, Gregory F. DDS, MSLS†; Hernandez, Mike MS‡; Boddu, Krishna MBBS, FANZCA†; Riedel, Bernhard MD, PhD§ Epidural Space Identification: A Meta-Analysis of Complications After Air Versus Liquid as the Medium for Loss of Resistance, *Anesthesia & Analgesia*: December 2009 - Volume 109 - Issue 6 - p 2012-2021;doi: 10.1213/ANE.0b013e3181bc113a
 11. Habib AS, George RB, Allen TK, Olufolabi AJ. A pilot study to compare the Episire Autodetect syringe with the glass syringe for identification of the epidural space in parturients. *Anesth Analg*. 2008 Feb;106(2):541-3, table of contents. doi: 10.1213/ane.0b013e3181606c0a. PMID: 18227314.
 12. Riley ET, Carvalho B. The Episire syringe: a novel loss of resistance syringe for locating the epidural space. *Anesth Analg*. 2007 Oct;105(4):1164-6, table of contents. doi: 10.1213/01.ane.0000281935.78144.82. PMID: 17898406.
 13. Capogna G. (2020) New Techniques and Emerging Technologies to Identify the Epidural Space. In: *Epidural Technique In Obstetric Anesthesia*. Springer, Cham. https://doi.org/10.1007/978-3-030-45332-9_6
 14. Lee N, Park SS, Yeul G, et al. Utility of an epidural pressure checker in the administration of trans-laminar epidural blocks. *Asian J Pain*. 2016;2:6
 15. Simopoulos T, Peeters-Asdourian C. Pneumocephalus after cervical epidural steroid injection. *Anesth Analg* 2001;92:1576-7. .
 16. Laviola S, Kirvelä M, Spoto MR, Tschuor S, Alon E. Pneumocephalus with intense headache and unilateral pupillary dilatation after accidental dural puncture during epidural anesthesia for cesarean section. *Anesth Analg* 1999;88:582-3
 17. Dogliotti AM. A new method of block anaesthesia. Segmental peridural spinal anaesthesia. *Am J Surg* 1933;20:107-18.
 18. Carter MI. Cervical surgical emphysema following extradural analgesia. *Anaesthesia* 1984;39:1115-6.
 19. Eappen S, Blinn A, Segal S. Incidence of epidural catheter replacement in parturients: A retrospective chart review. *Int J Obstet Anesth* 1998;7:220-5.
 20. Baraka A. Identification of the peridural space by a running infusion drip. *Br J Anaesth* 1972;44:122.