

TITLE

**"DETERMINANTS OF EARLY
COMPLICATIONS OF
ADENOTONSILLECTOMY"**

UNIVERSITY OF NAIROBI
MEDICAL LIBRARY

A PROSPECTIVE STUDY

USE IN THE LIBRARY ONLY

**A THESIS SUBMITTED IN PART FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF MEDICINE IN EAR, NOSE AND
THROAT - HEAD AND NECK SURGERY, UNIVERSITY OF NAIROBI 2007.**

BY

DR. HENRY NGOITSI NONO, MBCHB (NRB)

SUPERVISOR

**H. O. OBURRA,
M MED (GENERAL SURGERY) (NBI), FRCSE (OTO) (EDIN),
ASSOCIATE PROFESSOR: ENT H&N SECTION,
CHAIRMAN, DEPARTMENT OF SURGERY,
UNIVERSITY OF NAIROBI, KENYA.**


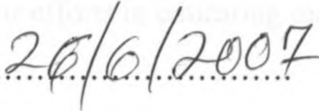
University of NAIROBI Library



0512612 3

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Signed:.......... Date..........

Dr Ngoitsi Henry Nono
(Candidate)

This thesis was supervised and has been submitted for examination with my approval.

Signed:.......... Date..........

H. O. Oburra,
FRCSE (Oto), (Edin)
Associate Professor: ENT H&N section,
Chairman, Department of surgery,
University of Nairobi, Kenya.

DEDICATION

This work is dedicated to my wife Frida and my daughters Jill and June for their patience and support throughout the study. I also dedicate this work to my parents Jotham and Tabitha Nono, and to my brothers and sisters for their efforts in educating me.

ACKNOWLEDGEMENTS

I would like to thank my supervisor Prof H. O. Oburra for his continued assistance and guidance during this study. I also greatly appreciate the contributions of my teachers Prof. I.M. Macharia and Dr P. Mugwe to make this work a success. I would also like to thank the entire ENT/HN fraternity of KNH for their assistance in various ways during this study. Special thanks go to Alice Lakati for her assistance with statistical services that went a long way in making this work a success.

ABBREVIATIONS

AH	ADENOID HYPERTROPHY
AS	ADENOID SURGERY (ADENOIDECTOMY)
ASTS	ADENOID SURGERY AND TONSILLAR SURGERY
ATH	ADENOTONSILLAR HYPERTROPHY
ENT/HN	EAR, NOSE, THROAT HEAD AND NECK
KNH	KENYATTA NATIONAL HOSPITAL
SHO	SENIOR HOUSE OFFICER
TH	TONSILLAR HYPERTROPHY
TS	TONSILLAR SURGERY (TONSILLECTOMY)
URTI	UPPER RESPIRATORY TRACT INFECTION
VPI	VELOPHARYNGEAL INSUFFICIENCY

TABLE OF CONTENTS

DECLARATION	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
ABBREVIATIONS	vi
TABLE OF CONTENTS	vii
LIST OF TABLES AND FIGURES	viii
ABSTRACT	ix
INTRODUCTION	1
HISTORICAL PERSPECTIVE	2
BACKGROUND	5
1.1 RELEVANT ANATOMY	5
1.2 FUNCTION OF THE ADENOIDS AND THE PALATINE TONSILS	7
1.3 ADENOTONSILLECTOMY	8
1.4 COMPLICATIONS OF ADENOTONSILLECTOMY	12
1.5 FACTORS ASSOCIATED WITH COMPLICATIONS POST ADENOTONSILLECTOMY	16
LITERATURE REVIEW SPECIFIC TO THE STUDY	19
STUDY JUSTIFICATION	24
BROAD OBJECTIVE	24
SPECIFIC OBJECTIVES	24
METHODOLOGY	25
SAMPLE SIZE DETERMINATION	26
PROCEDURE.....	27
QUALITY CONTROL	32
ETHICAL ISSUES	33
RESULTS	34
DISCUSSION	48
CONCLUSIONS	54
RECOMMENDATIONS	56
REFERENCES	57
APPENDIX I	63
GENERAL PATIENT INFORMATION AND CONSENT FORM.....	63
APPENDIX II	68
QUESTIONNAIRE	68
APPENDIX III	76
SEVERITY OF MALNUTRITION	76
APPENDIX IV	80
SURGICAL TECHNIQUE	80
APPENDIX V	85
APPROVAL LETTER	85

LIST OF TABLES AND FIGURES

TABLES

Table 1: Nutritional status	37
Table 2: Duration of clinical features	38
Table 3: Cormobidity	38
Table 4: Average waiting time before surgery	39
Table 5: Indications for surgery	39
Table 6: Category of surgeon	40
Table 7: Category of anaesthetist	40
Table 8: Time of surgery	41
Table 9: Duration of surgery.....	41
Table 10: Overall complications.....	42
Table 11: Specific complications.....	43
Table 12: Intraoperative complications	44
Table 13: Immediate post operative complications	44
Table 14: Immediate post operative complications timing.....	45
Table 15: Delayed complications	45
Table 16: Delayed complications timing	46
Table 17: Factors significantly associated with Odynophagia:	46

FIGURES

Figure 1: Sex distribution	34
Figure 2: Clustered age distribution	35
Figure 3: Departments the patients presented to:	35
Figure 4: Admission wards	36
Figure 5: Clinical features at presentation	37
Figure 6: Duration of surgery	42
Figure 7: Specific complications	43

ABSTRACT

Background: Adenotonsillectomy (ASTS) is the commonest surgical procedure undertaken in children by otolaryngologists the world over. This operation is associated with various complications the commonest of which include haemorrhage, infection, vomiting and odynophagia. I carried out a prospective study aimed at determining the rate, timing and factors associated with early complications after ASTS at Kenyatta National hospital (KNH), Nairobi, Kenya.

Methodology: The patients' demographic data, socio-economic status, history of disease, physical examination findings, experience of the surgeon and anaesthetist doing the operation were entered into a proforma. All the patients were operated using the same surgical technique. Complications arising intraoperatively and two weeks post operatively were recorded. The data obtained was analyzed and conclusions and recommendations drawn from the results.

Results: The study was carried out between November 2006 and May 2007 and involved 148 patients (96 males and 56 females). Their age range was 1 to 17.5 years with a mean age of 4.73 years (56.76 months). The complications encountered in the early post operative period included haemorrhage, odynophagia, dehydration and fever. The overall complication rate was 33.8% (50 patients). Post tonsillectomy haemorrhage (PTH) occurred in only one patient (0.7%). Most complications in the immediate post operative period occurred in the first eight hours post operatively. Odynophagia was found to be significantly associated with gender and age. Odynopahgia was also significantly associated with weight loss within the first two weeks post operatively.

Conclusions: Adenotonsillectomy is a common operation in the under 6 years at KNH. Most complications in the immediate postoperative period occur in the first 8 hours post operatively. The rate of serious complications post adenotonsillectomy is low and thus ASTS can safely be done as day cases at KNH with at least an 8 hour post operative observation period. Female gender and age less than 6 years are important risk factors in the development of prolonged odynophagia post ASTS.

INTRODUCTION

Adenoidectomy (AS), tonsillectomy (TS) and adenotonsillectomy (ASTS) are among the commonest major surgical procedures undertaken in children the world over. The number of these operations have however been declining with time over the past 50-60years (1, 3). These numbers reached their peak in the USA in 1940s and 50s and thereafter started declining. For instance, in 1959 1.4 million tonsillectomies were done in USA but this decreased to half a million in 1979 and fell further to 340 000 in 1985 (2, 48). The number of adenoidectomies has also been decreasing with time. One of the main reasons for this is the constantly changing indications for these operations. The operations are no longer done for indications for which they used to be done before such as rheumatic heart disease (RHD), chronic cough, and chronic suppurative otitis media (CSOM) among others. The indications for these operations have been reducing in number with time all over the world and up to now there is still some controversy over some of the current indications. These includes chronic and acute recurrent tonsillitis (CRT), peritonsillar abscesses and sleep apnoea for tonsillectomy and nasal obstruction, otitis media with effusion (OME), recurrent acute otitis media and sleep apnoea for adenoidectomy (1). The number of these operations has probably been increasing with time in Kenya due to an increase in the number of otolaryngologists although no study has been done to determine the trend of events in our set up.

Adenotonsillar surgery is associated with various complications. The commonest complications encountered include haemorrhage, infection, vomiting, odynophagia, dehydration, postoperative airway obstruction, local trauma to surrounding tissues, psychological trauma, night terrors, depression and even death. Haemorrhage is the most serious complication documented in literature and the rate at which it occurs ranges from 0.28-4.4 %. The other complications mentioned above also occur but they are rare and less fatal than haemorrhage (1, 2, 3, 7).

Elsewhere most children undergo these procedures as day cases but care must be taken not to generalize this practice to all patients. It is important to identify the high risk groups in whom day care surgery is not appropriate. These includes children less than 3 years old, those with severe obstructive sleep apnoea, bleeding disorders, immunosuppression, recent or current infections, fever, malnutrition and co-pulmonale

among others. Those that fall in any of these groups should be admitted to hospital and managed as inpatients under close observation and prompt intervention if need be (9, 11, 12, 13, 15).

Studies done at KNH to clarify the various aspects of adenotonsillectomy have all been retrospective in nature and none has looked at the factors associated with complications of adenotonsillar surgery. It is on this basis that I intent to carry out this study. For the purposes of this study adenotonsillectomy is used to mean surgery performed to remove both the adenoids and the tonsils.

HISTORICAL PERSPECTIVE

In 1868, Wilhelm Meyer of Copenhagen, Denmark proposed that adenoid vegetations were responsible for nasal symptoms and hearing impairment. He proposed diagnosis of adenoid hypertrophy by posterior rhinoscopy and their removal using a ring knife. This is probably the period when the first adenoidectomy was done (56). Later on in 1885 Gottstein described the first adenoid curette and in 1000BC tonsillectomy was first described in India. Cornelius Celsius (30AD) also described the procedure of tonsillectomy. He 'tore' out the tonsils then achieved homeostasis by painting the raw surface with vinegar (25BC - 50AD). Opium and hyoscryamus were used reluctantly for pain relief during surgery because they were 'bad for the stomach' as they were associated with postoperative complications such as nausea and vomiting. Because part of the tonsil was left behind, it became hypertrophied and caused symptoms recurrence (41).

Paul Aegina in the year 625 and Physick in 1827 described a forceps for tonsil removal which formed the basis of the modern tonsil guillotine. He wrote that during the initial tonsil surgery, failure to tear out the indurate tonsils, they were to remove the tonsillar tumor with a hook or tenaculum and cut it out (4, 48).

S.J. Crowe in 1911-1917 developed a technique of tonsillectomy by sharp surgical dissection and use of a Crowe-Davis mouth gag for complete tonsil removal, haemostasis and good anaesthetic technique to prevent postoperative lung abscess which was a

common complication then. This is the technique in use to date. He described a low complication rate which compares to modern reports on complications of adenotonsillectomy. By 1917 lung abscess as a complication had reduced to almost nil (41, 48).

The location of the adenoids in a hidden and restricted area certainly had an impact on the historical timing of their discovery, which came much later after tonsillectomy was discovered.

The two operations of tonsillectomy and adenoidectomy have been routinely performed together since the early part of the 1900s when the tonsils and adenoids were considered reservoirs of infections. The surgeries were considered as treatment for many conditions such as anorexia, mental retardation, and enuresis or were performed simply to promote good health. These were explained by the observation that children had 'improved appetite' and gained weight after these surgeries because of improvement in their breathing and their chronically sore throats. Hearing loss and the associated poor speech development due to recurrent and persistent middle ear effusion and infections may cause some children be branded as mentally retarded. Enlarged tonsils and adenoids also block normal breathing pathways which interfere with normal brain and brain stem control of urinary function and may result in enuresis in some children (48).

In 1930s and 40s tonsillectomy and adenoidectomy became controversial because of various reasons among which were:-

- a) Advent of antibiotics to treat tonsillitis and adenoiditis which had been some of the major indications for the surgery.
- b) Evidence that showed that there was a natural decline in the incidence of URTIs in older school aged children due to improvement in their natural immunity with age.
- c) Recognition of an increased risk of developing poliomyelitis following these surgeries. This was believed to be due to decreased immunity after removing the adenoids and tonsils which are part of the immune system (43).

This led to a significant decrease in the number of these operations. In 1960 mass removal of the adenoids and tonsils which had lasted for long without proper indications was questioned (2, 4, 48).

The operations of adenoidectomy and tonsillectomy have been associated with various complications since their inception. The most notable complication has been haemorrhage which if not adequately treated is associated with significant morbidity and mortality. The early surgeons actually performed tonsillotomy as opposed to tonsillectomy whereby they did not remove the whole tonsillar tissue. They feared cutting the tonsillar tissue from its base for fear of fatal hemorrhage. Phares advised them against removing enlarged and red tonsils for the same reason. Thus, then and even now hemorrhage was the most feared complication. In the event of its occurrence, hemorrhage was treated by gargles, direct pressure or by application of caustic agents such as sulphuric acid. Fuller in 1888 described ligature of blood vessels and blood transfusion for management of hemorrhage. (16) Warren & Morton in 1946 introduced anesthesia though the exact time this was applied to AS & TS is unclear. By 1965 cardiopulmonary complications for chronic upper airway obstruction (UAO) became recognized from ATH and treatment of cor-pulmonale by AS & TS was described (17, 41, 43, 53).

This led to a significant decrease in the number of these operations. In 1960 mass removal of the adenoids and tonsils which had lasted for long without proper indications was questioned (2, 4, 48).

The operations of adenoidectomy and tonsillectomy have been associated with various complications since their inception. The most notable complication has been haemorrhage which if not adequately treated is associated with significant morbidity and mortality. The early surgeons actually performed tonsillotomy as opposed to tonsillectomy whereby they did not remove the whole tonsillar tissue. They feared cutting the tonsillar tissue from its base for fear of fatal hemorrhage. Phares advised them against removing enlarged and red tonsils for the same reason. Thus, then and even now hemorrhage was the most feared complication. In the event of its occurrence, hemorrhage was treated by gargles, direct pressure or by application of caustic agents such as sulphuric acid. Fuller in 1888 described ligation of blood vessels and blood transfusion for management of hemorrhage. (16) Warren & Morton in 1946 introduced anesthesia though the exact time this was applied to AS & TS is unclear. By 1965 cardiopulmonary complications for chronic upper airway obstruction (UAO) became recognized from ATH and treatment of cor-pulmonale by AS & TS was described (17, 41, 43, 53).

BACKGROUND

1.1 RELEVANT ANATOMY

The pharyngeal tonsils are also referred to as the adenoids and the palatine tonsils as the 'tonsils'. These are aggregations of lymphoid tissue that form part of the larger Waldeyer's lymphatic ring around the oropharyngeal isthmus and the nasopharynx. The most important aggregations are the right and left palatine tonsils which are usually referred to simply as the tonsils. To complete the ring, posterosuperiorly there are the adenoids (pharyngeal tonsils), superolaterally the tubal tonsils and inferiorly there are the lingual tonsils at the base of the tongue (10).

ADENOIDS

Adenoids are located on the posterior wall of the nasopharynx in a depression called the bursae pharyngea. They lie posterior to the nasal cavity overlying the base of the skull and the clivus region. They overlie mucosa that in turn overlies the superior constrictor muscle of the pharynx. They form the superior component of the larger Waldeyer's lymphatic ring. They unlike tonsils have no crypts. The adenoids can be large enough as to obstruct the choanae and the percentage of this obstruction can be used to size them.

Superiorly and posteriorly the adenoids are anatomically related to the superior constrictor muscle of the pharynx. On the lateral aspect there is the torus tubarius and the medial orifice of the Eustachian tube which can be injured during adenoidectomy. Anteriorly there is the posterior choanae of the nose while the soft palate is situated on the anterior inferior aspect of the adenoid tissue. The soft palate regulates the amount of air flow into the nasal cavity and the nasopharynx from the oral cavity and the oropharynx by opening and closing the posterior and lateral nasopharyngeal walls. This sphincter of muscles is called the velopharynx. Incompetence of this sphincteric mechanism leads to hypernasal speech (rhinolalia aperta) whilst its stenosis or blockage causes hyponasal speech (rhinolalia clausa). Typically rhinolalia clausa occurs when the adenoids are hypertrophied and restricting nasal airway while rhinolalia aperta frequently occurs in the

immediate postoperative period when pain from surgery causes spasm of the relevant muscles and hence failure of sphincteric activity during speech.

The arterial blood supply to the adenoids is by branches from the ascending pharyngeal artery, the sphenopalatine artery, the descending palatine artery, the artery of the pterygoid canal and branches from the tonsillar branch of the facial artery. The venous drainage goes to the pharyngeal plexus which communicates with the pterygoid plexus then finally drains into internal jugular and facial veins. Occasionally an aberrant artery may occur in the adenoid bed causing excessive bleeding uncontrollable by conventional packing.

The nerve supply is by the maxillary nerve (V) and the pharyngeal plexus of nerves which is formed by branches from glossopharyngeal and vagus nerves. Pain following adenoidectomy is mainly through the vagus nerve (10).

TONSILS

The 'tonsil' usually refers to the palatine tonsils located laterally in the oropharynx. The right and the left tonsils can be seen through the open mouth. They occupy the tonsillar fossa (or sinus) between the palatoglossal and palatopharyngeal arches. When grossly enlarged, they frequently obliterate the oropharyngeal airway which is common to both the oral and nasal air passages. The floor of the tonsil is covered by fascia which is an extension of the pharyngobassillar fascia. This forms the tonsillar capsule which is loosely attached to the muscular wall of the pharynx consisting of the superior constrictor and the styloglossus muscles. The capsule is firmly attached to the side of the tongue anteroinferiorly in front of insertion of palatoglossus and palatopharyngeus muscles. This helps to keep the tonsil in place during swallowing. There is a loose pseudocapsule formed of loose areolar tissue enabling the tonsil to be easily enucleated during tonsillectomy. The pseudocapsular space is the area occupied by a peritonsillar abscess.

The tonsillar artery enters the tonsil by piercing the superior constrictor muscle behind this firm attachment just at the level of the superior pole of the tonsil. The palatine (paratonsillar) vein descends from the palate in the loose areolar tissue on the lateral surface of the capsule, crosses the tonsil and then pierces the pharyngeal wall. This is

frequently divided during tonsillectomy and has to be recognized, coagulated or ligated. It is a common cause of post-tonsillectomy haemorrhage (PTH) and if unrecognized, can result into fatal haemorrhage.

The lateral relation which forms the floor or tonsillar bed is formed by the superior constrictor muscle. Superiorly there is the soft palate while inferiorly are the lingual tonsils at the base of the tongue. The anterior tonsillar pillar formed by the palatoglossus is the anterior relation and the palatopharyngeus (posterior tonsillar pillar) forms the posterior relation. Injury of these muscles by excessive coagulation or rough handling can lead to speech defects.

Of importance is to note that the glossopharyngeal nerve, lingual artery and the internal carotid artery are all located deep to the inferior pole of the tonsil. In a rare congenital anomaly where the carotids are ante placed, they not only course through the middle ear, but can also be located in the areolar tissue at the tonsillar bed. Failure to recognize this can be catastrophic.

The arterial blood supply is by tonsillar branches of ascending pharyngeal artery and the lesser palatine artery which enters the tonsil via the superior pole whilst branches of the facial artery, dorsal lingual artery and ascending palatine artery supply it via the inferior pole. All these arteries arise from the external carotid system. The venous drainage is by the pharyngeal plexus of veins, the plexus around the tonsillar capsule and the lingual vein. They all ultimately drain into the jugular system. The lymphatic drainage goes to the superior deep cervical nodes and the jugulodigastric nodes. The Sensory nerve supply is by the glossopharyngeal and the lesser palatine nerves (10, 43).

1.2 FUNCTION OF THE ADENOIDS AND THE PALATINE TONSILS

The tonsils and the adenoids are a large collection of immunologically active lymphoid tissue in the pharynx whose function is to protect the host against foreign microbes in the upper aerodigestive tract. They are part of the mucosal associated lymphoid tissue (MALT). Their role remains incompletely understood but are thought to be involved in processing of the antigenic material rushing passed them in the nose and the mouth and this assists in the maintenance of normal immune competence. Thus bacteria, viruses and

other particles entering the body through the upper aerodigestive tract are deposited on the tonsils and adenoids where the macrophages and dendritic cells ingest and analyse them at the same time releasing IL1. IL1 attract CD4 cells which in turn release IL2. IL2 is important in recruiting B cells to the proximity of CD4 cells. The CD4 cells pass the information gained from the dendritic cells to the B cells which in turn produce the relevant monoclonal antibodies. In doing this the lymphoid tissues may get inflamed (tonsillitis) as a symbol of local defence mechanism at work. They may also get hyperplastic and hypertrophic thus blocking the upper aerodigestive tract. This may warrant their surgical removal. In immunosuppressed individuals, tonsils and adenoids may be diffusely hypertrophied in concert with generalized lymphoid hyperplasia usually seen in this syndrome.

Some studies have shown that removal of the adenoids and the tonsils does lead to low immunoglobulin A (IgA) production and that children immunized with live oral polio vaccine (OPV) had a drop in their titers of antibodies 3-4 fold after AS or TS. This drop in antibodies is temporary as their levels go back to normal afterwards. The drop in antibodies is thought to be associated with the surgical trauma rather than the removal of the tonsils or adenoids. ASTS does not thus compromise the immune system of the patients as there are numerous other groups of lymphoid tissue left behind such as the lingual and tubal tonsils, the peyer's patches, the spleen and the lymph nodes (47,52,58).

1.3 ADENOTONSILLECTOMY

Adenoidectomy and tonsillectomy can be done individually. However in many circumstances these two operations are done concurrently in a procedure called adenotonsillectomy.

INDICATIONS OF ADENOTONSILLECTOMY

There are various indications for this procedure. These are:-

Obstruction. Currently, this is the most common indication for adenotonsillectomy.

Usually the combined hypertrophy of tonsils and adenoids compromise both nasal and

oral airway leading to sleep disturbance, restlessness and diurnal inattention. Left untreated the problem can proceed to cor pulmonale, gastric hyperacidity and even high blood pressure. Adenoid tissue hypertrophy can cause upper airway obstruction and this is associated with excessive snoring, chronic mouth breathing or sleep disturbances. AH may also lead to right ventricular hypertrophy and cor-pulmonale, dysphagia, failure to thrive, speech abnormalities, craniofacial growth abnormalities and dental malocclusion abnormalities (1, 54)

Infection. These include purulent adenoiditis and adenoid hypertrophy associated with chronic otitis media with effusion (OME), recurrent acute otitis media, chronic otitis media with perforation and otorrhea or chronic tube otorrhea.

Recurrent acute tonsillitis. This is one of the commonest indications for tonsillectomy. This can be defined as more than six attacks of acute tonsillitis per year or three episodes per year for 2 years. An acute attack of tonsillitis manifests as general malaise, pyrexia, headaches and sore throat (dysphagia) lasting for at least 5 days. The most prevalent bacteria to be isolated is group A beta haemolytic Streptococcus although Staphylococcus aureus, Pneumococcus, Hemophilus influenzae, Moraxella catarrhalis and anaerobes can be found. It is important to differentiate this attack from a viral URTI which is associated with coryza and is short lived. It is not abnormal for any child to have one or more attacks of acute tonsillitis but it is however very important though difficult to determine if an acute attack of tonsillitis will be followed by recurrent episodes of the same. If one is able to predict this then tonsillectomy is indicated to save the child the morbidity associated with this illness. There is no consensus regarding the number of infections per year that would be an absolute indication for tonsillectomy as various variables like severity of infection and its effect on the patient's school or work performance must be taken into consideration (1, 62). Recurrent acute tonsillitis may also be associated with other conditions such as recurrent febrile seizures or cardiac valvular disease which is associated with recurrent streptococcal tonsillitis. The tonsillar infection is considered a source of infection to the heart valves and may thus cause recurrent episodes of subacute bacterial endocarditis.

Chronic tonsillitis. This is when the symptoms of tonsillitis persist for more than 4 weeks. This results from recurrent acute or sub clinical infections due to inadequate antibiotic

treatment for acute tonsillitis. It may also arise in a streptococcal carrier not responding to beta-lactamase resistant antibiotics. This condition is associated with other problems such as halitosis, persistent sore throat, dysphagia and tender cervical adenitis and is regarded by many as an indication for tonsillectomy. Persistent sore throat may cause poor feeding and hence result into failure to thrive in these children (43, 54).

Peritonsillar abscess (Quinsy). This can arise near the superior pole of the tonsil or from infection in the tonsillar fossa due to adjacent acute tonsillitis. There are many controversies regarding proper diagnosis, management and indications for surgery which could be either urgent or elective. Very young patients are not able to tolerate drainage under local anaesthesia and may need a general anaesthetic. Opinion is divided between those who advocate for hot tonsillectomy at presentation and those who prefer treatment of the quinsy with antibiotics, incision and drainage and then plan for elective tonsillectomy. Some surgeons fear doing hot tonsillectomy due to its historical association with excessive haemorrhage and dissemination of infection. This is not the case in clinical practice especially if the surgeon has mastered the technique of hot tonsillectomy. The friable tonsil must not be grasped with a tonsil holding forceps but instead a cleavage plane is developed and the tonsil is peeled off the tonsillar bed with a blunt instrument such as a tonsil dissector or even a Yankaur's suction nozzle. Some workers advocate for tonsillectomy following a peritonsillar abscess only if it is recurrent and the likelihood of its recurrence is estimated to be 20%. It should also be noted that it is difficult to tell if a peritonsillar abscess will recur or not during the initial attack (1, 5, 54).

Other indications for ASTS include tonsillitis associated with abscessed cervical nodes and mononucleosis with severely obstructing tonsils that is unresponsive to medical therapy. AH associated with chronic sinusitis is also considered an indication for AS because the adenoid tissue is thought to be a source of infection to the sinuses (1, 44, 48).

Suspected neoplasia. This may manifest as asymmetrical (unilateral) tonsillar enlargement and is an important indication for tonsillectomy. Excision of the whole tonsil is done in cases of suspected neoplasia because incision biopsy of such tonsils may result

into fatal haemorrhage. If the tumor is small and confined to the tonsil then tonsillectomy becomes a therapeutic measure (54, 62). Suspected neoplasia of the adenoid tissue is also considered an indication for adenoidectomy (1, 48, 54).

CONTRAINDICATIONS

No absolute contraindication exists for ASTS but absolute contraindication to anaesthesia may also be regarded as absolute contraindication for ASTS. There are relative contraindications to this procedure and these can be subdivided into the following categories:-

Pre-existing velopharyngeal insufficiency. This is found in patients with true cleft palate, sub mucous cleft palate, congenitally short palate and those with pharyngeal muscle weakness associated with muscular or neurological disorders. These can be overcome by partial AS or muscular speech therapy after surgery (48, 54).

Haematological disorders. Anaemia and coagulation defects need proper workup and proper preoperative and postoperative management. Patients with haemoglobin levels less than 10g% need top-up of the haemoglobin before surgery. This may be done by use of hematinics or by blood transfusion. For those with coagulation disorders proper preparation with the help of a physician may be required before, during and after surgery depending on the condition (40, 48).

Active infection. Patients with active infection are not operated unless urgent removal is necessary. An interval of 3 weeks is recommended between infection and surgery to reduce the incidence of haemorrhage and dissemination of infection (1).

Atlantoaxial joint laxity. This condition is seen in 10% of children with Down's syndrome and is regarded as a relative contraindication to adenoid and tonsil surgery. Surgery may however be done with the neck in neutral position or following stabilization by neurosurgery to reduce the risk of injury (48, 53).

Untreated respiratory allergy. This is a relative contraindication as it may predispose one to postoperative complications such as haemorrhage and nasal obstruction (48, 54).

1.4 COMPLICATIONS OF ADENOTONSILLECTOMY

Complications following adenotonsillectomy have markedly reduced in number following restriction of these procedures to well trained Ear, nose, throat/head and neck (ENT/HN) surgeons. The complications from ASTS are now rare and can be divided into: -

1. Intraoperative complications. These occur during surgery.
2. Immediate postoperative complications. These can occur up to 24 hours postoperatively.
3. Delayed complications. These occurs between 24 hours to 2 weeks postoperatively and
4. Long term complications. These may occur many months or years after surgery and will not be included in this study (38).

Haemorrhage. This is the most common serious complication encountered after adenotonsillectomy with a reported incidence rate ranging from 0.5 to 11% though this may vary depending on the different surgical techniques used (47, 48). Choudhury et al (11, 17) found an incidence of 2.5% for post adenotonsillectomy hemorrhage. Attention to the surgical technique and good intra-operative haemostasis can lead to acceptable post-operative hemorrhage rates. Possible fatal post-operative hemorrhage may be determined either by history, physical examination or pre-operative screening for bleeding disorders in selected patients in order to avert this complication. Hemorrhage can be subdivided into intra-operative, primary (or immediate) hemorrhage which occurs in the first 24 hours and secondary (or delayed) hemorrhage which occurs between 24 hours and 10 days postoperatively. Secondary hemorrhage is the most common and accounts for most of the patients who present to the outpatient departments for treatment. Management is by packing, ligation and diathermy. Some patients may require blood transfusion if the blood loss is severe (21, 40, 48, 60).

Pain. This can be in form of odynophagia or otalgia. Otalgia results form referred pain from the pharynx due to the tympanic branch of glossopharyngeal nerve (3, 39).

Dehydration. This is another common complication of adenotonsillectomy and results from inadequate oral intake of fluids due to postoperative pain. Patients should thus be

encouraged to take enough fluids postoperatively in order to avoid dehydration. Dehydration can be classified into mild, moderate and severe (3, 38).

Weight loss. This may also occur if odynophagia persists for a long period of time and thus reducing oral intake of nutrients (43).

Fever (Infection). This may occur but is less frequent and is related to local infection of the raw surface after surgery. Fever is regarded as temperature of more than 37.2°C (3).

Retropharyngeal abscess. This is rare but can occur due to infection following adenoidectomy. Some of the lymphatics in the adenoid bed drain into the retropharyngeal lymph nodes hence the spread of infection via this route. If this is suspected then a lateral neck plain x-ray will aid in the diagnosis (1).

Airway obstruction. This may occur after ASTS especially in children under 3 years of age. This is usually due to oedema of the tongue, nasopharynx and palate. This may necessitate replacement of a nasal airway temporarily or use of intravenous corticosteroids to reduce oedema. Dislodged blood clots may also obstruct the larynx leading to death and therefore all clots should be evacuated from the pharynx before reversal from general anaesthesia (5, 49).

Pulmonary oedema. This may occur in patients with long-term upper airway obstruction due to ATH and hence have pulmonary hypertension. This may necessitate prolonged mechanical ventilation. These patients should be closely monitored postoperatively preferably with a pulse oximeter. Persistent hypercapnia may require planned postoperative mechanical ventilation until PCO₂ levels return to normal. Patients with airway obstruction before surgery are therefore better of managed as inpatients (50, 61).

Torticollis (Wry neck). This is rare and it occurs because adenoids are removed from the posterior wall of the nasopharynx over the spine and the superior constrictors, which may undergo spasm. Management by warm compresses, a neck brace and anti-inflammatory drugs has proved to be useful (38).

Mandibular condyle fracture. This is very rare but can occur if the condyle is subluxed during surgery. Physical examination and plain x-rays will help in making the diagnosis (38).

Eustachian tube injury. This may occur by direct trauma to the tissues on the lateral pharyngeal wall during adenoidectomy (48).

Cervical spine complications. These can occur and includes Grisel syndrome (atlantoaxial subluxation from infection), which is common in patients with Down's syndrome undergoing ASTS. Infection or inflammation in the nasopharynx following AS is rare but can lead to decalcification of the anterior arch of the atlas and laxity of the anterior transverse ligament between the atlas and axis. This may also result from spasm of the sternocleidomastoid or deep cervical muscles that may occur. Patients complain of stiffness of the neck and may hold their head to one side with slight rotation towards the opposite side. Cervical spine radiographs are useful in diagnosis of this condition. Treatment is by intravenous antibiotics and cervical spine traction with the help of a neurosurgeon (38).

Velopharyngeal insufficiency. This may occur as a result of incomplete approximation of the palate to the posterior and lateral nasopharyngeal walls where the hypertrophied adenoids occupied during swallowing and speech. It occurs in more than 50% of patients undergoing AS but usually resolve in most of them in 2-4 weeks. Persistence occurs in 1 in 2000 AS patients and is common in those with neuromuscular disorders; those with a congenitally short soft palate or in those with deformities of the palate such as true or sub mucous cleft palate. Partial AS is recommended in these high risk groups. This can best be done using the laser technique, which is not readily available in our set up. Most cases are transient and will resolve with time but severe cases will require treatment which includes speech therapy for up to one year then if no response, surgery can be done. Surgical intervention includes the use of pharyngeal flaps, sphincteroplasty or posterior pharyngeal wall augmentation. Habit palsy is transient postoperative VPI due to pain when the patient has altered pharyngeal muscle control during speech and swallowing. Failure to resolve shortly after surgery may necessitate speech therapy as well (1, 43, 38)

Nasopharyngeal stenosis. This is a circumferential contracture in the region of the Waldeyer's lymphatic ring. It is more common with ASTS than with AS or TS alone. It may arise from excessive cauterization with extensive mucosal destruction involving the nasopharynx, lateral nasopharyngeal wall and superior tonsillar pillar tissue. It may also occur if surgery is done during acute pharyngitis, purulent sinusitis or revision AS. It presents with nasal obstruction and hyponasal speech. It can be repaired by palatal or pharyngeal rotation flaps but these are prone to failure (1, 38).

Cervical spine complications. These can occur and includes Grisel syndrome (atlantoaxial subluxation from infection), which is common in patients with Down's syndrome undergoing ASTS. Infection or inflammation in the nasopharynx following AS is rare but can lead to decalcification of the anterior arch of the atlas and laxity of the anterior transverse ligament between the atlas and axis. This may also result from spasm of the sternocleidomastoid or deep cervical muscles that may occur. Patients complain of stiffness of the neck and may hold their head to one side with slight rotation towards the opposite side. Cervical spine radiographs are useful in diagnosis of this condition. Treatment is by intravenous antibiotics and cervical spine traction with the help of a neurosurgeon (38).

Velopharyngeal insufficiency. This may occur as a result of incomplete approximation of the palate to the posterior and lateral nasopharyngeal walls where the hypertrophied adenoids occupied during swallowing and speech. It occurs in more than 50% of patients undergoing AS but usually resolve in most of them in 2-4 weeks. Persistence occurs in 1 in 2000 AS patients and is common in those with neuromuscular disorders; those with a congenitally short soft palate or in those with deformities of the palate such as true or sub mucous cleft palate. Partial AS is recommended in these high risk groups. This can best be done using the laser technique, which is not readily available in our set up. Most cases are transient and will resolve with time but severe cases will require treatment which includes speech therapy for up to one year then if no response, surgery can be done. Surgical intervention includes the use of pharyngeal flaps, sphincteroplasty or posterior pharyngeal wall augmentation. Habit palsy is transient postoperative VPI due to pain when the patient has altered pharyngeal muscle control during speech and swallowing. Failure to resolve shortly after surgery may necessitate speech therapy as well (1, 43, 38)

Nasopharyngeal stenosis. This is a circumferential contracture in the region of the Waldeyer's lymphatic ring. It is more common with ASTS than with AS or TS alone. It may arise from excessive cauterization with extensive mucosal destruction involving the nasopharynx, lateral nasopharyngeal wall and superior tonsillar pillar tissue. It may also occur if surgery is done during acute pharyngitis, purulent sinusitis or revision AS. It presents with nasal obstruction and hyponasal speech. It can be repaired by palatal or pharyngeal rotation flaps but these are prone to failure (1, 38).

Death. This may occur following adenotonsillectomy but is rare. This can result from excessive hemorrhage due to injury to the carotid arteries which may be having an abnormal course. It could also be related to anaesthetic complications such as endotracheal tube kinking, accidental extubation or due to inhalation of blood which may lead to suffocation. Sudden relief of the hypoxic drive after ASTS in a child who had prolonged sleep apnoea preoperatively may also lead to apnoea postoperatively and death may ensue (33, 38, 48, 53).

Other complications. These are uncommon but include hypogeusia, dysgeusia, psychological trauma, night terrors or depression following ASTS (1, 43).

ANAESTHETIC COMPLICATIONS

This includes severe bradycardia following endotracheal tube kinking or occlusion at surgery and self extubation which may lead to cerebral ischemia and permanent brain damage. This problem is currently overcome by use of angled non-kinkable tubes which are firmly secured using straps. Some patients may also lose their teeth or sustain oropharyngeal trauma during intubation. Poor anaesthetic techniques may also lead to death (5, 43).

For the purposes of this study these complications will be classified into:-

A. Intraoperative complications. This includes hemorrhage, operative trauma, anaesthetic, dental, and musculoskeletal complications.

B. Immediate postoperative complications. This occurs in the first 24 hours post ASTS and includes pulmonary oedema, hypoventilation syndrome, infection (fever), nausea, vomiting, dehydration, odynophagia, otalgia, and primary hemorrhage.

C. Delayed complications. This occurs between 24 hours and the first two weeks post-operatively. These will include hemorrhage, infection of the pharynx or lungs, dehydration, weight loss and velopharyngeal insufficiency (7, 24, 31, 32, 38).

1.5 FACTORS ASSOCIATED WITH COMPLICATIONS POST ADENOTONSILLECTOMY

This includes:-

Age. This is one of the main factors associated with complications post adenotonsillectomy. Children less than 3 years of age are prone to developing respiratory complications especially when this operation is done to treat obstructive sleep apnoea syndrome. Postoperatively these patients are likely to get upper airway obstruction resulting from oedema of the uvula and the surrounding nasopharyngeal and oropharyngeal tissues. These children are also prone to developing pulmonary oedema due to preoperative pulmonary hypertension as explained above. It is thus advisable to have these population of children admitted to the hospital postoperatively for close monitoring. Adults aged 20 years and above have also been found in some studies to have an increased incidence of hemorrhage. This is probably due to the indication of TS in most of them being recurrent tonsillitis which is associated with fibrosis of the tonsillar tissues. There is also a higher incidence of elevated blood pressure in adult patients perioperatively than in children. This is as a result of anxiety in these patients before and after surgery (49, 61, 63, 65).

Gender (sex). Female gender has been associated with increased incidence of complications post adenotonsillectomy by some workers although no appropriate explanation for this is given and thus needs further research (65).

Nutritional status. Poor nutritional status is likely to predispose patients to complications due to the associated low immunity in malnourished children. These patients are prone to develop infection and hence delayed healing. Nutritional status can be assessed by taking weight at a given age or upper arm circumference of a child and comparing this to the standard WHO reference charts (Appendix III). Poor nutritional status could result due to the low socioeconomic status of the family which is directly related to the level of education, the occupation and thus the income of the sole bread winners in the family (5).

Experience of the surgeon and the anaesthetist. This may also have an impact on the complications encountered. These could be due to factors such as the duration of surgery, the methods used for hemostasis and the surgical techniques used among other factors (3,

65). Experience of the anaesthetist may also be associated with anaesthetic complications encountered during surgery.

Infection. The high frequency of inadequately treated URTIs and the depressed immune systems in patients in our set up could be responsible for complications occurring post ASTS. Many surgeons avoid performing adenotonsillectomy during the acute inflammatory illness due to the associated intra-operative bleeding and provocation of infection spread or bacteraemia (1, 5). However, one may still have to operate on an infected operation field in circumstances of severe obstructive tonsillar cellulitis not responding to antibiotics.

Co-morbid Medical Conditions. This may also be associated with a high incidence of complications post adenotonsillectomy. Immunosuppressive conditions such as diabetes mellitus and Human Immunodeficiency Syndrome (HIV) may be associated with a higher incidence of postoperative infections and hence a delayed healing process. Other co-morbid conditions associated with complications include pulmonary hypertension with cor pulmonale, asthma and chromosomal abnormalities such as Down's syndrome. Patients with Down's syndrome are predisposed to obstructive sleep apnoea syndrome (OSAS) due to midfacial hypoplasia, micrognathia, narrow nasopharynx, small oral cavity, relative tonsil and adenoid hypertrophy, increased secretions, hypotonia of the palatal, lingual, and pharyngeal muscles, laryngotracheal abnormalities and obesity. There is also an increased risk of chronic rhinosinusitis and tonsillitis in Down's syndrome. These children should thus be admitted for monitoring after ASTS (1, 48, 65). Patients with bleeding diathesis may develop excessive intraoperative or postoperative hemorrhage. A correlation may thus also be made between history of abnormal bleeding and the actual intra and post-operative bleeding that may occur. Those found to have a positive history of abnormal bleeding may then have to routinely do a coagulation screen before surgery if a strong correlation is found between the two (63, 65).

Duration of symptoms before surgery. This has been implicated by some studies to be a risk factor for complications post adenotonsillectomy. Patients who have waited for so long (more than 6 months) are said to have complications of the disease such as pulmonary hypertension, sleep apnea and polycythemia due to obstructive sleep apnea

syndrome (OSAS) hence these patients have a higher incidence of complications post ASTS (61, 64, 65).

Indication for ASTS. Some indications for adenotonsillectomy are associated with higher incidences of postoperative complications. These include obstructive sleep apnea syndrome as described above (61). Some studies have also associated peritonsillar abscess with increased perioperative bleeding and bacteremia but lately some workers have refuted this due to the fact that these patients are usually put on high dose antibiotics before surgery and the techniques used in this surgery is slightly different from the one used in ordinary ASTS as described above (5, 51).

LITERATURE REVIEW SPECIFIC TO THE STUDY

Complications due to adenotonsillectomy are rare. Serious complications following these surgeries are primarily related to pain, hemorrhage, dehydration, infection, weight loss, airway obstruction, postoperative pulmonary edema, VPI, nasopharyngeal stenosis and death (43, 48). Majority occur in the first three hour period postoperatively. Sixty-four to 100% haemorrhage incidences occur in the first eight hour post operative period. Complication rates for day stay ASTS range from 0.28 to 4.4% for hemorrhage, 1.3-14.4% for emesis and 1.4% for fever hence day stay surgery for these procedures with at least a 4 hour postoperative observation period is considered safe (3).

Oburra and Idenya in 2001 (5) did a retrospective study in a sample of Kenyan hospitals in Nairobi to review indications, timing and complications in a sample of 97 cases of patients who had undergone ASTS. The overall rate of complications resulting from these operations in this study was found to be 29.9%. Of these 5.2% had complications that necessitated admission of the patients to the hospital postoperatively for management. The rest (94.8%) were safely managed as day cases due to the low rate of serious complications encountered. Among the serious complications encountered in this study, one patient developed acute airway obstruction because of edema of the uvula postoperatively and was managed by reintubation and uvulectomy. Two patients had serious hemorrhage and eight patients had delayed onset of feeding due to pain (odynophagia). Anaesthetic complications occurred in 2 patients one having severe bradycardia due to endotracheal tube occlusion due to kinking while the other had accidental self extubation leading to cerebral ischemia and permanent brain damage. The indication for surgery in the latter case was sleep apnea since neonatal period. The other complications encountered in this study included upper respiratory infection, postoperative somnolence, trauma on nasal turbinate by nasotracheal tube, prolonged healing of tonsillar bed and persistent failure to improve obstructive airway symptoms postoperatively.

Although this study gives an overview of the problems of tonsil and adenoid surgery, its sample size was not predetermined and the clarification of the determinants of the complications was not an objective of the study. It was a retrospective study done on

many different centers hence patients had a varied socioeconomic background. They considered surgeries done by the authors only and could not thus compare complications with experience of the surgeon.

Masinde in 1995 (59) in his master of medicine in ENT-HN surgery dissertation did a 6 year retrospective study on 449 patients at KNH on indications and complications of adenoidectomy and tonsillectomy. In his study he considered both the early and the late complications of adenotonsillectomy. The follow up period considered in his study was the first 6 months period postoperatively. He found the rate of occurrence of complications after adenotonsillectomy to be 22.5%. Thirty two out of 124 patients who underwent ASTS developed complications. Hemorrhage which is the most feared complication occurred in 1.6% (3 out of 449 patients). Recurrent URTIs or tonsillar abscesses in tonsillar remnants formed a very small percentage of the complications with 2 cases having to undergo repeat tonsillectomy due to severe attacks of tonsillitis.

Again this study was retrospective in nature and does not delve into clarifying the determinants of the complications. In this study all the three surgeries (AS, TS & ASTS) were considered in the same study.

Nikki M, Brian JA, Collin B et al, in 2002 (42) reported an overall rate of complications due to tonsillar surgery to be 9.3%. In the same study the rate of occurrence of primary and secondary bleeding was reported as 6.27% and 0.48% respectively. Post-tonsillectomy vomiting was the commonest reason for conversion from day surgery to inpatients. This was a prospective study in which only tonsillectomy was considered. They did not relate complications to their determinants.

Paradise et al 1984 (48) reported an overall complication rate of 14% following ASTS. All of these complications were self-limiting. In this study, determinants of the complications were not considered.

Richmond and others in 1998 (50) reported various complication rates in a series of 794 ASTS patients. Postoperative hemorrhage of various degrees was reported in 4.2% whilst postoperative airway obstruction occurred in 1.3% of the patients.

Crysdale and Russel in 1986 (17) reported an overall hemorrhage rate of 2.15% in 9409 patients of whom only 0.06% required a second general anaesthetic to achieve hemostasis. Incidence of serious surgical complications was reported as 15/1000 (1.5%). In the above three studies, there were no deliberate attempts to define the determinants. These studies were also done in the west where the standard of living is higher than in our set up.

Stutham MM, Elluru RG, Buncher R et al, in 2001 (49) did a retrospective study in a series of children younger than 6 years undergoing adenotonsillectomy for treatment of OSAS to determine the effect of age on prevalence of postoperative respiratory complications at the University of Cincinnati, College of Medicine, USA. The primary objective of this study was to define a practice standard for postoperative hospital admission in these patients. In this study, of the 2315 patients recruited 6.4% (149) developed a postoperative respiratory complication. Even though there was a lower incidence of comorbid medical conditions in the cohort, children younger than 3 years were at a greater risk for developing a post-operative respiratory complication (9.8%) compared to those aged between 3-5 years (4.9%). Logistic regression analysis revealed that children younger than 3 years had a nearly 2 fold increased risk for respiratory complications postoperatively when controlled for race and sex. They concluded that ASTS to treat OSAS is associated with a significantly higher rate of postoperative respiratory complication in children younger than 3 years compared with children aged 3-5 years. These results support hospital admission for all patients younger than 3 years undergoing ASTS for treatment of OSAS. This was a retrospective study which was done in a completely different population with a different socioeconomic background. They considered patients with the same indication for surgery (OSAS) and only one aspect of the complications (respiratory complications) was evaluated.

Klung and Ovesen, in 2003 (63) did a retrospective study on 918 tonsillectomy patients at Arhus university hospital to quantify hemorrhage and evaluate the risk factors of post-tonsillectomy hemorrhage (PTH). PTH occurred in 5.2% (48 patients) and among these 2.8% needed reoperation. The following factors correlated significantly with PTH: high age, abscess tonsillectomy, greater perioperative hemorrhage and high perioperative blood pressure. They concluded that this operation had a high complication rate and that it needs a solid indication before surgery. Again this study was retrospective in nature and considered only one complication (hemorrhage).

Sanchez Legaza E, Sanchez Legaza B, Pozo Rodriguez C et al, in 2006 (65) did a study on complications of adenotonsillectomy. They found AS, TS and ASTS to be among the commonest operations performed by otolaryngologists with the most serious complication being postoperative bleeding. They highlighted risk factors associated with the complications, which included: age less than 3 years, female gender, duration of surgery, incomplete hemostasis and coagulopathies in the patients. Postoperative bleeding could not be related to the surgical technique or the methods used for achieving hemostasis. This study considered all the three operations (AS, TS and ASTS) and was done in a different set up from ours.

Kalra M, Buncher R and Amin RS 2005 (63) did a case control study in 115 patients at Cincinnati Children's Hospital Ohio USA to determine whether asthma is a risk factor for respiratory complications after ASTS in children with OSAS. Children with asthma are known to be at increased risk for obstructive breathing during sleep. The postoperative respiratory complications encountered ranged from oxygen desaturation to respiratory failure that required mechanical ventilation. Logistic regression analysis showed that asthma increases the odds of postoperative respiratory complications after controlling for age, sex, race, and medical conditions other than asthma. It was concluded that in children with obstructive breathing during sleep, the presence of asthma is associated with an increased risk of respiratory complications after ASTS.

Brown KA, Morin I, Hickey C et al 2001 (61) did a retrospective study to assess risk factors predictive of respiratory complications after urgent adenotonsillectomy. The proforma for the study included the preoperative status (including an evaluation for OSAS), anaesthetic management and need for postoperative respiratory interventions. They concluded that severe OSAS and an associated medical condition are risk factors for post ASTS respiratory complications. Risk reduction strategies should focus on their assessment. Again the last two studies were retrospective and were done in different populations and set ups. In most of them only one risk factor or complication was considered. No study correlated the socioeconomic status to complications of ASTS.

STUDY JUSTIFICATION

Surgery of the palatine tonsils and the adenoids is among the commonest surgical procedures undertaken by otolaryngologists. A prospective study to look at the various determinants of the complications of adenotonsillectomy has not been done in our set up. Knowledge of the frequency of these complications, their onset and the factors associated with them will be useful to the surgeons in trying to prevent or anticipate the complications that may occur in order to reduce the associated morbidity and mortality. This knowledge will also help surgeons to make an informed decision on the feasibility of these operations being done as day-cases in our set up without compromising safety of the patients. Day-care surgery if recommended will be beneficial in relieving heavy work load from the already overburdened health facilities. This will also be comfortable for the patient and the parents or insurance agents who pay for the escalating costs of health services.

BROAD OBJECTIVE

To assess the early complications of adenotonsillectomy and their determinants among patients undergoing ASTS at Kenyatta National Hospital.

SPECIFIC OBJECTIVES

1. To determine the rate of early complications of adenotonsillectomy (ASTS).
2. To determine the timing of occurrence of the various complications of ASTS.
3. To determine the risk factors associated with early complications of ASTS.

METHODOLOGY

Study design

This was a prospective descriptive cross sectional study.

Study setting

The study was carried out in the public ENT H&N unit, Department of Surgery and private wards at Kenyatta National Hospital, Nairobi, Kenya. The Hospital is the main national referral and teaching hospital in Kenya offering both in- and out-patient services.

Study population

This consisted of all patients undergoing ASTS at KNH during the study period.

Inclusion criteria

All patients undergoing ASTS who consented to the study.

Exclusion criteria:-

1. Those that declined to consent to the study.
2. Those that underwent other surgeries at the same time.
3. History of previous adenoid surgery (repeat AS).

Consent

Informed consent was obtained from the adult patients or from the children's parents or guardians by the principal investigator before induction into the study.

Recruitment

The principal investigator with the help of his research assistants (ENT-HN surgery residents) identified the patients and filled their details into a proforma designed for the study. Standard management of the patients continued as usual during the study period.

Information from specially designed surgeon's and anaesthetist's forms was transferred to the proforma (see Appendix II).

Study period

This study was carried out for a total of six months starting December 2006 to May 2007.

SAMPLE SIZE DETERMINATION

The sample was determined using the Kish and Leslie statistical formula (51).

$$n = \frac{z^2 p q}{d^2}$$

Where by:

n = desired sample size.

z = standard normal, two tail at 1.96.

p = proportion of the target estimated to have a particular characteristics. In the study by Statham MM et al 9.8% of children less than 3 years undergoing ASTS for obstructive sleep apnea syndrome (OSAS) developed postoperative respiratory complications (49).

q = 1-p

d = minimum permissible error (0.05).

n=135.8

Therefore the minimum number of patients to be recruited was 136.

Sampling method

Non-probability sampling method was used. All patients consecutively seen at KNH who meet the inclusion criteria were inducted into the study.

Materials and equipment: -

1. Portable head lamp
2. Gloves
3. Face masks
4. Spatula
5. Nasal speculum (Thudicum)
6. Thermometers
7. Blood pressure machines
8. Stethoscope
9. Digital watches
10. Otoscope and aural specula
11. Weighing machines
12. Measuring tapes

13. WHO charts for assessing dehydration and malnutrition (Appendix III)

14. Surgeon's and the anaesthetist's report forms (Appendix II)

PROCEDURE

All patients who met the inclusion criteria were recruited. After signing written consent for the study the patient was assigned a study number after which his demographic data and socioeconomic status was entered into the questionnaire (Appendix II). The vital signs, weight and height were taken and recorded.

A thorough medical history was taken from the patients or their parents/guardians. This included history of the presenting complaints, bleeding or coagulation disorders, speech history, anaesthetic intolerances and history to determine the general well being of the patient. All the information obtained was entered into the questionnaire.

A complete physical examination was done before surgery. This included both general and systemic examination. In the general examination, the patient was checked for pallor, edema, cyanosis and lymphadenopathy. A thorough ENT examination was also done to confirm findings from the history and exclude signs of true or submucous cleft palate, craniofacial syndromes, hyper- or hyponasal speech, neuromuscular abnormalities and the condition of their teeth was noted.

Using the head lamp and a spatula the patients' mouth and oropharynx was examined with special attention to the tonsils. The grade of tonsillar hypertrophy, any evidence of infection such as inflammation (hyperaemia), tonsillar exudates and any asymmetry in size was noted. Inspection of the uvula and both the soft and the hard palate was made to exclude any evidence cleft palate such as a bifid uvula or obvious cleft palate that could be seen.

The nose was examined for any evidence of rhinorrhoea, nasal septal deviation or hypertrophy of the inferior turbinates using a head lamp and a nasal speculum.

Otosopic examination was done to check for otorrhoea, the condition of the tympanic membrane and the middle ear cleft.

The neck was examined for enlarged lymph nodes with special attention to superficial upper cervical and jugulodigastric nodes. Any tender cervical nodes were noted in the proforma.

The rest of the body systems were examined with special attention to the cardiovascular (CVS) and the respiratory systems. CVS and the abdomen were examined for engorged neck veins, gallop rhythm, tender hepatosplenomegally and ascitis. The respiratory system was examined for any evidence of infection.

Laboratory, radiological and special examination

For diagnostic purposes a lateral plain x-ray view of the post nasal space soft tissues which is routinely taken to assess AH was reviewed and the findings noted.

Laboratory investigations routinely done before surgery were a full hemogram for which the minimum acceptable haemoglobin level for surgery was 10g%. White blood cells, platelets, urea and electrolytes were also within normal limits. All these were reviewed and the findings noted.

Any other investigations were done as indicated, mostly due to complications of the disease or comorbid medical conditions in the patients. These included a plain chest x-ray film for suspected pneumonia and ECG and/or ECHO for patients with heart disease (corpulmonale).

An informed consent for the surgery was sought. The patient or the guardians were first enlightened about the disease, surgery to be done, its indications, benefits of surgery, possible complications from surgery, risk of not having the surgery and the expected outcome from the surgery.

The patients were admitted into the ward one day before surgery where a review of the patients was done and investigations checked to ascertain fitness for surgery. The patients were also reviewed by the anaesthetist prior to surgery and classified according to the ASA (American Academy of Anaesthesiologists) system and this was recorded in the anaesthetist's form (Appendix II).

The patients fasted for at least 6 hours prior to surgery. They however were monitored closely and given intravenous rehydration if there was need. All patients were premedicated with atropine 30 minutes prior to surgery.

Surgical procedure

The patient was positioned on the operating table in a supine position with the head extended and a head ring used to stabilize the head.

All instruments used were sterilized before surgery. All procedures were done via the transoral route (Appendix IV) under general anaesthesia by use of an endotracheal tube (ETT). As is usually done, children were intubated using a non-cuffed ETT while in adults a cuffed tube was used.

A Boyle–Davies mouth gag was used to facilitate access to the oropharynx. The throat was packed with wet gauze to prevent aspiration of blood, secretions or vomitus. Inspection of the tonsils was done at this point. The soft palate and the uvula were retracted using a pillar retractor to facilitate inspection of the adenoids.

In all patients, AS was done first using sharp curettage. Haemostasis was achieved through pressure packing using tonsil swabs and/or electrocautery. Tonsillectomy was then done whereby the tonsils were removed one after the other. For tonsillectomy the blunt dissection method was used (appendix IV). After achieving good haemostasis, the patients were reversed from general anaesthesia and taken to the recovery ward. After surgery, patients with cardio-respiratory complications were taken to the intensive care

unit (ICU) or the high dependence unit (HDU) for close and more specialized monitoring if there was need.

In the recovery ward the patients were closely monitored for vital signs (temperature, pulse rate, respiratory rate and blood pressure) and their general well being every ¼ hourly till they were fully awake then they were transferred to the ward. In the ward close monitoring continued 4 hourly and the findings recorded. After the procedures the surgeon and the anaesthetist filled into the report forms designed for them and put these in the patient's files. These were later collected by the principal investigator and the information transferred into the main patient's proforma.

Complications encountered both intra- and postoperatively were recorded and managed accordingly. For instance, pain occurring postoperatively necessitated review of the analgesics and adjustment to stronger painkillers. Haemorrhage occurring postoperatively necessitated examination under anaesthesia (EUA) and the bleeding managed by electrocautery.

Postoperative care

In the wards the patients were observed for a minimum of one day before discharge.

Those with serious complications were kept for a longer period of time to manage the complications till they were safe for discharge.

All patients were put on appropriate doses of amoxicillin (or erythromycin) and paracetamol postoperatively for 5 days. The dosages were as follows: Amoxicillin 40mg/kg/day divided TDS given orally, erythromycin 30-50mg/kg/day divided QID given orally and paracetamol 10-15mg/kg/dose given TDS orally.

Feeding in the ward began when the patient was fully awake starting with liquids and progressing to semi-solid feeds and eventually to solids.

On discharge, patients or their guardians were given instructions on how to identify complications and if any serious complications were noted they were to take the patients to the nearest health facility or back to KNH for management. These complications included haemorrhage, refusal to feed, hotness of the body, excessive crying, dehydration and vomiting. The patients or their guardians were instructed to note down any complications that occurred while at home in a complications report form given to them on discharge (Appendix II). The filled forms were returned to the researcher on the first review date. This information was edited and transferred to the patient questionnaire.

Follow up

Patients were reviewed during their usual post-operative visits to the ENT-HN clinic. The first review was at two weeks postoperatively when the patient's weight was taken and compared to their preoperative weight to assess any weight loss. The patients or their guardians were interviewed for any complications encountered and a general and systemic examination done and the findings recorded (Appendix II). Any complications present were treated accordingly but details of this management are outside the scope of this study.

Assessment of complications was done as follows:-

1. Hemorrhage: –Blood loss was assessed by the number of soaked tonsil swabs plus the amount of blood in the suction receiver at the end of the operation. Each soaked tonsil swab was estimated to contain 10 millilitres of blood. Any sign of bleeding postoperatively was also considered a complication.
2. Dehydration: – Using the WHO chart for the assessment of dehydration - according to the clinical signs and symptoms elicited (Appendix III).
3. Infection/fever: – Temperature above 37.2⁰C and general and systemic assessment of the patient postoperatively. A full hemogram, chest x-ray and culture and sensitivity were done if indicated.
4. Vomiting: – Any sign of emesis postoperatively.
5. Weight loss: – Obtained by subtracting weight two weeks after surgery from the original weight of the patients before operation.

6. Pain (odynophagia):—Any delay in taking enough orally after the patient was fully awake was considered to be due to pain. The duration taken to start feeding on liquids, semi-solid and solid food postoperatively was noted and recorded. Those who could not take semi solid diet on the first post operative day were considered to be having prolonged odynophagia as most patients were able to feed at this time.
7. Trauma to soft tissues: – By clinical examination postoperatively.
8. Postoperative airway obstruction and pulmonary edema: – By clinical assessment postoperatively for snoring, stridor, sleep apnoea or respiratory distress in the absence of fever.
9. Anaesthetic complications: – As reported on the anaesthetic report form (Appendix II).

Data analysis

Data analysis was done with the help of a statistician. The data obtained was coded in the form of variables and analyzed using appropriate statistical packages namely SPSS version 10.0 and Epi Info 3.3.2, 2005. The results obtained were presented in text, pie charts, bar graphs, and tables. Tests of statistical significance were applied where appropriate. The correlation of age, sex, commobid diseases, nutritional status, socioeconomic status, duration of symptoms before surgery, experience of the surgeon and indication for surgery to complications were made via regression techniques.

QUALITY CONTROL

1. All aspects of the study were discussed with the research assistants (ENT HN Registrars) before commencement of the study.
2. The operation technique was standardized as much as possible (see section on methodology and forms in appendix II). All operations were done using the same technique namely blunt dissection for tonsillectomy and sharp curettage for adenoidectomy. Haemostasis was achieved by coagulation diathermy in the tonsillar bed while gauze packing was used in the adenoid bed (Appendix IV).
3. Only surgeons belonging to ENT-HN section and trained to perform the surgical procedures were allowed to manage the patients and fill the patient proformas.

4. There was a standard proforma for all patients recruited for the study (Appendix II).
5. Follow-up of the patients was done by the principal investigator.
6. The patients' proforma was pre-tested and the necessary changes made before commencement of the study.

DIFFICULTIES ENCOUNTERED

Interview of the patients or guardians (eg on voice changes, odynophagia etc etc) was used to collect some of the data hence some information obtained was subjective to a certain extent. This was minimized by the use of a standardised questionnaire for all patients.

ETHICAL ISSUES

1. The study was done after approval by the ethical and research committee of Kenyatta National Hospital.
2. Informed consent was sought from the participating subjects before induction into the study.
3. Those that declined to consent for the study received the same management as those participating in the study.
4. There was no extra cost to the patient for participating in the study.
5. Confidentiality of the participating subjects was maintained. Names and phone numbers on the questionnaires were used only for purposes of follow up if there was need.
6. The results of the study will be published and made available for use by members of the medical fraternity.

RESULTS

A total of 154 ASTS patients were operated during the study period. Of these, two parents declined to consent for the study. Three patients had other operations done together with ASTS and one patient had a repeat adenoidectomy. A total of 148 patients were thus recruited into the study. Of these 92 patients (62.2%) were males and 56 patients (37.8%) were females.

Figure 1: Sex distribution

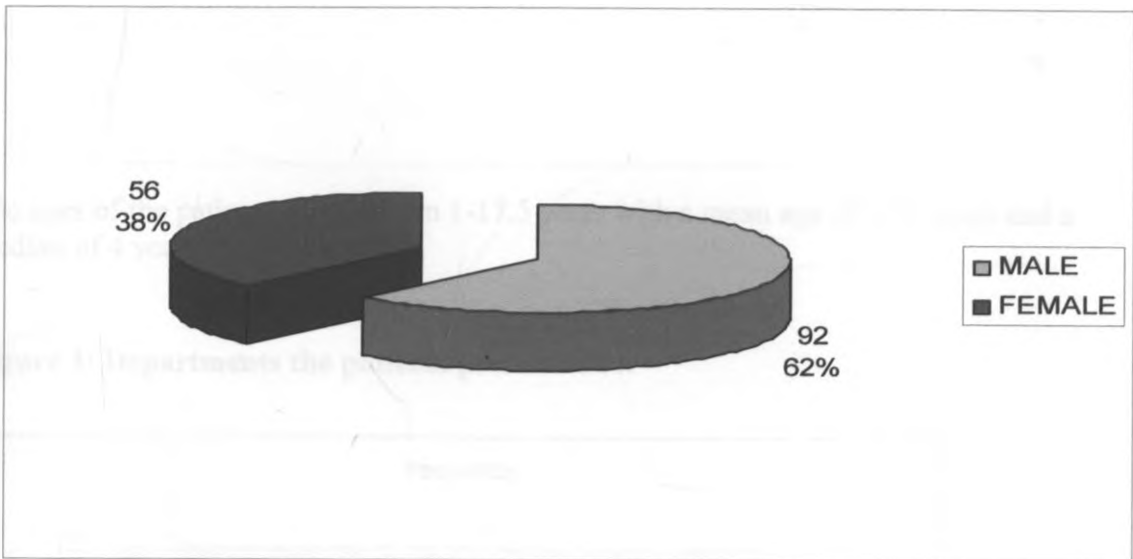
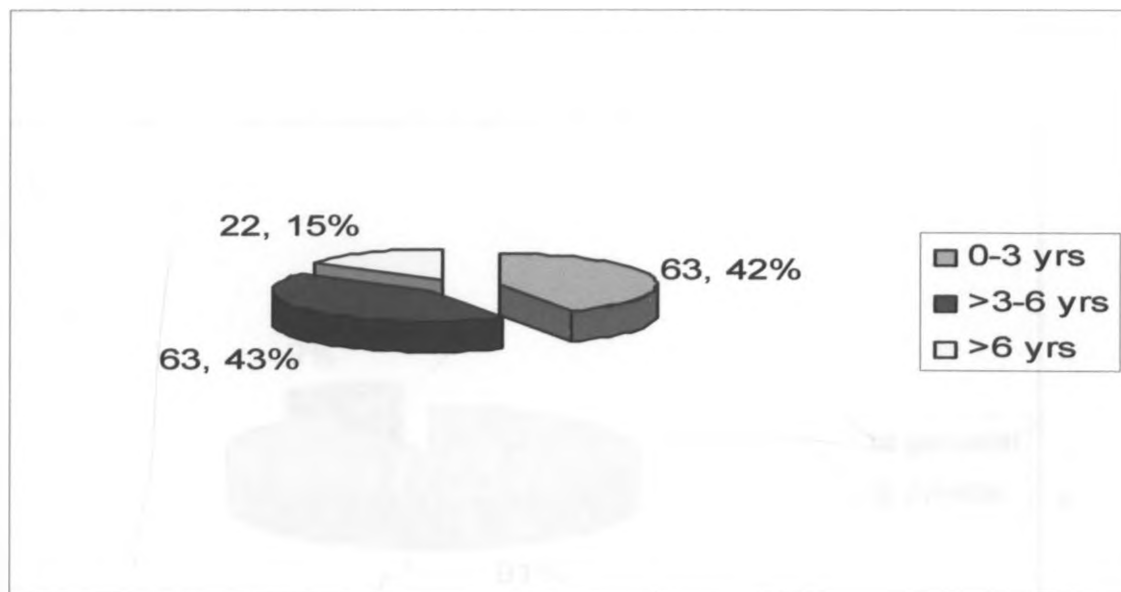
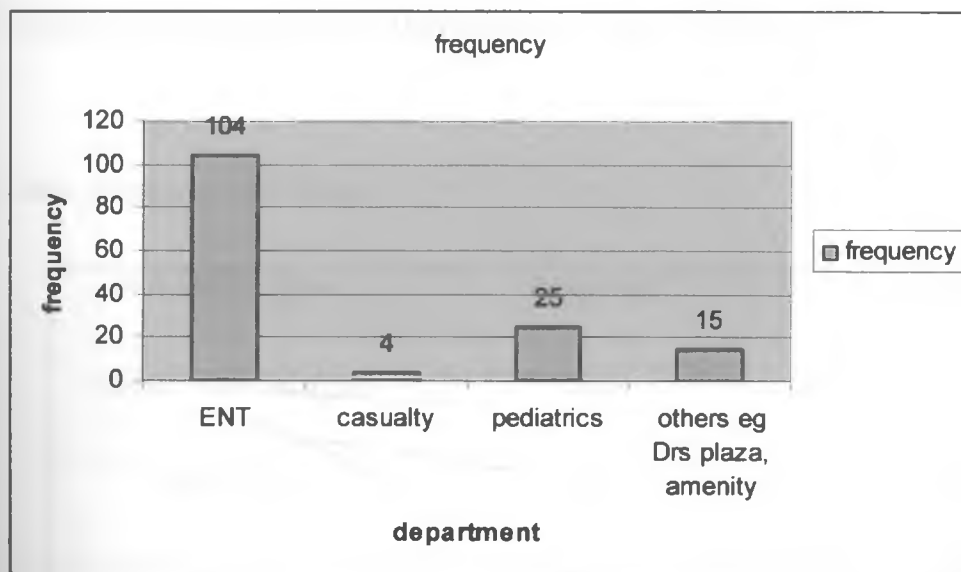


Figure 2: Clustered age distribution



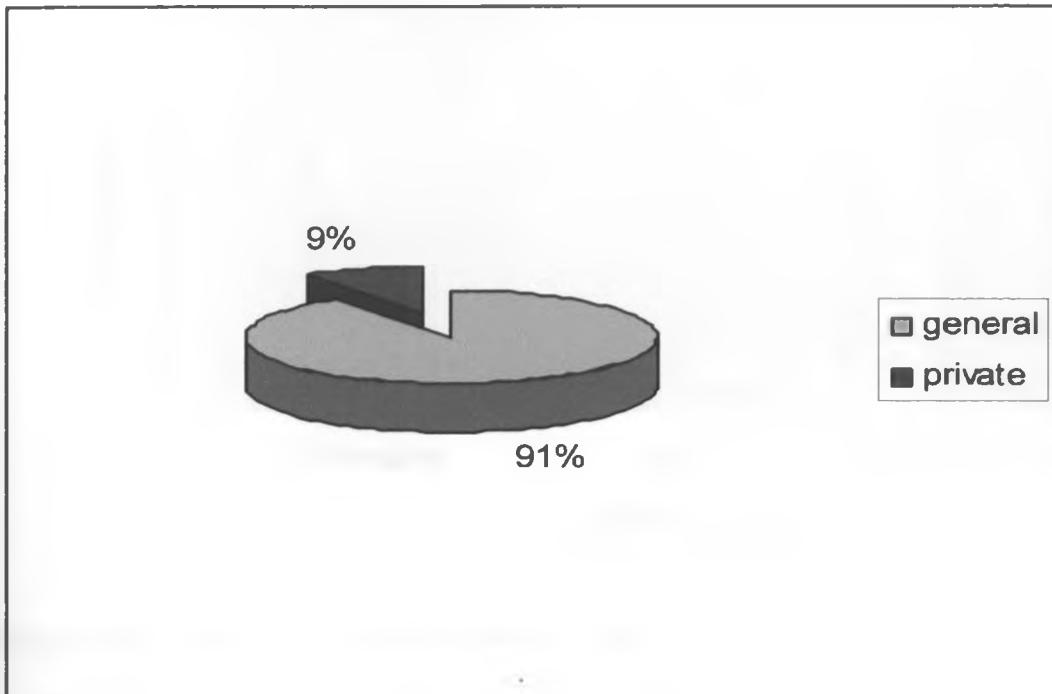
The ages of the patients ranged from 1-17.5 years with a mean age of 4.73 years and a median of 4 years.

Figure 3: Departments the patients presented to:



The patients presented through the various departments at KNH. The majority of the patients presented through ENT clinic accounting for 104 patients (70.3%). The rest presented to the various departments (Figure 3)

Figure 4: Admission wards

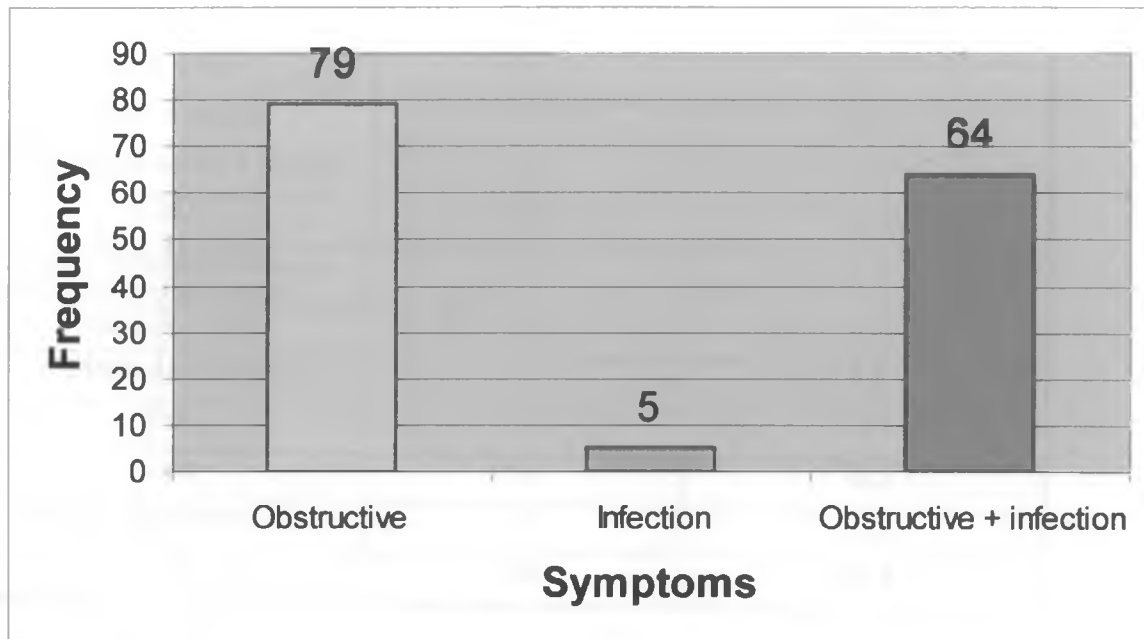


Majority of the patients were admitted to general wards (Figure 4)

Table 1: Nutritional status

Nutritional status	Frequency	Percentage
Normal (>90% body wt)	115	77.7
Malnutrition	33	22.3
Total	148	100.0

Figure 5: Clinical features at presentation



Majority of the patients had obstructive symptoms (figure 5)

Table 2: Duration of clinical features

clinical features	Frequency	Percent
< 6 months	10	6.8
6-12 months	37	25.0
> 1yr- 2 yrs	43	29.1
> 2 yrs	58	39.2
Total	148	100.0

Majority of the patients had clinical features for more than one year with a median of 24 months.

Table 3: Cormobidity

Cormobidity	Frequency	Percentage
allergy	12	8.1
malnutrition	7	4.7
allergy + asthma	3	2.0
sickle cell anaemia + allergy	1	.7
OSAS	17	11.5
Downs syndrome/craniofacial abnormalities+malnutrition	2	1.4
allergy + OSAS	17	11.5
anaemia+malnutrition	2	1.4
DM	1	.7
none	64	43.2
allergy+malnutrition+OSAS	22	14.9
Total	148	100.0

The various commobidities together and individually were not found to be significantly associated with complications (P=0.338)

Table 4: Average waiting time before surgery

Waiting time	Frequency	Percentage
< 6 months	71	48.0
6-12 months	37	25.0
13-24 months	20	13.5
>24 months	20	13.5
Total	148	100.0

The waiting time before surgery ranged from 0.25 months (1 week) to 73 months with a mean of 11.2 months and a median of 6 months. This was not found to be statistically associated with occurrence of complications (P=0.309)

SURGERY

Table 5: Indications for surgery

Indication for surgery	Frequency	Percentage
UAO	46	31.1
Recurrent attacks of adenotonsillitis	25	16.9
recurrent peritonsillar abscess	1	.7
OSAS	31	20.9
UAO+recurrent adenotonsillitis	45	30.4
Total	148	100.0

UAO was the commonest indication for surgery accounting for 46 patients (31.1%) followed by combined UAO with recurrent adenotonsillitis 45 patients (30.4%). OSAS accounted for 31 patients (20.9 %) leaving recurrent adenotonsillitis alone to account for a mere 25 patients (16.9%).

Table 6: Category of surgeon

Category of surgeon	Frequency	Percentage
SHO 2nd yr	61	41.2
SHO 3rd yr	20	13.5
SHO 4th yr	52	35.1
consultant <5 yrs	1	.7
consultant 5-10 yrs	7	4.7
consultant > 10 yrs	7	4.7
Total	148	100.0

Table 7: Category of anaesthetist

Category of anaesthetist	Frequency	Percentage
SHO 1 st yr	2	1.4
SHO 2nd yr	51	34.5
SHO 3rd yr	19	12.8
consultant < 5yrs	9	6.1
consultant 5-10 yrs	17	11.5
consultant >10 yrs	18	12.2
RCO anaesthetist	32	21.6
Total	148	100.0

The surgeries were performed by various categories of surgeons and anaesthetists (Table 7). Occurrence of complications was not found to be significantly associated with category of surgeon ($P=0.773$) nor that of the anaesthetist ($P=0.168$). SHOs second and fourth years did 41.2% and 35.1% of the surgeries respectively while SHO third years did the least (13.1%) amongst the category of registrars.

Table 8: Time of surgery

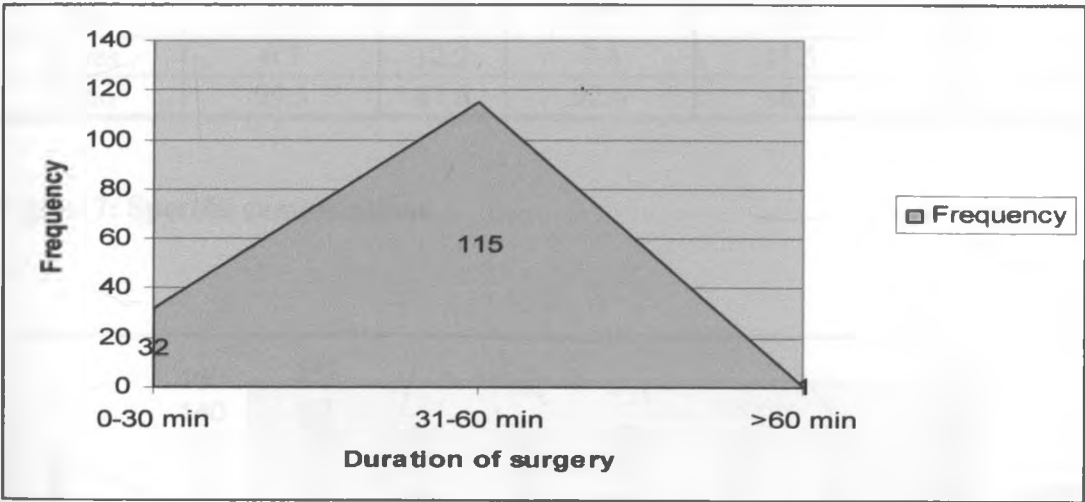
Time of surgery	Frequency	Percentage
8am-10am	73	49.3
>10am-12 noon	56	37.8
>12 noon-2 pm	15	10.1
after 2 pm	4	2.7
Total	148	100.0

Most of the surgeries were performed in the morning. One twenty nine (87.1%) of the patients had surgery by noon (Table 8) The time surgery was done did not significantly influence occurrence of complications ($P=0.485$)

Table 9: Duration of surgery

Duration of surgery	Frequency	Percentage
0-30 min	32	21.6
31-60 min	115	77.7
>60 min	1	.7
Total	148	100.0

Figure 6: Duration of surgery



In one hundred and fifteen patients (77.7%) surgery took between 30 minutes to one hour. Surgery took more than an hour in one patient while in the rest (21.6%) it took less than half an hour (Table 9). The mean duration of surgery was 44.9 minutes with a range of between 25 and 70 minutes. Occurrence of complications was not statistically influenced by the duration of surgery (P=0.519)

COMPLICATIONS

These consisted of haemorrhage, soft tissue injuries (STI), accidental extubation, dehydration, odynophagia, vomiting, weight loss, symptoms persistence, taste disturbances and otalgia. No death occurred.

Table 10: Overall complications

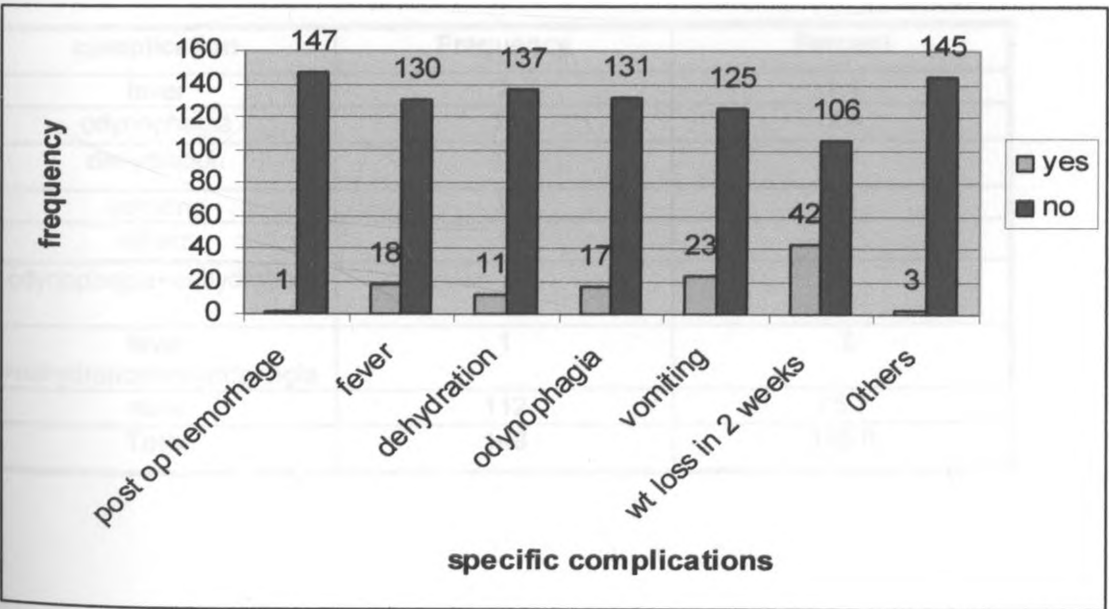
Occurrence of complications	Frequency	Percentage
Yes	50	33.8
No	98	66.2
Total	148	100

The overall complication rate was 33.8 % (50 patients).

Table 11: Specific complications

Complication	Post op haemorrhage	Fever	Dehydration	Odynophagia	Vomiting	Wt loss in 2 weeks	Others
Yes	1	18	11	17	23	42	3
No	147	130	137	131	125	106	145
% yes	0.7	12.2	7.4	11.5	15.5	28.4	2
% no	99.3	87.8	92.6	88.5	84.5	71.6	98

Figure 7: Specific complications



COMPLICATIONS TIMING

Table 12: Intraoperative complications

Complications	Frequency	Percentage
excessive haemorrhage	18	12.2
vomiting	1	.7
accidental extubation	1	.7
loss of teeth	4	2.7
STI/trauma	14	9.5
none	110	74.3
Total	148	100.0

No factors were found to significantly influence occurrence of intraoperative complications in this study.

Table 13: Immediate post operative complications

These occurred in the first 24 hours post operatively.

complication	Frequency	Percent
fever	2	1.4
odynophagia	11	7.4
dehydration	11	7.4
vomiting	9	6.1
others	1	.7
odynophagia+dehydration	1	.7
fever +dehydration+odynophagia	1	.7
none	112	75.7
Total	148	100.0

Table 14: Immediate post operative complications timing

Timing	Frequency	Percentage
0-4 hrs post op	23	15.5
>4-8 hrs post op	11	7.4
>8-24 hrs post op	2	1.4
N/A	112	75.7
Total	148	100.0

Twenty three (63.8%) of the 36 immediate post operative complications occurred in the first 4 hour period post operatively. Most immediate post operative complications (34 out of 36) were observed in the first 8 hours post operatively (Table 14).

Table 15: Delayed complications

These occurred between the 2nd and 14th post operative period.

Complications	Frequency	Percentage
hemorrhage	1	.7
fever	1	.7
taste disturbances+fever	2	1.4
no improvement in symptoms	5	3.4
dehydration +fever	15	10.1
odynophagia	16	10.8
none	108	72.9
Total	148	100.0

Table 16: Delayed complications timing

Timing	Frequency	Percent
2-7 days	37	25.0
7-14 days	3	2.0
not applicable	108	73.0
Total	148	100.0

Thirty seven patients (25%) had delayed post operative complications in the first 2-7 days post operatively.

DETERMINANTS OF COMPLICATIONS

Table 17: Factors significantly associated with Odynophagia:

Variable	ODYNOPHAGIA		Statistical test
	Yes	No	
Sex			
Male	6.5% (6)	93.5%(86)	$\chi^2= 4.639$: 1df: $P<0.05$ (0.031) significant difference
Female	17.9%(10)	82.1%(46)	
Age group			
0-6 years	7.9% (10)	92.1%(116)	$\chi^2= 7.263$: 2df: $P<0.05$ (0.026) significant difference
>6years	27.3%(6)	72.7%(16)	
Variable	Complications		Statistical test
	Yes	No	
Level of education			
Primary	16.7%	83.3%	$\chi^2= 8.840$: 3df: $P<0.05$ (0.031) significant difference
Secondary	37.3%	62.7%	
Middle college	32.7%	67.3%	
University	60.0%	40.0%	

1. Sex versus odynophagia. Female gender was significantly associated with increased incidence of odynophagia amongst the subjects ($P=0.032$) (Table 17) When subjected to

logistic regression test, Odds ratio (OR) for sex versus odynophagia was 0.32 (95% CI 0.10 – 1.04). Males are thus 32% less likely to develop odynophagia.

2. Age versus odynophagia. Age was found to be significantly associated with odynophagia. Those aged more than six years had increased incidence of odynophagia compared to those aged less than six years (P=0.041) (Table 17). When subjected to logistic regression test, Odds ratio (OR) for age more than 6 years vs. odynophagia was 0.21 (95% CI 0.06 – 0.76) P< 0.05. Those aged more than 6 years have a 21% risk of developing severe odynophagia.

3. Level of education versus complications. Level of education of the parents/guardians was significantly associated with occurrence of complications post ASTS. The complications were shown to be increasing with increasing level of education of the parents/guardians (P=0.031) When this factor was subjected to logistic regression test the P value was 0.056 -meaning that this factor is not strongly associated with occurrence of complications post ASTS.

4. Odynophagia versus weight loss. Prolonged odynophagia was significantly associated with weight loss in two weeks post operatively ($\chi^2=12.04$ 1 df P<0.001[0.00] Odds ratio 6.31 (95% CI 1.80-23.18). Prolonged odynophagia leads to poor feeding, dehydration and hence weight loss as observed in this study.

5. Odynophagia versus dehydration. Odynophagia was not shown to significantly affect the dehydration rate (P=0.632). Only one patient with dehydration had associated prolonged odynophagia.

6. The other factors namely nutritional status, duration of symptoms, waiting time before surgery, category of surgeon or anaesthetist, signs and symptoms at presentation and indication for surgery were not found to be significantly associated with occurrence of complications post ASTS (P values >0.05)

logistic regression test, Odds ratio (OR) for sex versus odynophagia was 0.32 (95% CI 0.10 – 1.04). Males are thus 32% less likely to develop odynophagia.

2. Age versus odynophagia. Age was found to be significantly associated with odynophagia. Those aged more than six years had increased incidence of odynophagia compared to those aged less than six years ($P=0.041$) (Table 17). When subjected to logistic regression test, Odds ratio (OR) for age more than 6 years vs. odynophagia was 0.21 (95% CI 0.06 – 0.76) $P < 0.05$. Those aged more than 6 years have a 21% risk of developing severe odynophagia.

3. Level of education versus complications. Level of education of the parents/guardians was significantly associated with occurrence of complications post ASTS. The complications were shown to be increasing with increasing level of education of the parents/guardians ($P=0.031$) When this factor was subjected to logistic regression test the P value was 0.056 -meaning that this factor is not strongly associated with occurrence of complications post ASTS.

4. Odynophagia versus weight loss. Prolonged odynophagia was significantly associated with weight loss in two weeks post operatively ($\chi^2=12.04$ 1 df $P < 0.001$ [0.00] Odds ratio 6.31 (95% CI 1.80-23.18). Prolonged odynophagia leads to poor feeding, dehydration and hence weight loss as observed in this study.

5. Odynophagia versus dehydration. Odynophagia was not shown to significantly affect the dehydration rate ($P=0.632$). Only one patient with dehydration had associated prolonged odynophagia.

6. The other factors namely nutritional status, duration of symptoms, waiting time before surgery, category of surgeon or anaesthetist, signs and symptoms at presentation and indication for surgery were not found to be significantly associated with occurrence of complications post ASTS (P values >0.05)

logistic regression test, Odds ratio (OR) for sex versus odynophagia was 0.32 (95% CI 0.10 – 1.04). Males are thus 32% less likely to develop odynophagia.

2. Age versus odynophagia. Age was found to be significantly associated with odynophagia. Those aged more than six years had increased incidence of odynophagia compared to those aged less than six years (P=0.041) (Table 17). When subjected to logistic regression test, Odds ratio (OR) for age more than 6 years vs. odynophagia was 0.21 (95% CI 0.06 – 0.76) P< 0.05. Those aged more than 6 years have a 21% risk of developing severe odynophagia.

3. Level of education versus complications. Level of education of the parents/guardians was significantly associated with occurrence of complications post ASTS. The complications were shown to be increasing with increasing level of education of the parents/guardians (P=0.031) When this factor was subjected to logistic regression test the P value was 0.056 -meaning that this factor is not strongly associated with occurrence of complications post ASTS.

4. Odynophagia versus weight loss. Prolonged odynophagia was significantly associated with weight loss in two weeks post operatively ($\chi^2=12.04$ 1 df P<0.001[0.00] Odds ratio 6.31 (95% CI 1.80-23.18). Prolonged odynophagia leads to poor feeding, dehydration and hence weight loss as observed in this study.

5. Odynophagia versus dehydration. Odynophagia was not shown to significantly affect the dehydration rate (P=0.632). Only one patient with dehydration had associated prolonged odynophagia.

6. The other factors namely nutritional status, duration of symptoms, waiting time before surgery, category of surgeon or anaesthetist, signs and symptoms at presentation and indication for surgery were not found to be significantly associated with occurrence of complications post ASTS (P values >0.05)

DISCUSSION

A total of 148 patients met the inclusion criteria and were recruited into the study. This is a relatively large number in six months compared to 124 patients who underwent ASTS over a period of six years in a retrospective study carried out by Masinde in 1992 (59). This shows that these operations are increasing in number in Kenya unlike in the developed world where these operations have been on the decline over the past 50-60 years. (1, 2, 4, 43, 48). The reason for this could be the increase in the number of otolaryngologists and awareness in Kenya over the years.

The overall complication rate was 33.8 %. These included odynophagia, haemorrhage, vomiting, dehydration and fever which are considered by many to be serious complications that warrant admission and management in the hospital (3, 5, 38). Oburra et al 2001 (5) reported an overall complication rate of 29.9%. His was a retrospective study done in many centres both public and private. His sample size was not predetermined and he also considered surgeries done by only two surgeons himself included. Masinde 1995 (59) reported an overall complication rate of 22.5% in a retrospective study done at KNH. At that time the ENT/HN department of KNH was not as big as it is now. Studies done in other set ups have generally reported lower complication rates compared to those done in our set up. For instance, Paradise et al 1984 (48) reported an overall complication rate of 14% following ASTS while Nikki et al 2002 (42) reported an overall rate of complications due to tonsillar surgery as 9.3%. The low complication rate in the last two studies could be explained by the fact that these studies were done in different set ups with different socio economic backgrounds compared to ours.

One patient (0.7%) in this study had secondary haemorrhage on the fifth post operative day. This occurred in a female aged 16 years who came back on the fifth post operative day with profuse bleeding through the mouth with impending shock. The indication for surgery had been combined UAO with recurrent throat infections for which she had the symptoms for 12 years. She had no comorbid disease and she had waited for only one month between presentation and surgery. During surgery haemostasis had been achieved

by temponade and electrocautery. Surgery took between 31-60 minutes as was the case in the majority of the patients. She was taken to theatre as an emergency and bleeding stopped by electrocautery. She did well post operatively. Blood transfusion was not required in the management of this patient. There was no sign of infection in the tonsillar fossae intraoperatively but the tonsillar fossa was raw with no granulation tissue. This must have occurred due to sloughing off of the granulation tissue/eschar which usually occurs on the 4-5th post operative day. In many patients no notable bleeding occurs but the patients usually experience recurrence of pain. Oburra et al in his study 2001 (5) had one patient with secondary haemorrhage. Kendrick et al 1993 (3) found serious post operative haemorrhage rate requiring active treatment of 0.7%. Nikki et al 2002 (42) reported secondary haemorrhage after tonsillectomy of 0.48%. The rate of post operative haemorrhage post ASTS is therefore low as has been reported in many other studies both locally and internationally. This strongly supports ASTS as a day case in our set up (3, 5, 38, 59)

The time surgery was done did not influence occurrence of complications post ASTS. From the findings in this study, an observation period of between 4-8 hours post operatively is adequate as most of the complications occurred during this time. Most of the surgeries were performed in the morning as 129 (87.1%) of the patients had surgery by noon. That means that these patients had enough time for observation before night fall were this a day case facility. Most patients with complications would thus have been detected and converted to hospital stay cases (admitted) if this was a day case centre. These findings were also demonstrated in the study by Kendrick et al 1993 (3) and Liane et al 2002 (38). Apart from the risk of major complications, other factors considered in day case surgery includes proximity to the hospital, availability of transport, availability of good care at home and home circumstances of the child's family (5, 38, 41, 43)

Female gender was found to be significantly associated with odynophagia. Sanchez Legaza et al 2006 (65) in their study also reported female gender as a risk factor associated with post ASTS pain and haemorrhage. There is no adequate explanation for this but it could be due to a difference in the genetic make up and/or cultural beliefs since

pain perception has a strong psychological aspect. This could also be due to the fact that females generally have a 'lower' pain threshold than males. When this factor was subjected to logistic regression test, the odds ratio (OR) for sex verses odynophagia was 0.32 (95%, CI 0.10 – 1.04). Males are thus less likely to get odynophagia than females.

Age more than 6 years was found to be significantly associated with odynophagia after ASTS. There are no reported studies that show an association between age and pain but there are numerous studies that show an association between age and other complications post ASTS. Klung et al 2006 (63) found a significant association between high age and post tonsillectomy haemorrhage. In the study by Sanchez 2006 (65) age less than three years was associated with post operative respiratory complications. Statham et al 2006 (49) also found age less than 3 years to be significantly associated with respiratory complications post ASTS (49). The finding in this study could be explained by the fact that older patients have chronic recurrent tonsillitis (CRT) which is associated with fibrosis and hence delayed healing of the tonsillar bed post ASTS. The older patients are also able to communicate well and could therefore readily volunteer complaints than the younger ones. The other explanation could be that older patients may not comply fully with instructions or medications and they may start feeding on solid feeds earlier than advised hence the higher incidence of odynophagia observed in these subjects.

Complications were found to increase with increasing level of educations of the parents/guardians. Contrary to popular belief that children whose parents/guardians have poor education attainment would have more complications and vice versa, one could put a case forward that most educated parents have a 'know it all attitude' hence have poor compliance with advice and/or medications given to them. They would tent to do what according to their 'medical knowledge' is 'right'. The other explanation would be that the more educated the parents/guardians are the more likely are they to detect and report these complications at the earliest possible opportunity. Needless to say, these parents/guardians may also be so busy with employment that they do not get to spent ample time nursing their children and therefore dedicate this to caretakers who may not understand fully the importance of compliance with medical advice/medication(s). This

has not been cited in literature. When this factor was subjected to logistic regression test the P value was more than 0.05 (0.056) meanings that this factor is not strongly associated with causation of complications post ASTS.

Nutritional status of the patients did not influence occurrence of complications. Contrary to what one would expect, malnourished patients did not seem to get more complications than the well nourished ones. One could explain this by the fact that all patients were given antibiotics post operatively and this could prevent them from getting infection.

Clinical features at presentation did not influence occurrence of complications post operatively. Statham et al 2006 (49) showed that ASTS to treat OSAS is significantly associated with a higher rate of post operative respiratory complications in children younger than 3 years. This study considered only children less than 6 years of age whose indication for surgery was OSAS. This was not observed in this study as only 5 patients had post operative persistence of obstructive symptoms. Three of these had allergy with HIT, one had Down's syndrome while the remaining one did not have any cormobid disease. HIT in the atopic patients and the relatively narrow pharynx coupled with neuromuscular weakness in the patient with Down's syndrome could explain the persistence of obstructive symptoms in four of these patients leaving only one patent for analysis. This was a small number for any valid test of statistical significance to be carried out.

The waiting time before surgery was not found to be significantly associated with complications post ASTS. This compares well with the study by Kendrick et al 1993 (3) which demonstrated that children with long waits before surgery were not likely to get complications than children with short waiting times. This needs further research as those with long waiting time are likely to have severe disease and/or complications of the disease hence are more likely to have complications post ASTS (3)

The various cormmobid diseases together and individually were not found to be associated with complications post ASTS. This compares well with the study by

Kendrick et al 1993 (3) who did not find an association between comorbidity and occurrence of complications.

Occurrence of complications after ASTS was not found to be significantly associated with the category of the surgeon nor that of the anaesthetist involved in the surgery. This compares well with the study by Kendrick et al 1993 (3) who did not find the grade of the surgeon undertaking the procedure to influence the complication rates. This is in contrast to what one would expect that more experienced surgeons take a shorter duration of time during surgery and have better surgical and/or homeostatic techniques leading to less complications post operatively.

Occurrence of complications was not influenced by the duration of surgery. This disagrees with the study by Sanchez Legaza et al 2006 (65) which showed duration of surgery to be a risk factor for post operative haemorrhage. There was only one patient with secondary haemorrhage in this study but the duration of surgery in this case did not take longer than in other patients.

Only 11 patients (7.4%) developed dehydration and were managed accordingly. Most of them had mild dehydration and did not need a longer hospital stay. The reason for this could be that most patients are well hydrated during and immediately after surgery. This is done by intravenous and/or oral fluids in appropriate situations. Most patients are also able to take fluids orally even in the immediate post operative period due to the soothing effect of cold fluids to their sore throats.

Odynophagia occurred in 17 patients (11.5%) These were those who took longer than usual to resume normal diet. Most of the patients resumed acceptable quantities of semi solid and solid diet by the second post operative day. These ones took longer to do the same as has been shown in other studies (5). Two patients reported taste disturbances and one reported otalgia in the two week post operative period. Taste disturbances may arise from trauma to the tongue taste buds by pressure from the mouth gag used or may result due to injury to branches of glossopharyngeal nerve supplying the tonsils as this nerve is

also judged with the responsibility of taste to the posterior one third of the tongue. Other studies have shown that most of these patients recover sufficiently with time (1, 17, 36, 43). Otolgia occurs due to referred pain through the tympanic branch of glossopharyngeal nerve which also contributes in the formation of the pharyngeal plexus of nerves that supply the tonsils (38). The patient who experienced otalgia was treated with stronger analgesics and improved.

Voice changes from Rhinolalia clausa to Rhinolalia aperta was reported in 48 patients (32.4%). This occurred between the 2nd-14th days. This was not regarded as a complication as these patients did not have a baseline normal voice preoperatively but had rhinolalia clausa. Rhinolalia aperta is a common phenomenon observed post ASTS as reported by many workers (1, 5, 38, 47, 50). It is believed to occur due to the relative velopharyngeal insufficiency (VPI) after ASTS. Some patients may even regurgitate liquids through their nostrils as a result of this. It occurs in more than 50% of patients undergoing AS but usually resolve in most of them in 2-4 weeks. Liane et al 2002 (38) reported voice changes to be a common occurrence post ASTS due to VPI and needs observation for at least 8 weeks. Persistence occurs in 1 in 2000 AS patients and is common in those with neuromuscular disorders; those with congenitally short soft palates or in those with deformities of the palate such as true or sub mucous cleft palate. Partial AS is recommended in these high risk groups and is best done using the laser technique, which is not readily available in our set up. Most cases are transient and will resolve with time but severe cases will require treatment with speech therapy for up to one year then if no response, surgery can be done. Surgical intervention includes the use of pharyngeal flaps, sphincteroplasty or posterior pharyngeal wall augmentation. It is important to note that 'Habit palsy' is transient postoperative VPI due to pain when the patient has altered pharyngeal muscle control during speech and swallowing. Failure to resolve shortly after surgery may necessitate speech therapy as well (1, 38, 43, 50)

CONCLUSIONS

1. The mean waiting time before ASTS in the study was 11.2 months with a median of 6 months and a range of 0.25 months (1 week) to 73 months.
2. Most ASTS cases are done by registrars and the complication rate is not affected by category of the surgeon doing the operation.
3. The overall complication rate after adenotonsillectomy is 33.8%. The complication rate of secondary haemorrhage which is the most feared complication is very low (0.7 %).
4. On average, adenotonsillectomy takes between 30 – 60 minutes.
5. Adenotonsillectomy can safely be done as day cases at KNH. This is because most ASTS cases are done by noon while most immediate post operative complications occur in the first 8 hour post operative period. Life threatening post operative complications post ASTS are rare. Day cases however, need to be observed for at least 4-8 hours post operatively before discharge. When doing day surgery for ASTS at KNH apart from the low serious complication rates one must also put into consideration proximity of the patients to good health facilities, availability of transport and the home circumstances of the child's family.
6. Female gender and age more than 6 years are associated with increased rate of odynophagia post ASTS.
7. Prolonged odynophagia is significantly associated with weight loss after ASTS due to inadequate intake of dietary nutrients.
8. Increase in level of education among parents had a corresponding increase in the rate of complications post ASTS. Educated parents/guardians therefore need thorough counselling regarding the expected complications post ASTS and how to avert them.

CONCLUSIONS

1. The mean waiting time before ASTS in the study was 11.2 months with a median of 6 months and a range of 0.25 months (1 week) to 73 months.
2. Most ASTS cases are done by registrars and the complication rate is not affected by category of the surgeon doing the operation.
3. The overall complication rate after adenotonsillectomy is 33.8%. The complication rate of secondary haemorrhage which is the most feared complication is very low (0.7 %).
4. On average, adenotonsillectomy takes between 30 – 60 minutes.
5. Adenotonsillectomy can safely be done as day cases at KNH. This is because most ASTS cases are done by noon while most immediate post operative complications occur in the first 8 hour post operative period. Life threatening post operative complications post ASTS are rare. Day cases however, need to be observed for at least 4-8 hours post operatively before discharge. When doing day surgery for ASTS at KNH apart from the low serious complication rates one must also put into consideration proximity of the patients to good health facilities, availability of transport and the home circumstances of the child's family.
6. Female gender and age more than 6 years are associated with increased rate of odynophagia post ASTS.
7. Prolonged odynophagia is significantly associated with weight loss after ASTS due to inadequate intake of dietary nutrients.
8. Increase in level of education among parents had a corresponding increase in the rate of complications post ASTS. Educated parents/guardians therefore need thorough counselling regarding the expected complications post ASTS and how to avert them.

They should also be educated about the importance of compliance with medications and/or advice given to them by the health care providers.

9. Hyper nasality (rhinolalia aperta) is an important phenomenon after ASTS. Pre operative evaluation of the patient's voice is important. When taking informed consent therefore, there is need to inform guardians about voice changes (hyper nasality) as a likely but less serious occurrence that should be expected.

RECOMMENDATIONS

1. It is safe to perform surgery of the adenoids and tonsils as day cases provided that the patients are observed for 4-8 hours after surgery for any complications. Those who develop complications during this observation period should then be converted to hospital stay cases (in patients). One should also consider proximity of the patients to good health facilities, availability of transport to the hospital and the home circumstances of the child's family.
2. Patient's especially females and those more than 6 years of age should be counselled for possible prolonged odynophagia and ensuing weight loss after ASTS.
3. Educated parents/ guardians should be advised on importance of compliance with medication and instructions/advice given to them by the health care providers in order to avert complications post ASTS. Further research with a bigger sample size is needed on this.
4. Further research needed with a bigger sample size to determine if the following factors affect complications post ASTS; comorbid medical conditions, duration of symptoms, waiting time before surgery, category of surgeon or anaesthetist, signs and symptoms at presentation and indication for surgery. The comorbid medical conditions include allergy, OSAS, malnutrition, Down's syndrome, asthma, cor pulmonale, sickle cell anaemia and diabetes mellitus among others.
5. Future studies with a bigger sample size and a long-term follow up of patients with voice changes/rhinolalia aperta are recommended to evaluate the various aspects of this phenomenon. These include its duration and whether it persists or not.

REFERENCES

1. Hibbert J. Tonsils and Adenoids. Scott-Brown's Paediatric Otolaryngology, 4th edition, Butterworth & Co. (publishers) Ltd. Copyright 1979, Reprinted 1984; Volume 6: 368-383.
2. Rosenfeld RM, Green RP. Tonsillectomy & adenoidectomy, changing trends. *Annals of Otorhinolaryngology* 1990; 99: 187-191.
3. Kendrick D & Gibbin K. An audit of the complications of paediatric tonsillectomy, adenoidectomy and adenotonsillectomy. *Clinical Otolaryngology* 1993; 18: 115-117.
4. Curtis JM. The history of tonsils and adenoid surgery. *Otol. Clin. North America* 1987; 20: 415-419.
5. Oburra HO and Idenya MP. Frequency of adenoidectomy in some Nairobi hospitals. *East African Medical Journal* 2001; 78 (7): 338-342.
6. Glenn Isaacson MD. Inside out complete Tonsillectomy: extended intracapsular Tonsillectomy for severe sore throat. *Annals of Oto, rhino, & laryngology* 2005; 114(10): 757-761.
7. Rusmussen N. Complications of adenoidectomy and tonsillectomy. *Oto. Clin. North America*, 1987; 20: 383-390.
8. Berkowitz RG, Zalzal GH. Tonsillectomy in children under three years of age. *Arch of Otolaryngology Head and Neck Surgery* 1990; 116: 685-686.
9. Tom IWC, Dediao RM, Cohen DE et al. Is outpatient tonsillectomy appropriate for young children? *Laryngoscope* 1992; 102: 277-280.
10. R.J. Last. *Anatomy: Regional and Applied*, Churchill Livingstone Medical Division of Longman group, Copyright 1984, reprinted 1988; 7th edition: pgs 38, 416-420.
11. Maniniglia AJ, Kushner H, Cozzi L. Adenotonsilectomy: a safe outpatient procedure. *Arch of otolaryngology Head and Neck surgery* 1989; 115: 92.
12. Guida RA, Mattucci KF. Tonsillectomy and adenoidectomy: an inpatient or outpatient procedure? *Laryngoscope*. 1990; 100: 491-493.
13. Mitchell RB, Preria KD, Friedman NR et al. Is it safe in children younger than 3 years? Outpatient adenotonsillectomy: *Arch Otolaryngology Head and Neck surgery* 1997; 123:681-613.

14. Lalakea ML, Marquez-biggs I, Messner A. Safety of paediatric short-stay tonsillectomy. Arch of Otolaryngology Head and Neck surgery 1996; 125: 749 -752.
15. Chiang TM, Sukis AE, Ross DE. Tonsillectomy performed on an outpatient basis. Report of a series of 40,000 cases performed without a death. Arch Otolaryngology 1968; 88:307-310.
16. Capper JW, Randall C. Post-operative hemorrhage in tonsillectomy and adenoidectomy in children. J. Laryngol Otolaryngology 1984; 98:363-365.
17. Crysedale W, Russel D. Complications of tonsillectomy and adenoidectomy in 9409 children observed overnight; CMAJ. 1986; 135:1139-1142.
18. Tewary AK, Barr GS, Bickerton RC. Parental preferences for duration of hospital stay following tonsillectomy: J. Laryngol Otolaryngol 1993; 107:709-710.
19. Shott S.R, Myer CM III, cotton R.T. Efficacy of tonsillectomy and adenoidectomy as an outpatient procedure; a preliminary report. Int. J. Paediatric. Otorhinolaryngol. 1987; 13:157-163.
20. Scloss MD, Tan AK, Schloss B et al. ENT tonsillectomy and adenoidectomy; complications and recommendations. INT. J Peadr. Otorhinolaryngol. 1994, 30:115-122.
21. Asaf T, Reuveni H, Yermiahu T, et al. The need for routine pre-operative coagulation screening tests (prothrombin time PT/Partial thromboplastin time PTT) for healthy children undergoing elective tonsillectomy and/or adenoidectomy. Int. J. Pediatr. Otorhinolaryngol. 2001; 61: 217-222.
22. Hellier W.P, Knight J, Hern J, T et al. Day case paediatric tonsillectomy: a review of three years experience in a dedicated day case unit. Clin. Otolaryngology 1999; 24:208-212.
23. Brown PM, Fowler F, Ryan R et al. ENT day surgery in England and Wales – an audit by the royal college of surgeons (Eng) Comparative Audit service. J. Laryngol. Otl. 1998; 112:161-165.
24. Panarese, Clarke RW, Yardley M P. Early post-operative morbidity following tonsillectomy in children: Implications for day surgery. J. Laryngol. Otl. 1999; 113: 1089-1091.

25. Kishore A, Haider-Ali AM, Geddes NK. Patient eligibility for day case paediatric adenotonsillectomy, *Clin Otolaryngol.* 2001; 26:47-49.
26. Postma DS, Folsom F. The case of an outpatient 'approach' for all paediatric tonsillectomies and /or adenoidectomies: a 4-year review of 1419 cases as a community hospital, *Otolaryngology. Head and neck surg.* 2002; 127:101-108.
27. Gabalski EC, Mattucci KF, Stezen M et al. Ambulatory tonsillectomy and adenoidectomy. *Laryngoscope* 1996; 106; 521-524.
28. Nicklaus PJ, Hezron FS, Steinle EWT. Short-stay out-patient tonsillectomy, *Arch Otolaryngol, Head Neck Surg.* 1995; 121: 521-524.
29. Helmus C, Grin M, Westfall R. Same-day-stay adenotonsillectomy, *Laryngoscope,* 1990; 100:593-596.
30. Tasmi TA, Parker SS, Taylor RE. Post-tonsillectomy bleeding: an evaluation of risk factors, *Laryngoscope.* 1987; 97:1307-1311.
31. Liu JH, Anderson KE, Willging JP et al Post tonsillectomy hemorrhage: What is it and what should be recorded? *Arch. Otolaryngol. Head and Neck Surg.* 2001; 127:1271-1275.
32. Randall DA., Hoffer ME. Complications of tonsillectomy and adenoidectomy, *Otolaryngol. Head Neck Surg.* 1998; 118: 61-68.
33. Carithers JS, Gebhart DE, Williams JA. Postoperative risks of paediatric tonsilloadenoidectomy. *Laryngoscope,* 1987; 97:422-429.
34. Shah C, Shahab R, Robb P. et al. Role of a home care team in paediatric day-case tonsillectomy, *J. Laryngol. Otl.* 2001; 115:39-43.
35. Rothschild MA, Catalano P, Biller HF. Ambulatory paediatric tonsillectomy and the identification of high risk sub-groups, *Otolaryngol. Head Neck Surg.* 1991; 110:203-210.
36. Waitrak BJ, Myer CM, Andrews TM. Complications of adenotonsillectomy in children under 3 years of age, *Am J. Otolaryngology.* 12: 170-172.
37. Leach JL, Manning S, Schaefer SD: Comparison of two methods of tonsillectomy. *Laryngoscope* 1993; 103:619.
38. Liane BJ, Ravandra GE Charles MM, Complications of adenotonsillectomy, *Laryngoscope.* 2002; 112.

39. Adam TR., Kazahaya K, Lawrence W et al. Revisiting out patient tonsillectomy in young children. *Otolaryngology Head and Neck Surgery* 2002; 28: 326-31.
40. Jeffrey P, Joseph DL. Post-tonsillectomy hemorrhage and paediatric emergency care. *Clinical Paediatrics* 2004; 43: 445-448.
41. Nikki M, Brian JA, Collin B et al. Day stay paediatric tonsillectomy-A safe procedure. *International Journal of Paediatric Otolaryngology* 2004; 68: 1367-1373.
42. Jose G, Pilar G, Villafruela M et al. Safety of outpatient tonsillectomy in children: A review of 6 years in a tertiary hospital experience. *Otolaryngology Head and Neck Surgery* 2004; 131: 383-387.
43. Drake, Amelia. Tonsillectomy. Copyright 2005, eMedicine. Com. Inc.
<http://www.eMedicine.com/ent/topic315.htm>
44. Jack LP, Charles D.KC, Beverly S. B et al. Tonsillectomy and Adenoidectomy for recurrent throat infection in moderately affected children. *Pediatrics* 2002; 110: 7-15.
45. Joseph Gigante. Tonsillectomy and Adenoidectomy. *Paediatrics in Review* 2005; 26(6): 199- 203.
46. John E McClay. Resistant bacteria in the adenoids: a preliminary report. *Archives of Otolaryngology Head and Neck Surgery* 2000; 126(5): 625-629.
47. George HZ, Robin TC. Pharyngitis and Adenotonsillar Disease. *Otolaryngology: Head and Neck Surgery*, Mosby-Year Book Inc. 2nd edition; 1993: 1180 – 1198.
48. Brian JW, Wooley AL. Pharyngitis and Adenotonsillar Disease, *Paediatric Otolaryngology: Head and Neck Surgery*, Mosby-Year Book Inc. 3rd edition; 1998:188 - 215
49. Statham MM, El*luru RG, Buncher R et al. Adenotonsillectomy for obstructive sleep apnea syndrome in young children: prevalence of pulmonary complications. *Arch Otolaryngol Head and Neck Surgery* 2006; 132(5): 476-480.
50. Wiatrak BJ and Woolly AL. Pharyngitis and adenotonsillar disease. *Paediatric Otolaryngology: Head and Neck Surgery*, Mosby-Year Book Inc. 3rd edition; 1998; pg 208.
51. Corliem M, Varkevisser, Indra P et al, Designing and conducting Health system research project. KIT publishers @ WHO Amsterdam. 2003 Vol.1: 215.

52. Akikatsu K, Yasuaki H. Tonsils: Recent progress in clinical and basic research, (Proceedings of the 3rd international symposium on tonsils Sapporo, Japan. 1995); Supplement 523.
53. Cowan DL and Hibbert J. Acute and chronic infection of the pharynx and tonsils. Scott-Brown's Otolaryngology (laryngology and head and neck surgery) Copyright 1997; 6th edition: pg 5/4/1-5/4/24.
54. Bluestone CD, Current indications for tonsillectomy and adenoidectomy, Ann Otol Rhinol laryngol. 1992; Suppl 155:58.
55. Goeringer GC, Vidic B. Embryogenesis and anatomy of waldeyer's ring. Otolaryngol. Clin. North Amer. 1987; 20: 207.
56. Wilhelm Meyer and the Adenoids. Arch Otolaryngology Head and Neck Surgery 1969; 90:383.
57. Bluestone C, Stool S, Kenna M. Tonsillectomy and adenoidectomy. Pediatric Otolaryngology 1996; Vol. 2, Chapter 5 pg.1054.
58. Haberman RS, Shattuck TG, Dion NM. Is outpatient suction cautery tonsillectomy safe in community hospital setting? 1990; 100: 511-515.
59. Masinde PW. Indications and complications of adenoidectomy and tonsillectomy at Kenyatta National Hospital. M med ENT H&N Surgery thesis. University of Nairobi, 1992: 53-62.
60. Handler SD, Miller L, Richmond KH et al, Post tonsillectomy hemorrhage incidence, prevention and management, Laryngoscope, 1986; 96: pg 1243-1247.
61. Brown KA, Morin I, Manoukian JJ et al. Urgent adenotonsillectomy: an analysis of risk factors associated with postoperative respiratory morbidity; International Journal of Pediatric Otorhinolaryngol. 2003; 67(7): 847-851.
62. Macharia IM. Adenotonsillectomy editorial, East African medical journal. 2001; 78(7): 337.
63. Klug TE, Ovesen T. Post tonsillectomy hemorrhage: incidence and risk factors. Ugeskr laeger. 2006; 168(26-32):2559-2562.
64. Kalra m, Buncher R, Amin RS. Asthma as a risk factor for respiratory complications after adenotonsillectomy in children with obstructive breathing during sleep. Ann Allergy Asthma Immunology 2005; 94 (5): 549-552.

65. Schez LE, Schez LB, Pozo Rodriguez C et al. Complications of adenotonsillectomy, An. Otorrinolaringol Ibero Am. 2006; 33(2): 193-201.
66. Olsen WL, Jeffrey jr RB, Sooy CD et al, Lessons of the head and neck in patients with AIDS: CT and MR findings. AJR Am J Roentgenol 1988; 151:785-790.
67. Kraus DH, Dehm SJ, Orlowski JP et al. Upper airway obstruction due to tonsillar lymphadenopathy in human immunodeficiency virus infection. Arch. Otolaryngology Head and Neck Surg. 1990; 116:738-740.

65. Schez LE, Schez LB, Pozo Rodriguez C et al. Complications of adenotonsillectomy, *An. Otorrinolaringol Ibero Am.* 2006; 33(2): 193-201.
66. Olsen WL, Jeffrey jr RB, Sooy CD et al, Lesions of the head and neck in patients with AIDS: CT and MR findings. *AJR Am J Roentgenol* 1988; 151:785-790.
67. Kraus DH, Dehm SJ, Orłowski JP et al. Upper airway obstruction due to tonsillar lymphadenopathy in human immunodeficiency virus infection. *Arch. Otolaryngology Head and Neck Surg.* 1990; 116:738-740.

APPENDIX I

GENERAL PATIENT INFORMATION AND CONSENT FORM

General patient information

We would like to seek your consent to participate in a study aimed at understanding the various aspects of the complications resulting from adenoid and tonsil surgery. This will include the rate, timing and the various risk factors associated with these complications. This would help us know the feasibility of having these operations done as day cases in future without compromising the safety of the patients.

How to participate

1. We will ask you questions seeking to know how the disease started, investigations done, any treatment given and the response to it.
2. We shall record any findings of examinations done, any investigations done for diagnosis and for surgery and the type of surgery done.
3. We shall monitor your progress closely during and after surgery (in the ward) and note any complications that may occur. In case of any complications these will be managed accordingly. We shall review the patients 2 weeks after discharge at the clinic to monitor their progress.
4. Similar findings from all the participants will be used to compute the rate, timing and the factors associated with the complications arising from these procedures.

How does your participation affect you?

It does not adversely affect you in any way because;

1. You will receive the same treatment you would receive without participating in the study.
2. No treatment will be given to you in addition to what you require and you would ordinarily get were you not participating in the study.
3. All information given will be confidential.

Are there any hidden dangers?

1. Not at all.
2. Refusing to consent will not affect the management you receive either.

How does your participation help us?

1. Yes. The findings from the study will help us improve management of similar patients in future.
2. We shall share the findings of the study with other professional colleagues elsewhere. Thus the findings can be published in scientific journals or be presented at scientific conferences.
3. You are free to discuss this with family members and we shall be ready to answer any questions raised. If you understand everything said and has accepted it then you can sign the consent form provided.

CONSENT FOR STUDY

Consent for patients less than 18 years:

I Mr/Mrs/Mss.....the parent/guardian of master/miss.....agree to enrol him/her into the study as explained to me by Dr..... My signature is confirmation that I have understood the nature of the study and that whatever information that I give will remain confidential.

I also confirm that no monetary or material gains have been promised or given to me for participating in the study.

Signed.....Relationship.....Date.....

Signature of principle investigator.....Date.....

Consent for patients more than 18 years:

I Mr/Mrs/Mss.....agree to enrol into the study as explained to me by Dr..... My signature is confirmation that I have understood the nature of the study and that whatever information that I give will remain confidential.

I also confirm that no monetary or material gains have been promised or given to me for participating in the study.

Signed.....

Date.....

Signature of principle investigator.....Date.....

MAELEZO YA UTAFITI KWA MGONJWA NA KIBALI CHA UTAFITI

Tungependa kukuomba ruhusa (kwa hiari yako) kukuhusisha kwenye utafiti huu. Utafiti huu ni juu ya madhara yanayoweza kutokana na upasuaji huu. Kutokana na utafiti huu tutafaidaka kwa kuwa tutaweza kujua madhara yatokanayo na upasuaji huu. Tutaweza pia kujua ni nini kinachosababisha madhara haya na ni njia gani zinazoweza kutumiwa kudhuia au kukabiliana na madhara haya. Dhidi ya hayo tutaweza kujua iwapo kwa siku za usoni tunaweza kufanya upasuaji huu bila kuladha wangonjwa kwenywe hospitali bila matatizo yoyote.

JINSI YA KUSHIRIKI

1. Tutakuuliza maswali kutaka kujua ni lini ugonjwa ulianza na ni matibabu gani uliyopewa na kama ilikusaidia au la.
2. Tutakupima na kurekodi ugonjwa ulio nao na kujua ni upasuaji gani utakayofaywa.
3. Baada ya upasuaji tutakutunza vilivyo kwenye wadi na kuwa macho na iwapo kutatokea madhara yoyote itatibiwa papo hapo. Baada ya kupewa ruhusa ya kwenda nyumbani, tutakuuliza urudi kwenye kliniki baada ya wiki mbili kama ilivyo kawaida ili tukupime na kujua iwapo unaendelea vyema.

4. Habari hii itakusanywa kutoka kwa watu wengi walio na shida kama yako na itatumiwa kujua zaidi juu ya upasuaji huu na ni nini kinachoweza kufanywa kuzua au kutibu madhara haya.

KUSHIRIKI KUNAKUDHURU VIPI?

Hakukudhuru kwa njia yoyote ile.

1. Utapata matibabu sambamba na wale wasioshiriki.
2. Hakuna chochote utakachopewa kukushawishi kushiriki kwenye utafiti huu.
3. Habari yoyote utakayotoa itawekwa kwa siri.

KUNA MADHARA YOYOTE ULIOFICHWA YANAYOWEZA KUTOKANA NA UTAFITI HUU

1. La hasha.
2. Hata kukataa kushiriki hakutabadili matibabu utakayopewa.

KUSHIRIKI KWAKO KUTATUFAIDI VIPI?

1. Kushiriki kwako ni muhimu kwa sababu matokeo ya utafiti huu itatusadia kujua jinsi ya kudhuia au kutibu madhara yanayotokana na upasuaji huu kwenye siku za usoni.
2. Matokeo haya yatatumika hata na madaktari wenzetu walioko kwengineko.
3. Uko huru kujadiliana na watu wa familia yako kabla ya kukubali kushiriki na maswali yoyote mutakayouliza yatajibiwa.

Iwapo umeelewa maelezo haya yote vizuri na umekubali kushiriki basi utatia sahihi kwenye kibali cha utafiti kudhibitisha ya kwamba umekubali.

KIBALI CHA UTAFITI

Watoto chini ya miaka 18:

Mimi, Bi/ Bwana.....mzazi wa.....

Nimekubali kuandikishwa kwa utafiti huu baada ya kuelezwa na daktari
.....

Sahihi yangu ni thibitisho ya kwamba nimeelewa umuhimu wa utafiti huu na kwamba habari yoyote nitakayotoa itawekwa kwa siri.

Pia nathibitisha ya kwamba sijapewa au kuhahidiwa pesa au chochote kile kwa kukubali kushiriki kwenye utafiti huu.

Sahihi.....Uhusiano.....Tarehe.....

Sahihi ya mtafiti.....Tarehe.....

Watu wazima/zaidi ya miaka 18:

Mimi, Bi/ Bwana.....nimekubali kuandikishwa kwa utafiti huu baada ya kuelezwa na daktari

Sahihi yangu ni thibitisho ya kwamba nimeelewa umuhimu wa utafiti huu na kwamba habari yoyote nitakayotoa itawekwa kwa siri. Pia nathibitisha ya kwamba sijapewa au kuhahidiwa pesa au chochote kile kwa kukubali kushiriki kwenye utafiti huu.

Sahihi.....Uhusiano.....Tarehe.....

Sahihi ya mtafiti.....Tarehe.....

APPENDIX II

QUESTIONNAIRE

DEMOGRAPHIC DATA

DATE : STUDY NO :

HOSPITAL IP. NO:

AGE :years SEX (tick): () male () female

CONTACT ADDRESS:

P.O. BOX:

TELEPHONE NO:

MOBILE TEL. NO:

Weight: Kilograms Height :Meters

% of weight for age:

Vital signs: Temp:^oc. RR: /min. PR..... /min. BP:..... / ...mmHg.

SOCIAL ECONOMIC STATUS ASSESMENT: (Appendix III)

RESIDENCE : Estate :
Town :
District :
Province :

PARENT/GUARDIANS'

OCCUPATION: (tick)

Score

- 1) a) Unemployed ()
b) Peasant farmer ()
c) Petty trader (hawker) ()
d) Casual worker ()
e) Housewife ()
f) Student ()
g) Servant ()
h) Artisan ()
i) Other (specify) ()

3) Professional (tick)

- a) Doctor ()
companies

score

- 2) a) Clerk ()
b) Carpenter ()
c) Mason ()
d) Kiosk owner ()
e) Other (specify).....

- 4) a) Businessman(owners of
etc) ()

- b) Lawyer ()
- c) Engineer ()
- d) Teacher ()
- e) Priest ()
- e) Other (specify).....

Average monthly income ksh.....

EDUCATION LEVEL (tick)

Score

- 1 0-primary school ()
- 2 Secondary school ()
- 3 Middle-level college ()
- 4 University ()

HOUSING:

Score	<u>TYPE</u>		<u>NO OF ROOMS</u>
1	Rental	()	
2	Temporary structures	()
3	Semi-permanent	()
4	Permanent	()

CLINICAL DETAILS

1. Date the patient first presented to KNH :

2. Department the patient first presented to:

ENT () CASUALTY () PEDIATRICS () OTHER () (specify)

3. SYMPTOMS & SIGNS AT PRESENTATION

	YES	NO	Duration (Months)
a) Nasal airway obstruction	()	()
b) Snoring	()	()
c) Mouth breathing	()	()
d) Sleep apnea or sleep disturbances	()	()
e) Dysphagia	()	()
f) Failure to thrive	()	()
g) Speech abnormalities	()	()
h) Hearing loss	()	()
i) Ear discharge	()	()
j) Recurrent throat infections	()	()
k) Rhinorrhoea/nasal discharge	()	()
l) Heart disease	()	()
m) Craniofacial growth abnormalities	()	()
n) Dental malocclusion abnormalities	()	()
o) Halitosis/foul breath	()	()

- p) Chronic persistent fever/HOB () ()
- q) Tender cervical adenitis/neck masses () ()
- r) Febrile convulsions () ()
- s) Peritonsillar abscess () ()
- t) Enlarged tonsils () ()
- u) Others (specify) () ()

HISTORY OF COMORBID CONDITIONS:

- | | Yes | No |
|-----------------------|-----|-----------|
| a) Allergy (specify) | () | () |
| b) Bleeding disorders | () | () |
| c) Heart disease | () | () |
| d) Asthma | () | () |
| e) OSAS | () | () |
| f) DM | () | () |
| g) HIV | () | () |
| h) Down's syndrome | () | () |
| i) Malnutrition | () | () |
| j) Others (specify) | () | () |

6. EXAMINATION FINDINGS:

General examination:

- a) Normal () b) Pallor () c) dehydration () d) lymphadenopathy ()
- e) Others (specify) ()

ENT EXAM:

- A) Ear: a) normal () b) OME () c) AOM () d) CSOM () e) other (specify) ()

- B) Nose: a) Normal () b) HIT () c) rhinorrhoea () d) other ()
- specify.....

- C) Throat: a) Normal () b) TH-inflamed () c) TH-not inflamed ()
- d) Other () (specify).....

OTHER SYSTEMS:

- a) Respiratory system: a) normal () b) Infected/pneumonia () c) other ()
- specify.....

- b) CVS: a) normal () b) cor- pulmonale () c) other ()
- specify.....

- c) Others systems (specify):

7. Investigations done for purposes of:

A) DIAGNOSIS:

	YES	NO
Lateral neck x-rays		
CXR		
CT scan of Para nasal sinuses		
Others (specify)		

B) SURGERY:

	YES	NO
Full Haemogram		
U/E		
Others (specify)		

8. TYPE OF SURGERY DONE:

Type	Date	Time	Indication
ASTS			

Indication for the surgery:

AH:

TS:

9. Duration of surgery: hours: minutes.....

10. Category of surgeon. (Tick)

- a) SHO 2nd yr ()
- b) SHO 3rd Yr ()
- c) SHO 4th Yr ()
- d) Consultant < 5yrs ()
- e) Consultant 5 -10 yrs ()
- f) Consultant >10 yrs ()

11. Category of the anesthetist (tick)

- a) SHO 1st yr ()
- b) SHO 2nd Yr ()
- c) SHO 3rd Yr ()
- d) Consultant < 5yrs ()
- e) Consultant 5 -10 yrs ()
- f) Consultant >10 yrs ()
- g) RCO anesthetist ()

12. ASA classification of patient before surgery:

- ASA I ()
- ASA II ()
- ASA III ()
- ASA IV ()

13. Duration of anesthesia: hours minutes.....

14. COMPLICATION(S) OF SURGERY:

a). Intra-operative:

Complication	YES	NO
Excessive Hemorrhage		
Fever		
Vomiting		
Tube kinking		
Accidental extubation		
Loss of teeth		
STI/trauma (specify)		
Others (Specify)		

Details of complications:

Hemorrhage-amount of blood lost:mls

Fever :°c

Vomiting :.....no of times.

Other (specify) :.....

b) Post-operative complications encountered and their timing:

Complication Occurrence	Hemorrhage	Fever	Odynophaga	Dehydration	Others (Specify)	None
Timing (hours)						

Specify :

Hemorrhage-amount of blood lost:mls

Fever :°c

Vomiting :.....no of times per day

Dehydration (tick) **DAY 0** mild () moderate () severe ()

(Refer to chart) **DAY 1** mild () moderate () severe ()

DAY 2 mild () moderate () severe ()

Other (specify):.....

Duration of odynophagia before starting to feed on:

Liquid food :hoursdays

Semi-solid food:days

Solid food :days

15. DISCHARGE DETAILS:

Date:

Medications given: YES () NO ()

Name and dosage:

If yes, specify: a) antibiotics YES () NO ().....

b) Analgesics YES () NO ().....

Advice/instructions given on discharge: YES () NO ()

If yes, specify :

16. Follow up in 2 weeks:

Weight: Kilograms

Wight loss: yes () no ()

If yes specify no of kilograms lost:kgs

Any reported complications; (specify number of days from day of surgery)

	Yes	No	No. of Days
a) Hemorrhage	()	()
b) Odynophagia	()	()
c) Vomiting	()	()
d) Dehydration	()	()
e) Voice Changes	()	()
f) No improvement in symptoms	()	()
g) Fever/infection	()	()
h) Others (specify)	()	()

.....
.....

Examination findings:

GENARAL EXAM:

a) Normal () b) Pallor () c) dehydration () d) lymphenopathy ()

e) Others (specify) ()

ENT EXAM: ENT EXAM:

A) Ear: a) normal () b) OME () c) AOM () d) CSOM () e) other (specify) ()
.....

B) Nose: a) Normal () b) HIT () c) rhinorrhoea () d) other ()
specify.....

C) Throat: a) Normal () b) other () (specify).....

SURGEON'S FORM

1. Category of surgeon (tick)

a) SHO 2nd yr ()

b) SHO 3rd Yr ()

c) SHO 4th Yr ()

d) Consultant < 5yrs ()

e) Consultant 5 -10 yrs ()

f) Consultant >10 yrs ()

2. Indication for ASTS (tick):

TS: UAO ()

Recurrent acute tonsillitis ()

Chronic tonsillitis ()

Quinsy ()

AS: UAO ()

purulent adenoiditis ()

OME ()

CSOM ()

Other (specify) () other(specify) ()

3. **Duration of surgery:** Hours..... Minutes.....

4. **Method used to achieve hemostasis (tick)**

- a) Gauze packs ()
- b) Diathermy (bipolar) ()
- c) Diathermy (monopolar) ()
- d) Other (specify) ()

5. **Amount of blood lost:**

No of soaked gauze swabs:

Amount of blood in suction receiver:mls

Total blood loss:mls

6. **Any complications encountered**

Intraoperative

- a) Hemorrhage ()
- b) Fever ()
- c) Odynophaga ()
- d) Dehydration ()
- e) Vomiting / aspiration ()
- f) Trauma to soft tissues ()
- g) Loss of teeth ()
- h) Death ()

Postoperative

- a) Hemorrhage ()
- b) Fever ()
- c) Airway obstruction ()
- d) Dehydration ()
- e) Vomiting / aspiration ()
- f) Trauma to soft tissues ()
- h) Death ()

ANASTHETIST'S FORM

- 1. Category of anesthetist:**
a) SHO 1st yr () d) Consultant < 5yrs ()
b) SHO 2nd Yr () e) Consultant 5 -10 yrs ()
c) SHO 3rd Yr () f) Consultant >10 yrs ()
g) RCO anaesthetist ()
- 2. ASA classification of patient before surgery:**
ASA I ()
ASA II ()
ASA III ()
ASA IV ()
- 3. Duration of anaesthesia: hours minutes.....**
- 4. Any complications encountered:**
- | <u>At intubation</u> | <u>specify</u> | <u>intra operative</u> |
|--------------------------|----------------|---------------------------|
| Trauma () | | vomiting/aspiration () |
| Difficult intubation () | | fever () |
| Loss of teeth () | | shock (hemorrhage) () |
| Bleeding () | | dehydration () |
| Aspiration () | | tube kinking () |
| | | Accidental extubation () |
| | | Trauma () |
| | | Loss of teeth () |
| | | Death () |
| | | Others (specify) () |

COMPLICATIONS REPORT FORM Patient study no:.....

This form will be filled by the patients or their parents/guardians at home and bring it to the researcher on their first review date.

- Complication (tick)**
- Bleeding/hemorrhage ()
Vomiting ()
Taste disturbances ()
Pain on swallowing (odynophagia) ()
Voice changes ()
Fever/infection ()
Other (specify)..... ()

APPENDIX III

SEVERITY OF MALNUTRITION

STUNTING AND WASTING - CHILDREN

Grade of malnutrition	Weight for age (Wasting)	Height for age (Stunting)
0, Normal	>90	>95
1, Mild	>75-90	90-95
2, moderate	60-74	85-89
3, Severe	<60	<85

Values represent percentage of median for age and height.

Normal expected weight $W = 2x + 8$ Normal expected height $H = 6x + 77$
 where x= age in years.

Assessment of malnutrition in adults

By use of the BMI (Body Mass Index) = $\frac{\text{weight in kgs}}{\text{Height in meters}^2}$

<18.5	- underweight
18.5-24.9	- normal
25-29.9	- overweight
>30	- obese

2. ASSESMENT OF THE DEGREE OF DEHYDRATION

Clinical evaluation of dehydration will be used according to WHO guidelines in the table below.

Clinical Findings of Dehydration Assessed (Adapted From WHO)

SIGNS AND SYMPTOMS	DEGREE OF IMPAIRMENT		
	None or mild (3-5%)	Moderate (7-10%)	Severe (10-15%)
General condition infants	Thirsty, alert, restless	Lethargic or drowsy Alert; postural dizziness	Limp; cold, cyanotic extremities; may be comatose
Older children	Thirsty, alert, restless		Apprehensive; cold, cyanotic extremities; muscle cramps
Quality of radial pulse	Normal	Thready or weak	Feeble or impalpable
Quality of respiration	Normal	Deep	Deep & rapid
Skin elasticity	Pinch retracts immediately	Pinch retracts slowly	Pinch retracts very slowly (>2sec)
Eyes	Normal	Sunken	Very sunken
Tears	Present	Absent	Absent
Mucous membranes	Moist	Dry	Very dry
Urine output (by report of patient)	Normal	Reduced	None passed in many hours

4. ASSESSMENT OF HEMORRHAGE

It is difficult to quantify hemorrhage intraoperatively but the amount of blood lost during surgery will be estimated by counting the number of tonsil swabs soaked with blood plus the amount of blood in the suction receiver.

Some surgeons have their tonsil packs completely soaked with blood before changing them while others don't hence it is difficult to quantify hemorrhage using this method. Before commencement of this study the surgeons will be asked to make sure that a pack

is completely soaked with blood before using another pack. One tonsil swab that is completely soaked with blood is estimated to contain 10mls of blood.

In children it is approximated that each kilogram of the body weight contains 75mls of blood and loss of 10% of the blood volume or more is considered significant blood loss and should be treated by blood transfusion.

The amount of blood lost during surgery will also be correlated with the various factors considered to be associated with complications arising from adenotonsillar surgery.

Any postoperative bleeding (primary or secondary) will be considered as a complication (hemorrhage) if the patient requires intervention to control the bleeding.

Patients requiring a postnasal pack to be left in situ to be removed in the ward postoperatively will be considered to have hemorrhage as a complication.

5. SOCIOECONOMIC STATUS ASSESSMENT

The following 4 variables will be considered:-

A) **Residence:-** This will be grouped into the following 4 categories and scored from 1-4 as shown below:-

Score

- 1 SLUMS e.g. kibera, mathare, kawangware, kangemi, gorogocho, mukuru etc
- 2 CITY COUNCIL LOW CLASS ESTATES e.g. Jericho, bahati, ziwani, kaloleni, umoja, shaurimoyo, kariobangi, mathare south etc
- 3 MIDDLE CLASS ESTATES e.g. buruburu, komarock, outer ring, imara daima, langata etc
- 4 HIGH CLASS ESTATES e.g. Karen, lavington, kileleshwa, muthaiga, gigiri, runda etc

B) **Occupation:** - The kind of work one does will be recorded, stratified and given a score from 1-4 as indicated above.

C) **Education:** –This will be scored from 1-4 as indicated in the questionnaire.

D) **Housing:** – This will be scored from 1-4 as indicated in the questionnaire.

After analysing the scores, the socioeconomic status of an individual will be stratified as follows:

Total score	Socioeconomic status
≤ 4	low
5-12	middle
13-16	high

APPENDIX IV

SURGICAL TECHNIQUE

ADENOTONSILLECTOMY

This is surgery done to remove both the adenoids and the palatine tonsils.

PREOPERATIVE DETAILS.

History. This is important for the diagnosis of adenoid and tonsillar hypertrophy as explained in the indications for ASTS in the background above. One also needs to rule out any history of bleeding or coagulation disorders which may predispose the patient to intraoperative or postoperative hemorrhage. The patients' speech history is also important as some patients may develop hypernasal or hyponasal speech after adenoidectomy (1).

In addition, the patients should be evaluated for anesthetic intolerances, obstructive sleep apnea and their general well being (43, 48).

Physical examination. A complete physical examination is also important before surgery. This involves a complete ENT-HN examination to rule out signs of true or sub-mucous cleft palate. Any signs of obvious craniofacial syndromes such as Treacher-Collins, Pierre robin, velocardiofacial syndrome and Down's syndrome should be noted. Preoperative hyper- or hyponasal speech, neuromuscular abnormalities and the condition of the teeth are assessed. A nasoendoscopy may be used to examine the postnasal space for hypertrophied adenoid tissue (1, 48). Systemic examination is done to rule out complications of ATH and any co-morbid conditions. Underlying cardiac abnormalities may be ruled out on systemic examination. Needless to say, a full physical examination is mandatory as this may reveal significant associated findings (1, 43, 48).

Radiological investigations. A lateral view plain x-ray of the postnasal space soft tissues is routinely done for the diagnosis of AH. From this, one can tell the size of the adenoid tissue relative to the nasopharynx and whether the adenoid tissue is completely obstructing the airway or not. If the lateral neck x-ray is negative, then one can go ahead and do examination under anesthesia (EUA) to assess the size of the adenoid tissue (1). Computed tomography (CT) scans and magnetic resonance imaging (MRI) are done for tonsillar masses suggestive of malignancy. MRI arteriography may be of value if there is

pulsation so close to the tonsil so as to check for an aberrant internal carotid artery that may be a source of fatal hemorrhage (1, 43).

Laboratory investigations. These include a full haemogram and urea and electrolytes which must be within normal limits. A hemoglobin level of less than 10g% precludes surgery and warrants investigations to find out the cause of the anemia and treat it before surgery. Similarly raised or depressed white blood cell count and platelets should be investigated before surgery as diseases such as lymphoma and leukaemia may also manifest with adenoid and tonsillar hypertrophy. Depressed platelet levels may occur in patients infected with Human immunodeficiency virus (HIV) and may thus warrant screening of these patients before surgery. A coagulation screen may also be necessary in patients with a history suggestive of a bleeding disorder (21). This includes haematological tests such as activated partial thromboplastin time (aPTT), platelet count, prothrombin time and bleeding time for inherited or acquired coagulation disorders such as haemophilia, von willebrands disease and thrombocytopenia (21,31).

Another investigation that may be done includes checking for antibodies for streptolysin –O (ASLO) which can be studied as a possible indication for tonsillectomy. Streptolysin-O is a toxin produced by Group A beta hemolytic streptococcus (a hemolysin) and is believed to be responsible for rheumatic heart disease. ASLO are the antibodies produced against this toxin and are believed in some instances to cross-react with the patient's own tissues of the heart leading to an endocarditis or myocarditis. However the incidence of acute rheumatic fever following streptococcal tonsillitis is variable and in 1950 was 2% if the tonsillitis was not treated and 0.3% if it was treated with penicillin (1). The likelihood of a second attack of rheumatic fever is about 60%but this reduces to 4% if one is put on long term prophylactic penicillin or sulphonamides. Tonsillectomy does not affect the recurrence rate of rheumatic fever in patients put on adequate antibiotic prophylaxis and thus has no place in management of this condition. Tonsillectomy is however advised in children who can't take antibiotic prophylaxis for a long time but it should be noted that TS does not eliminate future streptococcal infections. TS also has no place in the management of post-streptococcal acute glomerulonephritis (AGN) as this condition does not recur after a single attack but the effects of an attack may be longstanding (1, 43, 44, 48).

Informed consent. This is mandatory before surgery. The patient needs to be educated about the procedure, the expected outcome and the possible complications of the procedure being done.

INTRAOPERATIVE DETAILS

1. ADENOIDECTOMY

This is the surgical removal of the pharyngeal tonsils (adenoids).

There are several known surgical methods for removing the adenoids (1, 43). Transoral excision is the commonest route used for adenoidectomy and is normally done under general anesthesia. In this procedure a Boyle-Davis mouth gag is used to open the mouth and retract the tongue. The throat is packed with wet gauze to prevent aspiration of blood and secretions. Using a pillar retractor, the soft palate is retracted and a mirror may be used to view the adenoid tissue in the nasopharynx or this could simply be palpated with a finger. Through this approach several instruments may be used depending on their availability and the surgeon's preference.

Cold surgical techniques are in common use and these include:-

Adenoid curette: This is the standard and conventional method. The adenoids are removed using the sharp edged blade of the curette after placing it in position in the nasopharynx. Various curette sizes are available for the various sizes of the nasopharynxes. Hemostasis is achieved by pressure packing, electrocautery or both. This is the method used in this study.

Adenoid punch: This is a curved instrument with a chamber that is placed over the adenoids. The chamber is closed and a knife blade surgically removes the adenoids which are deposited in the chamber and removed with the instrument. Hemostasis is achieved by the use of dry gauze packs or diathermy.

Electrocautery with a suction bovie: This method is used for removing or shrinking the adenoid tissue. The suction bovie has a hollow centre to suction blood and a rim of metal contact for coagulation. This instrument can be set for pure coagulation or for both coagulation and sucking. It is time consuming as the suction may require frequent cleaning due to blockage.

Surgical microdebrider: This may be used although it is expensive and is thus not commonly used in developing countries.

Laser: Laser for adenoidectomy has also been described. This technique is associated with nasopharyngeal scarring and is best avoided.

Excision though the nose is uncommon but is sometimes used by some surgeons using the surgical microdebrider in this position. Bleeding is controlled by packing or by suction cautery. Macgill's forceps can be used to remove residual adenoid tissues deep in the choana or the posterior nasal cavity after attempted removal with a curette or adenoid punches.

2. TONSILLECTOMY

This is defined as the surgical excision of the lymphoid tissue that forms the palatine tonsils.

In theatre the patient is placed on the operating table in a supine position with the neck extended. The patient is then put under general anesthesia and a Boyle-Davies mouth gag used to open the mouth wide to allow adequate view and access to the palatine tonsils. The mouth gag is also used to hold the endotracheal tube in place away from the surgical field. The throat is packed using wet gauze (throat pack) to prevent aspiration of blood, secretions and abdominal contents which may lead to respiratory compromise. A tonsil holding forceps is applied to allow traction of the tonsil during dissection. Incision of anterior tonsillar pillar is done. The tonsillar capsule is identified then the superior tonsillar pole is released. Blunt extra-capsular dissection is done and finally transection of the inferior pole of the tonsil is done to achieve a complete tonsillectomy (6).

There are various methods used for dissection during tonsillectomy. This includes the use of the cold steel such as scissors or curettes, monopolar cautery, bipolar cautery with or without a microscope, radiofrequency ablation or coblation which can be used to shrink tonsils. Other rare dissection methods include the use of a harmonic scapel with vibrating titanium blades and the use of powered instruments such as the microdebrider for an intracapsular technique (43). For the purposes of this study the blunt dissection technique (cold steel) will be used.

Variations in hemostasis methods include pressure with gauze for several minutes, use of bismuth subgallate, ligatures and at times the use of suction cautery, bipolar or

monopolar cautery. One should be cautious not to touch the metallic mouth gag with the cautery forceps when using monopolar cautery as these could lead to burning of the normal tissues for which cautery was not intended (30, 32, 40).

POSTOPERATIVE DETAILS

It is very important to give adequate analgesia in the postoperative period for pain. Inadequate analgesia is associated with prolonged refusal to eat which may lead to complications such as dehydration and weight loss (1). Maintenance of good hydration is also important and can be achieved by giving oral fluids and intravenous fluids to those who can not take orally. Soft foods are easier to swallow than hard food in the immediate postoperative period due to odynophagia that may be experienced by these patients. The use of antibiotics has also been shown to have improved outcomes in both adults and children (43). Patients should be advised to avoid smoking which may predispose them to infections and a delayed healing process. They should also avoid heavy lifting and exertion for a period of about 2 weeks for the same reasons. In addition the patients should be warned that pain will abate during the first 3-5 days then increase for 1-2 days before completely disappearing. This is the period the eschar formed on the healing wound sloughs off to allow healing by secondary intention (granulation tissue formation) (48, 52).

The first postoperative follow-up visit is ideal in 5-8 days during the second peak of pain. Reassurance is adequate during this visit. The second visit is in 4-6 weeks after surgery to monitor symptoms resolution. For this a follow-up phone call may be adequate although the decision of the follow up method is dependent on the patient and the surgeon (1, 43, 48).

APPENDIX V

APPROVAL LETTER



KENYATTA NATIONAL HOSPITAL

Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP", Nairobi.
Email: KNHplan@Ken.Healthnet.org

Ref: KNH-ERC/ 01/ 3994

15th December 2006

Dr. Henry Ngoitsi Nono
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Ngoitsi

**RESEARCH PROPOSAL: "DETERMINANTS OF EARLY COMPLICATIONS OF
ADENOTONSILLECTOMY."** (P264/11/2006)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your above cited research proposal for the period 15th December 2006 – 14th December 2007.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A N GUANTAI
SECRETARY. KNH-ERC

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Surgery, UON
Supervisor: Dr. H. Oburra, Dept. of Surgery, UON

UNIVERSITY OF NAIROBI
MEDICAL LIBRARY

APPENDIX V

APPROVAL LETTER



KENYATTA NATIONAL HOSPITAL

Hospital Rd. along, Ngong Rd.

P.O. Box 20723, Nairobi.

Tel: 726300-9

Fax: 725272

Telegrams: MEDSUP, Nairobi.

Email: KNHplan@Ken.Healthnet.org

Ref: KNH-ERC/ 01/ 3994

15th December 2006

Dr. Henry Ngoitsi Nono
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Ngoitsi

**RESEARCH PROPOSAL: "DETERMINANTS OF EARLY COMPLICATIONS OF
ADENOTONSILLECTOMY."**

(P264/11/2006)

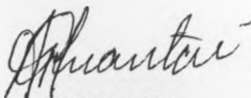
This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your above cited research proposal for the period 15th December 2006 – 14th December 2007.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely



PROF A N GUANTAI
SECRETARY, KNH-ERC

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Surgery, UON
Supervisor: Dr. H. Oburra, Dept. of Surgery, UON

UNIVERSITY OF NAIROBI
MEDICAL LIBRARY