



Complication Rate of Percutaneous Dilatational Tracheostomy in Critically Ill Adults With Obesity

¹ A.Ghouri, ¹ A.Dheendsa

¹ Charles R. Drew University of Medicine and Science

Correspondence : doctorghouri39483@gmail.com

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ABSTRACT

Background: The literature on the complication rate of percutaneous dilatational tracheostomy (PDT) in critically ill adults with obesity reveals a complex interplay of anatomical challenges and procedural outcomes. **Literature Review:** Further examination reveals a lack of standardized definitions for complications, as noted by (Širanović et al., 2007), complicating the comparison of outcomes across different studies. This inconsistency emphasizes the need for rigorous methodologies in future research to ensure clarity and reliability in reporting complications associated with PDT. (P Sasane et al., 2020) focus on bleeding complications, revealing a low complication rate even among high-risk patients, suggesting that PDT may be a safe option for a broader demographic, including those with obesity. (N. Zouk & Batra, 2011) provide a comprehensive overview of the complications associated with PDT, noting a significant rate of late complications and emphasizing the importance of ongoing monitoring. Finally, (Vudatha et al., 2013) explore PDT outcomes in a cardiac surgical intensive care unit, indicating manageable complication rates and suggesting that PDT may be an effective alternative for long-term ventilation needs in high-risk patients. Their findings contribute to the growing body of evidence supporting the safety of PDT in various clinical contexts. **Conclusion:** In conclusion, the literature indicates that while obesity presents unique challenges in performing PDT, the procedure can still be safe and effective when performed with appropriate considerations and adaptations. The variability in complication definitions and reporting necessitates more standardized methodologies in future studies to better assess the risks associated with PDT in this patient population. Overall, the evidence supports the notion that with careful patient selection and procedural modifications, PDT can be a beneficial intervention for critically ill adults with obesity.

Keyword: Complication Rate, Percutaneous Dilatational Tracheostomy, Critically Ill Adults, Obesity

INTRODUCTION

The literature on the complication rate of percutaneous dilatational tracheostomy (PDT) in critically ill adults with obesity reveals a complex interplay of anatomical challenges and procedural outcomes. (A Al-Ansari & H Hijazi, 2006) highlighted the increased risks associated with PDT in morbidly obese patients, noting a 2.7-fold increase in perioperative complications and a 4.9-fold increase in serious complications. Their findings underscore the difficulties in airway management due to obscured anatomical landmarks, suggesting that adaptations in technique, such as using a modified tracheostomy tube, can mitigate some risks.

Following this, (Širanović et al., 2007) pointed out the lack of standardized definitions for complications related to PDT, which complicates the comparison of outcomes across studies. Their research on the Griggs method indicated that while this technique is generally safe, the variability in complication reporting highlights the need for more rigorous methodologies in future studies.

(Kumar et al., 2012) further contributed to the discourse by comparing different PDT techniques, emphasizing that while PDT has largely replaced surgical tracheostomy in critically ill patients, it is not devoid of complications. They noted a higher incidence of perioperative complications with percutaneous techniques compared to surgical methods, which raises questions about the safety of PDT, particularly in patients with specific anatomical considerations such as increased body mass index and soft tissue thickness.

(P Sasane et al., 2020) focused specifically on bleeding complications in high-risk patients undergoing PDT, finding a remarkably low complication rate even in those deemed at high risk. This suggests that, contrary to earlier concerns, PDT may be a safe option for a broad patient demographic, including those with obesity and other comorbidities.

(Ghattas et al., 2011) expanded on the implications of obesity in PDT, revealing that obese patients may experience a higher incidence of serious complications such as posterior tracheal wall injury. Their findings reinforce the

notion that while PDT is a common procedure, the unique challenges posed by obesity necessitate careful consideration of patient selection and procedural techniques.

(N. Zouk & Batra, 2011) reviewed the evolution of PDT, acknowledging its acceptance as a bedside procedure despite the potential for severe complications, including mortality. They noted that a significant proportion of patients experience late complications, which emphasizes the importance of ongoing monitoring and management post-procedure.

(Barash & S. Kurman, 2011) highlighted the significance of preoperative evaluations in critically ill patients, particularly as obesity rates rise. Their analysis indicated that while complications can occur, PDT remains a viable option with careful patient selection and technique adaptation, especially for those with prior tracheostomy or cervical spine trauma.

Lastly, (Vudatha et al., 2013) examined PDT outcomes specifically in a cardiac surgical intensive care unit, finding that while complications such as bleeding and infection were noted, the overall safety profile of PDT remains favorable. Their findings suggest that PDT can be effectively performed in this high-risk population, contributing to the growing body of evidence supporting the procedure's safety in varied clinical contexts.

Overall, the literature indicates that while obesity presents unique challenges in performing PDT, with a heightened risk of complications, the procedure can still be safe and effective when performed with appropriate considerations and adaptations.

LITERATURE REVIEW

The article "Clinical review: Percutaneous dilatational tracheostomy" by Al-Ansari and Hijazi (A Al-Ansari & H Hijazi, 2006) provides valuable insights into the challenges and risks associated with performing percutaneous dilatational tracheostomy (PDT) in morbidly obese patients. The authors highlight a significant increase in complication rates among this demographic, noting a 2.7-fold increase

in perioperative complications and a staggering 4.9-fold increase in serious complications compared to non-obese patients. This statistic underscores the importance of understanding the unique anatomical and physiological challenges that obesity presents in airway management.

A critical evaluation of the material reveals that while the authors acknowledge the potential difficulties posed by obesity, they also assert that anatomical landmarks are typically identifiable in most obese patients, provided that adequate neck flexion is achieved. This finding is crucial as it suggests that with proper technique and positioning, the risks associated with PDT can be mitigated. The authors advocate for the use of PDT in this population, emphasizing its cost-effectiveness, simplicity, and safety, which are significant considerations in critical care settings.

However, the study's findings also prompt a closer examination of the implications for clinical practice. The increased complication rates in morbidly obese patients necessitate a tailored approach to PDT, including careful pre-procedural assessment and planning. It may also be beneficial to consider the design and size of tracheostomy tubes used, as the authors indicate that standard tubes may not be appropriate for this patient group.

The article titled "Early complications of percutaneous tracheostomy using the Griggs method" by Širanović et al. (Širanović et al., 2007) provides valuable insights into the complications associated with percutaneous dilatational tracheostomy (PDT) in critically ill patients. The authors highlight the absence of standardized definitions for risk and complications related to PDT, which poses a challenge for comparing outcomes across different studies.

The findings from the study suggest that the Griggs method is a relatively safe technique for performing tracheostomy in intensive care unit (ICU) patients. The reported complication rates, including hypotension (3%), hypoxemia (2.5%), bronchospasm (1%), and cardiac dysrhythmias (2.5%), reflect the potential risks involved in this procedure. Notably, the study identifies that minor bleeding occurred in 8% of cases, while major bleeding was reported at a much lower rate of

0.5%. These statistics provide a crucial foundation for understanding the complications that can arise during PDT, particularly in a population that may include individuals with obesity, who are often at an increased risk for procedural complications.

The authors emphasize the need for further research, particularly prospective, controlled, and randomized studies that utilize strictly defined and standardized criteria for complications. This recommendation is critical, as the variability in complication definitions can lead to discrepancies in reported outcomes and hinder the ability to draw definitive conclusions regarding the safety and efficacy of different PDT techniques.

The article "Percutaneous dilatational tracheostomy: Griggs guide wire dilating forceps technique versus ULTRA-perc single-stage dilator – A prospective randomized study" by Kumar, Trikha, and Chandralekha (Kumar et al., 2012) provides valuable insights into the comparative safety and efficacy of two percutaneous tracheostomy techniques in critically ill patients. The study is particularly relevant in the context of the increasing prevalence of obesity among critically ill adults, as it highlights the implications of patient-specific factors on procedural outcomes.

The authors note that percutaneous dilatational tracheostomy (PDT) has largely supplanted surgical tracheostomy in intensive care settings, primarily due to its perceived advantages, including safety, ease of performance, and reduced complication rates. However, the article also acknowledges a paradox where perioperative complications appear to be more frequent with the percutaneous approach, as indicated by a meta-analysis of tracheostomy trials. This observation raises concerns about the adequacy of the PDT technique in certain patient populations, particularly those with obesity, where anatomical variations can complicate the procedure.

Kumar et al. (Kumar et al., 2012) conducted a randomized study comparing the ULTRA-perc technique with the Griggs guide wire dilating forceps (GWDF) technique. They found that the time taken for the procedure was comparable

between both techniques, suggesting that either method can be effectively utilized in an ICU setting. However, the study goes further to explore critical factors influencing the success of PDT, such as body mass index (BMI), the thickness of soft tissues surrounding the trachea, and the duration of translaryngeal intubation. These variables are particularly pertinent in the context of obesity, as increased soft tissue can hinder dilatation and elevate the risk of complications.

The authors reported that the dilatation was adequate in 100% of the patients, which is promising; however, the study does not delve deeply into the specific complications encountered in patients with higher BMI. This is a noteworthy gap, as understanding the complication rates in this demographic is essential for optimizing clinical practices and ensuring patient safety. The findings imply that while the ULTRA-perc and GWDF techniques may be equally viable, the inherent challenges posed by obesity necessitate further investigation into tailored approaches that account for individual patient anatomy.

The article titled "Percutaneous Tracheostomy in Patients at High Risk of Bleeding Complications: A Retrospective Single-center Experience" by Sasane et al. (P Sasane et al., 2020) presents a comprehensive analysis of the complications associated with percutaneous tracheostomy (PDT) in critically ill patients, particularly focusing on those at high risk for bleeding. Conducted in the medical intensive care unit (MICU) of Rashid Hospital in Dubai, this retrospective study spans a 15-month period and offers valuable insights into the safety and efficacy of the procedure under specific conditions.

The study's methodology is noteworthy as it employs the single-tapered dilator technique under fiber optic bronchoscopic guidance, a practice that may enhance the precision and safety of the procedure. By categorizing patients into high-risk and low-risk groups based on their bleeding complications, the authors effectively delineate the impact of pre-existing conditions on procedural outcomes. The findings indicate that only two patients experienced bleeding complications, with one occurring in the high-risk group. This suggests that even in populations with significant risk factors, such as coagulation abnormalities and anatomical

anomalies, the overall complication rate remains low, thereby reinforcing the notion that PDT can be performed safely when appropriate precautions are taken.

Furthermore, the article emphasizes the nature of complications associated with PDT, primarily local bleeding and stomal infections. This focus is critical, as it directs attention to the need for careful patient selection and monitoring, particularly in those with known risk factors. The authors' conclusion that PDT is a relatively safe procedure aligns with existing literature, but it also underscores the necessity for ongoing vigilance in clinical practice, especially in critically ill patients with obesity who may present unique anatomical and physiological challenges.

The article "State of the art: percutaneous tracheostomy in the intensive care unit" by Ghattas, Alsunaid, Pickering, and Holden (Ghattas et al., 2011) provides a comprehensive examination of the complications associated with percutaneous dilatational tracheostomy (PDT) in critically ill adults, particularly focusing on the implications for obese patients. The authors highlight the increasing prevalence of obesity in the United States and its relevance to the practice of tracheostomy in intensive care settings.

The findings presented in the article indicate a concerning trend regarding the safety of PDT in patients with obesity. The authors reference several retrospective studies that document a range of serious complications, including bleeding, posterior membrane tear, and airway loss, which are particularly pertinent in the context of the obese population. Notably, a significant study involving 500 consecutive PDT procedures revealed that the complication rates were markedly higher among the 86 obese patients compared to those with a body mass index (BMI) under 30. This study identified specific complications such as oxygen desaturation, accidental extubation, posterior tracheal wall injury, and non-fatal bleeding, with a striking observation that four out of five cases of accidental decannulation occurred within the obese group.

The article further emphasizes the role of morbid obesity as an independent variable contributing to the heightened risk of tracheostomy-related complications.

This assertion is supported by comparative analyses, such as the study involving 89 morbidly obese patients, which similarly indicated elevated complication rates in this demographic. These findings are critical for clinicians as they underscore the need for heightened vigilance and potentially modified procedural approaches when performing PDT on obese patients.

However, the authors also acknowledge that some studies have reported PDT as being safe in obese individuals, suggesting a dichotomy in the existing literature. This discrepancy invites further investigation into the methodologies and patient selection criteria of these studies, as they may influence outcomes. The recognition of obesity as a complicating factor in PDT procedures necessitates an evidence-based approach to patient assessment and management strategies in the ICU.

The article "Managing complications of percutaneous tracheostomy and gastrostomy" by Zouk and Batra (N. Zouk & Batra, 2011) provides a comprehensive examination of the complications associated with percutaneous dilatational tracheostomy (PDT), particularly in critically ill patients, including those with obesity. The authors highlight the evolution of PDT since its inception in 1957 and its current status as a widely accepted bedside procedure in intensive care units.

A critical evaluation of the article reveals that while PDT is a common intervention, it is not without risks. The authors present alarming statistics, noting that approximately 500 patients in the United States suffer fatal or disabling outcomes due to tracheostomy annually. The meta-analysis referenced in the article indicates a procedure-related mortality rate of 2.18%, with a significant proportion of fatalities occurring intra-procedurally (31%) or within the first week post-procedure (49%). This underscores the urgent need for proper patient selection and procedural expertise, particularly in populations at higher risk, such as those with obesity.

The article also emphasizes the high incidence of late complications, estimated to affect up to 65% of patients, which can significantly impact long-term

quality of life. Among these complications, post-tracheostomy tracheal stenosis (PTTS) is highlighted as a critical area of concern. The authors provide insight into management strategies for these complications, suggesting that proper training in advanced airway management and emergent techniques is essential for healthcare providers performing PDT.

The article "Patient selection and preoperative evaluation of percutaneous dilation tracheostomy in the intensive care unit" by Barash and Kurman (Barash & S. Kurman, 2011) provides a comprehensive overview of the complexities involved in performing percutaneous dilatational tracheostomy (PDT) in critically ill patients, particularly focusing on those with obesity. The authors highlight the increasing prevalence of obesity and its implications for proceduralists, as larger neck sizes can complicate the identification of critical anatomical landmarks during the procedure.

Barash and Kurman (Barash & S. Kurman, 2011) discuss several studies that assess the safety outcomes of PDT in obese patients. For instance, Mansharamani et al. conducted a retrospective analysis and found that complications were minimal, with only one case of paratracheal tracheostomy placement that was promptly corrected. This finding suggests that, despite the challenges posed by obesity, PDT can be performed safely if appropriate measures are taken. Furthermore, the authors reference a review involving 89 obese patients, which indicated no significant differences in primary endpoints—such as malpositioning or loss of airway control—when compared to those undergoing surgical tracheostomy. This reinforces the notion that PDT may be a viable option even for patients with higher body mass indices.

The article also addresses specific considerations for patients with cervical spine trauma or recent neck surgeries, noting that traditional practices often involve neck extension during PDT. However, the authors cite evidence indicating that PDT can be performed safely without such maneuvers, as demonstrated in a case series involving cervical spine trauma patients, where no complications related to the procedure were observed. This is a significant finding, as it suggests that

proceduralists may have more flexibility in managing patients with complex neck conditions.

Another critical aspect discussed is the management of patients with prior tracheostomies. Historically, repeat PDT has been viewed with caution due to concerns regarding scar tissue and altered anatomy. However, the article references retrospective reviews that indicate no increase in complications for patients undergoing repeat PDT, thus challenging the notion that prior tracheostomy is a relative contraindication. The authors emphasize the potential utility of residual tracheostomy scars in aiding landmark identification, particularly in obese patients where external anatomy may be ambiguous.

The article titled "Percutaneous Dilatational Tracheostomy in a Cardiac Surgical Intensive Care Unit: A Single-Center Experience" by Vudatha et al. (Vudatha et al., 2013) provides an insightful examination of the outcomes and complications associated with percutaneous dilatational tracheostomy (PDT) in critically ill patients within a cardiac surgical intensive care unit (CSICU). This study is particularly relevant in the context of managing long-term ventilation needs in patients who have undergone cardiac, thoracic, or vascular surgeries.

The authors conducted a retrospective analysis of patients who underwent PDT from January 1, 2013, to January 1, 2011, focusing on critical postoperative metrics such as mortality, decannulation time, and complications. The findings reveal that while there were eight notable complications, including five instances of bleeding that required packing and one case of mediastinitis, the overall complication rate appears to be manageable. This suggests that PDT may be a safe alternative to surgical tracheostomy, particularly in the high-risk population of cardiac surgery patients.

The study's conclusion emphasizes that patients who undergo PDT generally experience a relatively short duration of tracheostomy, with no major post-procedural complications reported. This is a significant finding, as it highlights the potential for PDT to be an effective intervention in the management of

ventilation needs in critically ill patients, potentially reducing the burden of more invasive surgical procedures.

However, a critical evaluation of the material reveals certain limitations. The study is conducted in a single-center setting, which may limit the generalizability of the findings to other healthcare environments. Additionally, the retrospective nature of the analysis may introduce biases related to patient selection and data collection. The specific demographic characteristics of the patient population, particularly regarding obesity, are not thoroughly addressed, which is a crucial factor given the increasing prevalence of obesity in critically ill patients and its known association with higher complication rates in various medical procedures.

CONCLUSION

The literature on the complication rate of percutaneous dilatational tracheostomy (PDT) in critically ill adults with obesity presents a nuanced understanding of the risks and procedural outcomes associated with this intervention. The introduction highlights significant findings regarding the increased risks in morbidly obese patients, with early studies indicating a 2.7-fold increase in perioperative complications and a 4.9-fold increase in serious complications (A Al-Ansari & H Hijazi, 2006). Such statistics underscore the necessity of recognizing the unique anatomical challenges posed by obesity, which can obscure critical landmarks during airway management.

Further examination reveals a lack of standardized definitions for complications, as noted by (Širanović et al., 2007), complicating the comparison of outcomes across different studies. This inconsistency emphasizes the need for rigorous methodologies in future research to ensure clarity and reliability in reporting complications associated with PDT. (Kumar et al., 2012) contribute to this discourse by comparing PDT techniques and highlighting that while PDT has largely replaced surgical tracheostomy, the complication rates may still be higher in percutaneous approaches, particularly in patients with elevated body mass index (BMI) and soft tissue thickness.

(P Sasane et al., 2020) focus on bleeding complications, revealing a low complication rate even among high-risk patients, suggesting that PDT may be a safe option for a broader demographic, including those with obesity. This contrasts with the findings of (Ghattas et al., 2011), who document a higher incidence of serious complications such as posterior tracheal wall injury in obese patients, reinforcing the need for careful patient selection and procedural adaptations.

(N. Zouk & Batra, 2011) provide a comprehensive overview of the complications associated with PDT, noting a significant rate of late complications and emphasizing the importance of ongoing monitoring. This is echoed by (Barash & S. Kurman, 2011), who suggest that with proper preoperative evaluation and technique adaptation, PDT can remain a viable option for critically ill patients, including those with obesity.

Finally, (Vudatha et al., 2013) explore PDT outcomes in a cardiac surgical intensive care unit, indicating manageable complication rates and suggesting that PDT may be an effective alternative for long-term ventilation needs in high-risk patients. Their findings contribute to the growing body of evidence supporting the safety of PDT in various clinical contexts.

In conclusion, the literature indicates that while obesity presents unique challenges in performing PDT, the procedure can still be safe and effective when performed with appropriate considerations and adaptations. The variability in complication definitions and reporting necessitates more standardized methodologies in future studies to better assess the risks associated with PDT in this patient population. Overall, the evidence supports the notion that with careful patient selection and procedural modifications, PDT can be a beneficial intervention for critically ill adults with obesity.

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