

Clinical Audit

Clot Formation Within Tracheostomy Tube in Surgical Unit 1 of HFH Hospital Rawalpindi; a Quality Improvement Project

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Abstract

Introduction: Clot formation in tracheostomy tubes poses a critical risk of airway obstruction.

Objectives: The objectives of this study are to evaluate current practices in tracheostomy care, identify risk factors contributing to clot formation, and recommend strategies for quality improvement.

Material and Methods: A retrospective and prospective audit was carried out over two months in the Surgical ICU of HFH Rawalpindi. Data were extracted from patient files, care documentation, and incident reports. Inclusion criteria encompassed tracheostomized patients staying over 48 hours, excluding those with laryngectomy or coagulopathy.

Results: Among 50 patients, 20% experienced clot formation. Poor humidification (50%), infrequent suctioning (30%), and airway trauma (20%) were major factors. Only 60% received humidified oxygen per protocol, and 70% had appropriate suctioning.

Conclusion: The audit revealed gaps in protocol adherence, necessitating staff training and standardization to improve outcomes and patient safety.

Keywords: Tracheostomy; Airway Obstruction; Quality Improvement; Critical Care

Introduction

A tracheostomy is a procedure that creates an opening through the neck into the trachea for the purpose of maintaining the patient's airway.^{1,2} It is generally performed in patients with long term mechanical ventilation needs, long term airway protection needs, or management of upper airway obstruction.³ Tracheostomy management is important in ensuring patient safety and outcomes as it relates to the patient's clinical care particularly in the intensive care context, surgical patients, and long-term care.⁴ Tracheostomy care is comprised of ongoing assessment, cleaning, suctioning, and monitoring for complications, including infection, dislodgement of the tube, and obstruction of the airway. Given that tracheostomy is an invasive procedure and patients are typically clinically fragile, it is particularly important to follow the evidence-based care increasingly to guarantee the prevention of morbidity and mortality.³ When you conduct a tracheostomy care audit, you can evaluate the adherence of staff to best practice of care. You can determine if clinical practice is congruent with the professional bodies guidance like NCEPOD, the National Tracheostomy Safety Project, and local hospital policy. The primary purpose of an audit is always to improve patient safety by identifying shortcomings in care that may result in complications like tube dislodgement, infection, airway obstruction, or delayed emergency measures.⁴ Audits also allow for the reviewing of competence, confidence of staff, and to identify if continuing education or training is warranted. They can help facilitate standardization of care to ensure all patients are receiving equal

treatment and reduce variability in care. Moreover, audits encourage effective collaboration among multidisciplinary teams, including nurses, respiratory therapists, ENT specialists, and critical care physicians, by providing consistent frameworks for care delivery and decision-making.

The objectives of this audit are to evaluate current practice in the surgical ICU with respect to adherence to established tracheostomy care protocols, identify risk factors for clot formation in tracheostomy tubes, quantify the incidence of tube clotting, and develop evidence-based recommendations aimed at improving patient outcomes and safety.

Materials and Methods

This quality control project was conducted as a combined retrospective and prospective clinical audit to assess the incidence of clot formation within tracheostomy tubes and evaluate compliance with standard tracheostomy care protocols. Employing a descriptive observational design, the project involved both retrospective chart reviews and prospective clinical monitoring in order to identify procedural shortcomings and opportunities for improvement. The study was conducted in the Surgical Intensive Care Unit (SICU) of Holy Family Hospital (HFH), Rawalpindi, over a period of two months, from January 1st to February 28th, 2025.

All patients aged 18 years and above who underwent tracheostomy and remained in the SICU for more than 48 hours during the study period were included. Patients who had undergone laryngectomy, those with pre-existing coagulopathies (as per laboratory

records), and individuals who were discharged or transferred within 48 hours of tracheostomy were excluded from the audit.

Data collection was carried out using a structured proforma based on established tracheostomy care standards. Information was obtained from multiple sources, including patient medical records, nursing and physician documentation, incident reports of airway obstruction, ventilator and humidification logs, and suctioning records. The data recorded included demographic details, indication for tracheostomy, method and frequency of humidification, suctioning practices, evidence of clot formation or airway obstruction, and the clinical response to any such events. Compliance with key care parameters, such as adequate humidification, proper suctioning technique, daily cannula care, and airway patency monitoring, was evaluated against predefined benchmarks per hospital protocols.

Ethical approval for this audit was obtained from the Institutional Review Board of Holy Family Hospital, Rawalpindi. As this was a non-interventional audit using anonymized data for quality improvement purposes, the requirement for informed consent was waived. All patient information was handled with strict confidentiality in line with hospital policies and the ethical standards outlined in the Declaration of Helsinki.

Results

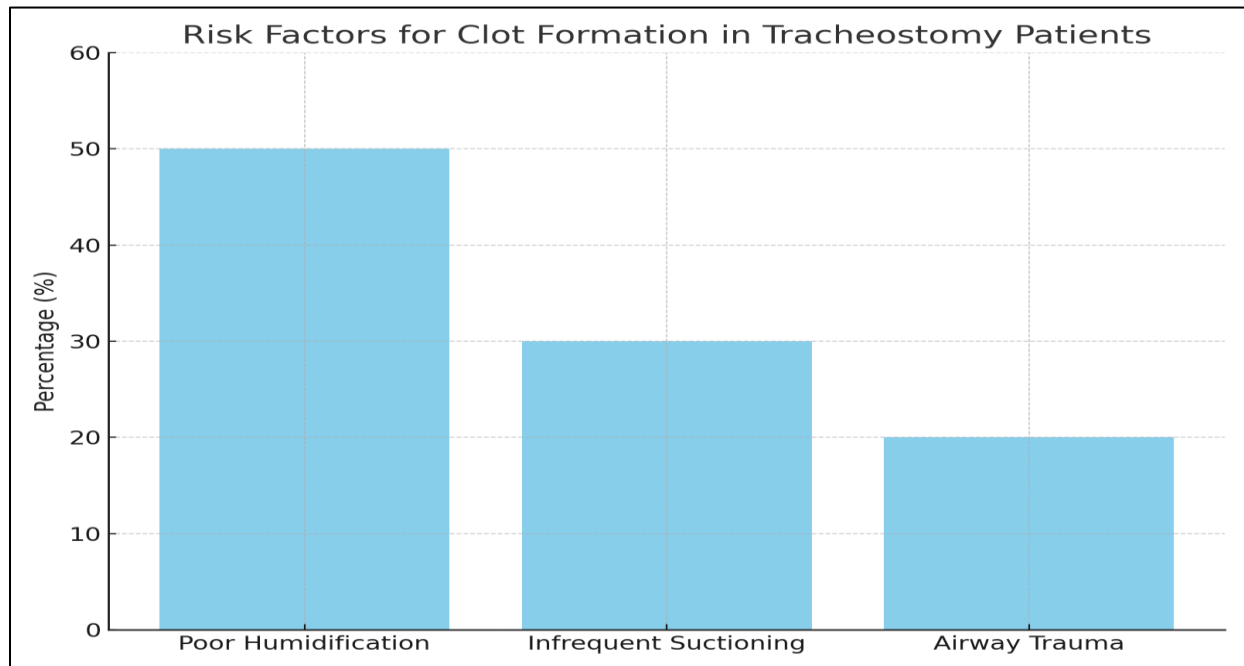
Out of the 50 tracheostomy patients reviewed during the audit period, 10 patients (20%) were found to have developed clot formation within the tracheostomy tube. A detailed evaluation of these cases revealed several

contributing factors. Poor humidification was the most frequently identified risk factor, present in 50% of the patients who experienced clotting events. This was followed by infrequent suctioning, which was observed in 30% of the cases. Additionally, airway trauma, such as mucosal injury during tracheostomy insertion or subsequent care, was documented in 20% of the affected patients. These findings indicate that suboptimal tracheostomy care practices may play a significant role in clot formation and subsequent airway obstruction.

Assessment of routine management practices across the entire patient sample showed notable variability in adherence to institutional protocols. Only 60% of patients were documented to have received humidified oxygen consistently, per standard tracheostomy care guidelines. Similarly, 70% of the patients underwent suctioning at the recommended intervals. These findings suggest potential lapses in care delivery that may contribute to increased risk of complications, including clot formation.

To enhance understanding, a bar graph was created to illustrate the relative distribution of the major risk factors among patients with tracheostomy tube clotting. In addition, a summary table was compiled to outline the proportions of patients who received appropriate care as per institutional protocols, providing a snapshot of compliance with key quality indicators. Together, these visuals underscore critical gaps in care and highlight actionable targets for quality improvement in tracheostomy management within SICU.

Figure 1. Prevalence of Different Risk Factors for Clot Formation in Tracheostomy Patients.



Discussion

During the audit, 20% of the tracheostomized patients in the surgical ICU developed clot formation in their tracheostomy tube. Poor humidification (50%), infrequent suctioning (30%), and airway trauma (20%) were proximal contributors, highlighting important lapses in the application of tracheostomy care protocols, particularly with respect to humidification and suctioning.

Several international studies emphasize that humidification is a critical component of airway management, helping to maintain patency and reduce obstruction rates. Poor humidification has been associated with sputum plugging and airway occlusion. Tracheostomy post-care protocols, including the Tracheostomy Safety Project, similarly

stress the importance of continuous humidification.⁶ Physiological studies also indicate that inspired gases must be adequately humidified during mechanical ventilation, as inadequate humidification can lead to epithelial injury, secretion retention, and clot formation.⁷⁻⁹ Our findings align with these reports, reinforcing the need for continuous humidified oxygen therapy in all tracheostomy patients.

In addition to humidification, suctioning practices were found to be inconsistent in our setting, with only 70% of patients suctioned according to protocol. This observation is consistent with international recommendations, including the AARC Clinical Practice Guideline, which emphasizes patient-need-based suctioning to prevent mucus plugging and tube blockage.¹⁰ Further evidence from quality improvement

interventions, such as tracheostomy care bundles in Egyptian ICUs, demonstrates that structured protocols incorporating suctioning, humidification, and inner tube management significantly improve nursing performance and patient safety.¹¹

Airway trauma was identified as an underlying issue in one-fifth of our cases. Lee et al. reported similar complications, attributing clot formation to mucosal injury during insertion or subsequent handling of the cannula.⁵ These findings underscore the importance of both technical precision during the procedure and ongoing vigilance in post-tracheostomy care to minimize trauma and clot formation.

The implementation of a multidisciplinary tracheostomy care team has been linked to a significant reduction in procedure-related trauma and associated complications in high-income settings. Considering resource-limited environments, structured education and protocolized care could provide viable avenues for improvement and safer patient outcomes.

At a national level, data from Pakistan reflect similar concerns. A cross-sectional study evaluating healthcare providers' knowledge of tracheostomy care found that only 52% demonstrated satisfactory understanding, particularly regarding suction pressures, cuff management, and recognizing tube blockage.¹² These knowledge gaps likely contribute to non-adherence to care protocols and underline the need for educational reinforcement and standardization of care pathways in local ICUs.

Taken together, the present audit demonstrates that clot formation within tracheostomy tubes is largely preventable and primarily associated with lapses in routine care. International evidence indicates that structured education, protocol-driven care bundles, and regular audit-feedback cycles effectively reduce adverse events. Implementing such interventions in our setting could significantly enhance patient safety and outcomes.

This study was conducted in a single tertiary care hospital with a small sample size (n=50), limiting generalizability. The observational period was short (two months), restricting assessment of seasonal or long-term practice changes. Data collection depended on documentation, which may have been incomplete or subject to reporting bias. Finally, the audit was limited to surgical ICU patients, and practices in medical ICUs or other wards were not assessed. Further multicenter studies with larger sample sizes and longer follow-up are necessary to validate these findings and evaluate the impact of staff training and care bundle implementation.

Conclusion

This audit highlights the need for improved adherence to tracheostomy care protocols to reduce clot formation in the surgical ICU of HFH Rawalpindi. By addressing identified gaps through education, protocol enhancement, and regular monitoring, patient outcomes can be significantly improved.

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