Cross Sectional Analysis Looking at the Disease Profile of Patients Requiring Tracheotomies by the Otorhinolaryngology Department at a Tertiary Care Centre

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Dedication

This dissertation is dedicated to my

dear husband Johannes Geyser,

for his patience, understanding, love and support.

Without your sacrifices, none of this

would ever have been possible.

My parents, Chris and Annelie Pretorius

for their encouragement and never-ending faith in me.

Declaration

Candidate

This dissertation is my original work and has not been presented for a degree, or other academic award, in any other university or institution of higher learning.

Signed _____

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This dissertation is submitted as a final copy with my approval as the University's Academic and Clinical Supervisor.

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List of Abbreviations

CHBAH – Chris Hani Baragwanath Academic Hospital

ENT – Ear, Nose and Throat or Otorhinolaryngology, head and neck

HREC – Human Rights and Ethics Committee

UAO – Upper Airway Obstruction

PI – Prolonged intubation

ICU – Intensive Care Unit

VAP – Ventilator-Associated Pneumonia

Abstract

Background:

Tracheotomy is an important lifesaving surgical procedure and plays a prominent role in developing countries where patients may present with advanced airway obstruction very late.(1) The world has seen a paradigm shift in the indication for tracheotomy from mainly short-term procedures for upper airway obstruction to long-term uses for chronic disease and prolonged ventilation.(2)

Aim:

Doing an audit on tracheotomies performed in a tertiary referral centre in a third-world country and comparing it to available literature.

Method:

A retrospective review was done in the Ear, Nose and Throat (ENT) Department at the Chris Hani Baragwanath Academic Hospital over a 4 year period from January 2012 to December 2016. Medical records of 269 tracheotomised patients were reviewed, and the data collected included age, gender, indication and diagnosis. Patients were then categorised according to indication for tracheotomy and different age groupings. The data was analysed using standard statistical methods.

Results:

Two hundred and sixty-nine patients were included in this study, with ages ranging from 2 weeks to 84 years (mean 41 years). Gender analysis revealed a male predominance of 68% (n = 184) with females making up 32% (n = 85). There was no statistically significant difference in the age of males compared to females (p = 0.43). The most common age group of patients requiring a tracheotomy was patients > 50 years (n = 117; 43%), followed by the 35-49 year age group (n = 62; 23%). The majority of tracheotomies were done for upper

airway obstruction (n = 220; 82%) and the rest for prolonged intubation (n = 49; 18%). The overwhelming majority of patients in the upper airway obstruction group had a head and neck tumour (n = 120; 56%), followed by airway stenosis (n = 40; 18%), head and neck sepsis (n = 24; 11%) and head and neck trauma (n = 22; 10%).

Analysis of the age distribution for each diagnosis showed upper airway stenosis to be more common in the 1-15 year age group (n = 16; 40%). Patients with head and neck sepsis requiring a tracheotomy were mostly in the > 50 year age group (n = 8%) followed by the 16-34 year age group (n = 8%). Tracheotomies for prolonged intubation were most frequent in the age group between 35-49 years (n = 18%) followed by the > 50 year group (n = 11%). Trauma to the head and neck occurred most frequently in the 16-34 year age group (n = 11; 50%), followed by the 35-49 year age group (n = 6; 27%). Head and neck tumours formed the most common diagnosis and the affected age group was patients > 50 years (n = 88; 73%).

A separate analysis of children younger than 16 years of age (n = 44) showed upper airway obstruction accounts for 70% (n = 31) and prolonged intubation 30% (n = 13) of the tracheotomies in children. The most common diagnosis in the upper airway obstruction group was airway stenosis (n = 19; 43%).

Conclusion:

Upper airway obstruction formed the overwhelming majority of the patients requiring a tracheotomy; this is in agreement with similar published studies from other African countries.(1,14,15,16) However, our data showed a higher percentage of tracheotomies performed as a result of prolonged intubation. The most common diagnosis for upper airway obstruction also differed with head and neck tumours found to be the most frequent, followed by head and neck sepsis and airway stenosis.(1,14,15,16)

The data showed a similar split to the Western world regarding paediatric tracheotomies with upper airway obstruction accounting for 70% of the indications and prolonged intubation the remaining 30%.(3-8)

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Chapter 1 – Introduction

A tracheotomy is an important lifesaving surgical procedure and plays a prominent role in developing countries where patients may present with airway obstruction very late.(1) Some of the earliest recordings of a tracheotomy appear on Egyptian artefacts from as early as 3600 BC. Alexander the Great was said to have saved the life of a soldier in anaphylactic shock using his sword to open the trachea.(2) The world has seen a paradigm shift in the indication for tracheotomy from mainly short-term procedures for upper airway obstruction to long-term uses for chronic disease and prolonged ventilation.(3)

The terms tracheotomy and tracheostomy can be easily confused and are often used interchangeably. Tracheotomy refers to the surgical procedure itself, to cut the trachea, whereas tracheostomy refers to the hole or fistula that is created to furnish the trachea with an opening.(4)

This study has two main objectives: firstly, to provide a review of the indications and demographics for tracheotomies performed at a tertiary referral centre in a third-world country and to compare these findings to those reported in the literature.

Chapter 2 - Literature review

2.1 Historical perspective

The earliest account of a tracheotomy is depicted on Egyptian tablets dating back to 3600 BC. Tracheotomies were described as a lifesaving procedure associated with a high mortality rate, and due to the high risk, it was generally not recommended. In the 1820s Pierre Bretonneau re-popularised the tracheotomy for treatment of obstructive diphtheria, but the procedure had a 73% mortality rate. Additionally, with the advent of diphtheria antiserum, the rate of tracheotomies decreased.(5) During the polio epidemic, and with the subsequent post-polio syndrome, the need for tracheotomies re-emerged. James Wilson proposed the use of tracheotomy in 1932 as a means of ventilation. This resulted in the concept of tracheotomy as an emergency airway procedure shifting to include its use during prolonged ventilation.(5)

2.2 Surgical technique

The incision site is planned approximately one-third to one-half distance between the cricoid cartilage and the sternal notch. A weight-appropriate dosage of lignocaine with epinephrine is injected, and a horizontal or vertical skin incision is made that extends through the subcutaneous tissue. Subcutaneous fat may be removed as doing so improves exposure and allows the tracheocutaneous stoma to mature faster.(6) Blunt dissection is performed in the midline down to the trachea, and “stay” sutures are placed through the cartilaginous rings on either side of the planned vertical incision in the trachea. Non-absorbable sutures such as 3-0 polypropylene are preferred. The “stay” sutures serve to assist in elevation of the trachea intraoperative and also in finding the stoma in accidental decannulation.

A vertical incision is made through the second and third cartilaginous rings until the tracheal lumen is visualised. The endotracheal tube is retracted slowly until the tip lies proximal to the superior side of the tracheal incision, and the tracheotomy tube is inserted. The tracheotomy tube is secured with ties that fit snugly around the neck, permitting one finger width under the tie. A flexible bronchoscope can be passed through the lumen of the tracheotomy tube and is used to visualise the carina. This allows for the assessment of the positioning and length of the tube.

The patient is examined daily for any skin breakdown from the ties, displacement of the stay sutures or purulent respiratory secretions. The first tracheotomy tube change is performed between postoperative day 5 and 7. This allows adequate time for the tracheocutaneous fistula to mature.(4,5)

Traditionally, chest radiography has been a standard part of the postoperative care. In a study done by Genther et al., 421 tracheostomies done in children under 18 years of age were studied. Only three patients complicated with a pneumothorax, and they were all diagnosed clinically. The study concludes that a postoperative chest radiography should be reserved for cases where a complication is suspected on the basis of intraoperative findings or clinical parameters.(7)

2.3 Open versus percutaneous tracheotomies

Adult tracheotomies may be divided into open and percutaneous techniques. With the percutaneous method, a needle is used to enter the tracheal space under endoscopic tracheal guidance. A guide wire is passed through the needle into the trachea. This wire is then used to guide serial percutaneous dilators into the trachea.(6) The above procedure is based on a modification of the Seldinger technique and was first introduced in 1985 by Ciaglia.(8)

The potential advantages of percutaneous dilatational tracheotomies are its simplicity to perform, smaller skin incisions, less tissue trauma, lower incidence of wound infection, lower incidence of peristomal bleeding and that it can be done at a patient's bedside, avoiding the need to transport patients to theatre. It is also more cost-effective since no theatre time or theatre personnel are needed. Johnson-Obaseki et al. provides a literature review in which they conclude that there is no significant statistical difference between open and percutaneous techniques regarding mortality, intraoperative haemorrhage and postoperative haemorrhage. They do, however, report a significantly lower infection rate and operative time in the percutaneous group and conclude that percutaneous tracheotomies appear to be as safe and efficient as open tracheotomies.(8)

Another meta-analysis conducted conclude that percutaneous tracheotomy techniques can be performed faster and reduce stoma inflammation and infection but are associated with increased technical difficulties when compared with open techniques. An open technique is recommended for critically ill adult patients.(9)

2.4 Paediatric tracheotomies

Tracheotomies in children are associated with significantly greater morbidity and mortality. The paediatric airway differs in many ways to the adult airway: the trachea is small, soft and pliable, thus any excessive retraction intraoperative may lead to disorientation, lateral dissection and accidental injury to the lung or a major vessel. The larynx in children is located much higher in the neck, altering the external landmarks used in children. One needs to be very meticulous in choosing the correct size tracheotomy tube in children, and there are many tables and formulae to assist one in selecting the adequate size. The general idea is to use a tube with the smallest lumen that will maintain adequate ventilation which helps to

minimise mucosal trauma. The distal tip of the tracheotomy tube should lie 7-20 mm proximal to the carina.(4)

2.5 Indications and incidence

The indications for tracheotomies have been changing over the past 40 years. There are multiple studies documenting the shift in indication and incidence for paediatric tracheotomies. Previously acute infection, such as diphtheria or epiglottitis, was the main cause of airway obstruction requiring a tracheotomy. However, the development of vaccines against Corynebacterium diphtheriae and Haemophilus influenzae combined with increasing use of endotracheal intubation and ventilation in the acute setting, has reduced the number of infection-based indications for tracheotomies.(10) Another change that has been noted is the increase in the frequency of tracheotomies performed in children less than 1 year of age. This is explained by the increase in survival rates of premature infants and patients with congenital anomalies as well as the improvement of intensive and paediatric care.(11)

A retrospective analysis of 119 children requiring tracheotomies at the University Children's Hospital in Zurich from January 1990 to December 2009 was compared to the results of a study done at the same institution in the preceding 10 years. Data were analysed in 10 year periods from 1979 to 1989 (group A), 1990 to 1999 (group B) and 2000 to 2009 (group C). In each 10 year period, the most common indication was still upper airway obstruction (average of 70%), but there was a shift noted towards an increase in tracheotomies done for prolonged ventilation (average of 30%). Another observation was a 70% increase in the patients operated on before 1 year of age.(7)

Contradictory to the above findings, the Connecticut Children's Medical Centre in the United States showed a decrease in the rate of tracheotomies for prolonged intubation. They did an 11-year review from 2000-2011 and found that the most common reason for

tracheotomy between the years 2000 and 2005 was prolonged intubation. However, upper airway obstruction was the most common indication between 2006 and 2011. The study suggests that the change might be due to improvements in paediatric intensive care and surgical advances in the management of many conditions that would have previously been treated with a tracheotomy.(11)

A French study reports that 75% of the tracheotomised children were aged < 1 year at tracheotomy, 56% were < 6 months and 38% of the neonates were premature.(10) They conclude that the average age at tracheotomy has declined slightly over the last 30 years and that currently most procedures are done on children in their first year of life.(12)

Starship Children's Hospital in New Zealand reviewed a total of 122 paediatric tracheotomies performed between 1987 and 2000. Their review shows upper airway obstruction (including craniofacial dysmorphism, n = 40, and subglottic stenosis, n = 18) to be the most common indication for surgery (n = 86; 70%) with a lesser number (n = 36; 30%) requiring tracheotomy for prolonged ventilation. The median age at tracheotomy was 4.5 months in patients with upper airway obstruction and 16 months in those patients requiring a tracheotomy for prolonged ventilation.(13) Table 1 summarises the above studies.

A Tanzanian and Nigerian study both report recurrent laryngeal papilloma as the most common indication for tracheotomy in the first decade of life.(1,16) A South African review over a 5-year period recorded 237 patients who had received a tracheotomy with the median age of 14 months. Of these, 145 (61.2%) tracheotomies were performed for upper airway obstruction, 79 (33.3%) for long-term ventilation and 13 (5.5%) for both.(15)

University Children's Hospital Zurich(7)	**1979 to 1989**	**1990–1999**	**2000–2009**
Indication	UAO – 89% PI – 11%	UAO - 72% PI – 28 %	UAO – 66% PI – 34%
Starship Children's Hospital(13)	**1987 -2003**		
Indications	UAO – 70% PI - 30 %		
Connecticut Children's Medical Centre(11)	**2000-2005**	**2006-2011**	
Indication	UAO – 22% PI – 43%	UAO – 33% PI – 28%	

Table 1 Summary of indications for tracheotomies in children, showing upper airway obstruction (UAO) and prolonged intubation (PI)

The literature is scant on the indications and demographics in adult tracheotomies. A Nigerian study reports on 52 tracheotomies performed on 36 males and 16 females with a male to female ratio of 2.3:1. Upper airway obstruction is noted as the most common indication (63.5%), with laryngeal tumour as the most common cause (32.7%).(16) Another study from Tanzania provides a 10-year review on the indications for tracheotomies during which it has found the majority of the patients to be in their third decade of life. The most common indication for tracheotomy was upper airway obstruction secondary to traumatic causes in 55.1% of patients, followed by head and neck tumours in 39.3%.(14)

2.6 Elective tracheotomies in the intensive care unit

Tracheotomies are performed in critically ill patients with the aim of increasing comfort and shortening the duration of sedation, ICU stay and mechanical ventilation. There is a great deal of heterogeneity in the various studies regarding the timing of tracheotomy in

ICU patients. A meta-analysis of randomized controlled trials was published in the British Journal of Anaesthesia in 2015. The study looks at patients allocated to tracheotomy within 10 days of the start of mechanical ventilation and compares those cases to tracheotomy done after 10 days of mechanical ventilation (if still required). Two thousand four hundred and six patients were included in the review. No evidence was found that early tracheotomy reduced mortality, duration of mechanical ventilation, ICU stay, or ventilator-associated pneumonia. The only favourable finding reported for early tracheotomy was a shorter duration of sedation.(17)

A literature review done by Stephen et al. contradicts the findings of the previous review and concludes that early tracheotomy has some merit. Many of the studies that they looked at show a reduction in ICU stay, shorter mechanical ventilation, less damage to the upper airway, fewer unwanted extubations and at least similar lower airway changes (short-term changes like infiltrates and long-term like fibrosis). They also hint that the incidence of ventilator-associated pneumonia and mortality, in general, may be reduced.(18)

A retrospective cohort study was undertaken in the ICU of the Hospital Naval Almirante Nef, Chile, between June 2011 and June 2012. The study attempted to identify early predictors of prolonged intubation (> 7 days). A regression model was used and showed that older age ($p = 0.026$), a ratio of partial pressure arterial oxygen and fraction of inspired oxygen (Pa/Fi) of less than 200 ($p = 0.046$), the presence of chronic pulmonary disease ($p = 0.035$) or hypernatremia ($p = 0.012$) (intubation day) are significantly associated with prolonged intubation. Formal validation is still needed before recommending its widespread use.(3)

Chapter 3 – Materials and methods

3.1 Hypothesis

The indications and demographic distribution of paediatric and adult tracheotomies performed by the Otorhinolaryngology Department at Chris Hani Baragwanath Academic Hospital, a tertiary referral centre, from 2012 to 2016 are in keeping with other centres around the world.

3.2 Aims and objectives

- To assess the disease profile of patients requiring a tracheotomy in an urban tertiary centre in a developing country.
- To compare results with those from other centres around the world.

3.3 Study design

The study was a retrospective clinical audit.

3.4 Study location

The study was conducted within the Otorhinolaryngology Department at Chris Hani Baragwanath Academic Hospital in Diepkloof, Soweto, South Africa. This is a tertiary level teaching hospital, under the jurisdiction of the Gauteng Department of Health.

3.5 Study period

The study extended from 1 January 2012 up to 31 December 2016.

3.6 Study population

The study included all patients who had a tracheotomy performed by the Otorhinolaryngology Department at Chris Hani Baragwanath Academic Hospital during the study period.

3.6.1 Inclusion criteria

All patients who had a tracheotomy performed by the ENT department, for any indication, by either an open or percutaneous technique.

3.6.2 Exclusion criteria

- Tracheotomies performed by other disciplines
- Tracheotomies done at other institutions
- Incomplete data available

3.7 Data collection

Patients were identified from three sources:

- The ENT operating theatre register
- The ENT ward admissions register
- Ward notes

The operating theatre register was the primary source used to identify the names and the details of patients who had undergone a tracheotomy within the study period. Details and missing information were traced by using the ENT ward admission book and old ward notes.

All patients who were identified were categorized as follows (Appendix A):

- Age
  - < 1 year
  - 1-15 years
  - 16-34 years

        - 35-49 years
        - > 50 years
    - Sex
    - Date of surgery
    - Indication for tracheotomy
        - Upper airway obstruction
            - Head and neck tumours
            - Airway stenosis
            - Head and neck sepsis
            - Head and neck trauma
            - Others
        - Prolonged ventilation

The information was then electronically recorded using Microsoft Excel.

3.8 Data analysis and presentation

- Microsoft Excel (2010) was used for data recording, storage and sorting.
- Data storage was done on a computer and hard drive.
- Statistical analysis was done using Microsoft Excel (2010).
- The mean and standard deviation was calculated for continuous variables. Tables and charts were used to summarize categorical variables.
- Standard statistical methods were used to analyze the data.
- A student's t-test was used to analyze the continuous data.
- The Pearson's chi-square test was used for categorical data.
- A probability value of less than or equal to 0.05 was regarded as significant.
- Microsoft Word was used for final documentation and presentation.

3.9 Ethics committee approval

As this is a retrospective clinical audit, no patient consent was required. The study was approved by the Human Research Ethics Committee of the University of the Witwatersrand (Clearance Number M161 035 – Appendix B). Signed written approvals were obtained from the CEO of Chris Hani Baragwanath Academic Hospital (Appendix C) and from the Head of Otorhinolaryngology Department at Chris Hani Baragwanath Academic Hospital (Appendix C). All data were stored on a password-protected database, and only the main researcher had access.

3.10 Funding

No funding was required for this study.

3.11 Potential limitations

- Retrospective nature of the study.
- Inadequate records.
- Excluding tracheotomies from other departments.
- No records of percutaneous tracheotomies performed in ICU.

Chapter 4 – Results

4.1 Study sample

A total of 271 patients who had tracheotomies were identified of which two patients were excluded as their diagnosis was not available. Therefore, a total of 269 patients were included in the study sample.

Study population	
Age	Number of patients
< 1 year	8 (3%)
1-15 years	36 (13%)
16-34 years	46 (17%)
34-49 years	62 (23%)
> 50 years	117 (44%)
Gender	Number of patients
Male	184 (68%)
Female	85 (32%)

Indication for tracheotomies	Diagnosis	Number of patients
Upper airway obstruction		220 (82%)
	Tumours	120 (55%)
	Airway stenosis	40 (18%)
	Trauma	22 (10%)
	Head and neck sepsis	24 (11%)
	Others	14 (6%)
Prolonged intubation		49 (18%)
Age Group	Upper airway obstruction	Prolonged intubation
< 1 year	5 (2%)	3 (6%)
1-15 years	26 (12%)	10 (20%)
16-34 years	39 (18%)	7 (14%)
35-49 years	44 (20%)	18 (37%)
> 50 years	106 (48%)	11 (23%)
Gender	Upper airway obstruction	Prolonged intubation
Male	155 (70%)	29 (59%)
Female	65 (30%)	20 (41%)

Table 2 Study population

4.2 Demographic data

4.2.1 Age

There was an age range of 2 weeks to 85 years, with a mean age of 41 years and a standard deviation (SD) at tracheotomy of 22 years. The average female age was 40 years, and the average male age was 43 years. A student's t-test showed no significant difference in

the age of males compared to females (p = 0.43). The majority (n = 117; 44%) of patients were aged more than 50 years. The second most common age group was 35-49 years (n = 62; 23%), followed by the 16-34 year age group (n = 46; 17%). The least number of patients (n = 8; 3%) were those less than 1 year of age.

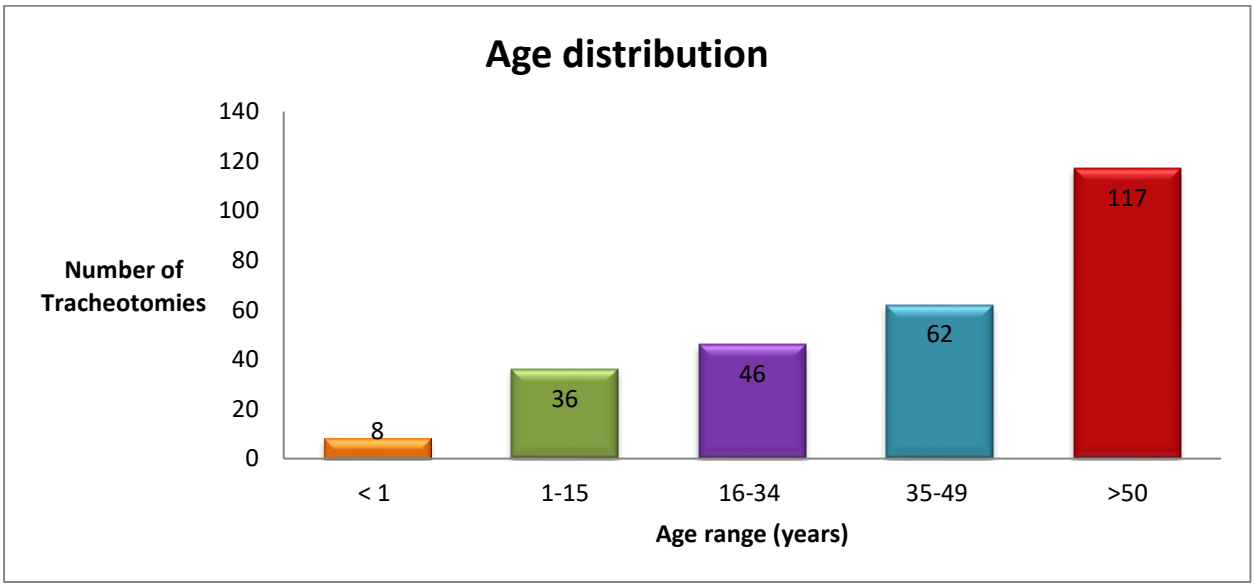

Figure 1 Age distribution

4.2.2 Gender

Male patients represented 68% (n = 184) and female patients 32% (n = 85) of the sample, giving a male to female ratio of 2.2:1. Head and neck tumours were the most common diagnosis in patients requiring tracheotomies in both genders: females 39% (n = 33) and males 47% (n = 87). Prolonged intubation comprised 16% (n = 28) in the male group and 24% (n = 20) in the female group. Evaluation of the data using Pearson's chi-square test showed a statistically significant correlation (p = 0.025) between the different genders and the indication for tracheotomies. The correlation was found to be between male requiring a tracheotomy for prolonged intubation and female for upper airway obstruction.

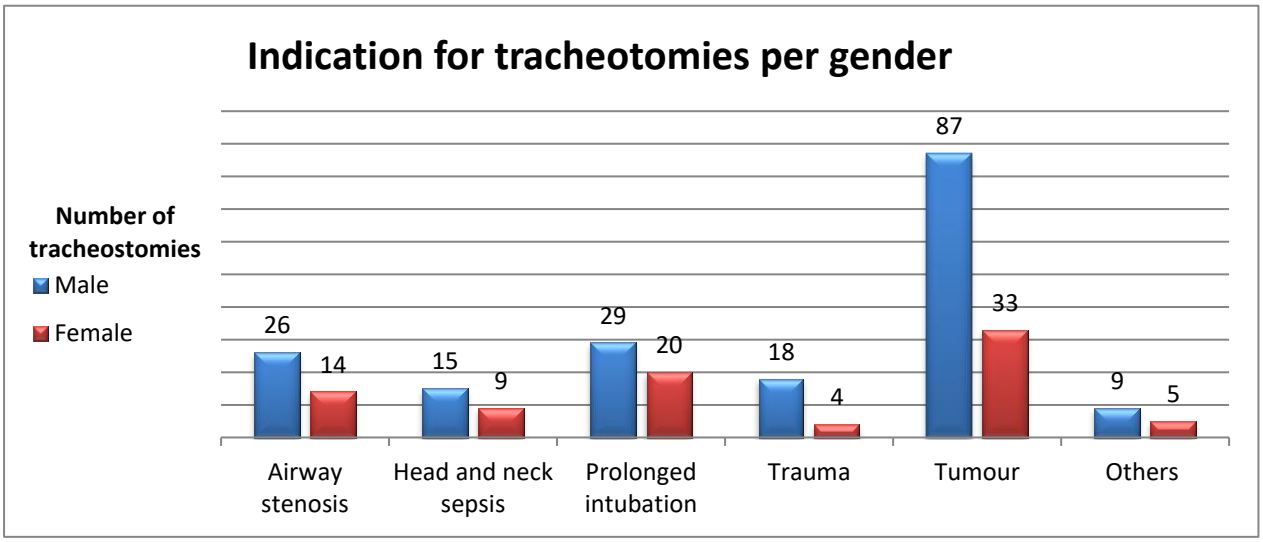

Figure 2 Indications for tracheotomies per gender

4.4 Indications for tracheotomies

4.4.1 Upper airway obstruction and prolonged intubation

Upper airway obstruction was the most common indication for tracheotomies (n = 220; 82%), and prolonged intubation (n = 49; 18%) had a much lower occurrence. The mean age for tracheotomy in upper airway obstructions was 44 years with a standard deviation of 22 years, where prolonged intubation showed a mean age of 52 years with a standard deviation of 22 years. The student's t-test showed the higher mean age in prolonged intubation to be statistically significant (p = 0.0056).

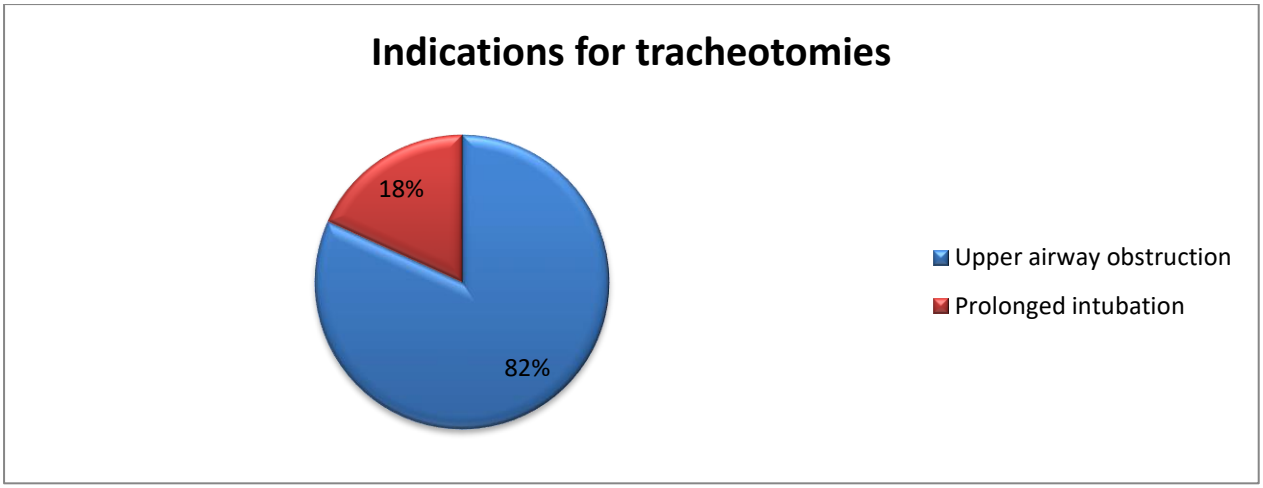

Figure 3 Indications for tracheotomies

Patients with upper airway obstruction requiring a tracheotomy were mostly in the age group > 50 years (n = 106; 48%). Prolonged intubation as an indication for a tracheotomy affected a slightly younger population; the majority fell into the 35-49 years group (n = 18; 37%), but this was closely followed by the over 50 years age group (n = 11; 22%). The Pearson's chi-square test showed that there was an overall statistically significant relationship between the different age groups and the indication for tracheotomies (p = 0.0038). Bonferroni post hoc analysis showed the significance to lie in the prolonged intubation age groups, < 1 year, 1-15 years, 35-49 years and > 50 years, as well as the patients > 50 years with airway obstruction.

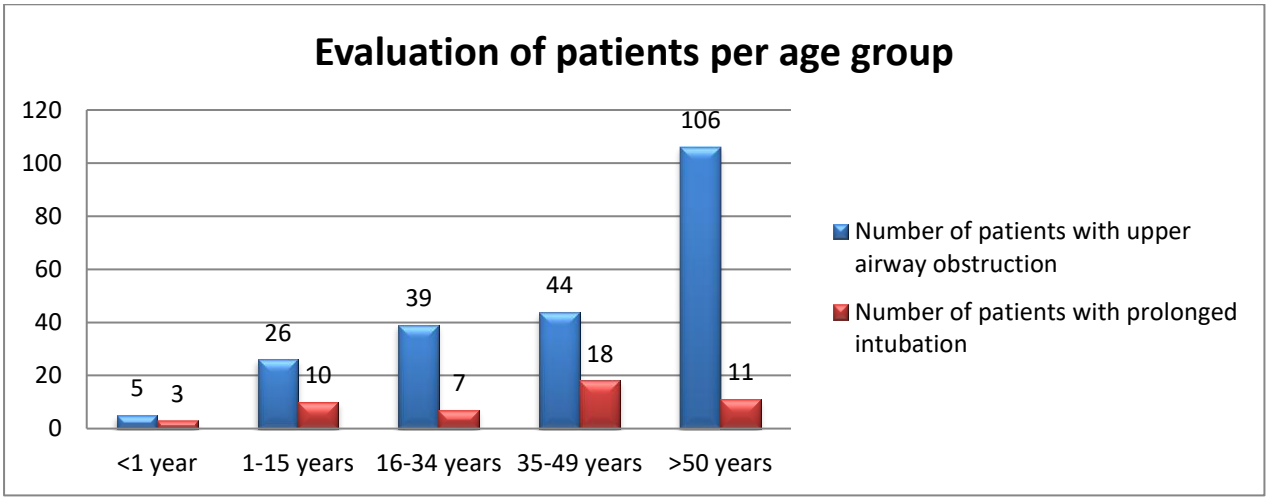

Figure 4 Evaluation of patients per age group

4.4.2 Evaluation of upper airway obstruction

Further evaluation of the patients requiring a tracheostomy for upper airway obstruction showed head and neck tumours to be the most common diagnosis (n = 120; 45%). This was followed by airway stenosis (n = 40; 18%) and head and neck trauma (n = 22; 10%).

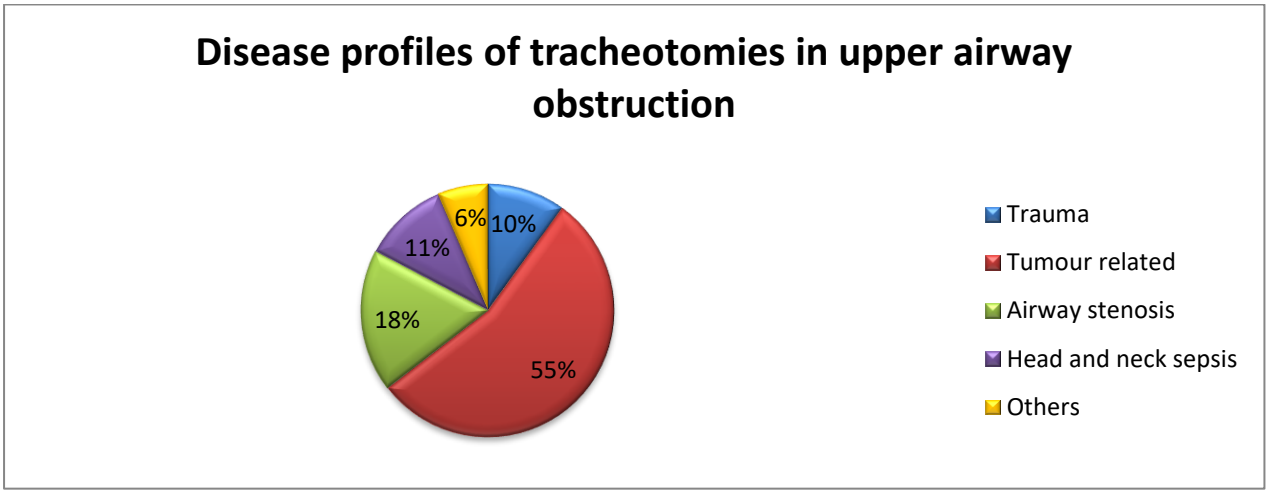

Figure 5 Disease profiles of tracheotomies in upper airway obstruction

4.4.3 Evaluation of patients younger than 15 years of age

Forty-four children below the age of 15 required a tracheotomy, making up a total of 16% of all the tracheotomies evaluated. Seventy percent (n = 31) of the children required a tracheotomy for upper airway obstruction, and 30% (n = 13) of the children required a tracheotomy for prolonged intubation.

The most common diagnosis requiring a tracheotomy was airway stenosis (n = 19; 43%), and the mean age for airway stenosis in the < 15 years age group was 5 years and 2 months. Recurrent laryngeal papillomatosis was the second most common diagnosis, and the tracheotomy was done at a mean age of 4 years and 7 months. Only one 13-year-old presented with head and neck sepsis requiring a tracheotomy, and two children with a mean age of 1 month presented with bilateral vocal cord palsy.

A tracheotomy was done for 30% (n = 13) of the patients with a mean age of 2 years 10 months for prolonged intubation, and these patients had multiple other co-morbidities. There were two patients that required tracheotomies as a result of a head and neck tumour that were younger than 5 years of age.

Children <16 years	Number of patients	Mean age
Upper airway obstruction	31 (70%)	4 years and 11 months
Prolonged intubation	13 (29%)	2 years and 10 months
Sub analysis of airway obstruction	**Number of patients**	**Mean age**
Airway stenosis	19 (43%)	5 years and 2 months
Neck sepsis	1 (2%)	13 years
Bilateral vocal cord palsy	2 (5%)	1 month
Recurrent laryngeal papilloma	7 (16%)	4 years and 7 months
Tumour	2 (5%)	4 years and 6 months

Table 3 Evaluation of diagnosis in children younger than 15 years of age requiring a tracheotomy

4.5 Age distribution as per diagnosis

4.5.1 Age distribution for airway stenosis

Airway stenosis as a cause for tracheotomies has a mean age of 19 years with a standard deviation of 22 years. The most common age group that required a tracheotomy for upper airway stenosis was the 1-15 years age group (n = 16; 40%), and this was closely followed by the 16-35 years age group (n = 15; 37%). Patients older than 50 years were the least likely to present with upper airway stenosis.

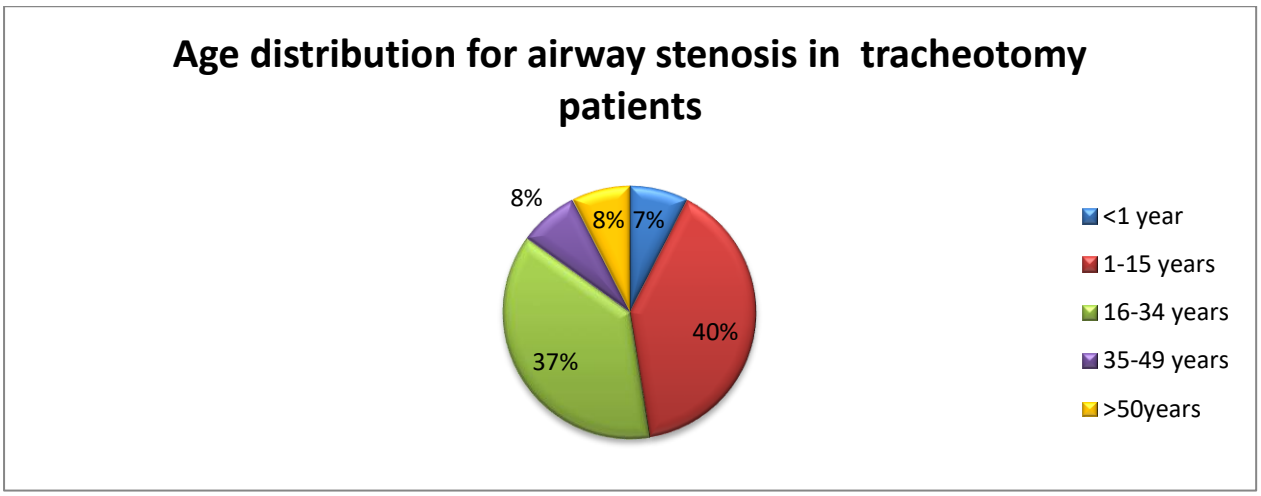

Figure 6 Age distribution for airway stenosis in tracheotomy patients

4.5.2 Age distribution for head and neck sepsis

Tracheotomies for head and neck sepsis were mostly indicated in the adult population. Patients older than 50 years (n = 8; 33%) made up the largest proportion, and this was closely followed by the 16-34 year age group (n = 8; 34%). No patients below one year of age presented with head and neck sepsis requiring a tracheotomy.

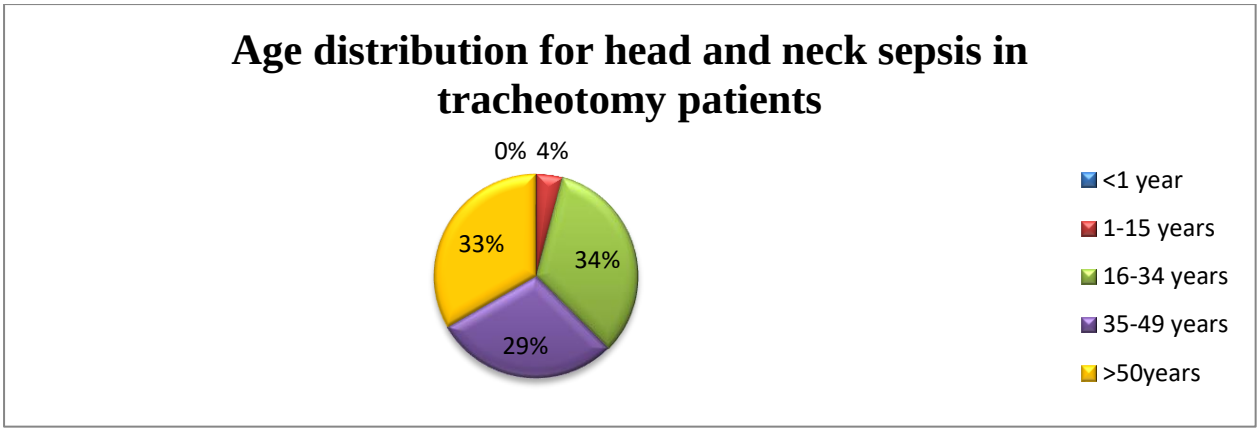

Figure 7 Age distribution for head and neck sepsis in tracheotomy patients

4.5.3 Age distribution for prolonged intubation

Prolonged intubation was the second most common indication for tracheotomies (n = 49; 18%). Eighteen patients (37%) in the age group between 35-49 years required tracheotomies, and 11 patients older than 50 years (23%) required tracheotomies for prolonged intubation.

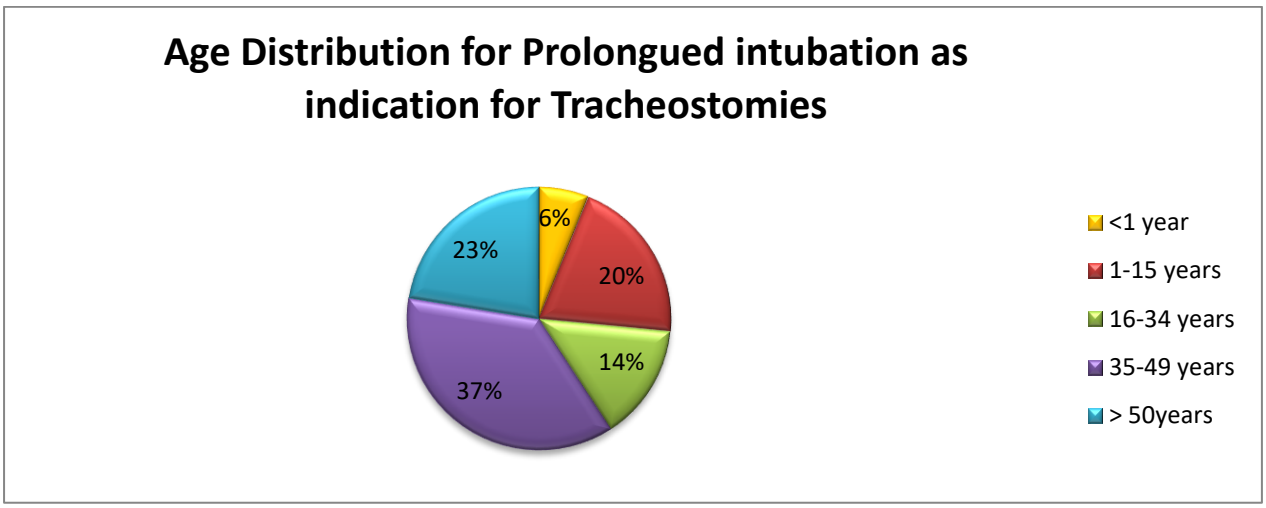

Figure 8 Age distribution for prolonged intubation in tracheotomy patients

4.5.4 Age distribution for trauma

Tracheotomies for trauma to the head and neck were mostly required in the 16-34 year age group (n = 11; 50%). This was followed by six patients (27%) in the 35-49 year age group. There were no trauma cases requiring tracheotomies in the age group < 16 years.

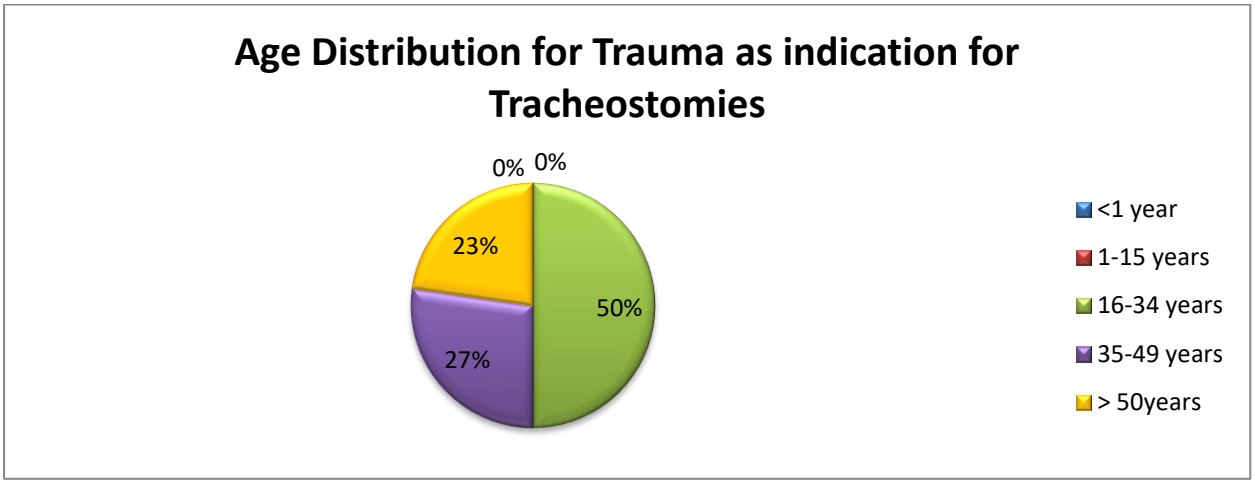

Figure 9 Age distribution for trauma in tracheotomy patients

4.5.5 Age distribution for tumours

The most common indications for tracheotomies were found to be head and neck tumours (n = 120; 45%). A total of 88 patients (73%) in the age group over 50 years required tracheotomies. No tracheotomies as a result of tumours were done in children under the age of 1 year and only two tracheotomies in children between 1-15 years.

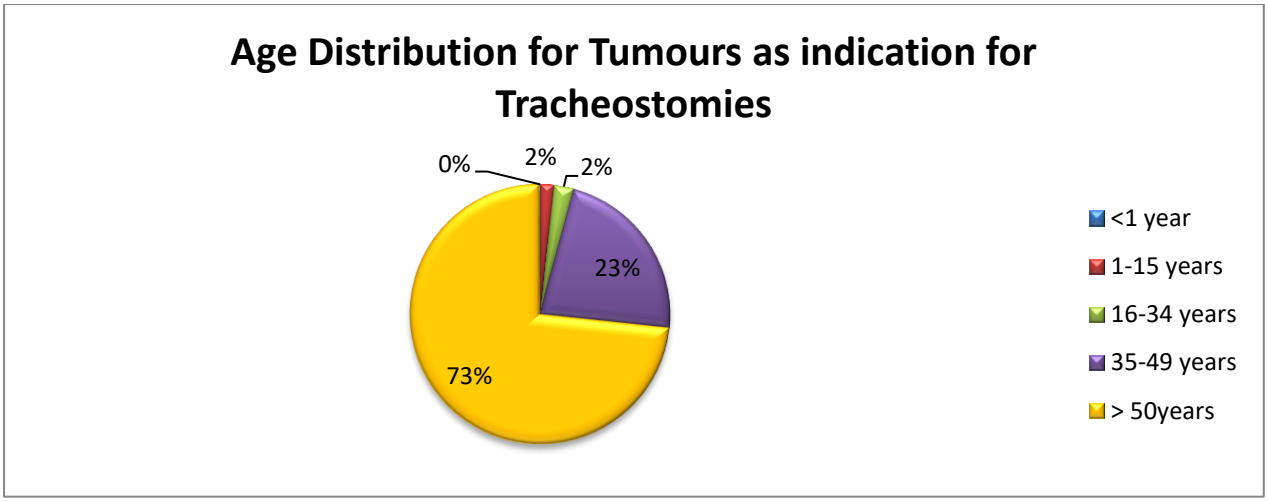

Figure 10 Age distribution for tumours as indication for tracheotomies

4.5.6 Analysis of patients classified as others

Fourteen patients received tracheotomies that could not be classified into any of the other diagnostic categories. Seven patients that required a tracheotomy for recurrent laryngeal papillomatosis were between the ages of 1-15 years. Two children younger than 1 year of age and two adults aged 41 and 70 years respectively received tracheotomies for bilateral vocal cord palsy. Tracheotomies were performed in three adults that presented with acute upper airway obstruction due to supraglottitis.

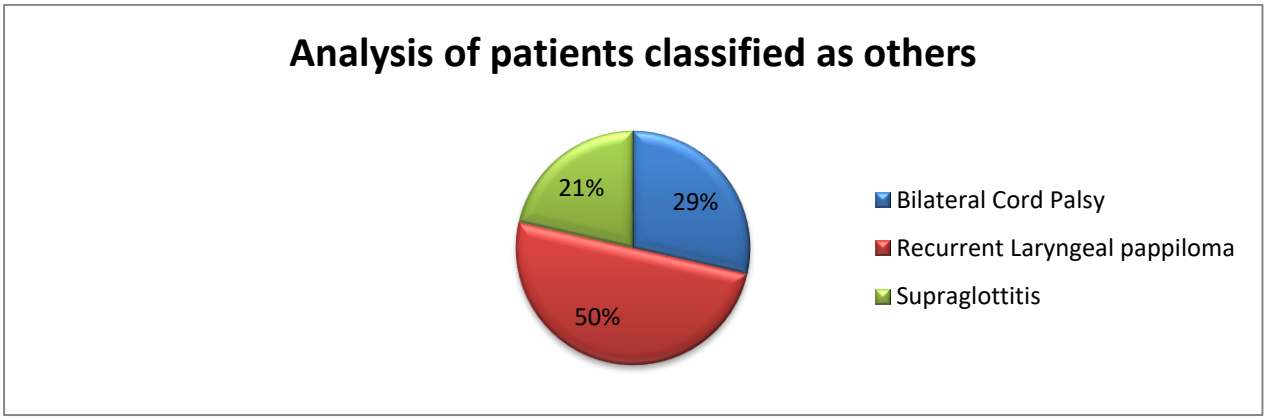

Figure 11 Analysis of patients classified as others

Chapter 5 – Discussion

Tracheotomy is a very important procedure in both emergency airway obstruction and prolonged intubation. The tracheotomy rate in developing countries may be higher as patients may only present with advanced disease in an acute and critical condition with imminent airway compromise, requiring a tracheotomy.(1) The two main objectives of the study were to evaluate the indications and demographics of tracheotomies performed and compare them to the available literature.

5.1 Limitations

Due to the retrospective nature of the study, data had to be obtained from historic theatre and patient records. The data that could consistently be obtained from the records were limited, thus restricting the variables that could be analyzed.

Tracheotomies were also performed by other surgical departments and were not recorded with the ENT theatre cases (the main source of data). Chris Hani Baragwanath Academic Hospital is a high-volume trauma centre, and many of the tracheotomies for trauma patients were done by trauma surgeons which were not reflected in the audit. The non surgical disciplines like the Physicians and Pediatricians referred their patients for tracheotomies to the ENT department.

Percutaneous tracheotomies performed in the ICU were not recorded anywhere. Although most of the tracheotomies from ICU were performed in theatre by the ENT department, there might be an underestimation of the tracheotomies performed for prolonged intubation.

Chris Hani Baragwanath Academic Hospital is a tertiary referral centre, and some of the patients were referred to the ENT department with a tracheotomy already done. Therefore, these patients were excluded from the study population.

5.2 Demographic data

5.2.1 Age

A wide age range (2 weeks to 85 years) of patients requiring tracheotomies presented to the ENT department at Chris Hani Baragwanath Academic hospital. The data showed a mean age of 41 years. This is approximately 6 years older than reported in the Nigerian study (mean age 35 years). The Nigerian study also found that children younger than 10 years of age constituted the majority of the patients with tracheotomies (34.6%).(16) This is in contrast with our findings where children < 15 years of age only comprised 16.4% (n = 44) of our study population.

A study from Tanzania reported a lower mean age of 36 years and found the majority of their tracheotomy patients to be in the third decade of life (36.7%).(14) This is in contrast to our data which reflected the overwhelming majority of patients requiring a tracheotomy to be > 50 years of age (n = 117; 44%). A possibility for the age difference might be that the Tanzanian study reported the most common indication for tracheotomy to be trauma (55.1%), and our data does not reflect all the trauma cases. Trauma is most likely to affect adults in the second to fourth decade of life.

5.2.2 Gender

The study found males to make up the largest percentage of the patients 68% (n = 184) whereas females were only 32% (n = 85), and the male to female ratio was 2.2:1. This was in keeping with other studies that also found males to make up the majority of the patients, although their male to female ratio was higher.(14,19) Indications for tracheotomies were the same in both males and females. The most common indication being upper airway obstruction due to tumours (females = 39% and males = 47 %), followed by prolonged intubation (females = 24% and males = 16%).

5.3 Indications for tracheotomies

5.3.1 Indications in children

In the paediatric group (< 15 years of age in our data) the findings were in keeping with most Western studies. The most common indication for tracheotomies was upper airway obstruction accounting for 70% (n = 31) of the paediatric group. The remaining 30% (n = 13) of the tracheotomies were needed for prolonged intubation. Studies from the University Children's Hospital in Zurich reported 66% of the patients requiring tracheotomies for upper airway obstruction and 34% for prolonged intubation.(7) Similarly, the Starship Children's Hospital reported 70% of the tracheotomies for upper airway obstruction and 30% for prolonged intubation.(13)

Looking at the disease profile for tracheotomies in children, they completely differ from those for adults. In adults, tumours of the head and neck area were by far the most common diagnosis that resulted in a tracheotomy being performed (n = 118; 52%). This differed in children where the most common diagnosis was found to be airway stenosis (n = 13; 43%).

Interestingly, another third-world country reported 82.24% (n = 125) of the patients younger than 16 years of age required a tracheotomy for a foreign body in the airway.(1) None of our patients audited in the four year period received a tracheotomy for a foreign body.

There is no consensus in the studies reviewed regarding the most common indication for tracheotomies in children presenting with upper airway obstruction. Parrilla et al. reported their two most common indications to be neuromuscular problems (n = 17; 44.7%) and congenital malformations (n = 8; 21.1%).(20) De Trey et al. found that craniofacial malformations (n = 24; 20.2%) and airway tumours were the most common indications in their study.(7) Only one study from France concurred with our findings. In it, they reviewed

57 cases and found airway stenosis to be the most frequent diagnosis in children requiring tracheotomies for airway obstruction.(10)

Very few of the first-world countries reported recurrent laryngeal papillomatosis to be an indication for a tracheotomy.(4,5,7,8,21) Data from this audit revealed seven children (16%) requiring a tracheotomy for recurrent laryngeal papillomatosis at Chris Hani Baragwanath Academic Hospital. Other studies from African countries also reported recurrent laryngeal papillomatosis to be an indication for tracheotomy.(1,14,22)

5.3.2 Indications in adults

Data from this audit concurs with the Nigerian and Tanzanian studies that upper airway obstruction is the main indication for tracheotomies in the adult population (older than 16 years). Upper airway obstruction comprised 63.5%, with laryngeal tumour as the most common diagnosis (32.7%) in the Nigerian study. Only five of their 52 tracheotomies (9.6%) were for prolonged intubation.(16) This study also found the most common diagnosis at Chris Hani Baragwanath Academic Hospital to be head and neck tumours (n = 120; 55%), but it comprised of a much higher percentage of the evaluated tracheotomies.

The Tanzanian study found the most common cause for upper airway obstruction to be trauma (55.1%), followed by head and neck tumours (39.3%). Furthermore, 24 of their 187 (12.83%) cases were for prolonged intubation.(14) At Chris Hani Baragwanath Academic Hospital trauma only accounted for 10% (n = 22) of the performed tracheotomies for upper airway obstruction, but this might be an under-representation due to most of the trauma tracheotomies not done by the ENT department.

The audit found a higher incidence of tracheotomies for prolonged intubation (n = 49; 18%) at the Chris Hani Baragwanath Academic Hospital. Although there is no agreement in the literature on the definition of prolonged intubation, the ICU staff would

generally consult the ENT department for a tracheotomy around day 10 of intubation in adults and a bit longer in the pediatric population. The higher incidence of tracheotomies seen at Chris Hani Baragwanath Academic Hospital might be as a result of more ICU facilities available compared to other centres in third-world countries. This finding is also reflected in the higher incidence of airway stenosis where intubation is one of the most common causes for airway stenosis.(23) There was no mention of airway stenosis in any of the other third-world studies. The study did not look at the specific causes of airway stenosis that required tracheotomies at the Chris Hani Baragwanath Academic Hospital, but some of the causes encountered during data collection were prolonged intubation, post debulking of airway papilloma, after radiation to the upper aerodigestive system for tumors and airway trauma.

Of note was the lower incidence of head and neck sepsis in other third-world countries where most of the reported cases classified as infections were from Tetanus.(14,16) This audit had no cases of Tetanus as an indication for a tracheostomy. One of the common causes of head and neck sepsis is dental in origin.(23) Our high incidence of head and neck sepsis requiring a tracheotomy may suggest a poorer primary health care, specifically dental care and awareness in the local community.

5.3.3 Relationship between cause and age

Head and neck tumours formed by far the majority of the cases requiring a tracheotomy (n = 120; 45%). As expected, the most common age group presenting with tumours were patients older than 50 years, which is in keeping with the age profile of head and neck tumours.(23) The high incidence of head and neck tumours that required a tracheotomy may be as a result of patients presenting late with advanced tumours. Reasons for this may be multifactorial, possibly due to poor primary healthcare and education.

Campaigns to inform patients and local clinics on the early signs of tumours may help to reduce this problem.

Airway stenosis as an indication for a tracheotomy had the lowest mean age of 19 years and a standard deviation of 22 years. Our data shows a relatively younger population requiring tracheotomies compared to the other indications looked at.

The mean age for trauma as a cause for tracheotomy is 37 years. The age group most commonly involved was found to be the 16-34 year group (n = 11, 50%). This might be an underestimation of cases as the trauma department do most of their tracheotomies, and ENT is only consulted with severe upper aerodigestive tract damage.

Patients with head and neck sepsis, requiring a tracheotomy, presented at a mean age of 40 years. There was an equal occurrence of head and neck sepsis among the age groups > 16 years. As mentioned before, one of the common causes for neck sepsis is dental in origin (23), highlighting the need for good primary healthcare.

Lastly, the mean age of patients requiring tracheotomies for prolonged intubation was found to be 34 years with a standard deviation of 19 years. The most common age groups affected was the 35-49 year group (n = 18; 37%). This might be due to the high volume trauma that we see at Chris Hani Baragwanath Academic Hospital that was not recorded as trauma cases in our study. An article on the WHO website looked at the high burden of injuries in South Africa, and they found most of the trauma to affect patients in their second, third or fourth decade.(24)

5.4 Summary

The data presented in this study show that in some areas Chris Hani Baragwanath Academic Hospital is on par with first-world countries, especially with respect to the indications in paediatric tracheotomies. The distribution of tracheotomies for airway obstruction and prolonged intubation were similar.

The audit also showed the higher incidence of head and neck tumours, and head and neck sepsis requiring tracheotomies were much higher than in other African countries. Perhaps more focus should be placed on the primary healthcare system, the education of the early signs of head and neck tumours and better dental care.

Lastly, the high percentage of airway stenosis compared to other African countries suggests a review of ICU protocols.

5.5 Suggested research and recommendations

Complications and the rate thereof were not reviewed, and this could possibly be investigated in a future study. The decannulation rate may be a good expansion of the current study.

A more in-depth disease profile of the prolonged intubation patients may give an interesting analysis, especially in children requiring tracheotomies. Special attention should be given to dysmorphisms and co-morbidities.

A closer look at the socio-economic status of the patients that presented with advanced tumours or head and neck sepsis could possibly provide insight into the late presentations.

Chapter 6 – References

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Appendix A

Date of surgery	Indications	Primary diagnosis	Age	Sex
	Upper airway obstruction			
		Head and neck tumours		
		Head and neck sepsis		
		Head and neck trauma		
		Airway stenosis		
		Others		
	Prolonged ventilation			

Appendix B

Ethics clearance certificate

R14/49 Dr Amelia Geyser

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M161035

NAME: (Principal Investigator)	Dr Amelia Geyser
DEPARTMENT:	Otorhinolaryngology Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	Cross Sectional Analysis at the Disease Profile of Patients Requiring Tracheotomies by the Otorhinolaryngology Department at a Tertiary Care Centre
DATE CONSIDERED:	28/10/2016
DECISION:	Approved uncoditionally
CONDITIONS:	
SUPERVISOR:	Dr Yahya Atiya
APPROVED BY:	Professor P Cleaton-Jones,Chairperson, HREC (Medical)
DATE OF APPROVAL:	11/01/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in October and will therefore be due in the month of October each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

02/02/2017
Date

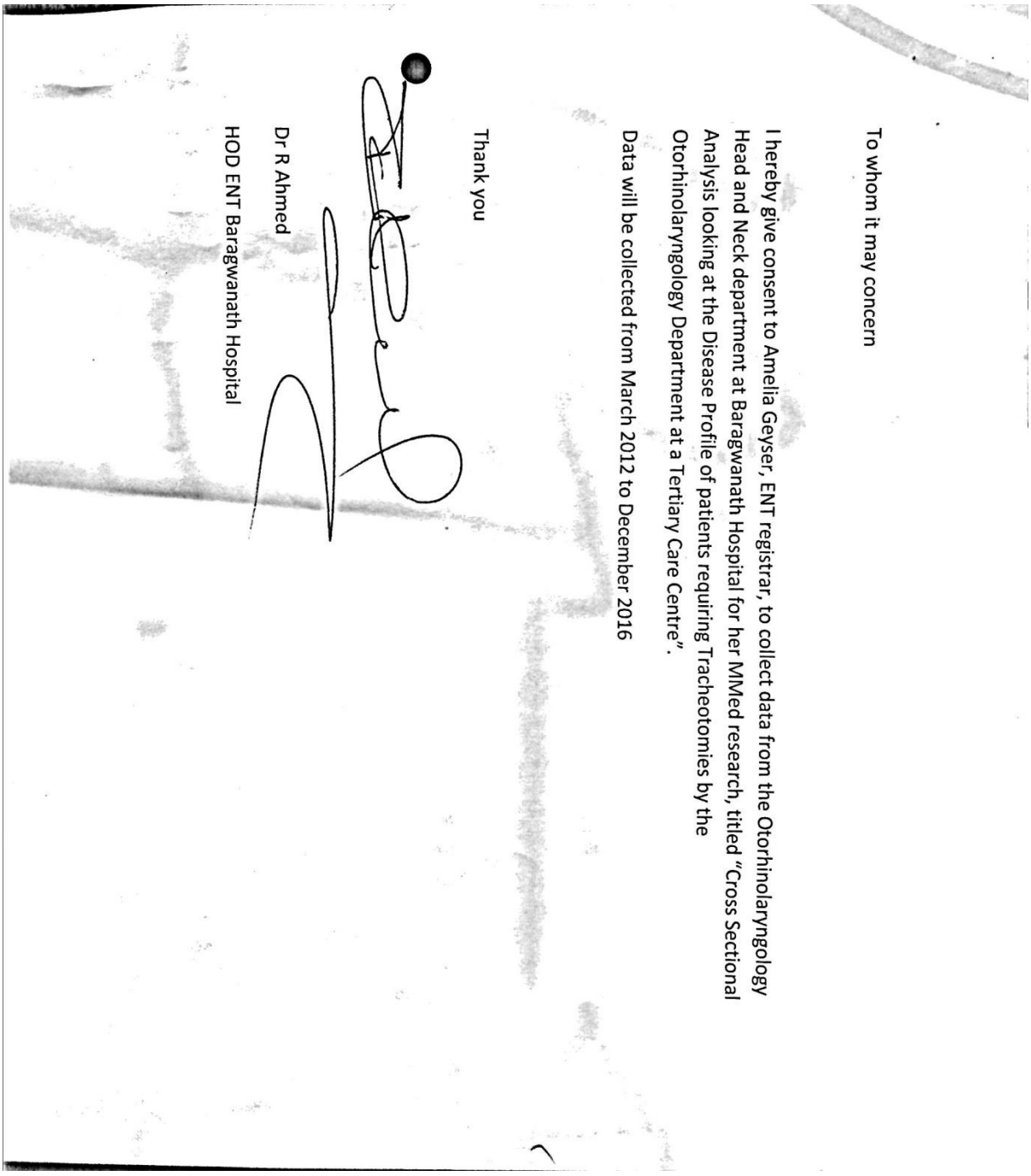
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix C

Letters of permission:

1. Head of Department – Chris Hani Baragwanath Academic Hospital

2. Office of the CEO – Charlotte Maxeke Johannesburg Academic Hospital



To whom it may concern

I hereby give consent to Amelia Geyser, ENT registrar, to collect data from the Otorhinolaryngology Head and Neck department at Baragwanath Hospital for her MMed research, titled "Cross Sectional Analysis looking at the Disease Profile of patients requiring Tracheotomies by the Otorhinolaryngology Department at a Tertiary Care Centre".

Data will be collected from March 2012 to December 2016

Thank you

Dr R Ahmed

HOD ENT Baragwanath Hospital

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 17 Oct 2016

TITLE OF PROJECT: Cross sectional analysis looking at disease profile of patients requiring tracheostomies by the Otorhinolaryngology department at a Tertiary Care Centre

UNIVERSITY: Witwatersrand

Principal Investigator: A Geyser

Department: ENT

Supervisor (If relevant): Y Atiya

Permission Head Department (where research conducted): Yes

Date of start of proposed study: October 2016
Date of completion of data collection: December 2017

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Human Research Ethics Committee of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 17 October 2016

.....
Approved/Not Approved
Hospital Management
Date: 18/10/16

Appendix D

Turnitin report

1234224:Dr_A_Geyser_MMed_(2).docx

by Amelia Geyser

Submission date: 20-Nov-2017 09:57AM (UTC+0200)
Submission ID: 882889036
File name: s_cce2d57e-8192-44ea-a0f2-0ef9ad9173a9_Dr_A_Geyser_MMed__2.docx (2.45M)
Word count: 7823
Character count: 49998

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