

Research Article

Epidural Analgesia in Labour: An Audit

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ABSTRACT

Background: Labour epidural analgesia is a widely used pain relief method; however, challenges such as obesity, poor spinal anatomy, and uterine contractions can affect its success. Human factors, including communication errors and inadequate training, may also contribute to failure rates. This audit evaluates the factors influencing epidural placement success, patient satisfaction, and the role of ultrasound guidance in difficult cases.

Methods: After obtaining ethical committee approval, a retrospective audit was conducted on epidural records from October 2023 to September 2024. A total of 317 pregnant women in labour who requested epidural analgesia were included. Consecutive (Non-Probability sampling technique) was used. Demographic data, parity, cervical dilation at the time of epidural placement, complications, anesthetist experience level, and patient satisfaction were recorded. Epidurals were administered by senior doctors (75%) and consultants (25%) using an 18G Tuohy needle in the sitting or lateral position. Difficult epidural placement was defined as requiring >2 intervertebral space attempts or >4 needle redirections. Statistical analysis was performed using SPSS v26.0, with $p < 0.05$ considered significant.

Results: A total of 317 pregnant women in labor were included in the audit. Epidural administration varied significantly across months ($p = 0.012$), with the highest numbers in October 2023 (40) and the lowest in September 2024 (15). The mean patient age was 28.52 years, with most between 23 and 34 years. Younger patients reported slightly higher satisfaction ($\beta = -0.08$, $p = 0.041$). The most common cervical dilation at epidural administration was 3 cm (82 patients), followed by 4 cm (69 patients). Satisfaction levels varied significantly with cervical dilation ($p = 0.007$). Epidurals were administered by senior consultants (75%) or consultants (25%), with senior consultant-administered epidurals showing slightly higher satisfaction rates (66% "Excellent" vs. 60%, $p = 0.054$). Epidurals at L4-L5 had the highest satisfaction ($p = 0.021$). Patients receiving infusions reported lower satisfaction ($\beta = -0.12$, $p = 0.032$). Parity influenced satisfaction, with second-time pregnancies reporting the highest satisfaction (67% "Excellent") and fourth-time pregnancies the lowest ($p = 0.019$).

Conclusion: Labour epidural placement is influenced by patient anatomy, cooperation, and provider expertise. Pre-labour anesthetic assessment and ultrasound guidance can improve success rates, while effective communication and standardized protocols enhance patient satisfaction.

Keyword: Anesthetist, Labour Analgesia, Difficult Epidural, Assessment.

INTRODUCTION

The introduction of epidural analgesia for labor pain relief over four decades ago has sparked continuous debate regarding its impact on the labor process. Initially, concerns were raised about potential drawbacks, including

prolonged labor, increased oxytocin requirements, and higher rates of instrumental or operative deliveries(1). Despite ongoing controversy, epidural analgesia remains a widely used pain relief method, with approximately 25% of women in the UK and

66% in the USA opting for it (2,3). The American College of Obstetricians and Gynecologists has emphasized the ethical obligation to provide adequate pain relief, reinforcing the importance of epidural analgesia in obstetric care (1).

Compared to intramuscular opioid analgesia and patient-controlled opioid administration, epidurals have demonstrated superior pain relief (4).

While epidural analgesia provides effective pain relief, it is not without risks. Common side effects include muscle weakness, nausea, shivering, itching, and headache, with rare but serious complications also possible. Concerns about safety influence decision-making, underscoring the need for thorough patient education and informed consent (3, 5).

A Cochrane review confirmed that epidural analgesia provides superior pain relief compared to other methods but noted associations with a longer second stage of labor, increased labor augmentation, and higher incidences of hypotension and temporary immobility(6). Notably, epidurals do not significantly increase the risk of cesarean section.

MATERIALS AND METHODS

After obtaining approval from the hospital ethical committee, we conducted a retrospective audit of epidural records from October 2023 to September 2024. Consecutive convenience sampling was used to include all eligible pregnant women in labor who requested epidural analgesia during this period. All epidurals were performed in the labor ward by anesthetists with varying levels of experience, including senior registrars and consultants.

Patient demographics, parity, cervical dilation at the time of epidural administration, complications, anesthetist grade, and patient

positioning during the procedure were recorded. Patient satisfaction was assessed using a standardized categorical scale: "Excellent," "Satisfactory," or "Unsatisfactory." Before administering the epidural, all patients underwent standard pre-procedure monitoring, including non-invasive blood pressure (NIBP) measurement, pulse oximetry, and electrocardiography (ECG). An intravenous (IV) cannula (preferably 18G) was inserted in all patients, and IV fluid (Hartmann's or Plasmalyte) was started before the epidural catheter placement.

Epidurals were administered in a sitting or lateral position using an 18G Tuohy needle. The catheter was placed when cervical dilation reached at least 4 cm, following institutional labor analgesia protocols. An experienced anesthetic technician was present to assist with optimal patient positioning during catheter insertion. Patients who were using inhaled nitrous oxide (Entonox) for labor pain relief were allowed to continue its use during the procedure. The epidural catheter was inserted between L2-L3, L3-L4, or L4-L5 intervertebral spaces, depending on the anesthetist's clinical judgment and patient anatomy.

In cases of difficult epidural placement, defined as requiring more than two intervertebral space attempts or multiple needle redirections (>4), the difficulty level was recorded. If an epidural difficulty index (EDI) score ≥ 3 was observed, ultrasound guidance was used to improve success rates (Table 1). Complications such as accidental dural puncture were noted, and if they occurred, intrathecal analgesia was administered with standard post-dural puncture headache (PDPH) management. If an epidural could not be successfully placed after multiple attempts, an alternative pain management plan was implemented based on the patient's preference.

Table 1: Epidural difficulty index (EDI) for labour analgesia

Parameter	Score
1. BMI	
<29.9	0
30-39.9	1
40-49.9	2
≥50	3
2. Spine anatomy	
Able to palpate spinous process	0
Difficult to palpate spine/obscured by skin or tissue folds	1
Cannot palpate spine	2
3. History of previous difficult epidural/spinal	
No previous history of difficult epidural/spinal	0
Previous history of difficult epidural/spinal	1
4. Patient cooperation	
Cooperative patient	0
Non-cooperative patient/unable to maintain position	1

Patient satisfaction and outcomes were assessed after epidural administration. Statistical analysis was performed using descriptive statistics, expressed as mean $\pm$ standard deviation (SD). Non-parametric data were analyzed using the chi-square test or Fisher's exact test, as applicable. Correlation coefficients were calculated to assess associations between variables. Statistical significance was set at $p < 0.05$, and all analyses were conducted using SPSS software version 26.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

We have monthly data for epidurals administered to 317 patients between October 2023 and September 2024. As shown in Figure 1, the greatest number of epidurals were administered during October 2023 (40), followed by August 2023 (36) and May 2024 (32). The least number of epidurals were administered during September 2024 (15) and April 2024 (21). The average number of epidurals administered each month were 26.41.

Figure 2 displays the number of epidurals administered sorted by age of patients. The average age of patients was 28.52 with a majority of the ages ranging between 23 and 34. A total of 33 patients were aged 27, 31 patients aged 25 and 26, and 30 aged 28 years old. A total of 13 patients were of the ages 22 or younger with the youngest being 17 years old, while a total of 15 patients were of the ages 37 or older with the eldest being 43 years old.

Figure 3 displays the distribution of patient cervical dilation when the epidural was administered. The most common figure was 3 cm with a total of 82 patients and 4 cm with a total of 69 patients. There were also 3 instances when the epidural was administered where patients had a cervical dilation of 10 cm and 10 instances where patients had a cervical dilation of 1 or 1.5 cm.

The epidurals were either administered by a senior doctor or consultants with roughly 75% being administered by senior doctors and the remaining 25% being administered by consultants as displayed in Figure 4.

Patient satisfaction regarding epidural administration was recorded as a categorical variable with 3 categories: Excellent, Satisfactory, and Unsatisfactory. In addition, any complications with the procedure were also noted. The satisfaction scale was used to assess which background factors impacted the patient's experience.

Figures 5 to 7 display patient satisfaction for epidurals administered by consultants and senior doctors respectively. Of the 68 epidurals administered by consultants, 45 (66%) patients reported a satisfaction of "Excellent" with very few complications, 21 (31%) reported a satisfaction of "Satisfactory", with complications such as numbness in legs or blood inside catheter upon removal. The remaining 2 (3%) patients reported a satisfaction of "Unsatisfactory," with one reporting patchiness after administration.

Senior doctors administered a total of 218 epidurals, with 130 (60%) reporting satisfaction as "Excellent." 77 (35%) patients reported satisfaction as "Satisfactory" and the remaining 11 (5%) patients reported satisfaction as "Unsatisfactory." A few patients who reported satisfaction levels of "Satisfactory" and "Unsatisfactory" expressed dissatisfaction due to multiple attempts to insert catheter, or a patchy epidural even after withdrawing the catheter. It is important to note that while the proportion of "Excellent" satisfaction rating was higher by 6% in those administered by consultants, it may be due to the low number of epidurals administered by consultants as senior doctors administered epidurals more than 3 times the number of those administered by consultants.

Figures 8 to 11 display the patient satisfaction for patients separated by age categories.

Patients were divided into 4 age groups: 17 to 22, 23 to 28, 29 to 34, and 34 plus. No patient in the first age category reported a satisfaction level of "Unsatisfactory," while 8 (67%) and 4 (33%) reported satisfaction as "Excellent" and "Satisfactory" respectively. Of the 159 patients in the second age category, 97 (66%) reported a satisfaction of "Excellent", 43 (29%) reported a satisfaction of "Satisfactory", and 6 (4%) reported a satisfaction of "Unsatisfactory." In the third age category, a total of 93 epidurals were administered, with 53 (57%) reporting satisfaction of "Excellent," 35 (38%) reporting a satisfaction of "Satisfactory" and 5 (5%) reporting a satisfaction of "Unsatisfactory." In the final age category, a total of 24 epidurals were administered with 9 (38%) of the patients reporting satisfaction of "Excellent," 13 (54%) reporting "Satisfactory" and 2 (8%) reporting satisfaction as "Unsatisfactory." With the exception of the final category, all the other categories had higher proportions of "Excellent" satisfaction ratings than "Satisfactory" and "Unsatisfactory." In the oldest age group, more patients reported a "Satisfactory" rating than "Excellent" ratings.

Figures 12 to 14 show the satisfaction results by where the epidural was administered. The epidural was either administered between L2L3, L3L4, or L4L5. Of the 30 patients who were administered the epidural between L2L3, 14 (47%) reported satisfaction level of "Excellent," 12 (40%) reported "Satisfactory," while 4 reported "Unsatisfactory." Next, from the 217 patients who received the epidural between L3L4, 135 (62%) reported satisfaction as "Excellent," 73 (34%) reported satisfaction as "Satisfactory" and 9 (4%) reported satisfaction as "Unsatisfactory." Of the remaining 39 patients no one reported satisfaction as "Unsatisfactory" and 26 (67%) reported satisfaction levels of "Excellent" while 13 (33%) reported satisfaction as "Unsatisfactory." Through this we can see that patients who were administered the epidural between L4L5 had the highest satisfaction rate, followed by L3L4, and finally L2L3.

Finally, Figures 15 to 19 show patient satisfaction with the epidural experience based on number of previous pregnancies. The data reflected multiple categories such as patients who had their first pregnancy, whether or not there was a miscarriage, and whether or not the fetus was aborted. However, for the sake of the analysis, patients were categorized into

the number of times they had been pregnant before to create 5 categories: 1st pregnancy, 2nd pregnancy, 3rd pregnancy, 4th pregnancy, or if the current pregnancy was their 5th or more.

For the 146 patients who had their 1st pregnancy, 85 (58%) reported satisfaction as "Excellent," 52 (38%) reported it as "Satisfactory" and 9 (6%) reported it as "Unsatisfactory." From the 67 patients who had their 2nd pregnancy, 45 (67%) reported satisfaction as "Excellent," 20 (30%) reported satisfaction levels of "Unsatisfactory" and only 2 (3%) reported a satisfaction of "Unsatisfactory." From the 32 patients belonging to the third pregnancy category, 21 (66%) reported a satisfaction of "Excellent," 10 (31%) reported a satisfaction of "Satisfactory" and only 1 (3%) reported it as "Unsatisfactory." From the patients in the remaining 2 categories none reported satisfaction as "Unsatisfactory." There were a total of 15 patients in the 4th category and 7 (47%) patients reported satisfaction levels of "Excellent" while 8 (53%) reported satisfaction levels of "Satisfactory." From the remaining 8 patients in the 5th category there was an even split of 4 (50%) patients who expressed satisfaction as "Excellent" and "Satisfactory." The results show that satisfaction was highest among the patients in the 2nd category, followed by the 3rd, 1st, and 5th category. Patients who received the epidural during the 4th pregnancy were the least satisfied and the only category where more patients expressed satisfaction as "Satisfactory" relative to "Excellent."

Lastly, Figures 20 to 22 show the satisfaction of patients if they underwent infusions during the epidural process. Of the 190 patients that underwent infusions, 114 (60%) reported satisfaction levels as "Excellent," 67 (35%) reported it as "Satisfactory" and only 9 (5%) reported it as "Unsatisfactory." From the 96 patients that did not undergo infusions, 61 (64%) reported their satisfaction as "Excellent," 31 (34%) reported it as "Satisfactory," while only 4 (4%) reported it as "Unsatisfactory." This highlighted that patients who did not receive infusions had a higher overall satisfaction which could indicate a bias as infusions would generally be continuously administered if the patient was already experiencing higher pain levels during their pregnancy.

Appendix

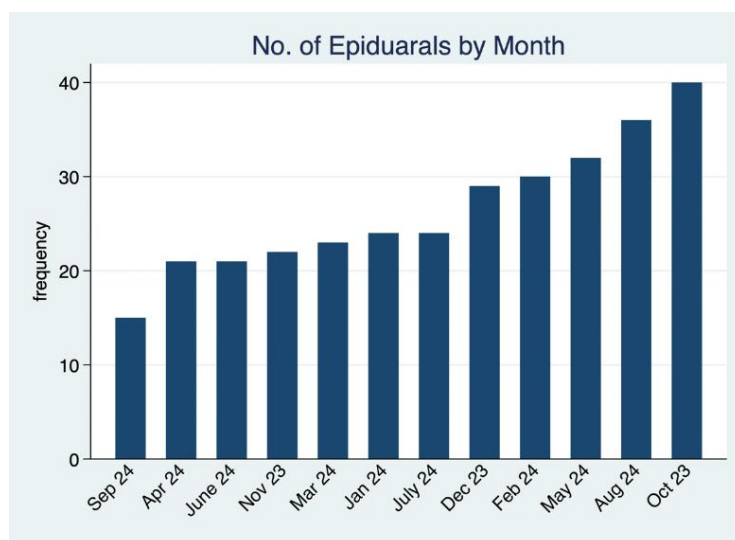


Figure 1: Number of Epidurals Administered Sorted by Month

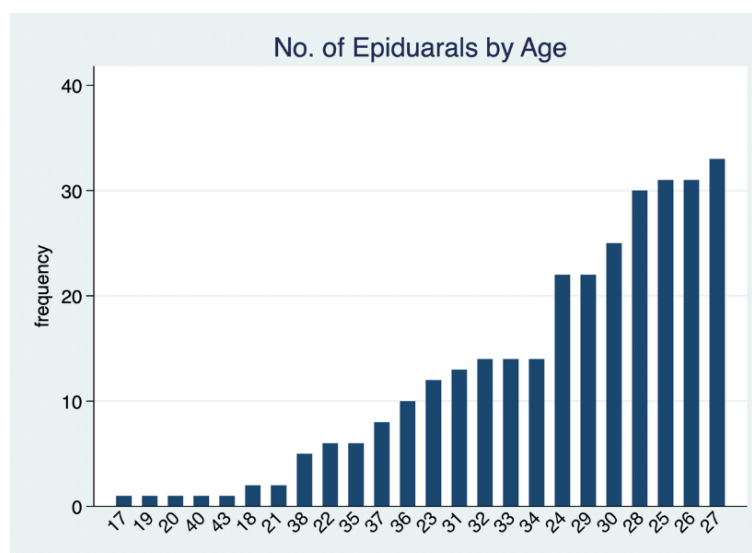


Figure 2: Number of Epidurals Administered Sorted by Age

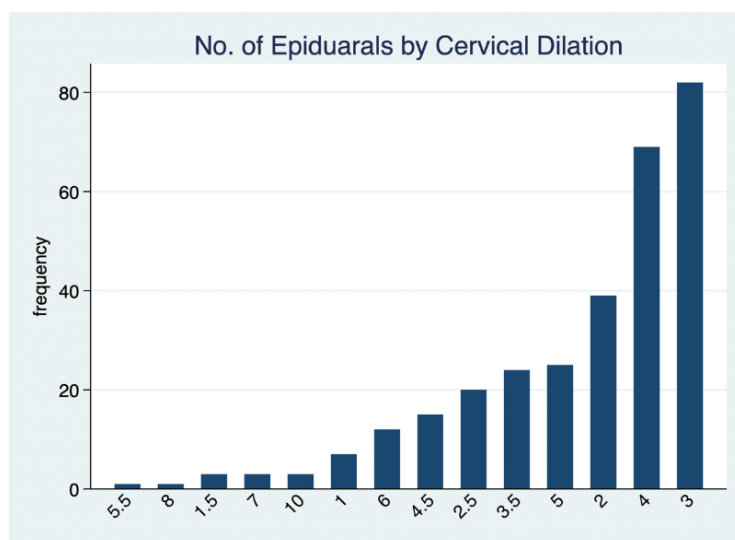


Figure 3: Number of Epidurals Administered Sorted by Cervical Dilation

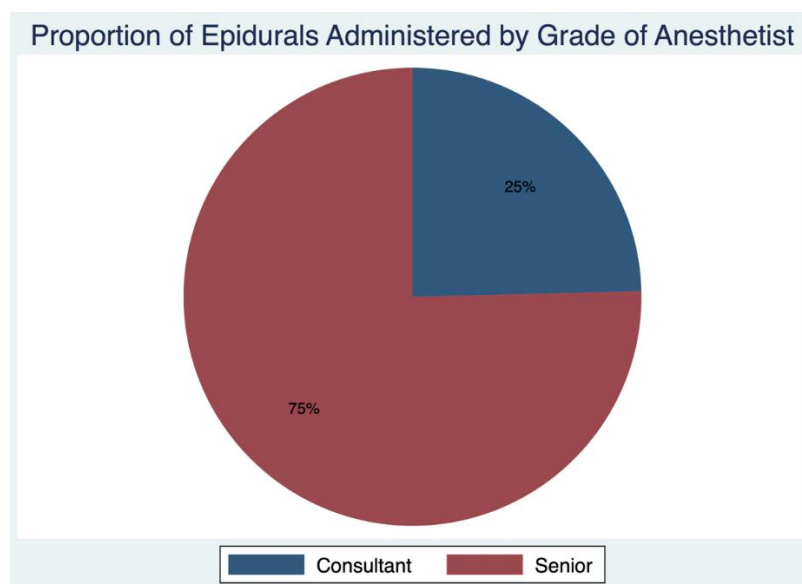


Figure 4: Number of Epidurals Administered by Grade of Doctor



Figure 5: Patient Satisfaction for Epidurals Administered by Consultants

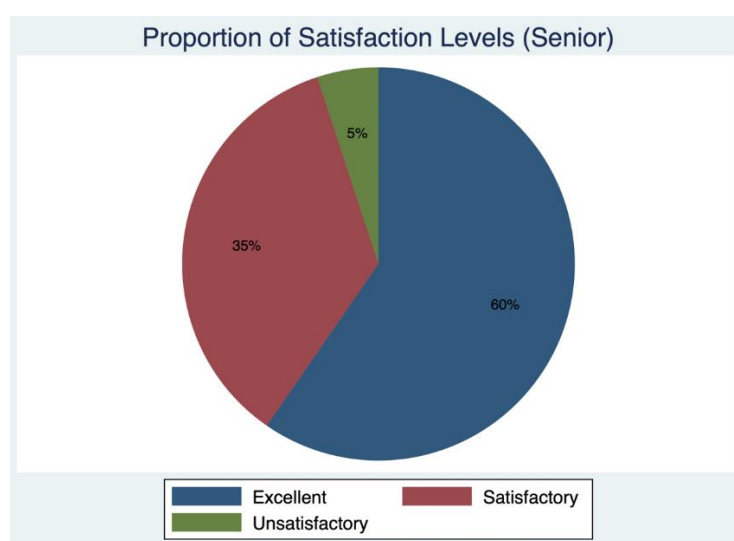


Figure 6: Patient Satisfaction for Epidurals Administered by Senior Doctors

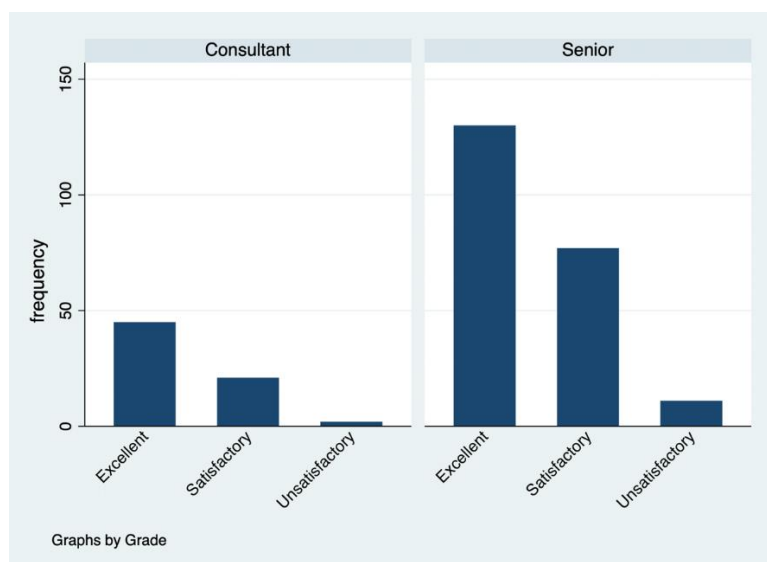


Figure 7: Patient Satisfaction by Grade of Doctors

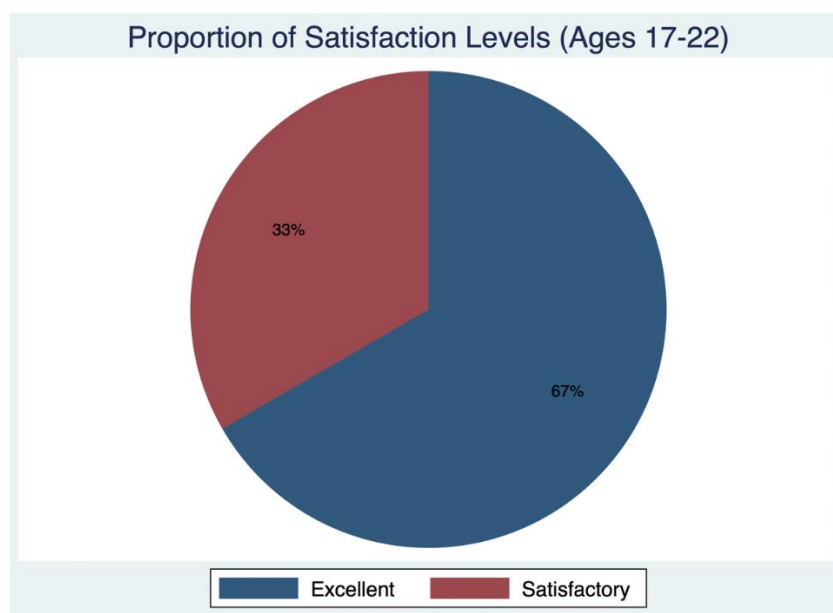


Figure 8: Patient Satisfaction by Age Group (17-22)

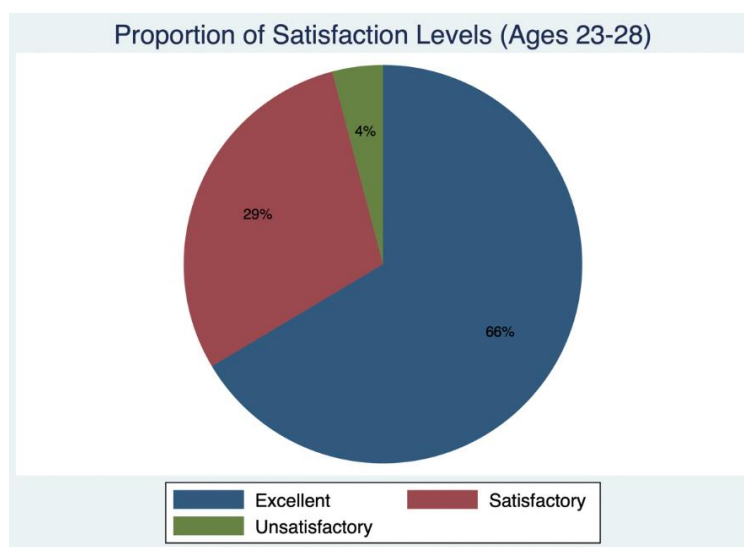


Figure 9: Patient Satisfaction by Age Group (23-28)

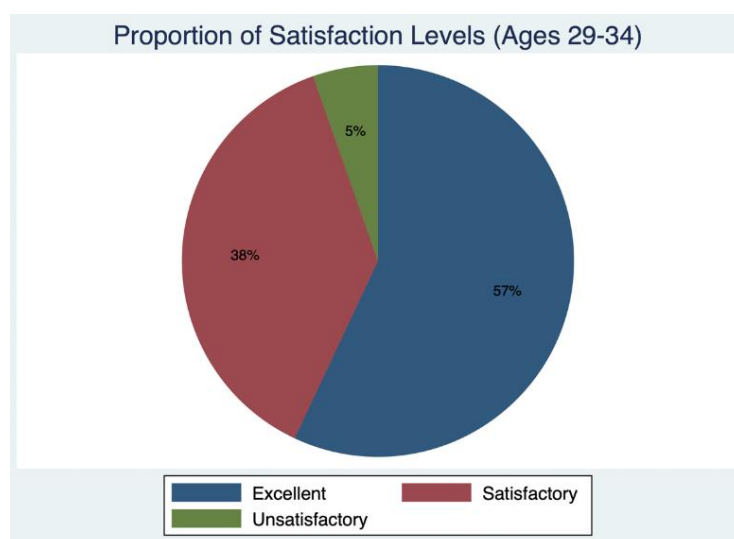


Figure 10: Patient Satisfaction by Age Group (29-34)

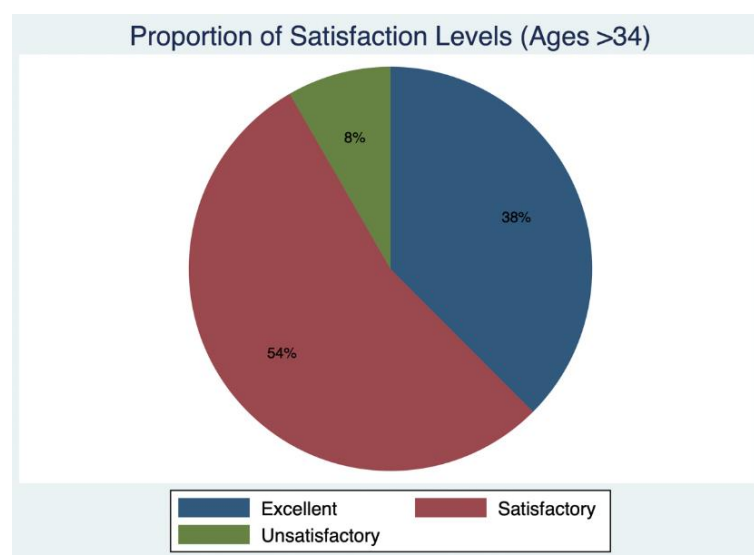


Figure 11: Patient Satisfaction by Age Group (Greater than 34)



Figure 12: Patient Satisfaction by Location of Epidural (L2L3)

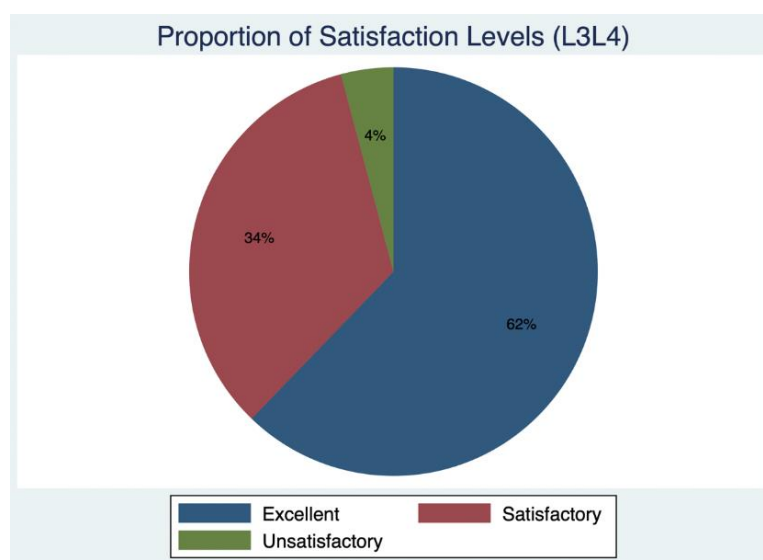


Figure 13: Patient Satisfaction by Location of Epidural (L3L4)

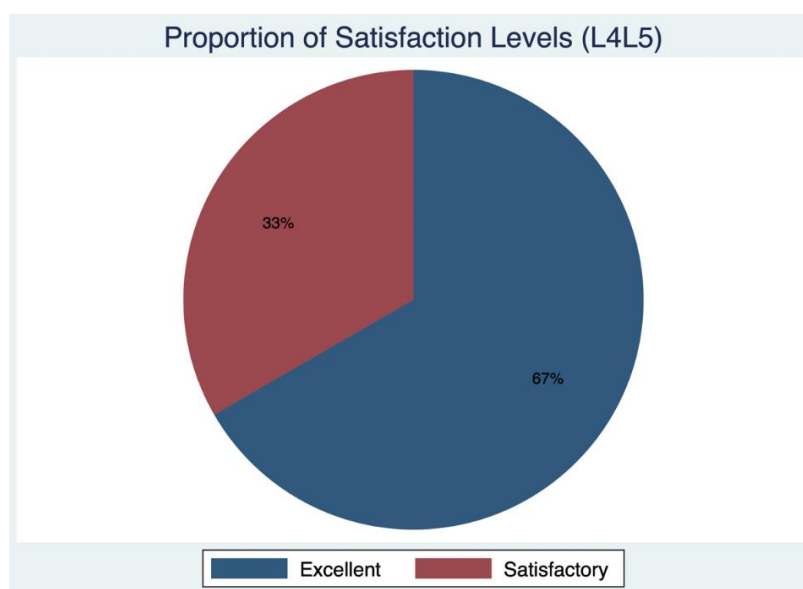


Figure 14: Patient Satisfaction by Location of Epidural (L4L5)

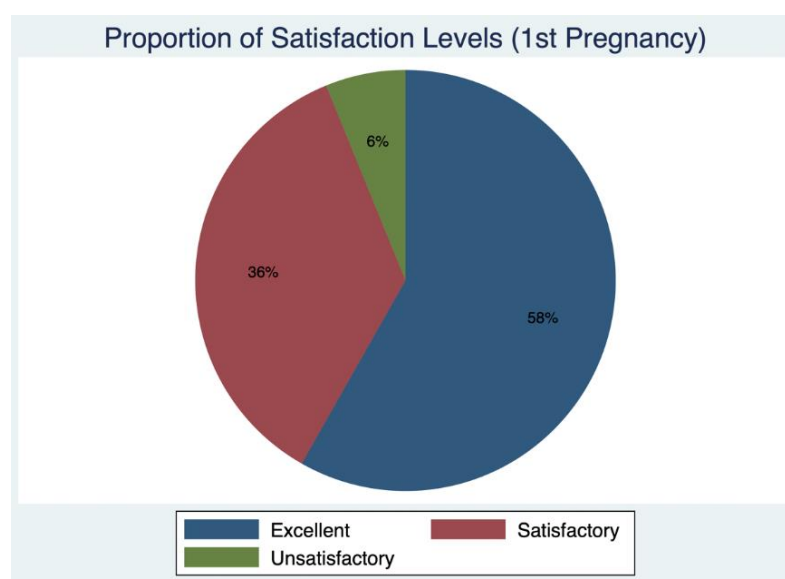


Figure 15: Patient Satisfaction by Number of Pregnancies (1st)

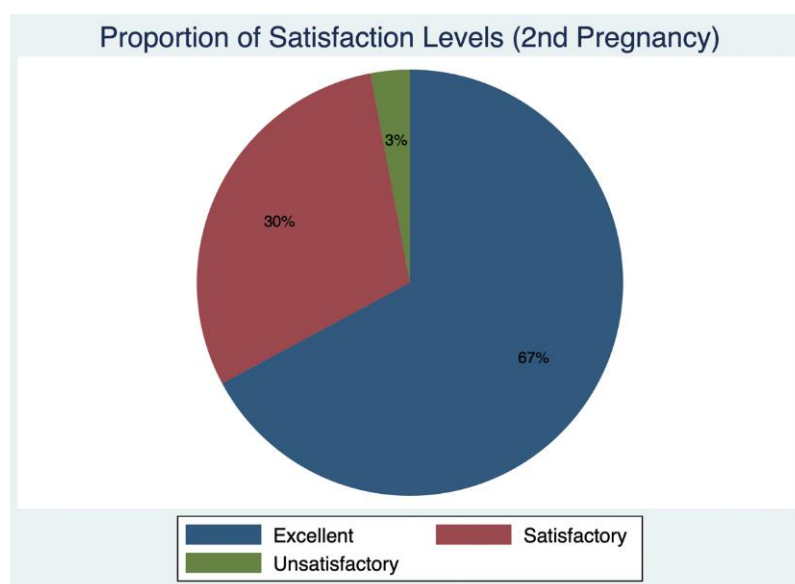


Figure 16: Patient Satisfaction by Number of Pregnancies (2nd)



Figure 17: Patient Satisfaction by Number of Pregnancies (3rd)

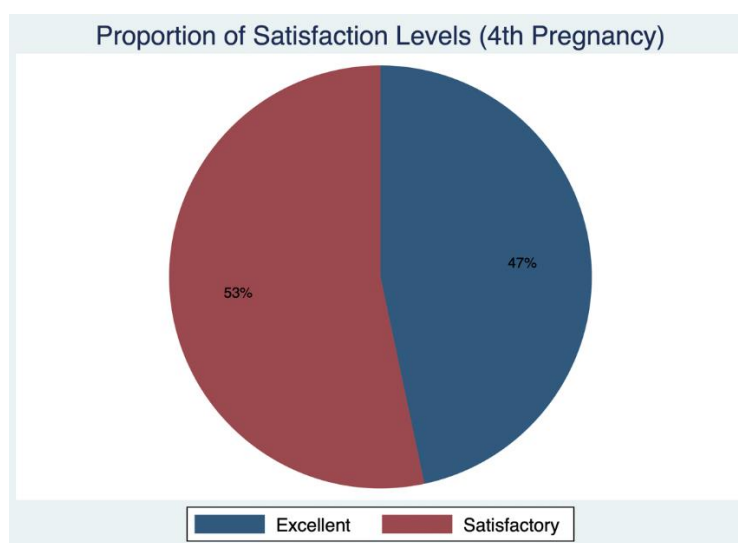


Figure 18: Patient Satisfaction by Number of Pregnancies (4th)



Figure 19: Patient Satisfaction by Number of Pregnancies (5th or More)

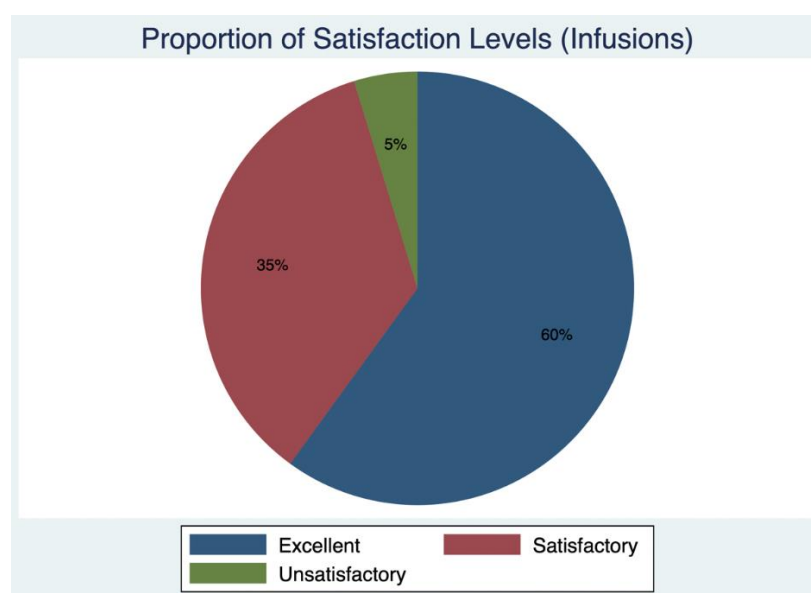


Figure 20: Patient Satisfaction by Infusions During Epidural



Figure 21: Patient Satisfaction by No Infusions During Epidural

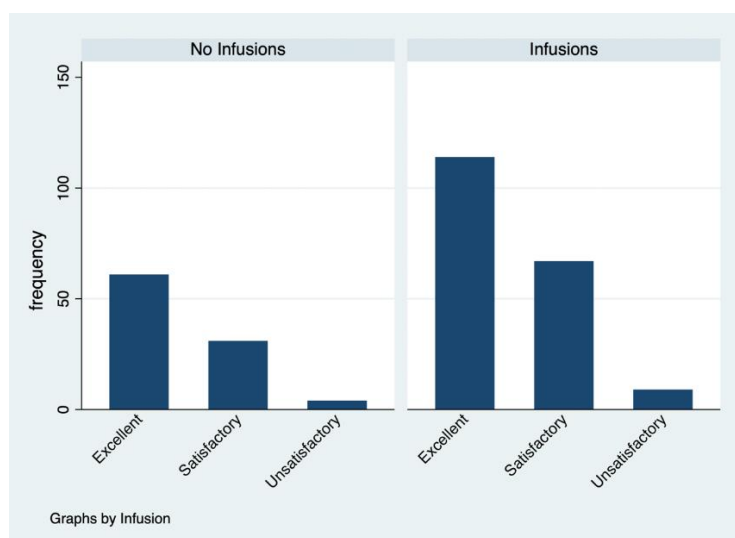


Figure 22: Patient Satisfaction by Infusions

DISCUSSION

Upon thorough examination of the literature, we conclude that a systematic and substantive guideline is required for the administration of challenging labor epidurals. We emphasize the significance of reassessing women at high risk for a challenging epidural procedure. Furthermore, we believe it is imperative to elucidate the challenges faced by the lady and to solicit aid under suitable conditions (1, Plan A to D,). We recommend restricting the number of attempts at each point in the guideline. We endeavored to maintain the guideline's simplicity and clarity, ensuring that when an anesthetist encounters a hard epidural, there exists a clear, sequential protocol to follow.

In this audit, we noted that in 10% of cases, limiting the number of efforts and obtaining an early second opinion correlated with an increased success rate in Plan B. The subsequent elements were taken into account for the formulation of the guidelines: Human factors In anesthesia, human factors contribute to numerous unfavorable outcomes (7,8). Flin and colleagues identified latent threats (e.g., ineffective communication, insufficient training and teamwork, equipment limitations, and inadequate systems and processes) that predispose individuals to a loss of situational awareness and subsequent bad decision-making, serving as precursors to final action errors. Marcus demonstrated that almost 40% of anesthetic mistakes were attributable to human causes (9–11). We focused on the human components that are crucial in the administration of a challenging epidural during the audit. For instance, we noted that efficient communication among the

pregnant woman, the anesthetist, and other clinical personnel before to the surgery facilitated the lady's coping mechanisms and enhanced patient satisfaction (6, 11).

The pre-procedure assessment and communication were essential elements in this audit. Similar to airway evaluation, we have pre-assessed the majority of our patients (96.8%) prior to labor analgesia, either in the anesthetic pre-assessment clinic or in the labor ward, to identify potential complications(9,10). While pre-procedural examination may not consistently suffice to forecast challenges with our EDI, it affords us the opportunity to inform the woman about potential issues and to deliberate alternate strategies. When the difficulty index exceeds 2, we prepare for a challenging insertion, which involves an experienced obstetric anesthetist performing the epidural, utilizing ultrasound, and providing a comprehensive explanation of the associated risks and problems to the patient.

CONCLUSION

Labour epidural placement presents several challenges, including obesity, poor spinal anatomy, patient cooperation, and the impact of uterine contractions, all of which can complicate the procedure. Additionally, human factors such as communication errors, inadequate training, and poor teamwork can further affect success rates. Addressing these challenges requires a multidisciplinary approach, including improved anesthetist training, standardized protocols, and enhanced communication within the obstetric team. Implementing strategies such as ultrasound guidance for difficult epidurals, better patient positioning techniques, and continuous staff

education can improve procedural success and patient satisfaction.

Recommendations

Based on our findings, we recommend several strategies to improve the success and safety of labour epidural placement. Pre-labour anesthetic assessment should be prioritized, as it plays a crucial role in identifying potential challenges early and significantly reduces epidural failure rates. The use of ultrasound guidance is strongly encouraged in cases predicted to be difficult, as it enhances accuracy and improves success rates. Additionally, adopting a structured, stepwise approach to epidural placement can help minimize complications, reduce unnecessary repeated attempts, and improve overall patient satisfaction. Strengthening teamwork, communication, and training among anesthetists and obstetric staff is also essential to enhance procedural efficiency and patient safety.

Limitations

This study has several limitations. First, as a retrospective audit, it is subject to potential biases related to incomplete or inconsistent documentation in medical records. Second, the study was conducted in a single center, which may limit the generalizability of the findings to other institutions with different patient demographics, anesthetic practices, or healthcare resources. Third, patient satisfaction was assessed using a categorical scale, which may not fully capture the nuances of individual experiences with epidural analgesia. Additionally, factors such as interobserver variability in assessing complications and the subjective nature of pain perception could have influenced the results. Lastly, while we attempted to analyze associations between patient characteristics, anesthetist experience, and epidural outcomes, the study design does not allow for establishing causal relationships. Future prospective studies with larger sample sizes and standardized assessment tools are needed to further validate these findings.

Proposed Plan of Action

Based on the findings of the audit and our observations, we propose a structured stepwise approach (Plan A to D) to minimize repeated epidural attempts, optimize patient positioning, and enhance overall safety.

1. Plan A – Initial Assessment, Planning, and Teamwork

- Conduct a thorough pre-labour anesthetic assessment to identify high-risk patients early.
- Limit epidural attempts to a maximum of two intervertebral spaces with no more than four repositions to reduce unnecessary trauma.
- If the epidural placement remains unsuccessful, proceed to Plan B.

2. Plan B – Explanation, Repositioning, and Second Opinion

- Reposition the patient to improve anatomical access and facilitate easier placement.
- Allow only one additional attempt before consulting a senior anesthetist for expert guidance.
- If still unsuccessful, escalate to Plan C for further intervention.

3. Plan C – Consultant Intervention for Further Attempts

- A senior anesthetist or consultant takes over the epidural placement process.
- If the Epidural Difficulty Index (EDI) score is ≥ 3 , ultrasound guidance should be utilized to improve accuracy.
- If the procedure remains unsuccessful despite these measures, proceed to Plan D.

4. Plan D – Alternative Pain Management Strategies

- If an epidural cannot be placed, consider spinal anesthesia for cesarean sections if required.
- Provide non-epidural analgesia options for labour pain management, including:
 - **Entonox (Gas Inhalation)** for immediate pain relief.
 - **Pethidine Injections** as an alternative pharmacological approach.
 - **TENS (Transcutaneous Electrical Nerve Stimulation)** for non-invasive pain management.
 - **Psychological Support and Coaching** to help manage pain perception and enhance the birth experience.

By implementing this structured approach, we aim to improve the overall success of labour epidural placement, reduce unnecessary repeated attempts, and ensure better patient outcomes.

Final Takeaways

This audit highlights the need for a clear and structured guideline to manage difficult labour epidurals effectively. Early risk assessment and

careful planning play a crucial role in reducing epidural failure rates. Ultrasound guidance should be incorporated as a standard tool for high-risk cases to improve accuracy and success rates. Additionally, effective teamwork, clear communication, and patient reassurance are essential factors in optimizing outcomes and ensuring patient satisfaction. By implementing a practical, stepwise approach, this study provides anesthetists with a structured framework to handle challenging epidural placements safely and efficiently, ultimately enhancing patient care and procedural success.

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