



PROLONGED INTUBATION IN THE INTENSIVE CARE UNIT: CHALLENGES, COMPLICATIONS, AND OPTIMAL TIMING OF TRACHEOSTOMY

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PROLONGIRANA INTUBACIJA U JEDINICI INTENZIVNE NEGE: IZAZOVI, KOMPLIKACIJE I OPTIMALNO VREME TRAHEOTOMIJE

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ABSTRACT

Prolonged endotracheal intubation in intensive care units (ICUs) is a frequent and clinically challenging aspect of managing critically ill patients. While intubation is essential for airway protection and adequate ventilation, its extended use is associated with a substantial risk of complications, including laryngeal and tracheal injury, ventilator-associated pneumonia, increased sedation requirements, prolonged mechanical ventilation, longer ICU stays, and higher mortality. In this setting, tracheotomy represents an important therapeutic alternative for patients anticipated to require long-term respiratory support.

This paper aims to examine the challenges of prolonged intubation, outline its most common complications, and explore the issue of optimal timing for tracheotomy. Particular attention is given to the comparison between early and late tracheotomy and their impact on key clinical outcomes, such as duration of mechanical ventilation, infection rates, patient comfort, sedation needs, and overall length of hospitalization. Evidence from the literature indicates that timely consideration of tracheotomy, combined with an individualized approach based on the patient's clinical status and prognosis of the underlying condition, may reduce complication rates, facilitate ventilator weaning, and improve overall outcomes.

Furthermore, decision-making regarding tracheotomy is influenced by several factors, including the primary diagnosis, neurological status, expected duration of ventilatory support, and the risk of extubation failure. Modern clinical practice emphasizes the use of structured weaning protocols and close multidisciplinary collaboration among intensivists, anesthesiolo-

gists, otorhinolaryngologists, and nursing staff. This coordinated approach supports early identification of appropriate candidates for tracheotomy, reduces variability in clinical practice, and enhances patient safety.

In conclusion, determining the timing of tracheotomy requires careful assessment of risks and benefits within a multidisciplinary framework. Although no universally optimal time point exists, early recognition of patients likely to need prolonged mechanical ventilation and timely intervention may provide significant clinical benefits in contemporary intensive care medicine.

Keywords: *intubation, tracheotomy, dysphagia, obesity, intensive care unit, mechanical ventilation*

SAŽETAK

Prolongirana intubacija u jedinicama intenzivne nege (JIN) predstavlja čest i klinički kompleksan problem povezan sa lečenjem kritično obolelih pacijenata. Iako je endotrahealna intubacija ključna za obezbeđivanje disajnog puta i adekvatne ventilacije, njeno produženo trajanje nosi značajan rizik od brojnih komplikacija, uključujući oštećenje larinksa i traheje, ventilator-asociranu pneumoniju, povećanu potrebu za sedacijom, produženu mehaničku ventilaciju i dužinu boravka u JIN, kao i povećan mortalitet. U tom kontekstu, traheotomija se nameće kao važna terapijska alternativa kod pacijenata kod kojih se očekuje produžena potreba za respiratornom podrškom.

Cilj rada je analiza izazova povezanih sa prolongiranom intubacijom, pregled najčešćih komplikacija, kao i razmatranje optimalnog vremena izvođenja traheotomije. Poseban fokus stavljen je na poređenje rane i kasne traheotomije u odnosu na kliničke ishode, uključujući trajanje mehaničke ventilacije, učestalost infekcija, komfor pacijenta, potrebu za sedacijom i ukupnu dužinu hospitalizacije. Rezultati dostupnih istraživanja ukazuju da pravovremeno razmatranje traheotomije, uz individualizovan pristup zasnovan na kliničkom stanju pacijenta i prognozi osnovne bolesti, može doprineti smanjenju komplikacija, lakšem odvikavanju od respiratora i poboljšanju ukupnog ishoda lečenja.

Dodatno, značajnu ulogu u donošenju odluke o traheotomiji imaju faktori kao što su osnovna dijagnoza, neurološki status pacijenta, očekivana dužina ventilatorne podrške, kao i rizik od neuspešnog ekstubiranja. Savremeni pristupi naglašavaju važnost protokola za procenu spremnosti za odvikavanje od respiratora i multidisciplinarne saradnje lekara intenzivista, anesteziologa, otorinolaringologa i medicinskih sestara. Ovakav organizovani pristup omogućava pravovremeno prepoznavanje kandidata za traheotomiju, smanjenje varijabilnosti u kliničkoj praksi i optimizaciju bezbednosti pacijenata.

Zaključuje se da odluka o vremenu izvođenja traheotomije zahteva multidisciplinarni pristup i pažljivu procenu koristi i rizika. Ne postoji univerzalno optimalan trenutak, ali rana identifikacija pacijenata sa verovatnom prolongiranom ventilacijom i pravovremena intervencija mogu biti od velikog kliničkog značaja u savremenoj intenzivnoj medicini.

Ključne reči: *intubacija, traheotomija, disfagija, gojaznost, jedinica intenzivne nege, mehanička ventilacija*

INTRODUCTION

Prolonged intubation represents a key challenge in the management of critically ill patients requiring mechanical ventilation. Although orotracheal intubation is the gold standard for short-term ventilatory support, prolonged presence of an endotracheal tube can lead to numerous complications, both local and systemic, which significantly affect the course of treatment and patient outcomes, including extended stay in the intensive care unit and increased mortality [1-5].

One of the central dilemmas in daily clinical practice is determining the optimal moment to transition from prolonged intubation to tracheotomy. Early tracheotomy may facilitate airway maintenance, reduce the need for sedation, and potentially shorten ICU stay, but it carries the risk of surgical complications, including bleeding, infection, pneumothorax, and technical difficulties in patients with specific anatomical features or comorbidities [6,7]. Conversely, delaying tracheotomy may increase the risk of permanent laryngeal injury, post-extubation dysphagia, and other complications of prolonged intubation, thereby potentially compromising patient outcomes [1,5,8].

The question of optimal tracheotomy timing is further complicated by the heterogeneity of ICU patients, differences in underlying pathology, presence of comorbidities, and technical challenges such as obesity, edema, or anatomical anomalies [9-11].

The aim of this paper is to review current evidence regarding complications of prolonged intubation, the incidence of post-extubation dysphagia, and the impact of factors such as obesity on tracheotomy timing, as well as to provide an overview of current guidelines and clinical recommendations for optimal management of these complex patients. This review also seeks to highlight gaps in existing studies and identify directions for future research that could contribute to practice standardization and improved patient outcomes.

METHODOLOGY

This paper represents a narrative literature review aimed at synthesizing the latest evidence on prolonged intubation, its complications, and optimal timing of tracheotomy in critically ill patients. The literature search included the PubMed, Web of Science, Embase, and Cochrane Library databases up to October 2025, using keywords such as “prolonged intubation,” “tracheostomy timing,” “post-extubation dysphagia,” “obesity,” “ICU,” and “mechanical ventilation”. Original research studies, systematic reviews, and meta-analyses involving adult patients on mechanical ventilation in ICUs were included.

Studies analyzing intubation duration longer than seven days, the incidence of complications such as post-extubation dysphagia or laryngeal lesions, and the impact of comorbidities on tracheotomy timing were included, while pediatric populations, studies with fewer than ten patients, or those lacking relevant clinical outcomes were excluded. The selection process involved initial screening of titles and abstracts, followed by full-text review of relevant studies. Data extracted from each study included demographics, duration of intubation, criteria for tracheotomy, incidence of post-extubation dysphagia, impact of comorbidities, mortality, and complications. The quality of each study was assessed according to study design, sample size, standardization of definitions, and risk of bias.

DISCUSSION

Prolonged intubation is a common and complex challenge in intensive care units, as approximately 10–15% of patients on mechanical ventilation require intubation longer than seven days [2]. The definition of “prolonged intubation” varies among authors, but in clinical practice, an interval of 7 to 14 days is most commonly used [3]. Long-term intubation is associated with numerous complications that may significantly affect patient outcomes. Local complications include tracheal and laryngeal lesions, mucosal ulcerations, and the development of stenosis, while systemic complications include respiratory insufficiency, post-extubation dysphagia, infections, multiorgan dysfunction, as well as psychological stress and cognitive difficulties that may accompany critical illness [1-5,10,12]. These complications often require a multidisciplinary approach and timely intervention to reduce the risk of prolonged ICU stay and improve overall clinical outcomes. In addition to physical complications, long-term intubation may lead to reduced mobility, depression, and increased anxiety, directly affecting recovery and overall quality of life.

Among these complications, post-extubation dysphagia (PED) represents a particularly important and often underestimated problem. According to the most recent systematic analysis by Yu et al. [5], PED occurs in approximately 36% of patients following orotracheal intubation, and its incidence significantly increases with intubation duration and patient age. PED not only increases the risk of aspiration pneumonia and malnutrition but may also prolong ICU stay and increase the likelihood of hospital readmission. Consequently, timely recognition and management of dysphagia represent key aspects of comprehensive clinical care, as they directly influence patient outcomes, reduce complications, and contribute to the economic efficiency of treatment. Integrating dysphagia assessment into routine ICU protocols, together with a multidisciplinary approach involving speech therapists, nutritionists, and intensive care physicians, can significantly improve quality of care and contribute to faster recovery in patients with prolonged intubation.

The timing of tracheotomy remains one of the central dilemmas in managing patients with prolonged intubation, as it requires balancing the potential benefits of the procedure with associated risks. Determining the optimal moment involves assessment of the patient’s respiratory status, presence of comorbidities, expected duration of ventilatory support, and the potential risk of complications resulting from prolonged intubation. Early tracheotomy may offer several potential advantages, including reduced sedation requirements, better tolerance of mechanical ventilation, earlier mobilization, easier airway clearance, and lower risk of laryngeal and tracheal injuries associated with prolonged translaryngeal intubation. However, early tracheotomy also has disadvantages, such as procedural risks (bleeding, infection at the incision site, damage to surrounding structures) and the possibility of performing the procedure in patients whose respiratory status might still improve without tracheotomy.

On the other hand, late tracheotomy may allow natural recovery and avoidance of an invasive procedure but is associated with the risks of complications of prolonged intubation, such as post-extubation dysphagia, respiratory insufficiency, multiorgan dysfunction, and longer ICU stay.

A prospective cohort study by Tekin and Bulut [6] showed that early tracheotomy can

significantly shorten ICU stay, while mortality and the number of sedation-free days do not show statistically significant differences compared to late tracheotomy. Similar conclusions were confirmed by the meta-analyses of Adly et al. [7] and Andriolo et al. [8], which emphasize that early tracheotomy contributes to better ventilation tolerance, reduced total sedative dose, and increased patient comfort, which may indirectly lead to faster recovery and reduction of complications related to prolonged intubation.

Comorbidities, particularly obesity, further complicate decisions regarding tracheotomy timing. A study by Yousef et al. [9] showed that morbidly obese patients often require a longer period of intubation before tracheotomy, although complication rates and mortality do not show a significant increase. These findings highlight the need for a personalized approach, in which the decision on tracheotomy should consider the underlying disease, respiratory status, nutritional condition, presence of comorbidities, and technical factors [1,5,6,9,13]. Integrating these parameters into clinical assessment enables optimization of outcomes, reduction of complications, and better planning of ventilatory support duration, thereby improving overall safety and quality of care in patients with prolonged intubation.

The use of standardized protocols for identifying patients in whom prolonged intubation is likely or unavoidable could reduce variability in clinical practice. Such protocols should integrate routine dysphagia monitoring, systematic risk assessment in obese patients, and individualized analysis of respiratory parameters. In this way, decisions regarding tracheotomy can be based on objective criteria and evidence from the literature, reducing reliance on subjective judgment and potential differences among teams [6,9,14–22].

Further prospective and multicenter studies with clearly defined criteria for early and late tracheotomy are necessary to establish consensus and optimize patient outcomes. Particular focus should be placed on developing algorithms and guidelines that include assessment of swallowing function, individualization of ventilation plans, evaluation of comorbidities, and psychological monitoring of patients. Based on current evidence, tracheotomy should be considered in patients who remain on mechanical ventilation for more than 7–10 days, especially if risk factors for prolonged intubation are present, such as advanced age, obesity, chronic lung disease, or impaired respiratory status. Routine swallowing assessment and early involvement of a speech therapist or dysphagia team can reduce the risk of aspiration pneumonia and malnutrition, while individualized tracheotomy decisions should consider ventilator parameters, sedation needs, and expected recovery trajectory. Such an integrated and standardized approach may help reduce complications, shorten ICU stay, and improve overall treatment outcomes, thereby enhancing safety and quality of care for patients with prolonged intubation.

CONCLUSION

Prolonged intubation remains a significant challenge in the management of critically ill patients, with the potential for numerous complications, including post-extubation dysphagia affecting more than one-third of patients. Early tracheotomy may shorten ICU stay and facilitate ventilatory support management, including adjustment of ventilator param-

ters, but does not guarantee reduced mortality. Obesity may delay the decision to perform tracheotomy without negatively affecting short-term outcomes. Optimal tracheotomy timing should be determined through a multidisciplinary approach, with individualized assessment of clinical condition and comorbidities.

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