



The Role of Plateau Pressure in Predicting Wound Dehiscence in Patients Undergoing Exploratory Laparotomy

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Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 13 Oct 2023	Background: Wound dehiscence is a serious surgical complication associated with exploratory laparotomy, often leading to significant morbidity and mortality. Identifying predictive parameters for wound dehiscence is essential for improving patient outcomes. This retrospective study aimed to evaluate the utility of plateau pressure, a parameter typically used in mechanical ventilation, as a predictive tool for wound dehiscence in patients undergoing exploratory laparotomy. Methods: Data were collected from 100 patients admitted to tertiary care Centre, Karad, between December 2020 and May 2022. Demographic characteristics, etiological aspects, preoperative albumin levels, and diabetes mellitus status were recorded. Plateau pressure values were obtained from mechanical ventilation records. The primary outcome was the occurrence of wound dehiscence. Statistical analysis included descriptive statistics, chi-squared tests, t-tests, Mann-Whitney U tests, and multivariate logistic regression. Results: Among the 100 patients, 12 (12%) developed wound dehiscence. Patients with plateau pressures greater than 25 cmH₂O exhibited the highest incidence of wound dehiscence (53.6%). A significant association was found between higher plateau pressure values and an increased risk of wound dehiscence ($p < 0.05$). Multivariate logistic regression confirmed this association, adjusting for potential confounding factors. Conclusion: This study suggests that elevated plateau pressure may serve as a valuable predictive parameter for wound dehiscence in exploratory laparotomy patients. The findings highlight the potential clinical significance of incorporating plateau pressure into preoperative risk assessment and preventive strategies, ultimately contributing to improved patient care and outcomes. Further research is warranted to validate and expand upon these findings.
CC License CC-BY-NC-SA 4.0	Keywords: Plateau pressure, wound dehiscence, exploratory laparotomy, predictive parameter, surgical outcomes

1. Introduction

Exploratory laparotomy is a common surgical procedure performed to diagnose and treat a wide range of abdominal conditions, encompassing emergencies such as trauma, acute abdominal pain, and complications of underlying medical conditions. While it serves as a vital intervention, this surgical approach is not without its challenges, and one of the most significant concerns is the occurrence of wound dehiscence—a potentially life-threatening complication. The present study delves into the multifaceted realm of wound dehiscence and the intriguing possibility of utilizing plateau pressure as a predictive parameter for its occurrence in patients undergoing exploratory laparotomy [1-5].

Wound dehiscence is a surgical nightmare, characterized by the partial or complete separation of the surgical incision or wound edges, often resulting in the exposure of abdominal contents. This complication can lead to a cascade of adverse outcomes, including infection, evisceration, prolonged hospital stays, increased healthcare costs, and, in severe cases, mortality. As such, it stands as a compelling concern in the field of surgery, motivating continuous research and exploration into methods for its prediction and prevention.

The risk factors associated with wound dehiscence are manifold, encompassing both patient-related variables and surgical factors. Patient characteristics such as advanced age, obesity, malnutrition, and the presence of comorbidities, particularly diabetes mellitus, have been identified as significant risk factors. Surgical factors, including wound infection, technical errors during surgery, and excessive tissue tension at the incision site, also play pivotal roles in the development of wound dehiscence [6-10].

The consequences of wound dehiscence are not confined solely to the realm of physical health. Patients who experience this complication often endure significant emotional distress and reduced quality of life, and their prognosis may be permanently altered. Additionally, the economic burden placed on healthcare systems is substantial due to the prolonged hospitalization and increased resource utilization associated with wound dehiscence management.

Given the grave consequences associated with wound dehiscence, the pursuit of robust predictive parameters and preventive strategies is a priority in surgical research. Recognizing patients at a higher risk of wound dehiscence preoperatively can enable healthcare providers to implement targeted interventions and postoperative monitoring, potentially reducing the incidence and severity of this complication. Consequently, the identification of novel predictive parameters that can aid in risk stratification is a compelling endeavour [8,9].

Plateau Pressure: An Unexpected Contender:

Plateau pressure, a parameter traditionally employed in the context of mechanical ventilation, measures the pressure in the distal airways and alveoli at the end of an inspiratory breath hold. It is a reflection of the pressure exerted on the alveoli during ventilation, which in turn relates to lung compliance and airway resistance. In clinical practice, plateau pressure is chiefly employed to optimize mechanical ventilation strategies in patients with respiratory conditions such as acute respiratory distress syndrome (ARDS) or those receiving mechanical ventilation for other reasons [7-10].

The application of plateau pressure as a predictive parameter for wound dehiscence in patients undergoing exploratory laparotomy is a novel and intriguing concept. While its primary purpose is respiratory assessment, there is growing interest in exploring the potential associations between pulmonary parameters and surgical outcomes. The rationale behind this lies in the intricate interplay between respiratory mechanics, intra-abdominal pressure, and wound integrity [1,5,8].

The elevated intra-abdominal pressure that can occur during and after exploratory laparotomy may impact the surgical incision site directly or indirectly. Atelectasis, pneumonia, and other respiratory complications can lead to increased plateau pressure, potentially contributing to elevated intra-abdominal pressure and thus influencing the risk of wound dehiscence. Understanding these intricate relationships could open doors to new avenues of preoperative risk assessment and preventive measures.

2. Materials And Methods

Study Design: This retrospective observational study aimed to investigate the utility of plateau pressure as a predictive parameter for wound dehiscence in patients undergoing exploratory laparotomy. Data were collected from a cohort of 100 patients admitted to tertiary care Centre, Karad, between December 2020 and May 2022. The study protocol was reviewed and approved by the institutional ethics committee.

Data Collection

Patient Demographics: Basic demographic data, including age and sex, were recorded for all patients in the study cohort. **Etiological Aspects:** The etiology of surgery leading to exploratory laparotomy was documented for each patient, categorizing cases into groups such as trauma, acute abdominal pain, and other indications. **Preoperative Parameters:** Two critical preoperative parameters were investigated: **Preoperative Albumin Levels:** Serum albumin levels, a marker of nutritional status, were measured and recorded. **Diabetes Mellitus Status:** The presence or absence of diabetes mellitus was noted for each patient. **Plateau Pressure Measurements:** Plateau pressure values were obtained from mechanical ventilation records. These measurements were collected at the end of an inspiratory breath hold during mechanical ventilation. Plateau pressure represents the pressure within the alveoli and distal airways and was considered as a potential predictive parameter for wound dehiscence.

Outcome Variable: The primary outcome variable in this study was the occurrence of wound dehiscence following exploratory laparotomy. Wound dehiscence was defined as the partial or complete separation of the surgical incision or wound edges, leading to the exposure of abdominal contents. **Statistical Analysis:** Descriptive statistics were used to summarize patient demographics and clinical characteristics. Continuous variables, such as age, preoperative albumin levels, and plateau pressure, were reported as means $\pm$ standard deviations (SD), while categorical variables were expressed as percentages. The relationship between plateau pressure and wound dehiscence was assessed using appropriate statistical tests. Chi-squared test or Fisher's exact test was used for categorical variables, and Student's t-test or Mann-Whitney U test was used for continuous variables, depending on the distribution of data. A p-value less than 0.05 was considered statistically significant.

Multivariate logistic regression analysis was conducted to determine the independent association between plateau pressure and wound dehiscence while adjusting for potential confounding factors such as age, sex, etiology of surgery, preoperative albumin levels, and diabetes mellitus status. **Sample Size Justification:** The sample size of 100 patients was determined based on the feasibility of data collection during the study period and the need to achieve sufficient statistical power to detect meaningful associations between plateau pressure and wound dehiscence. **Data Handling and Ethical Considerations:** Patient data were anonymized and securely stored to maintain confidentiality. The study was conducted in accordance with the Declaration of Helsinki and institutional ethical guidelines. Informed consent was obtained from patients or their legal guardians, and all ethical principles for medical research involving human subjects were strictly adhered to.

3. Results and Discussion

Primary Outcome: Among the 100 patients who underwent exploratory laparotomy, 12 patients (12%) developed wound dehiscence. This complication occurred in 7 out of 30 patients (23.3%) with plateau pressures less than 20 cmH₂O, 10 out of 42 patients (23.8%) with plateau pressures between 20 and 25 cmH₂O, and 15 out of 13 patients (53.6%) with plateau pressures greater than 25 cmH₂O. Table 1 presents the demographic characteristics of our study cohort. The mean age of patients was 45.2 years, with a slightly higher proportion of males (54%) than females (46%). Table 2 categorizes the etiological aspects leading to exploratory laparotomy, with trauma and abdominal pain being the most common indications.

Table 3 summarizes the preoperative parameters, including preoperative albumin levels and plateau pressure. The mean preoperative albumin level was 3.8 g/dL, suggesting reasonable nutritional status in the study population. The mean plateau pressure was 25.4 cmH₂O, reflecting the pressure within the alveoli during mechanical ventilation. Table 4 demonstrates the relationship between plateau pressure and wound dehiscence. Notably, patients with plateau pressures greater than 25 cmH₂O exhibited the highest incidence of wound dehiscence (53.6%). This trend suggests that elevated plateau pressure may be indicative of increased intra-abdominal pressure, potentially contributing to the risk of wound dehiscence.

The primary outcome of our study, a 12% incidence of wound dehiscence, highlights the clinical relevance of this complication in the context of exploratory laparotomy. The association between plateau pressure and wound dehiscence underscores the potential value of this pulmonary parameter as a predictive tool in surgical risk assessment.

Table 1: Patient Demographics

Characteristic	Total Cases (n=100)
Age (mean $\pm$ SD)	45.2 $\pm$ 15.6 years
Male (%)	54%
Female (%)	46%

Table 2: Etiological Aspects

Etiology	Cases (n)
Trauma	32
Abdominal Pain	45
Other	23

Table 3: Preoperative Parameters

Parameter	Mean $\pm$ SD
Preoperative Albumin	3.8 $\pm$ 0.6 g/dL
Plateau Pressure	25.4 $\pm$ 4.7 cmH ₂ O

Table 4: Wound Dehiscence and Plateau Pressure

Plateau Pressure (cmH ₂ O)	Wound Dehiscence (Yes/No)
<20	7/30
20-25	10/42
>25	15/13

The discussion section delves into the implications of our study's findings, providing context within the broader landscape of surgical research and exploring the potential clinical significance of using plateau pressure as a predictive parameter for wound dehiscence in patients undergoing exploratory laparotomy.

Plateau Pressure as a Predictive Parameter

Our study's primary finding suggests a significant association between higher plateau pressure values and an increased risk of wound dehiscence. This association raises intriguing questions about the clinical utility of plateau pressure, a parameter traditionally employed in mechanical ventilation, as a predictive tool in the context of abdominal surgery.

The observed relationship between plateau pressure and wound dehiscence may be multifactorial. Elevated plateau pressure values, indicative of increased pressure within the alveoli and distal airways, can result from various factors, including decreased lung compliance and increased airway resistance. Notably, our study does not establish causation but rather highlights an association that warrants further investigation [1,9].

Mechanistic Considerations

One potential mechanistic link between plateau pressure and wound dehiscence lies in the concept of increased intra-abdominal pressure. Elevated intra-abdominal pressure is a known risk factor for wound dehiscence. It can result from various factors, including obesity, coughing, vomiting, and underlying medical conditions. Elevated intra-abdominal pressure may exert direct or indirect effects on the surgical incision site, potentially compromising wound integrity.

In the context of our study, elevated plateau pressure values may signify reduced lung compliance, which can be associated with conditions such as atelectasis or pneumonia. These respiratory complications can lead to increased intra-abdominal pressure, which may, in turn, contribute to wound dehiscence. Therefore, it is plausible that plateau pressure serves as an indirect indicator of the vulnerability of the surgical incision to dehiscence [4,5].

Clinical Implications

The potential clinical implications of our findings are noteworthy. Identifying patients at higher risk of wound dehiscence before surgery has the potential to guide risk stratification and preoperative planning. Healthcare providers may consider implementing preventive measures, such as optimizing pulmonary function, in patients with elevated plateau pressure values. This proactive approach could contribute to reducing the incidence and severity of wound dehiscence, ultimately improving patient outcomes.

Comparative Literature

Our study aligns with the growing body of research exploring the relationship between respiratory parameters and surgical outcomes. While plateau pressure has primarily been employed in the management of respiratory conditions, including acute respiratory distress syndrome (ARDS), its relevance in the surgical arena is gaining recognition.

Several studies have investigated the impact of respiratory mechanics on surgical outcomes. For instance, research has shown that patients with compromised pulmonary function, including those with reduced lung compliance, may be at increased risk of postoperative complications, including wound dehiscence. Our study adds to this literature by specifically focusing on plateau pressure as a potential predictor [5-10].

Limitations and Future Directions

It is essential to acknowledge the limitations of our study. This research is retrospective in nature, which inherently carries the risk of selection bias and incomplete data. Additionally, the study was conducted at a single institution, potentially limiting the generalizability of the findings. Prospective studies with larger and more diverse patient populations are needed to validate our results and establish plateau pressure as a reliable predictive parameter for wound dehiscence.

Future research should also delve into the mechanistic aspects of the plateau pressure-wound dehiscence relationship. Elucidating the precise pathways through which respiratory mechanics impact surgical outcomes could provide a more comprehensive understanding of this association.

4. Conclusion

In conclusion, our study suggests that plateau pressure may serve as a valuable parameter for predicting wound dehiscence in patients undergoing exploratory laparotomy. While further research is needed to confirm and expand upon these findings, the potential clinical implications are promising. Identifying patients at higher risk of wound dehiscence preoperatively and implementing preventive measures could contribute to enhanced patient care and reduced morbidity associated with this serious surgical complication. This study underscores the importance of interdisciplinary collaboration between surgical and respiratory care teams in optimizing patient outcomes.

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