



## Risk Factors of Early Complications of Tracheostomy at Kenyatta National Hospital.

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**Background:** A tracheostomy is a surgical intervention that can mean the difference between life and death and has been practiced for thousands of years. The aim of this study was to identify risk factors that contribute to complications following tracheostomies. The aim of this study was to establish the determinants of early complications following tracheostomies in Kenyatta National Hospital.

**Methods:** This was a prospective cohort study carried out at Kenyatta National Hospital. A total of 100 patients undergoing tracheostomy between October 2010 and March 2011 were recruited. Ethical approval was obtained from Kenyatta National Ethics and Research Committee and consent obtained from all patients recruited. Data was analyzed in Stata version 11.0. Association between complications and various patient and surgery characteristics was investigated via a series of univariable and multivariable logistic regression.

**Results:** The age ranged from one year old to eighty nine years old. In the study, 7/100 patients died, majority secondary to decannulation. Prevalence of intraoperative complications was 23% while that of post operative complications was 42%. Intraoperative haemorrhage was the most common complication (21%). There was increased morbidity of 2% for every year increase in age above the mean and a 31 fold higher risk of complications in patients who had a neck mass.

**Conclusion** The prevalence of complications following tracheostomies in this study was comparable with the findings from other studies. The study found an increased risk of complications with increased age of the patient and patients with a distorted neck anatomy. The importance of properly trained staff in perioperative care of patients post tracheostomy cannot be over emphasized.

### Introduction

As with any surgery, there are some risks associated with tracheostomies. Previous studies have reported complication rates of surgical tracheostomy ranging from 6 to 65 %<sup>1,2,3</sup>. Early complications are complications that occur within 1 week postoperatively<sup>1,4,5,6,7</sup>. Risk factors for complications following tracheostomy have been associated with the age of the patient<sup>1,8</sup>, whether the surgery is performed as an elective or emergency procedure<sup>9,10</sup>, surgeons experience<sup>11</sup> or the site in which it is performed<sup>1,9</sup>. No previous prospective study on complications or risk factors associated with the complications following tracheostomies had been done in our setup. Tracheostomy is a common surgery performed in the Ear, Nose and Throat (ENT) unit of Kenyatta National hospital and it was important to perform an objective audit on the complications following this important surgery.

The study associated complications encountered with possible risk factor Various factors were found in literature to contribute to development of early complications of tracheostomies. These included: age, indication for surgery, site of surgery (ICU, versus operating room), whether the surgery was elective or emergency and surgeons experience. These were assessed in this study as the presumed risk factors<sup>1, 9, 10, 11</sup>.

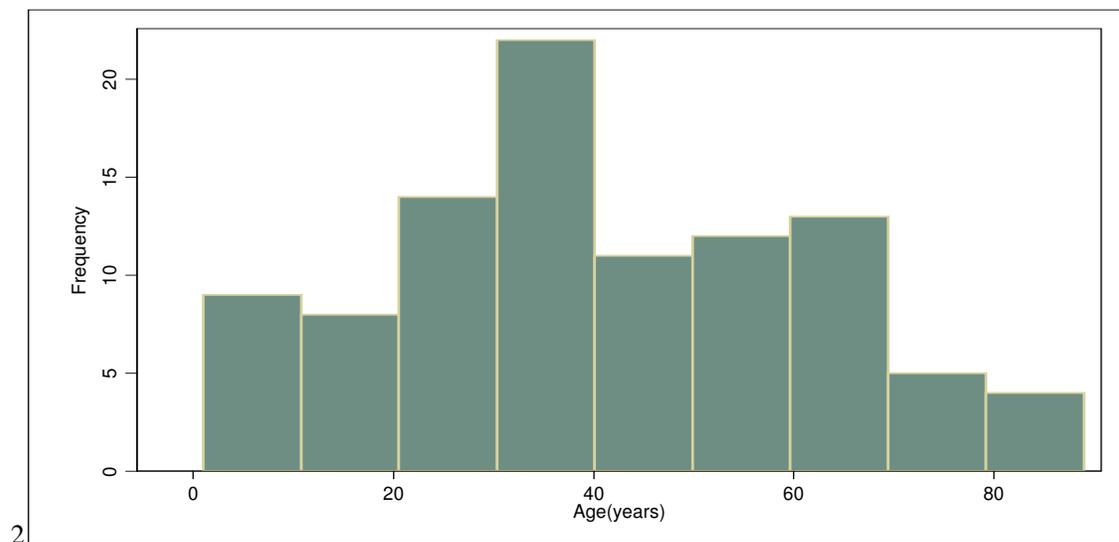
### Patients and Methods

This was a prospective cohort study. Patients undergoing tracheostomy were followed up for 7 days to determine the risk and risk factors for complications amongst this inpatient group. Approval was obtained from the Kenyatta National Hospital Ethics and Research Committee. Informed consent was

taken from the participating patients or their parents or guardians. Patients recruited into the study were examined preoperatively. A standardized tracheostomy procedure was carried out on all the patients and any intraoperative complications noted. Complications occurring postoperatively were recorded, investigated and managed accordingly. Analysis was conducted in Stata version 11.0. To investigate association between the complications and various patient and surgery characteristics, a series of univariate logistic regression were fitted. Variables that were significant at 5% level were entered into the respective multivariate models. The results were presented as odds ratios with 95% confidence intervals. The age was centered at the grand mean.

## Results

One hundred patients were recruited into the study between October 2010 and March 2011. Of the 100 patients, 24% of the patients were female. Their ages ranged from 1.5 to 89 years with a median age of 41.5 years (Figure 1). Of the 100 operations, majority (61) were performed in the operating room while 35 and 3 were performed in Intensive care unit (ICU) and casualty respectively. The significance of the site of surgery towards development of complications was assessed.



**Figure 1.** Age distribution of patients undergoing tracheotomy.

**Table 1.** Significant Examination Findings.

Variable	Number	Percentage
<b>Pallor</b>	17	17.0
<b>Cervical adenopathy</b>	13	13.0
<b>Mass on indirect laryngoscopy (yes)</b>	9	9.0
<b>Mouth (mass/trauma)</b>	7	7.0
<b>Nose (mass/trauma)</b>	6	6.0
<b>Widened laryngeal framework(yes)</b>	6	6.0
<b>Neck mass(yes)</b>	5	5.0
<b>Previous surgical scar(yes)</b>	3	3.0
<b>Ear (mass/trauma)</b>	2	2.0
<b>Trachea displacement (yes)</b>	1	1.0

**Table 2.** Prevalence Estimates for the Various Complication and 95% Confidence Intervals

Variable	Number	95% Confidence intervals
<b>Intraoperative</b>	<b>23</b>	<b>14.6, 31.4</b>
Haemorrhage	21	12.9 , 29.1
Decannulation	3	0, 6.4
Injury to structures	1	0, 3.0
Tube displaced	1	0, 3.0
<b>Post-operative complication</b>	<b>42</b>	<b>32.7 , 51.8</b>
Death	7	1.9, 12.1
Pneumonia	17	9.5, 24.5
Emphysema	15	7.9, 22.1
Decannulation	5	0.7 , 9.4
Infection	10	4.0 , 16.0
Tube obstruction	5	0.7 , 9.3
Haemorrhage	2	0, 4.8
Tracheo oesophageal Fistula	2	0 , 4.8

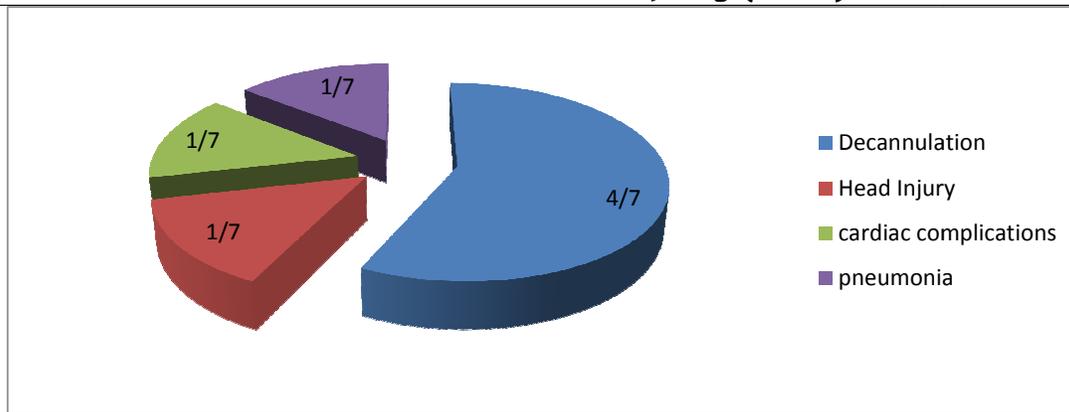
*Note: intraoperative decannulation refers to the patients in whom the tube was initially correctly placed but was later found to be completely extracted from the cervical region before the patient was reversed from anaesthesia or the surgery completed (skin closure). Intraoperative tube displacement was considered in cases where the tube was found to be in a false tract before completion of the surgery.*

It was noted that 47% of the patients had upper airway obstruction as the indication for tracheostomy while 53% had a non obstructive indication for this surgery. The study revealed that elective tracheostomies (54%) were slightly more common than emergency tracheostomies (46%). Table 2 shows the prevalence (and the corresponding 95% confidence intervals) for the various complications observed. Overall, 56% experienced at least one complication either intraoperatively or post operatively. Twenty three patients experienced at least one intraoperative complication. Seven patients enrolled in this study died. Figure 2 shows causes of death

### **Logistic regression**

Univariate logistic regression was applied to the data obtained. Patients occupation, history of difficulty in breathing, stridor and trauma, pallor, neck mass, site of surgery, whether surgery was elective or emergency, whether the patient had an obstructive cause or not and, type of anaesthesia were all independently associated with occurrence of intraoperative complications. No variables were significantly associated with post operative complication at the 5% level.

The results of the final multivariate regression are presented in table 3. The estimates comparing the odds of an intraoperative complication between those with an obstructive or non obstructive cause and, those who had the surgery done as an emergency or as an elective case were poorly estimated by the model and the results have been excluded. The odds of any complication increased by 2% (p=0.026) for every one year increase in age. Compared to those who had their tracheostomy performed in ICU, those who had it performed in the operating room were at approximately four fold odds of post operative complications(p=0.017). Patients with a neck mass had 31 fold increased risk in intraoperative complications after multivariate analysis (p= 0.018).



**Figure 2.** Cause of death of patients enrolled into the study

Note: The table refers to the cause of death of patients enrolled into the study. However 2 of the patients' (cardiac complication and head injury) death was not related to the tracheostomy nor the surgery.

**Table 3.** Results of Multivariate Regression.

Variable	Intraoperative			Post operative		
	OR	95% CI	p value	OR	95% CI	p value
Age (centered)	1.02	0.97, 1.06	0.468	1.02	1.00, 1.05	0.072
Gender: Male vs Female	0.04	0.00, 0.33	0.003	1.99	0.67, 5.94	0.218
Occupation: unemployed vs student	0.12	0.01, 2.23	0.155			
Occupation: working vs student	0.02	0.00, 0.50	0.018			
Pallor: yes vs no	2.49	0.37, 16.64	0.347			
Neck mass: yes vs no	31.34	1.17, 836.89	0.04			
Site where tracheotomy was performed: Operating room vs I.C.U	0.11	0.00, 5.74	0.27	4.27	1.07, 17.07	0.04
Emergency vs elective	-a	- a	0.986	0.17	0.01, 2.16	0.171
Obstructive vs non obstructive	- a	- a	0.989	1.49	0.13, 17.18	0.748
Anaesthesia: local vs general	0.87	0.15, 5.19	0.878	0.89	0.26, 3.09	0.854
Surgeon: registrar vs consultant	8.85	0.26, 301.13	0.226	0.97	0.21, 4.49	0.965

## Discussion

In this prospective study at Kenyatta National Hospital (KNH), 100 patients who underwent tracheostomy were recruited into the study. Intraoperative complications were found to be 23% and

early postoperative complications found to be at 42%. Some patients experienced both intraoperative and post operative complications (56%). The prevalence estimates are higher than those obtained by Prabhat<sup>12</sup>, and Zeitouni<sup>13</sup> who found a complication rate of 18.36%, and 14% respectively, in retrospective studies. In these two studies no differences in complications were found in elective versus emergency surgeries. These findings are in agreement with those of the present study. In a retrospective study by Macharia<sup>1</sup> at KNH, the prevalence of intra operative complications was only 7%.

Death secondary to tracheostomies has been reported to range from 0.5 to 1.6% and, is often as a result of tube displacement<sup>13</sup>. Intraoperative decannulation of the tracheostomy tube was found to be at 3% and 5% intraoperatively and postoperatively respectively. The mortality from decannulation was 4 out of 8 patients. This is a mortality rate of 50%. This complication is known to carry a high risk of death with literature providing mortality rates of 25%<sup>14</sup>. Zeitouni<sup>13</sup> found a mortality rate of 2% in elective tracheotomies. Similarly 2/7 of deaths occurred after elective tracheostomy in our study.

### ***Presumed Risk Factors of Complications.***

Age has been found to be a risk factor in the occurrence of complications. In this study no patients were found to have pneumothorax or pneumomediastinum post tracheostomy. Rabuzzi found the rate of intrathoracic complications to be nearly 70% in children between 6 months and 2 years<sup>15</sup>. In this study, however, only 2 patients were below the age of two years and therefore may have been insufficient to review this trend. It was found that the odds of post operative complication increase by 2% ( $p = 0.026$ ) for every one year increase in age from the grand mean of 41.5 years in univariate analysis. This may be attributed to the fact that older patients have more co morbidities and also to older patients having a higher likelihood of having a neck mass or obstructive indication for their tracheostomy. Males were at 96% lower odds of intraoperative complications compared to females ( $p = 0.03$ ). This significant difference in complications could be attributed to the difference in anatomy between males and females with an increased likelihood of females having a shorter and fatter neck. However a larger sample size maybe necessary to make this a definitive conclusion.

Tracheostomies done as emergencies were found to have a higher rate of complications at 73.9% of all patients with complications. When this is compared with elective tracheostomies in a multivariate analysis, the difference was not significant. This was however in keeping with other studies done where Morphy<sup>10</sup> found a complication rate of 35% in emergency setting while Bruno<sup>16</sup> found a complication rate of 20.9% in electively done tracheostomies. In our setup, this rate is much higher possibly because patients undergoing emergency tracheostomies have advanced disease in comparison to those in more developed countries.

As compared to complications encountered in patients whose tracheostomy was performed in the Intensive Care Unit (ICU), there was a 5 times increased risk of complications in the Operating room in the multivariate analysis. This shows that there is a reduced risk of complications in intubated patients and electively done tracheostomies. The incidence of 24.6% of early complications also closely compares with that of 24.5% reported by Gunawardana<sup>17</sup> in an ICU based study. A significant finding was that the odds of intraoperative complications was increased 31 fold for patients who had a neck mass ( $p=0.04$ ). This could be due to the distortion in the anatomy of the neck as a result of the mass.

### **Conclusion**

The overall intraoperative complication rate was found to be 23%. Early post operative complications were found to be 42%. This finding was in concurrence with other studies that obtained a range of 6-65%. An increase in risk for complications was seen in this series in patients who are older and in emergency cases as well as those performed under local anaesthesia and for those performed by residents vis a vis consultants. However these were not found to be significant after multivariate

analysis. A significant risk was noted for patients whose tracheostomy was performed in the Operating room compared to those performed in ICU and for those patients who presented with a neck mass.

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