JURNAL LOCUS: Penelitian & Pengabdian
Volume 4 No. 9 September 2025
E-ISSN 2829-7334| P-ISSN 2829-5439
Hompage: https://locus.rivierapublishing.id/index.php/jl

Initial Management Strategy for Pneumothorax and Hemothorax in the Emergency Department

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Abstract:
Pneumothorax and hemothorax are emergency conditions that require rapid and appropriate intervention to prevent life-threatening complications. The emergency department (ED) plays a crucial role in providing initial management through early identification, patient stabilization, and determination of appropriate interventions. The purpose of this research is to comprehensively explain the initial management strategy for pneumothorax and hemothorax in the Emergency Department, from early detection and triage flow to appropriate medical intervention in accordance with emergency management standards. This study used the Systematic Literature Review (SLR) method to identify, analyze, and synthesize literature related to initial management strategies for pneumothorax and hemothorax in the emergency department. The review results show that the dominant themes in the literature are chest trauma patient management, emergency department intervention strategies, and clinical outcomes. Network visualization shows key words such as patient, trauma, pneumothorax, hemothorax, and emergency department. The overlay map indicates a shift in trends from a focus on basic trauma to the evaluation of complications and the latest management strategies, especially in the period 2021–2025. The density map confirms the high level of research attention on patient conditions and trauma, while the development of initial management strategies still needs to be explored further. The initial management strategy for pneumothorax and hemothorax in the emergency department is greatly influenced by a combination of clinical and non-clinical factors. A comparison with international guidelines such as ATLS shows gaps in implementation, particularly in terms of technology availability and protocol consistency.

Keywords*:* Pneumothorax, Hemothorax, Initial Management, Emergency Department, Systematic Literature Review, Chest Trauma

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INTRODUCTION

Prompt and appropriate treatment in the emergency department is a key determinant of prognosis for patients with chest injuries. In emergency situations, delays in identification and initial intervention are directly associated with increased morbidity and mortality. Studies in Indonesian referral hospitals show that the length of time patients spend in the emergency department is associated with an increased risk of in-hospital mortality, making an efficient initial response crucial to saving lives (Habib & Sudaryo, 2023).

Globally, thoracic trauma accounts for a large proportion of trauma-related deaths and requires standardized triage and management protocols from the moment the patient arrives at the ED. The epidemiological picture in Indonesia shows a pattern similar to other countries, where traffic accidents, falls, and penetrating injuries are the main contributors to chest trauma. Several retrospective studies from Indonesian referral hospitals show a high frequency of chest trauma in the productive age group, resulting in a significant clinical and socioeconomic burden (Pitojo et al., 2016).

In the national context, chest trauma is classified into blunt trauma and penetrating trauma, both of which have the potential to cause life-threatening intrathoracic complications, including pneumothorax and hemothorax. Reports and reviews from Indonesian health education institutions confirm that chest trauma remains the leading cause of emergency hospitalizations and poses a challenge to the emergency system, both in terms of early detection and the provision of definitive interventions (Nasti et al., 2023; Novitasari et al., 2023).

Pneumothorax is defined as the presence of air in the pleural cavity, causing partial or total lung collapse and ventilation impairment. The latest Indonesian medical literature emphasizes the basic principles of pneumothorax diagnosis through *anamnesis*, careful physical examination, and imaging confirmation such as chest X-ray or ultrasound/CT if available, because initial management decisions depend on the assessment of the degree of lung collapse and the presence of hemodynamically threatening signs (Adhadi, 2025; Paramartha & Kesuma, 2025).

Hemothorax is the accumulation of blood in the pleural cavity that can result from rupture of intrathoracic vasculature, lung injury, or mediastinal lesions. In large hemothorax, intravascular volume loss and lung compression can occur rapidly, so initial interventions such as chest drainage and fluid management are often necessary. Clinical studies in Indonesian referral facilities describe varying patterns of presentation but always require immediate action to prevent hypovolemic shock and long-term complications (Gomez & Tran, 2025).

The pathological differences between pneumothorax and hemothorax are important to understand in the context of initial management because the mechanisms of injury and intervention priorities differ. Pneumothorax requires air evacuation and prevention of intrapleural pressure development, as in tension pneumothorax, while hemothorax requires bleeding control, blood drainage, and assessment of transfusion needs. Indonesian educational references and clinical articles emphasize triage algorithms that differentiate between the two conditions from the initial assessment in the emergency department.

Clinically, patients with pneumothorax typically present with sudden shortness of breath, unilateral chest pain, or hemodynamic signs if the condition worsens, while patients with hemothorax may show signs of shock, decreased breath sounds, and mediastinal shift if bleeding is severe. A prospective cohort study in Indonesian emergency departments highlights the importance of rapid yet systematic basic examinations, as clinical factors upon initial arrival at the ED predict deterioration and the need for surgical intervention.

The availability and utilization of diagnostic tools in the emergency department determine the accuracy of initial management. Standard chest X-rays remain the primary modality in many facilities, while point-of-care ultrasound and CT scans provide additional diagnostic value, especially in cases of overlapping injuries. Several Indonesian publications from 2021–2025 discuss the integration of chest ultrasound and rapid imaging protocols in the ED as a way to speed up diagnosis and therapeutic decision-making.

The principles of initial management prioritized in the ED include stabilization of the airway and circulation, immediate decompression in tension pneumothorax, and thoracic drainage in significant hemothorax or large pneumothorax. Indonesian clinical practice guidelines and academic papers emphasize the need for standardized algorithms that can be

applied by emergency teams to minimize practice variation and accelerate life-saving interventions.

However, the implementation of these strategies is often constrained by resource factors, variations in human resource capacity, and patient load in the ED. A study of risk factors for worsening outcomes in patients with blunt chest trauma at referral hospitals in Indonesia showed a correlation between facility limitations, delayed diagnosis, and unfavorable clinical outcomes, making it urgent to emphasize training for ED teams and initial management protocols.

Pneumothorax and hemothorax are two critical conditions in the thoracic cavity that require rapid detection and intervention because both can dramatically impair respiratory and circulatory function. When air or blood accumulates in the pleural space, intrathoracic pressure can increase, causing lung collapse and, in severe cases such as tension pneumothorax or massive hemothorax, triggering life-threatening hemodynamic disturbances. This statement is supported by studies and clinical practice reviews that confirm the relationship between the degree of pleural accumulation and the risk of respiratory failure and shock (Setyowati et al., 2024).

Delays in initial management are directly associated with increased morbidity and mortality. Patients who receive definitive treatment later show a risk of complications such as respiratory insufficiency, secondary infection, delayed hemothorax, and organ failure requiring further measures such as thoracotomy. Observational data from Indonesian emergency departments also show that ARDS and clinical deterioration that are not treated immediately are strongly associated with poorer outcomes in chest trauma. These findings confirm that time is a critical factor in determining patient prognosis (Sukarna et al., 2023).

In the Emergency Department, quick and appropriate initial steps can make the difference between recovery with definitive treatment and a disease course that leads to disability or death. The ED serves as a location for triage, stabilization, and determination of initial treatment plans. These tasks involve identifying danger signs, ABC resuscitation, and emergency decisions such as chest tube insertion or decompression. Clinical literacy and clear work protocols in the ED minimize practice variation and accelerate life-saving decisions (Haryanto & Pratiwi, 2023).

However, the challenge in many health facilities in Indonesia is the uneven availability of resources and personnel capabilities in the ED. Limitations in rapid diagnostic tools, such as access to radiography or point-of-care ultrasound, as well as variations in staff clinical experience, can lead to delays in diagnosis or intervention. Therefore, strengthening ED capacity is not only a matter of equipment but also of strengthening clinical competence, workflows, and routine simulation training so that the response to pneumothorax and hemothorax becomes more consistent (Marlika, 2025).

The fatal consequences of delayed treatment often arise in specific forms of thoracic trauma, such as massive hemothorax causing obstructive shock. Case reports and series from teaching hospitals in Indonesia emphasize the role of emergency pleural drainage to prevent further hemodynamic collapse (Lainy et al., 2024). These cases show that simple, standardized early interventions such as chest tube placement can reduce the need for more invasive definitive measures if performed promptly (Laksono et al., 2021).

Good initial management begins with effective triage. The availability of a triage scheme sensitive to signs of thoracic distress, standardized physical examination, and the use of FAST thorax or rapid chest X-ray guides initial clinical decisions. Implementing this triage flow reduces decision time for life-saving interventions and helps prioritize resources in the often-busy emergency department (Ramli, 2024). Evidence from local clinical practice demonstrates that clear triage protocols correlate with reduced time to intervention and improved outcomes (Purba et al., 2025).

In addition to clinical aspects, documentation and inter-team communication are important parts of the initial management strategy. Clear records of presentation time, triage findings, response to resuscitation, and initial interventions ensure continuity of care when patients are transferred to a care bed or operating room. Communication errors and poor documentation have been linked to delays in follow-up and suboptimal decisions, so strengthening communication SOPs in the ED should be part of patient safety strategies.

Management strategies also need to incorporate an adaptive approach to the local context. Hospitals with limited resources may need to optimize the use of non-invasive tools and realistic evidence-based decision algorithms, while referral centers can emphasize definitive thoracic surgery capabilities. This layered approach allows each facility to provide the most effective immediate interventions according to their capacity while maintaining rapid referral pathways when necessary. Several local studies emphasize the need to adapt protocols so they can be implemented consistently across different levels of care (Takwa, 2025).

Continuing education and interdisciplinary training in the emergency department have been shown to speed up decision-making and improve technical skills such as chest tube insertion and early mechanical ventilation (Sari, 2025). Simulation of thoracic trauma scenarios, case audits, and structured feedback can bridge the gap between theory and practice. Experience in several hospitals indicates that structured training programs reduce critical response times and improve clinical outcomes (Wibowo et al., 2024).

The urgency of developing a formal strategy for initial management arises from cumulative evidence that a combination of rapid detection, appropriate technical interventions, efficient triage flow, and effective communication can significantly reduce complications and mortality rates in cases of pneumothorax and hemothorax (Billa & Subandi, 2025). Such strategies must be incorporated into operational local guidelines, supplemented with performance indicators for periodic evaluation, and supported by hospital management to ensure sustainable implementation. Without a structured framework, efforts to improve services tend to be partial and unstable (Irfani & Arif, 2022).

While previous research has addressed various aspects of pneumothorax and hemothorax management, significant gaps remain in the comprehensive analysis of integrated management strategies. Studies by Adhadi (2025), Billa & Subandi (2025), Lainy et al. (2024), and Laksono et al. (2021) have contributed valuable insights into diagnostic approaches, case-specific management, and procedural techniques, yet they predominantly focus on isolated aspects or utilize limited methodologies without considering broader system-level factors. This leaves a critical research gap in understanding how clinical and non-clinical elements interact within resource-constrained settings like Indonesian emergency departments, where holistic management strategies are essential but underexplored.

The novelty of this research addresses these limitations through a comprehensive bibliometric analysis using VOSviewer to map emerging trends and knowledge clusters in emergency management literature. By integrating both clinical and non-clinical factors affecting management success, the study provides a holistic understanding of care challenges while specifically contextualizing findings within the Indonesian healthcare environment. Furthermore, the systematic synthesis of evidence from 2021-2025 captures the most recent innovations and developments, offering culturally appropriate and resource-sensitive strategies that bridge international best practices with local implementation realities.

Based on the above description, the purpose of this paper is to comprehensively explain the initial management strategy for pneumothorax and hemothorax in the Emergency Department, from early detection and triage flow to appropriate medical intervention in accordance with emergency management standards. In addition, this paper also aims to identify various factors that influence the success of early management, both from clinical aspects, human resources, facility availability, and coordination systems in the ED. With a deeper understanding of these strategies and supporting factors, it is hoped that the quality of service can be improved, the treatment process can be accelerated, and ultimately the complication and mortality rates in patients with pneumothorax and hemothorax can be reduced.

RESEARCH METHODS

This study used the Systematic Literature Review (SLR) method with the main objective of identifying, analyzing, and synthesizing research findings related to initial management strategies for pneumothorax and hemothorax in the Emergency Department. SLR was chosen because this approach allows researchers to collect evidence in a structured and comprehensive manner from various scientific sources, thereby obtaining a comprehensive picture of clinical practices and initial management strategies for thoracic emergencies.

The data search process was conducted through various international and national electronic databases, namely PubMed, ScienceDirect, Google Scholar, Directory of Open Access Journals (DOAJ), and Garuda (*Garba Rujukan Digital Indonesia*). These databases were selected based on the availability of extensive medical literature, access to recent publications, and relevance to the research theme. Additionally, the search was expanded to university repositories in Indonesia to ensure coverage of local research that might not be indexed in international databases.

The literature selected in this study was defined by specific inclusion criteria. Articles had to be published between 2015 and 2025 to ensure relevance to the latest developments in the field of emergency medicine. Articles in both Indonesian and English were included to broaden the scope of sources. The main focus was on studies that directly discussed the initial management of pneumothorax and hemothorax in the emergency department, whether observational, experimental, case reports, case series, or relevant literature reviews.

Exclusion criteria were also applied to filter out inappropriate literature. Articles that only discussed non-emergency cases were excluded because they were not relevant to the research objectives. Articles with limited access that were not available in full text were also excluded due to insufficient data for evaluation. Similarly, publications such as opinions, editorials, or

comments without empirical data were not included because they did not meet the scientific standards required in SLR.

The literature search strategy was conducted using a combination of relevant keywords in both Indonesian and English. The keywords used included "pneumothorax," "hemothorax," "initial management," "emergency department," "emergency management," and "emergency unit." To improve search accuracy, these keywords were combined using Boolean operators such as AND and OR. For example, the search was performed using the formula ("pneumothorax" OR "hemothorax") AND ("emergency department" OR "emergency unit") AND ("initial management" OR "emergency management").

Literature selection was carried out through several systematic stages. The first stage was the initial identification of articles through databases according to the keywords used. The next stage was screening the titles and abstracts to assess their suitability with the inclusion and exclusion criteria. Articles that passed this screening were then analyzed further by reading the full text to ensure the relevance of the content to the research topic. The final stage was to determine which articles were eligible for further analysis. The entire selection process was documented using a PRISMA diagram to ensure transparency and replicability.

After the selection process was complete, the next stage was data extraction. This process was carried out by recording important information from each selected article. The data extracted included the author's identity, year of publication, research location, research design used, sample size, initial management strategies reported, and clinical outcomes found.

This data extraction was carried out systematically to facilitate the synthesis process at the analysis stage. With consistent data collection from each article, it was hoped that comparisons between studies could be made to produce a clearer picture of the initial management practices for pneumothorax and hemothorax in the emergency department. In addition, this data also served as a basis for identifying differences in approach, similarities in findings, and factors that influenced the success of treatment.

RESULT AND DISCUSSION

The results of the analysis using VOSviewer through network visualization show a fairly broad distribution of keywords related to initial management strategies for pneumothorax and hemothorax in the Emergency Department. The network map shows that a number of keywords are strongly connected, forming main nodes that are the focus of research discussion. This shows that the focus of the literature is not only on the disease itself, but also on the clinical context, management strategies, and patient outcomes.

The keywords that occupy a central position in the network are patient, injury, trauma, pneumothorax, hemothorax, and emergency department. These keywords have larger node sizes and denser connections than other keywords, indicating the dominance of these themes in the research. The central position of patient and injury confirms that related studies are more focused on the condition of patients and the injuries they suffer, while pneumothorax and hemothorax are the main topics discussed as part of chest trauma in the emergency department.

The network also shows the formation of several clusters representing research orientations. The first cluster appears to focus on patients, outcomes, complications, and mortality, reflecting a focus on the clinical outcomes of early management. The second cluster

emphasizes chest trauma with keywords such as chest trauma, blunt chest trauma, and rib fracture, which shows the relationship between the mechanism of injury and the risk of pneumothorax and hemothorax. Another cluster focuses on medical strategies and interventions in the emergency department with keywords such as strategy, emergency medicine, and intervention.

The relationship between clusters shows the integration of various aspects of research. Management strategies in the ED cannot be separated from the patient's trauma condition, as each intervention is aimed at reducing complications and improving outcomes. The strong interconnection between the emergency department and the patient confirms the role of the ED as the main entry point that determines the success of initial management of chest trauma cases. The sooner the diagnosis and intervention are made, the greater the possibility of reducing complications and mortality.

The significance of these findings is important for clinical practice, as the network formed shows that research does not only stop at describing clinical conditions, but also links management strategies to patient outcomes. In other words, the right strategy in the emergency department has been proven to be a key factor in determining outcomes, and this is consistent with the literature that emphasizes the importance of early intervention in cases of pneumothorax and hemothorax.

Overall, the visualization of the network underscores that the focus of the research is more centered on patients, injuries, and trauma, with pneumothorax and hemothorax as an integral part of chest trauma studies in the ED. The emphasis on clinical outcomes, complications, and management strategies confirms that the current direction of research aims to find the most effective strategies for improving patient safety. These findings.

The results of the overlay map analysis show that research on initial management strategies for pneumothorax and hemothorax in the Emergency Department has shifted in focus over time. The blue to dark green colors represent keywords that appeared earlier, such as pneumothorax, hemothorax, chest trauma, and emergency medicine. This shows that the initial focus of the literature was still very much centered on the main clinical conditions, trauma mechanisms, and general emergency management. These keywords became an important foundation in building initial studies that defined clinical problems and challenges in the emergency room.

Over time, keywords in a lighter shade of green emerged, such as trauma, complication, outcome, and intervention. This shift indicates that research no longer stops at identifying clinical problems but begins to emphasize intervention strategies and evaluation of patient outcomes. This trend reflects greater attention to the effectiveness of management strategies and their impact on patient safety and prognosis in the emergency department.

From 2021 to 2025, keywords in yellow, such as development, rib fracture, and respiratory failure, have emerged. These keywords indicate the latest research directions oriented towards developing new strategies, gaining a deeper understanding of specific complications, and emphasizing broader outcome evaluation. The emergence of rib fracture and respiratory failure shows that researchers' attention has shifted to advanced complications that often arise in patients with chest trauma, which, if not treated early on, can increase mortality rates.

The keyword "development" in the overlay map indicates that current research tends to focus on innovation in management strategies. This may include the development of more adaptive clinical guidelines, the application of faster diagnostic technologies, or even collaborative models for decision-making in the emergency department. This research direction shows that both global and national literature is beginning to highlight the need to update initial management protocols based on the latest data and clinical practice experience.

This temporal trend change is important because it illustrates that research on pneumothorax and hemothorax is evolving from a classic focus on initial diagnosis to a more comprehensive strategy for preventing complications. With the increasing frequency of themes such as complications, outcomes, and mortality in the overlay map, it is clear that the initial management strategy in the emergency department is not only about immediate life-saving measures, but also about how these measures can reduce the incidence of complications and improve the long-term prognosis of patients.

Overall, the findings of the overlay map can be used as a basis for improving initial management strategies in the ED. By understanding that the current research focus is more on developing new strategies, evaluating complications, and managing risk, medical practitioners in the ED can update their approach. Implementing evidence-based strategies from current research trends can help improve the quality of emergency care, accelerate interventions, and ultimately increase patient safety rates for cases of pneumothorax and hemothorax.

The results of the density map analysis show areas with very high research intensity marked in bright yellow, especially for the keywords patient, injury, and trauma. These three keywords are the focus of attention in the literature related to initial management strategies for pneumothorax and hemothorax in the Emergency Department. This dominance indicates that research focus has been concentrated on key clinical aspects directly related to patient conditions and traumatic events that are the main triggers of serious complications in the emergency room.

High density is also seen for the keywords "hemothorax," "pneumothorax," and "emergency department." This indicates that although the main focus is on patients and trauma, the literature also pays attention to the two main clinical conditions that are the core of the research and the location of clinical practice that determines the effectiveness of interventions. Thus, research related to pneumothorax and hemothorax in the context of the ED is seen as an integral part of improving the overall emergency health care system.

In addition, there is moderate density for the keywords emergency medicine, chest trauma, and research. The green color surrounding these keywords indicates a significant contribution from research, although not as significant as core keywords such as patient and trauma. This signals that the fields of emergency medicine and scientific research on chest trauma are still developing, but their intensity has not yet reached the same level of dominance as the main focus of research.

Several other keywords such as "outcome," "complication," and "mortality" appear with moderate to low intensity. This position indicates that although the evaluation of treatment outcomes and complication prevention has become a concern, it is not yet as prominent as the aspects of diagnosis and initial clinical conditions. These findings illustrate that research is more directed at direct patient care, while long-term evaluation still requires greater attention.

On the outer edge of the density map, keywords such as development, rib fracture, and respiratory failure are visible, with low intensity and marked in bluish green. This position indicates that these themes are only beginning to be explored in the current literature and still have considerable room for development. Thus, future research has the potential to expand the direction of study to specific complications, treatment innovations, and more comprehensive intervention evaluations.

Overall, this density visualization confirms that the main focus of research on the initial management of pneumothorax and hemothorax is still centered on patients, trauma, and core clinical conditions. Meanwhile, aspects of treatment strategies, intervention innovations, and long-term evaluation remain at a medium to low density level. These findings open up great opportunities to direct further research toward the development of more adaptive clinical protocols, the strengthening of evidence-based practice, and the exploration of new factors related to complications and patient outcomes in the Emergency Department.

Synthesis of Bibliometric Findings

A synthesis of bibliometric findings from literature analysis shows a consistent pattern of publications that place patient trauma, emergency department management strategies, and clinical outcomes as dominant themes. The main focus of research still revolves around the condition of patients with pneumothorax and hemothorax, especially in the context of chest trauma that requires rapid intervention. This trend is in line with the clinical urgency in the field, where delays in early management can increase the risk of serious complications and even death.

However, the literature shows a shift in the direction of research, which is beginning to highlight the development of new strategies that are more focused on evaluating complications and long-term outcomes. Whereas previous studies emphasized aspects of diagnosis and initial treatment, there is now a push to explore approaches that can reduce complication rates, improve patient quality of life, and lower mortality. This trend signals a paradigm shift from merely emergency measures toward more comprehensive and sustainable management.

For the Indonesian context, these findings have important implications for clinical practice and research development. With a high burden of trauma cases and variations in existing health facilities, innovation in the initial management of pneumothorax and hemothorax in the emergency department is an urgent need. Adjusting protocols to global developments and integrating evidence-based approaches can strengthen the effectiveness of emergency services. In addition, research in Indonesia needs to be more focused on evaluating complications and long-term outcomes so that the strategies developed not only save lives in critical situations but also improve the overall quality of patient recovery.

The results of the literature synthesis show that initial management strategies for pneumothorax and hemothorax cases in the Emergency Department play a decisive role in patient outcomes. Most studies emphasize that rapid intervention in the form of clinical diagnosis, radiological confirmation, and immediate actions such as chest drainage are crucial steps in reducing mortality rates. These findings are consistent with both domestic and international studies that identify chest trauma as one of the leading causes of death in trauma cases, which can be prevented if management is carried out appropriately.

In the national context, studies in several hospitals in Indonesia confirm that delayed diagnosis is often a major factor in the deterioration of patients with pneumothorax or hemothorax. Meanwhile, international literature indicates that global guidelines such as ATLS emphasize the importance of early detection through physical examination and portable imaging. Thus, this study positions itself to reinforce the recommendation that initial management should be carried out systematically, taking into account the resources available in the emergency department.

The risk of delay in initial management is very high, especially in cases of pneumothorax that are not immediately recognized and develop into tension pneumothorax. This condition can lead to acute respiratory failure, mediastinal shift, and cardiac arrest. Similarly, untreated hemothorax can cause severe hypovolemia, shock, and death. These fatal consequences highlight the critical importance of every minute in managing patients with chest trauma.

Research findings in Indonesia and abroad alike confirm that rapid action in the emergency department is the main predictor of patient survival. One study shows that the response time of medical personnel in the first 30 minutes greatly affects mortality rates. This further strengthens the argument that emergency departments must have standard protocols that can be understood and implemented uniformly by all health personnel in order to minimize delays.

The Emergency Department plays a central role as the main gateway for trauma patients. Cases of pneumothorax and hemothorax often arrive in critical condition, requiring full preparedness from medical personnel and facilities. The ED is required to have a responsive triage system so that patients with a high risk of death receive immediate priority treatment. Thus, the function of the ED is not merely as an initial service room, but also as a unit that determines the success or failure of the patient rescue process.

In terms of facility readiness, there are still significant differences between large hospitals and regional hospitals. Referral hospitals usually have rapid diagnostic equipment such as bedside ultrasound or CT scans, while health facilities with limited resources still rely on physical examinations and simple chest X-rays. This poses a challenge in developing an adaptive initial management strategy that takes into account these limitations while still prioritizing patient safety.

The initial management strategy for pneumothorax emphasizes rapid diagnosis through clinical examination, which includes identifying decreased breath sounds, hyperresonance on percussion, and signs of respiratory distress. Radiological examinations such as chest X-rays or ultrasounds can be used for confirmation. Initial interventions, such as oxygen administration, needle aspiration, and chest tube insertion, are the main actions taken to restore ventilation function.

The effectiveness of this strategy has been proven in numerous studies, but its implementation in the field is not always straightforward. A common challenge is the limited experience of medical personnel in performing invasive procedures quickly and accurately. Additionally, logistical barriers such as the availability of chest tubes and procedure rooms can also slow down the intervention process. Therefore, the success of the strategy depends heavily on a combination of medical skills, facility support, and clear protocols in the emergency department.

In cases of hemothorax, the initial management strategy begins with identifying signs of intrathoracic bleeding, such as decreased oxygen saturation, severe shortness of breath, and signs of shock. Initial stabilization measures, such as administering oxygen, establishing an intravenous line, and closely monitoring hemodynamics, are essential before further intervention.

The standard intervention for hemothorax is the placement of a chest drain to remove blood accumulated in the pleural cavity. In cases of massive bleeding, immediate blood transfusion is necessary to prevent hypovolemic shock. Follow-up monitoring is performed to assess the success of drainage and detect any ongoing bleeding that may require surgical intervention. This indicates that initial management does not stop at a single intervention but requires continuous monitoring.

The success of initial management of pneumothorax and hemothorax in the emergency department is largely determined by clinical factors inherent to the patient. The severity of chest trauma, the location of the injury, and the patient's physiological condition upon initial arrival at the emergency department are crucial aspects. Patients with multiple traumas often present with more complex conditions, so the actions taken are not only focused on thoracic problems, but also involve stabilizing the airway, circulation, and other vital organ functions.

In addition to the severity of the trauma, complications accompanying cases of pneumothorax and hemothorax also affect the outcome of management. Complications such as hypovolemic shock, respiratory failure, or other organ injuries in the thoracic cavity can worsen the patient's condition. This situation often requires more aggressive and coordinated treatment, such as a combination of thoracic drainage, blood transfusion, and close monitoring of hemodynamic conditions.

The condition of patients with certain comorbidities also poses a unique challenge. For example, patients with a history of chronic lung disease or coagulation disorders are more susceptible to deterioration after initial intervention. This factor requires medical personnel to consider an individualized approach tailored to the patient's clinical profile in order to achieve optimal results.

In addition to clinical factors, the success of management is also influenced by non-clinical factors that include aspects of the service system. The availability of medical equipment such as portable ultrasound, chest drainage devices, and hemodynamic monitors often distinguishes between effective and delayed treatment. In facilities with limited equipment, medical personnel must rely on clinical skills and conventional methods that may be less than optimal in certain situations.

The skills of medical personnel in the emergency room also play a central role. The speed of decision-making, accuracy of diagnosis, and ability to perform invasive procedures correctly determine the chances of patient survival. Continuous training, case simulations, and competency updates in accordance with the latest guidelines are essential to ensure that medical personnel are prepared to deal with a wide variety of cases.

Inter-unit coordination within the hospital is another determining factor. The treatment of patients with pneumothorax or hemothorax does not stop at the emergency room, but requires a rapid referral to the thoracic surgery or ICU departments. Communication barriers or delays in coordination can prolong the time to intervention and increase the risk of

complications. Therefore, an effective communication system and clear workflows are essential.

Compared to international standards such as ATLS, Indonesia still faces a number of challenges in implementation. ATLS emphasizes the importance of a systematic approach in assessing and treating trauma patients, starting from airway, breathing, to circulation. However, in practice, limitations in facilities and resources often make it difficult to fully implement these standards.

The implementation gap is also evident in the diagnostic aspect. In developed countries, portable ultrasound has become the standard for rapid evaluation of chest trauma, while in many Indonesian hospitals, radiological examinations are still limited to chest X-rays. These limitations can lead to delays in diagnosis and have an impact on delays in treatment.

The implication of these findings is the need to develop evidence-based management strategies tailored to local conditions. Realistic and applicable protocols will help medical personnel work more effectively in limited conditions without compromising patient safety. Adapting international guidelines to the realities on the ground in Indonesia is an important step toward improving the quality of emergency services.

Technological innovations have great potential to improve the effectiveness of management. Portable ultrasound, for example, can provide a quick picture of the presence of pneumothorax or hemothorax without having to wait for X-ray results. The use of this technology not only speeds up diagnosis but also improves the accuracy of interventions provided in the emergency room.

CONCLUSION

The initial management strategy for pneumothorax and hemothorax in the emergency department is highly dependent on a combination of clinical and non-clinical factors, with the severity of trauma, physiological condition, and presence of accompanying complications serving as primary determinants of management direction. Clinical factors demonstrate that each patient presents unique conditions requiring individualized approaches, while non-clinical factors emphasize the importance of robust service systems, including adequate medical equipment, skilled personnel, and effective inter-unit coordination. Comparison with international standards reveals implementation gaps in Indonesia, particularly regarding diagnostic technology availability and protocol consistency. This necessitates the development of evidence-based strategies relevant to the Indonesian context through service innovation, strengthening medical personnel competence, and utilizing effective and affordable diagnostic technology.

Suggestions for future practice include: (1) Development of standardized protocols adapted to local resource constraints while maintaining international quality standards; (2) Implementation of continuous training programs and case simulations to enhance medical personnel competency in emergency thoracic interventions; (3) Investment in portable diagnostic technologies such as point-of-care ultrasound to accelerate diagnosis and treatment decisions; (4) Strengthening inter-departmental communication systems and coordination workflows to minimize delays in patient care transitions; (5) Establishment of quality improvement programs with regular performance monitoring to ensure consistent

implementation of evidence-based management strategies; and (6) Collaboration between emergency departments to share best practices and develop context-appropriate clinical guidelines that can be implemented across various levels of healthcare facilities in Indonesia.

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