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Assessment of the incidence and associated factor of failed extubation at adult intensive care units at Tikur Anbessa Specialized Hospital and Menelik II Compressive Specialized Hospital in Addis Ababa, Ethiopia.

Investigator: Dr. Emebet Damtew (ACCPMRIII)

Advisors:Dr. Semira Endris (MD,Assistance Professor of Anesthesiology)

A RESEARCH THESIS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY SCHOOL OF MEDICINE, DEPARTMENT OF ACCPM IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR SPECIALTY CERTIFICATE IN ACCPM

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Table of Contents

List of tables

List of figures

Summary

Background: Extubation Failure (EF) is one of the common events in the intensive care unit (ICU). The incidence of EF can be as high as 17%. While most articles define EF as re-intubation within 72 hours after planned extubation, some studies narrowed it down to 24 hours.

Objective: Assessment of the incidence and associated factor of failed extubation at adult ICUs at Tikur Anbessa specialized hospital and Menelik II comprehensive specialized hospital in Addis Ababa, Ethiopia.

Methods: From October to March 2024, a hospital-based cross-sectional study was conducted in the intensive care unit, which fulfilled the inclusion criteria at Tikur Anbessa specialized hospital and Menelik II comprehensive specialized hospital in Addis Ababa, Ethiopia.. The data collection method included questionnaires and patient chart reviews , which were fulfilled by the ICU physicians. Then the date collected was entered into Epi-data software (version 4.6.0.2) and was analyzed using the Statistical Package for the Social Sciences (SPSS version 25) statistical software. Independent and dependent variable were analyzed using binary logistic regression to determine if the variables were independently predictive of failed extubation. Odd ratio, P-value, and 95% confidence interval were calculated to differentiate risk factors and to assess association strength. Variables with a P-value of 0.25 on bivariate analysis were evaluated using multivariable analysis, and a P-value less than 0.05 was used as the cut point to test the statistical significance.

Result: In this study, the prevalence of extubation failure was significantly palpable (21%). The determinant factors for extubation failure were:

- Age (greater than 60 years of age) compared to those of 15-30 years olds (AOR=2.7, 95%CI=1.26, 28.74)
- Length of stay on mechanical ventilation (greater than 10 days) compared to those of LOS mechanical ventilation less or equal to 4 days (AOR=14.9, 95%CI=4.17, 54.80),
- Systolic blood pressure of (greater or equal to 140) compared to those SBP of 90-129 (AOR=18.5, 95%CI=1.91, 78.63)
- GCS of 5-7T compared to those of GCS 8-10T (AOR=16.7, 95%CI=2.09, 34.12), and
- Residency of internal medicine compared to those of residency ACCPM (AOR=2.7, 95%CI=1.30, 23.69).

Key words: Failed extubation, associated factor, LOS

Acronyms and abbreviations

- COPD: Obstructive pulmonary disease
- EF: Extubation failure

- ETT: Endotracheal tube
- ICU: Intensive care unit
- PLOS: prolonged lengths of stay
- SBT: spontaneous breathing trial
- TASH: Tikur Anbessa Specialized Hospital
- TT: Tracheostomy tube
- UE: Unplanned extubation
- MSSCH: Menelik II hospital,

1.Introduction

1.1 Background

Critical care, or intensive care, is a multidisciplinary and interprofessional specialty devoted to the whole management of patients and organ support to maintain life when an organ system is critically compromised. (1). Half to two thirds of critically ill patients who are admitted need mechanical ventilation and endotracheal intubation, either as an organ support for patients with

hemodynamic instability or decreased consciousness or as a lifesaving intervention for respiratory failure patients (2–3).

The decision of extubation is considered as soon as a patient meets weaning criteria and successfully passes a spontaneous breathing trial (SBT). An extubating patient on a ventilator is not a risk-free for surgery, though. In intensive care units, 5–20% of planned extubations end in failure, and up to 50% of those cases necessitate reintubation within 72 hours (4–7).

In contrast, studies show that between 10–15% of patients who are extubated due to severe respiratory failure need reintubation. When patients are reintubated after being successfully extubated, their clinical results tend to be worse, and they often end up staying longer in intensive care units (ICU) (8–9).

The risk of failed extubation is approximately 10% and is associated with a poor prognosis (10-11). An extubation failure is defined as the need for reintubation within 48 hours of tube removal and the absence of mechanical assistance for 48 hours after extubation (12-13). Extubation failure (EF) is one of the most common events in the ICU. Research shows that incidence of EF can be as high as 17%. While most studies define EF as re-intubation within 72 hours after planned extubation, some studies narrowed it down to 24 hours (14).

The standard test for extubation readiness is the spontaneous breathing trial, often performed by simply disconnecting the patient from the ventilator and providing additional oxygen. Among patients who pass this test, approximately 15% subsequently fail extubation, a rate usually considered acceptable (15–16). Factors known to be associated with extubation failure include age, general disease severity, primary reason for intubation, cough strength, and amount/volume of secretions (17-18). Numerous investigations have demonstrated that extubation failure raises the risk of ventilator-associated infections, prolonged hospital stay, death, and higher medical cost (19–20).

Thus, doctors working in intensive care units are interested in finding the factors linked to EF. Number of variables, including the degree of critical illness, age (elderly patients), co-occurring conditions, positive fluid balance, volume of secretions from the airways, poor cough reflexes, compromised mental state, and unstable hemodynamic parameters have been linked to extubation failure in the past (21-26). However, depending on the population under study, the weaning guidelines, medical resource availability in the clinical setup, and trained expertise, some inconsistent outcomes were recorded (27–29).

1.2 Statement of the problem

Controlling the airway in the ICU with artificial airway devices, such as endotracheal tube (ETT) or tracheostomy tube (TT) is an essential part of care. However, use of a tracheal tube is associated with many complications, like unplanned extubation (UE), malposition of the tube (movement), blockage of both ETT and TT, endobronchial intubation, kinking of the tube, and leaking cuffs and failure of extubation. These airway management-related complications end up with life-threating conditions like hypoventilation and hypoxia (30).

Nevertheless, there is still a chance of reintubation, which also increases the length of time on mechanical ventilation, the chance of needing a tracheostomy, PLOS, expense, and mortality. Therefore, although failing to perform scheduled extubation is not risk-free, the relative risk of death is elevated 2.5–10 times higher in patients who do not successfully extubate (31-33).

The major issue is that patients requiring reintubation have a high mortality rate (34). This high mortality may be ascribable to greater disease severity at extubation or to clinical deterioration resulting from extubation failure, reintubation, or prolongation of mechanical ventilation. In addition, the cause of extubation failure and time to reintubation may also influence the outcome (35). Nevertheless, patients at elevated risk of extubation failure, prophylactic noninvasive ventilation after extubation may prevent acute respiratory failure and the need for reintubation (36-38).

Causes of EF are of great importance because consequences of EF vary from longer ICU stays to death. Research has identified risk factors for EF. . Initiatives and preventive measures have aimed at reducing such consequences by implementing the weaning/extubation protocol (39) have been developed. This study aims to assess the incidence of EF and identify risk factors associated with EF in ICUs and the outcomes following EF at TASH and MSRH.

1.3 Significance of the study

The frequency of unsuccessful extubations at TASH and MSRH ICUs is not well documented on a distinct sheet with structured information regarding the issue. Understanding the frequency and contributing variables to unsuccessful extubation in ICUs could help mitigate the problem's incidence and risk factors.

This research would contribute to future research by shading light on as a base line by indicating the incidence of failed extubation and associated factors in the management of EF at ICUs . For health care providers, this study will also increase their knowledge about the incidence and risk factors of failed extubation in ICU patients and help to promote health research and education.

2. Literature review

2.1 Incidence of failed extubation

In a study done in Brazil on 480 patients extubated following the institutional protocol, 415 (86.5%) were successful after 48 hours and 65 (13.5%) failed, requiring reintubation and return to IMV. Women had a higher incidence of failure and a more positive fluid balance of 622.5 ml (-324.5-1997.5) compared to men's 246 ml (-758.5-1682.1) ($p = 0.0297$) (40).

A study done at Srinakharinwirot University, Nakhon Nayok, Thailand, showed that extubation was considered in all 2,890 patients during admission. However, only 2,749 patients underwent successful extubation, but 141 patients required re-intubation within 72 hours, making a failure rate of 4.9% (41).

Extubation failure was more likely in surgical patients than in medical patients, according to a study conducted at the Medical University of Pennsylvania in Philadelphia, Pennsylvania, USA. Of these, the gastrointestinal and vascular services were more common in the failed extubation group. A median of twenty-four hours had passed after the extubation of the study cases (42).

study done in St. Joseph's Hospital and Medical Center, Phoenix, Arizona, USA, indicates that the overall rate of extubation failure was 5.7% and the mean time to reintubation was 13.0 hours (43).

A study done in Bangkok, Thailand, revealed that, in total, 127 intubated elderly patients in extubation failure occurred in 15 patients (11.8%). Patients with failed extubation had a lower

body temperature (37.0°C vs. 37.3°C, P < 0.05) but a higher Facial Anxiety Scale (FAS) score than those with successful extubation (3 vs. 2, P < 0.05). (44)

Out of 826 subjected to mechanical ventilation (86%). There were 30 failed extubations and 120 successful extubations, making the proportion of failed extubations 5.32% (45).

A randomized trial study done in Barcelona, Spain, revealed that the primary endpoint variable was the decrease in respiratory failure after extubation. In the noninvasive ventilation group, respiratory failure after extubation was less frequent (13, 16 vs. 27, 33%), and the intensive care unit mortality was lower (2, 3 versus 12, 14%) (46).

The median duration of intubation was 4 days, ranging from 1 to 31 days. Stridor following extubation occurred in 28 patients (18.7%); 3 of them required reintubation due to respiratory distress and in 1 child stridor persisted for which a surgical intervention was necessary (47).

An analysis of the correlation between fluid intake and extubation failure in patients with negative fluid balance in Ethiopian critical care units reveals 3433 extubation occurrences in total. For the final study, 1803 cases with negative fluid balance were considered, of which 201 cases (11.1%) involved extubation failure. 42 (34.15%) of the 123 adult patients in the critical care unit in the low-resource environment of Ethiopia had acquired EF, according to the incidence of extubation failure and its predictors (48).

2.2 Associated factor of Failed extubation

A study done in Brazil revealed that the logistic regression that allowed establishing the chance of failure was: logit FAILURE = -2.051638, being +0.000165 Water Balance; and +1.923026 Cough Strength (40).

In Nakhon Nayok, Thailand, a study conducted at Srinakharinwirot University found that patient characteristics in EF groups were compared to those in successful groups. Significant differences included advanced age, the existence of vascular disease, obstructive lung disease (COPD), congestive heart failure, emergency surgery, low APACHE II and SOFA scores, and the concomitant use of sedatives, inotropes, and vasopressors. The incapacity to cough, laryngeal edema, and respiratory failure were the most frequent causes of EF. Prolonged lengths of ICU stays [2 (IQR 1-5) vs. 11 (IQR 6-15) days] and hospital stays [16 (IQR 10-27) vs. 23 (IQR 15-33) days] were among the outcomes of EF. Patients who had EF were at risk of an ICU stay that was six times longer than successful extubation. Age, congestive heart failure, emergency surgery, and SOFA score were found to have adjusted odds ratios.

Patients who failed extubation had significantly greater ICU mortality (odds ratio = 12.2, 95% confidence interval [CI] = 1.5–101; P <0.05), whereas hospital mortality (odds ratio = 2.1, 95% CI = 0.8–5.4; P <0.15) did not differ significantly. There was a substantial increase in total hospital expenditures (calculated from direct and indirect charges) of US$33,926 (95% CI = US$22,573–45,280; P < 0.01) (42).

The results of multiple regression analysis showed that EF was linked to higher probabilities of both non-surgeon intensivist consultation (OR 24.2, 95% CI 5.5 to 105.9) and temperature >38° C at the time of extubation (OR 5.9, 95% CI 1.7 to 20.8). In trauma patients, extubation failure is linked to higher lung oxygen saturation (LOS), ventilator days, and mortality. Extubation failure is linked to fever during the procedure. The management of ventilated patients with trauma may be best served by a surgical critical care service, as non-surgeon intensivist involvement increases the chance of extubation failure (43).

A study done in Bangkok, Thailand, revealed that patients with extubation failure had significantly higher levels of blood urea nitrogen (BUN) (39.88 vs. 58.47 g/dL), serum sodium (137.66 vs. 141.47 mmol/L), and serum calcium (9.52 vs. 10.0 g/dL) but a wider anion gap (12.23 vs. 9.97), but no significant differences in respiratory parameters were found between the two groups. Multiple logistic regression revealed no independent factors associated with successful extubation (44).

The study identified several risk factors associated with unsuccessful extubations, including extended periods of mechanical ventilation (>7 days) (OR = 3.84, 95%CI = 1.01 - 14.56, p = 0.04), stays in the intensive care unit (OR = 1.04, 95%CI = 1.00 - 1.09, p = 0.03), and prolonged use of sedatives (OR = 4.81, 95%CI = 1.28 - 18.02; p = 0.02) (45).

The study examines the relationship between fluid intake and extubation failure in patients in the intensive care unit who have negative fluid balance. The results indicate that there was no significant correlation between the extubation outcome and moderate fluid intake (30 to 60 ml/kg), lower (30 ml/kg, OR 0.75, 95% CI [0.54, 1.05], p=0.088), or higher (>60 ml/kg, OR 1.63, 95% CI [0.73, 3.35], p=0.206) intake. Extubation failure was linked to the length of the MV, COPD, hypercapnia, use of diuretics, and SAPSII score (47).

The following characteristics were found to be significant predictors of EF among adult patients in an intensive care unit in a low-resource setting in Ethiopia: age > 60 years old (AOR: 4.157 [95% CI 1.38 12.48]), moderate to copious secretions (AOR: 3.483 [95% CI 1.10–11.4]), and prolonged duration of MV > 10 days (AOR: 4.77 [95% CI 1.55–14.66]) (48).

3. OBJECTIVE

3.1 General objectives

- ✓ To assess the incidence and associated factors of failed extubation in ICU at Tikur Anbessa Specialized Hospital and Menillik Second Referral Hospital, Addis Ababa, 2023/2024

3.2 Specific objectives

- ✓ To assess the incidence of failed extubation in ICU at selected Addis Ababa Tikur Anbessa specialized hospital and Menillik second referral hospital, Addis Ababa
- ✓ To identify factors associated with failed extubation in ICU at Tikur Anbessa Specialized and Menillik second referral hospital, Addis Ababa

4. METHODOLOGY

4.1 Study Design and Period

Institutional based cross-sectional study was conducted in intensive care unit at TASH and MSRH, Addis Ababa, Ethiopia from July-October, 2024.

4.2 Study Area

The study was conducted in TASH and MSRH, Addis Ababa, which is the capital city of Ethiopia located at the center of the country with an area of 210 km2. Addis Ababa has 11 subcities in which the city lies at an altitude of 2,300 meters; each subcity has 10-12 woredas. The study was done in TASH and MSRH, which is one of the higher hierarchy hospitals in the country and one of the attachment hospitals, respectively.

4.3 source population and study population

4.3.1 Source population

- All intubated patients in ICU at TASH and MSRH.

4.3.2 Study population

- All extubated ICU patients during the study period at TASH and MSRH

4.4 Eligibility criteria

4.4.1 Inclusion criteria

- All Extubated patients in ICU at the time of study period.

4.4.2 Exclusion criteria

- The patients who had a tracheostomy prior to attempts at extubation either passed away or stopped receiving assistance before extubation.
- unplanned/self-extubation

4.5 Study variables

4.5.1 Dependent variable

- failed extubation

4.5.2 Independent variables

- Sociodemographic characteristics: age, sex

- Patient factors: GCS, co-exacting diseases, amount of secretion, cough strength, ICU location, indication of mechanical ventilation.
- Staff-related factors: staff experience, level of icu staff during extubation.
- time-related factors during extubation: morning, afternoon, night

4.6 Operational definition

- Extubation failure: re-intubation within 72 hours after extubation
- Accidental extubation: Extubation occurred during a medical procedure or patient transport.
- Self-extubation: Extubation occurred by the action of patients

4.7 Sample determination

To determine the sample size, single proportion formula will be used.

$$n = \frac{(Z\alpha/2)2\ p\ (1-p)}{d2}$$

Where: n = desired sample size

z = z value at 95% confidence interval (CI)

p = incidence of failed extubation

d = margin of error

The Z value at 95% CI is 1.96 (from significance level α = 5%). P value 34.2 for the study done in Ethiopia ICU setting health facility and the tolerated margin of error is 5%. Therefore,

$$n = \frac{(1.96)^2\ (0.342)\ (1-0.342)}{(0.05)^2} = 345$$

Adding 10% non-response rate the total sample size calculated to be is 380 participants.

Then the number of populations during the study period was an estimated of 150 depicted from the last year reference, so correction formula was used for the final sample size

$$nf = \frac{n}{}$$

1+n/N

Where n is sample size

N is estimated population during the study period

There for the final sample size=380/1+380/150=**108**

4.8 Data Collection Techniques

Questioners were utilized as data collection instruments by skilled data collectors who completed the data gathering. The lead investigator stays in regular contact with the data collectors throughout the process to assist them in the event that they run into any issues or challenges. Age and sex were the demographic data that was gathered. The responsible data collector recorded the patients' GCS prior to extubation, the physician's experience providing treatment, and the exact moment of extubation.

4.9 Data Quality Control

The training for data collectors lasted one day. In reference to the data collection instruments, a pretest was conducted at Saint Pitter Specialty Hospital on 5% of patients who were intubated in the ICU; that is, 5% of patients were intubated during situational analysis to verify the questionnaire.

4.10 Data analysis and interpretation

The gathered information was coded, imported into Epidata 4.6.0.2, and exported to the statistical program SPSS version 25 for additional examination. Some of the variables were recoded prior to beginning the analysis. Binary logistic regression was used to examine all independent variables and the dependent variable in order to determine which variables were predictive of the dependent variable. The risk factors were divided into groups, and the strength of the connection was evaluated using the odd ratio, 95% confidence interval, and P-value calculations. Variables having a binary logistic regression analysis P-value of less than 0.25 were moved to a multivariable logistic regression analysis, where a P-value of less than 0.05 served as the cutoff limit for testing statistical significance.

4.12 Ethical consideration

The study received ethical approval from Addis Ababa University College of Health Science's anesthesiology, critical care, and pain medicine committee, ensuring privacy and consent from intubated patients, and providing information about benefits and dangers.

4.13 Dissemination plan

The study's final results were submitted to Addis Ababa University College of Health Science, Ministry of Health, anaesthiology association conference, and journal publication.

5. Result

5.1 Sociodemographic characteristics of the study participants

Two-thirds of the study participants were from TASH, and 38.7% were an age group of 15-30 years with mean and SD of 41.3±18.0 respectively. Almost fifty-seven percent of the study participants were male, and 66% of them had normal body mass index.

Table 1. The sociodemographic characteristics of the study participants having extubation in MASRH and TASH, October –March 2023/4.

Variable	frequency	Percent
Study setting		
MSRH	33	31.1
TASH	73	68.9
Age in years		
15-30	41	38.7
31-45	25	23.6
46-60	24	22.6
>60	16	15.1

Sex of the study participants		
Female	46	43.4
Male	60	56.6
BMI in kg/m^2		
<18.5	10	9.4
18.5-24.9	70	66.0
>25	26	24.5

5.2 The medical Characteristics of ICU admission

The majority of the study participants admitted ICU for the support of mechanical ventilation, followed by postoperative distress, severe traumatic brain injury, polytrauma, and sepsis, as shown in the figure below.

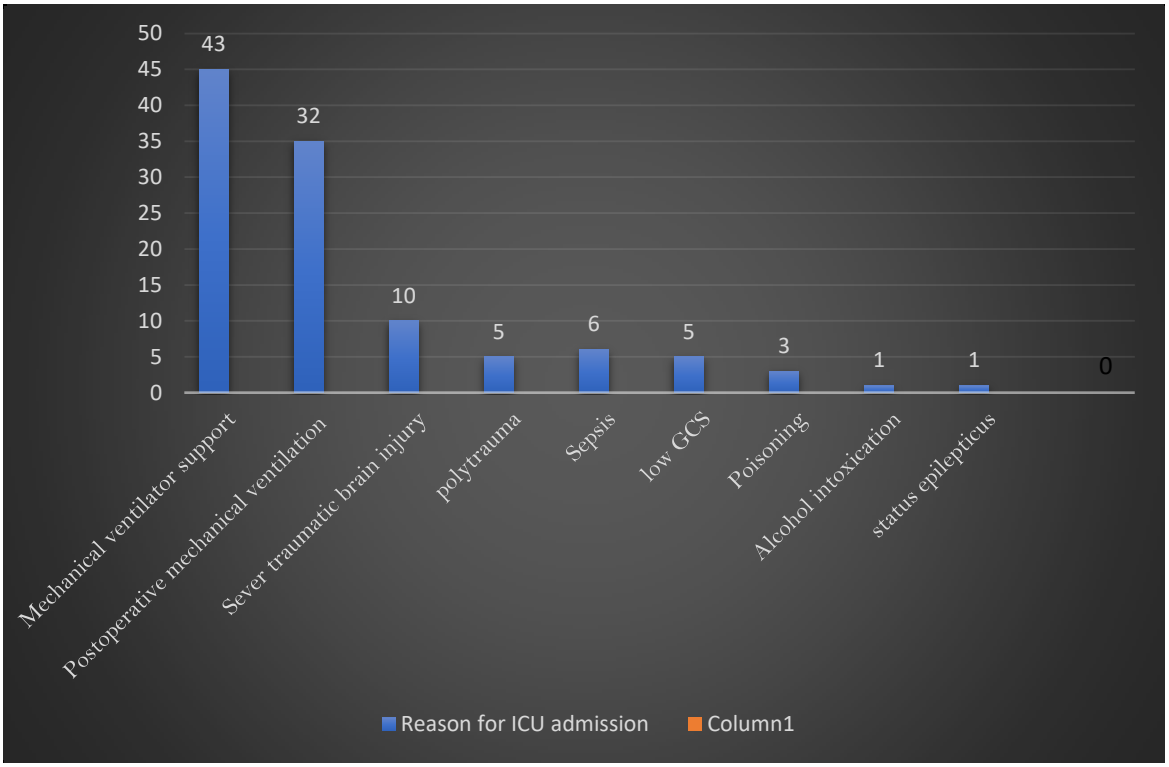

Figure 1. The reason of study participants IUC admission.

Thirty-two percent of the mechanical ventilation indications were respiratory distress, followed by postoperative mechanical ventilation support, and 56.6% of the study participants had coexisting disease other than the hospital admission indication. Half of the study participants were admitted to the surgical ICU, and 59.4% of the participants were admitted for surgical management. From those admitted for surgery, neurosurgery accounts for 42.9%, followed by cardiothoracic (22.2%), general surgery (14.2%), and obstetric surgery, as shown in the table below.

Table 2. The study participants disease related characteristics

Variable	frequency	Percent
Indication of mechanical ventilation		
Altered level of consciousness	28	26.4
Postoperative	44	41.5
Respiratory distress	34	32.1
Coexisting disease of the patient other than hospital admission		
Yes	60	56.6
No	46	43.4
Location of ICU		
C-ICU	20	18.9
Medical	33	31.1
Surgical	53	50.0
The patient admitted for surgery		
Yes	63	59.4
No	43	40.6
Types of surgery (n=63)		
Cardiothoracic	14	22.2
ENT	4	6.3
General surgery	9	14.2
Gynecology	1	1.6
Neuro surgery	27	42.9
obstetric surgery	3	4.8
Orthopedics	1	1.6
Thyroid surgery	1	1.6
Vascular	3	4.8
Types of cardiothoracic(n=14)		
Cardiac	9	0.67
Thoracic	5	0.33

From those of having coexisting disease, hypertension accounts 32% followed by CHF, CRVHD, DM and stroke as shown in the figure below.

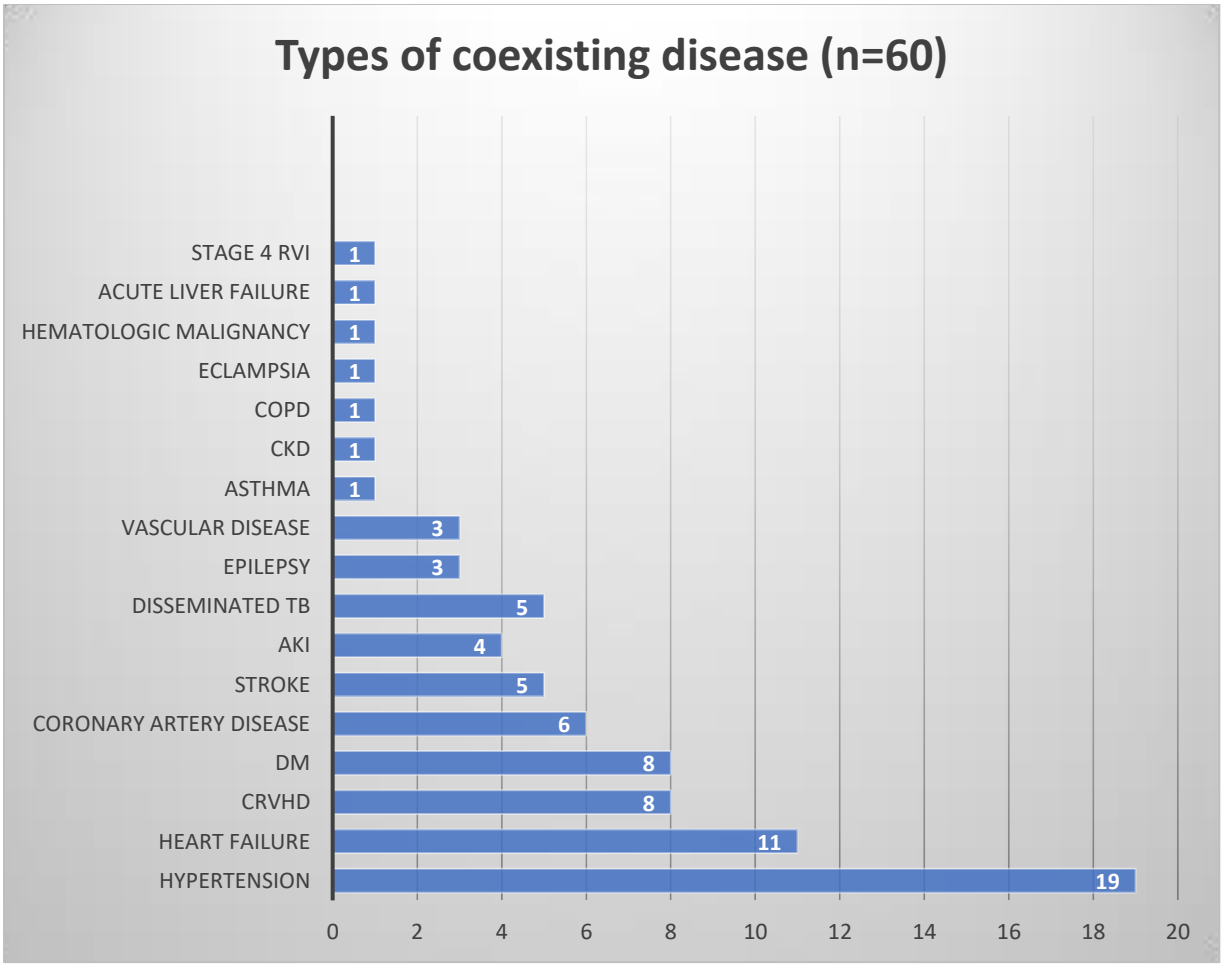

Figure 2. The study participants characteristics on coexisting disease other than hospital admission.

5.4 Vital sign related characteristics of the study participants during extubation

Fifty-nine percent of the study participants were waiting in mechanical ventilation for less than four days, with a mean duration of waiting of 4.67 days. Two-thirds of the study participants had a normal heartbeat pattern, 22.6% of the participants had 140 systolic blood pressure, and 67.9% of the participants had 21-35 breaths per minute. Ninety-seven percent of the study participants had 40-50 FIO2, and 83% of the participants had 3-5 PEEP. Eleven percent of the study participants had 5-7T GCS, 75.5% of the participants had a moderate amount of tracheal secretion, and 96.2% of the participants had strong cough strength.

Table 3. Vital sign related characteristics of the study participants during extubation

Variable	frequency	Percent
Length of waiting in mechanical ventilation in days		
≤4	63	59.4
5-10	30	28.3
>10	13	12.3
Heart beat pattern		
60-100/min	68	64.2
101-125/min	35	33.0
≥126/min	3	2.8
Systolic blood pressure		
90-129	60	56.6
130-139	22	20.8
≥140	24	22.6
Diastolic blood pressure		
60-80	70	66.0
81-90	29	27.4
>90	7	6.6
RR in minute		
16-20	34	32.1
21-35	72	67.9
RSBTI		
<105	105	99.1
>105	1	0.9
FIO2		
40-50	103	97.2
>50	3	2.8
PEEP		
3-5	88	83
6-7	16	15.1
≥8	2	0.19
Tidal volume in ml/kg		
4-6	19	17.9
6.1-10	83	78.3
>10	4	3.8
SPO2		
85-95	11	10.4
>95	95	89.6
GCS		
5-7T	12	11.3
8-10T	94	88.7
Mount of tracheal secretion		
Copious	2	1.9
minimal	80	75.5
Moderate	24	22.6
Cough strength		

Strong	102	96.2
Weak	4	3.8

5.5. Laboratory results related characteristic of the study participants during extubation

Fifty-five point seven percent of the participants had 135-145 mg/dl serum sodium. More than 41 percent of the study participants had >10k WBC count, and 7.5% of the study participants had a hemoglobin level of 7-10mg/dl.

Table 4. Laboratory results related characteristic of the study participants during extubation

Variable	frequency	Percent
Serum sodium in mg/dl		
<135	25	23.6
135-145	59	55.7
≥146	22	20.8
WBC		
<4k	1	.9
4-10k	61	57.5
>10k	44	41.5
Albumin in mg/dl		
<2.5	17	16.0
2.5-3	22	20.8
3-3.5	24	22.6
>3.5	43	40.6
Hemoglobin in mg/dl		
7-10	8	7.5
10-12	76	71.7
>12	22	20.8
BUN mg/dl		
10-20	44	41.5
21-39	59	55.7
≥40	3	2.8
Creatinine in mg/dl		
<0.4	4	3.8
0.4-1.1	79	74.5
≥1.2	23	21.7

5.6 The incidence of extubation failure

The findings of the study revealed that 21% of the study participants had failed extubation, as shown in the figure below.

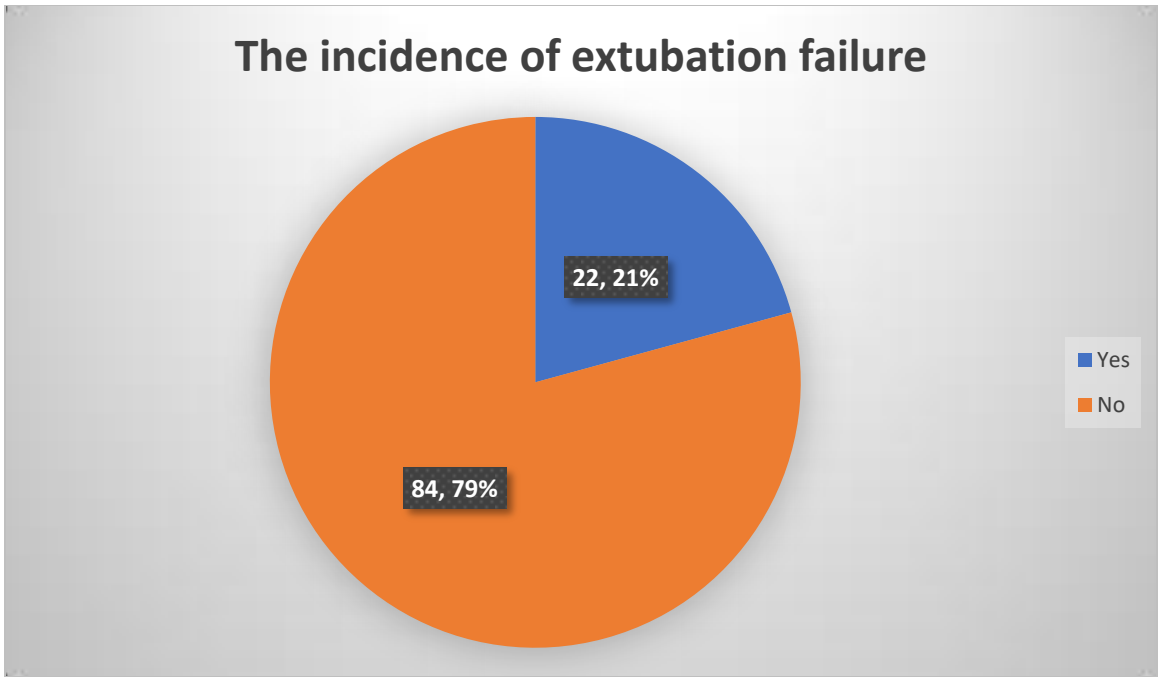

Figure 3.The incidence of failed extubation

Regarding the characteristics of extubation, 97.2% of the participants were extubated in the morning, and of those reintubated, 27.3% were due to respiratory failure from exhaustion, 22.7% were due to inability of cough, and 18.2% were due to a decrease in level of consciousness. 99.1% were on CPAP, and 73.6% of the extubations were done by year 3 ACCPM residents, as shown in the table below.

Table 5. The characteristics of the study participants on extubation

Variable	frequency	Percent
Time of extubation		
Morning	103	97.2
Afternoon	3	2.8
Cause of reintubation (n=22)		
Inability of cough	5	22.7
Respiratory failure from exhaustion	6	27.3
Alteration of consciousness	4	18.2
Heart failure	2	9.1
Laryngeal edema	2	9.1
massive tracheal secretion	1	4.5
respiratory muscle weakness	1	4.5
unable to expectorate	4	18.2
Respiratory support before extubation		
VCV	1	.9
CPAP	105	99.1
Level of ICU professions during extubation		

Anesthesiologist	14	13.2
R1 internal medicine resident	3	2.8
R2 ACCPM resident	1	.9
R2 internal medicine resident	9	8.5
R3 ACCPM resident	78	73.6
R3 internal medicine resident	1	.9

5.7 The determinants factor of extubation failure among ICU patients

The odd ratio and 95% CI were used to calculate the strength of the relationship. Consequently, bivariate logistic regression showed a connection between extubation failure and age, the number of days spent on mechanical ventilation, serum sodium, GCS, SBP, and the type of profession performing extubation. The results of the multivariate logistic regression showed that study participants who were older than 60 had an extubation failure that was 2.7 times higher than that of participants who were 15 to 30 years old (AOR=2.7, 95%CI=1.26, 28.74), and study participants who had been on mechanical ventilation for more than 10 days had an extubation failure that was 14.9 times higher than that of those who had been on it for less than 4 days (AOR=14.9, 95%CI=4.17, 54.80).

Extubation failure was increased 18.5 fold in study participants with systolic blood pressure of ≥ 140 compared to those with SBP of 90-129 (AOR=18.5, 95%CI=1.91, 78.63); it was increased 16.7 fold in participants with GCS of 5-7T compared to those with GCS of 8-10T (AOR=16.7, 95%CI=2.09, 34.12); and it was increased 2.7 fold in participants with an internal medicine residency as compared to those with an ACCPM residency (AOR=2.7, 95%CI=1.30, 23.69).

Table 6.The bivariate and multivariate logistic regression of association between independent variable and extubation failure.

Variable	Extubation failure	p-value	COR with 95%CI	P-value	AOR with 95%CI	
	yes	No				
Age in years						
15-30	8	33	1		1	
31-45	3	22	0.431	0.56(0.13, 2.36)	0.683	0.63(0.07, 5.88)
46-60	3	21	0.470	0.59(0.14, 2.48)	0.200	0.19(0.02, 2.36)
>60	8	8	0.026	4.1(1.18, 14.37)	0.046	**2.7(1.26, 28.74)**
Indication of mechanical ventilation						

Altered level of consciousness	8	20	1		1	
Postoperative	5	39	0.072	0.32(0.09, 1.11)	0.174	0.21(0.02, 1.98)
Respiratory distress	9	25	0.854	0.90(0.29, 2.76)	0.977	0.97(0.12, 7.93)
Coexisting disease of the patient other than hospital admission						
Yes	15	45	0.222	1.8(0.69, 5.02)	0.796	1.3(0.14, 12.65)
No	7	39	1		1	
Length of stay on mechanical ventilation in days						
≤4	6	57	1		1	
5-10	8	22	0.037	3.5(1.08, 11.10)	0.998	1.0(0.13, 8.05)
>10	8	5	0.000	15.2(3.75, 61.55)	0.002	**14.9(4.17, 54.80)**
SBP						
90-129	8	52	1		1	
130-139	4	18	0.583	1.4(0.39, 5.38)	0.387	2.5(0.31, 20.96)
≥140	10	14	0.006	4.6(1.54, 13.96)	0.012	**18.5(1.91, 78.63)**
DBP						
60-80	14	56	1		1	
81-90	5	24	0.751	0.83(0.27, 2.57)	0.512	0.47(0.05, 4.42)
>90	3	4	0.180	3.0(0.60, 14.97)	0.705	0.57(0.03, 10.42)
RR in minute						
16-20	4	30	1		1	
21-35	18	54	0.125	2.5(0.77, 8.07)	0.703	0.57(0.22, 9.18)
GCS						
5-7T	7	5	0.002	7.4(2.06, 26.35)	0.008	**16.7(2.09, 34.12)**
8-10T	15	79	1		1	
Serum sodium mg/dl						
<135	9	16	1		1	
135-145	11	48	0.093	0.41(0.14, 1.16)	0.990	0.98(0.17, 5.74)
≥146	2	20	0.042	0.18(0.0	0.062	0.09(0.0

				3, 0.94)		1, 1.13)
Types and level of profession						
ACCPM resident	14	65	1		1	
internal medicine resident	6	7	0.028	3.9(1.16, 13.67)	0.037	**2.7(1.30, 23.69)**
Anesthesiologist	2	12	0.754	0.77(0.16, 3.85)	0.858	1.3(0.09, 16.70)

6. Discussion

In this study, the incidence of extubation failure was 21%. This finding was lower than the study done in Ethiopia (34.1%) (48). This finding was also higher than the study done in Brazil (13.5%), Srinakharinwirot University, Nakhon Nayok, Thailand (4.9%), St. Joseph's Hospital and Medical Center, Phoenix, Arizona, USA (5.7%), and Bangkok, Thailand (11.8%) (40, 4, 43, 44). This may be due to different patient populations with varying severity of illness, comorbidities, and underlying conditions. The other reason may be that variations in study design, such as inclusion criteria, exclusion criteria, and the definition of extubating failure, can influence the reported incidence. Differences in the management protocols and interventions used during extubation, such as the use of spontaneous breathing trials, the criteria for extubation readiness, and the presence of extubation protocols, can impact the likelihood of extubation success or failure. And also the setting in which the study was conducted, such as a tertiary care hospital, community hospital, or intensive care unit, can affect patient outcomes and the incidence of extubation failure due to variations in resources, expertise, and patient characteristics.

study participants whose age of >60 years had 2.7 folds increase its extubation failure compared to those age 15-30 years old (AOR=2.7, 95%CI=1.26, 28.74). This finding was congruent with the study done in Srinakharinwirot University, Nakhon Nayok, Thailand, and the study done in Ethiopia (41, 48). This may be due to the fact that the fact that as age becomes older, there's a natural decline in respiratory muscle strength, making it harder for them to sustain breathing on their own after extubation. Aging can lead to decreased lung elasticity, which may impair the ability of the lungs to expand and contract effectively, making it harder to maintain adequate oxygenation and ventilation post-extubation. Aging can blunt the cough reflex, which is essential for clearing secretions and maintaining airway patency. This impairment can increase the risk of airway obstruction after extubation.

study participant whose length of stay on mechanical ventilation >10 days had 14.9 folds increase in extubation failure compared to those of LOS on mechanical ventilation <=4days (AOR=14.9, 95%CI=4.17, 54.80). This finding was congruent with the study done by Weinberg JA et al., the study done by Aracely Lizet Silva-Cruz et al., and the study done in Ethiopia (43, 45, 48). This may be due to prolonged time ventilation increasing the risk of ventilator-associated pneumonia, pneumothorax, and other complications, which can exacerbate respiratory distress in the post-extubation period. Prolonged reliance on mechanical ventilation can lead to muscle weakness and atrophy, including respiratory muscles, making it harder for the patient to sustain breathing efforts after extubation. The longer a patient remains on mechanical ventilation, the greater the likelihood of developing ventilator dependence, where the patient's respiratory effort becomes compromised. Prolonged mechanical ventilation can disrupt fluid and electrolyte balance, leading to complications such as electrolyte abnormalities, dehydration, and fluid overload, which can affect respiratory effort and increase the risk of extubation failure.

Study participants whose systolic blood pressure of ≥ 140 was 18.5 folds increased its extubation failure compared to those with SBPs of 90-129 (AOR=18.5, 95%CI=1.91, 78.63). This may be due to high SBP and reflect underlying cardiovascular instability, such as myocardial ischemia, arrhythmias, or heart failure, which can increase the risk of extubation failure due to inadequate cardiac output and oxygen delivery.

study participant whose GCS of 5-7T were 16.7 folds increased its extubation failure compared to those of GCS 8-10T (AOR=16.7, 95%CI=2.09, 34.12). This finding was in line with the study done at Srinakharinwirot University, Nakhon Nayok (41). This may be due to a low GCS score that may indicate underlying neurological impairment, such as brain injury, stroke, or encephalopathy, which can affect the patient's ability to maintain airway patency and respiratory drive post-extubation. Patients with a low GCS score may have impaired airway protective reflexes, increasing the risk of airway obstruction, aspiration, and respiratory compromise following extubation.

7. Conclusion

In this study, the prevalence of extubation failure was significantly palpable (21%). The determinant factors for extubation failure were age of >60 years compared to those age 15-30 years old (AOR=2.7, 95%CI=1.26, 28.74), length of stay on mechanical ventilation >10 days compared to those of <=4days (AOR=14.9, 95%CI=4.17, 54.80), systolic blood pressure of ≥ 140 compared to those SBP of 90-129 (AOR=18.5, 95%CI=1.91, 78.63), GCS of 5-7T compared to those of GCS 8-10T (AOR=16.7, 95%CI=2.09, 34.12), and residency of internal medicine compared to those of residency ACCPM (AOR=2.7, 95%CI=1.30, 23.69).

9. Recommendation

In this study the prevalence of extubation failure was significantly palpable. Therefore, the recommendation will be for those

- **Old Age:**

✓ **Recommendation**: While chronological age is a risk factor, individualized assessment considering overall health status, functional capacity, and comorbidities is essential. Incorporate geriatric assessments and multidisciplinary input to guide decision-making regarding extubation readiness and postextubation management strategies.

- **Low Glasgow Coma Scale (GCS):**

✓ **Recommendation:** Assess the underlying cause of the low GCS score and its potential reversible factors. Consider neuroimaging, neurology consultation, and optimization of sedation and neuroprotective strategies. Individualize extubation decisions based on neurological prognosis, severity of impairment, and potential for neurological recovery.

- **Prolonged Mechanical Ventilation:**

✓ **Recommendation:** Implement protocols for early identification of patients at risk for prolonged mechanical ventilation. Emphasize daily assessment of readiness for spontaneous breathing trials, proactive management of sedation, and strategies to mitigate ventilator-associated complications. Consider multidisciplinary collaboration to optimize respiratory muscle strength and weaning protocols.

- **High Systolic Blood Pressure (SBP):**

✓ **Recommendation:** Evaluate the underlying etiology of elevated SBP, including pain, anxiety, cardiovascular comorbidities, and medication effects. Optimize hemodynamic management, pain control, and anxiety reduction strategies pre-extubation. Consider pharmacological interventions, such as antihypertensive agents, in collaboration with cardiology or critical care specialists, to achieve hemodynamic stability and mitigate the risk of extubation failure.

Reference

1. Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz J V, Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care [Internet]. 2017; 37: 270–6. DOI: https://doi.org/10.1016/j. jcrc.2016.07.015.
2. Metnitz PGH, Metnitz B, Moreno RP, Bauer P, Sorbo L Del, Hoermann C, et al. Epidemiology of Mechanical Ventilation: Analysis of the SAPS 3 Database. Intensive Care Med. 2009;35(5):816–25.
3. Chaiwat O, Kongsayreepong S, Permpikul C, Jaikriengkrai K, Ittawatanarat K, et al. An assessment of the respiratory support provided to patients in critical care at ten tertiary hospitals in Thailand. Thail J Med Assoc. 2014;97(1 SUPPL).
4. Thicke AW, Brochard L, Brun-Buisson C, Harrois A, Schortgen F. consequences of extubation failure in patients receiving medical critical care. The journal Critical Care Medicine, 39(12), 2612–2612, doi: 10.1097/CCM.0b013e3182282a5a PMID: 21765357
5. Wang D, Wang C, Lin Q, Zhou D, Zhao D, and Li T. Retrospective observational study examining the relationship between fluid intake and extubation failure in patients with negative fluid balance in the critical care unit. 22(1):1–8 in BMC Anesthesiology, 2022.
6. Tragulmongkol W, Permpikul C, Tongyoo S, and Thomrongpairoj P. Predictive factors for noninvasive ventilation failure can keep medically critical patients from reintubating themselves. Critical Care Journal. 2017; 38:177–81. PMID: 27927604; https://doi.org/10.1016/j.jcrc.2016.11.038..
7. . Yoda T, Kanda K, Suzuki H, Asaga T, Bekku S, Okabe Y, et al. A retrospective cohort research found that lung-thorax compliance assessed during a spontaneous breathing trial is a reliable indicator of extubation failure in the surgical intensive care unit. Intensive Care Journal, 2018; 6(1):1–9. PMID: 30083347; https://doi.org/10.1186/s40560-018-0313-9
8. A comparative study of four approaches to weaning patients off of mechanical breathing was conducted by Esteban A, Frutos F, Tobin M, Alia I, Solsona J, Valverdu I, Fernan dez R, De la Cal JF, Benito S, Tomas R, et al. 1995; N Engl J Med 332:345–352.
9. 9. Tragulmongkol W, Permpikul C, Tongyoo S, and Thomrongpairoj P. Predictive factors for noninvasive ventilation failure can keep medically critical patients from reintubating

themselves. Critical Care Journal. 2017; 38:177–81. PMID: 27927604; https://doi.org/10.1016/j.jcrc.2016.11.038 Suzuki H, Kanda K, Yoda T, Okabe Y, Asaga T,
10. Bekku S, et al. A retrospective cohort research found that lung-thorax compliance assessed during a spontaneous breathing trial is a reliable indicator of extubation failure in the surgical intensive care unit. Intensive Care Journal, 2018; 6(1):1–9. PMID: 30083347; https://doi.org/10.1186/s40560-018-0313-9

11. Tragulmongkol W, Tongyoo S, Thomrongpairoj P, and Permpikul C. Reintubation in severely ill medical patients can be avoided with the help of factors that indicate noninvasive ventilation failure. 2017; 38:177–81; Journal of Critical Care. Publication number: 27927604; doi: 10.1016/j.jcrc.2016.11.038

12. Okabe Y, Yoda T, Kanda K, Suzuki H, Asaga T, Bekku S, and others. An excellent indicator of extubation failure in the surgical intensive care unit is lung-thorax compliance as assessed during a spontaneous breathing trial: a retrospective cohort study. 2018; Journal of Intensive Care 6(1):1–9. Publication number: 30083347; doi:10.1186/s40560-018-0313-9.

13. Esteban A, Frutos F, Tobin M, Alia I, Solsona J, Valverdu I, Fernan dez R, De la Cal JF, Benito S, Tomas R, et al.: A comparative analysis of four approaches to patient weaning off respirator support. 1995; 332:345–352. N Engl J Med.

14. Thomrongpairoj P, Tongyoo S, Tragulmongkol W, Permpikul C. Factors predicting failure of noninvasive ventilation assist for preventing reintubation among medical critically ill patients. Journal Of Critical Care. 2017; 38:177–81. https://doi.org/10.1016/j.jcrc.2016.11.038 PMID: 27927604
15. Okabe Y, Asaga T, Bekku S, Suzuki H, Kanda K, Yoda T, et al. Lung-thorax compliance measured during a spontaneous breathing trial is a good index of extubation failure in the surgical intensive care unit: a retrospective cohort study. Journal of Intensive Care. 2018; 6(1):1–9. https://doi.org/10.1186/s40560-018-0313-9 PMID: 30083347.
16. Esteban A, Frutos F, Tobin M, Alia I, Solsona J, Valverdu I, Fernan dez R, De la Cal JF, Benito S, Tomas R et al.: A comparison of four methods of weaning patients from mechanical ventilation. N Engl J Med 1995, 332:345-352.

17. Ely E, Baker A, Dunagon D, Burke HL, Smith AC, Kelly PT, Johnson MM, Browder RW, Bowton DL, Haponik EF: Effect on duration of mechanical ventilation of identifying patient capable of breath ing spontaneously. N Engl J Med 1996, 335:1864-1869.
18. Jaber S, Chanques G, Matecki S, Ramonatxo M, Vergne C, Souche B, et al. Post extubation stridor in intensive care unit patients. Risk factors evaluation and importance of the cuff-leak test. Intensive Care Med 2003;29(1):69–74.
19. Wang J, Ma Y, Fang Q. Extubation with or without spontaneous breathing trial. Crit Care Nurse 2013; 33:50–5.
20. Boles J-M, Bion J, Connors A, Herridge M, Marsh B, Melot C, et al. Weaning from mechanical ventilation. Eur Respir J 2007; 29:1033–56.,10.
21. Thille AW, Richard J-CM, Brochard L. The decision to extubate in the intensive care unit. Am J Respir Crit Care Med 2013; 187:1294–302.
22. Brouillette B, Clark A, Czysz C, Daigle JB, Foulkrod KH, Brown CV, et al. A prospective observational study examining the risk factors linked to early reintubation in trauma patients. 2011. J Trauma; 71: 37–41.
23. . Esteban A, Alia I, Gordo F, et al.: The result of extubation following trials of spontaneous breathing using pressure support ventilation or a T-tube.The Spanish Collaboration Group on Lung Failure. Am J Respir Crit Care Med 156:459–465 (1997–2006).
24. Vallverdu I, Calaf N, Subirana M, and colleagues: Clinical features, respiratory functional metrics, and results of a two-hour T-tube experiment in patients transitioning off of mechanical ventilation. 158:1855-2662 in Am J Respir Crit Care Med (1998).
25. Khamiees M, Raju P, DeGirolamo A, et al.: Extubation outcome predictors in patients who have passed a spontaneous breathing trial with success. 2001; Chest 120:1262–1270.
26. Smina M, Khamiees M, Salam A, et al: Extubation results and cough peak flows. Chest 124 (2003): 262-268.
27. Fuchs BD, Christie JD, Martinez A, and Seymour CW. A cohort study examining the consequences of extubation failure in an intensive care unit at a community hospital. 2004; 8(5):1-6 in Critical Care.

28. Salam A, Tilluckdharry L, Amoateng-Adjepong Y, Manthous CA. Neurologic status, cough, secretions, and extubation outcomes. Intensive care medicine. 2004; 30(7):1334–9. https://doi.org/10.1007/ s00134-004-2231-7 PMID: 14999444].
29. thille AW, Harrois A, Schortgen F, Brun-Buisson C, Brochard L. Outcomes of extubation failure in medical intensive care unit patients. Critical care medicine. 2011; 39(12):2612–8. https://doi.org/10.1097/ CCM.0b013e3182282a5a PMID: 21765357.
30. Wang D, Wang C, Lin Q, Zhou D, Zhao D, and Li T. Retrospective observational study examining the relationship between fluid intake and extubation failure in patients with negative fluid balance in the critical care unit. 22(1):1–8 in BMC Anesthesiology, 2022. Song J, Zhang X, and Duan J. A systematic study and meta-analysis of the predictive value of cough strength in the diagnosis of extubation failure
31. . Haruna J, Tatsumi H, Kazuma S, Sasaki A, Masuda Y. Critical Care. 2021; 25(1):1-2. A single-center retrospective cohort analysis found that in patients who had a successful spontaneous breathing trial, frequent tracheal suctioning was linked to extubation failure. JA Clinical Reports, 8(1), 2022, 1-6.
32. Frutos-Vivar F, Esteban A, Apezteguia C, Gonza´lez M, Arabi Y, Restrepo MI, et al. Outcome of reintu bated patients after scheduled extubation. Journal of critical care. 2011; 26(5):502–9. https://doi.org/ 10.1016/j.jcrc.2010.12.015 PMID: 21376523.
33. Jaber S, Quintard H, Cinotti R, Asehnoune K, Arnal JM, Guitton C, et al. Risk factors and outcomes for airway failure versus non-airway failure in the intensive care unit: a multicenter observational study of 1514 extubation procedures. Critical Care. 2018; 22(1):1–2.
34. Suraseranivong R, Krairit O, Theerawit P, Sutherasan Y. Association between age-related factors and extubation failure in elderly patients. PloS one. 2018; 13(11):e0207628. https://doi.org/10.1371/journal. pone.0207628 PMID: 30458035.
35. Lee ES, Lim DT, Taculod JM, Sahagun JT, Otero JP, Teo K, et al. Factors associated with reintubation in an intensive care unit: A prospective observational study. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2017; 21(3):131.

36. Ko R, Ramos L, Chalela JA. Conventional weaning parameters do not predict extubation failure in neurocritical care patients. Neurocritical care. 2009; 10(3):269–73. https://doi.org/10.1007/s12028-008- 9181-9 PMID: 19184557.
37. Dasgupta S, Singh SS, Chaudhuri A, Bhattacharya D. Airway accidents in critical care unit : A 3 - year retrospective study in a Public Teaching Hospital of Eastern India. 2016;(37):91–6.
38. Epstein SK, Ciubotaru RL, Wong JB. Effect of failed extubation on the outcome of mechanical ventilation. Chest 1997;112:186–92.
39. Rothaar RC, Epstein SK. Extubation failure: magnitude of the problem, impact on outcomes, and prevention. Curr Opin Crit Care 2003;9:59–66.
40. Thille AW, Harrois A, Schortgen F, Brun-Buisson C, Brochard L. Outcomes of extubation failure in medical intensive care unit patients. Crit Care Med 2011;39:2612–18.
41. Epstein SK, Ciubotaru RL, Wong JB: Effect of failed extubation on the outcome of mechanical ventilation. Chest 1997; 112:186 –192
42. Epstein SK, Ciubotaru RL: Independent effects of etiology of failure and tubation on outcome for patients failing extubation. Am J Respir Crit Care Med 1998;158:489 – 493.
43. Nava S, Gregoretti C, Fanfulla F, et al: Noninvasive ventilation to prevent respiratory failure after extubation in high-risk patients. Crit Care Med 2005; 33:2465–2470.
44. Ferrer M, Valencia M, Nicolas JM, et al: Early noninvasive ventilation averts extubation failure in patients at risk: A randomized trial. Am J Respir Crit Care Med 2006; 173:164 – 170.
45. Ferrer M, Sellares J, Valencia M, et al: Noninvasive ventilation after extubation in hy percapnic patients with chronic respiratory disorders: Randomised controlled trial. Lan cet 2009; 374:1082–108.
46. Perren A, Domenighetti G, Mauri S, Genini F, Vizzardi N. Protocol-directed weaning from mechanical ventilation: clinical outcome in patients randomized for a 30-min or 120-min trial with pressure support ventilation. Intensive Care Med 2002; 28: 1058-63.
47. Ana Beatriz Braga Arcanjo1, Lúcia Marinilza Beccaria. Factors associated with extubation failure in an intensive care unit: a case-control study. Rev. Latino-Am. Enfermagem 2023;31:e3864. DOI: 10.1590/1518-8345.6224.3864.

48. Phakapan Buppha MD, Chaiyapruk Kusumaphanyo MD. Outcomes and Risk Factors of Extubation Failure:A Multicenter Study of the THAI Surgical Intensive Care Units (SICUs). J Med Assoc Thai 2016; 99 (Suppl. 6): S136-S144.
49. Christopher W Seymour, Anthony Martinez, Jason D Christie and Barry D Fuchs. The outcome of extubation failure in a community hospital intensive care unit: a cohort study. Critical Care 2004, 8:R322-R327 (DOI 10.1186/cc2913): http://ccforum.com/content/8/5/R322).
50. Weinberg JA, Stevens LR, Goslar PW, et al. Trauma Surg Acute Care Open Published Online First: [please include Day Month Year] doi:10.1136/ tsaco-2016-000052
51. Suraseranivong R, Krairit O, Theerawit P,Sutherasan Y (2018) Association between agerelated factors and extubation failure in elderly patients. PLoS ONE 13(11): e0207628. https://doi. org/10.1371/journal.pone.0207628.
52. Aracely Lizet Silva-Cruz, Karina,Velarde-Jacay, Nilton Yhuri Carreazo, Raffo Escalante-Kanashiro. Risk factors for extubation failure in the intensive care unit. Rev Bras Ter Intensiva. 2018;30(3):294-300.
53. Miquel Ferrer, Mauricio Valencia, Josep Maria Nicolas, Oscar Bernadich, Joan Ramon Badia, and Antoni Torres. Early Noninvasive Ventilation Averts Extubation Failure in Patients at Risk. Am J Respir Crit Care Med Vol 173. pp 164–170, 2006,
54. L. L. Veder· K. F. M. Joosten · K. Schlink · M. K. Timmerman · L. J. Hoeve · M. P. van der Schroef· B. Pullens. Post-extubation stridor after prolonged intubation in the pediatric intensive care unit (PICU): a prospective observational cohort study. European Archives of Oto-Rhino-Laryngology .https://doi.org/10.1007/s00405-020-05877-0.
55. Kifle N, Zewdu D, Abebe B, Tantu T, Wondwosen M, Hailu Y, et al. (2022) Incidence of extubation failure and its predictors among adult patients in intensive care unit of low-resource setting: A prospective observational study. PLoS ONE 17(11): e0277915. https://doi.org/10.1371/ journal.pone.0277915.

I. ANNEX

II. Informed consent

My name is_____ on behalf of Dr Emebet Damtew a student of post graduate at Addis

Ababa University College of health science department of anesthesiology. She is conducting research for the partial fulfillment of the specialty of anesthesiology on the incidence and associated factors of failed extubation in TASH and MSRH. She received ethical clearance from Addis Ababa University College of Health Science, Department of Anesthesiology, Ethics Committee. Being part of this study will not affect in any way the service your family or lovely are getting in this hospital.

You are selected to participate in this study on the behavior of your family or lovely because your family or loved ones are intubated and can't communicate in the intensive care unit. You are free to withdraw your family (lovely) from the study. In the study, any assessment is confidential, and in addition, your family's (lovely) name, address, or any information that identifies your family (lovely) will not be used. The data will be kept strictly confidential and will not be disclosed to anyone other than a member of our survey team. I respect any of your decisions.

The findings of my study will provide information about the incidence and risk factors of failed extubation, helping responsible stakeholders to develop strategies and take appropriate measures to solve the gaps and ensure the welfare of patient management in the ICU.

This study will not harm any participants.

Do you agree to participate in this study?

1. Yes

2.No (if no stop)

Family signature_____

Data collector's _____

Questionnaires

A questioner form for data collection for patients intubated in ICU in TASH and MSRH. Assessment on the incidence and associated factors of failed extubation in TASH and MSRH, Addis Ababa, Ethiopia, 2023-2024.

Part I. sociodemographic characteristics of the patients

1. name hospital
   I. TASH
   II. MASRH
   III. Other:

2. Age of the study participants in years_____, MRN_____
3. weight in Kg of the study participants _____,height in cm___
4. Sex of the study participants
   I. Male
   II. Female

Part II icu related questions

5. Reason for ICU admission _____
6. Indication of mechanical ventilation
   - respiratory distress
   - Altered level of consciousness
   - Postoperative mechanical ventilation support
   - Neuromuscular disease
   - trauma
   - CVD
   - other_____

7. Co-existing disease of the patient other than hospital admission diagnosis
    I. Yes
    II. No
8. If, yes specify which one of the following
    I. Hypertension
    II. Coronary artery diseases
    III. heart failure
    IV. Vascular disease
    V. Stroke
    VI. Asthma
    VII. COPD
    VIII. Diabetes mellitus
    IX. Other specify_____
9. ICU location

I. Medial
II. Surgical
III. CICU

10. Is the patient admitted for surgery
    I. Yes
    II. No
11. If yes types of surgery
    I. General surgery
    II. Urology
    III. Neuro surgery
    IV. ENT
    V. Cardiothoracic
    VI. Gynecology
    VII. Orthopedics
    VIII. Other specify _____
    IX. IF cardio-thoracic specify
        - Thoraxic

- Cardiac

12. Substance abuse
    I. Yes
    II. No
13. If yes specify _____

III. Vital sign and MV related characteristics during extubation

1. Number of Ventilator stay in days _____
2. Heart rate _____
3. BP _____
4. Respiratory rate _____
5. PaO2_____
6. FIO2_____
7. RSBI_____
8. PEEP_____
9. TV_____
10. GCS _____
11. Cough strength
    - Weak
    - Strong
12. Amount of tracheal secretion
    - Minimal
    - Moderate
    - Copious

Part IV. Laboratory results

I. WBC_____
II. Album in mg/dL_____-
III. Hemoglobin, g/dL_____
IV. BUN (mmol/l) _____-

V. Creatinine(mmol/l) _____

Part V. Extubating characteristics

Cause of Re-intubation

I. Respiratory failure from exhaustion
II. Inability to cough
III. Heart failure
IV. Laryngeal edema
V. Alteration of consciousness
VI. Other, specify_____

2 Respiratory support before extubation

I. T-piece
II. PSV
III. SIMV
IV. PCV, VCV or full support mode
V. CPAP

1. Level of professions during extubatation

I. Anesthesiologist
II. R1 ACCPM resident
III. R2 ACCPM resident
IV. R3 ACCPM resident

V. R1 Internal medicine resident
VI. R2 Internal medicine resident
VII. R3 Internal medicine resident
VIII. Pulmonology fellow