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Extubation protocol in critically ill patients: evidence-based strategies for a tertiary public hospital in the Federal District

Extubation protocol in critically ill patients: evidence-based strategies for a tertiary public hospital in the Federal District.

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Abstract

Introduction: Extubation in intensive care units (ICUs) is a complex process with a high failure rate and significant impact on clinical outcomes. In a public tertiary hospital in the Federal District, the lack of a standardized protocol results in variations in procedures and risks to patients. The literature highlights the importance of standardization to reduce complications and mortality. **Objective:** Propose an institutional extubation protocol for critically ill patients in the Intensive Care Units of a public hospital in the Federal District, aiming at standardizing the criteria, conduct and care involved in this procedure. **Methodology:** This study consisted of a narrative review of literature with a qualitative approach. The bibliographic search was conducted in the PubMed, Scielo and Embase databases. The study was structured in three main stages: survey and analysis of the scientific literature; comparison between the current recommendations found in the literature and the extubation practices adopted in the hospital's ICUs, based on analysis of institutional documents; proposal of an institutional extubation protocol based on the verified results. **Results:** Evidence suggests that factors such as a positive fluid balance, the presence of abundant secretions, advanced age, and compromised nutritional status increase the risk of extubation failure. Studies show that structured and standardized protocols, including functional testing and multidisciplinary management, increase the extubation success rate, especially in surgical and neurocritical patients. Corticosteroid prophylaxis, primarily dexamethasone and methylprednisolone, has been shown to reduce post-extubation complications.

Furthermore, early extubation, when clinically feasible, is associated with better outcomes. These findings support the proposal of an institutional protocol to standardize criteria, procedures, and care for extubation in ICUs. **Conclusion:** Based on the study, it is possible to conclude that there are significant variations and gaps in extubation practices across the hospital's ICUs, which reinforces the need for a standardized institutional protocol. The literature review highlighted evidence-based criteria and practices that can be adapted to local circumstances, and the analysis of available resources demonstrated the feasibility of implementing a unified protocol that promotes greater safety, uniformity, and quality in the care of critically ill patients.

Keywords: Intensive Care Units. Airway Extubation. Clinical Protocols.

Summary

Introduction: Extubation in intensive care units (ICUs) is a complex process with a high failure rate and a significant impact on clinical outcomes. In a tertiary public hospital in the Federal District, the absence of a standardized protocol results in variations in procedures and risks for patients. The literature highlights the importance of standardization to reduce complications and mortality. Objective: To propose an institutional extubation protocol for critically ill patients in the Intensive Care Units of a public hospital in the Federal District, aiming to standardize the criteria, conduct, and care involved in this procedure. Methodology: This study consisted of a narrative literature review with a qualitative approach. The bibliographic search was conducted in the PubMed, SciELO, and Embase databases. The study was structured in three parts.

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Main steps: review and analysis of scientific literature; comparison between current recommendations found in the literature and extubation practices adopted in the hospital's ICUs, based on the analysis of institutional documents; and proposal of an institutional extubation protocol based on the verified results. Results: Evidence suggests that factors such as positive fluid balance, presence of abundant secretions, advanced age, and compromised nutritional status increase the risk of extubation failure. Studies demonstrate that structured and standardized protocols, including functional tests and multidisciplinary management, increase the success rate of extubation, especially in surgical and neurocritical patients. Prophylaxis with corticosteroids, mainly dexamethasone and methylprednisolone, has been shown to reduce post-extubation complications. In addition, early extubation, when clinically feasible, is associated with better outcomes. These findings corroborated the proposal of an institutional protocol to standardize criteria, procedures, and care for extubation in ICUs. Conclusion: Based on the study, it is possible to conclude that there are significant variations and gaps in extubation practices in the hospital's ICUs, which reinforces the need for a standardized institutional protocol. The literature review highlighted evidence-based criteria and practices that can be adapted to local circumstances, and the analysis of available resources demonstrated the feasibility of implementing a unified protocol that promotes greater safety, uniformity, and quality in the care of critically ill patients.

Keywords: Intensive Care Units. Airway Extubation. Clinical Protocols.

Introduction

Extubation of critically ill patients in Intensive Care Units (ICUs) is a complex procedure requiring well-defined criteria and evidence-based practices to reduce failures. However, in a tertiary public hospital in the Federal District, there is no unified institutional protocol to standardize the procedure in all ICUs. Each unit follows its own practices, and variations include the use of the cuff leak test, functional assessments, and corticosteroid administration. Other than that, key readiness parameters such as maximal inspiratory and expiratory pressures are often not assessed due to structural limitations and absence of guidelines. This heterogeneity may compromise patient safety, and extubation efficacy, while also making multidisciplinary integration more difficult.

The procedure shows that failure rates vary from 13.7% to 25.7% and are associated with longer ventilation time, extended hospitalization, higher medical costs, and mortality (Parada-Gereda et al., 2023; Wang et al., 2025). According to Cinotti et al. (2022), the temporary withdrawal of ventilation support is associated with reduction in complications such as hospital-acquired pneumonia, prolonged hospitalization, and increased healthcare costs, however, the variables that predict extubation success things are still uncertain.

According to Wang et al. (2025), comprehensive weaning and extubation protocols can prevent respiratory failure, reduce reintubation rates, and decrease mortality. Standardizing these processes minimizes variations in clinicians' judgment and the risks associated with the post-extubation period. Zajic et al. (2023) point out that the decision regarding the timing of extubation is generally guided by the patient's current physiology and the perceived safety of the procedure. However, other factors also influence this decision, such as the possibility of difficult airway, the

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need for additional stabilization, the expected complexity of post-extubation care, the team's workload, and even the time of day when extubation would occur. The authors highlight that there is still limited knowledge about how extubation timing affects patient-centered clinical outcomes, revealing an important gap in both literature and clinical practice.

In this context, given the absence of a standardized institutional extubation protocol in the ICUs of a tertiary public hospital in the Federal District, it becomes essential to develop a proposal that considers both current scientific recommendations and the institution's structural and clinical reality. The creation of a comprehensive, evidence-based protocol can help standardize practices while respecting the specificities of each unit and will serve as a decision-support tool for the multidisciplinary team.

By incorporating objective clinical criteria, such as ventilatory parameters and strategies for managing the risk of post-extubation stridor, this protocol can reduce complications, optimize resources, and strengthen patient safety. This standardization, both flexible and evidence-based, represents an improvement in the quality of intensive care and an important milestone in consolidating safe and effective practices within the public hospital setting.

Methodology

The general objective of this study is to propose an institutional extubation protocol for critically ill patients in the Intensive Care Units of a tertiary public hospital in the Federal District, aiming to standardize the criteria, procedures, and care involved in this process. The specific objectives are: to analyze the criteria currently used for extubation in the hospital's different Intensive Care Care Units, identifying similarities, divergences, and gaps in clinical practice; to assess the current scientific literature on extubation protocols in critically ill patients in order to support the development of an evidence-based institutional protocol; and to investigate the availability and use of diagnostics and therapeutic resources across the hospital's ICUs, with the goal of mapping the real possibilities for implementing a unified protocol.

Extubation of critically ill patients

Extubation of critically ill patients undergoing mechanical ventilation represents a decisive moment in managing an Intensive Care Unit (ICU), as it is directly associated with important clinical outcomes such as length of hospital stay, morbidity, and mortality (Li et al., 2024). The of extubation failure are severe, including the need for reintubation, prolonged mechanical ventilation, increased length of hospitalization, and a higher risk of mortality. Among the most common factors leading to extubation failure are inadequate cough strength, respiratory insufficiency after extubation, excessive airway secretions, and neurological deficits (Li et al., 2024).

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The findings of Arcanjo and Beccaria (2023) indicate that certain clinical factors are significantly associated with extubation failure in patients admitted to intensive care units. In a retrospective study involving 480 patients, the extubation failure rate was 13.5%. Compared with Those who were successfully extubated, patients who experienced failure had a more positive fluid balance, higher APACHE II scores (indicating greater clinical severity), weak cough in nearly half of the cases (47.7%), and a higher prevalence of abundant pulmonary secretions (47.7%). conversely, patients who were successfully extubated had a more negative fluid balance, lower clinical severity, and a lower prevalence of weak cough. The authors conclude that a positive fluid balance and the inability to effectively clear respiratory secretions, particularly when associated with weak cough, are significant predictive factors for extubation failure.

Also evaluating predictive factors for extubation failure in critically ill patients, Kifle et al. (2022) conducted a prospective observational study that included 123 patients aged 18 years or older who had been on mechanical ventilation for at least 48 hours and who tolerated the spontaneous breathing trial (SBT). The patients were divided into two groups: extubation success and extubation failure. The observed extubation failure rate was 34.15% (42 patients). Three independent and Statistically significant predictive factors for failure were identified: the presence of moderate to abundant secretions, age over 60 years, and prolonged mechanical ventilation (ten days or more). Specifically, patients with moderate to abundant secretions had a 3.5-fold greater risk of failure, those older than 60 years had more than a 4-fold increased likelihood of failure, and prolonged mechanical ventilation increased this risk by nearly 5-fold.

In the same direction, Chuang et al. (2023) investigating the relationship between low body weight and extubation failure in critically ill patients who had undergone mechanical ventilation for over 72 hours. The retrospective study included 268 patients who passed the SBT and were extubated in a planned manner, with an overall extubation failure rate of 7.1%. Underweight patients had a significantly higher risk of failure compared with patients of normal weight and overweight individuals. In the multivariate analysis, being underweight increased the likelihood of failure by nearly four times (aOR = 3.80), and lower maximal inspiratory pressure was also associated with the negative outcome. The results indicate that both nutritional status and respiratory muscle strength are important factors to be assessed before extubation, as they may directly influence the success of the procedure and the need for reintubation.

Considering this, identifying objective and reliable parameters that can predict extubation success is, therefore, one of the main challenges faced by multidisciplinary teams in high-complexity settings.

Zajic et al. (2023), in turn, investigating whether the timing of extubation in tracheally intubated patients admitted to intensive care units (ICUs) after surgery — either on the day of

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admission (day 1) or on the first postoperative day (day 2) is associated with differences in clinical outcomes. Through a retrospective analysis of data from an Austrian ICU registry, 52,982 adults patients undergoing elective or emergency surgeries between 2012 and 2019 were included, all of whom were extubated either on day 1 or day 2 after surgery. The results showed that hospital mortality was 3.3% among patients extubated on day 1, compared with 5.9% among those extubated on day 2. Furthermore, 1.3% of patients extubated on day 1 experienced agitation or excessive sedation after extubation during their ICU stay, whereas this number was 3.8% among those extubated on day 2. Based on these findings, the authors concluded that immediate extubation, as soon as clinicians give it feasible, is associated with better outcomes and may therefore be preferred in postoperative intubated patients admitted to the ICU.

Objective physiological indicators in extubation planning

In this context, Li et al. (2024) conducted a prospective observational study aimed at evaluating the feasibility and clinical usefulness of measuring cough decibel level as a predictor marker of extubation outcomes in mechanically ventilated patients. Conducted in three interdisciplinary medical-surgical ICUs in China, the study included 71 patients, of whom 55 were successfully extubated and 16 experienced failures. The results showed significant differences between the groups in terms of duration of mechanical ventilation and length of stay in both the ICU and the hospital, although baseline characteristics were similar. The most relevant finding, however, concerned cough intensity measured in decibels (dB): patients with extubation failure exhibited significantly lower levels (78.69 ± 8.23 dB) compared with those who were successfully extubated (92.28 ± 7.01 dB). ROC curve analysis identified a cutoff point of 85.77 dB as the optimal threshold for predicting extubation failure, with a sensitivity of 80% and a specificity of 91.67%.

Considering the Rapid Shallow Breathing Index (RSBI), also known as the Tobin Index, measured serially to predict extubation success in ICU patients under mechanical ventilation, Turhan et al. (2024) conducted a study with 86 patients, divided into two groups: success (53 patients) and failure (33 patients) in extubation. There was no significant difference between the groups regarding age or duration of intubation. However, the RSBI-1a and RSBI-2 values were significantly lower in the success group, with particular emphasis on RSBI-2a, whose median was 80 in the successful patients and 92 in those who failed (p = 0.001). In addition, the variation in RSBI (ÿRSBI) was greater in the failure group. ROC analysis showed that an RSBI-2a ÿ 72 and a ÿRSBI ÿ ÿ3 are good predictors of success, with areas under the curve (AUC) of 0.715 and 0.648, respectively. When combined, these two criteria increased the likelihood of successful extubation by 28.48 times. Therefore, the lower the Tobin Index (especially below 72) and the more it decreases over time (negative ÿRSBI), the higher the probability of extubation success. Thus, the authors conclude that serial measurement of the Tobin

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Index is an effective tool for assessing readiness for extubation in ICU patients.

Image diagnosis as a decision-making tool

Parada-Gereda et al. (2023) indicates that diaphragmatic ultrasound is an effective tool for predicting successful weaning from mechanical ventilation. In a systematic review and meta-analysis of 26 studies (19 included in the meta-analysis, totaling 1,204 patients), the authors evaluated two parameters: diaphragmatic excursion and diaphragmatic thickening fraction. Both demonstrated good diagnostic accuracy, with sensitivity and specificity of approximately 80% and an area under the ROC curve of 0.87, indicating high predictive power. The thickening fraction showed slightly higher sensitivity (0.85) and slightly lower specificity (0.75), while diaphragmatic excursion showed both values at 0.80. The analysis also revealed significant heterogeneity among the studies, influenced, for example, by patient positioning during the examination. Excluding studies with atypical cutoff values improved accuracy, and the type of test used (pressure support vs. T-tube) did not show relevant differences. In conclusion, the authors reinforce that diaphragmatic ultrasound is a promising and accurate strategy to support clinical decision-making regarding patient extubation.

The study by Dres et al. (2021) investigated whether the intensity of dyspnea and early ultrasound assessment of the respiratory musculature could predict extubation failure in critically ill patients. Conducted in two ICUs, in France and Canada, it included 122 patients who had been intubated for at least 48 hours and were extubated after a successful SBT. The assessment was performed within two hours after extubation, using dyspnea scales (VAS and IC-RDOS), ultrasound examination of the parasternal intercostal muscles and the diaphragm, and the MRC muscle strength score. Extubation failure occurred in 17% of cases. These patients exhibited higher dyspnea scores, greater relative thickening of the intercostal muscles compared with the diaphragm (median 0.9 versus 0.3), and lower overall muscle strength (median MRC 45 versus 52). The ratio between muscles thickenings had the highest accuracy for predicting failure (AUC 0.81), followed by dyspnea scores (VAS 0.78 and IC-RDOS 0.74), indicating that these tools may be useful for early identification of patients at risk of reintubation.

The use of technology in decision-making for the extubation of critically ill patients

The use of artificial intelligence has shown potential for accurately predicting extubation success in ICU patients undergoing mechanical ventilation due to respiratory failure, thereby increasing the accuracy of clinical decisions related to extubation (Otaguro et al., 2021).

Otaguro et al. (2021) demonstrated that machine-learning algorithms, especially LightGBM, can predict extubation success in ICU patients on mechanical ventilation with high accuracy. machine learning is a field of computer science that develops systems capable of learning from environmental

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data and, based on that, making predictions and decisions when facing new situations. In the context of intensive care medicine, the authors suggest that this technology may improve the prediction of extubation success in mechanically ventilated patients.

In their results, Otaguro et al. (2021), based on a retrospective analysis of data from 117 patients, found that reintubation occurred in 11.1% of cases and that the duration of mechanical ventilation was the most important variable for predicting failure, followed by respiratory parameters and level of consciousness. The LightGBM model achieved superior performance, with an AUC of 0.950 and a sensitivity of 96%, suggesting that the use of artificial intelligence may be a valuable tool to support clinical decision-making and reduce extubation failure rates.

Hur et al. (2021) developed and validated predictive models for unplanned extubation (UE) in ICU patients using machine-learning algorithms. Conducted in a large university hospital in Seoul, South Korea, the retrospective study analyzed 6,914 extubation cases between 2010 and 2018, of which 248 were EU. The UE group showed a higher proportion of men, greater use of physical restraints, lower frequency of surgeries, and a higher incidence of events during night shifts. In In addition, this group had higher rates of 24-hour reintubation and hospital mortality. Four models were tested: Random Forest (RF), Logistic Regression (LR), Artificial Neural Network (ANN), and Support Vector Machine (SVM). The best-performing model was RF, with an AUROC of 0.787, followed by LR (0.762), ANN (0.763), and SVM (0.740). The results indicate that the use of machine-learning algorithms can be a promising tool to predict UE, contributing to preventive actions and improvements in patient safety in ICUs.

Corticosteroid administration

The study by Feng et al. (2023) evaluating the effectiveness of different systemic corticosteroids in preventing post-extubation stridor and reintubation in adults undergoing mechanical ventilation with planned extubation. The analysis included 11 randomized clinical trials comparing methylprednisolone, dexamethasone, hydrocortisone, and placebo. The results showed that both dexamethasone (5 mg every 6 hours, also administered before extubation) and Methylprednisolone (20 mg every 6 hours, initiated before extubation) significantly reduced the risk of post-extubation stridor compared with placebo (OR = 0.39 and OR = 0.22, respectively). Methylprednisolone was also more effective than hydrocortisone (OR = 0.24) and showed a trend toward superiority over dexamethasone (OR = 0.55, with 95% CI including the null value). Regarding the risk of reintubation, both dexamethasone (OR = 0.34) and methylprednisolone (OR = 0.42) provided significantly more effective than placebo. Cluster analysis confirmed that dexamethasone and Methylprednisolone were the treatments associated with the lowest risks of stridor and reintubation, including in subgroups of patients with a positive cuff-leak test, suggesting greater prophylactic

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benefit in these situations.

Kuriyama, Umakoshi, and Sun (2017) evaluated the efficacy and safety of prophylactic systemic corticosteroids before elective extubation in adults on mechanical ventilation. Eleven Randomized clinical trials were included, totaling 2,472 participants. The results showed that the use of prophylactic corticosteroids significantly reduced the incidence of post-extubation respiratory events (RR = 0.43; 95% CI: 0.29–0.66) and the need for reintubation (RR = 0.42; 95% CI: 0.25–0.71), when compared with placebo or no treatment. The benefits were more evident in high-risk patients, identified mainly by the cuff-leak test, with even more pronounced reductions in respiratory events (RR = 0.34) and in reintubation (RR = 0.35). The authors conclude that it is reasonable to administer prophylactic corticosteroids before extubation in patients at high risk of airway obstruction as a strategy to prevent stridor and reintubation.

Carvalho (2019), in turn, evaluated the effectiveness of dexamethasone in reducing extubation failure in children and adolescents admitted to a Pediatric Intensive Care Unit (PICU) who had been on mechanical ventilation for more than 48 hours and presented relevant clinical risk factors. The 85 eligible patients were divided into two groups: a treatment group (TG), which received intravenous dexamethasone (a loading dose of 1 mg/kg followed by 0.25 mg/kg every 6 hours), and a control group (CG), which did not receive corticosteroids prior to extubation. The results showed that the treatment group had a lower Westley score of 60 minutes after extubation, indicating a lower degree of laryngeal stridor, and a lower frequency of respiratory distress between 6 and 48 hours after extubation. However, the reintubation rate was similar between the two groups, with no statistical significance significance. Thus, the study concluded that although dexamethasone demonstrated benefits in reducing clinical signs of respiratory distress and laryngeal stridor, there was no significant difference in preventing extubation failure, as measured by the need for reintubation.

Protocol proposed by literature

Burns et al. (2024) evaluated, in a randomized clinical trial with 797 critically ill patients, the effects of screening frequency (once daily versus more frequent) and SBT technique (pressure-support versus T-piece) on the time to successful extubation. The first technique, known as the pressure-support SBT, used pressure support between >0 and ÿ8 cm HÿO and PEEP between >0 and ÿ5 cm HÿO, providing partial assistance to the patient during the trial. The second technique, the T-piece SBT, allowed the patient to breathe spontaneously without any ventilatory assistance, requiring greater respiratory effort. Both tests were performed for a period of 30 to 120 minutes after screening indicated that the patient was ready for the procedure. The results showed that, overall, there was no Statistically significant difference between the isolated strategies of screening frequency or SBT technique regarding the time to sustain extubation for at least 48 hours. However, an unexpected

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interaction was observed: the combination of more frequent screening with pressure-support SBT resulted in a longer time to successful extubation (HR 0.70; 95% CI 0.50–0.96; p = 0.02), indicating that this strategy may delay ventilator release. Daily screening combined with pressure-support SBT, on the other hand, did not show a significant reduction in extubation time compared with the T-SBT piece.

Complementing the discussion on mechanical ventilation weaning strategies, Desantis et al. (2023) conducted a retrospective analysis focusing on an exclusively surgical population, which is known to be more vulnerable to complications during the extubation process. The study the evaluation effects of implementing a structured protocol based on Spontaneous Awakening Trials (SAT) and SBT in the surgical ICU of Heidelberg University Hospital. The comparison between the pre- and post-protocol adoption periods (2018 to 2020) showed a significant increase in the rate of success extubation — defined as the absence of reintubation until ICU discharge — with 82% in the intervention group compared with 64% in the control group ($p < 0.004$).

In contrast to the findings of Burns et al. (2024), which suggest caution when combining certain strategies, the results of Desantis et al. (2023) reinforce that, even in more complex clinical contexts, the standardization of practices through well-defined protocols can positively contribute to patient outcomes.

Cinotti et al. (2022), in turn, investigating strategies for weaning from invasive mechanical ventilation (IMV) in neurocritical patients, a group with high complexity and an elevated risk of extubation failure. The observational, prospective study was conducted in 73 intensive care units (ICUs) across 18 countries, between 2018 and 2020, including 1,512 patients with a Glasgow Coma Scale score ÿ12 who had been on IMV for at least 24 hours and underwent an extubation attempt or tracheostomy. Among the 1,193 patients who attempted extubation, 19.4% experienced failure, which was associated with longer IMV duration (median of 14 days versus 6 days) and higher ICU mortality (8.7% versus 2.4%). A predictive score for extubation success was developed based on 20 variables, showing good accuracy in the training cohort (AUC 0.79) and moderate accuracy in the validation cohort (AUC 0.71). Patients who underwent primary tracheostomy (21.1%), however, had longer IMV duration and higher mortality than those who underwent an extubation attempt, regardless of success.

The protocol developed by Wang et al. (2025) is based on the work of a multidisciplinary team composed of professionals from medicine, nursing, anesthesiology, and respiratory physiotherapy. To develop the protocol, the authors compiled the best available evidence and combined it with clinical experience. Subsequently, a Delphi survey was conducted with 17 specialists in intensive care, critical-care nursing, clinical anesthesia, and respiratory physiotherapy to review and refine the protocol content. The two consultation rounds showed high response rates

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(100% and 94.1%) and high expert authority coefficients (0.94 and 0.93), in addition to statistically significant Kendall's concordance coefficients (0.152 and 0.198; $p < 0.001$). The final protocol consists of three first-level indicators, 14 second-level indicators, and 34 third-level indicators, covering extubation assessment, procedure execution, and post-extubation management. The authors concluding that the protocol developed is scientific, practical, and reliable, offering a structured guideline for the safe extubation of critically ill patients.

It is noteworthy that the protocol was developed based on the Knowledge-to-Action Framework (KTA). In the extubation assessment phase, the following criteria are considered: improvement or resolution of the cause of invasive mechanical ventilation (IMV); spontaneous and regular breathing with adequate gas exchange; appropriate oxygenation parameters (PaOÿ/FiOÿ ÿ 150–200 mmHg or SaOÿ ÿ 90% with FiOÿ of 40%–50% and PEEP of 5–8 cmHÿO), pH > 7.25, and appropriate partial pressure of COÿ; hemodynamic stability (mean arterial pressure > 60 mmHg and without the use of high-dose vasopressors); preserved level of consciousness (GCS ÿ 8); successful completion of the SBT lasting 30 minutes to 2 hours; and a patent airway, assessed through the cuff leak test when there is risk of stridor. In addition, airway protection capacity (effective cough and controlled secretions) and the risk of reintubation (including the presence of a difficult airway) are evaluation (Wang et al., 2025).

In the extubation execution phase, the protocol requires preparation of the necessary materials (suction device, syringes, oxygen therapy equipment, reintubation tools, among others), as as well as the presence of at least two experienced professionals, with additional staff reinforcement in high-risk cases. Standard precautionary measures must be implemented, including the use of PPE as needed. Patient and family education regarding the procedure and the associated risks is also recommended. The ideal patient position is with the head of the bed elevated to 45°, or in left lateral decubitus if there is concern about gastric emptying. Finally, the protocol emphasizes that post-extubation management should consider the use of devices such as high-flow nasal cannula for patients with hypoxemia, intolerance to non-invasive ventilation, or high oxygen demands, depending on clinical condition (Wang et al., 2025).

Despite the existence of structured guidelines, evidence suggests that the practical execution of extubation may diverge from recommendations. Hofmaenner et al. (2020) evaluated the use of eye-tracking technology to analyze the visual behavior of professionals during the extubation process in intensive care units. The observational study involved 22 participants and examined variables such as mean fixation time, dwell time, and revisit frequency across 18 areas of interest, with the patient being the most observed area. Despite this, many participants ignored monitored parameters considered important, such as respiratory rate on the ventilator (checked by only 54%), tidal volume (59%), and peak pressure (63.6%). Experienced physicians focused more visual time on the patient

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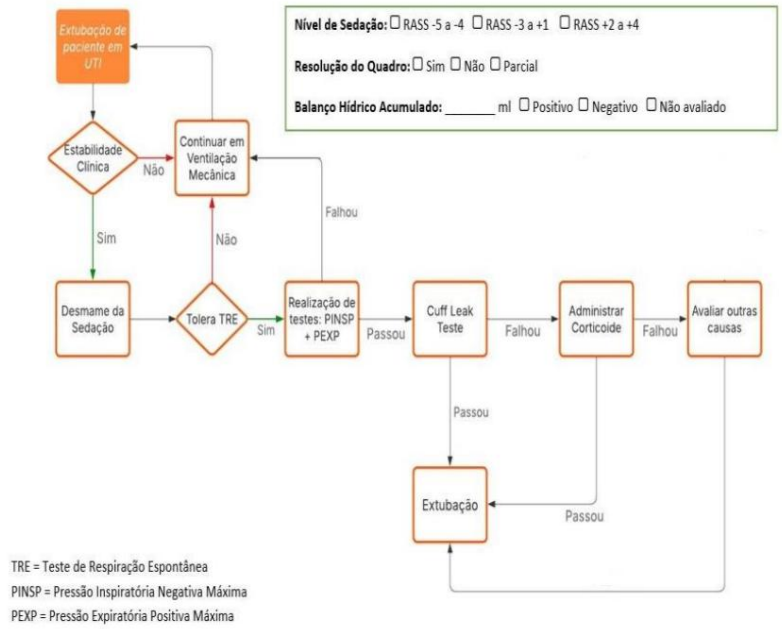
and less on the monitors, revealing behavioral differences according to experience level. The study concluding that there is a mismatch between what professionals claim to value and what they observe, reinforcing the need for standardized extubation processes to improve patient safety.

Proposed Protocol

Based on the reviewed evidence, a protocol was developed that can be applied across the different ICUs of the hospital, aiming to standardize the general actions involved in the extubation process and to enhance safety and consistency in clinical practice (Figure 1). However, the implementation of this protocol does not eliminate the need to consider the particularities of each unit and the specific characteristics of each patient. Individualized care must be maintained, respecting clinical conditions, available resources, and the expertise of local teams, to ensure patient-centered and appropriate management in every case

Figure 1. Proposed extubation protocol for patients admitted to the ICU



Source: Elaborated by the author (2025).

It is important to note that the use of corticosteroids has been primarily indicated for patients who present a negative cuff leak test result, as this finding is associated with a higher risk of laryngeal stridor and extubation failure. The literature describes the use of different corticosteroids, such as methylprednisolone, dexamethasone, and hydrocortisone, with varying protocols regarding dosage and timing of administration. However, despite the promising results, research on this topic is still limited, and the available data is not sufficiently consolidated to allow universal standardization of clinical practice.

Final Considerations

This study proposed and supported the development of an institutional extubation protocol

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for critically ill patients in the Intensive Care Units of a public hospital in the Federal District, aiming to promote the standardization of the criteria, procedures, and care related to this complex process.

The analysis of current practices adopted across the different ICUs revealed significant heterogeneity and gaps, particularly in the use of predictive parameters and essential diagnosis resources, which reinforces the need for standardization to ensure safety and effectiveness in extubation. The review of the current scientific literature highlighted relevant clinical factors, the effectiveness of multidisciplinary approaches, and the positive impact of structured protocols on reducing failures and post-extubation complications.

Finally, the investigation into the availability and use of resources showed that, despite some structural limitations, there are real conditions for the implementation of a unified protocol, provided it is adapted to local specificities. Thus, the proposed protocol represents an important advancement in the quality of respiratory care in the hospital's ICUs, with the potential to improve clinical outcomes and promote greater integration among multidisciplinary teams. It is recommended that future steps include the practical validation of the protocol and its incorporation into continuing education programs to maximize its effectiveness.

References

ARCANJO, Ana Beatriz Braga; BECCARIA, Lúcia Marinilza. *Factors associated with extubation failure in an intensive care unit: a case-control study.* Revista Latino-Americana de Enfermagem, v. 31, p. e3864, 2023.

BURNS, Karen EA et al. *Frequency of Screening and Spontaneous Breathing Trial Techniques: A Randomized Clinical Trial.* JAMA, vol. 332, n. 21, p. 1808-1821, 2024.

CARVALHO, Haroldo Teófilo. *The use of dexamethasone in the prevention of extubation failure in a pediatric intensive care unit: evaluation and development of a protocol in the Pediatric ICU of the Hospital das Clínicas de Botucatu – Randomized controlled clinical study.* Dissertation (Master's) — Universidade Estadual Paulista (Unesp), 2019.

CHUANG, Chung-Yeh et al. *Underweight predicts extubation failure after planned extubation in intensive care units.* PLoS One, v. 18, no. 4, p. e0284564, 2023.

CINOTTI, Raphaël et al. *Extubation in neurocritical care patients: the ENIO international prospective study.* Intensive Care Medicine, vol. 48, no. 11, p. 1539-1550, 2022.

DESANTIS, Marianna et al. *Implementation of a spontaneous awakening/spontaneous breathing trial protocol in a surgical intensive care unit: a before and after study.* Minerva Anestesiologica, v. 89, no. 4, p. 306-315, 2022.

DRES, Martin et al. *Dyspnoea and respiratory muscle ultrasound to predict extubation failure.* European Respiratory Journal, vol. 58, no. 5, 2021.

FENG, I.-Jung et al. *Comparative efficacies of various corticosteroids for preventing postextubation stridor and reintubation: a systematic review and network meta-analysis.* Frontiers in Medicine, vol.

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10, p. 1135570, 2023.

HOFMAENNER, Daniel A. et al. *The doctor's point of view: eye-tracking as an investigative tool in the extubation process in intensive care units. A pilot study.* Minerva Anestesiologica, v. 86, no. 11, p. 1180-1189, 2020.

KIFLE, Natnael et al. *Incidence of extubation failure and its predictors among adult patients in intensive care unit of low-resource setting: a prospective observational study.* PLoS One, v. 17, no. 11, p. e0277915, 2022.

KURIYAMA, Akira; UMAKOSHI, Noriyuki; Sun, Rao. *Prophylactic corticosteroids for prevention of postextubation stridor and reintubation in adults: a systematic review and meta-analysis.* Chest, vol. 151, no. 5, p. 1002-1010, 2017.

KURIYAMA, Akira; JACKSON, Jeffrey L.; KAMEI, Jun. *Performance of the cuff leak test in adults in predicting post-extubation airway complications: a systematic review and meta-analysis.* Critical Care, vol. 24, p. 1-11, 2020.

LEWIS, Kimberley et al. *Cuff leak test and airway obstruction in mechanically ventilated intensive care unit patients: a pilot randomized controlled clinical trial.* Annals of the American Thoracic Society, vol. 19, no. 2, p. 238-244, 2022.

LI, Huan et al. *Decibel level of coughing as a predictor of extubation outcome in mechanically ventilated intensive care patients: a prospective, observational study.* Intensive and Critical Care Nursing, v. 85, p. 103800, 2024.

OTAGURO, Takanobu et al. *Machine learning for prediction of successful extubation of mechanically ventilated patients in an intensive care unit: a retrospective observational study.* Journal of Nippon Medical School, vol. 88, no. 5, p. 408-417, 2021.

PARADA-GEREDA, Henry M. et al. *Effectiveness of diaphragmatic ultrasound as a predictor of successful weaning from mechanical ventilation: a systematic review and meta-analysis.* Critical Care, vol. 27, no. 1, p. 174, 2023.

TURHAN, Semin et al. *Predictive Value of Serial Rapid Shallow Breathing Index Measurements for Extubation Success in Intensive Care Unit Patients.* Medicine, vol. 60, no. 8, p. 1329, 2024.

WANG, Li et al. *Construction of an extubation protocol for adult tracheal intubation patients in the intensive care unit: A Delphi study.* Australian Critical Care, vol. 38, no. 2, p. 101111, 2025.

ZAJIC, Paul et al. *Association of immediate versus delayed extubation of patients admitted to intensive care units postoperatively and outcomes: A retrospective study.* PLoS One, v. 18, no. 1, p. e0280820, 2023.