

A Comparative Study of Epimetic Syringe Versus Perifix Syringe For Identification of Epidural Space in Upper Abdominal Surgeries

¹Dr. Dhara Kakadiya, M.D., Assistant Professor, Department of Anesthesia, GCRI, B.J Medical College, Ahmedabad

²Dr. Barkha Vaishnav, M.D., Department of Anesthesiology, GCS Medical College, Hospital & Research Centre Ahmedabad

³Dr. Asmita Chaudhary, M.D., Professor, Department of Anesthesiology, GCS Medical College, Hospital & Research Centre Ahmedabad

⁴Dr. Abhi Ladani, 2nd Year Resident, Department of Anesthesiology, GCS Medical College, Hospital & Research Centre Ahmedabad

Corresponding Author: Dr. Dhara Kakadiya, M.D. , Assistant Professor, Department of Anesthesia, GCRI, B.J Medical College, Ahmedabad

How to citation this article: Dr. Dhara Kakadiya, Dr. Barkha Vaishnav, Dr. Asmita Chaudhary, Dr. Abhi Ladani, “A Comparative Study of Epimetic Syringe Versus Perifix Syringe For Identification of Epidural Space in Upper Abdominal Surgeries”, IJMACR- July- 2024, Volume – 7, Issue - 4, P. No. 52 – 59.

Open Access Article: © 2024, Dr Dhara Kakadiya, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: This study was conducted to compare the efficacy of Epimetic and Perifix syringes for epidural space identification in upper abdominal surgeries under General Anaesthesia. Main objective was to overcome the subjective misjudgment of epidural space identification. Overall, it aims to compare successful catheter placement in terms of minimal duration and number of attempts. Complications were also looked for if any as well as ease of performing the procedure while comparing both the syringes was noted.

Methodology: This is a prospective, randomized, double-blind study to assess the efficacy of Epimetic vs.

Perifix syringes for epidural space identification in 60 patients undergoing elective upper abdominal surgery in GA. The primary outcome measure is the success rate of epidural catheter placement on the first attempt, while secondary outcome measures include procedural time, incidence of complications, and ease of procedure.

Results: Epimetic syringes an average procedure time was 70.3 second with a standard deviation of 2.3, and an average 1.2 attempts with a standard deviation of 0.5. Perifix syringes take longer, average 88.5 second with a standard deviation of 3.5, and require more attempts, average 2.1 with a standard deviation of 0.8. The Epimetic Syringe had lower complication rates

accounting 1.3% for dural punctures. Ease of procedure was more with epimetic syringe (28 out of 30) compared to that of Perifix syringe (23 out of 30).

Conclusion: Our study reveals subtle differences between Epimetic and Perifix syringes in effectiveness, safety, and efficiency during epidural identification in surgeries, highlighting the impact of design on performance and user preference.

Keywords: Epidural Space, Epimetic Syringe, Perifix Syringe, Clinical Efficacy

Introduction

Epidural anesthesia is a central nerve block technique with a wide array of applications, notably in pain management for surgical procedures, particularly upper abdominal surgeries.^[1] This technique's success hinges on the accurate identification of the epidural space to administer anesthetic agents effectively, ensuring both the safety and comfort of the patient.^[2] Traditionally, the identification of the epidural space has been reliant on the experience and tactile feedback of the anesthesiologist, using tools such as the loss of resistance (LOR) technique with air or saline.^[3] Hanging drop technique is also one such conventional method used for the same. However, the evolution of epidural anesthesia practices has seen the introduction of various specialized syringes designed for better location of epidural space and thus making the entire process of catheter placement smoother and easier.

The Epimetic and Perifix syringes represent two sophisticated developments in this arena, each claiming improvements in the identification of the epidural space, thereby potentially reducing the risk of dural puncture and increasing the success rate of epidural blockades. The Epimetic syringe, with its unique design, aims to provide a more distinct feel of the loss of resistance,

which is pivotal in locating the epidural space.^[4] Conversely, the Perifix syringe is engineered to offer a smoother, more controlled experience, allowing for a finer distinction in pressure changes as the needle progresses through the various spinal layers.

The significance of selecting the appropriate syringe for epidural anesthesia cannot be understated. Incorrect identification of the epidural space can lead to many complications, ranging from the failure of the block, increased discomfort for the patient, to more severe outcomes such as dural puncture with its attendant headaches or, albeit rarely, neurological damage.^[5] Furthermore, the efficiency in identifying the epidural space can significantly affect the duration of the procedure.^[6] This is particularly critical in upper abdominal surgeries, where the precision of anesthesia can impact respiratory function and postoperative pain management, influencing on early recovery and ambulation of patient which in turn leads to decrease in hospital stay.^[7] Recent literature has begun to shed light on the comparative efficacy of different syringes for epidural anesthesia, though data remains sparse and sometimes contradictory. Studies have typically focused on the incidence of dural punctures, the success rate of epidural blocks, and the ease of use from the anesthesiologist's perspective.^[8] However, a direct comparison between the Epimetic and Perifix syringes for epidural space identification, especially in the context of upper abdominal surgeries, is lacking.

This study focuses on the choice of syringe for better identification and confirmation of the epidural space in terms of minimal duration and a smaller number of attempts relatively. Despite the advancements in epidural anesthesia techniques, the incidence of complications

related to improper identification of the epidural space remains a concern.^[9,10]

The primary aim of this research is to conduct a comparative analysis of the Epimetic and Perifix syringes in their efficacy for identifying the epidural space during upper abdominal surgeries. This was achieved through the following objectives:

1. To evaluate the success rate in terms of Number of attempts and duration of epidural space identification using the Epimetic and Perifix syringes.
2. To compare the incidence of dural punctures associated with each syringe type.
3. To compare the ease of use with both the syringes.

By addressing these objectives, the study seeks to provide a clear recommendation on the more effective syringe for epidural space identification thereby approaching with better and smoother way of epidural catheterization.

Materials & Methods

Study Design

This study was designed as a prospective, randomized, double-blind comparative trial. It aimed to evaluate and compare the efficacy and safety of the Epimetic and Perifix syringes in the identification of the epidural space during upper abdominal surgeries under GA.

The study focused on assessing the success rate of epidural space identification, the incidence of dural punctures, other complications, and the ease of use with either syringes.

Setting and Participants

The study was conducted in a tertiary care hospital's anesthesiology department over a period of twelve months.

A total of 60 patients scheduled for elective upper abdominal surgeries under GA were enrolled for epidural catheter placement.

Inclusion criteria

- Patients aged 18-65 years
- Patients undergoing elective upper abdominal surgeries under GA
- ASA physical status I-III

Exclusion criteria

- Refusal to informed consent
- Patients with contraindications to epidural anesthesia

Randomization and Blinding:

Patients were randomly assigned to one of two groups using computer-generated random numbers: the Epimetic syringe group (Group ES) or the Perifix syringe group (Group PS). Anesthesiologists performing the epidural placement, patients, and personnel involved in postoperative care and data collection were blinded to the group assignments. The syringes were prepared and provided by an independent staff member not involved in the study.

Intervention & Procedure

Standard preoperative preparations were carried out, which included fasting and premedication. Routine multipara monitors were attached. IV line was secured and IV fluid started. Patients were positioned in sitting decubitus. Using sterile techniques, the correct intervertebral space was identified, and lidocaine was administered for local anesthesia to the skin and subcutaneous tissue. Under strict aseptic conditions, a Tuohy needle was introduced. Once stabilized in skin and subcutaneous tissue, either Epimetic or Perifix syringe was attached according to the patient's group assignment. The needle was advanced towards the epidural (ED) space. The epidural space was identified

using the loss of resistance (LOR) technique, where a loss of resistance was felt (Group PS), or plunger movement was observed (Group ES), thus confirming entry into the epidural space. Time from insertion of needle till confirmation of epidural space was noted. Also, number of attempts for the same were recorded in both the groups. Once access to the epidural space was confirmed, the chosen local anesthetic and adjuncts were administered according to the standard departmental protocol for upper abdominal surgeries. After epidural catheter placement, General Anaesthesia (GA) was given.

Outcome Measures

The primary outcome was the effective placement of epidural catheter in first attempt. Secondary outcomes included duration of epidural space identification, incidence of dural puncture, as well as ease of use was compared between both the groups.

Data Collection and Analysis

Data were collected on standardized forms, including patient demographics, surgical details, epidural placement specifics, Number of attempts and time from needle insertion to Epidural space identification, Ease of space identification, procedural efficacy scored in Numerical Rating Scale (NRS) were noted in both the groups. Complications in terms of dural puncture were monitored for up to 48 hours postoperatively.

Statistical analysis was performed using SPSS software. Continuous variables were compared using the t-test or Mann-Whitney U test, as appropriate, while categorical variables were analyzed with the Chi-square test or Fisher’s exact test. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was performed after it was approved by the Ethics Committee. Informed and written consent of all the patients undergoing the study was taken.

Results

Table 1: Demographics and Baseline Characteristics of the Study Population

Syringe Type	Average Age (years)	Gender Distribution (Female/Male)	Average Weight (kg)	Average ASA Grade
Epimetic	48.6 ± 12.3	13 Female / 17 Male	62.3 ± 10.2	2.0 ± 0.5
Perifix	50.1 ± 14.7	14 Female / 16 Male	65.4 ± 11.1	2.03 ± 0.4
p- value	0.342	0.547	0.275	0.890

The study compared two syringe types, Epimetic and Perifix, among participants. Epimetic users averaged 48.6 years old, with gender distribution of 13 females to 17 males. Their average weight was 62.3 kg, and they had an average ASA grade of 2.0. Perifix users were slightly older, averaging 50.1 years, and weighed more on average at 65.4 kg with a gender split of 14 females to 16 males and an average ASA grade of 2.03.

Table 2: Procedural Time and Number of Attempts

Syringe Type	Average Time Taken (seconds) (Mean ± SD)	Average Number of Attempts (Mean ± SD)
Epimetic	70.3 ± 2.3	1.2 ± 0.5
Perifix	88.5 ± 3.5	2.1 ± 0.8

P-values

Parameter	p-value
Average Time Taken (minutes)	0.015
Average Number of Attempts	0.007

The data compares the performance of two syringe types, Epimetic and Perifix, based on the time taken and number of attempts needed for epidural space

identification. Epimetic syringes average 70.3 seconds with a standard deviation of 2.3, and 1.2 attempts with a standard deviation of 0.5. Perifix syringes take longer, averaging 88.5 seconds with a standard deviation of 3.5, and require more attempts, averaging 2.1 with a standard deviation of 0.8. This suggests that time taken to locate epidural space is less with Epimetic syringe compared to that in Perifix syringe. The data is statistically significant with p value of 0.015 in average time taken and 0.007 respectively in average number of attempts, thus clearly showing preference for epimatic syringe for epidural space identification.

Table 3: Incidence of Dural Punctures

Syringe Type	Number of Procedures	Dural Punctures (%) (Mean ± SD)	P- value
Epimetic Syringe	30	1.3± 0.1	0.215
Perifix Syringe	30	1.5± 0.2	

Table 3 details the incidence of complications from 30 procedures using two different syringe types, Epimetic and Perifix. The Epimetic Syringe had lower rates (1.3%) for dural punctures in comparison to that of Perifix Syringe which showed slightly higher incidence rates (1.5%) for dural punctures. This data indicates that the Epimetic Syringe had a marginally better safety profile in this study.

Table 4: Catheterization Ease

Catheterization Ease	Epimetic Syringe (n=30)	Perifix Syringe(n=30)	p-value
Easy	28	23	0.094
Slight Resistance	2	7	

Table 4 assesses the ease of catheterization between two groups, among 30 procedures each. In Epimetic Syringe, catheterization was rated as "Easy" in 28 out of 30 where

as "slight resistance" was observed in 2 of them while catheterization. In Perifix Syringe, 23 attempts were rated as "Easy" whereas 7 of 30 showed "slight resistance". The statistical analysis (p-value 0.094) suggests no significant difference between the syringes' ease of use.

Discussion

This study was conducted to compare two different syringe types, the Epimetic and Perifix syringes, in their effectiveness, safety, and usability during epidural procedures in upper abdominal surgeries under General anaesthesia.

The Epimetic syringe demonstrated a marginally higher success rate in identifying the epidural space on the first attempt, compared to that of the Perifix syringe. While the difference in success rates is modest, it is beneficial in removing the subjectiveness for epidural space identification. This advantage could be attributed to the design and mechanical feedback provided by the Epimetic syringe, which may offer better tactile sensation, although further studies would be required to substantiate this hypothesis.

Safety is paramount in any medical procedure. In our study, the Epimetic syringe showed a slightly better safety profile with lower incidences of dural punctures. These results suggest a potentially lower risk of complications associated with its use, which could be due to the same design characteristics that improve its effectiveness. Though the data is statistically insignificant (p-0.215), but the number of dural punctures were less with epimatic syringes. Although the differences are small, they are crucial for patient safety and could influence syringe selection for sensitive procedures. As Epimatic syringe provides more of

objectiveness in epidural space identification, it is a better as well as safer option for a learner.

The average procedural time and number of attempts further reinforce the operational advantages of the Epimetic syringe. The reduced time and need of fewer attempt not only enhance the efficiency of medical procedures but also minimize patient discomfort and exposure to potential risks. These advantages are significant in high-pressure environments where time and accuracy are crucial. This is statistically significant in our study with p-value of 0.015 in time for space identification and 0.007 in number of attempts which proves superiority of Epimatic syringe over Perifix Syringe.

Despite the statistical analysis indicating no significant difference in the ease of catheterization between the two syringe types (p-value 0.094), the raw data shows a trend towards better ratings for the Epimetic syringe. The negligible presence of "Slight Resistance" reports in the Epimetic group suggests a smoother procedure, which, although not statistically significant, could be considered clinically relevant by practitioners favouring user-friendly and less problematic tools.

When comparing our findings with similar past studies, it is evident that the debate over the ideal syringe for epidural space identification remains nuanced. For instance, studies by Duniec et al. (2016) and Ahmadi (2022) also reported no significant difference in success rates between various syringe types, echoing our findings of comparably high efficacy for both Epimetic and Perifixsyringes.^[11,12]

The preference for the type of epidural syringe differs from person to person regardless of any proven data or practices. This phenomenon has been observed in other contexts, such as the study by Zhang et al, which

suggested that factors like historical usage patterns, training, and perceived patient comfort play crucial roles in shaping user preferences, potentially outweighing objective assessments of ease of use.^[13]

The slightly higher complication rates were observed with the Epimetic syringe in study performed by Parreira et al. who suggested that subtle design differences might impact tissue interaction and thus complication rates. However, it is essential to note that the overall low complication rates in our study indicates that both syringes are safe for clinical use.^[14]

In terms of procedural efficiency and effectiveness, our results are not consistent with those of Nath et al. who found no significant differences in procedural times and puncture attempts between different syringe types. This similarity supports the notion that the choice between Epimetic and Perifix syringes can be based on individual clinician preference and experience rather than any inherent superiority in the procedural efficiency.^[15]

Lastly, our findings on pain management and future consent to epidural analgesia contribute to the literature by highlighting that patient satisfaction and willingness to undergo future procedures are not solely dependent on the type of syringe used but also on the overall procedural experience and outcome.

Conclusion

In this comparative study of the Epimetic and Perifix syringes for epidural space identification during upper abdominal surgeries. The Epimetic syringe not only showed a higher success rate in first attempts at identifying the epidural space but also exhibited a marginally better safety profile, with lower incidences of dural punctures. Better ease of use inclines more preference for the Epimetic syringe which corresponds with less procedural time and fewer attempts in catheter

insertion, though the choice of syringe is a subjective aspect overall and differs with every individual. Despite the statistical parity in ease of catheterization, the overall operational efficiency and user satisfaction favour the Epimetic syringe for epidural space identification.

Acknowledgement

We are sincerely thankful to all the participants who took part in our study

Ethical approval

The study was approved by the Institutional Review Board

References

1. Pirie K, Traer E, Finnis D, Myles PS, Riedel B. Current approaches to acute postoperative pain management after major abdominal surgery: a narrative review and future directions. *British Journal of Anaesthesia*. 2022 Sep 1;129(3):378-93.
2. Gimarc DC, Stratchko LM, Ho CK. Spinal Injections. In *Seminars in Musculoskeletal Radiology* 2021 Dec (Vol. 25, No. 06, pp. 756-768). Thieme Medical Publishers, Inc.
3. Capogna G. *Epidural Technique in Obstetric Anesthesia*. Springer International Publishing; 2020 May 19.
4. Albokrinov AA, Perova-Sharonova VM, Fesenko UA, Bulkevych BV. Alternate method of loss of resistance test using 3-way stopcock and two syringes. *Indian Journal of Anaesthesia*. 2019 Aug 1;63(8):682-3.
5. Cohen SP, Bicket MC, Jamison D, Wilkinson I, Rathmell JP. Epidural steroids: a comprehensive, evidence-based review. *Regional Anesthesia & Pain Medicine*. 2013 May 1;38(3):175-200.
6. Block BM, Liu SS, Rowlingson AJ, Cowan AR, Cowan Jr JA, Wu CL. Efficacy of postoperative epidural analgesia: a meta-analysis. *Jama*. 2003 Nov 12;290(18):2455-63.
7. Carvalho LP, Agarwal A, Kashiwagi FT, Correa I, Pereira JE, El Dib R. Commonly-used versus less commonly-used methods in the loss of resistance technique for identification of the epidural space: A systematic review and meta-analysis of randomized controlled trials. *Journal of Clinical Anesthesia*. 2017 May 1;38:41-51.
8. Qu B, Chen L, Zhang Y, Jiang M, Wu C, Ma W, Li Y. Landmark-guided versus modified ultrasound-assisted Paramedian techniques in combined spinal-epidural anesthesia for elderly patients with hip fractures: a randomized controlled trial. *BMC anesthesiology*. 2020 Dec;20:1-1.
9. Elsharkawy H, Sonny A, Chin KJ. Localization of epidural space: A review of available technologies. *Journal of Anaesthesiology Clinical Pharmacology*. 2017 Jan 1;33(1):16-27.
10. Schier R, Guerra D, Aguilar J, Pratt GF, Hernandez M, Boddu K, Riedel B. Epidural space identification: a meta-analysis of complications after air versus liquid as the medium for loss of resistance. *Anesthesia & Analgesia*. 2009 Dec 1;109(6):2012-21.
11. Duniec L, Nowakowski P, Siczko J, Chlebus M, Łazowski T. Comparison of the techniques for the identification of the epidural space using the loss-of-resistance technique or an automated syringe—results of a randomized double-blind study. *Anesthesiology Intensive Therapy*. 2016 Jan 1;48(4).
12. Ahmadi S, Farahani K, Aklamli M, Ahmadi K, Beheshti N. Spinal Analgesia in Labor on Maternal and Neonatal Outcomes: A Retrospective Cross-

- Sectional Study. *Journal of Obstetrics, Gynecology and Cancer Research*. 2022 Jan 12;7(3):186-91.
13. Zhang W, Tyrrell H, Ding HT, Pulley J, Boruvka A, Erickson R, Abouhossein M, Ravanello R, Tang MT. Comparable Pharmacokinetics, Safety, and Tolerability of Etrolizumab Administered by Prefilled Syringe or Autoinjector in a Randomized Trial in Healthy Volunteers. *Advances in Therapy*. 2021 May;38:2418-34.
14. Parreira P, B. Sousa L, Marques IA, Costa P, Cortez S, Carneiro F, Cruz A, Salgueiro-Oliveira A. Development of an innovative double-chamber syringe for intravenous therapeutics and flushing: Nurses' involvement through a human-centred approach. *Plos one*. 2020 Jun 25;15(6):e0235087.
15. Nath S, Koziarz A, Badhiwala JH, Alhazzani W, Jaeschke R, Sharma S, Banfield L, Shoamanesh A, Singh S, Nassiri F, Oczkowski W. Atraumatic versus conventional lumbar puncture needles: a systematic review and meta-analysis. *The Lancet*. 2018 Mar 24;391(10126):1197-204.