COLLEGE OF MEDICINE AND HEALTH SCIENCES

Department of ENT, Head and Neck Surgery

Profile of tracheostomy in intensive care units (ICUs) of tertiary hospital: case of CHUK and KFH

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Master of Medicine in ENT, Head and Neck Surgery

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Kigali, December 2020

Tracheostomy in intensive care Units (ICU)

DECLARATION

Researcher:

I hereby declare that the dissertation titled: "Profile of tracheostomy in intensive care units (ICUs) of tertiary hospital: case of CHUK and KFH" is my own work and has not been submitted to any university in Rwanda for the award of any degree.

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I hereby declare that this dissertation has been submitted with my approval as the supervisor.

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Prof BANGUTI R. Paulin

DEDICATIONS

To The Almighty God

To My beloved parents

To My friends and relatives

To my teachers and co-workers

This work is dedicated

ACKNOWLEDGEMENTS

ABSTRACT

Introduction: Tracheostomy is the most common surgical procedure in critically ill ventilator-dependent patients to provide long-term airway access. Early timing of tracheostomy in such patients reduces the length of stay in intensive care units (ICU) and the number of days on ventilator by facilitating weaning.

Objective: The current study was aimed to assess the profile of tracheostomy patients by determining the incidence, timing and its effect on length of ICU stay and duration of mechanical ventilation, complications, and the outcome of tracheostomy on patients in the intensive care units (ICU) at two tertiary hospitals, Kigali University teaching hospital (CHUK) and King Faisal Hospital KFH)

Methods: This study was prospective observational and descriptive study, conducted in adult ICUs of both Kigali University teaching hospital and King Faisal Hospital. The study has been conducted from December 2019 to May 2020. Information related to patients' demographic data, cause of admission, indications of tracheostomy, timing, complications, tracheostomy outcomes as well as duration of mechanical ventilation and duration of ICU stay have been recorded.

Results: 53 patents were included in this study and the incidence of tracheostomy was 20 %. The majority in age group of 18-34 and were predominantly male in 56.6%. Prolonged intubation was the most common indication for tracheostomy (94.3%). The mean of timing for tracheostomy was 12.08days (± 3.05) and the mean of MV was 10.57 ± 6.95 days. Length of ICU stay and number of MV was associated with timing for tracheostomy P value was 0.011 and 0.023 respectively. Eight patients (15.1%) were successfully decannulated and failure was observed in 19% and 2% due to laryngeal edema and subglottic stenosis respectively.The correlation between timing of tracheostomy and decannulation time was observed (P value 0.022). Mortality in general was 22.6% with 50% occurred in ICU, no death related to tracheostomy was recorded.

Conclusion: Tracheostomy in ICU is mainly due to prolonged intubation and timing for tracheostomy should be considered to reduce time for MV, ICU length of stay as well as time for decannulation.

Keywords: tracheostomy; endotracheal intubation; ICU; mechanical ventilation

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LIST OF ABBREVIATIONS

MD: Medical Doctor

USA: United States of America

UR: University of Rwanda

CHUK: University Teaching Hospital of Kigali

KFH: King Faisal Hospital/Rwanda

ENT: Ear, Nose and Throat

ICU: Intensive Care Unit

MV: Mechanical Ventilation

VAP: Ventilator Associated Pneumonia

MMed: Master of Medicine

GO: Gynecology and Obstetrics

CHAPTER I. GENERAL CONSIDERATIONS

BACKGROUND INFORMATION

Introduction

Tracheostomy is one of the oldest surgical procedure and is the most performed surgical procedure in intensive care units (ICU) for different reasons[1], [2]. Mainly tracheostomy is performed in critically ill patients with respiratory failure to whom mechanical ventilation (MV) is expected to be prolonged or those with multiple failed extubations to help in the weaning process[3].

Although large number of critically ill patients with respiratory failure tolerate short term trans laryngeal intubation with few complications, greater than one week of mechanical ventilation is associated with adverse outcomes[4]. There are four main general indications for tracheostomy: long term mechanical ventilation, weaning failure, upper airway obstruction, and airway protection [5]–[7]. The role of tracheostomy is not only providing airway stability, facilitating pulmonary toilet and ventilator weaning but also to decrease laryngeal injury of endotracheal intubation, to make patients comfortable, and to improve daily living activity such as vocalization, feeding and mobility[8]–[10].

Early and late tracheostomies are two categories of the timing of tracheostomy. The evidence on the advantages attributed to early over late tracheostomy is somewhat conflicting but includes shorter hospital stays and lower mortality rates[11]. Early tracheostomy decreases ventilator time, the incidence of ventilator associated pneumonia, and length of ICU and hospital stay [11]–[13].

Historically, the complication rate was high which led some authors to suggest that a tracheostomy should be performed only in the operating room but concerns regarding the hazards of transporting critically ill patients to operation theatre led to the concept of bedside tracheostomy. These have been shown to be safe in ICUs and wards, but this concept has not been widely accepted[14]. About 10% of mechanically ventilated critically ill patients undergo tracheostomy to facilitate prolonged airway and ventilator support which make tracheostomy to be common surgical procedure performed in critically ill patients[15]. Most of the cases of brain injury patients require prolonged

ventilator support to protect their airway from aspiration, reduce anatomical dead space and to treat pulmonary complications. Extubation is delayed in these patients due to their impaired level of consciousness so early tracheostomy in such patients reduces length of stay in ICU, number of days on ventilator and incidence of Ventilator Associated Pneumonia[10], [11], [16], [17]. The main critical issue is to identify those patients who will more often require long term ventilator support and determine the timing for tracheostomy. Such patients should meet the standard weaning criterion.

Although the need for and optimal timing of tracheostomy for brain-injured patients is a common clinical problem, no large randomized trials have unequivocally clarified whether this intervention improves outcome. Acute respiratory failure requiring mechanical ventilation is common in critical illness, and progressive advancements in the understanding of and technologies for the care of the critically ill have resulted in an increase in the number of patients who remain dependent on mechanical ventilation for prolonged periods of time. Prolonged trans-laryngeal endotracheal intubation increases the risk of ventilator-associated pneumonia (VAP) by bypassing and disabling the laryngeal mechanisms, promoting oropharyngeal contamination of the bronchial tree and lung. In addition, prolonged translaryngeal endotracheal intubation is associated with the development of sinusitis and may cause severe laryngeal and tracheal damage. Placement of a tracheostomy has become a viable alternative to prolonged endotracheal intubation, with the benefits of improving patient comfort, reducing need for sedation, lowering airway resistance, and allowing for easier airway care. Complications related to tracheostomies include pneumothorax, bleeding, subglottic stenosis, tracheoesophageal fistula, vocal cord dysfunction, stoma granulation, persistent tracheal fistula, and scarring. The indications, technique, timing, and selection of critically ill patients for tracheostomy have been topics of considerable debate. In this study, we address general issues regarding tracheostomy and specifically review the literature on the subjects of appropriate timing of tracheostomy tube placement and specific techniques of tracheostomy tube placement.

1.1.2 Overview of Tracheostomy

1.1.2.1 Terminology and Definitions

The following terms and definitions are used. The term tracheostomy, is used referring to a tracheal opening with attachment to the skin, in this study. A tracheotomy refers to any procedure that involves opening the trachea (temporary opening). A tracheostomy is a procedure that exteriorizes the trachea to the skin of the neck, producing a more permanent fistula/opening. A tracheostomy is a permanent opening into the trachea through the neck; it also refers to the opening after permanent laryngectomy.

1.1.2.2 History of Tracheostomy

The first known depiction of tracheostomy is from 3600 BC, on Egyptian tablets. According to legend, Alexander the Great used his sword to open the airway of a soldier choking from a bone lodged in his throat[18]. Both Aretaeus and Galen, in 2nd Century A, wrote that Asclepiades, Greek physician performed elective tracheostomy in around BC. Additional contributions of medieval Islamic physicians to the history of tracheostomy have been detailed recently[19]. The first scientific reliable description of successful tracheostomy by the surgeon who performed it was by Antonio Musa Brasavola in 1546, for relief of airway obstruction from enlarged tonsils. From 1546 to 1833, only 28 successful tracheostomies were recorded, and almost all were for relief of upper airway obstruction. In the early 20th century, tracheostomy was made much safer, and the technical aspects of the procedure were refined and described in detail by the famous surgeon Chevalier Jackson[20].

Tracheostomy was subsequently used extensively during the polio epidemic, and at present, tracheostomy is more commonly used for prolonged mechanical ventilation rather than for upper airway obstruction.

1.1.2.3 Epidemiology

Tracheostomy is a common surgical procedure in ICU patients with worldwide prevalence varies widely according to geographic area but ranges around 10%[21].

Around 34% of patients who need mechanical ventilation for more than 48 hours receive tracheostomy in United States with average number of tracheostomies performed annually in the United States now being more than 100000[22].

In the state of North Carolina between 1993 and 2002, the incidence of tracheostomy for prolonged mechanical ventilation increased in all age groups from 8.3 to 24.2/100,000, most significantly among patients less than 55 years old. This was associated with a significant decrease in mortality (39% vs25%), median ventilator days (12 vs 10), and median stay (47vs 33 d). By 2002, patients were almost 3 times less likely to be discharged to home independently and twice as likely to be sent to a skilled nursing facility.

In multi-center observational study in 50 countries report high income European countries to have tracheostomy incidence of 15.7%[23].

A single-center study of tracheostomy incidence in Zagazig University hospital in Egypt reported incidence of 29%[24].

1.1.2.4 Indications for Tracheostomy

The indications for tracheostomy can be divided among emergent tracheostomy and elective tracheostomy. Emergent tracheostomy is most commonly carried out in the setting of acute obstruction such as aspiration of a foreign body into the upper airway, Ludwig's angina, and penetrating trauma to the airway that is not amenable to endotracheal intubation and in case of pan facial fractures.

The reason for tracheostomy in the ICU is to provide access for prolonged mechanical ventilation. Observational studies document that >10% of mechanically ventilated patients undergo tracheostomy, but there is significant variability with regard to optimal timing and optimal patient selection.Tracheostomy is frequently needed in ICU critically ill patients on prolonged MV, in order to mitigate long-term airway management. While the concept remains unchanged, its prevailing timing is still a matter of debate, and need continued investigation as it depends on physician regarding the need for prolonged MV rather than on evidence based practice. Authors of different studies on matter of tracheostomy timing differ in opinion regarding definition of early and late tracheostomy[25], [26].The indications for tracheostomy can be divided among emergent tracheostomy and elective tracheostomy[27].

Emergent indications

Acute upper airway obstruction with failed endotracheal intubation

Post cricothyrotomy

Penetrating laryngeal trauma

Pan facial fractures

Indications of elective tracheostomy

Prolonged ventilator dependence

Prophylactic tracheostomy prior to head and neck cancer treatment

Obstructive sleep apnea refractory to other treatments

Chronic aspiration

Neuromuscular diseases

Subglottic stenosis

1.1.2.4. a. Upper airway obstruction

The advent of the antibiotic era and advances in anesthesia have made tracheostomy a commonly performed elective procedure. Important to note, however, is that there are situations when tracheostomy is quite urgent or emergent. This typically involves patient who is immediately need of a surgical airway because of impending airway obstruction. Upper airway obstruction is no longer the most common indication for tracheostomy[1].

1.1.2.4. b. Prolonged intubation

Tracheostomy is the safest mean of assisting ventilation where prolonged positive pressure is needed. It is easier to secure tracheostomy tube than either orotracheal or nasotracheal tube and the reduced dead space help in weaning of respiratory support. Tracheostomy also help to avoid serious oropharyngeal trauma and laryngeal injuries due to prolonged translaryngeal intubation.[5] With the introduction of low pressure cuffs endotracheal tubes, a prolonged intubation became acceptable. Despite advantages of tracheostomy in the setting of prolonged mechanical ventilation, optimal timing for tracheostomy has remained controversial. A number of observational studies have

documented considerable variability in tracheostomy timing. Early and late tracheostomies are two categories of the timing of tracheostomy.

There have been several randomized trials evaluating early versus late tracheostomy and systematic reviews which vary widely in methodology, definitions of early and late, and measured outcomes.

A significant shorter duration of mechanical ventilation in early tracheostomy group versus in the late group has been demonstrated in several studies[12].

In addition, the short duration of mechanical ventilation reflected on the mean ICU stay and the mean hospital stay which were significantly longer in the late group as compared to the early one. However there is no demonstrated benefit of early tracheostomy on mortality[11], [28].

There are studies showing an increased rate of subglottic stenosis if the intubation has been more than 10days, although some urge that intubation can continue up to 3weeks[29], [30]. As no evidence-based guidelines available, the suitable timing of tracheostomy in ICU patients on MV depends mostly on medical conditions, the judgment of the attending physician, along with counseling and communication with the families of the patients.

1.1.2.4. c. Providing pulmonary toilet

The accumulation of secretions in the lower respiratory tract is responsible for a reduction in gas exchange within alveoli. This results in respiratory failure. A tracheostomy reduces the dead space, so reducing the work of breathing and also makes it easier to aspirate secretions with less upset to the patient.

1.1.2.4. d. Part of other surgery

A permanent tracheostomy is an unavoidable consequence of a major head and neck procedure in which it is necessary to remove the whole of larynx. A temporary tracheostomy should be regarded as mandatory for all major resections involving the oral cavity or pharynx. In these cases, the tracheostomy allows protection of the lower airway from aspiration of blood, in the event of a hemorrhage, as well as guarding against upper airway obstruction from postoperative edema.

1.1.2. 5. Complications of Tracheostomy

Tracheostomy complications can be considered in 3 time frames: immediate, early, and late.In the most recent prospective randomized tracheostomy trials, adverse events associated with tracheostomy were common, especially bleeding, but were not life-threatening[31].

All clinicians who are credentialed to perform tracheostomy should be familiar with the proper methods of managing complications associated with tracheostomy. **Complications of tracheostomy**

Immediate complications	Early complications	Late complications
Hemorrhage	Hemorrhage	Tracheal stenosis
Structure damage to trachea	Tube displacement	Granulation tissue
Loss airway	Pneumothorax	Tracheomalacia
Death	Subcutaneous emphysema	Tracheoarterial fistula
Failure of procedure	Stomal infection	Tracheoesophageal fistula
Aspiration event	Accidental decannulation	Accidental decannulation
Hypoxemia	Dysphagia	Dysphagia
	Aspiration event	Pneumonia
		Aspiration event

Chapter II. PROBLEM STATEMENT AND STUDY JUSTIFICATION

2.1. PROBLEM STATEMENT

ICUs receive patients in need of ventilation support following decreased level of consciousness due to road traffic accident or other medical conditions. These are patients who may require long period of hospital stay under endotracheal intubation. Such patients need sedations, lung toilet and oral hygiene. The alternative for the comfort for ICU patients is tracheostomy which can be done bedside or in operating theater.

Tracheostomy in ICU patients is mostly done for different reasons but the main indications include prolonged intubation and improving ventilation support by reducing dead spaces.

Unfortunately, there are controversies as far as prolonged intubation is concerned. It has been showed that timely performed tracheostomy shortens the duration of MV by improving weaning rate and also it has been shown even to prevent risk of airways trauma[32], [33]. In some settings, it has been shown that intensive care specialists prefer to wait for several days to decide for tracheostomy and decide to observe the status of the patient hoping that the cause of intubation and ventilation support will improve and be able to extubate some ICU patients. This observation may lead to the different adverse outcomes including laryngotracheal sequellae like edema, granuloma, stenosis or prolonged ICU stay and time for mechanical ventilation. Deciding for timely tracheostomy has been one of the solution to improve the status of such patients in need of prolonged MV although tracheostomy is also a surgical procedure with its own complications[34].

2.2 JUSTIFICATION OF STUDY

Tracheostomy is one of the surgical procedure requested in ICU patients to improve ventilation support of patients on mechanical ventilation

In Rwanda, CHUK and KHF are institutional hospital which has big number of ICU beds, though majority are critically ill patients especial with traumatic brain injuries or neurological sequels of different systemic diseases.

Securing these patients airway using ETT is associated with complications which have been shown to increase ICU and hospital stay, morbidity and mortality. Furthermore, most intubated patients often require ICU admission for care of ETT and mechanical ventilation and yet these patients require little or no assistance from mechanical ventilation if the airway has been secured with a tracheostomy. With limited number of ventilators and beds in ICU and increased demand for ICU admission especially in CHUK hospital, this poses a challenge about weaning from mechanical ventilators. The evidence on the advantages attributed to Timing of tracheostomy is somewhat conflicting but includes shorter good weaning rate and lower ICU length of stay as well as improving outcomes.

Little is known and no published data about tracheostomy in ICU patients in Rwanda. This study is aimed to evaluate incidence, timing and outcome of tracheostomy in ICU patients of two main tertiary hospitals in Rwanda.

2.3. RESEARCH QUESTION

What is the incidence, timing and outcome of tracheostomy in a multidisciplinary intensive care unit (ICU) of two main tertiary hospitals in Rwanda?

2.4. STUDY OBJECTIVES

General Objectives

To determine the incidence, timing and outcome of tracheostomy in a multidisciplinary intensive care unit (ICU) of two main tertiary hospitals in Rwanda.

Specific objectives

1. To evaluate ICU stay length

2. To evaluate length of mechanical ventilation

3. To determine immediate and intermediate outcomes after tracheostomy

CHAPTER III. METHODOLOGY

3.1. STUDY DESIGN AND SITE

This study was a cross-sectional study, conducted in mixed adult, 10 bed ICU of University teaching hospital of Kigali and in a mixed, 7bed ICU of KFH.

3.2. POPULATIONS

Populations were adults patients admitted in ICU of KFH and CHUK

3.2.1. Inclusion criteria

Adult's critically ill patients on mechanical ventilation.

3.2.2 Exclusion criteria

- Urgent tracheostomy.
- Patients admitted in ICU with tracheostomy.
- Those patients whose caretaker or family refuse to consent for the study.

3.3. TYPES OF INTERVENTIONS

No interventions, it was a prospective and observational descriptive study.

3.4. OUTCOMES

1. Duration of mechanical ventilation
2. Timing for tracheostomy
3. Length of stay in ICU
4. Possible complication associated with tracheostomy.

3.5. SAMPLE SIZE CALCULATION

The sample size has been obtained using Fischer formula

$$n = \frac{Z^2 x PQ x D}{\alpha^2}$$

Where: n= minimum sample size, D=design effect =1, Z= standard deviation at a confidence interval of 95%=1.96 **Q**= 1-p; α**:** precision=5%

Worldwide about 10% of the ICU patients require prolonged mechanical ventilation and hence a tracheostomy is needed.[14], [15], [17], [23].

From observational data, between 6% and 11% of mechanically ventilated patients receive a tracheotomy after a median of 9 to 12 days; however, there is significant variability around both patient selection and timing.[5], [6], [35]. Retrospective data in CHUK for 3 years showed that 29patients among 300(12.6%) admitted in ICU underwent elective tracheostomy for prolonged mechanical ventilation. So P=8%, Fischer's formula in less than 10000 population **is nf =** $\frac{n}{1+n/N}$

Our sample size was calculated at **53 cases.**

Sample size was obtained by convenience sampling methods but not less than 53.

3.6. DATA COLLECTION

Using a data collection tool, data has been collected prospectively by the investigator and a designated ENT resident.Information about demographic data, cause of admission, indication of tracheostomy, timing for tracheostomy, length of mechanical ventilations, duration of ICU stay, complications and patients outcome post tracheostomy have been recorded using a pre-established data collection tool.

3.7. DATA MANAGEMENT

Data were recorded using Epidata 3.1 software. The data processing and statistical analysis has been performed using SPSS 21.0. Comparison of categorical variables were performed using the chi-squared test. The limit of significance has been established at P=0.05, Microsoft Word and Power Point used in draft, final writing and presentation of this study.

3.8. ETHICAL CONSIDERATIONS

This study has been carried out after approval given respectively by the Department of ENT and the Research and Ethics committee of the School of Medicine and Pharmacy at the University of Rwanda. Patients were enrolled into the study after the caretakers have given their written informed consent.

Confidentiality was guaranteed to all data collected and there was no additional cost for the patients.

Chapter IV. PRESENTATION OF RESULTS/ FINDINGS

During this study period a total number of 262 patients were admitted in ICU at CHUK and KFH and tracheostomy was performed on 53 patients (20.2%).

4.1. Demographic characteristics and reasons for admission

Table 1 age, gender and reason for admission

Variables	N	%
Gender		
Male	**30**	**56.6**
Female	23	43.4
Age		
18-34	**27**	**50.9**
35-60	21	39.6
>60	5	9.4
Reason for admission		
Trauma	**26**	**49.1**
Post-surgery	5	9.4
Cardiovascular	5	9.4
Metabolic	3	5.8
Infections	4	7.5
Respiratory	4	7.5
GO	4	7.5
Others	2	3.8

[i]GO: Gynecology and obstetrics related conditions

Table 1 shows the frequency of gender, age and reason of admission. Our sample showed the predominance of male 30(56.6%) with a male-to-female ratio of 1.30 and mostly younger age between 18-34 years in 27(50.9%). The main reason for admission was traumatic brain injury post RTA in 26(49.1%) patients followed by cardiovascular diseases and post-surgery in 5(9.4%) for each category.

4.2. Timing for tracheostomy

Figure 1. Timing for tracheostomy

Duration of ETT in days
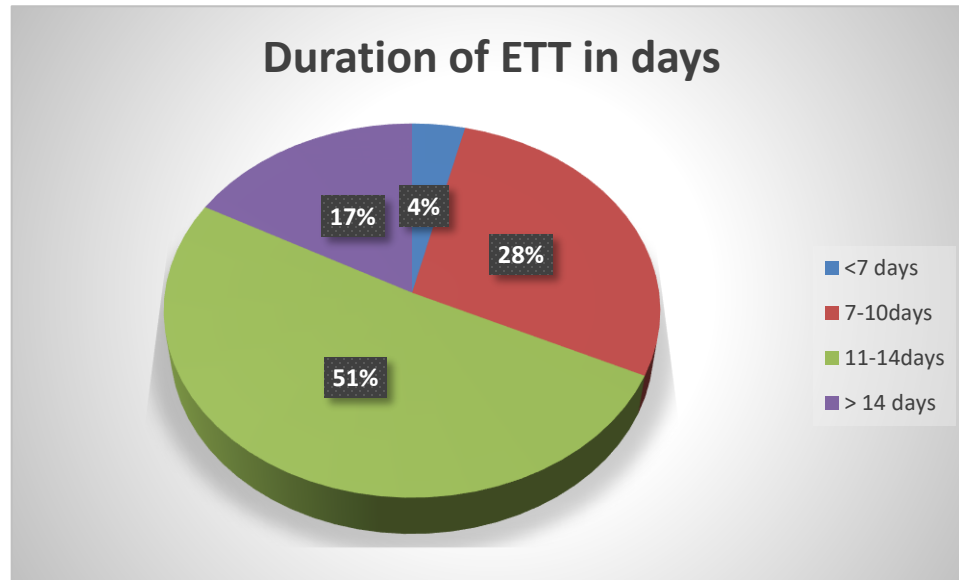
[1]ETT: Endotracheal Tube, <7: below 7days, >14: Above 14 days

Figure 1 above represents timing for tracheostomy in ICU patients. It shows that the majority of tracheostomy was performed between 11-14 days post endotracheal intubations in 51% of cases followed by 7-10 days in 28% of cases.

4.3. Post tracheostomy patients' characteristics

4.3.1. Tracheostomy related complications

Variable	N	%
Complications		
None	38	71.7
Tube blockage	8	15.1
Stomal infections	4	7.5
Subglottic stenosis	1	1.9
Accidental decannulation	2	3.8

Table 2 Tracheostomy related complications above shows that no intraoperative tracheostomy

related complications recorded in our study however intermediate complications such as tube blockage represent 15.1%, stomal infection in 7.5% and accidentally decannulations or tube dislodge in 3.8%

4.3.2. Length of mechanical ventilation post tracheostomy
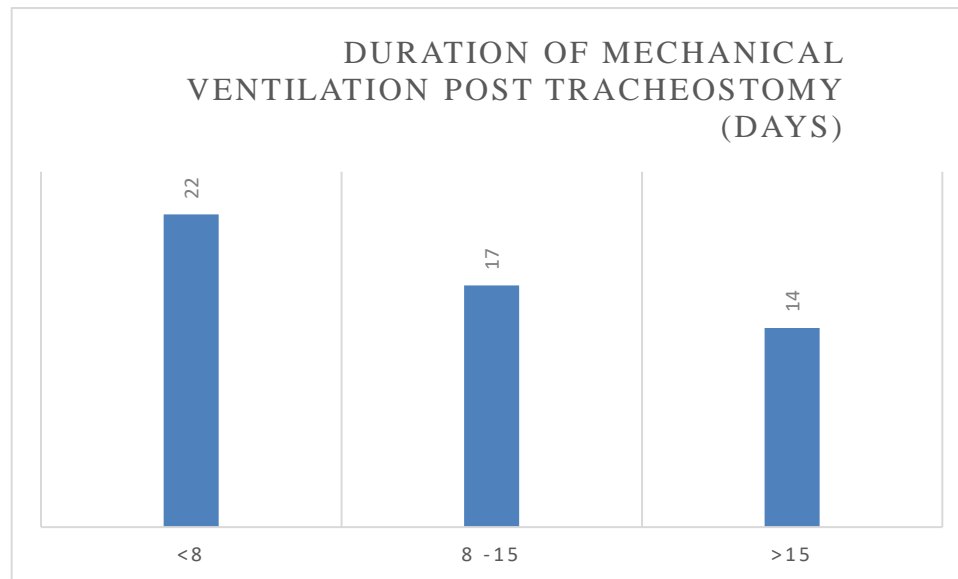
Figure 2 represents duration of mechanical ventilation; it shows that majority spent less than 8 days on MV post-tracheostomy in 22 (41.5%) and loss shows that about 73.6% were free of MV within 2 weeks.

4.3.3. Length of ICU stay

Table 3. ICU stay

Length of stay in ICU	N	%
< 15 days	7	13.2
15-21 days	19	35.8
>21 days	27	51.0

Abbreviation ICU: Intensive care Unit

Above table represents length of ICU stay where more than a half 51% spend more than 21 days in ICU

4.3.4. ICU patient's outcome post tracheostomy

Table 4 Patient's outcome post-tracheostomy

Variable		N	%
	Decannulated in wards	8	15.1
Discharged from ICU	Failed trial of decannulation	10	18.9
	Not candidates for decannulation	22	41.5
Kept on MV		1	1.9
Died for their own condition		12	22.6

Abbreviation MV: Mechanical ventilation; ICU: Intensive care unit

Table 4; shows post-tracheostomy outcomes, among 40 patients discharged from ICU 15.1% were successfully decannulated in wards, 10(18.9%) failed decannulations process. It shows also that 12(22.6%) died from their own conditions, no death related to tracheostomy was recorded in this study.

4.3.5. Airways non tracheostomy related complications

Variable	Frequency	%
Laryngotracheal edema	10	18.9
Subglottic granuloma	0	0.0
Subglottic stenosis	1	1.9
Normal	42	79.2

Table 5 Airways non tracheostomy related complications

Above table represents airways non tracheostomy related complications mainly identified on flexible laryngoscopy done on patients with improved GCS but who failed decannulation process.10 (18.9%) patients were found to have laryngeal edema, one patient (1.9%) found to have subglottic stenosis.

4.4 Correlation of timing for tracheostomy and duration of MV, ICU length of stay and outcomes of ICU patients in post-tracheostomy (airways non tracheostomy related complications)

Variable	Timing of tracheostomy				P value
Length of MV	< 7days	7-10 days	11-14 days	>14 days	
<8 days	2(9.0%)	9(41%)	9(41%)	2(9.0%)	
8-15 days	0(0.0%)	4(22.2%)	9)50.0%)	5(27.8%)	0.033
>15 days	0(0.0%)	2(15.4%)	9(69.2%)	2(15.4%)	
Length of ICU stay					
<15 days	2(28.6%)	4(57.1%)	1(14.3%)	0(0.0%)	<0.001
15-21 days	0(0.0%)	7(36.9%)	10(52.6%)	2(10.5%)	
>21 days	0(0.0%)	4(14.8%)	16(59.2%)	7(26%)	
Decannulated					
Yes	2(25.0%)	2(25.0%)	4(50.0%)	0(0.0%)	0.022
No	0(0.0%)	13(28.9%)	23(51.1%)	9(20.0%)	
Non tracheostomy related findings for patients failed decannulation					
Yes	2(4.7%)	13(30.2%)	24(55.8%)	4(9.3%)	0.023
No	0	2(20.0%)	3(30.0%)	5(50.0%)	

Abbreviation MV: Mechanical ventilation; ICU: Intensive care unit

Table 6; represents correlations between timing for tracheostomy and duration of MV, ICU stay and outcome post-tracheostomy.

Early timing of tracheostomy is significantly associated with shorter ICU stay (P value <0.001). Timing of tracheostomy affect more ventilator free-days and sedation time p value 0.033, and also it has been found to affect time of decannulation (P value = 0.022) and delay in deciding tracheostomy is associated with laryngeal trauma (P value is 0.023).

Chapter V DISCUSSION OF RESULTS / FINDINGS

This study was conducted in ICUs of two main hospitals in Kigali (CHUK and KFH) with a large number of ICU beds.

In this current research we included 53 patients who underwent elective tracheostomy during study period equal to 20.2% of all cases above 18 years admitted in ICU of both institutional hospitals.

Each patient had follow up for 30 days post converting translaryngeal tube to tracheostomy tube.

There were 56.6% male and 43.4% female with male to female ratio of 1.30. This is consistent with what have been found by Chavan et al and Young et al [25], [36] who found respectively male to female ratio of 1.26 and 1.39.

Patients' ages ranged from 18 to 89 years with mean of 38.77±16.99 years. Our study showed that tracheostomy in ICU patient tend to be more frequent in young patients (<40years). The predominant age group was 18-34 years (50.9%). All cases underwent open surgical tracheostomy under general anesthesia in operating theatre 17/53(32.07%) patients and (67.93%) Performed in ICU and or Emergency wards, this is consistent with what has been found by Mohamad el[14], [24].

Several review for consecutive tracheostomies found that about 80% were performed to facilitate prolonged mechanical ventilation. In our study that included only ICU adult patients in 2 tertiary hospitals in Kigali, the main indication for doing tracheostomy was prolonged mechanical ventilation, This agrees with what was found in Turkey by Gucyetmez B et al who studied epidemiology of elective tracheostomy and found prolonged mechanical ventilation as indication in 76.9%[37]. Indications for endotracheal tube placement and ventilator support on admission are diverse. In our study the majority of participants had trauma as the reason for ICU admission (49.1%), followed by post-surgery (9.4%), consistent with findings of Tereq Mahafza et al [13].

In this study where participants had prolonged translaryngeal intubation as indication of tracheostomy were 50/53 (94.3%) and time relapse between translaryngeal tube and tracheostomy ranged from 6 and 23 days of intubation with mean of 12.08 ± 3.05 days. Predominant cases were performed within two weeks (83.0%) consistent with what found by Toshikazu et al and Sunil Kumar K.P et al[14], [23]. Our study also showed that 68% of tracheostomies, were performed beyond day

10 of initial oral tracheal intubation. The timing of tracheostomy was mainly in the second week of ICU admission.

In this study forty six patients (86.8%) were successfully weaned from the ventilator and discharged from ICU to different wards. Later 6/46 died in hospital while death in ICU count 11.3%.One patient (1.98%) was ventilated more than 30days post tracheostomy. This agrees with A.Khammas et al who found weaning rate of around 71%.[26]

Regarding times spent on MV post tracheostomy, the current study found the range from 1to 30 days with mean of 10.57 ± 6.95 days, almost 73.6% was free from MV by the second week post tracheostomy. This study also showed that the weaning duration is influenced more by timing of tracheostomy P value less than 0.05 this agrees with what found by A.Makram et al[38] who studied effect of tracheostomy on weaning process for adult with prolonged MV post cardiac surgery.

ICU length of stay in our study ranged from 7 to 43 days with a mean of 24.85 ± 9.31 days and also this study showed that timely tracheostomy is associated with shorter ICU stay and it was statistically significant with a P value less 0.001. This goes with what found in literature[39],but differ to what described by A.Khammas in prospective study done to assess impact of timing of tracheostomy on various outcomes[26].

In total out of 53 participants, 15 (28.3%) had complications; no intra operative complication occurred during this study, early post-operative complications such as tube blockage, 8 (15.1%), accidental tube dislodgement 2 (3.8%) patients and stoma site infection 4 (7.5%) patients has been recorded in this current study and treated them by changing tube and local care.

All patients left ICU with tracheostomy tube, none were decannulated in ICU, 8 (15.1%) were completely decannulated within one month of follow up and this current study showed correlation between timing of tracheostomy and decannulation success with a P value of 0.022 this match with what found by O' Connor et al and G Hernandez et al[27], [40].

18.9% among those failed tracheostomy closure found to have supraglottic edema. Delay in transglottic intubation is significantly associated with supraglottic trauma, P value 0.023.[30], [41] During 30 days of follow up we encountered one case (1.9%) subglottic stenosis occurred one week

post complete decannulation and it has been treated by dilatation. Consistent with what found by Halum et al[42]

The limitations of this study were that it was performed during short period at two ICU centers only with a small sample size, with not blinded study, because decision on the timing of tracheostomy was judged according to the opinion of the attending physician and to the clinical status of the patient. Therefore, a probable interpretation bias may have influenced some of the outcomes of the study parameters

Chapter VI CONCLUSIONS AND RECOMMENDATIONS

VI.1. CONCLUSIONS

This study was aimed to evaluate the profile of tracheostomy in adult multidisciplinary ICU at University Teaching hospital of Kigali and King Faisal hospital.

The researcher evaluate incidence of tracheostomy among adult ICU patients with prolonged mechanical ventilation, timing of tracheostomy, weaning rate and duration of mechanical ventilation, length of ICU stay and complication associated with tracheostomy.

At the end of this study, the following conclusions were developed.

- ❖ The incidence of tracheostomy in adult ICU a tertiary hospital is significant and the main indication is prolonged intubation.
- ❖ Timing for tracheostomy is mainly done within two weeks of intubation.
- ❖ Timing for tracheostomy is associated with weaning rate, duration of mechanical ventilation, and ICU stay in post tracheostomy.
- ❖ Tracheostomy in ICU is not associated with major complication.
- ❖ Decannulation post tracheostomy in ICU is successful for patients without comorbidities.
- ❖ Prolonged endotracheal intubation is found to be associated with laryngotracheal sequelae, including laryngeal edema, subglottic stenosis that needed timing of tracheostomy to be addressed by timing for tracheostomy.

VI. 2. RECOMMENDATIONS

Based on the conclusion of this study showing that timing of tracheostomy in ICU patient has significant importance on the outcome of ICU patients and considering the opinion of medical providers on tracheostomy for critically ill patients on ventilation support, following recommendations are formulated:

To ICU and Accident-Emergence units

- Inform ENT surgeons as soon as the patients on ventilation support are spending more than a week in ventilator and not improving clinical for timing of tracheostomy to avoid prolonged intubation.

- Avoid multiple intubation and monitor the cuff as this can lead to laryngotracheal sequellae and subsequent decannulation failure.

- Increase the awareness on consequences of prolonged intubation and benefit of timing for tracheostomy for both staff and students.

To ENT Units

- Rounding regularly in ICU and Emergence Units to detect non communicated patients on Ventilator support at risk of prolonged intubation and decide together timing for tracheostomy.

- Share the knowledge of with different health professionals through meetings, conferences about the timing of tracheostomy and its benefits.

To researchers

- Conduct Multicenter study on tracheostomy in ICU patients for better generalizing the findings.

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APPENDICES

Data collecting tool

I. Identification of the patient

- Hospital …………………………………..
- Patient's   Code (ID)…………………………………..
- Age………………………………………

  ……..
- Gender: Male Female   ☐
- Contact (phone number): …………..…

II. Reason for ICU admission/ Diagnosis on ICU admission

- GCS on admission
- Trauma
- Post-Surgery
- Cardio-vascular
- Metabolic
- neurology
- Infectious
- Respiratory
- Gynecology and obstetrics related conditions
- Others (to specify)…..

III. Tracheostomy

- GCS on day of tracheostomy
- Duration between endotracheal intubation and tracheostomy in days…………..
- Indications of tracheostomy
  1. Prolonged intubation.
  2. Lung toilet
  3. Failed weaning from ventilator machine
  4. Others to specify ……………………

- o Types of tracheostomy??
    1. Open
    2. Percutaneous dilatational
- o Complications of tracheostomy
1. Immediate perioperative
- o Surgical emphysema
- o Bleeding
- o Pneumothorax
2. Immediate post-operative
- o Tube blockage with secretions
- o Hemorrhage
- o Accidental decannulation
3. Later complications
- o Infection of stoma site
- o Tracheoesophageal fistula
- o Tracheomalacia

IV. Post tracheostomy follow up
    1. Weaned from mechanical ventilator? Yes   No
    - Duration of mechanical ventilation post tracheostomy in days……………………..
    2. Discharged from ICU?
    - Length of ICU stay in days…………………………………………………………….
    3. Died?   If yes reason………………………………….

V. 4weeks post-tracheostomy.

   Disposition
   - ICU
   - Ward
   - Home

   Decannulated?   Yes.   No

If yes how long has been with tracheostomy tube (from procedure to decannulation)……

If failed decannulation;

- Neurological status

- Airways status

- Chest status

- Others

Findings on direct laryngoscopy/ fibreoptic laryngoscopy if performed for airway assessment

- Normal findings

- Laryngeal trauma(Intubation granuloma, supraglottic edema)

- Subglottic stenosis

- Tracheal stenosis

Consent Form

INFORMEDCONSENT (English version)

Title of the study: Profile of tracheostomy in intensive care units (ICUs) of a tertiary hospital: case of CHUK and KFH

Explanation to the patient

I am Dr. Etienne NDAMYIYUMVA, a senior resident in ENT-Head and Neck Surgery at University of Rwanda, School of Medicine. I am conducting a study at CHUK and KFH for the degree of Master of Medicine in ENT-Head and Neck Surgery. My study is aimed to investigate the effectiveness, safety, present analysis of the timings and outcomes of elective tracheostomy in critically ill adult patients on prolonged mechanical ventilation with different conditions.

In fact, I am recruiting patients with prolonged translaryneal intubations. Then the patient will be scheduled for tracheostomy. I will follow every patient meeting inclusion criteria for a period of 4weeks after surgical airways (tracheostomy) to evaluate the clinical outcomes in term of length of ICU stay, duration of mechanical ventilation and ventilation associated. During the study, the caretaker of the patient candidate for the study will sign the consent form before the surgical procedure. The collection data tool will be filled by one of the ENT staff at CHUK/KFH (Investigator, senior resident or a consultant) where the study is being conducted.

No direct benefit, no additional cost and no risks for the participants but the result of this study may be used to benefit other patients in future.

All information obtained from this study will be handled in a confidential manner and be used for only research purposes.

If you have question about the study, please feel free to contact **Dr.Etienne NDAMYIYUMVA,** cell: 0788832038 and E-mail:**stefnnda@gmail.com**.

Chairperson of CMHS/IRD: 0788490522

If you agree to be included in this study, please sign the section below.

CONSENTFORM

I……………………………………………confirm that the purpose of this study and my role have been well explained to me by Dr……………………………......................................I agree to the conditions explained and give consent that Mr./Mrs./Miss…………………………………………………. Can be included in the study.

Names of the participant/attendant………………………………………………………Signature……

……………………………. Date……/……./…..……….

Name oftheWitness……………………………………………………………......Signature…………

……………………..……………….Date……/……/………...

Researcher'snames…………………………………….Researcher'ssignature……………………

…………………Date…../……. /……..

IBISOBANURO NO KWEMERA UBUSHAKASHATSI (Kinyarwanda version)

Umutwe w'ubushakashatsi

Profile of tracheostomy in intensive care units (ICUs) of a tertiary hospital: case of CHUK and KFH

Ibisobanuro

Njyewe **Etienne NDAMYIYUMVA**, ukora ubu bushakashatsi, ndi umuganga wiga muri Kaminuza y'u Rwanda ishami ry'Ubuvuzi, aho niga ibijyanye no kuvura indwara z' Amatwi, Amazuru, Umuhogo, umutwe n'ijosi.

Muri ubu bushakashatsi, ndimo gukurikirana abarwayi barwariye munzu y'indembe (ICU) Bakeneye gufashwa n'imashini kugirango bahumeke. Hanyuma abo barwayi bakazashyirwamo agapira katanyura mu ngoto (tracheostomy) gatuma imashini iguma kubaha umwuka. Buri murwayi mubazaba bujuje ibisabwa azakurikiranwa mugihe cy'ukwezi 1 hagenderewe kureba igihe bamara bagihumekeshwa n'imashini

Mbere ko umurwayi ashyirwa muri ubu bushakashatsi, umuhagarariye cyangwa umurwaza asobanurirwa ibijyanye n'ububushakashatsi. Hanyuma, agasinya ko yemeye ko umurwayi we ajya mu bushakashatsi.

Mu kujya muri ubu bushakashatsi ntakiguzi cyangwa inyungu yihariye umuntu ku giti cye akuramo; ariko ibizavamo bishobora kugirira akamaro uwabugiyemo ndetse bishobora kuzagirira akamaro abandi mu gihe kizaza.

Hakoreshwa inomero mu mwanyaw'amazinay'umurwayi; kandi amakuru yose avuye kumurwayi akabikanwa ibanga.
Ibizava muri ubu bushakashatsi ntibizakoreshwa kuzindi nyungu zitari iz'ubushakashatsi kandi mu kubitangaza ntanahamwe hazagaragazwa amazina y'ababukoreweho.

Inyigoy'ububushakashatsi yasuzumwe inemezwa na Komisiyo y'ubushakashatsi muri Kaminuza y'u Rwanda (Research commission: Chair**person of the CMHS/IRB: 0788490522).**

Ku bibazo cyangwa ibindibisobanuro, baza **Etienne NDAMYIYUMVA**
Tel: 0788832038
E-mail: stefnnda@gmail.com

Kwemera kwinjira mu bushakashatsi kubushake

Njyewe …………………………………………………………, (imyaka…………)
Nemeyeko nahawe ibisobanuro birambuye na Dr…………………………………………kuri ubu bushakashatsi mpabwa n'umwanya wo gusobanuza. Mu gusinya, nemeye kubushake bwanjye ntagahato   ko   ububushakashatsi bunkorerwaho/bukorerwakuri…..……………………….............................. (Imyaka…………) mpagarariye. (Isano……………………………………………..)

Umukono…………………………………….…………itariki……/…………/…………….
Isano…………………………………………………………………………………………..
Umukonoy'ukoraubushakashatsi/Umuhagarariye…………………itariki……/…………/…….

Amazina y'umutangabuhamya………………………………………………………………….
Umukono…………………………… itariki……/…………/………………………………..