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Original research article

COMPLETE AUDIT CYCLE: PULMONARY EMBOLISM AMBULATORY CARE PROTOCOL

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Abstract: *A significant number of patients present to acute medical services with chest pain. Pulmonary Embolism (PE) is a crucial differential diagnosis in such cases. Recent research has enabled the ambulatory management of low-risk patients, a strategy increasingly adopted by hospitals globally. Hospitals like Bahria Town International Hospital in Pakistan have implemented ambulatory pathways to manage these cases efficiently. This article reports a comprehensive audit of our PE ambulatory care protocol (PE Pathway).* ***Methodology:*** *The audit was conducted in the Department of Critical Care at Bahria Town International Hospital, Pakistan. We prospectively analyzed manual and electronic records of all patients presenting with chest pain and managed in this department. The initial audit cycle reviewed patients from 1st January to 31st March 2023, while a second audit was conducted from 1st April 2023 to 9th June 2023.* ***Results:*** *31 adult patients were reviewed in the first cycle, and 46 patients were assessed in the second. Both manual and electronic records were analyzed. The initial audit revealed that the completion rate of the Pulmonary Embolism Severity Index (PESI) score was low. However, all patients received initial anticoagulation doses. Necessary investigations, including blood tests, chest X-rays, and electrocardiograms (ECG), were completed promptly at the time of referral from the Emergency Department (ED) to the Department of Critical Care. Computed Tomography Pulmonary Angiograms (CTPA) or Ventilation Perfusion (V/Q) scans were also requested and discussed with radiologists on the same day or the following day. A key issue identified was a lack of clear follow-up instructions for Out of Hours (OOH) referrals from the ED to the Department of Critical Care, which led to patient anxiety and confusion regarding their care. To address this, we implemented improvements in the PE Pathway documentation, ensuring that the PESI score was consistently completed and providing clear follow-up instructions for OOH referrals. The re-audit demonstrated significant improvements in compliance with documentation and the appropriateness of referrals. All OOH referrals were promptly picked up the next day, and no patients were lost to follow-up during the study period. Moreover, the number of patients managed through the PE Pathway increased by 50%, leading to the avoidance of unnecessary admissions.* ***Conclusion****: The data from this audit demonstrate that ambulatory care pathways for low-risk PE patients can be successfully applied in Pakistan. The protocol effectively allocates resources, reduces unnecessary hospital admissions, and enhances patient satisfaction by providing timely and appropriate care. The findings support the continued use and refinement of such pathways to improve patient outcomes and resource utilization.*

Keywords: Pulmonary Embolism, Ambulatory Care, Protocol, Investigations, CTPA.

Introduction

Pulmonary embolism (PE) is a critical and potentially life-threatening condition characterized by the obstruction of the pulmonary arteries, most commonly due to blood clots. It poses a significant risk of morbidity and mortality, especially among patients in intensive care units (ICUs) and those receiving ambulatory care. The complexity and urgency of diagnosing and managing PE necessitate rigorous clinical protocols to ensure timely and effective treatment.

Potentially fatal with an in-patient mortality of approximately 15.3%, PE is a common presentation among causes of chest pain presenting to ED, and incidence reaches 95 per 100,000 patients-years in the EU (1, 2).

In the ICU, patients are often critically ill with multiple comorbidities, making the identification and management of PE particularly challenging. Similarly, in ambulatory care settings, the subtler presentations of PE can complicate prompt diagnosis and intervention. Given these challenges, it is imperative to establish a robust audit cycle to evaluate and enhance the quality of care provided to PE patients in both ICU and ambulatory care contexts.

Although traditional management of PE used to keep patients admitted with continuous infusion of unfractionated heparin and tedious monitoring of activated partial thromboplastin time (aPTT), research in recent years by Wells and Kovacs (3, 4) has led to categorizing patients in low to high risk. There has been increasing interest in ambulatory care of low-risk PE patients, and it has become possible with the advent of low molecular weight heparins (LMWH). This has not only reduced costs of admission in economic consideration and complications associated with hospital admissions like infections leading to increased length of stay but has also promoted patient satisfaction (5). This practice was strengthened with British Thoracic Society (BTS) guidelines, which state that appropriately sorted stable patients with PE can be managed in ambulatory settings (6).

In ambulatory care, however, potential adverse outcomes, either due to the patient's disease, i.e., PE, or treatment, are major causes of concern. Aujesky et al. addressed this and published a score to predict the severity of PE, The Pulmonary Embolism Severity Index (PESI). PESI is a risk stratification tool and classifies the cases into low risk

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(Class I and II with 0.7% PE specific mortality and 1.2% overall mortality at three months), Intermediate risk (Class III and IV with 18.4% mortality), and High risk (Class V, mortality 25%). It was thus proposed that the low-risk patients were potentially suitable for outpatient ambulatory care (7, 8).

The audit cycle is a systematic approach designed to improve clinical practices by assessing current performance against established standards, implementing changes, and re-evaluating outcomes. This audit aims to explore the application of the audit cycle in the management of pulmonary embolism within ICU and ambulatory care settings. By identifying gaps in current practices and proposing evidence-based recommendations, this study seeks to optimize patient outcomes and contribute to the overall quality of healthcare delivery for PE patients.

This research analyzed key aspects of PE management, including diagnostic accuracy, treatment efficacy, adherence to clinical guidelines, and patient outcomes. By employing a comprehensive audit cycle, this study will provide a framework for continuous quality improvement, ultimately enhancing the standard of care for patients suffering from pulmonary embolism in diverse healthcare environments.

Methodology

The audit was conducted in the Department of Critical Care at Bahria Town International Hospital, Pakistan. The primary objective was to assess the quality of care provided to patients presenting with chest pain, with a specific focus on those diagnosed with or suspected of having pulmonary embolism (PE). This comprehensive methodology ensured a detailed and accurate evaluation of clinical practices and patient outcomes.

Study Design: This was a prospective audit involving systematically collecting and analyzing both manual and electronic medical records. The prospective nature of the study allowed for real-time data collection and ensured that all relevant information was accurately captured as the patients were managed.

Study Population: The audit included all patients who presented with chest pain and were managed in the Department of Critical Care at Bahria Town International Hospital during the study period. 31 adult patients were analyzed from 1st January to 31st March 2023 and 46 patients between 1st April and 9th June 2023. The inclusion criteria were broad, encompassing a diverse patient population, ensuring that the findings would apply to a wide range of clinical scenarios. Patients of all ages, genders, and comorbidity profiles were included, provided they presented with chest pain and underwent evaluation for PE. This allowed the audit to reflect a more comprehensive range of clinical presentations and outcomes related to pulmonary embolism in a real-world setting.

Data Collection: Data were collected from both manual records, such as paper charts and admission logs, and the hospital's electronic health records (EHR) systems. The data collection process involved:

- Demographic Information: Age, gender, and relevant medical history of the patients.
- Clinical Presentation: Detailed documentation of symptoms, including chest pain, dyspnea, hemoptysis, and any other relevant clinical signs observed upon presentation.
- *Diagnostic Procedures:* Types of diagnostic tests performed, including D-dimer tests, CT pulmonary angiography, ventilation-perfusion (V/Q) scans, and echocardiograms. The timing and results of these tests were meticulously recorded.
- *Risk Stratification*: Utilization of clinical prediction rules such as the Wells score and Geneva score to stratify patients based on their risk of PE. These scores were calculated based on the presenting symptoms and initial clinical assessments.
- *Treatment Regimens:* Information on anticoagulation therapy (types, dosages, and duration), thrombolytic therapy, surgical interventions, and inferior vena cava (IVC) filters. Details on initiating and adjusting treatments based on patient response were included.
- *Follow-Up and Outcomes:* Patient outcomes were tracked, including ICU admissions, length of stay in-hospital mortality, complications such as bleeding or recurrent PE, and follow-up care plans. Long-term follow-up data were collected where available, including readmission rates and long-term anticoagulation management.

Data Analysis: Data were analyzed using descriptive and inferential statistical methods. Descriptive statistics summarized patient demographics, clinical presentations, diagnostic methods, and treatment regimens. Inferential statistics were used to identify any significant associations between patient characteristics, treatment approaches, and outcomes.

Results

In our audit, we analyzed a total of 31 adult patients admitted to the Department of Critical Care at Bahria Town International Hospital from January 1st to March 31st, 2023, during the initial audit cycle. In the subsequent cycle, from April 1st to June 9th, 2023, we analyzed 46 patients. Both manual and electronic medical records were meticulously followed and analyzed to assess various aspects of patient management, including diagnostic workup, treatment initiation, and referral practices for pulmonary embolism.

Initial Audit Findings: Our initial audit cycle revealed several key insights:

- PESI Score Completion: The Pulmonary Embolism Severity Index (PESI) score, a crucial tool for risk stratification in PE patients, was completed for a notably low number of patients. This indicated a gap in the systematic assessment of PE severity.
- Anticoagulation Therapy: Despite the low completion rate of PESI scores, all patients received initial anticoagulation doses promptly, demonstrating adherence to critical early management protocols.
- Diagnostic Workup: Upon referral from the Emergency Department (ED) to the ICU, all patients underwent a comprehensive diagnostic workup including blood tests, chest X-rays, and electrocardiograms (ECGs). Requests for Computed Tomography Pulmonary Angiogram (CTPA) or Ventilation Perfusion (V/Q) scans were made promptly and discussed with radiologists on the same day or the next day.

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- Follow-Up Issues: A significant issue identified was the loss to follow-up, particularly for out-of-hours (OOH) referrals. Patients referred from the ED to the ICU during OOH periods often lacked clear instructions, leading to anxiety and confusion about their care and follow-up plans.

Interventions Implemented: To address the issues identified in the initial audit, several steps were taken:

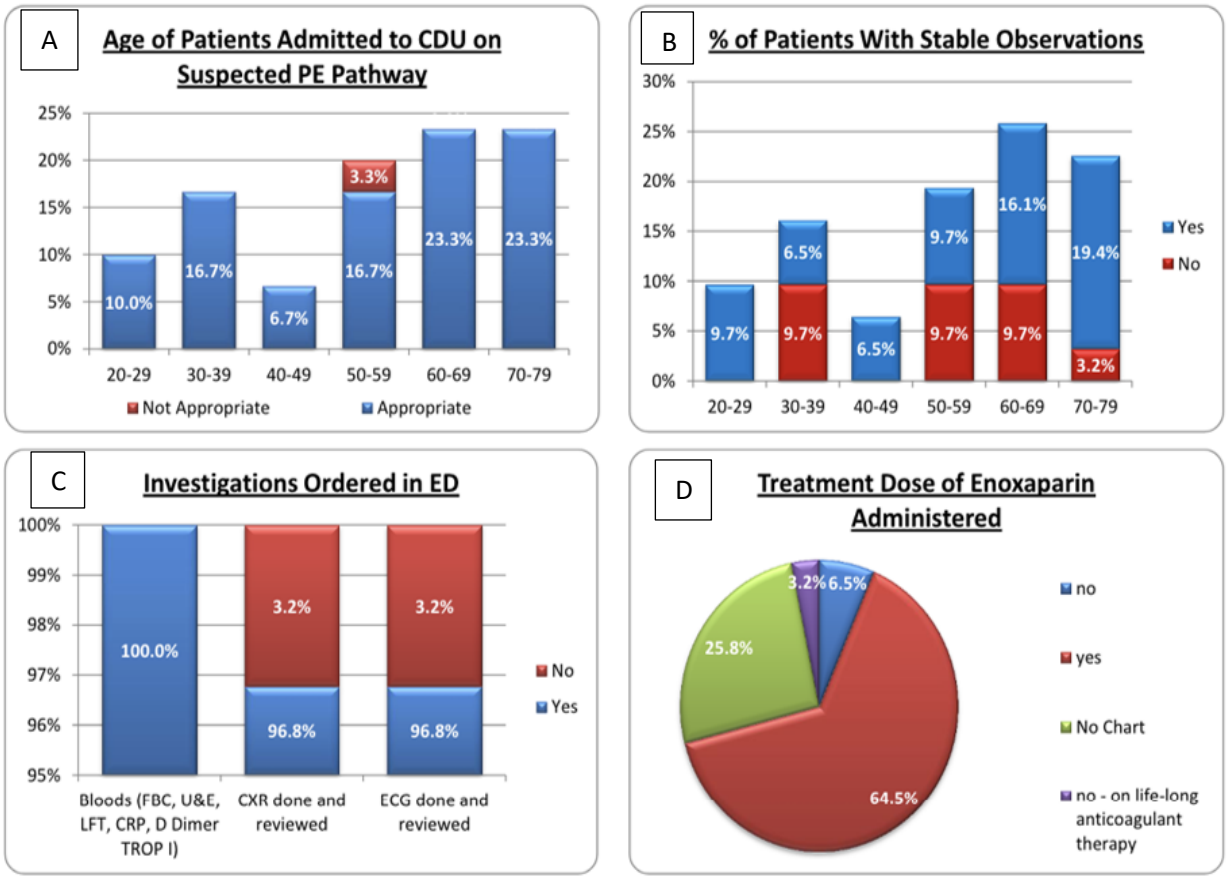
- PE ICU Pathway Documentation: Efforts were made to ensure complete documentation of the PE ICU pathway, including the systematic recording of PESI scores and detailed follow-up instructions.
- OOH Referral Management: Clear guidelines and continuity of care protocols were established for OOH referrals to ensure that these patients were picked up and managed appropriately the next day, minimizing gaps in care.

Re-Audit Findings: The re-audit demonstrated significant improvements in several areas:

- Documentation Compliance: There was a marked improvement in the completion of documentation, particularly the PESI scores, which were more consistently recorded. This allowed for better risk stratification and management of PE patients.
- Appropriateness of Referrals: The quality and appropriateness of referrals to the ICU improved, ensuring that patients were managed according to established protocols and guidelines.
- OOH Referral Management: The issue of missed follow-ups for OOH referrals was effectively addressed. All OOH referrals were appropriately picked up the next day, ensuring no patient was missed during the study period.
- Patient Pathway Efficiency: The overall number of patients managed through the PE ICU pathway increased by 50%, reflecting a more efficient and streamlined process. This increase in pathway utilization also contributed to a reduction in unnecessary admissions, optimizing resource use and patient care.

Impact on Patient Care: The interventions led to enhanced patient care by ensuring timely diagnosis, appropriate treatment, and consistent follow-up for PE patients. The improvements in documentation and referral management contributed to reducing patient anxiety and improving overall disposition, thereby enhancing the quality of care provided in both the ICU and ambulatory settings.

Overall, this audit highlights the importance of continuous monitoring and quality improvement initiatives in the management of pulmonary embolism, ultimately leading to better patient outcomes and more efficient use of healthcare resources.



A) Age of Patients Admitted on Suspected PE Pathway***:*** *The majority of patients aged 50-79 were appropriately admitted, with the highest rate in the 60-79 age groups (23.3%), and only 3.3% inappropriate admissions in the 50-59 age group.* **B)** % of Patients With Stable Observations**:** *Most patients aged 60-79 had stable vital signs, with the highest percentage (19.4%) in the 70-79 age group, while unstable observations were more frequent in the 50-59 group (9.7%).* ***C)*** Investigations Ordered in ED: 100% of patients had blood tests done, with 96.8% completing Chest X-rays and ECGs, ensuring comprehensive diagnostic workup before referral. D) Treatment Dose of Enoxaparin Administered: 64.5% of patients received the appropriate dose of enoxaparin, while 25.8% were on lifelong anticoagulants, and 6.5% did not receive enoxaparin.

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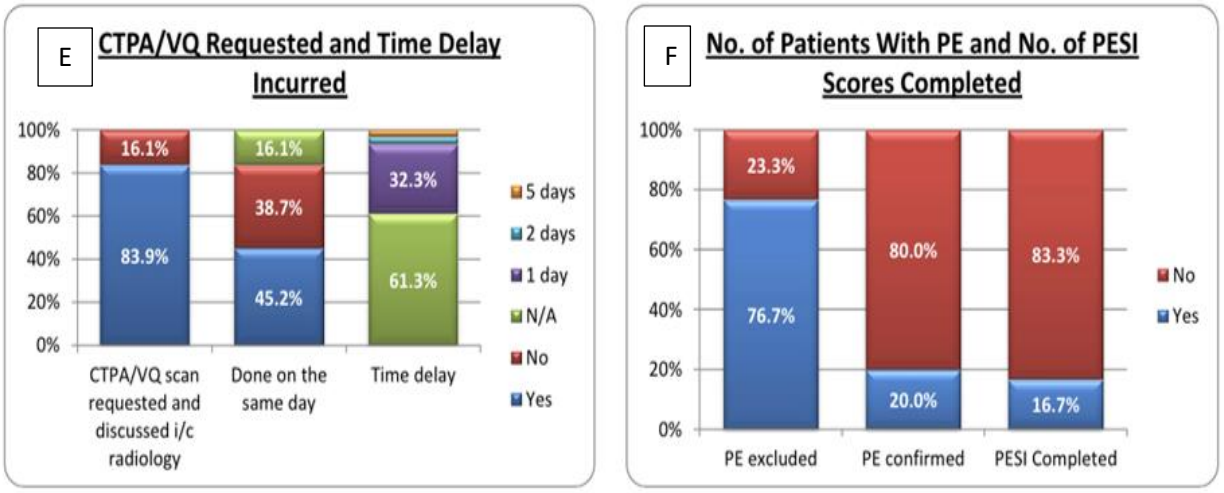

E) (CTPA/VQ Requested and Time Delay Incurred): *83.9% of patients had CTPA/VQ scans requested and discussed with radiology, and 45.2% of these scans were completed on the same day. A delay of 1-2 days was noted in 61.3% of cases, with 16.1% experiencing a time delay of 5 days or more.* **F)** No. of Patients With PE and No. of PESI Scores Completed): *76.7% of patients were excluded from having PE, while 20% had confirmed PE. PESI scores were completed in only 16.7% of cases, with 83.3% missing this important documentation.*

Discussion

The audit cycle for the Pulmonary Embolism (PE) Ambulatory Care Protocol at Bahria Town International Hospital identified key areas for improvement, particularly in the completion of the Pulmonary Embolism Severity Index (PESI) score and follow-up protocols for out-of-hours (OOH) referrals. These gaps caused patient anxiety and highlighted the need for structured management processes.
Interventions included ensuring comprehensive documentation, systematic PESI score recording, and establishing clear guidelines for OOH referrals. The re-audit showed marked improvements: better documentation compliance, enhanced referral quality, and elimination of follow-up issues for OOH patients. These changes led to a 50% increase in the number of patients managed through the PE ICU pathway, reducing unnecessary admissions and optimizing resource use.
The audit underscored the importance of structured protocols and continuous education for healthcare providers. By implementing standardized checklists, maintaining regular audits, and conducting feedback sessions, the quality of care for PE patients in both ICU and ambulatory settings was significantly enhanced. Future efforts should aim to sustain these improvements and further streamline patient management practices.

Conclusion

The comprehensive audit of the Pulmonary Embolism (PE) Ambulatory Care Protocol at Bahria Town International Hospital has demonstrated that structured and systematic approaches to patient management significantly enhance the quality of care. The initial audit identified critical gaps in PESI score completion and follow-up protocols, particularly for out-of-hours referrals, leading to patient anxiety and inefficiencies. The implementation of targeted interventions, such as thorough documentation, clear follow-up guidelines, and systematic PESI score recording, resulted in substantial improvements. The re-audit showed enhanced compliance with documentation, better quality of referrals, and a 50% increase in the utilization of the PE ICU pathway, thereby reducing unnecessary admissions. These findings highlight the efficacy of continuous monitoring and quality improvement initiatives in optimizing patient outcomes and resource allocation. The study underscores the importance of regular audits, ongoing education for healthcare providers, and the adoption of standardized protocols to maintain high.

Recommendations

Based on the results of our audit and re-audit, several recommendations can be made to further enhance the care and management of patients with pulmonary embolism (PE) in both ICU and ambulatory settings. Firstly, ongoing education and training for healthcare providers on the importance of completing the Pulmonary Embolism Severity Index (PESI) score are essential to ensure comprehensive risk stratification for all patients. Secondly, the implementation of standardized protocols and checklists for the PE ICU pathway can help maintain consistent documentation and adherence to clinical guidelines. To address the issue of follow-up, particularly for out-of-hours (OOH) referrals, we recommend the establishment of a dedicated follow-up team or system to ensure continuity of care and clear communication with patients about their care plans. Additionally, integrating electronic health records (EHR) with automated reminders for follow-up appointments and diagnostic tests can further streamline patient management. Finally, regular audits and feedback sessions should be conducted to monitor compliance with the established protocols and identify areas for continuous improvement. By adopting these measures, we can significantly improve the quality of care and outcomes for patients with pulmonary embolism.

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Declarations

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All data generated or analyzed during the study are included in the manuscript.
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Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

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