



OUT COME AND ASSOCIATED FACTORS OF INTUBATED AND MECHANICALLY VENTILATED PATIENTS AT SPHMMC AND AaBET HOSPITAL EMERGENCY AND INTENSIVE CARE UNIT, ADDIS ABABA, ETHIOPIA

A ONE YEAR HOSPITAL BASED CROSS SECTIONAL STUDY

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ST. PAUL'S HOSPITAL MILLENIUM MEDICAL COLLEGE
DEPARTMENT OF EMERGENCY AND CRITICAL CARE MEDICINE

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Assurance of the principal investigator

I understand that as Principal Investigator, I have responsibility for the conduct of the study, the ethical clearance of the project and the protection of the rights and welfare of study participants.

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Table of Contents

Assurance of the principal investigator	3
Aknowlwgement.....	4
List of figures.....	6
List of Tables.....	5
List of Acronyms	8
CHAPTER - ONE	
Abstract.....	9
Background.....	9
1.1. Introduction.....	10
1.2 Statement of the problem.....	12
1.3 Significance of the study.....	13
CHAPTER - TWO	
2. LITERATURE REVIEW	14
CHAPTER - THREE	
3. OBJECTIVES OF THE STUDY.....	22
3.1 General Objectives:.....	22
3.2 Specific Objectives:.....	22
CHAPTER - FOUR	
4. METHODS and MATERIALS.....	22
4.1 Study area and period.....	22
4.2 Study design:.....	23
4.3. Population.....	23
4.3.1. Source Population:.....	23
4.3.2. Study Population:.....	23
4.5 Data source :	23
4.6 Eligibility Criteria.....	23
4.6.1 Inclusion Criteria-.....	23
4.6.2 Exclusion Criteria-.....	24
4.7. Sample Size Determination and Sampling Procedure.....	24
4.7.1. Sample Size Determination.....	24
4.7.2. Sampling Procedure.....	24
4.8. Data Collection tool and procedure.....	25
4.9. Data Quality Control.....	25
4.10. Data Processing and Analysis.....	25
4.11. Study variable.....	26
4.11.1 Dependent variables	26

4.11.2 Independent variables.....	26
4.12. Operational definition	26
4.13. Ethical consideration.....	27
4.14. Dissemination of results.....	27
CHAPTER - 5	
5.1. Results.....	28
CHAPTER - 6	
6.1. Discussion.....	51
CHAPTER - 7	
7.1. Conclusion.....	54
CHAPTER - 8	
8.1. Strength and Limitation of study.....	55
CHAPTER - 9	
9.1. Recommendation.....	56
References.....	57
Ethical consent form.....	61
ANNEX.....	62

List of Tables and figures

Figure 1: Conceptual framework diagram.....	21
Figure 2.Bar graph age distribution percent.....	29
Figure.3.pie graph triage category distribution percent.....	29
Figure 4.Bar graph indication for intubation distribution percent.....	31
Figure 5.Pie graph GCS before intubation distribution percent.....	32
Figure 6. Pie graph weaning method distribution percent.....	35
Figure 7.Bar graph intubation procedure distribution percent.....	36
Figure 8.pie graph death and discharge distribution percent.....	42
Figure 9.Bar graph immediate cause of death distribution percent.....	42
Table 1.Age and sex frequency cross tabulation.....	28
Table 2. Place where patient intubated and after intubation where patient admitted Cross tabulation.....	30
Table 3. Patient category frequency based on type of illness.....	30
Table 4. Medical illness frequency which is the cause for intubation.....	32
Table 5. Comorbidity and length of stay frequency cross tabulation.....	33
Table 6. Comorbidity and final outcome frequency cross tabulation.....	34
Table 7.Mostly used machine mode during ventilator	

Support and the final outcome of patient Cross tabulation.....	35
Table 8.sedative drugs used during mechanical ventilator support frequency.....	36
Table 9.Immediate complication during intubation frequency.....	37
Table 10.mechanical ventilator support related complication frequency.....	38
Table 11.surgical procedure done for patients who were on Mechanical ventilator support frequency.....	38
Table 12.complication due to prolonged intubation and the final Outcome of patient Cross tabulation.....	39
Table 13.complication of patient due to prolonged hospital stay and the Final outcome of patient Cross tabulation.....	40
Table 14. Ventilator care bundle and treatment given for Patients who were on mechanical ventilation frequency.....	41
Table.15.Extubated patient disposition after liberation from mechanical ventilation.....	41
Table 16.Patient types and indication for intubation.....	43
Table 17. Patient category.....	44
Table 18. The indication for intubation.....	44
Table 19.Types of medical illness resulting intubation.....	45
Table.20. Factors Associated with the outcome of intubated and Mechanically ventilated patients.....	46

List of Abbreviations

AaBET.....	Addis Ababa Burn, Emergency and Trauma
AKI	Acute kidney injury
AOR.....	Adjusted Odds Ratio
ARDS.....	Acute respiratory distress syndrome
CI.....	Confidence Interval
COPD.....	Chronic obstructive pulmonary disease
COR.....	Crude Odds Ratio
CPR.....	Cardio pulmonary resuscitation
CPAP	Continuous positive airway pressure
ETT.....	Endotracheal Tube
FIO2.....	Fraction of Inspired Oxygen
GCS.....	Glasgow coma scale
HAP	Hospital acquired pneumonia
HIV.....	Human immune deficiency virus
IMV.....	Invasive mechanical ventilation
ICU.....	Intensive care unit
MODS.....	Multi organ dysfunction
MV.....	Mechanical ventilation
PaO2.....	Partial Arterial Oxygen
PEEP	Peak end expiratory pressure
PSV.....	Positive support ventilation
RCT.....	Randomized control Trial
SIMV.....	Synchronized intermittent mandatory ventilation
SPHMMC.....	Saint Paul hospital millennium medical collage
SPSS... ..	Statistical Package for Social Sciences
TASH.....	Tikur Anbessa Specialized Hospital
VAP.....	Ventilator Associated Pneumonia

Abstract

Introduction: Intubation and mechanical ventilation is a lifesaving therapy, allowing the support of patients with respiratory failure and coma with the objectives of improving gas exchange and decreasing work of breathing.

Objective:

To assess the outcome and associated factors of intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit from June 1 2021 to May 30 2022 G.C

Methodology

The study was conducted in SPHMMC and AaBET hospital by using a cross-sectional study design over one year. Systematic random sampling technique was used to get required samples from database. Data was entered and exported to SPSS for analysis. Bivariate and multivariate logistic regression was used to analyze the association between dependent and independent variables.

Result:

From 384 patients who met the inclusion criteria 233 (58.1%) were male and 161 ((41.9%) were females. Majority of patients 212 (55.2%) who were intubated and mechanically ventilated were medical patients. The final outcome were 167 (43.5 %) discharged and 217 (56.5 %) were died. The immediate cause of death for majority patients 103 (47.46%) were refractory septic shock. The indication for intubation for majority 214 (55.7 %) were for coma or air way protection. Mostly used machine mode as weaning method was CPAP 101 (50 %). Mostly used sedative agent during mechanical ventilator support was ketofol for 180 (46.9 %) patients. Rapid sequence intubation was the most commonly used procedure during intubation in 270 (70.3 %) of patients. Most commonly seen mechanical ventilator support related complication was reintubation 42 (10.9 %). Most common complication due to prolonged intubation was Laryngeal edema in 100 (26 %) patient. Most common complication due to prolonged hospital stay was HAP – VAP 134 (34.9 %) patients.

Conclusion:

The survival of intubated and mechanically ventilated patients at AaBET and SPHMMC Adult emergency and critical care unit in this study was poor.

This is due to patients who need intubation and mechanical ventilation are in refractory septic shock and others are severe traumatic brain injury who have poor prognosis at initial presentation who develop multiple complication.

Key word:

Assessment, mechanical ventilation, Intensive Care Unit, intubation, outcomes.

CHAPTER - ONE

1.1. Introduction

Background:

In an era of technological bounds and leaps, our ability to sustain life has drastically improved (1). From all of this intubation and mechanical ventilation is one of supportive treatment for patients who are unable to maintain adequate oxygenation and/or removal of carbon dioxide (1). Many studies have reported an increased rate of using mechanical ventilation over the last 7 years (2).

This increase is attributable to increases in demand for acute and critical care delivery in many health care systems (2). Patients admitted to intensive care units who need mechanical ventilation had higher mortality rates than those who do not require respiratory support (2).

One of the most common indications of admission to the intensive care unit (ICU) is the need for the ventilator support (2).

The first systematic use of ventilators in modern medicine was reported to have begun by Doctor Bjorn Ibsen in Copenhagen in 1953, whose use of mechanical ventilation helped to save thousands of lives of patients with polio who were dying of respiratory failure, reducing mortality from 87 percent to 25 percent (3).

Mechanical ventilation can be provided through non-invasive or invasive means and involves the delivery of positive airway pressure. Gas flow is delivered through a constant or decelerating pattern and the volume depends on inspiration time, gas flow and airway pressure. All are interrelated with pressure, flow, time and volume (4).

The main indications for Intubation and mechanical ventilations are airway protection and respiratory failure, which are considered to be vital for survival of critically ill patients (5). The goal of intubation and mechanical or artificial

ventilation is to improve gas exchange, reduce work of breathing and prevent complications while ensuring optimum conditions for patients to recover from their underlying illness. Whatever should be the reason for respiratory assistance, the patient's underlying condition must be reversible; otherwise subsequent weaning may not be possible (6).

Intubation and mechanical ventilation can cause significant and often permanent mental, physical and behavioral impairments requiring long-term access to health care. However, predicting the health care service utilization and mortality rate associated with invasive mechanical ventilation is difficult because of its widely varying rate and extent of recovery.

Although intubation and Invasive Mechanical Ventilation patients consume significant medical resources, their outcomes tend to be poor, especially in the elderly population (7).

Intubation and mechanical ventilation is often a life-saving intervention, but carries potential complications including pneumothorax, airway injury, alveolar damage, ventilator-associated pneumonia, and ventilator-associated tracheobronchitis. Other complications include diaphragm atrophy, decreased cardiac output, and oxygen toxicity. One of the primary complications that presents in patients mechanically ventilated is acute lung injury or acute respiratory distress syndrome. Acute lung injury or acute respiratory distress syndrome are recognized as significant contributors to patient morbidity and mortality (8).

Timely liberation from invasive mechanical ventilation is important to reduce the risk of ventilator-associated complications. Mechanical ventilation weaning is a major problem in intensive care units (9). Failure in weaning patients from the ventilator increases morbidity, mortality, the duration of mechanical ventilation, and the length of the stay in the ICU. Prolonged use of the ventilator can result in numerous complications, including respiratory tract infections, instability of hemodynamic status, sleep disorders, psychological dependence on the ventilator, higher rate of mortality, lung damage, laryngeal injuries, tracheal stenosis, sinusitis, pneumothorax, decreased cardiac output, physiological problems, reduction in oxidative enzymes in the respiratory muscles, nervous myopathy, increase in taking sedatives, higher gastrointestinal stress, skin fragility, bed sores, muscle atrophy and weakness, and pulmonary barotrauma (10).

1.2. Statement of the problem

A study in Duke University stated that among the millions of patients admitted to intensive care units (ICUs) annually; approximately one in three will receive intubation and mechanical ventilation (11). The frequency of utilizing intubation and mechanical ventilation, according to previous studies, varies from 40-65% of all adult intensive care units (AICUs) (5).

Recent epidemiological research in the United States showed that about 310 persons per 100,000 adult populations undergo intubation and invasive mechanical ventilation for non-surgical intervention. This situation has led to increased health care expenditures(12) It is estimated that patients admitted to intensive care units(ICUs) who need mechanical ventilation(MV) will have higher mortality rates than those who do not require respiratory support (13).

Many studies in developing countries showed that the mortality rate of patients on mechanical ventilation range from 26.6% to 67.2%. Age, comorbidities, number of days on ventilation, intensive care unit stay and total number of days in hospital were significantly associated with mortality (5, 7, 13–18). While mechanical ventilation have crucial role in patients with acute respiratory failure, its use can also cause harm. The adverse consequences of intubation and mechanical ventilation include airway lesions by intubation, pneumonia/sinusitis associated with mechanical ventilator, volutrauma, and barotrauma.

Mechanical ventilation regardless of its important role, it may aggravate, or even initiate, lung injury and inflammation and has therefore been identified as a risk factor for poor patient outcome (10).

A research conducted in Brazil, Malawi and India described that mechanical ventilation is associated with significant mortality and high rate of iatrogenic complications. The Crude mortality rates in LMICs ranges between 36 and 72 % for ventilated patients (19).

In Africa, Egypt study showed that the mortality rate in intubated and mechanically ventilated patients was 64%. Moreover, for invasive ventilation mortality rate was higher than non-invasive ventilation while the higher mortality was reported in patients with inadequate weaning (14).

Another study conducted in Mekelle ayder comprehensive specialized hospital also reported that the use of a mechanical ventilator in ICU is high. Among 286 adult patients admitted to the ICU, 4 105 (35.2%) were mechanically ventilated from initial admission to discharge or death. The overall ICU mortality rate for patients under Invasive MV was 28.6 percent (15). Despite significant advances in ventilator support, it remains with high mortality and significant impairment in the post-ICU setting of patients' quality of life (16).

For patients requiring intubation and mechanical ventilation the basic characteristics and management have changed over time, but the effect of these improvements on patient outcomes is unclear (20). Therefore an awareness of the clinical demographics and outcomes of intubated and mechanically ventilated patients in the intensive care unit (ICU) is important because it allows for better use of resources and helps in clinical decision making(21).

Intubation and mechanical ventilation is one of the most common reasons for ICU admissions in Ethiopia too. Even though, there are few studies carried out to show clinical characteristics and outcomes of patient on intubation and mechanical ventilation in Ethiopia in which those few previous studies are not adequate to show the full picture of the phenomenon, and still more studies are required to show the outcome of patients on the mechanical ventilation.

Thus, this study is intended to assess the outcome of intubated and mechanically ventilated patients in SPHMMC and AaBET emergency and critical care department, Addis Ababa, Ethiopia.

1.3 Significance of the Study

This study on outcomes of intubation and mechanical ventilation are important for better use of resources and clinical decision making in the intensive care unit (6). Providing such information important to the patient's outcome on intubation and mechanical ventilation will help to draw up possible recommendations for patients on intubation and mechanical ventilation care and will be useful in various ways for the Ministry of Health Policymakers and stakeholders, health care professionals and the hospital society at large.

It may have a direct positive impact on the quality of patient care and may help the hospital's in improving patients outcome on intubation and mechanical ventilation management protocol. This can improve the outcome of the patients and shorten the duration of hospital stay. This study will also serve as a literature for further researchers and health care providers for better quality care of patients on intubation and mechanical ventilation.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Clinical profiles and outcome

A twenty-eight-day international study performed in 361 ICUs of 20 countries showed that out of the total 15,757 admitted patients 5,183 (33%) received MV for an average of 5.9 (7.2) days. From the intubated and mechanically ventilated patients 3428 (66.1%) were medical patients and 1755 (33.9%) were surgical patients. From this 61.3% were male and 38.7% were female. Intubation was done through an oral-tracheal tube in 4614 (89.0%) patients, a nasal-tracheal tube in 211 (4.1%) patients, and a tracheostomy in 102 (2.0%) patients. The ICU stay average mean (SD) was 112 (13.7) days. The indication for ventilation for 120 (52%) patients were for ARDS and 115 (22%) were for COPD exacerbation (22).

A 1-day point-prevalence study conducted in North America, South America, Spain, and Portugal showed that 75% of patients used ETT to access to the airway. Ninety-six percent of intubation done through the Oral-tracheal and 4 percent through the nasal-tracheal route. The most frequently used ventilator mode was assist/control (47%) and synchronized intermittent mandatory ventilation (SIMV) (46%). The most common weaning approach was pressure support, which was used in 36 percent of patients, and 28 percent of patients used the combination of SIMV and pressure support (23).

A prospective cohort study conducted in southern Brazil showed that a total of 2,430 patients were admitted to ICU. From this 1,115 patients were in need of intubation and mechanical ventilation for more than 24 hours. The sources of admission were from the hospital ward (56%), emergency department (25%) and other hospitals (19%) with a male majority (52%). The main indications for MV were sepsis

(41.8%), shock (37.8%), pneumonia (37%) and ALI/ARDS (15%). In this study patients who developed renal failure were (290; 26%), cardiovascular failure (227; 20.4%), coagulopathy failure (201; 18%), neurological failure (115; 10%) and hepatic failure (86; 7.7%) during the course of MV (13). From this study the mortality rate of patients on invasive mechanical ventilation was 215/622(34.5%)(16).

Another study conducted in 45 Brazilian intensive care units indicated that from 773 admitted patients 622(80%) patients received intubation and mechanical ventilation. The source for admission was emergency room, ward and operation room (47%, 31% and 22%) respectively. The type of medical illness causing intubation and ventilator support were Pneumonia (27 %), neurologic disorders (19 %) and non-pulmonary sepsis (12 %). The most commonly used mechanical ventilation mode was pressure-controlled ventilation 371(60%) followed by volume-controlled ventilation 186(30%) and pressure-support ventilation 54(9%)(16).

A retrospective study in western Indian showed that a total of 500 patients were admitted to ICU in 1 year study period. From this 130 (26%) patients received intubation and mechanical ventilation for more than 6 hours. The length of stay on mechanical ventilation was 4(3.4) days. The average length of stay in ICU and hospital was 4.49 (3.52) and 6.4 (3.6), respectively (17). From this study the mortality rate of adult patients on mechanical ventilation was 67.2%, while 76.1% for ARDS patients. The main factors independently associated with increased mortality were (i) pre-MV factors: age and heart failure (ii) patient management factors: positive end-expiratory pressure (iii) Factors occurring during MV: PaO₂/FiO₂ ratio < 100 ,presence of renal and hepatic failure following initiation of MV(17).

A retrospective study conducted in a rural hospital in India indicated that a total of 505 patients were admitted to ICU within 2 years. From this admitted patients, 161(31.88%) received intubation mechanical ventilation. The ICU length of stay, duration on ventilation and length of total hospital stay were 5(3–10) days, 2 (1–5) days and 6(3–10) days respectively. Type of illness causing IMV were acute kidney injury (36.6%), Sepsis (31.28%), neurological (26.34%), cardiac (16.23%), and respiratory (14.46%). The commonest comorbidities were chronic kidney disease (CKD) (17.23%) and coronary artery disease (CAD) (14.65%) followed by hypertension (12.27%) and diabetes (11.68%)(7). From this study the mortality rate

of patients on mechanical ventilation was 87/505(17.2%). Age, comorbidities, number of days on ventilation, ICU stay and total number of days in hospital were significant factors associated with mortality (7).

A study conducted in 138 sampled patients in Maharashtra, India shows that the most common cause for mechanical ventilation was poisoning (53.6%). The mean age of patients was 43.22 years, ranging from 14 to 75 years with male predominance (73.91%). The average length of stay in ICU before MV, on MV and the cumulative length of stay in ICU were 0.78, 5.9 and 6.4 days in non-survivors. From sampled patients 17 patients were having bradycardia, 41 were having normal heart rate while 80 patients were having tachycardia. From this study the mortality rate of patients on mechanical ventilation was 42.1%. A total of 77 patients required tracheostomy and 35 patients required inotropes support with mortality of 31.1% and 62.8 % respectively. Coronary artery disease (mortality-60%), hypertension (mortality-56%) and CKD (mortality-80%) showed significant association with outcome (24).

A prospective observational study conducted over 18 months in a Mumbai tertiary hospital shows that a total of 1150 patients were admitted to ICU. Out of this patients 397(34.5%) were in need of intubation and mechanical ventilation. The average age of the mechanically ventilated patients was 32 years. The most common complication associated with MV support was VAP (53.33%), followed by decubitus ulcers (40%) and deep vein thrombosis (8.89%) (25).

A study conducted in Korean Intensive Care Units in Ethiopia showed that 275 patients were received MV. The median (IQR) age was 69 (54-75) years. The common indication for initiation of mechanical ventilation were pneumonia (23%), acute respiratory failure on chronic pulmonary disease (ARF-CPD, 16%), sepsis (10%), and ARDS (10%). Pressure control ventilation mode (40%) was the preferred mode used in the ICU. Sedatives drugs were used in 155 patients (56%), analgesics in 141 (51%) patients, and neuromuscular blockers in 71 (26 %) patients. Midazolam and fentanyl were the preferred sedative and analgesic drugs, used in the ICU (21).

A 5-year retrospective study in Cairo, Egypt, showed that over 5-year a total of 1081 patients were intubated and ventilated. The ventilation duration was 6 ± 10 days, and ICU stays length was 13 ± 15 days. Predominant type of disease causing ventilation were heart diseases followed by respiratory diseases, neurological diseases, sepsis,

and septic shock. The preferred initial ventilation mode was volume-controlled ventilation (61.8%) followed by Continuous Positive Airway Pressure (CPAP) (15.4%), pressure controlled ventilation (PCV) (14.7%), and Pressure Support – Continuous Positive Airway Pressure (PS-CPAP) (8%) (14). In this study the mortality rate among the mechanical ventilation patients was 696(64.4%). The mortality was higher in patients ventilated because of heart disease (41.8%) followed by respiratory diseases (31.8%), central nervous system (13.8%), and septic shock (12.6%) (14).

A research conducted in Egypt at EL-Mahalla Chest Hospital indicates that 412 patient were admitted to the ICU. From all this 130 received invasive and noninvasive ventilation. The commonest indication of MV was acute on top of chronic respiratory failure (77.7%) and COPD (48.5%) (5).

Another study conducted in Abbassia Chest Hospital, Egypt tell us that 223(54.79%) patients on mechanical ventilation were died and 184(45.2%) patients were survived. Out of the 184 patients, 111(27.27%) patients were transferred to the ward, 70(17.2%) were discharged without recommendation, and 3(0.74%) were discharged with home on O2 therapy (27).

A prospective, case-control survey conducted in Nigeria Tertiary hospital indicated that a total of 128 patients were admitted into the ICU over the six months. From this 44(34.4%) patients were mechanically ventilated. The length of average duration of MV was 12.30 ± 10.10 days. The mean age of patients ventilated was 37.7 ± 21.10 years. The male to female ratio was 1:1.2. The major indications for mechanical ventilation were respiratory distress (38.6%), 9 airway protection (27.3%), low Glasgow coma score (20.5%) and hyperventilation (13.6%)(26). From this study the mortality rate of mechanically ventilated patient was 31.8% which is different from the overall mortality rate of in intensive care unit was 63.6%(26).

A secondary analysis of three prospective, observational multicenter studies conducted in 1998, 2004 and 2010 in 927 ICUs from 40 countries. They screened 18,302 patients receiving MV for more than 12 hours during a one-month-period and they included 812 patients receiving MV after cardiac arrest. The result shows the use of protective mechanical ventilation in patients after cardiac arrest increased from 1998 to 2010, and is associated with a decrease in pulmonary

complications. Variables independently associated with 28-day in-hospital mortality were: older age, PaO₂ <60 mmHg, cardiovascular dysfunction and less use of sedative agents. The application of protective mechanical ventilation and the prevention of single and multiple organ failures may be considered to improve outcome in patients after cardiac arrest (31).

A prospective observational study done at Mekelle Ayder comprehensive specialized hospital showed that 286 patients were admitted to ICU. From all this patients 105 (36.7%) of them received invasive mechanical ventilation. The surveyed patients' median [IQR] age was 32 [24, 52] years and 16.2% was above 60 years of age. Acute respiratory failure (50.5%) was the leading indications followed by coma (35.2%). The median [IQR] duration of MV stay was eight [5, 14] days and 11.4 percent had prolonged mechanical ventilation. Complications were seen in 63.8% including; stress induced gastric bleeding (28.6%), VAP (27.6%), AKI (22.9%) and new septic shock growth (20%). (15).

An observational cohort study conducted in Philippines states that out of 191 intubated patients 39% were died and 54% were weaned from the mechanical ventilation. From the weaned patients 35% were planned weaning, and 19% were unplanned weaning. From 191 intubated patients 7% left against medical advice. The main factors associated with the unplanned weaning were male sex and age (28).

A study conducted in Ayder specialized hospital showed that the overall ICU mortality rate for patients under Invasive MV was 28.6 percent. Over 60 years of age and new septic shock development was associated with a significantly increased mortality risk (15).

A cross sectional study done in Tikur Anibesa specialized hospital in 2020 G.C on outcome of mechanically ventilated patients showed that there were 693 patients admitted to adult ICU over the one year period. From this 348(50.2%) were mechanically ventilated. The main source for admission was Adult emergency and operation room with same percent (37.6%). The main reason for ICU admission was respiratory support (55.2%). The predominant indication of mechanical ventilation was respiratory failure (41.9%), neurological failure (36.7%) and sepsis (11.4%). Volume control ventilation was the most common initial mode of ventilation used. From the total study participants 115(54.8%) died and 95(45.2%) survived. From

the non-survived patients on mechanical ventilation 73(34.8%) died in ICU and the remaining 42(20%) died after transfer to inpatient department or in the ward (30).

A study done in Michigan university hospital indicates that total of 3,423 emergent non - operating room airway management cases were identified. The incidence of difficult intubation was 10.3%. Complications occurred in 4.2% patients: aspiration, 2.8%; esophageal intubation, 1.3%; dental injury, 0.2%; and pneumothorax, 0.1%. A bougie introducer was used in 12.4% of cases. The average patient age was 58 year, and 56.4% were male. The most frequent indication for intubation was respiratory distress, followed by cardiac arrest, airway protection. Etomidate was the most frequently used induction agent (57%), followed by propofol (18%). Muscle relaxation was used in 2,466 cases (72.0%), and succinylcholine was used most often used drug (32).

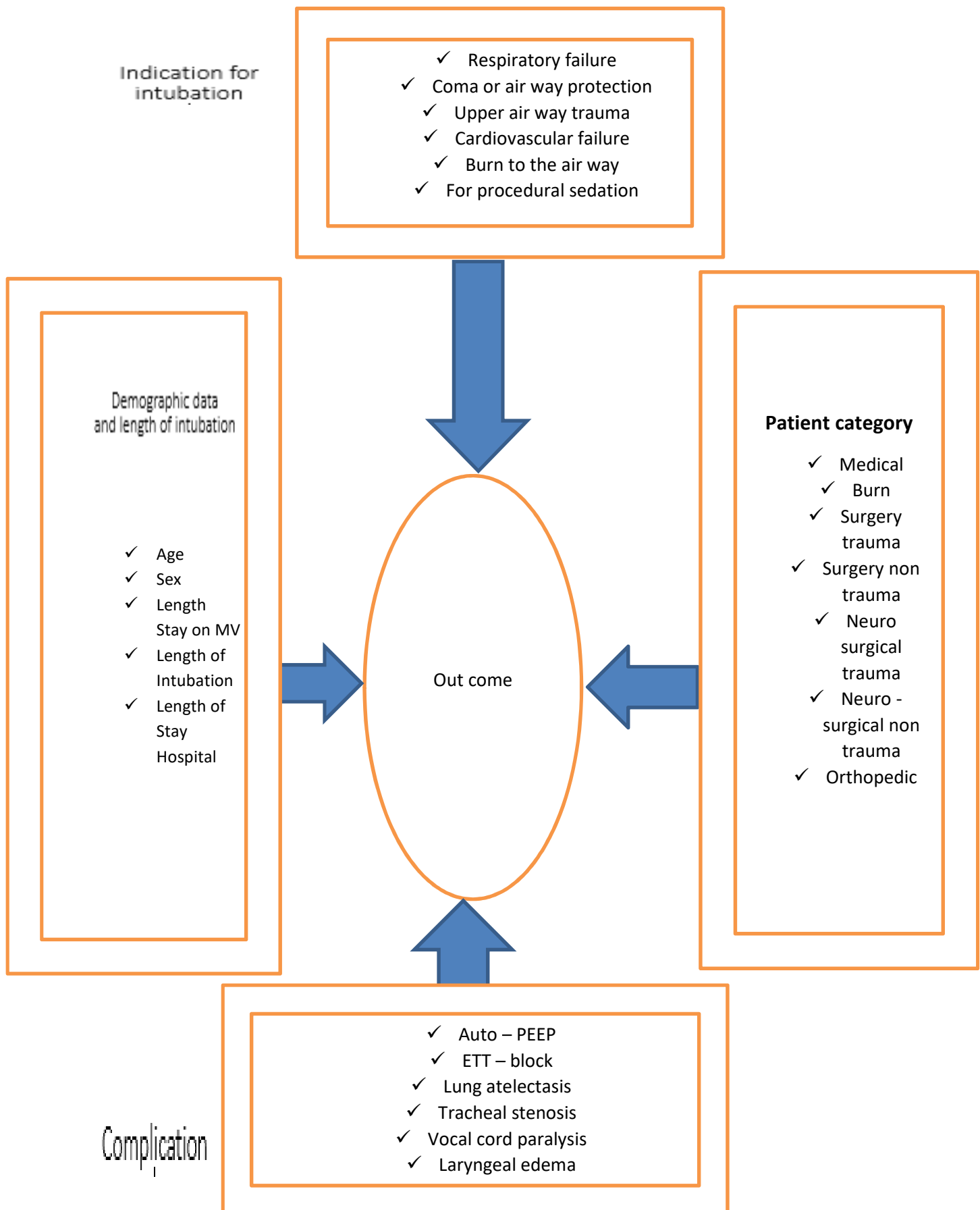
RCT research done to compare the outcome of prehospital and emergency intubation show us twenty-one studies examining 35,838 patients were included. The median mortality rate in patients undergoing pre-hospital intubation was 48% (range 8–94%), compared to 29% (range 6–67%) in patients undergoing intubation in the emergency department. Odds ratios were in favor of emergency department intubation both in crude and adjusted mortality, with 2.56 (95% CI: 2.06, 3.18) and 2.59 (95% CI: 1.97, 3.39), respectively. The overall quality of evidence is very low. Twelve of the twenty-one studies found a significantly higher mortality rate after pre-hospital intubation, seven found no significant differences, one found a positive effect, and for one study an analysis of the mortality rate was beyond the scope of the article (33).

Retrospective review of prospectively collected data from an airway surveillance database at an urban Level trauma center between 2001 and 2004 show us Of the 9,980 patients evaluated during the three-year study period, 1,435 (14%) were emergently intubated and made up the study population. About 92% of ED intubations were performed by the anesthesia team. Of all emergently intubated patients, 46% were lean, 37% were overweight, 15% were obese, and 2% were morbidly obese. Logistic regression analysis revealed that BMI was not an independent risk factor for failed intubations in the field or in the ED, post intubation airway complications, or death. Only early respiratory complications demonstrated a statistically significant association with a higher BMI. Emergency intubation of obese trauma patients can be safely and successfully performed in a

high volume Level I trauma center. Obesity is not a predictor of post intubation airway complications or mortality (34).

2.3. Conceptual Frame Work for Mortality Associated Factor

Figure 1: Conceptual framework diagram



CHAPTER – THREE

3. OBJECTIVES

3.1. General Objective

To assess the outcome and associated factors of intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit Addis Ababa, Ethiopia from June 1,2021 to May 30,2022 G,C.

3.2. Specific Objectives

- 1.To assess the clinical profile of intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit.
- 2.To assess the outcomes of intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit.
- 3.To identify factors which are associated with poor outcome in intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit.

CHAPTER - FOUR

4. METHODOLOGY

4.1 Study area

This study was conducted in AaBET and SPHMMC emergency and critical care unit , which is found in Addis Ababa - a capital city of Ethiopia. Saint Paul's Hospital was established in in July 1947. After 60 years of hospital service to the community it opened a medical college during the Ethiopian millennium celebration and was renamed Saint Paul's Hospital Millennium Medical College (SPHMMC) in 2007. Currently it has postgraduate and sub specialty programs with more than 2,800 clinical, academic and admin staff .it has more than 700 beds for inpatient service and more than 2,000 outpatient and emergency clients are visiting the health facility daily.

The adult Emergency department in SPHMMC serves about 600-700 patients monthly with 8 beds in red – orange area and 9 beds in yellow - green area. It has also separate two ICU which has 18 beds.

The affiliate of SPHMMC called Addis Ababa burn emergency and Trauma center named as AaBET Hospital which was established in 2015. It has one ICU with 13 beds and emergency floor having 5 beds in the red side, 13 beds in orange side and 31 beds in yellow green side. It serves about 650 to 750 patients monthly.

4.2 Study design:

Hospital based cross-sectional study over a period of one year was conducted by reviewing the charts of intubated and mechanically ventilated patients in AaBET and SPHMMC emergency and intensive care unit from June 1, 2021 up to May 30, 2022 G.C

4.3. Population

4.3.1. Source Population:

All patients who were visiting to emergency and intensive care unit of SPHMMC and AaBET hospital from June 1, 2021 up to May 30, 2022 G.C

4.3.2. Study Population:

All sampled patient who were intubated and mechanically ventilated at AaBET and SPHMMC emergency and intensive care unit from June 1, 2021 up to May 30, 2022 G.C will be included in this study.

4.5 Data source:

Medical records of sampled patients that fulfill the inclusion criteria who were intubated and mechanically ventilated at AaBET and SPHMMC Adult Emergency and intensive care unit from June 1, 2021 up to May 30, 2022 G.C will be used.

4.6 Eligibility Criteria

4.6.1 Inclusion Criteria

Patients who were visiting to AaBET and SPHMMC Adult emergency and intensive care unit who require intubation and mechanical ventilation from June 1, 2021 up to May 30, 2022 G.C will be eligible and included in this study.

4.6.2 Exclusion Criteria

Those patients with incomplete records, those with lost cards, those who transferred to other centers before extubation, patients who were intubated in OR and extubated thier are excluded from study.

4.7. Sample Size Determination and Sampling Procedure

4.7.1. Sample Size Determination

The following assumptions were considered in calculating the sample size. Since the prevalence of the problem in the study area is not known, P value is taken as 50% (0.5) and 95% confidence interval was used, with 5% margin of error tolerated. Then the sample size can be determined by using single population proportion formula.

$$n = \frac{(Z_{\alpha/2})^2 p (1-p)}{d^2}$$

Where,

n - Required Sample

z - Standard normal value at 95% CI which is 1.96

p - Estimated population proportion which is 0.5

d - Possible margin of error tolerated which is 0.05

$$n = \frac{(1.96)^2 0.5 (1-0.5)}{(0.05)^2} = 384$$

Since the source population is around 18,000 which is > 10,000, population correction formula is not important.

4.7.2. Sampling Procedure

List of patients who were intubated and mechanically ventilated were taken from the database.

K value can be calculated as, $K = \text{Total intubated} / \text{Sample size}$ which is $480/384 = \text{One}$. Then systematic random sampling method was used to select the sample by everyone interval according to the registration order and the first number was selected by lottery method.

4.8. Data Collection tool and procedure

Before data collection structured questionnaires in English version were adopted from different literatures mentioned on reference developed for similar purposes by different authors; it then reviewed to suit the local condition. The first part of questionnaire discuss about socio-demographic, patient and triage category, route and indication for intubation. The second part of questionnaire discuss about comorbidity, length of stay, machine mode and type of intubation procedure and sedative drug used. The third part of questionnaire discuss about complication due to prolonged intubation, prolonged hospital stay, mechanical ventilator support and cause of death. During data collection necessary data were extracted by reviewing patient's chart. One MPH supervision officer was recruited for data collection and completeness and accuracy was checked by the research conductor. After data collection data was entered to Epi-info version 3.5.3 and exported to SPSS Version 26 for analysis.

4.9. Data Quality Control

Data collection tool was pretested on 5% samples of similar study subjects on records of patients for validity of the survey tool and questionnaires were standardized. Based on the finding possible amendments was made on the questionnaires.

After that data was collected by MPH supervision officer who received training for one day and supervision was done by the principal investigator on daily basis throughout the data collection period. After completion of the data collection, each questionnaire was checked for completeness.

4.10 Data Processing and Analysis

After the data collection the data was cleared, coded and entered to computer by using epi info Version 3.5.3 and SPSS version 26.0.0 for analysis. Data analysis include descriptive statistics, including frequency, percentage, and mean. Tables and

graphs were also used for data presentation. Those variables with p-value of ≤ 0.25 on binary logistic regression will be considered for multivariate logistic regression to determine associations of each variable.

Multivariable logistic regression model was fitted to control the possible effect of confounders and to see association between dependent and independent variables. Finally the variables which had independent association with poor outcomes identified on the basis of OR, with 95%CI and p-value less than 0.05.

4.11. Study variable

4.11.1 Dependent variables

Outcome

- ✓ Death
- ✓ Discharged improved

4.11.2 Independent variables

- ✓ Age
- ✓ Sex
- ✓ admission source
- ✓ reason for intubation
- ✓ mode of airway access
- ✓ complications
- ✓ Admission diagnosis
- ✓ mode of weaning
- ✓ Sedation used.
- ✓ Length of hospital stay
- ✓ length of ICU stay
- ✓ Length of stay on MV
- ✓ mechanical ventilator mode
- ✓ Comorbidities (HTN, DM, Asthma, CKD.....)

4.12. Operational definition

Outcome: conditions of patients written on patients chart at discharge time (improved and death).

Death: The irreversible cessation of all vital functions especially as indicated by permanent loss of the heart, respiration, and brain activity as result of disease process which lead to intubation.

Admission: is transferring of patient to ward or ICU

Intensive care unit: is a specially staffed and equipped, separate and self-contained area of a hospital dedicated to the management of patients with life-threatening illnesses, injuries and complications, and monitoring of potentially life-threatening conditions.

Complication: a secondary disease or condition aggravating an already existing one which developed due to hospital stay or secondary to treatment side effect.

Intubation: the insertion of artificial endo tracheal a tube into a patient's body, especially into the trachea for ventilator support.

Mechanical ventilation : The process of using positive pressure devices to provide O₂ and remove CO₂ transport between the environment and the pulmonary capillary bed after intubation to maintain adequate levels of PO₂ and PCO₂ in arterial blood.

Prolonged intubation: Intubation greater than seven days or in excess of seven days.

4.13. Ethical consideration

Ethical clearance and approval to conduct this research was obtained from St. Paul's hospital millennium medical college institutional research review board. To ensure confidentiality name and other personal identities were not used during data collection.

4.14. Dissemination of results

The result of the study was reported to St. Paul's hospital millennium medical college, the result will also be presented to medical/scientific community on different national and international meetings. Finally it was submitted to Emergency and Critical Care Medicine department at AaBET hospital.

CHAPTER FIVE – RESULT

5.1 Social demographic and triage category of patients

There were 480 patients who were intubated and mechanically ventilated in both SPHMMC AaBET hospital Adult emergency and ICU during the study period. From all this 384 patients met the inclusion criteria and included in the study. From all this revised charts 233 (58.1%) were male and 161 ((41.9%) were females. The Patients age ranges from 5 to 86 year. The mean age of the patients was 37.03 years.

The majority of patients 203 (52.9%) belong to the age group 21-40 years.

Table.1.Age of respondent and sex of respondent Cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		sex of respondent		Total
		male	female	
age of respondent	1 to 20	19	26	45
	21 to 40	130	73	203
	41 to60	51	45	96
	61 to 80	21	15	36
	81 to 100	2	2	4
Total		223	161	384

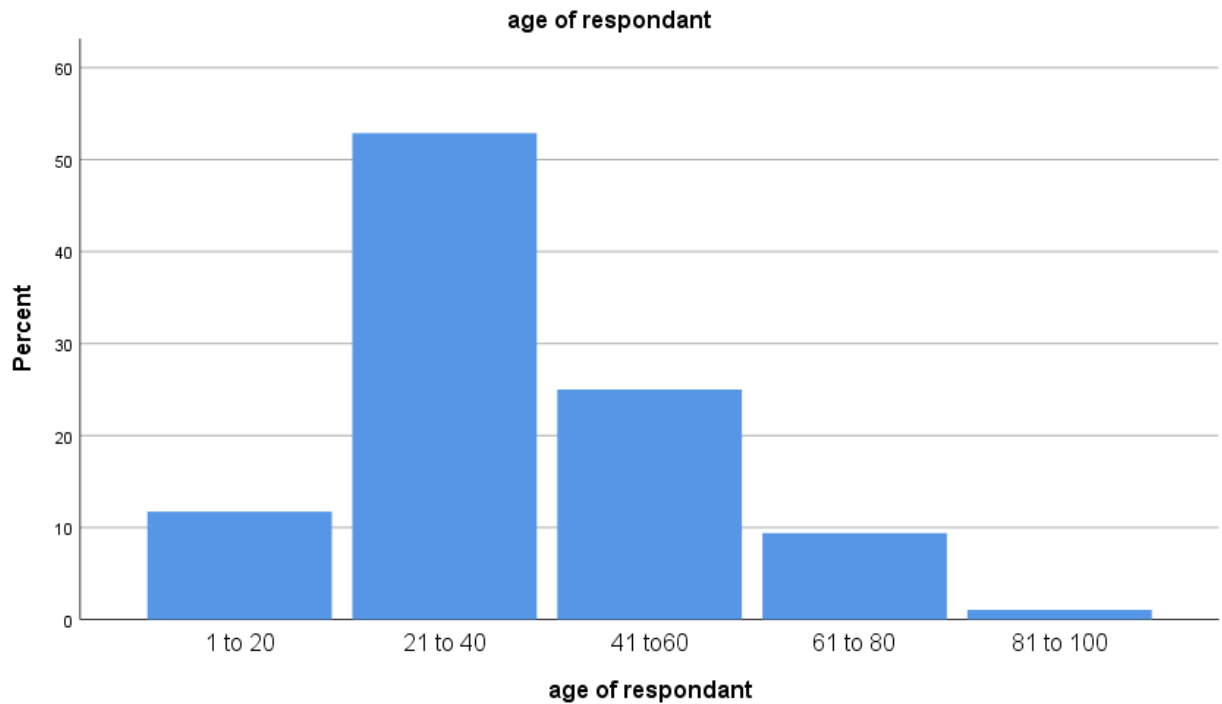


Figure Two bar graph: Age frequency distribution graph in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C
 Majority of patients 299 (77.9 %) triaged to the Red area immediately after arrival.

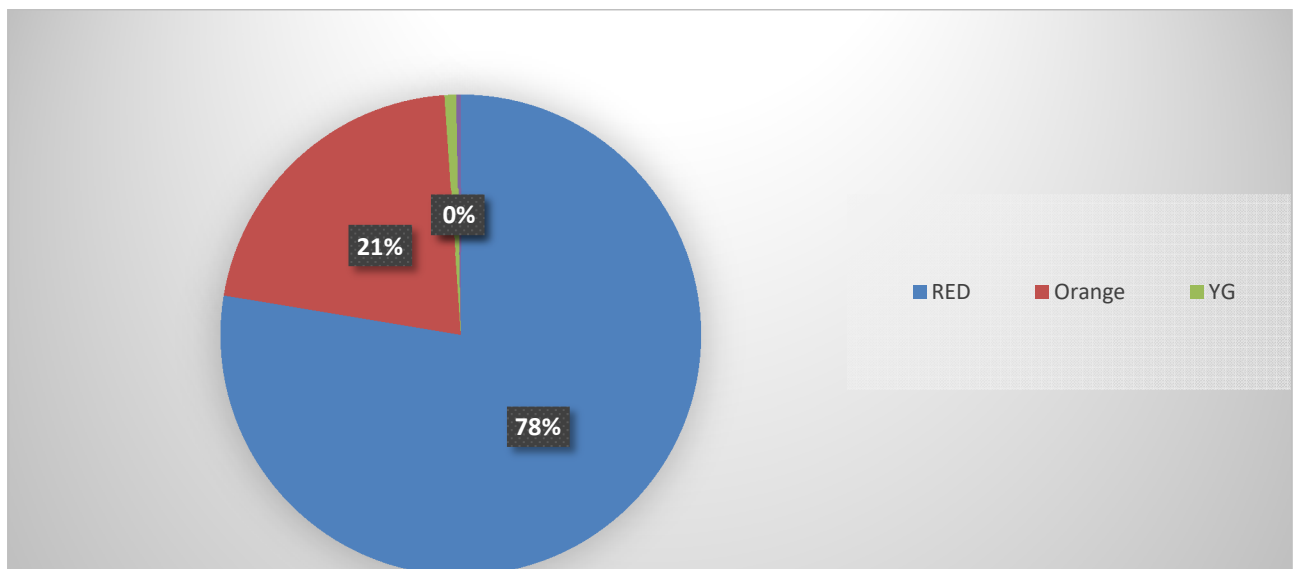


Figure three pie graph triage category by percent in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C .

5.2 Patient category based on type of illness and place patient intubated

About 138 (36%) of patients are extubated on place of intubation and 190 (49.5%) are intubated in the emergency department. About 173 (44.5%) are intubated in the ICU and 23 (6%) are intubated in the operation room.

Table two place where patient intubated and after intubation where patient admitted Cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		after intubation where patient admitted				Total
		to ICU	Extubated on place of intubation	Died on the place of intubated	Transferred to other hospital	
place where patient intubated	AaBET ED	32	44	22	0	98
	OR or recovery	10	10	3	0	23
	ST paul ED	30	25	36	1	92
	AaBET ICU	0	39	44	0	83
	ST paul ICU	0	20	68	0	88
Total		72	138	173	1	384

Majority of patients 212 (55.2%) who were intubated and mechanically ventilated were medical patients followed by orthopaedic trauma patients 92 (24 %).

	frequency	percent
General surgery trauma	17	4.4
General surgery non trauma	19	4.9
Neurosurgical trauma	29	7.6

Neurosurgical non trauma	6	1.6
Medical	212	55.2
Burn	9	2.3
Orthopedic	92	24
Total	384	100

Table 3. Patient category based on type of illness in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

5.3. Indication and route of intubation for medical and trauma patients and GCS score

In this study indication for intubation for majority 214 (55.7 %) were coma or air way protection and the route of intubation was 364 (95 %) through oro tracheal and 20 (5%) were through surgical air way and naso – trachea.

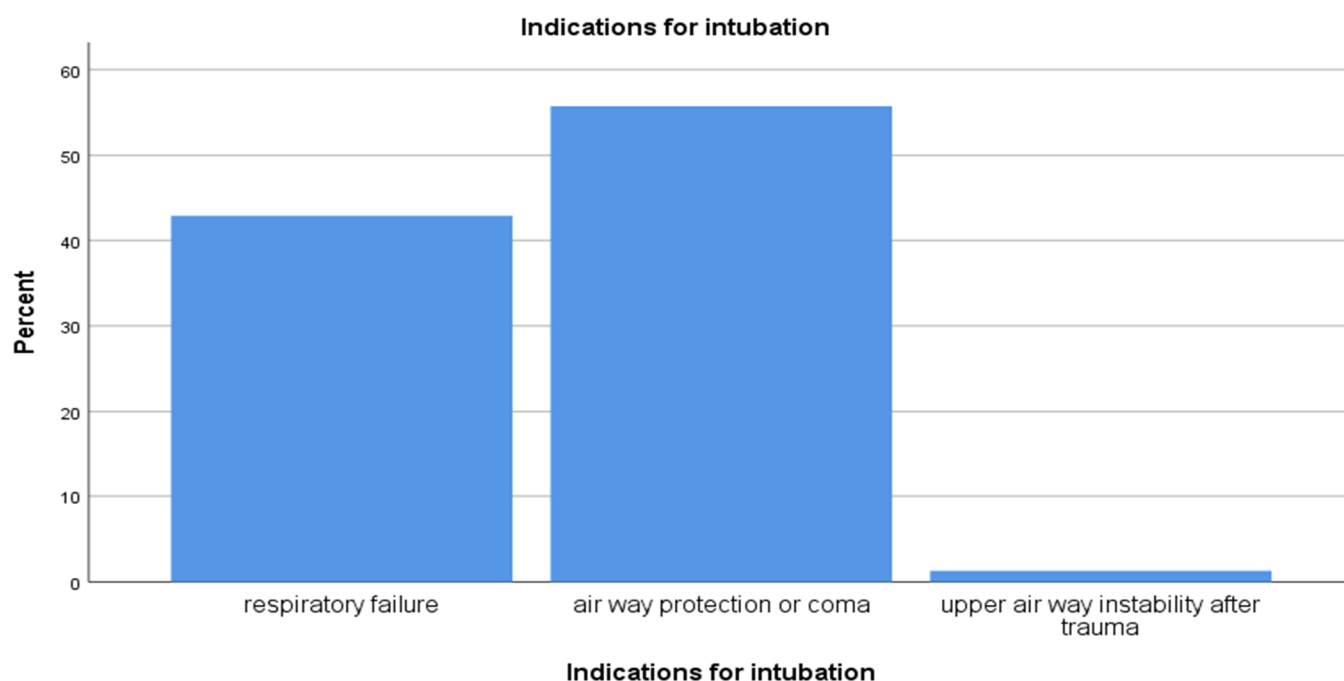


Figure four bar graph showing Indication for intubation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

The major type of medical illness resulting in intubation was HAP 86 (40.5 %) followed by sepsis and septic shock 73 (34.4 %).

Medical illness	frequency	percent
HAP	86	40.5
Asthma	14	6.6
CVD	8	3.7
Poisoning	19	8.9
DKA	2	0.9
GBS	7	3.3
Sepsis or septic shock	73	34.4
Others	3	1.4
Total	212	100

Table 4. Medical illness which is the cause for intubation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

The Glasgow coma scale for most patients 276 (71.9 %) immediately before intubation was comatose 3 to 8 and for the rest 108 (28.1 %) it was 9 to 12.

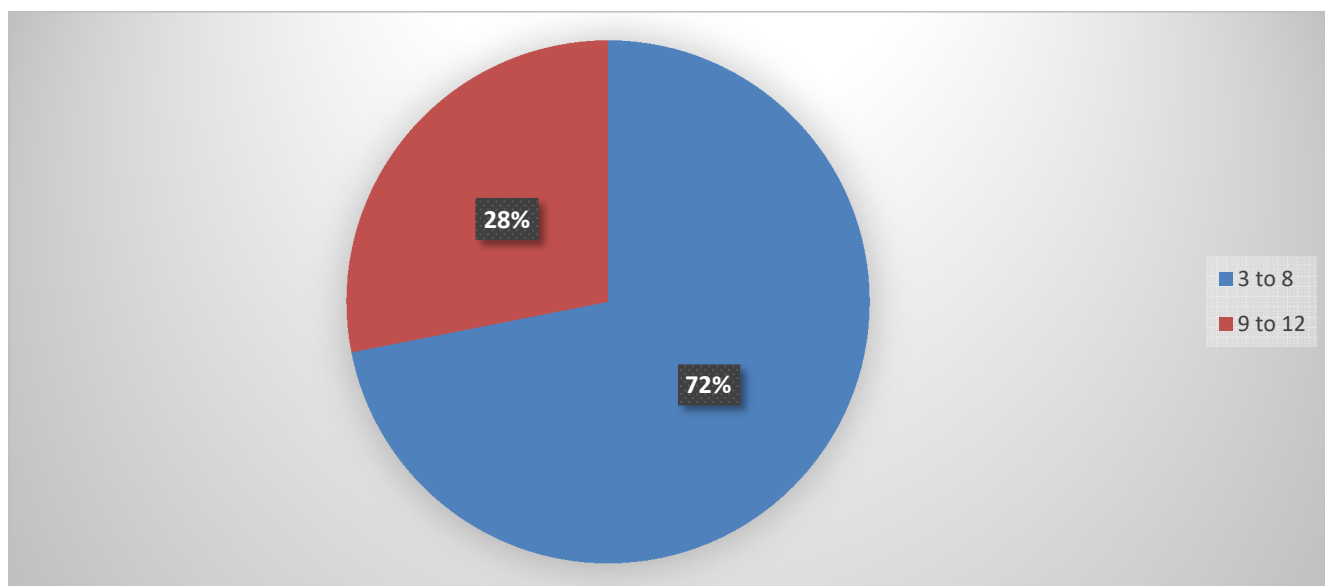


Figure Five Pie graph showing GCS of patient immediately before intubation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

5.4. comorbid disease and length of stay on mechanical ventilation and final out come

Having Comorbidity increase mortality and morbidity and increase length of time being supported on mechanical ventilator. In this study Cardiovascular disease is the most common comorbidity 72 patients and followed by chronic kidney disease in 48 patients.

Table five . Comorbidity and length of stay cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		The length of intubation				Total
		Less than 24 hours	24 hours to 3 days	3 days to 7 days	7 days to one month	
comorbid disease	DM	3	7	17	4	31
	Asthma	2	8	20	6	36
	CKD	2	17	19	10	48
	hypertension	5	3	6	13	27
	CVD	6	6	38	22	72
	Cancer	3	2	5	3	13
	others	6	11	10	9	36
	CKD & HTN	0	1	0	3	4
	RVI	2	1	8	1	12
	no comorbidity	9	16	41	39	105
Total		38	72	164	110	384

		The final outcome of patient		Total
		discharged	died	
comorbid disease	DM	13	18	31
	Asthma	19	17	36
	CKD	10	38	48
	hypertension	12	15	27
	CVD	32	40	72
	Cancer	4	9	13
	others	19	17	36
	CKD & HTN	2	2	4
	RVI	6	6	12
	no comorbidity	50	55	105
Total		167	217	384

Table six . Comorbidity and final outcome cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

5.5. Weaning method, sedative drug, machine mode and intubation procedure used for ventilator support

The decision of weaning a patient from the ventilator is influenced by the attending clinician clinical judgment Mostly used machine mode as weaning method was CPAP 101 (50 %) followed by SIMV 66 (33 %).

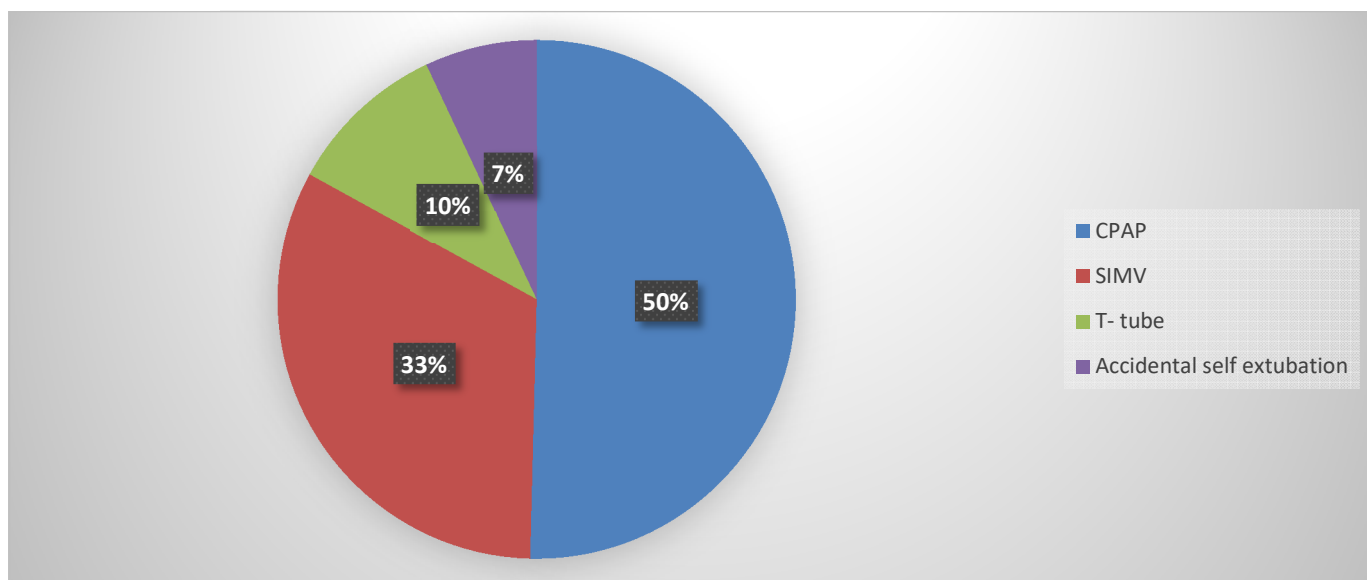


Figure Six pie graph shows weaning method by percent in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

The selection of mode of mechanical ventilation can vary based on the individual preference and institutional usual practice. In this study mostly used machine mode during mechanical ventilation was VCV – AC for 270 (70.3%) and PCV – AC for 110 (28.6 %) patients.

Table Seven. Mostly used machine mode during ventilator support and the final outcome of patient Cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		The final outcome of patient		Total
		discharged	died	
mostly used machine mode	PCV - AC	51	59	110
	PCV - SIMV	0	1	1
	PCV - CPAP	3	0	3
	VCV - AC	113	157	270
Total		167	217	384

Mostly used sedative agent during mechanical ventilator support was ketofol for 180 (46.9 %) patients.

Table 8 . Sedative drugs used during mechanical ventilator support in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
ketamine	104	27.1
propofol	44	11.5
ketofol	180	46.9
diazepam	56	14.6
Total	384	100.0

Rapid sequence intubation was the most commonly used procedure during air way protection 270 (70.3 %) of patients.

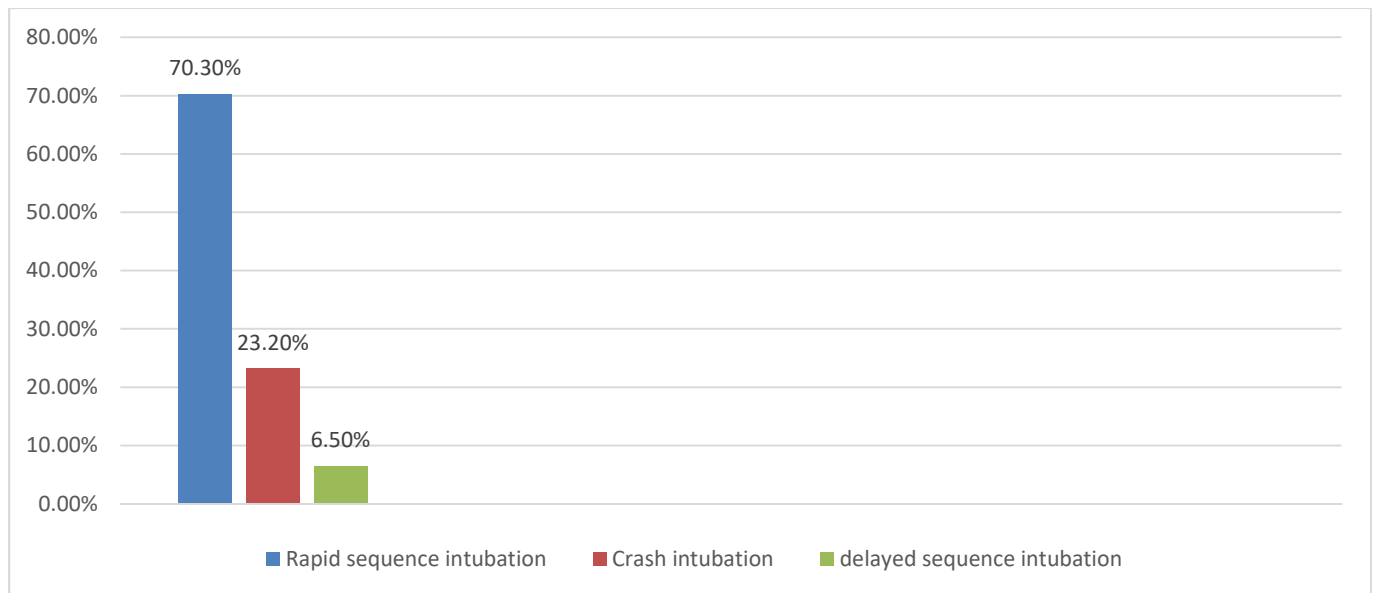


Figure Seven bar graph shows intubation procedure by percent in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

5.6. Complication of intubation and mechanical ventilation and prolonged hospital stay

The most common immediate complication during intubation was air way trauma 66 (17.2%) followed by dental trauma 27 (7%).

Table nine . Immediate complication during intubation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
cardiac arrest	10	2.6%
air way trauma	66	17.2
hypoxia	25	6.5
dental trauma	27	7.0
no complication	211	54.9
ETT misplacement	23	6
Aspiration	17	4.4
others	5	1.3
Total	384	100.0

Mechanical ventilation is an important instrument, with both negative and positive effects .Most commonly seen mechanical ventilator support related complication was Re - intubation 42 (10.9 %) which is followed by Auto PEEP 20 (5.2 %) and ETT block 20 (5.2 %).chest tube was inserted for 20 patients who develop Auto PEEP and CPR was done for 10 patients who develop cardiac arrest.

Table Ten .mechanical ventilator support related complication in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
auto PEEP	20	5.2
lung atelectasis	10	2.6
ETT block	20	5.2
Dislodgement	7	1.8
ETT cuff rupture	2	0.5
Re - intubation	42	10.9
no complication	273	71.1
auto PEEP & ETT block	1	0.3
ETT block and dislodgement	2	0.5
ETT block,ETT cuff rupture,re - intubation	5	1.3
ETT block,dislogement, ETT cuff rupture,re - intubation	2	0.5
Total	384	100.0

Surgical procedures done for patients who were on mechanical ventilator support are wiring and fixation of fracture 56 (14.6 %) and craniotomy 46 (12 %) patients. Tracheostomy was done for 65 (16 .8 %) patients and the indication was prolonged intubation for 61 (93.8 %) and tracheal stenosis for 4 (6.2 %) patients.

Table 11. Surgical procedure done for patients who were on mechanical ventilator support in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
craniotomy	46	12.0
wiring & fixation for fracture	56	14.6
abscess drainage	6	1.6
laparotomy	16	4.2
chest thoracotomy	22	5.7
no procedure	235	61.2
others	3	0.8
Total	384	100.0

Patients develop complication due to prolonged intubation. Laryngeal edema was detected in 100 (26 %) patients and tracheal stenosis in 75 (19.5 %) patients.

Table 12 .complication due to prolonged intubation and the final outcome of patient Cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		final outcome of patient		Total
		discharged	died	
Complication due to prolonged intubation	Tracheal stenosis	36	39	75
	Trachea - malacia	2	5	7
	laryngeal edema	42	58	100
	Trachea - esophageal fistula	4	5	9
	vocal cord paralysis	8	18	26
	no complication	68	78	146
	vocal cord paralysis & Trachea- esophageal fistula	4	10	14
	laryngeal edema , Trachea - esophageal fistula, vocal cord paralysis	0	2	2
	Trachea – malacia, Trachea - esophageal fistula vocal cord paralysis	3	2	5
Total		167	217	384

Patients develop complication due to prolonged hospital stay. Most common complication seen in this study was HAP – VAP 134 (34.9 %) patients then followed by stress ulcer in 63 (16.4 %) patients.

Table 13.complication of patient due to prolonged hospital stay and the final outcome of patient Cross tabulation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		final outcome of patient		Total
		discharged	died	
complication due to prolonged hospital stay	HAP	68	66	134
	bed sore	18	24	42
	DVT or PTE	21	25	46
	Others	0	0	0
	Stress ulcer	40	23	63
	delirium	9	14	23
	organ failure	5	57	62
	UTI	6	8	14
Total		167	217	384

5.7. Ventilator care bundle and patient disposition

Patients on mechanical ventilation should be on mechanical care bundle in addition to treating complication specific to each patient. The following table 14 used to show numbers represented in the analysis.

1. Ulcer prophylaxis	4. Adequate feeding	7. Anti-pain	10.Pressure sore prevention
2. DVT prophylaxis	5. Oral care	8. Antibiotics	11. Diuretics including Mannitol
3. Head elevation	6. Sedation	9. Seizure prophylaxis	

Table 14 . Ventilator care bundle and treatment given for patients who were on mechanical ventilation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
All	57	14.8
2,3,4,6,7,8, & 10	37	9.6
2,3,4,6,8,10	41	10.7
2,3,4,6, 10	4	1.0
all except 9 & 11	245	63.8
Total	384	100.0

After liberation from mechanical ventilation patients are disposed to specific care area for follow up or further management plan. Majority of extubated patients are transferred to the ward 121 (31.5 %).

Table .15 .Extubated patient disposition after liberation from mechanical ventilation in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
Discharge home	24	6.3
Transferred to ward	121	31.5
Linked to chronic follow up	1	0.3
Total	146	38.0
Unknown	21	

5.8. Final outcome of intubated and mechanically ventilated patients and immediate cause of death

The final outcome of intubated and mechanically ventilated patients at AaBET and SPHMMC Adult emergency and critical care unit 167 (43.5 %) were discharged and 217 (56.5 %) were died.From discharged patients around 20 patients died in home after leaving the hospital and 17 patents are reported to have permanent disability either from underlying illness or from complication of intubation and mechanical ventilation. The rest of discharged patient's status is unknown. The immediate cause

of death for majority patients 103 (47.46%) were refractory septic shock. Since this study was conducted in COVID 19 pandemic all patients are tested negative.

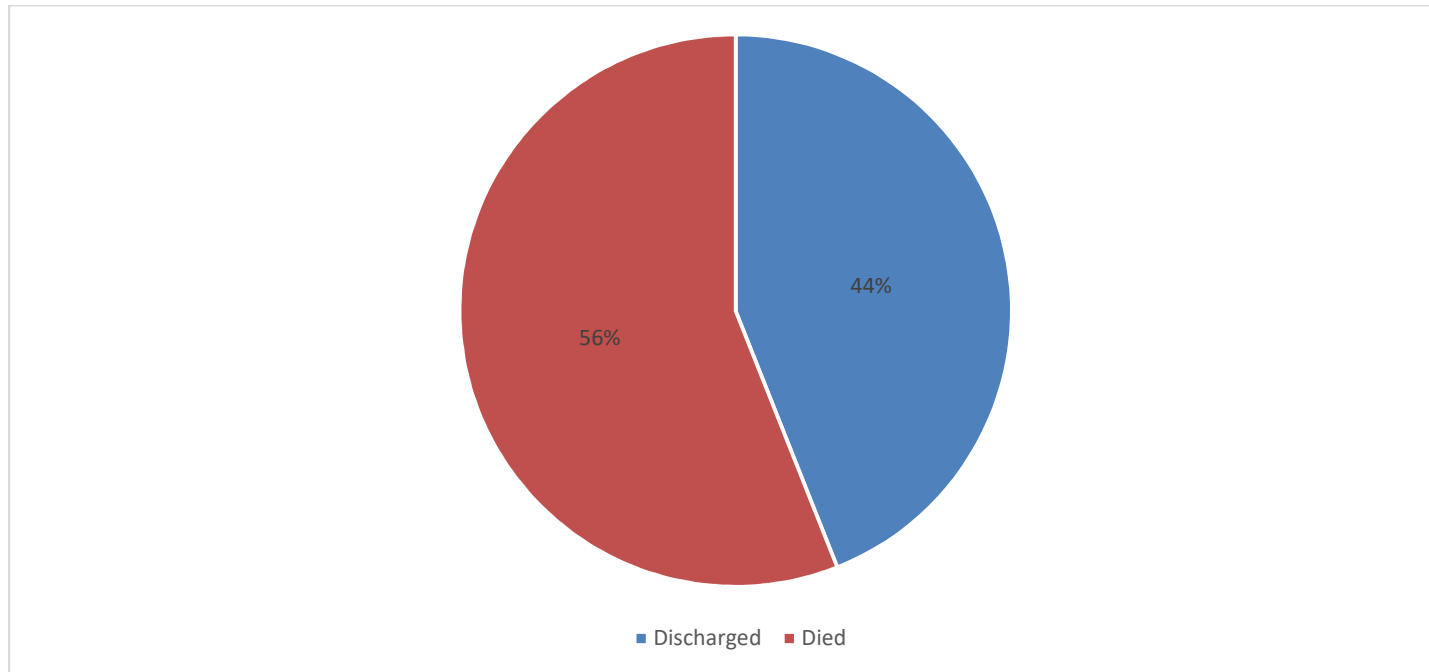


Figure Eight Pie graph died and discharged patients by percent in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

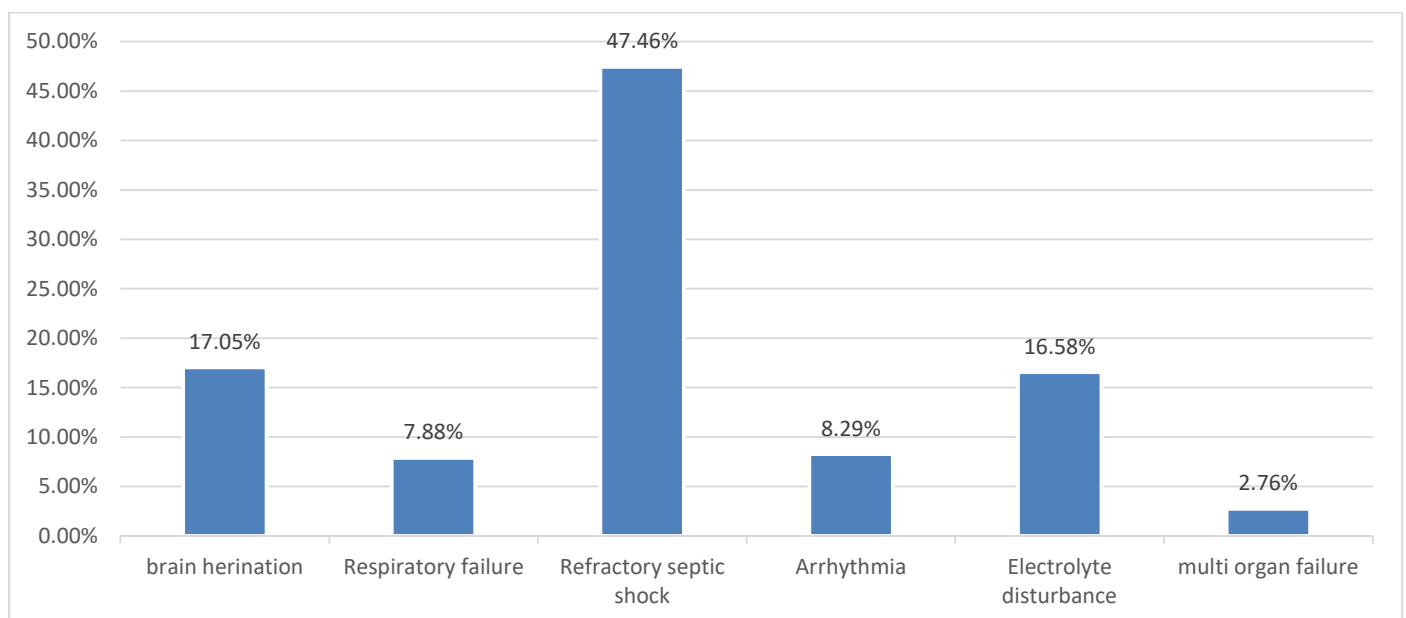


Figure Nine bar graph showing immediate cause of death by percent in SPHMMC and AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

5.9. Sub – group analysis

5.9.1.Sub – group analysis of study participants in AaBET Hospital

There were 194 patients who were intubated and mechanically ventilated at AaBET hospital emergency and ICU during the study period. From this 133 (68.5%) were male and 61 ((31.5%) were females. The majority of patients age 119 (61%) found between 21 to 40 years of age. The initial triage category for majority of patients 139 (71.6%) were red side. Most patients 95(49%) are intubated at AaBET ICU and AaBET emergency floor 83 (42.8%).

Most patients 92 (47.4%) were orthopedic trauma patients. The main indication for intubation was for coma or air way protection for 158 (81.4% patients. Most patients 135 (70 %) were trauma. Most common type of trauma causing intubation was TBI for 68 (35%) patients. The mechanism of injury for majority of patients 105(54%) was road traffic accident.

Table 16. Patient types and indication for intubation in AaBET hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
medical	12	6.2
post-surgical non trauma	47	24.2
trauma	135	69.6
Total	194	100.0

Majority of patients 97 (50 %) were intubated for 3 to 7 days. Majority of patients 151 (77.8%) stayed in the hospital from 7 days to one month. Final outcome of patients at AaBET was discharged 95 (48.5%) and died 99 (51.5%). The immediate cause of death for majority of patients was refractory septic shock followed by brain herniation.

5.9.2.Sub – group analysis of study participants at SPHMMC

There were 190 patients who were intubated and mechanically ventilated at SPHMMC emergency and ICU during the study period. From this 90 (47.5%) were male and 100 ((52.5%) were females. The majority of patients age 84 (44.2%) found between 21 to 40 years of age. The initial triage category for majority of patients 160 (84.2%) were red side. Most patients 92(48.4%) are intubated at SPHMMC emergency floor and SPHMMC ICU 85 (44.8%). Most patients 180 (94.7%) were medical patients.

Table 17. patient category in SPHMMC hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
general surgery non trauma	9	4.7
medical	180	94.7
others	1	.5
Total	190	100.0

The main indication for intubation was for respiratory failure for 134 (70.2%) patients.

Table 18. The indication for intubation in SPHMMC hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
respiratory failure	134	70.5
air way protection or coma	56	29.5
Total	190	100.0

Most common type of medical illness causing intubation was HAP for 61 (32%) patients which is followed by sepsis and septic shock for 60 (31.6%) patients.

Table 19.Types of medical illness resulting intubation in SPHMMC hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

	Frequency	Percent
HAP	61	32.1
Asthma	13	6.8
CVD	7	3.7
poisoning	20	10.5
DKA	2	1.1
GBS	3	1.6
sepsis or septic shock	60	31.6
others	24	12.6
Total	190	100.0

Majority of patients 67 (35.3 %) were intubated for 3 to 7 days. Majority of patients 92 (48.4%) stayed in the hospital from 7 days to one month.Final outcome of patients at SPHHMC was discharged 72(37.8%) and died 118 (62%).The immediate cause of death for majority of patients was refractory septic shock which is followed by electrolyte disorder.

5.10. Factors Associated with the outcome of intubated and mechanically ventilated patients

All independent variables were analyzed using binary logistic regression with the dependent variable knowledge using SPSS and those which were significant at a p-value of <0.25 were fitted to a multivariable logistic regression to check their association with the outcome variable, practice, at a p-value of <0.05.

Respondent's age, triage category, place of intubation, patient category, admission source, indication for intubation, type of medical and trauma illness, route of intubation, mechanism of injury, vital sign before intubation, GCS before intubation, comorbidity, weaning method, length of intubation period, length of stay in the hospital, sedative drug used, intubation procedure type, early and late complication of intubation, complication during mechanical ventilation, list of treatment given during mechanical ventilation were found to be significantly associated at the p-value of < 0.25 in binary logistic regression and entered to multiple logistic regression for further analysis and variables.

In the multiple logistic regression model place of intubation with P –value 0.012 AOR 0.828(0.716, 0.959), admission source with P value 0.000 AOR 0.085(0.053,0.135), indication for intubation with p value 0.000 AOR 3.729(2.070,6.717), mechanism of injury with p value 0.017 AOR 1.403(1.064,1.851), weaning method with p value 0.001 AOR 0.512(0.344,0.762), list of treatment given with p value 0.001 AOR 1.267(1.104,1.457) were significantly associated with outcome of intubated and mechanically ventilated patients.

Table 20 : Factors Associated with the outcome of intubated and Mechanically ventilated patients in SPHMMC and AaBET

hospital emergency and ICU from June 1 2021 to May 30 2022 G.C

		Out come		P - Value		COR	AOR
		Died	Discharged	COR	AOR	B (L,U)	B (L,U)
Age from 41 to 60		217 (56%)	167 (44% 0	0.125	0.263	2.08 (0.815, 5.300	0.866 (0.674,1.114)
Triage category red		176(59 %)	123(41%)	0.152	0.100	0.7(0.428,1.140)	1.483(0.927,2.373)
Place of intubation AaBET ICU		52(53%)	46 (47%)	0.001	0.012	3(1.590,5.680)	0.828(0.716,0.959)
Illness category	General surgery trauma	12(70%)	5(30%)	0.163	0.437	0.375(0.095,1.488)	0.938(0.799,1.102)
	General surgery non trauma	9(47%)	10 (53%)	0.096	0.437	0.339(0.095,1.211)	0.938(0.799,1.102)
	Burn	5(55.5%)	4 (44.5%)	0.079	0.437	0.366(0.119,1.122)	0.938(0.799,1.102)
Where Admitted	To ICU	21(44.6%)	26(55.4%)	0.000	0.000	0.039(0.012,0.123)	0.085(0.053,0.135)
	Extubated their	4(3%)	127(96%)	0.000	0.000	16.8(7.660,37.240)	0.085(0.053,0.135)
Indication intubation Respiratory failure		108(65.5%)	57(34.5%)	0.005	0.000	0.548(0.361,0.832)	3.729(2.070,6.717)
Patient	medical	120(62%)	73(38%)	0.063	0.713	0.566(0.311,1.031)	1.160(0.524,2.568)

category	Non trauma surgical	27(48%)	29(52%)	0.063	0.713	0.655(0.420,1.023)	1.160(0.524,2.568)
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Variable		Out come		P - Value		COR B (L,U)	AOR B (L,U)
		Died	Dischar ged	COR	AOR		
Route of intubation		217(56%))	167 (44%)	0.133	0.781	0.494(0.197,1.239)	1.208(0.317,4.600)
Non- trauma indicati on intubati on	Asthma	8(57.2%)	6(42.8%)	0.138	0.967	0.321(0.072,1.438)	0.998(0.921,1.082)
	CVD	3(38%)	5(62%)	0.043	0.967	0.357(0.132,0.969)	0.998(0.921,1.082)
Trauma indicati on for intubati on	Solid organ injury	7(41%)	10(59%)	0.162	0.460	0.3359(0.086,1.507)	0.961(0.865,1.068)
	Spinal cord injury	7(44%)	9 (56%)	0.141	0.460	2.514(0.736,8.583)	0.961(0.865,1.068)
Mechanism of injury assault		14(56%)	11(44%)	0.002	0.017	0.088(0.019,0.402)	1.403(1.064,1.851)
Vital sign	Choice One	79(66%)	41(34%)	0.080	0.855	0.425(0.163,1.107)	0.989(0.883,1.109)

before intubati on	Choice Three	1(33%)	2(67%)	0.177	0.855	0.559(0.240,1.300)	0.989(0.883,1.109)
	Choice four	14(52%)	13(48%)	0.004	0.855	0.460(0.273,0.777)	0.989(0.883,1.109)
	Choice six	13(65%)	7(35%)	0.023	0.855	0.415(0.195,0.886)	0.989(0.883,1.109)

Variable		Out come		P - Value		COR B (L,U)	AOR B (L,U)
		Died	Discharged	COR	AOR		
GCS 3 to 8		168 (61%)	108(39%)	0.006	0.248	0.534(0.341,0.837)	1.720(0.685,4.322)
Comorbidity asthma		17(47 %)	19(53%)	0.047	0.232	2.75(0.1013,7.438)	0.917(0.795,1.057)
Weaning CPAP				0.000	0.001	5.115(2.232,11.723)	0.512(0.344,0.762)
Length Intubation Period	Less than 24 hour	28(74%)	10(26%)	0.002	0.238	0.255(0.108,0.603)	0.824(0.597,1.137)
	24 hour to 3 days	30(42%)	42(58%)	0.067	0.238	0.480(0.219,1.052)	0.824(0.597,1.137)
	3 - 7 days	94(57%)	70(43%)	0.112	0.238	0.516(0.228,1.167)	0.824(0.597,1.137)
Length of stay in the hospital	24 hour to 3 days	14(74%)	5(26%)	0.0019	0.119	0.298(0.108,0.821)	1.314(0.932,1.853)
	3 day to 7 days	42(47%)	47(53%)	0.0073	0.119	0.417(0.160,1.086)	1.314(0.932,1.853)
Sedative	Ketamine	66(63%)	38(37%)	0.003	0.775	0.329(0.158,0.684)	1.029(0.847,1.250)

drug	Propofol	16(36%)	28(64%)	0.193	0.775	0.720(0.438,1.181)	1.029(0.847,1.250)
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Variable		Out come		P - Value		COR	AOR
		Died	Discharged	COR	AOR	B (L,U)	B (L,U)
Type of intubation procedure	RSI	143	126	0.004	0.740	2.135(1.275,3.576)	0.948(0.691,1.300)
	Crash				0.740	0.220(0.024,1.997)	0.948(0.691,1.300)
Early complication intubation	Cardiac arrest	27(52%)	25(48%)	0.0050	0.101	2.130(1.000,4.536)	1.107(0.980,1.250)
	ETT misplacement	3(100%)	0(0%)	0.020	0.101	0.198(0.051,0.773)	1.107(0.980,1.250)
Treatment given	Choice one	43(75%)	14(25%)	0.060	0.001	0.427(0.176,1.037)	1.267(1.104,1.457)
	Choice four	3(75%)	1(25%)	0.001	0.001	0.328(0.171,0.631)	1.267(1.104,1.457)
Complication During M.V	Auto- PEEP	14(70%)	6(30%)	0.122	0.326	0.286(0.059,1.395)	0.944(0.841,1.059)
	Lung atelectasis	4(40%)	6(60%)	0.201	0.326	0.429(0.117,1.568)	0.944(0.841,1.059)
	ETT block	10(50%)	10(50%)	0.026	0.326	0.071(0.007,0.729)	0.944(0.841,1.059)
Late Complication	TEF	5	4	0.131	0.756	2.077(0.805,5.360)	1.016(0.920,1.122)
	No complication	78	68	0.188	0.756	2.308(0.665,8.013)	1.016(0.920,1.122)

intubation							
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CHAPTER : Six

Discussion

In this study the mean age of the study population was 37.03 and ranges from 5-86 years with majority of male 233(58.1%) which was similar with study conducted in Maharashtra, India and Nigeria which reported by a mean age 43.22 years, ranging from 14 to 75 years with male predominance (73.9%) (24, 26). But this differs from study conducted in Korea and Ayder which reported by mean age of 69 and 32 year respectively (15, 21). This may be different due to the life expectance of the population.

In this study Majority of patients 212 (55.2%) who were intubated and mechanically ventilated were medical patients followed by orthopaedic trauma patients 92 (24 %) which is in line with the research done in 361 ICU of 20 country with result of medical (66.1%) and surgical (33.9%) patients(22).

Indications for mechanical ventilation are wide-ranging. In our study, we observed that neurological failure or coma 214(55.7%) were the main indications for mechanical ventilation then respiratory failure 165 (43%) was second cause which is not similar with study in Ayder comprehensive specialized hospital, Korean, Egypt El mahalla chest hospital and Nigeria(5,15,21,26). But it is different in study in Cairo, Egypt which reported that heart disease was the main indication for mechanical ventilation (14). This difference may be due to type of ICU specialization which means the ICU found in Cairo is general medical ICU but our hospital ICU is both medical and surgical.

The selection of mode of mechanical ventilation can vary based on the individual preference and institution usual practice. In our study Mostly used initial machine

mode during mechanical ventilation were VCV – AC for 270 (70.3%) and PCV – AC for 110 (28.6 %) patients which was similar with studies in Cairo, Egypt. Volume control ventilation (61.8%) was the preferred mode of mechanical ventilation in Cairo(14). Our result was different from studies conducted in 45 Brazilian intensive care units and Korean which reported as pressure control ventilation was the preferred one(16,21). The airway access used to deliver mechanical ventilation in this study was almost all 95 % passed through the orotracheal tube which was the same with study in North America, South America, Spain, and Portugal in which 96% of endotracheal tube passed through the mouth(23).

Length of stay on mechanical ventilation in this study was ranged from less than 24 hour to two months. The average length of stay was 7.9 days. But a study by Chiwhane A. and Diwan S et al showed that average ventilator stay in India rural hospital was 2(1-5) days which is less than this study(7). This difference may be due to severity of disease and complication prevention and ICU specialty staff. Our finding was similar with study conducted in 361 ICUs of 20 countries length of stay was 5.9(7.2) days and study conducted in Maharashtra, India which was 5.9 days(22,24). A study in Nigeria Tertiary hospital showed that the mechanical ventilation average duration was 12.3 days(26). This is very high compared to our finding.

In the current study 279(72.6%) patients has various comorbidity. Among this comorbidity cardiovascular disease 72(19%) and chronic kidney disease 48(12.5%) was the most common comorbidity followed by asthma15(9.4%), DM 31(8.1%).This findings was different from study done by Chiwhane A, and Diwan S.et al (7) ,which showed that the most common comorbidity were Chronic kidney disease (CKD) (17.23%) and coronary artery disease (CAD) (14.65%). In our study most intubated and mechanically ventilated patients have associated comorbidity which may be reason for high mortality.

Mechanical ventilation is an important instrument, with both negative and positive effects. In our study complication was reported in most of patients . Most commonly seen mechanical ventilator support related complication was reintubation 42 (10.9 %) which is followed by Auto PEEP 20 (5.2 %) and ETT block 20 (5.2 %). Complication due to prolonged intubation were Laryngeal edema in 100 (26 %) patients and tracheal stenosis in 75 (19.5 %) patients. Most common

complication due to prolonged hospital stay was HAP – VAP 134 (34.9 %) patients then followed by stress ulcer in 63 (16.4 %) patients. More than one complication occurred in more than half of patients. Our study was not similar with study conducted by Berhe et al .In this study Complications were observed in 63.8% including; stress induced gastric bleeding (28.6%), VAP (27.6%), AKI (22.9%) and new septic shock growth (20%) (15). Our result is also different from study conducted in Mumbai tertiary hospital(25) specifically the complication were VAP (53.3%) followed by decubitus ulcers(40%) and deep vein thrombosis(8.89%). which is higher than this study the possible reason may be the study design difference or there might be difference in the quality of care. Even though the complication rate in our study is low there is still high incidence of complications in our setting too.

The decision of weaning a patient from the ventilator is influenced by the attending clinician clinical judgment. In this study, 44 % of patients were successfully weaned off from ventilator. In this study the most commonly used mode of weaning were CPAP 101(60.4%), SIMV 66(39.6%), T-tube trial 17(10%) and accidental extubation 11(7%). Our result different from study conducted in North America, South America, Spain, and Portugal in which the most common weaning approach was PS, which was used in 36 percent of patients and SIMV in 28 percent of patients, combination of SIMV and PS (23). The difference could be due to the preference of the physicians and patients capacity of maintaining their saturation on both methods.

In the this study, the death percent was 56 % .Studies done in different countries showed that the death percent of patients on mechanical ventilation were in Brazil ICU (34.5%), in western India 67.2%, Maharashtra India 42.1%, in rural hospital India 17.2%, Cairo 64.4%, Philippines 39%, in Nigeria tertiary hospital 31.8%, Abbassia chest hospital, Egypt 54.79% and in Ayder comprehensive specialized hospital 28.6% (2,7,14–17,26–28). Our finding also higher than from studies done in Brazil ICU (34.5%), Maharashtra India (42.1), India rural hospital (17.2%), Philippines (39%), Nigeria(31.85) and Ayder (28.6) (2,7,15,16,26,28). The reasons for high mortality rate in our result could be due to poor referral system (delayed referral), poor quality service in emergency and critical care unit, development of multiple complication and having multiple comorbidity. Our

finding was lower than from studies conducted in western India (67.2%) and Cairo (64.4%) (14,17). This may be due to the emergency and ICU setup.

In this study the leading cause of death was refractory septic shock (47.4%) and brain herniation (17.05%) patients. This result is match with studies conducted by Nassar Y et al (14) . Sepsis was one of the main causes for death in our finding but it is a preventable and potentially curable disease which shows there is a gap in infection prevention practice. The gap can be solved by positioning the patient frequently and 30 degree head up, giving adequate feeding, and timely administration of medication and follow infection prevention guidelines.

In this study the outcome of patients on mechanical ventilation were significantly associated with place of intubation, admission source, indication for intubation, mechanism of injury, weaning method, list of treatment given were significantly associated with outcome of intubated and mechanically ventilated patients with p-value less than 0.05. This result finding is different from study done in Maharashtra India(2) and Ayder(15) which reported that age, comorbidity, new septic shock development, number of days on ventilation were significant associated with mortality. This difference might be due to study design, sample size and set up the hospital.

CHAPTER 7:

Conclusion

The mortality rate of intubated and mechanically ventilated patients at AaBET and SPHMMC Adult emergency and critical care unit in this study was high. The main indication for intubation was for coma or for air way protection. Study participants were subject to many complication due to intubation procedure or due to prolonged intubation or due to prolonged hospital stay. The major type of medical illness resulting in intubation was respiratory failure due to HAP followed by sepsis and septic shock. Mostly used machine mode as weaning method was CPAP. Mostly used sedative agent during mechanical ventilator support was ketofol . Rapid sequence intubation was the most commonly used procedure during intubation.

In this study place of intubation, admission source, indication for intubation, mechanism of injury, weaning method, list of treatment given were significantly associated with outcome of intubated and mechanically ventilated patients with p-value less than 0.05.

CHAPTER - 8

8. Strength and limitations of the study

8.1 Strength

This study is very extensive in looking at different variables in AaBET and SPHMMC hospital and it is the first of its kind in this hospital, and it could generate new ideas for further studies.

The study assessed the outcome of intubated and mechanically ventilated patients and the commonest diagnosis and its indication for intubation.

The study also tried to identify some of the determinants of outcome, which is important for quality officers as a means of input for improvement in quality of the service.

It is also important for policy makers at large for development of Guidelines and opening of rehabilitation and convalescent centers.

8.2 Limitation

Being a hospital based cross sectional study, the findings are not generalizable to general population, and doesn't address cause and effect of issues raised completely.

There were incomplete patient's charts and missing of important information on the chart was a biggest challenge.

The outcome of intubated and mechanically ventilated patients might be biased by loss of vital signs and follow up card which has important information for our study.

Lack of similar study in similar set up made comparison a bit difficult, and the study looked at data's for one year only.

CHAPTER - 9

Recommendation

To hospital management

It's better if there is adequate human power for intubated and mechanically ventilated patient's care starting from nurse to specialists from each department. It is better to prepare special trainings for doctors and nurses about MV usage and its complications.

It's better to increase the number of beds and mechanical ventilator in the ICU and emergency department.

To Saint Paul's Hospital Millennium Medical College

To give more emphasis on emergency and ICU care which are areas of high mortality needing qualified professionals.

It is better to prepare written guideline on management of critically ill patients and have rehabilitation center for patients with permanent disability.

It is better to optimize infection prevention through implementing the IPC policy and to invest and buy materials used in ICU and emergency department.

It is better to have software for full documentation patient data and to keep data safe.

To researchers

It is better if they use primary data and good data collector to conduct a research in prospective manner in order to find out the outcome of intubated and mechanically ventilated patients.

To have better generalization it is better to have many samples and include many hospitals in their study.

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Ethical Approval and Hospital consent Form

Name of the investigator : Dr Nigat Endalamaw Embiale

Research Proposal Title : OUT COME AND ASSOCIATED FACTORS OF INTUBATED AND MECHANICALLY VENTILATED PATIENTS AT SPHMMC AND AaBET HOSPITAL EMERGENCY AND INTENSIVE CARE UNIT,SPHMMC,ADDIS-ABABA, ETHIOPIA.

Research Proposal objective: To assess the outcome and associated factors of intubated and mechanically ventilated patients in SPHMMC and AaBET hospital emergency and intensive care unit Addis Ababa, Ethiopia from June 1,2021 to June 1,2022 G.C.

Study procedure : To achieve the objective of the study data including Socio-demographic factors (sex, age) reason for initiation of MV, Length of hospital stay, length of ICU stay, Length of stay on MV, mechanical ventilator mode, complications, Admission diagnosis, investigation, co morbidities, mode of weaning, sepsis, organ failed in ICU, sedation used, intubation and patient's outcome will be collected from patients' medical record unit using patients chart.

Confidentiality: The collected information will be used only for study purpose and kept confidential in all possible circumstances. The patients' personal information like name and/or others was not collected. All records of the study were secured. Therefore the overall hospital's participation and collaboration is helpful in generating the required information will be appreciated. Finally, the hospital has all the right to accept or reject the study at any time.

Relevance of study: provide information to assess the outcome and associated factors of intubated and mechanically ventilated patients and help to draw up possible recommendation for better resource usage.

Contact Person: if there is any question or assumption if data collectors, supervisors or other hospital administrative staffs have any question regarding the study feel free to contact the principal investigator through the following addresses:

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Questionnaires

1. Socio - demographic variables.

1. MRN _____ 2. Sex of patient A. Male B. Female

3. Age in years

4. What is the patient triage category?

A. Red B. Orange C. Yellow and green

5. What is the place where the patient intubated?

A. Red C. OR or Recovery E. AaBET ICU

B. Orange D. ST paul ED F. ST paul ICU

6. What is the category of the patient?

A. General surgery trauma E. Neurosurgical non

B. General surgery non trauma F. Medical

C. Neurosurgical trauma G. Burn

D. Orthopedic H. Other specify

7. After intubation where does the patient admitted

A. Admitted to ICU C. Died on place of intubation

B. Extubated on place of intubation D. Transferred to other hospital

8. What is the Indication for intubation?

A. Respiratory failure F. upper air way instability after trauma

B. Air way protection or coma G. for procedural sedation

C. Cardiovascular failure (shock) H. Cardiorespiratory arrest

D. for flail chest I. for status Epileptics

E. Burn to air way J. Other specify

9. What is the type of illness resulting intubation?

A. medical B. Post-surgical non trauma C. Trauma

10. What is the route of Intubation Method?

- | | |
|------------------|----------------------------|
| A. Oro-tracheal | D. Through surgical airway |
| B. Naso-tracheal | E. Others specify |
| C. Fiber optic | |

11. If it is non trauma patient what type of medical illness resulting in intubation

- | | |
|---------------------------|----------------------------|
| A. HAP | F. Poisoning |
| B. Asthma | G. Diabetic ketoacidosis |
| C. CVD | H. Tetanus |
| D. Seizure | I. Guillain Barre syndrome |
| E. Sepsis or septic shock | J. Other specify |

12. If it is trauma patient what type of trauma resulting in intubation

- | | |
|-----------------------|-----------------------|
| A. TBI | F. Lung contusion |
| B. Solid organ injury | G. Limb bone fracture |
| C. Rib fracture | H. Pelvic fracture |
| D. Hemo-thorax | I. Spinal cord injury |
| E. Pneumothorax | |

13. For trauma patient what is mechanism of injury?

- | | |
|--------------------------|-------------------------------------|
| A. Road traffic accident | D. Assault including stone or stick |
| B. Fall down accident | |
| C. Gun shot or Blast | E. Others specify. |

14. What is the vital sign of the patient before intubation?

- | | |
|--------------------|-----------------|
| A. Hypotension | F. Hypothermic |
| B. Hypertension | G. Desaturating |
| C. Febrile | H. Bradycardia |
| D. Tachypnea | I. Tachycardia |
| E. Hypoventilation | |

15. What is the GCS of patient immediately before intubation?

- A. 3 to 8 B. 9 to 12 C. 13 to 15

16. What Comorbid disease the patient has more than one answer possible

- | | |
|-----------------|------------------|
| A. DM | E. CKD |
| B. Hypertension | F. Cancer |
| C. CVD | G. HIV |
| D. Asthma | H. Other specify |

17. What is the weaning method?

- | | |
|-----------------|--------------------------|
| A. PS with CPAP | D. Accidental Extubation |
| B. CPAP | E. SIMV |
| C. T-TUBE | |

18. What is the length of intubation period?

- | | |
|-----------------------|---------------------------|
| A. Less than 24 hours | D. 7days to one month |
| B. 24 hour to 3days | E. greater than one month |
| C. 3days to 7days | |

19. What is the length of stay in the hospital?

- | | |
|-----------------------|---------------------------|
| A. Less than 24 hours | D. 7days to one month |
| B. 24 hour to 3days | E. greater than one month |
| C. 3days to 7days | |

20. Which is mostly used machine mode when the patient was on ventilator support

- | | |
|-----------|-----------|
| A.PCV AC | D.VCVAC |
| B.PCVSIMV | E.VCVSIMV |
| C.PCVCPAP | F.VCVCPAP |

21. What is the machine mode you put patient immediately after intubation

- | | |
|-----------|-----------|
| A.PCV AC | D.VCVAC |
| B.PCVSIMV | E.VCVSIMV |

C.PCVCPAP

F.VCVCPAP

22. What Sedative drugs you used during mechanical ventilatory support

A. Ketamine B. propofol C. ketofol D. Diazepam

23. What type of intubation procedure you used for airway protection

A .Rapid sequence intubation D. Delayed sequence intubation
B. Crash intubation
C. Awake intubation E. Others specify

24 .what are the immediate complication of intubation

A. Cardiac arrest D. Hypoxia G. no complication
B. Air way trauma E. Dental trauma H. Other specify
C. ETT misplacement F. Aspiration

25. What are the complication during mechanical ventilator support?

More than one answer possible

A. Auto PEEP D. Dislogement
B. Lung atelectasis E. ETTcuff rupture
C. ETT block F. Reintubation
G. No complication

26. What Procedures are done for complication?

A. CPR for Arrest C. Surgical air way Access
B. Chest tube or needle decompression D.No procedure
E. Others Specify

27. What major surgical procedures done for the patient

A. Craniotomy B. laparotomy G. Other specify
C. wiring and fixation for fracture D. chest thoracotomy
E. Abscess drainage F. No procedure

28. Was tracheostomy done for the patient?

A. Yes B. No

29 .What is the indication for tracheostomy

- | | |
|-------------------------|-------------------|
| A .prolonged intubation | D. Neck trauma |
| B. Tracheal stenosis | E. Others specify |
| C. Difficult air way | |

30. Was reintubation done after extubation

A. Yes B. No

31. If re intubation done what was the time of intubation

- A. With in 72 hours of extubation
- B. 72 hour to one week after extubation
- C. After one week of extubation

32. What are the late complication of intubation more than one answer possible?

- | | |
|----------------------|-------------------------------|
| A. Tracheal stenosis | D. Vocal cord paralysis |
| B. Tracheomalacia | E. Tracheo esophageal fistula |
| C. Laryngeal edema | |

33. What are the treatment given after intubation in hospital stay more than one answer possible?

- | | |
|-----------------------------|--------------------------------|
| A. Ulcer prophylaxis | G. Antibiotics |
| B. DVT prophylaxis | H. Sedation |
| C. Head elevation | |
| D. Adequate feeding | I. Anti pain |
| E. Oral care | J. Seizure prophylaxis |
| F. Pressure sore prevention | K. Diuretics including Manitol |

34. What are the complication of patient due to hospital stay?

- | | |
|---------------|------------------|
| A. HAP | E. Stress ulcer |
| B. Bed sore | F. Delirium |
| C. DVT or PTE | G. Organ failure |

D. VAP

H. UTI

35. What is the COVID -19 status of the patient?

A. Tested positive in hospital stay

B. previously ill and improved

C. Tested negative

D. COVID status unknown

36. What is the final outcome of the patient?

A. Discharged

C . Other specify

B. Died

37. What is the current status of the patient if he discharged live in the hospital?

A. died after leaving the hospital

C. living well with good daily activity

B. living with permanent disability

D. current status unknown

38. if the patient died after discharge what is the cause of death

A. Multi organ failure

D. Respiratory failure

B. Refractory septic shock

E. Arrhythmias

. Brain herniation

F. Electrolyte disorder.

G. Other specify

39. After extubation from ED or ICU where does the patient leave?

A. Discharged home

D. Linked to rehabilitation center

B. Transferred to ward

E. Transferd to burn unit

C. Transferred to ED floor

F. Linked to Chronic follow Up

40. If the patient died in the hospital what is the immediate cause of death?

A. Multi organ failure

D. Respiratory failure

B. Refractory septic shock

E. Arrhythmias

C. Brain herniation

F. Electrolyte disorder

G. Other specify

