



East and Central Africa Journal of Otolaryngology, Head and Neck Surgery

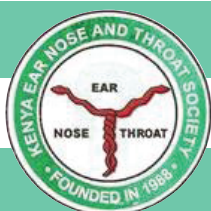
July, 2020

ISSN 2664-0376

Volume 4, No. 2

Contents

Editorial: Challenges of otolaryngology practice in the Covid-19 era <i>Gikonyo M</i>	1
Editor's note: Making a life <i>Gitonga S</i>	2
Epstein barr-virus and human papillomavirus co-infection in nasopharyngeal carcinoma patients at Kenyatta National Hospital, Kenya <i>Aswani JM, Anzala O, Mwang'ombe JN</i>	3
Effect of the starkey hearing foundation phase 4 intervention on speech, language and audition on pupils living with hearing impairment in Kochi; a quasi controlled trial <i>Lawal L, Buttars C, Prem Nair, Pillai S, Sarath PV, Larsen J</i>	8
Nonvascular anatomical variants of temporal bone as depicted on high resolution computed tomography done in Nairobi, Kenya <i>Onyango S, Mugwe P, Thinwa J</i>	17
Knowledge and practices of tracheostomy care in Kenyatta National Hospital: clinical audit <i>Mokoh L, Gitonga S</i>	25
Hypopharyngeal cancer in an adolescent maasai male: an unusual case report <i>Chumba U, Okerosi S, Gitonga S</i>	29
Novel technique for tongue suspension: a case report <i>Musyoka DM</i>	32
How businesses have kept afloat during Covid-19 and lessons learnt from the pandemic <i>Steve Muga</i>	36
Peer reviewers of the issue	40
Authors guidelines	41



Published by Kenya Ear Nose & Throat Society (KENTS)

Editorial Board

Editor-in-Chief

Dr. Sophie Gitonga, MBChB, MMed (ENT), Kenyatta National Hospital and Nairobi

Assistant Editor

Dr. Peter Ochungo, MBChB, MMed (ENT), Makueni Referral Hospital and Hope ENT Clinic

Members

Dr. Samuel Nyagah, MBChB, MMed (ENT), Kenyatta National Hospital and Nairobi
Ear Nose and Throat Clinic, Nairobi, Kenya

Dr. Cyrus K Gakuo, MBChB, MMed (ENT), Jomo Kenyatta University of Science &
Technology and Prodigy Ear Nose and Throat Clinic, Nairobi, Kenya

Dr. Samuel Gatherer, MBChB, MMed (ENT), Kenya Medical Research Institute, Nairobi, Kenya

Dr. Ian Macharia, MBChB, MMed (ENT), Kangundo Level 4 Hospital, Machakos, Kenya

Dr. Samuel N Okerosi, MBChB, MMed (ENT), Machakos Level 5 Hospital, Kenya

Dr. Joyce Aswani, MBChB, MMed (ENT), Fellow Head and Neck (SA), Thematic Head, ENT
Department, School of Medicine, University of Nairobi, Kenya

Dr. Clemence Chidziva, MBChB, FC ORL, Department of Surgery, Faculty of Medicine,
University of Zimbabwe, Harare Eye, Ear, Nose and Throat institute (HEENT), Zimbabwe

Dr. Asmeeta Patel, MBBS, MS (ENT) ENT, Head and Neck Surgeon, Aga Khan University
Hospital Nairobi, Kenya

Prof. Isaac Macharia, MBChB, MMed (ENT) Senior Lecturer and Consultant, Department of
Surgery, School of Medicine, University of Nairobi and Nairobi Ear Nose and Throat Clinic,
Nairobi, Kenya

Dr. Wakisa Mulwafu, PhD (University of Bergen), FCORL (SA), MBBS (Malawi), Associate
Professor, College of Medicine, University of Malawi, Blantyre, Malawi

Dr. Mukara Kaitesi, MBChB, MMed (ENT) MSc (Audiology) . University of Rwanda,
Humanhood Clinics Kigali, Rwanda

Correspondence to be addressed to:

Dr. Sophie Gitonga
The Editor-in-Chief
East and Central Africa Journal of Otolaryngology,
Head and Neck Surgery
P.O. Box 29784 Nairobi, Code 00202 Kenya
Email: editor.ecajohns@gmail.com/sereyans@gmail.com
Tel: 0722 867302

EDITORIAL: CHALLENGES OF OTOLARYNGOLOGY PRACTICE IN THE COVID-19 ERA

The pandemic spread of the SARS-CoV-2 Coronavirus and its Covid-19 illness has upended the lives of billions of people around the world. This has disrupted society, sent students home, shuttered businesses and has had economic ramifications reaching far beyond its morbidity and mortality. Today even two year old children in Africa have some knowledge of the value of social distancing, wearing masks and washing hands in the prevention of Covid-19.

The impact of the Covid-19 pandemic on otolaryngological practice has been considerable. Otolaryngologists can actually tell the severity of the Covid-19 waves and Covid-19 storms where infection rates rise in the community by the events occurring in their own practices. As the case positivity rates rise, patients present with overt symptoms of Covid-19 illness including anosmia, dysgeusia, ageusia, dry coughs, fever and general malaise. With worsening Covid-19 storm causing rising deaths, the numbers of patients seeking treatment fall precipitously, with patients fearful of Covid-19, avoid healthcare providers. How is the ENT practitioner handling this Covid-19 era and how can we prepare ourselves to be both safe and effective in management of our patients?

The use of technology in booking patients prior to their arrival is critical. This has to go beyond booking patients to taking history including establishing the purpose of the visit and taking note of any Covid-19-like or flu symptoms. A patient with recent sudden onset of Covid-19 symptoms such as anosmia, fever, dry cough after a social gathering a week earlier has to be assumed to have Covid-19. Such a patient is best managed by phone and kept away from the clinic and be referred for the Covid-19 test. A prescription can be sent to them for symptomatic treatment.

Patients who qualify to be seen physically in the clinic still require assessment on arrival with a form that they fill out that should still enquire for Covid-19 symptoms and history of contact with a Covid-19 patient. Note that whereas the patient may have made a booking complaining of ear blockage, they may since then have developed new symptoms or learnt that a relative or friend they interact with who has now been newly diagnosed with Covid-19. Their temperature should be taken and pulse oximetry measurement

considered to avoid interacting with Covid-19 'happy hypoxia' patients. Clinic staff can wear PPEs and usher the patient to see the doctor who may be on full PPEs, gloves, googles and face-shields but a Hazmat Suit is thought both impractical and unnecessary in a clinic outpatient setting.

Careful history taking is important and watch out for patients with chronic conditions who talk of recent worsening of symptoms. A patient complaining of feeling very unwell, worse than she has ever felt may require careful handling and a Covid-19 test. Take an interest in the family and social history: attendance to funerals and social gatherings followed by illness is telling. The ENT physical examination has become a professional hazard that is not to be approached lightly. Every time you ask a patient to remove their mask for an examination of their nose and throat is potentially a Covid-19 spreading moment. One is not to examine the throat unless it is deemed completely necessary.

Medical management of otolaryngological conditions will continue to play a pre-eminent role. Elective surgical procedures have been greatly curtailed by lockdowns, theatre closures, and hospital policies affected by the pandemic. Both patients and their doctors remain cautious of hospitalization and surgical procedures, fearful of nosocomial Covid-19 infections. Hospital policies around pre-admission and pre-procedure Covid-19 testing have begun to allay these fears.

Like in the rest of the economy, incomes in both hospital based and private ENT clinics have fallen by more than half as the numbers of patients and procedures have fallen. Some practitioners have even opted out of surgeries all together or markedly reduced their interactions with patients. The overriding attitude is to remain safe, healthy and ready to rebound once the promising vaccines do their work of helping stop the pandemic. The idea is to maintain a sound mind, a spirit of cautious optimism and good health, ready to resume work as normalcy is restored in the next year or two.

Gikonyo M, Landmark Medical Plaza, PO Box 61042-00200 CSQ, Nairobi. Email: bgikonyo@gmail.com; bgikonyo@mbira.co.ke

EDITOR'S NOTE: MAKING A LIFE

Tuesday 31st December 11:59pm, the air was full of drum beats, merry making and final countdown to usher in a new decade. The euphoria was palpable, 2020 was taken as year full of hope.

Some of the themes for 2020- clear vision, focus, dramatic shift, dynamic shift, dimensional shift among many others. As quickly as the year began, and we hit the road running, we were stopped without warning, and it became a year like we have never witnessed since Spanish pandemic.

The words, of Yuval Noah Harari in his book, "Sapiens - A brief history of Humankind" hang in our mind.... Fire gave us power, farming made us hungry for more, money gave us purpose and science made us deadly.

With this pandemic, whether it was as a result of climate changes cries that had been predicted or prophesied some 10 years back, or as a result of a virus manufactured in the lab, has left us all wondering, does my career or money give me purpose? With the number of patients we are seeing now dwindling and not forgetting the weeks or months we shut our clinics and sat watching the news unfold, or the many people we know who have gone before us..... we reflect on what gives us hope.

Am glad to invite you to read this exciting 5th issue of our journal. I would like to thank all the authors and peer review committee who have taken several months to write, read, correct and re-correct the articles within. Am glad to report, that since our 1st issue, this journal has indeed attracted the largest published articles. As the practice of ENT is growing in our continent, and many more medical schools have been established, I urge you all to publish the cases you are treating in your institutions and private practice.

Obstructive sleep apnea cases are on the rise in our country, partly due to increase in obese patients¹. UPPP has gained traction as the most common surgery performed for OSA. In this issue, you will see a novel technique for tongue suspension in which tongue base prolapse can be corrected by the otolaryngologists using cheap readily available materials within our set up.

Nasopharyngeal carcinoma still remains the third most commonest carcinoma in Kenya². Local study in the largest referral hospital showed EBV and HPV co-infection in these patients, which is similar to results published in endemic areas.

This year's theme, for the World Hearing Day was "Hearing for life". The World Health Organization (WHO), highlighted that timely and effective

interventions can ensure people with hearing loss are able to achieve their full potential. All the way from India, the Starkey Hearing Foundation, observed that most teachers and parents of hearing impaired students did not use speech in the classrooms or homes, which consequently prevents the pupils from developing speech and ultimately reaching their full potential. The Foundation therefore developed a phase 4 training program for teachers and parents which promotes the utilization of total communication strategy in schools and homes³.

Tracheostomy is the most common emergency surgical procedure carried out at the ENT department at the Kenyatta National Hospital. A clinical audit carried out in the hospital on the knowledge and care of patients with tracheostomies, showed that except for the nursing staff in the ENT ward, majority of the healthcare workers had no confidence in taking care of patients with tracheostomy tubes⁴. This can be extrapolated to be true in the periphery hospitals, hence continuous medical education seminars can be carried out by us the otolaryngologists in the places we work.

I hope with this glimpse of what is in store for you in this journal, I have created curiosity, eagerness and excitement to keep turning pages and reading for yourself the great work done by all the authors.

Dr. Sophie Gitonga
Editor-in-Chief

REFERENCES

1. Musyoka D. Novel technique for tongue suspension: A case report. *East Central Afr J Otolaryngol Head Neck Surg.* 2020; 4(2): 32-35.
2. Aswani JM, Anzala O, Mwang'ombe JN. Epstein Barr-virus and human papillomavirus co-infection in nasopharyngeal carcinoma at Kenyatta National Hospital. *East Central Afr J Otolaryngol Head Neck Surg.* 2020; 4(2): 3-7.
3. Lawal L, Buttars C, Prem Nair, Pillai S, Sarath PV, Larsen J. Effect of the starkey hearing foundation phase 4 intervention on speech, language and audition on pupils living with hearing impairment in Kochi; a quasi controlled trial. *East Central Afr J Otolaryngol Head Neck Surg.* 2020; 4(2): 8-16.
4. Mokoh I, Gitonga S. Clinical audit: knowledge and practices of tracheostomy care in Kenyatta National Hospital. *East Central Afr J Otolaryngol Head Neck Surg.* 2020; 4(2): 25-28.

EPSTEIN BARR-VIRUS AND HUMAN PAPILLOMAVIRUS CO-INFECTION IN NASOPHARYNGEAL CARCINOMA PATIENTS AT KENYATTA NATIONAL HOSPITAL, KENYA

Aswani JM¹, Anzala O², Mwang'ombe JN¹

¹ Department of Surgery, School of Medicine, University of Nairobi, Kenya

² Department of Medical Microbiology, School of Medicine, University of Nairobi, Kenya

Address for correspondence: Dr. Joyce M. Aswani, Department of Surgery, School of Medicine, University of Nairobi, P.O. Box 19676 – 00202, Nairobi, Kenya. Email: joyceaswani@gmail.com; j.aswani@uonbi.ac.ke

ABSTRACT

Background: Nasopharyngeal Carcinoma (NPC) is the third commonest head and neck malignancy in Kenya.

Objective: To determine the prevalence of Human Papillomavirus (HPV) and Epstein Barr-virus (EBV) co-infection in NPC patients at Kenyatta National Hospital (KNH).

Design: This was a prospective study.

Methods: Sixty-two patients with NPC who presented to the Ear Nose and Throat (ENT) clinic between 2015 and 2018 had their histories taken and clinical examination along with haematological and radiological work-up done. Two tissue biopsies were taken from the primary tumour for histology and HPV and EBV real time polymerase chain reaction.

Results: The patients were aged 16 to 80 years with a male to female ratio of 2:1. The commonest histology was WHO type III (75.8%). All patients tested positive for EBV with seven (11.3%) being positive for HPV.

Conclusion: The characteristics of NPC at KNH reflect those of endemic areas with regard to EBV and HPV presence.

Key words: Nasopharyngeal carcinoma, Epstein Barr-virus, Papillomaviridae

INTRODUCTION

Nasopharyngeal Carcinoma (NPC) is a malignancy with unique geographical and ethnic distribution. It is the third commonest head and neck malignancy in Kenya¹. Its aetiology has for a long time been linked to an interaction between EBV and other viruses, genetic factors, diet and environmental factors. Some of these factors are thought to act as initiators while others are promoters of the carcinogenic process.

Epstein Barr-Virus (EBV) is a member of the herpes virus family that has been known to infect up to 90% of the population worldwide. Despite this observation, only a small fraction of Epstein Barr-virus infected people go on to develop cancer. This has led to the presupposition that there must be other co-factors that play a role in cancer initiation. In nasopharyngeal carcinoma, these co-factors include certain human leucocyte antigen groups, environmental factors and dietary carcinogens. More lately, Human Papillomavirus (HPV) has been shown to co-exist with Epstein Barr-virus in these patients.

The presence of both EBV and HPV in nasopharyngeal cancer cells has been reported but their interactive role is still a subject of study. Both viruses

are thought to interact through suppression of P53 and retinoblastoma protein resulting in cell immortalization as well as viral replication¹. Like EBV, HPV positivity in NPC is associated with a better prognosis^{2,3}. More often, the EBV negative NPC tumours are the ones that tend to test positive for HPV. A number of EBV-positive NPC specimens have tested positive for HPV while others have demonstrated HPV positivity only in EBV-negative tumours of the nasopharynx^{2,4-8}. A study from Greece during the mid 1990s tested positive for EBV in 32% and HPV in 19% of 63 specimens with no co-infection. This led to the conclusion that HPV might be involved in the pathogenesis of EBV-negative tumours of the nasopharynx⁹. More recent studies involving endemic and non-endemic cohorts have demonstrated EBV in the endemic cohorts only with presence of HPV among the non-endemic cohorts, and no co-infection with the two viruses^{2,3,8}. Several other studies have, however, reported co-existence of EBV and HPV in NPC specimens from endemic regions thereby adding a new dimension to the subject^{4,7,6,10,11}.

MATERIALS AND METHODS

Sixty-two patients with nasopharyngeal carcinoma who presented to the Ear Nose and Throat clinic (ENT)

during the study period and consented to participate in the study were recruited. A detailed history including their age, symptoms, smoking, alcohol and other substance use was taken. A complete clinical examination was done and standard haematological tests (haemogram, liver and renal function tests, and immunoassay for HIV) for head and neck cancer patients ordered. Radiological tests were ordered and clinical tumour staging done as per AJCC 2010. The patients underwent rigid nasoendoscopy at which two tissue biopsies from the primary tumour were taken from each patient. One specimen was fixed in 10% buffered formal saline for histopathological analysis. The other sample was placed in a specimen bottle and stored at -80°C for EBV and HPV DNA extraction and determination as per the QIAGEN QIAamp DNA Mini and Blood Mini Handbook manual.

DNA extraction

Approximately 25 mg of each of the frozen tissue was cut into small pieces and placed in a 1.5 ml micro-centrifuge tube. 100 µl of Buffer ATL were added to each sample followed by 20 µl of proteinase K. The contents were mixed by vortexing and incubated at 56°C in a shaking water bath until the tissues were completely lysed (overnight). The samples were then briefly centrifuged. Two hundred µl of Buffer AL was added to each sample and mixed by pulse-vortexing for 15 seconds then incubated at 70°C for 10 minutes. The mixture was briefly centrifuged to remove drops from inside the lid. Two hundred µl of 100% ethanol was added to the sample and mixed by pulse-vortexing for 15 seconds then centrifuged to remove drops from inside the lid. The mixture was pipetted into the QIAamp Mini spin column in a 2 ml collection tube, which was closed and centrifuged at 8000 revolutions per minute (rpm) for 1 minute. The QIAamp Mini spin column was placed in a clean 2 ml collection tube and the tube containing the filtrate discarded. The QIAamp Mini spin column was opened carefully and 500 µl of Buffer AW1 added then closed again. The mixture was centrifuged at 8000 rpm for 1 minute. The tube containing the filtrate was discarded. Five hundred µl of Buffer AW2 was added to the QIAamp Mini spin column and the mixture centrifuged at 14,000 rpm for 3 minutes. The QIAamp Mini spin column was placed in a new 2 ml collection tube and centrifuged at full speed for 1 minute to eliminate the Buffer AW2 carryover. The QIAamp Mini spin column was put in a clean 1.5 ml centrifuge tube and the collection tube discarded. Two hundred µl of Buffer AE was added and incubated at room temperature for 1 minute before centrifuging at 8000 rpm for 1 minute. This last step was repeated for increased DNA yields. The resultant eluate was stored at -20°C for EBV and HPV DNA genotyping.

EBV DNA determination

The sixty-two DNA samples extracted from nasopharyngeal carcinoma tissue were subjected to EBV real time PCR. The Reaction mix was made by mixing Hot Start Polymerase, PCR mix-1 and PCR mix-2 in the ratios provided in the manufacturer's manual. Sixty-six test tubes were prepared for the procedure. Fifteen microliters of the Reaction mix was put in each of the 64 tubes. Ten microliters of extracted DNA sample was added to 62 of the test tubes with the reaction mix. Internal control DNA was added to the 63rd test tube with the reaction mix and the negative control sample added to the 64th test tube with reaction mix. QS1 and QS2 standards were added to the 65th and 66th test tubes respectively. The tubes were closed and loaded into the Real Time Thermal cycler (Rotor Gene Q, QIAGEN). The machine was programmed as per the kit's PCR cycling conditions for EBV. PCR was performed and the results interpreted using the Rotor Gene Q software.

HPV DNA genotyping

Real Time PCR was performed on 10 microliters of the extracted DNA using HPV Genotype Real-TM Quant kit from SACACE as per the manufacturer's instructions. The kit detects 14 genotypes (16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68) of high-risk HPV.

Reaction mix was made using Hot Start DNA Polymerase, PCR-buffer-FRT and PCR mix-1 as per manufacturer's instructions for the sample to be tested. Four tubes for each clinical sample, four tubes for K2 standards and four tubes for negative control were set up. Ten microlitres of extracted DNA sample was added to each test tube. For each panel, 10 µl of controls and standards were prepared for cycling.

The tubes were closed and transferred into the Real Time Thermal cycler (Rotor Gene Q, QIAGEN). The machine was programmed as per the kit's PCR cycling conditions. PCR was performed and the results interpreted using the Rotor Gene Q software. A signal was considered to be positive if the corresponding fluorescence accumulation curves crossed the threshold line.

RESULTS

There were 62 patients with nasopharyngeal carcinoma with a male to female ratio of approximately 2:1. The age range for the whole study group was 16 to 80 years with a mean of 45.5 years. Figure 1 shows the age distribution of the patients.

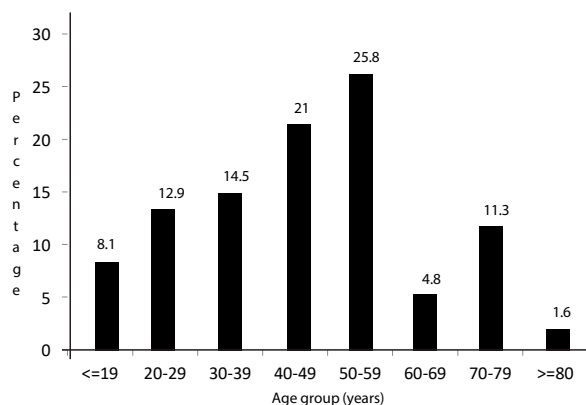


Figure 1: Age distribution

The most frequent symptoms at presentation were nasal obstruction (75.8%), hearing loss (58.1%), neck swelling (56.6%) and epistaxis (48.4%). The other symptoms, which were infrequent, included neck pains, otalgia, dysphagia, hoarseness of voice, breathing difficulties, cough, visual disturbance and headaches.

Only 29% of NPC patients had a smoking history, with majority (77.8%) of the smokers having less than 30-pack years. Nineteen (32.3%) of the patients had a history of alcohol use. The most common histological type was WHO type III (75.8%) followed by type II (17.7%) and type I (6.5%).

All the patients with nasopharyngeal carcinoma tested positive for EBV with 7 (11.3%) testing positive for HPV. The seven consisted of 3 males and 4 females giving a male: female ratio of nearly 1:1 compared to 2.4:1 for the HPV negative patient ($p = 0.19$). The seven patients who tested positive for HPV were aged 16, 37, 42, 49, 50, 54 and 80 years. Their mean age was 46.9 years while that for HPV negative patients was 45.4 years ($p = 0.707$). All except one HPV positive patient had genotype 56. The exception was genotype 33. Only two of the HPV positive patients had used alcohol and only one had a smoking history. Two HPV positive patients were also HIV positive. The histological types of the HPV positive patients were WHO type III five patients and type II and I, one patient each.

DISCUSSION

Kenya has been classified as an intermediate incidence region with regard to nasopharyngeal carcinoma. Low risk areas tend to have two age peaks in the teens and 6th decade^{12, 13}. This study had a single peak in the 6th decade that is in keeping with high incidence areas. There were, however, five patients below 20 years of age. There was a male preponderance as observed in most studies on nasopharyngeal carcinoma. Two earlier studies done at KNH had shown peaks at 31-40

and 41-50 years with a male: female ratio of 2.2:1 and 1:1^{14, 15}. It would appear that the peak age for NPC in Kenya has been increasing progressively with time. This might suggest a new factor in the pathogenesis of the disease that either requires more time to induce carcinogenesis or affects more of the older generation. Nasal, aural and neck complaints were, as expected, the most frequent symptoms at presentation.

The predominance of WHO type III (75.8%) histological type as well as the presence of EBV in all NPC specimens in this study mirrors what is seen in endemic areas. A study done at KNH in 2007 comparing the serum levels of EBV viral capsid antigen among NPC patients and blood donors revealed raised titres in 35% of patients against 22.5% for controls. The histological types found then were type III 60%, type II 15% and type I 25%¹⁵. It is estimated that most NPC cases in endemic areas are undifferentiated and have EBV while the WHO type I associated with non-endemic areas is usually negative for EBV but positive for HPV^{1, 16-18}. Association of EBV with the differentiated NPC types has, however, been reported in geographical regions with high incidence of undifferentiated NPC¹⁹.

The role of HPV in the pathogenesis of NPC is not as clear as EBV. What is known is that both viruses suppress the p53 and retinoblastoma protein in similar ways. Studies comparing endemic and non-endemic areas seem to associate EBV positivity with endemic status and HPV positivity with non-endemic status. In America, a cohort study comparing EBV and HPV presence in endemic (Southern China) and non-endemic (USA) cohorts with NPC showed no HPV among the Southern China cases or Chinese American patients. All except three cases from the endemic cohort were EBV positive. All EBV negative cases were white Americans who also had high risk HPV and smoking association. There was no co-infection with both viruses³. This is similar to another study where HPV was detected in non-endemic (Danish) cohort but not in the endemic (Inuit) cohort¹⁸. A low incidence area in America posted similar results where HPV positivity was reported in four of five subjects all of whom were EBV-negative and white Americans. The only EBV positive patient in the said study was HPV-negative and Korean⁸. In Greece, there was EBV presence in 32% and HPV in 19% of 63 FFPE NPC tissues with no co-infection⁹. The current study had 100% EBV presence with co-infection with HPV in 11.3%. This is not an isolated case of co-infection with HPV and EBV under seemingly endemic characteristics. Similar results have been posted in Morocco, Ghana and Iran^{4, 5, 7}. The co-infection aspect is the one interaction that

seems to cut across continents and might be significant with regard to the role of HPV in NPC in Africa. It is notable that HPV presence in head and neck squamous cell tumours in African countries has generally remained low²⁰⁻²³. Whether EBV-HPV interaction is a similar situation to what has been observed between EBV and malaria within the Burkitt lymphoma belt remains to be proven²⁴. These findings, definitely, call for further research in the area of EBV-HPV co-infection.

CONCLUSION

Kenyatta National Hospital has 100% prevalence of EBV in NPC with associated 11.3% HPV co-infection. When the results of this study are considered against the background of observed findings from areas of different endemicity, it would seem that Kenya might have, over time, become an endemic area with regard to NPC. The results of the study support the presence and role of EBV among Kenyan NPC patients. It may, therefore, be prudent to consider use of EBV serology in screening for NPC and follow-up of NPC patients. With regard to HPV presence in NPC, the prevalence is low and its significance, especially with regard to prognosis requires more research.

REFERENCES

1. Mauser A, Saito S, Appella E, Anderson CW, *et al.* The Epstein-Barr virus immediate early protein BZLF1 regulates p53 function through multiple mechanisms. *J Virol.* 2002; **76**: 12503-12.
2. Dogan S, Hedberg ML, Ferris R, *et al.* Human papillomavirus and Epstein-Barr virus in nasopharyngeal carcinoma in low-incidence population. *Head Neck.* 2014; **36**:511-516.
3. Lin Z, Khong B, Kwok S, *et al.* Human papillomavirus 16 detected in nasopharyngeal carcinomas in white Americans but not in endemic Southern Chinese patients. *Head Neck.* 2014; **36**: 709-714.
4. Laantri N, Attaleb M, Kandil M, *et al.* Human papillomavirus detection in Moroccan patients with nasopharyngeal carcinoma. *Infect Agents cancer.* 2011; **6**:3.
5. Mirzamani N, Salehian P, Farhadi M, *et al.* Detection of EBV and HPV in nasopharyngeal carcinoma by in situ hybridization. *Exp Mol Pathol.* 2006; **81**:231-34.
6. Lo EJ, Bell D, Woo JS, *et al.* Human papillomavirus and WHO I nasopharyngeal carcinoma. *Laryngoscope.* 2010; **120**: 1990-97.
7. Tung YC, Lin KH, Chu PY, *et al.* Detection of human papillomavirus and Epstein-Barr virus DNA in nasopharyngeal carcinoma by polymerase chain reaction. *Kaohsiung J Med Sci.* 1999; **15**: 256-262.
8. Maxwell JH, Kumar B, Feng FY, *et al.* HPV-positive / p16-positive / EBV-negative nasopharyngeal carcinoma in white North Americans. *Head Neck.* 2010; **32**: 562-567.
9. Giannoudis A, Ergazaki M, Segas J, *et al.* Detection of Epstein-Barr virus and human papillomavirus in nasopharyngeal carcinoma by polymerase chain reaction technique. *Cancer Lett.* 1995; **89**: 177-181.
10. Punwaney R, Brandwein MS, Zhang DY, *et al.* Human papillomavirus may be common within nasopharyngeal carcinoma of Caucasian Americans: investigation of Epstein-Barr virus and human papillomavirus in eastern and western nasopharyngeal carcinoma using ligation-dependent polymerase chain reaction. *Head Neck.* 1999; **21**: 21-29.
11. Asante D, Asmah RH, Adjei AA, *et al.* Detection of Human Papillomavirus genotypes and Epstein Barr Virus in nasopharyngeal carcinomas at the Korle-Bu Teaching Hospital, Ghana. *Scientific World J.* 2017; Article ID 2017:2721367.
12. Matalaka I, Al Hamad M, Al-Hussaini M, *et al.* The incidence of Epstein-Barr virus in nasopharyngeal carcinoma Jordanian patients. *Eur Arch Otolaryngol.* 2012; **269**: 229-234.
13. Adam AAM, Abdullah NE, El Hassan LAM, *et al.* Detection of Epstein-Barr virus in nasopharyngeal carcinoma in Sudanese by in situ hybridization. *J Cancer Therapy.* 2014; **5**: 517-522.
14. Muchiri M. Demographic study of nasopharyngeal carcinoma in a hospital setting. *East Afr Med J.* 2008; **85**: 406-411.
15. Nyawanda H. EBV VCA specific immunoglobulin serum antibody titre levels in nasopharyngeal carcinoma patients at Kenyatta National Hospital. *MMed Dissertation (UoN).* Available at: erepository.uonbi.ac.ke.
16. Polesel J, Eranceschi S, Talamini R, *et al.* Tobacco smoking, alcohol drinking, and the risk of different histological types of nasopharyngeal cancer in low-risk population. *Oral Oncol.* 2011; **47**: 541-545.
17. Raab-Traub N. Epstein-Barr virus and nasopharyngeal carcinoma. *Semin Cancer Biol.* 1998; **83**:582-588.
18. Hording U, Nielsen HW, Daugaard S, *et al.* Human papillomavirus types 11 and 16 detected in nasopharyngeal carcinomas by the polymerase chain reaction. *Laryngoscope* 1994; **104**: 99-102.
19. Xu FH, Xiong D, Xu YF, *et al.* An epidemiological and molecular study of the relationship between

- smoking, risk of nasopharyngeal carcinoma, and Epstein-Barr virus activation. *J Natl Cancer Inst.* 2012; **104**: 1396-410.
20. Faggons CE, Mabedi CE, Liomba NG, *et al.* Human papillomavirus in head and neck squamous cell carcinoma: A descriptive study of histologically confirmed cases at Kamuzu Central Hospital in Lilongwe, Malawi. *Malawi Med J.* 2017; **29**:142-145.
 21. Oga EA, Schumaker LM, Alabi BS, *et al.* Paucity of HPV-Related head and neck (HNC) in Nigeria. *PLoS One.* 2016; **11**: 1-9.
 22. Blumberg J, Monjane L, Prasad M, *et al.* Investigation of the presence of HPV related oropharyngeal and oral tongue squamous cell carcinoma in Mozambique. *Cancer Epidemiol.* 2015; **39**:1000-5.
 23. Seeke TR, Burt FJ, Goedhals D, *et al.* Human papillomavirus in head and neck squamous cell carcinomas in a South African cohort. *Papillomavirus Res.* 2018; **6**:58-62.
 24. Thorley-Lawson D, Deitsch KW, Duca KA, *et al.* The link between plasmodium falciparum malaria and endemic Burkitt's lymphoma –New insight into a 50-year old enigma. *PLoS Pathog.* 2016; **12**: e1005331.

EFFECT OF THE STARKEY HEARING FOUNDATION PHASE 4 INTERVENTION ON SPEECH, LANGUAGE AND AUDITION ON PUPILS LIVING WITH HEARING IMPAIRMENT IN KOCHI; A QUASI CONTROLLED TRIAL

Lawal L ^{1,2} Buttars C³, Prem Nair⁴, Pillai S⁵, Sarath PV⁵, Larsen J ⁶

¹Division of Health Policy and Management, University of Minnesota School of Public Health

²Department of Global Health & Research, Starkey Hearing Foundation

³Department of International Programs, Starkey Hearing Foundation

⁴Department of Audiology and Speech Pathology, Amrita University

⁵Starkey Hearing Foundation India

⁶Utah State University, Department of Audiology

Address for correspondence: Dr. Luqman Lawal, Division of Global Health & Research, Starkey Hearing Foundation, 6700 Washington Ave, S Eden Prairie, Minnesota, USA. Email: lawal026@umn.edu

ABSTRACT

Background: The Starkey Hearing Foundation (SHF) observed that most parents and teachers of the hearing impaired in low to middle-income countries do not use speech in the classrooms or homes (total communication strategy) which could prevent the pupils from developing speech and audition, or make the post-lingual hearing-impaired children lose speech. The foundation developed a parent and teacher training program (Phase 4) to promote the practice of utilizing total communication strategy in schools and at homes with hearing impaired children.

Objectives: To assess the effect of training parents and teachers to use total communication (SHF Phase 4 intervention) on speech, language and audition of pupils living with hearing impairment.

Methods: A quasi-controlled trial in Kochi, India where ninety-five pupils from seven schools were assigned to interventional or control groups. Fifty pupils in three schools were randomized into the intervention group and forty-five from four schools to the control group. Both groups had similar participants, with the pupils tested aged 4 to 10 years. Audition was measured using the Glendonald Auditory Screening Procedure (GASP) and we assessed sound detection and identification as well as word comprehension and identification. A Malayalam speech inventory was utilized to assess speech and both receptive and expressive language were measured using three tests: Scales of Early Communication (SECS), Skills for Hearing-Impaired Children (SKI- HI) and Receptive Expressive Emergent Language Scale (REELS). Children in the intervention group received the SHF hearing aids and their teachers and at least one parent each was trained and supervised to implement total communication for six months. The control group received only hearing aids.

Results: For audition, a paired t-test revealed an 8.09% increase (CI 4.9% - 11.3% $p < 0.005$) in the intervention group while the control group did not show any statistically significant difference. It was also similar for speech evaluation, where a paired t-test revealed a statistically significant difference ($p = 0.02$) between the intervention and control groups. All language tests also revealed highly statistically significant results ($p < 0.005$) between the two groups.

Conclusions: Overall, the results indicates the SHF Phase 4 program can increase the audition and speech of children living with hearing impairment.

Key words: Audition, Speech, Language, Hearing-impairment, Training, Total communication

INTRODUCTION

In most low and middle-income countries, pupils with different degrees of hearing impairment who have been fitted with hearing aids are placed in schools for the deaf¹⁻³. Placements are done inappropriately due

to lack of or non-enforcement of the legislation for appropriate screening process to determine the right schools for such children. Most schools for the deaf in low and middle-income countries utilize only sign language as a means of communication⁴⁻⁶.

A body of evidence exists to corroborate how total communication - defined as a combination of speech usage and signs^{7,8} - enhance educational achievements in the hearing-impaired pupils⁹.

Historically there have been different schools of thought on the oral/manual method of teaching the hearing impaired¹⁰⁻¹². Most children with hearing impairment have the potential to acquire better spoken language and there have been well-documented gains of auditory-oral intervention causing increased oral communication in industrialized countries¹³. Evidence from several studies¹²⁻¹⁶ shows increased success when parents and teachers are involved.

Study aim, design, and hypotheses

The aim of the study was to assess the hypothesis that training teachers and parents in the use of total communication with their hearing-impaired wards fitted with hearing aids would result in an increase and improvement in the pupils' speech, language and audition.

A quasi-controlled trial was utilized where the teachers and parents in the intervention group received training and those in the control group did not. This is a proof-of- concept study assessing the impact of Starkey Hearing Foundation's Phase 4 program that trains teachers and parents to use speech in communicating with their hearing-impaired children who use hearing aids.

MATERIALS AND METHODS

Participants

A total of 95 students participated in the study (experimental group N=50; control group N=45). Pupils included in the study fulfilled the following inclusion criteria: hearing impaired in one or both ears with previous hearing impairment diagnosis made; enrolled in a school for the hearing impaired; less than 18 years of age; and received hearing aids from the Starkey Hearing Foundation. The exclusion criterion had no previous cochlear implants.

Baseline characteristics

The participants were between 4 and 10 years old. Hearing loss was identified on average at 1 year 8 months; this ranged between 5 months and 3 years of age (Table 1). In both the control and experimental group, congenital causes contributed to a significant proportion of hearing loss (56% and 38% respectively) while for many participants the causes remain unknown. At least 94% of all pupils had a history of hearing aid use while at least 70% of them had previously attended speech and language therapy. Academic performance and mean aided response were very similar between the two groups when measured at baseline. Overall, the baseline characteristics of the control and experimental groups did not differ significantly in all relevant variables (Table 1).

Table 1: Baseline characteristics of the study participants

Characteristics		Experimental Group (N=50)				Control Group (N=45)		
Mean Age in Years (Mean \pm SD)		6.71 \pm 2.54				7.10 \pm 2.40		
Mean Age on Identifying Hearing Loss (Mean \pm SD)		1.75 \pm 1.12				1.56 \pm 1.13		
Gender	Male	28 (56%)				20 (44.4%)		
	Female	22 (44%)				25 (55.6%)		
Cause for hearing loss		Congenital	Others	Unknown		Congenital	Others	Unknown
		19 (38%)	17 (34%)	14 (28%)		25 (55.6%)	10 (22.2%)	10 (22.2%)
History of hearing aid use	Used	47 (94%)				44 (97.8%)		
	Not used	3 (6%)				1 (2.2%)		
	Mean years used (Mean \pm SD)	4.09 \pm 2.52				3.57 \pm 2.48		
History of speech and language therapy	Attended	35 (70%)				35 (77.8%)		
	Not Attended	15 (30%)				10 (22.2%)		
	Mean years Attended (Mean \pm SD)	2.21 \pm 1.60				1.86 \pm 1.75		
Academic performance		Good/Fair	Average	Poor	NA	Good/Fair	Average	Poor
		22	7	1	20	23	21	1
Aided Response (Mean \pm SD) in Hz	500	60.66 \pm 19.60				59.75 \pm 20.05		
	1000	61.11 \pm 22.97				59.97 \pm 21.89		
	2000	67.26 \pm 30.98				64.31 \pm 31.28		
	4000	72.89 \pm 38.90				67.25 \pm 35.10		
Type of loss		92% (46) bilateral				91% (41) bilateral		

N = Number of children SD = Standard Deviation Hz = Hertz NA = Not Applicable

The participants in this study were not representative of the Kochi population of hearing-impaired children.

Procedure

The study was reviewed and approved by the University of Amrita, Kochi Institutional Review Board committee and parents gave their signed consent on behalf of the participating pupils. We identified seven schools for the hearing impaired located within a logistically convenient distance in Kochi, the Kerala province of India and randomized three schools to the experimental group and four schools to the control group. Baseline assessments were made to measure the degree of hearing loss, level of audition and speech for the pupils in the study.

The teachers and parents in the experimental group were then trained on ways to improve the use of voice by their wards while the control group did not receive any intervention but were based on the existing standard of care. To assess the effectiveness of the parents and teachers' training, we compared the pre- and post-intervention differences of the control and experimental groups under the categories of speech, language and audition.

Testing

Participant's history and baseline information was collected via an interview questionnaire and hearing tests were completed in both aided and unaided conditions using a Maico MA 44 audiometer. Four frequencies (500, 1000, 2000 and 4000Hz) were tested in each condition while unaided testing -testing without hearing aids, was completed using headphones. Aided testing was completed in a bilateral condition using speakers with the patient sitting at 0 degrees azimuth and 3 meters away from the speakers. The speakers were placed at a one-meter distance apart.

Audition testing was completed using a modified version of the Glendonald Auditory Screening Procedure (GASP) and measured sound detection, sound identification, word comprehension and word identification.

Speech testing was completed by using an inventory of all speech sounds in the Malayalam language. Testing was first completed by using audition only and then by auditory and culturally appropriate visual cues. If the child could not repeat the word by listening only, they were then given a chance to repeat the sound by using visual cues as well.

Language was tested using three different scales: SKI-HI, Skills for Hearing-Impaired Children Scales of Early Communication (SECS) and Receptive Expressive Emergent Language Scale (REELS).

These were modified and included measurements for both receptive and expressive language.

Timeline

The program began in September 2016 with assessments and continued through March 2017. Each of the three schools in the experimental group was visited by the two Speech Language Pathologist interns and a supervisor for two weeks each month. During those two weeks, four different types of activities will be completed. These activities are parent training, teacher training, teacher observations and group work. Each of these activities is defined below.

Parent training

Parent training was carried out twice each month. In the first session, all participating parents were trained together at the schools. Content on the role of parents in the hearing-impaired child, the importance of wearing hearing aids and how to take care of the hearing aids were taught at these trainings. The trainings were carried out by 2 audiologists and two speech pathologists and coordinated by a project manager

During subsequent training sessions (one hour each), parents were divided into groups based on their child's language, age, and score on the SECS test. More training to more effectively communicate with their child using verbal communication were discussed with the parents. At least one parent of participating child was present at each of the training sessions. The trainings involved patients watching videos of how to work with kids at home, practicing through role-play, receiving handouts and going home with assignments.

Teacher training

Teacher training at each school was completed two times each month for one hour each. During these sessions, basic concepts of audition, speech and language were taught. The teacher training was similar to parents training except the context of the classroom settings. Additionally, the Sustainable Development Goal 4 was vital in developing and implementing the teacher training.

Teacher observations

Each teacher was observed by the SLP four times each month during one lesson (45-60 minutes of observation) while teaching their class. During each observation, a form was filled noting the techniques the teachers used during their classes to work on speech and listening and follow up sessions were held to reinforce skills

that were identified to have been missed out during observation sessions termed group work

Group work

From this information, the SLP then worked with the teacher the next day during class to work on curriculum-based group work implementing techniques to improve children's listening and speaking.

RESULTS

Audition

We measured audition by assessing sound detection, sound identification, word identification and word comprehension. Both groups of children showed improvement in sound detection and sound identification after receiving hearing aids. However, the changes in sound detection did not differ significantly ($p=0.06$) between the experimental group (13.3% change) and the control (10.57% change) at the end

of the study (Table 2). When sound identification was measured from baseline to the end of the study, a highly significant difference ($p<0.001$) was detected between the improvement of the experimental group (89.30% change) and that of the control (22.97%).

Audition showed a statistically significant difference between experimental and control group using Chi-Square test post-test analysis ($p<0.05$) in sound identification (Figure 1).

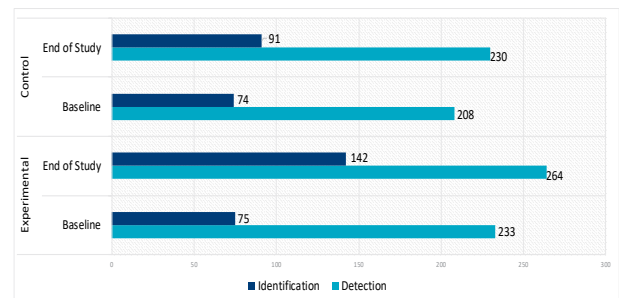


Figure 1: Effect of training parents and teachers to use speech on audition change in children with hearing loss

Table 2: Effect on sound detection and sound identification of training parents and teachers to use speech in children with hearing loss

		Experimental Group (N=47)			Control Group (N=43)			P-value between groups ¹
		Baseline	End of Study	% Change	Baseline	End of Study	% Change	
Sound detection	Detected	233	264	13.30	208	230	10.57	0.06
	Not detected	49	18	-	50	28	-	
Sound identification	Identified	75	142	89.30	74	91	22.97	0.001**
	Not identified	207	140	-	184	167	-	

¹Chi square exact test ** $p<0.005$ N = Number of children

There was no significant difference ($p>0.05$) between the children who received the intervention and those who did not when we measured word comprehension and word identification (Table 3). In the control group, word comprehension had worsened at the end of the study (-15%) while the experimental group showed some improvement (37.5%). The difference between groups was not statistically significant ($p>0.05$), owing to a high standard deviation in both groups (Figure 2). The non-significant results may be explained by the high standard deviation in both groups.

Table 3: Effect on word comprehension and word identification of training parents and teachers to use speech in children with hearing loss

		Experimental Group (N=50)			Control Group (N=44)			P-value between groups ¹
		Baseline	End of study	% Change	Baseline	End of study	% Change	
Word comprehension	Mean	11.84	16.25	37.3	12.69	10.72	-15.5	0.31
	SD	21.18	29.11	-	22.59	22.56	-	
Word identification	Mean	20.87	25.12	25.2	16.94	21.54	27.1	0.34
	SD	37.52	35.99	-	25.26	26.99	-	

¹Welch t test

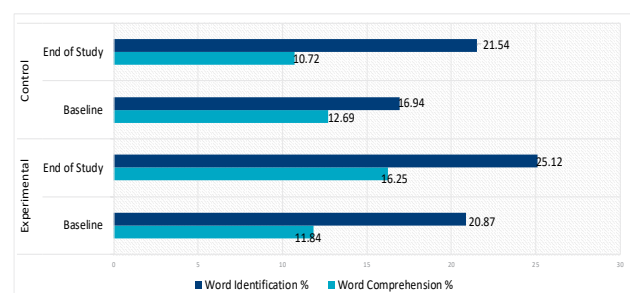


Figure 2: Effect of training parents and teachers to use speech on word comprehension/ identification in children with hearing loss

Speech

The children's speech inventory improved with the use of hearing aids regardless of which group they were in

(Figure 3). There was a significant difference ($p=0.02$) between the improvement in the experimental group (72%) than the control group (41.23%) when measured by a Welch t-test (Table 4).

Table 4: Effect on speech inventory of training parents and teachers to use speech in children with hearing loss

Baseline		Experimental Group (N=50)			Control Group (N=44)			P-value between groups ¹
		End of study	% Change	Baseline	End of study	% Change		
Speech Inventory	Mean	9.75	16.85	72.9%	7.54	10.65	41.23	0.02*
	SD	8.35	10.58		5.40	7.61		

¹Welch t-test * $p<0.05$

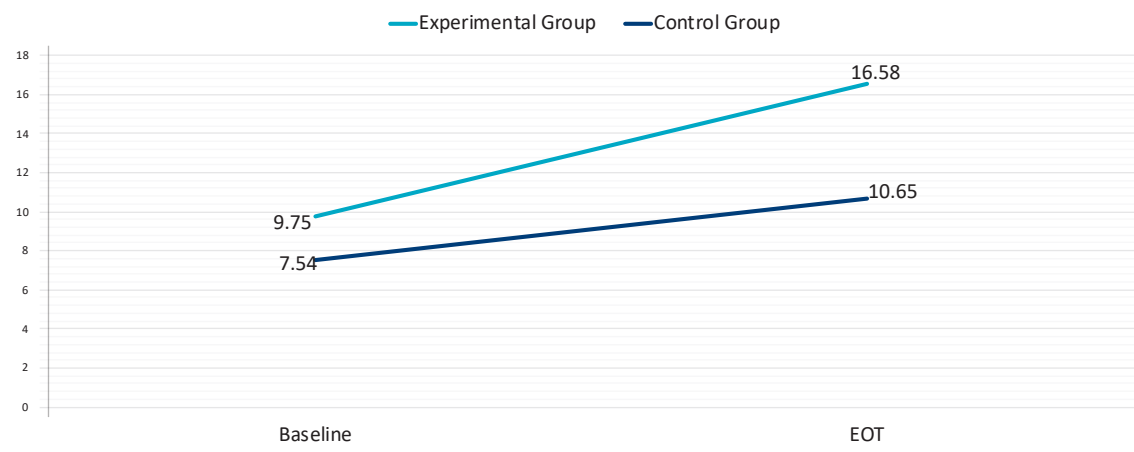


Figure 3: Effect of training parents and teachers to use speech on speech inventory in children with hearing loss

Language

Using the SECS Combined Receptive test on language assessment, the children whose parents and teachers were trained to use speech in addition to signing

showed a 52.1% improvement while the control group improved by 4.5% (Table 5). A Fischer's exact test showed this difference to be highly significant ($p=0.001$).

Table 5: Results of SECS Combined Receptive test for language assessment in children with hearing loss

Variables	Experimental Group (N=48)			Control Group (N=42)			P-value between groups ¹
	Baseline visit	End of study visit	% Change	Baseline visit	End of study visit	% Change	
2-2.11	26	14	52.1	35	33	4.5	0.001**
3-3.11	14	17		7	7		
4-4.11	3	7		1	3		
5-5.11	5	3		1	1		
6-6.11	0	1		0	0		
7-7.11	0	4		0	0		
8-8.11	0	2		0	0		

¹Fischer's exact test ** $p<0.005$

For the SECS Combined Expressive language assessment, the change observed in the experimental group was 41.7% compared to 11.3% in the control

group (Table 6). An exact Fischer's test revealed a statistically significant ($p=0.003$) difference between the changes in the two groups.

Table 6: Results of SECS Combined Expressive test for language assessment in children with hearing loss

Variables	Experimental Group (N=48)			Control Group (N=42)			P-value between groups ¹
	Baseline visit	End of study visit	% Change	Baseline visit	End of study visit	% Change	
2-2.11	26	14	41.66%	39	35	11.33%	0.003**
3-3.11	14	18		3	6		
4-4.11	3	7		2	3		
5-5.11	5	6		0	0		
6-6.11	0	2		0	0		
7-7.11	0	0		0	0		
8-8.11	0	1		0	0		

¹Fischer's exact test ** $p<0.005$

When language was measured using the SKI HI Receptive and Expressive test, a proportion of children in both the experimental and control groups showed no change or had worsened at the end of the study. For the SKI HI Receptive test, 83% of the experimental group improved compared to 27.2% of the control group at

a significance of $p<0.005$. We measured expressive language and found that there was a 76.6% change in the experimental group and 38.6% in the control group (Table 7). This difference was statistically significant ($p<0.0005$).

Table 7: Results of SKI HI Receptive and Expressive test for language assessment in children with hearing loss

	Experimental Group (N=47)			Control Group (N=44)			P-value between groups ¹
	Improved at end of study	No change/ Worsened at end of study	% Change	Improved at end of study	No change/ Worsened at end of study	% Change	
Receptive	39	8	83.0	12	32	27.2	0.001**
Expressive	36	11	76.6	17	27	38.6	0.0002***

Fischer's exact test ** $p<0.005$ *** $p<0.0005$

When we measured language using the REELS test, both the experimental and control group showed improvements. The two groups showed a statistically significant difference ($p=0.001$) in receptive language; the experimental group improved by 74.5% while the control group improved by 40.9% (Table 8). When we looked at expressive language, the experimental group had improved by 89.4% by the end of the study compared to the control group which improved by 43.2%. This was highly statistically significant ($p=0.000$).

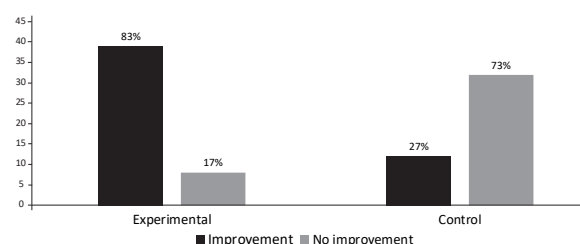


Figure 4: Effect of training parents and teachers to use speech on SKI-HI Receptive in children with hearing loss

As displayed in Figures 4 and 5, the SKI-HI receptive and expressive test for language showed an increase in the proportion of children in the intervention group as opposed to the control group. A proportion of 83% of those in the intervention group saw improvement in the SKI_HI receptive test as

opposed to 27% in the control group Fischer's exact score ($P < 0.005$). For the SKI-HI expressive, 77% of those in the intervention group saw improvement in their language as opposed to 39% in the control group, Fischer exact test ($P < 0.0005$) (Figure 5).

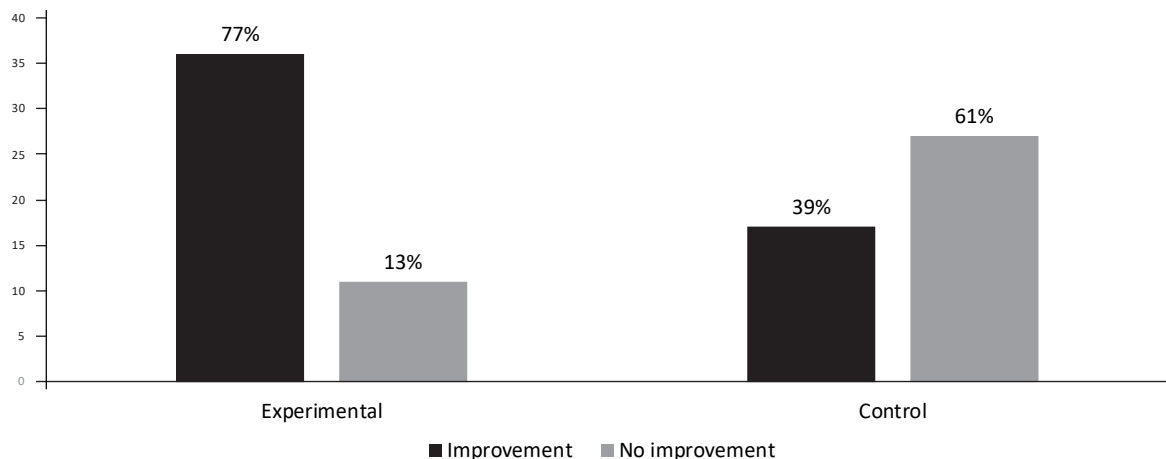


Figure 5: Effect of training parents and teachers to use speech on SKI-HI Expressive in children with hearing loss

Table 8: Results of the Receptive Expressive Emergent Language Scale (REELS) test for language assessment in children with hearing loss

	Experimental Group (N=47)			Control Group (N=44)			P-value between groups ¹
	Improved at end of study	No change/ Worsened at end of study	% Change	Improved at end of study	No change/ Worsened at end of study	% Change	
Receptive	35	12	74.5	18	26	40.9	0.001**
Expressive	42	5	89.4	19	25	43.2	0.000**

¹Chi square test ** $p < 0.005$

The results of the REELS assessment demonstrate a greater difference than the SECS tests and the SKI HI test.

DISCUSSION

The development of hearing loss early in a child's life (before age 3) impacts their speech and language acquisition¹⁷⁻²⁰. Currently, most children with hearing loss in low- and middle-income countries attend schools for the deaf and communicate primarily through signing, though there is evidence that incorporating speech improves audition, speech and language. Research on the use of total communication by parents and teachers is essential to guide policies and recommendations and may improve several outcomes for children with hearing loss and evidence from a previous study by Lawal *et al*²⁴ have shown the same.

A quasi-controlled trial design was used to assess the effects of parent and teacher training on the audition, speech and language of children with hearing loss. We found that there were significant improvements in sound identification, speech inventory and language for the children whose parents and teachers were trained to use speech in communication. The improvements in speech inventory are consistent with a study by Geers and Moog²¹ in which the use of oral communication improved speech in 16 and 17-year-old students with hearing loss. Some studies²²⁻²⁵ have observed that children with hearing loss who underwent audio-verbal therapy attained similar receptive and expressive language skills as their hearing counterparts.

Changes in word comprehension were not significant and this may be because the results from objective audiology tests vary greatly depending on a child's age and development, as highlighted by Bagatto

et al²³. This could explain the large variability reflected in a high standard deviation.

Limitations

The findings from the study are exciting however, there are some limitations to the study. Sample size of the study may serve as a limitation to generalizing the findings from the study to the entire population of the hearing impaired. More controlled studies especially are needed for a comprehensive understanding of how best to apply principles of total communication as well as the factors determining the rate of improvements identified.

CONCLUSIONS

Although, this study does not give a representative picture of the effect of training teachers and parents of children living with hearing impairment on their audition, speech and language in India, several conclusions can be made. The Starkey Hearing Foundation's Phase 4 program involving the training of teachers and parents to use speech when communicating with hearing impaired wards had a significant impact on the audition and speech improvement of the wards involved in the intervention. This is consistent with current body of knowledge that have identified total communication strategies as a tool to improve audition, speech and language in children living with hearing impairment.

This may be replicable in many other low and middle-income countries that do not utilize total communication approach in communicating with children living with hearing impairment and benefit from the use of hearing aids. The policy implication is for governments to enact and enforce policies that promote the culture of total communication with children living with hearing impairment most especially in schools.

REFERENCES

1. Geers AE, Moog JS, Biedenstein J, Brenner C, Hayes H. Spoken language scores of children using cochlear implants compared to hearing age-mates at school entry. *J Deaf Studies Deaf Educ.* 2009; **14**(3): 371-385.
2. Stacey PC, Fortnum HM, Barton GR, Summerfield AQ. Hearing-impaired children in the United Kingdom, I: Auditory performance, communication skills, educational achievements, quality of life, and cochlear implantation. *Ear and Hearing.* 2006; **27**(2): 161-186.
3. Davis JM, Elfenbein J, Schum R, Bentler RA. Effects of mild and moderate hearing impairments on language, educational, and psychosocial behavior of children. *J Speech Hearing Disorders.* 1986; **51**(1): 53-62.
4. Brasel KE, Quigley SP. Influence of certain language and communication environments in early childhood on the development of language in deaf individuals. *J Speech Hearing Res.* 1977; **20**(1): 95-107.
5. Meadow KP. Early manual communication in relation to the deaf child's intellectual, social, and communicative functioning. *J Deaf Studies Deaf Educ.* 2005; **10**(4): 321-329.
6. Tucker BP. Deaf culture, cochlear implants, and elective disability. *Hastings Center Report.* 1998; **28**(4): 6-14.
7. Ronski MA, Ruder KF. Effects of speech and speech and sign instruction on oral language learning and generalization of action+ object combinations by Down's syndrome children. *J Speech Hearing Disorders.* 1984; **49**(3): 293-302.
8. Iacono T, Duncum J. Comparison of sign alone and in combination with an electronic communication device in early language intervention: Case study. *Augmentative and Alternative Communication,* 1995; **11**(4) 249-259.
9. White Jr AH, Stevenson VM. The effects of total communication, manual communication, oral communication and reading on the learning of factual information in residential school deaf children. *Amer Annals Deaf.* 1975; **120**(1): 48-57.
10. Vernon M, Koh SD. Early manual communication and deaf children's achievement. *Amer Annals Deaf.* 1970; **115**(5): 527-536.
11. Moores DF. The history of language and communication issues in deaf education. *The Oxford Handbook of Deaf Studies, Language, and Education.* 2010; **2**: 17-30.
12. Kampfe CM, Turecheck AG. Reading achievement of prelingually deaf students and its relationship to parental method of communication: A review of the literature. *Amer Annals Deaf.* 1987; **132**(1): 11-15.
13. Yoshinaga-Itano C. From screening to early identification and intervention: Discovering predictors to successful outcomes for children with significant hearing loss. *J Deaf Studies Deaf Education.* 2003; **8**(1): 11-30.
14. Lederberg AR, Schick B, Spencer PE. Language and literacy development of deaf and hard-of-hearing children: successes and challenges. *Develop Psychology.* 2013; **49**(1): 15.
15. Calderon R. Parental involvement in deaf children's education programs as a predictor of child's language, early reading, and social-emotional development. *J deaf studies Deaf Education.* 2000; **5**(2): 140-155.

16. Yoshinaga-Itano C, Sedey AL, Coulter DK, Mehl AL. Language of early-and later-identified children with hearing loss. *Pediatrics*. 1998; **102**(5): 1161-1171.
17. Mah-rya LA, Yoshinaga-Itano C. Early identification of infants with significant hearing loss and the Minnesota Child Development Inventory. In: *Seminars in Hearing*. 1995; **16**(2): 124-135. Copyright© 1995 by Thieme Medical Publishers, Inc.
18. Geers AE. Factors affecting the development of speech, language, and literacy in children with early cochlear implantation. *Language, Speech, and Hearing Services in Schools*. 2002; **33**(3):172-183.
19. Geers AE, Nicholas JG, Sedey, AL. Language skills of children with early cochlear implantation. *Ear and hearing*. 2003; **24**(1): 46S-58S.
20. Moeller MP. Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics*. 2000; **106**(3), e43-e43.
21. Geers AE, Moog JS. Speech perception and production skills of students with impaired hearing from oral and total communication education settings. *J Speech, Language, Hearing Res*. 1992; **35**(6), 1384-1393.
22. Dornan DI, Hickson L, Murdoch B, Houston T. Outcomes of an auditory-verbal program for children with hearing loss: a comparative study with a matched group of children with normal hearing. *Volta review*. 2007; **107**(1): 37-54.
23. Bagatto MP, Moodie ST, Seewald RC, Bartlett DJ, Scollie SD. A critical review of audiological outcome measures for infants and children. *Trends in Amplification*. 2011; **15**(1): 23-33.
24. Lawal L, Karia M, Buttars C, Larsen J, Mulwafu W, Mukara K. Training teachers and parents on verbal communication among children with hearing impairment: Preliminary results from schools in Kenya. *J Comm Disorders, Deaf Studies & Hearing Aids*. 2016; **4**(2):1-7.
25. Hickson L, Thy BS, Aud M, Murdoch B. Longitudinal study of speech perception, speech, and language for children with hearing loss in an auditory-verbal therapy program. *Volta*, 2009; **109**(2-3): 61-85.

NONVASCULAR ANATOMICAL VARIANTS OF TEMPORAL BONE AS DEPICTED ON HIGH RESOLUTION COMPUTED TOMOGRAPHY DONE IN NAIROBI, KENYA

Onyango S¹, Mugwe P¹, Thinwa J²

¹ Department of Surgery (ENT), School of Medicine, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya

² Department of Radiology, Kenyatta National Hospital, Nairobi, Kenya

Address for correspondence: Dr Onyango Stephen, Department of Surgery (ENT), University of Nairobi, P.O. Box 19676– 00202, Nairobi, Kenya. Email: dronyango@gmail.com

ABSTRACT

Background: Temporal bone is the center of otology practice thus understanding its anatomy and variations is important for diagnosis, treatment and planning surgeries in ear pathology.

Objective: To determine the spectrum and prevalence of nonvascular anatomical variations of temporal bone as depicted on High Resolution Computed Tomography (HRCT) scans.

Design: A descriptive cross-sectional study.

Methods: The study was conducted on 100 participants (182 radiologically normal temporal bones) who underwent HRCT of the temporal bone at the Kenyatta National Hospital and Plaza Imaging Solutions.

Results: Data analysis was conducted using SPSS version 22. The age range was 2-74 years with a mean of 31.6 ± 16.5 years and a male:female ratio of 1:1.1. The most prevalent nonvascular variants were type B sinus tympani (73.1%), Korner's septum (57.1%) and petrous apex pneumatization (56.5%). The least prevalent nonvascular variants included large cochlea aqueduct (0.6%), enlarged vestibular aqueduct (1.1%) and sclerosed petrous (3.3%). Correlations by Fisher's exact test showed significant correspondence between degrees of mastoid and petrous apex pneumatization ($p < 0.001$), male preponderance to large internal auditory canal ($p = 0.03$) and Hans 1 mastoid pneumatization ($p = 0.003$), and female preponderance to low lying tegmen ($p = 0.02$). Paediatric petrous apex was predominantly diploe (80%) while adults petrous apex was aerated in 62.4% ($p < 0.003$).

Conclusion: The study revealed a high prevalence of nonvascular variants with significant disparity between gender, age groups and individuals. These variants should be actively sought when reviewing patients' scans.

Key words: Nonvascular variants, Temporal bone, HRCT and prevalence

INTRODUCTION

Anatomical variations are the normal flexibilities or differences in topography and morphology of body structures usually of embryonic or genetic origin¹. The variations clinically influence predisposition to certain illnesses, symptomatology, clinical findings, investigation findings and patient management especially in surgical procedures². There are significant differences in temporal bone by gender and age where below 10.8 years temporal bone may be considered immature by bone density³ thus paediatric-type and this may account for the higher prevalence of anatomical variants in the paediatric age group. This study aimed to determine the spectrum and prevalence of nonvascular anatomical variations of the temporal bone in patients who underwent HRCT scanning in two Nairobi based centres; Kenyatta National Hospital (KNH) and Plaza Imaging Solutions.

MATERIALS AND METHODS

Study procedure

This was a descriptive cross-sectional study conducted after approval by the local ethics and research committee. The study population consisted of patients independently referred by their physicians for HRCT of temporal bone to either study site. The sample size of 100 participants was calculated using a World Health Organization formulae for the "safest choice" of prevalence at 50%⁴. Participants were recruited by convenience sampling. Their demographic data was entered into a data collection sheet while their HRCTs were stored in a compact disc and subsequently evaluated by the principal researcher and one (the same) consultant radiologist. Temporal Bones (TBs) with pathology obscuring and/or eroding anatomical features were excluded from the study but the normal

contralateral TBs were included as an unpaired TB thus 18 unpaired and 82 paired TBs, totaling 182 radiologically normal TBs, were evaluated.

The anatomical variations noted were then captured in the data collection sheet. The criteria for diagnosis of the anatomical variants is shown in Table 1.

Table 1: Diagnostic criteria for nonvascular anatomical variants

Nonvascular anatomical variations		Description on HRCT
1.	Sinus tympani types ⁵ A	The depth does not exceed the anterior aspect of the mastoid facial nerve segment
	B	The depth exceeds the anterior but not the posterior limit of the mastoid facial nerve
	C	The depth exceeds the posterior limit of the mastoid facial nerve
2.	Korner's septum ⁶	Persistent petrosquamous suture seen as a bony septum running through the mastoid antrum best on axial view
3.	Enlarge vestibular aqueduct ⁷	Vestibular aqueduct with a midpoint girth of > 1mm or operculum girth of \geq 2mm (Cincinnati criteria) or the width is wider than that of the ipsilateral posterior semicircular canal
4.	Large cochlea aqueduct ⁸	Cochlear aqueduct whose width is 4.5mm at the medial operculum or \geq 1mm at the midpoint best on axial view
5.	Cochlear cleft ⁹	A hypodense region within the cochlear bony labyrinth especially anterior to the oval window best seen in axial view
6.	Large internal acoustic canal ¹⁰	IAC with a width of \geq 9mm or a width difference of > 2mm when compared to the contralateral IAC in axial view
7.	Low lying tegmen ⁶	Significant tegmen sloping laterally below the level of the crista pyramid is and the attic/epitympanum best seen in coronal view
8.	Facial nerve dehiscence ¹¹	The absence of bony covering over the facial nerve when seen in axial and coronal views
9.	Mastoid type ¹¹	
	Hans 1	Poor mastoid pneumatization, aircells limited to the presigmoid sulcus region of the mastoid on axial view
	Hans 2	Moderately good mastoid pneumatization that is up to the anterior half of the sigmoid sulcus on axial view
	Hans 3	Good mastoid pneumatization that is up to the posterior half of the sigmoid sulcus on axial view
	Hans 4	Mastoid hyperpneumatization that is beyond the posterior end of the sigmoid sulcus on axial view
	Sclerosed	No significant aircells in the mastoid bone
10.	Superior semicircular canal dehiscence	Deficient bony labyrinth over the superior SCO thus directly exposing it to the intracranial space best on coronal or Poschl
11.	Tegmen tympani dehiscence	Deficient bony ridge in the tegmen tympani best on coronal view
12.	Foramen of Huschke	Deficient bony ridge in the anterior EAC wall thus communicates with the temporomandibular joint best on axial view

Abbreviations: EAC- External Auditory Canal; IAC- Internal Auditory Canal; SCC- Semicircular Canal

Equipment

The CT scanner at KNH was a Philips 16 slice Brilliance machine that took standard axial scans by helical technique (140kV, 250mA, rotation time of 0.75 seconds, section thickness of 0.6mm). The CT scanner at Plaza Imaging Solutions was Aquilion One Toshiba 320 slice machine that took standard axial plane scans by helical technique (135kv, 200mA, rotation time of 1.5 seconds, slice thickness of 0.5mm). To standardize image evaluation, RadiAnt Dicom viewer version 5.5.0 was utilized.

Data analysis

Data analysis was performed using IBM SPSS statistical software (Version 22) and correlations analyzed using Fisher's exact test.

Study limitations

Soft tissue definition on HRCT is inferior to magnetic resonance imaging thus inferences such as "no soft tissue lesion expanding a canal" were made with reservation. The indications for the HRCTs were not captured thus only limited clinico-radiological correlation could be deduced.

RESULTS

Temporal bone HRCT scans of 100 participants (182 normal temporal bones) were examined as 82 paired and 18 unpaired TBs. The ages ranged from 2-74 years. The mean age was 31.8 ± 16.5 years. Males were 47 (47%) and 53 (53%) females.. The paediatric group (aged 11 years and below) consisted of 14 participants (14% of study group) where 25 TBs were evaluated. The comparative demographics by age group were contrasted in Table 2.

Table 2: Age and gender of participants

Tendencies Group	Study size	Range (years)	Mean age	Median age	Mode	M:F
Paediatric group	14(14%)	2-10	6.4	7.5	2	1.3: 1
Adult group	86(86%)	12-74	35.9	36	48	1: 1.2
Overall group	100(100%)	2-74	31.8	32	48	1: 1.1

Variant anatomy of temporal bone

Nonvascular variants with the highest prevalence included type B sinus tympani (73.1%), Korner's septum (57.1%) and petrous aeration (56.5%). Variants with the lowest prevalence included large cochlear aqueduct (0.6%), enlarged vestibular aqueduct (1.1%) and sclerosed petrous apex (3.3%). Vestibular and cochlear aqueducts were seen in 100% of TBs and the complete course of cochlear aqueduct was appreciated in 32.4% of TBs (n=59/182). The overall prevalence of variants are summarized in Table 3.

Korner's septum was noted in 57.1% of TBs with 77.8% bilaterality. The prevalence of sinus tympani types (Figure 1) were type A -10.4%, B- 73.1% and C 16.5%.

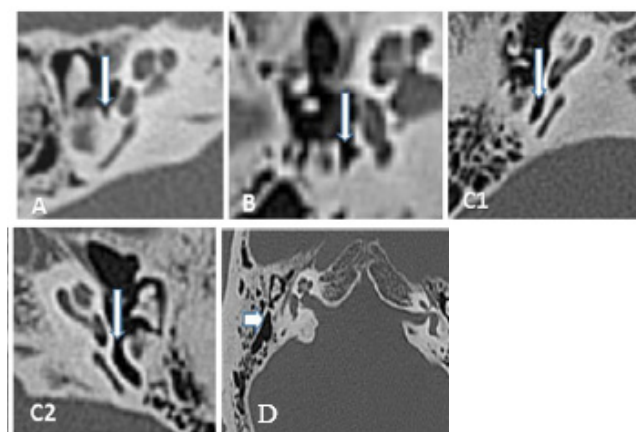


Figure 1: Scans of types of sinus tympani in axial view as A, B, and 2Cs and D showing Korner's septum bilaterally

Table 3: Prevalence of overall temporal bone variations and age groups comparison

Variations		Paediatric group n=25(100%)	Adult group n=157(100%)	Overall group n=182(100%)	P-value
1.	Sinus tympani types				
	A	1(4%)	18(11.5%)	19(10.4%)	0.45
	B	22(88%)	111(70.7%)	133(73.1%)	0.35
	C	2(8%)	28(17.8%)	30(16.5%)	0.5
2.	Korner's septum	18(72%)	86(54.8%)	104(57.1%)	0.35
3.	Petrous type				
	Fully aerated	3(12%)	53(33.8%)	56(30.8%)	0.03
	Supralabyrinthine aeration	00	00	00	
	infralabyrinthine aeration	1(4%)	24(15.9%)	25(13.7%)	
	Supra and infralabyrinthine aeration	1(4%)	21(13.4%)	22(12.1%)	
	Diploe	20(80%)	53(33.8%)	73(40.1%)	0.001
	Sclerosed	00	6(3.8%)	6(3.3%)	0.001
4.	Enlarge vestibular aqueduct	00	2(1.3%)	2(1.1%)	1.00
5.	Large cochlea aqueduct	00	1(0.6%)	1(0.6%)	1.00
6.	Cochlear cleft	11(44%)	36(22.9%)	47(25.8%)	0.14
7.	Large internal acoustic canal	2(8%)	19(12.1%)	21(11.5%)	0.64
8.	Low lying tegmen	8(32%)	45(28.7%)	53(29.1%)	0.95
9.	Facial nerve dehiscence	1(4%)	12(7.6%)	13(7.1%)	0.33
10.	Mastoid type				
	Hans 1	7(28%)	16(10.2%)	23(12.6%)	0.11
	Hans 2	6(24%)	24(15.9%)	30(16.5%)	0.31
	Hans 3	3(12%)	22(14.0%)	25(13.7%)	1.00
	Hans 4	7(28%)	80(50.9%)	87(47.8%)	0.35
	Sclerosed	2(8%)	15(9.6%)	17(9.3%)	1.00
11.	SSCCD	4(16%)	12(7.64%)	16(8.8%)	0.56
12.	Tegmen tympani dehiscence	3(12%)	22(14.0%)	25(13.7%)	1.00
13.	Foramen of Huschte	5(20%)	43(27.4%)	48(26.4%)	0.84

Cochlear cleft prevalence was 25.8% and one case of a large right cochlear aqueduct was noted. Superior Semicircular Canal Dehiscence (SSCCD) was observed in 8.8% TBs. The paediatric petrous apex was predominantly diploe n=20/25 (80%) while the adult petrous apex was predominantly aerated at 62.4% (p= 0.03). Sclerosed petrous apex was only noted in the adult group (p=0.001). Overall, the petrous

apices were diploe in 40.1% of TBs while partial and full aeration totaled 56.6%. Mastoid pneumatization was classified as sclerosed (9.3%) or pneumatized (Hans classification) as Hans 1= poor pneumatization (12.6%), 2= moderate pneumatization (16.5%), Hans 3= good pneumatization (13.7%) and Hans 4= very good pneumatization/hyperpneumatization (47.8%) as seen in Figure 2.

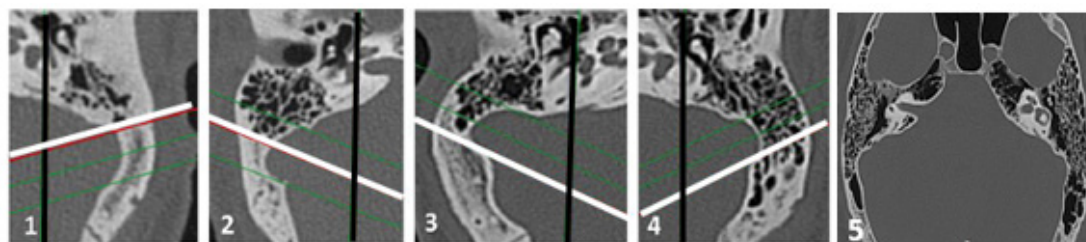


Figure 2: Scans showing mastoid pneumatization Hans types 1-4 respectively (axial cut at level of incudomalleor joint with black lines in the anteroposterior plane while white and green lines are at 40-45° consistent with Hans classification). Scan 5 shows total temporal bone pneumatization.

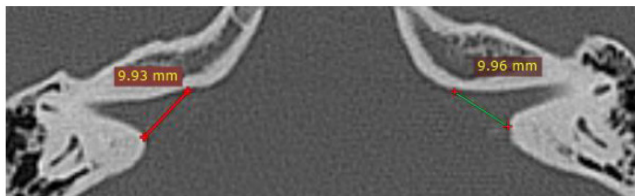


Figure 3: Scan of bilateral large IAC where porus acusticus width is ≥ 9 mm

Large IAC was noted in 11.5% TBs (Figure 3) where the widest IAC was 11.3% at the porous acusticus. The shape of IAC was also evaluated and four different shapes were observed (Figure 4) and their prevalence given in Table 4.

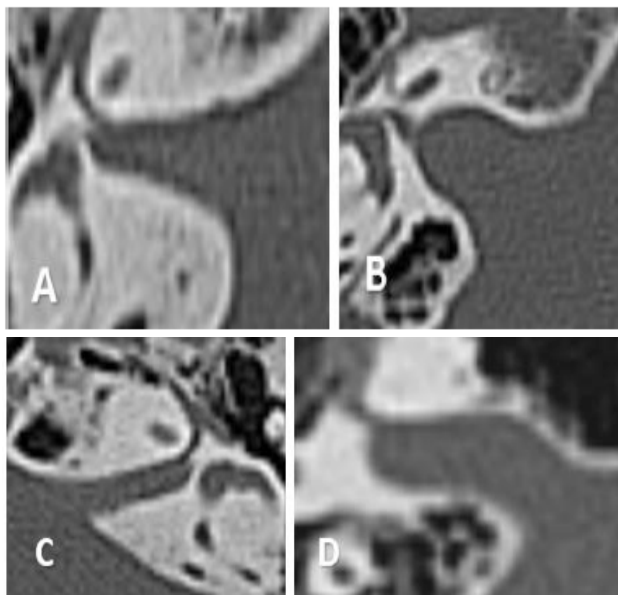


Figure 4: IAC shapes (axial views): Funnel- A, Bud- B, Cylindrical- C and S-shaped – D

Table 4: Frequency table of IAC shape

IAC shape	Rt	Lt	Total
Funnel shaped	47	44	91 (50%)
Bud shaped	25	25	50 (27.5%)
Cylindrical	11	20	31 (17.0%)
S-shaped	6	4	10 (5.5%)
Total	89 (48.9%)	93 (51.1%)	182 (100%)

Asymmetry of the IAC was observed in 15/82 (18.3% of paired TBs) as shown in Figure 5. Size asymmetry was ≥ 2 mm difference at porous acusticus.

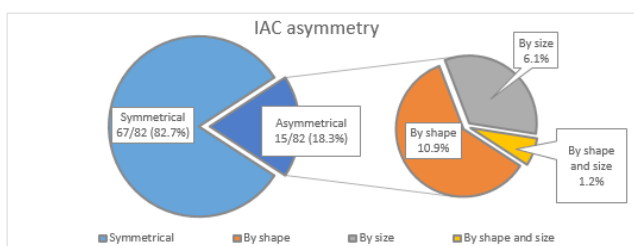


Figure 5: IAC asymmetry

Low lying tegmen was seen in 29.1% (n=53/182) TBs where 8.2% (n=15/182) were ≥ 7 mm deep and the deepest was 12.3mm. Prevalence of tegmen tympani dehiscence was 13.7% but no meningeal herniation was noted (Figure 6).

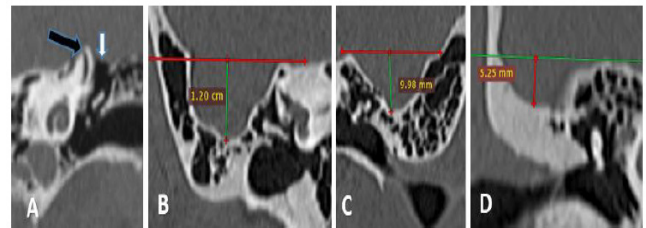


Figure 6: Scan A- concurrent dehiscence tegmen tympani (black arrow) with SSCCD (white arrow), B- coronal scan of low lying dura at 12mm depth, C and D show Foramen of Huschke

Foramen of Huschke was noted in 26.4% of TBs (Figure 6). Prevalence of facial nerve dehiscence was 7.1% with one case of oval window obstruction. Correlation of the temporal bone anatomical variants by gender revealed higher male prevalence of large IAC ($p=0.03$) and Hans 1 mastoid pneumatization ($p=0.003$), and female preponderance for low lying tegmen ($p=0.02$). Higher rates of petrous apex aeration were observed in higher degrees of mastoid pneumatization with up to 74.8% (n= 77/103) of petrous apex aeration being associated with Hans 3 and 4 mastoid pneumatization ($p=0.001$).

DISCUSSION

Temporal bone pneumatization patterns and Korner's septum

In this study, full petrous apex pneumatization and aeration was seen in 30.8% TBs which was higher than previous prevalence as high as 12.8%^{12,13}. Partial and full petrous aeration totaled 56.6% which was within the 32.7- 76% range by other studies^{13,14}. Petrous

apex aeration was associated with higher degrees of mastoid aeration ($p=0.001$), an association replicated in other studies^{12,14}. Higher rates of infralabyrinthine than supralabyrinthine pneumatization and aeration were noted in this and other studies¹²⁻¹⁴. Petrous apex pneumatization is important because it has been associated with higher incidence of apical mucocele, petrous apicitis, Gradenigo's syndrome and petrous air-cell effusion in the background of chronic ear disease¹⁵. Petrous pneumatization is also a risk factor for cerebrospinal fluid (CSF) rhinorrhea in skull base surgery¹⁴.

Prevalence of well pneumatized mastoid which comprised of Hans types 2-4 was 78% nearing the highest reported rate of 90.7%¹⁶. Mastoid pneumatization of Hans 3 and 4 patterns, which comprised 61.5% TBs in this study and 70-76.5% by others^{13,14}, has been associated with up to 100% protective cushioning against otic capsule violation in temporal bone trauma¹¹.

Korner's septum prevalence was 57.1% compared to other studies that noted 6.6-30.4% prevalence with lower rates seen in normal TBs and higher rates chronic ear disease cases^{6,17}. Korner's septum has been associated with tympanosclerosis, chronic ear disease and increased surgical time with higher ear disease persistence and recurrence^{6,17,18}. The higher prevalence in this study may be a regional/ genetic variation and could be a contributing factor to the higher rates of chronic otitis media and cholesteatoma recurrence observed anecdotally in this geographical region.

Canals, foramina and recesses

The Enlarged Vestibular Aqueduct (EVA) observed in 1.1% TBs was diagnosed using the Cincinnati criteria⁷. EVA has been associated with Sensorineural Hearing Loss (SNHL), vestibulocochlear anomalies, third window syndrome, perilymphatic gusher, and congenital syndromes^{19,20}.

The large cochlear aqueduct prevalence was 0.6% in tandem with other studies at 0.6- 3%^{21,22}. Its association with SNHL is disputed but its presence may predispose one to perilymphatic gusher or form a conduit for infection tracking between the inner ear and subarachnoid space⁷. The complete course of the cochlear aqueduct was seen as in 32.4% of TBs resonating other studies 31%^{8,23}. This complete course (Figure 7) may be mistaken for temporal bone fracture.

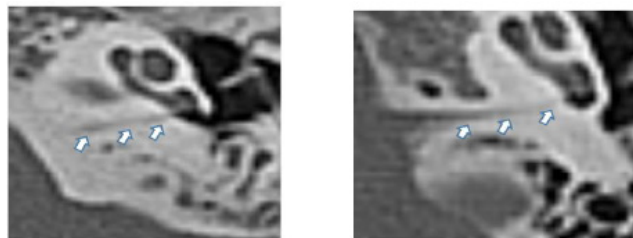


Figure 7: Scans of cochlear aqueduct showing long courses resembling fracture lines (white arrows)

Large IAC was seen in 11.5% of TBs as opposed to 0.3-2.3% by other studies^{7,21,22}. The IAC varied in shape where the funnel (50%) and bud (27.5%) types were the most prevalent whereas Sergio *et al*²⁴ found 58.3% funnel, 30.9% cylindrical and 10% bud shape. The S-shaped IAC observed in this study at 5.5% is rarely reported. Large IAC can be associated with congenital syndrome like Goldenhar syndrome, CSF leak during cochleostomy, vestibular anomalies and higher rates of meningitis²⁵. The IAC size asymmetry seen in 7.3% of paired TBs in this study, may be a normal variant or pathological result from intrameatal tumours, dural ectasia and chronic hydrocephalus, inter alia, none of which were noted in this study.

Foramen of Huschke was seen in 26.4% of TBs which was higher than previous reports of 14.9-17.9%^{26,27}. It is reportedly commoner in paediatric age group, an observation not replicated in this study²⁶. This foramen has been associated with ease of spread of disease between the ear, the temporomandibular joint and parotid salivary gland (deep lobe)^{26,27}.

The type C sinus tympani prevalence of 16.5% was significantly higher than the reported 4.4-5.9%^{5,21,22}. Disease in the deep sinus tympani is difficult to access and clear thus it has been associated with higher disease persistence and recurrence rate. Disease in the deep sinus requires use of endoscopes, intratympanic mirrors, blind probing and mastoidectomy with retrofacial approach, therefore adding to the complexity, duration and possible complications of surgery²⁸.

Labyrinthine and tegmen variations

The paediatric prevalence of cochlear cleft was 44% which compared well with 41% by Chadwell *et al*⁹. The higher paediatric rates than the older group (44% vs 22.9%) is as reported by Chadwell *et al*⁹. Cochlear cleft is considered a marker for the fissula ante fenestrum but it can be confused for fenestral otosclerosis or a fracture line²⁹.

Superior semicircular canal dehiscence was noted in 8.8% of TBs whereas prevalence rates are as low as 2% in asymptomatic patients to 13.6% in symptomatic patients³⁰. Symptomatic cases may present with vertigo, atypical conductive hearing loss, third window effect, autophony, pulsatile tinnitus, Tullio phenomenon and Hennebert sign³⁰.

Low lying tegmen, also known as low hanging dura, was observed in 29.1% of TBs thus marginally higher than upper range of 26.7% by other studies^{6,31}. The depth of tegmen in 8.2% of TBs was ≥ 7 mm where this depth complicates mastoid surgeries due to the contracted operating field especially when its concurrent with other variants like anterior sigmoid sinus³¹.

Tegmen tympani dehiscence was noted in 13.7% of TBs without dural herniation. No pathologies were observed as causes for the dehiscence. Tegmen dehiscence is seen in 15- 34% of the population³². When symptomatic, tegmen dehiscence may present as CSF effusion, CSF otorrhoea, serous otitis media, CSF rhinorrhoea, conductive hearing loss, meningitis, aural pain, headache, epilepsy, and other neurological complications. It also increases risk of dural breach, CSF otorrhea and meningocele/ meningoencephalocele³².

Facial nerve dehiscence

Facial nerve dehiscence had a prevalence of 7.1% compared to 0.5-74% by others⁶. Higher prevalence were noted in chronic otitis media cases than normal TBs⁶. This dehiscence predisposes the facial nerve to injury during middle ear exploration and surgery.

CONCLUSIONS AND RECOMMENDATIONS

There is a high prevalence rate of nonvascular temporal bone variants in this study. This may suggest a reciprocal predisposition to surgical complications or chronic ear disease. The higher rates of variants in the paediatric age group is possibly due to the immaturity of their temporal bones. The differences in the prevalence rates of the nonvascular variants between this study and others, may imply that variants differ based on geographical region and may have a genetic element. It is prudent for the otolaryngologist and radiologists to actively seek these variations on case by case basis to reduce pitfalls in diagnosis and management of ear pathology.

Declaration of interest: The authors report no conflicts of interest.

Ethical approval: This was given by KNH/UoN Ethics and Research Committee.

REFERENCES

1. Aprajita S and Anjali J. Bilateral variation in the origin and course of the vertebral artery. *Anatomy Res Intern*. 2012. Article ID 580765.
2. Willan PL, Humpherson JR. Concepts of variation and normality in morphology: important issues at risk of neglect in modern undergraduate medical courses. *Clin Anatomy*. 1999; **12**:186 – 190.
3. Takahashi K, Morita Y, Ohshima S, *et al*. A bone density development of the temporal bone assessed by computed tomography. *Otology Neurotology*. 2017; **38**(10): 1445-1449.
4. Wanga SK, Lemeshow S. Sample size determination in health studies. A practical manual. Ginebra: World Health Organization, 1991.
5. Marchioni D, Valerini S, Mattioli F, *et al*. Radiological assessment of the sinus tympani: temporal bone HRCT analyses and surgically related findings. *Surg Radiol Anatomy*. 2015; **37** (4): 385- 392.
6. Cigdem KT, Sema ZT, Hulya KN. Analysis of anatomical variations in temporal bone by radiology. *J Intern Advan Otology*. 2012; **8** (2): 239- 243.
7. Giovanni B, Valeria P, Patrizia F, *et al*. Cerebrospinal fluid leak in cochlear implantation: enlarged cochlear versus enlarged vestibular aqueduct (Common Cavity Excluded). *Intern J Otolaryngol*. 2016. Article 6591684.
8. Suresh KM, Henry CB, Jay A, *et al*. Enlarged cochlear aqueduct. *Amer J Neuroradiology*. 1998; **19**: 330– 332.
9. Chadwell JB, Mark JH, Daniel IC, *et al*. The cochlear cleft. *Amer J Neuroradiology*. 2004; **25**: 21– 24.
10. Lela Migirov. Patulous internal auditory canal. *Archives Otolaryngology- Head Neck Surg*. 2003; **129** (9): 992- 993.
11. Tae KK, Ryun H, Jae HO, *et al*. The potential protective effects of temporal bone pneumatization: A shock absorber in temporal bone fracture. *Plos One*. Published online 31st May 2019. Available at <https://doi.org/10.1371/journal.pone.0217682>.
12. Hentona H, Ohkubo J, Tsutsumi T, *et al*. Pneumatization of the petrous apex. *J Otolaryngology*. 1994; **97** (3): 450- 456.
13. Yamakami I, Uchino Y, Kobayashi E, *et al*. Computed tomography evaluation of air cells in the petrous bone: Relationship with postoperative cerebrospinal fluid rhinorrhea. *Neurologia Medico Chirurgia*. 2003; **43** (7): 334– 338.

14. Arthur DT, Jia HN, Su AL, *et al.* Classification of temporal bone pneumatization on high resolution computed tomography: prevalence patterns and implications. *Amer Acad Otolaryngology-Head Neck Surg Foundation*. 2018; **159**(4): 743–749.
15. Philip RC, Ritu S, Joel KC, *et al.* Petrous apex lesions. pictorial review. *Amer J Roentgenol*. 2011; **196** (3): 26-37.
16. Khalid H, Sarmad A, Rajagopalan R, *et al.* Pneumatization of mastoid air cells, temporal bone, ethmoid and sphenoid sinuses. any correlation? *Indian J Otolaryngol Head Neck Surg*. 2014; **66** (4): 429– 436.
17. Goksu N. Clinical importance of the Koerner's Septum. *Amer J Otolaryngol*. 1997; **18**(3): 304-306.
18. Ozer E. Korner's septum and chronic ear disease. *J Surg Radiol*. 2004; **26** (2): 118-121.
19. Mohamed ME, Nasr MO, Haytham MM, *et al.* Evaluation of the radiological criteria to diagnose large vestibular aqueduct syndrome. *Int J Pediatr Otorhinolaryngol*. 2016; **81**:84-91.
20. Karuna D, Franz JW, Judith EC. Enlarged vestibular aqueduct in pediatric SNHL. *Otolaryngology- Head Neck Surg*. 2009; **140** (4): 552- 558.
21. Tomura N, Sashi R, Kobayashi M, *et al.* Normal variations of the temporal bone on high-resolution CT: Their incidence and clinical significance. *Clin Radiol*. 1995; **50** (3): 144- 148.
22. Visvanathan V, Morrissey MS. Anatomical variations of the temporal bone on high-resolution computed tomography imaging: How common are they? *J Laryngol Otol*. 2015; **129** (7): 634-637.
23. Jackler RK, Hwang PH. Enlargement of the cochlear aqueduct: fact or fiction? *Otolaryngol Head Neck Surg*. 1993; **109**:14–25.
24. Sergio RM, Sergio A, Giuseppe DI, *et al.* Morphometric analysis of the internal auditory canal by computed tomography imaging. *Iran J Radiol*. 2012; **9**(2): 71–78.
25. Bisdas S, Lenarz M, Lenarz T, *et al.* The abnormally dilated internal auditory canal: A non-specific finding or a distinctive pathologic entity. *J Neuroradiol*. 2006; **33**: 275-277.
26. Pękala JR, Pękala PA, Satapathy B, *et al.* Incidence of foramen tympanicum (of Huschke): Comparing cadaveric and radiologic studies. *J Craniofacial Surg*. 2018; **29** (8): 2348- 2352.
27. Tozoğlu U, Caglayan F, Harorlı A. Foramen tympanicum or foramen of Huschke: anatomical cone beam CT study. *Dentomaxillofacial Radiology*. 2012; **41**(4): 294–297.
28. Fatthi AB, Mohammed BD, Ibrahim ES, *et al.* Sinus tympani endoscopic anatomy. *Otolaryngology - Head Neck Surg*. 2002; **127**(3): 158-162.
29. Bela P, Robert H, Katya OB. Imaging in otosclerosis: A pictorial review: *Insights Imaging*. 2014; **5** (2): 245– 252.
30. Berning AW, Arani K, Branstetter BF. Prevalence of superior semicircular canal dehiscence on high-resolution CT imaging in patients without vestibular or auditory abnormalities. *Amer J Neuroradiol*. 2019; **40** (4): 709- 712.
31. Júnior ARP, Pinheiro SD, Castro JD, *et al.* Mastoidectomy: Anatomical parameters x surgical difficulty. *Intern Archives Otorhinolaryngol*. 2012; **16** (1): 57- 61.
32. Chao YK, Chih HW, Hui MF. Conductive hearing loss as the initial manifestation of spontaneous herniation of epitympanic meningocele. *J Intern Advanced Otol*. 2014; **10** (1): 91- 93.

KNOWLEDGE AND PRACTICES OF TRACHEOSTOMY CARE IN KENYATTA NATIONAL HOSPITAL: CLINICAL AUDIT

Mokoh L, Gitonga S

ENT Department, Kenyatta National Hospital, Nairobi, Kenya

Address for correspondence: Dr. Lillian Mokoh. Email: warimumokoh@gmail.com

ABSTRACT

Background: Tracheostomy is the most common emergency procedure in Kenyatta National Hospital. Between the month of November 2018 and April 2019 a total of 86 tracheostomies were done. Previous studies done in the hospital show that tracheostomies have a high morbidity and complication rate especially in the post-operative phase

Objectives: The audit was carried out to determine the level of knowledge on tracheostomy care among the health care workers in Kenyatta National Hospital.

Methods: Clinical audit done by use of questionnaires administered to health care workers in each department.

Results: Majority of health care workers except those in the ENT Department have little knowledge on tracheostomy care and have no confidence taking care of a patient with a tracheostomy tube.

Conclusion: It is recommended for the department to hold various CMEs and teachings on tracheostomy care throughout the year. Tracheostomy care should be incorporated into the schedule of classes for both the doctors and nurses in training.

Key words: Tracheostomy, Stoma, Intubation, Fistula, Haemorrhage

INTRODUCTION

Tracheostomy is a word used to describe the creation of a stoma on the skin surface that leads to the trachea. It is a surgical procedure mainly done to relief upper airway obstruction and also in ICU patients due to prolonged intubation. Tracheostomy care is important in management of patients after the procedure especially in the immediate post-operative period. Tracheostomy care can be complex and requires individuals to have adequate knowledge and effective practices when taking care of these patients to minimize potential complications. A retrospective study done by Macharia¹ on 115 patients who underwent tracheostomy, found a morbidity rate of 39% in adults and 78.3% of paediatric patients.

Some of the common complications of tracheostomy include infections, tube dislodgement, blockage by secretions, tracheoesophageal fistula, pneumothorax trachea-innominate fistulas and even death. According to the study above majority of the complications were found in the early post-operative phase. Most of the complication can be avoided by simple procedures such as suctioning. In KNH the incidence of tube blockage was found to be 19.5%².

Ongulo³ looked at the quality of tracheostomy care among patients in Kenyatta National Hospital. He showed that the health care workers especially the nurses needed trainings and frequent updates on tracheostomy care.

MATERIALS AND METHODS

In Kenyatta National Hospital a total of 86 tracheostomies were done between November 2018 and April 2019. The audit was carried out during this period. A review of ENT consults done on patients with a tracheostomy tube was also done (Figure 1).

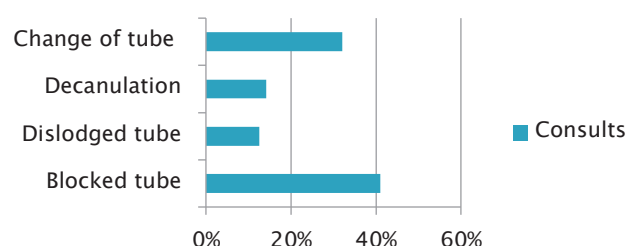


Figure 1: Reasons for ENT consults over the month of March 2019

Objectives of the audit

- (i) Find out the level of knowledge on tracheostomy care among the clinical staff in KNH.
- (ii) To come up with an education or training policy on tracheostomy care with the aim of improving patient safety.

Audit procedure

Permission to carry out the audit was sought from the head of ENT department and the head continuous learning and research in KNH.

- (i) Questionnaire developed and administered among doctors/registrars, nurses and clinical officers in KNH.
- (ii) Total of 100 respondents from each of the four main departments.
- (iii) Questionnaire divided into 3 sections analysed separately.
- (iv) A review of patient's records and files.

Audit standards

The questionnaire was divided into 3 sections: Demographics, knowledge and practices and image recognition

- (i) Knowledge and practices –Minimum score of 60%, for ICU, ENT and A/E workers- 80%.
- (ii) Competence in care -80% should be comfortable to care for a patient with a tracheostomy.
- (iii) 100% should identify the problem with the photo in the questionnaire.

RESULTS

A total of 100 participants filled the questionnaire. These comprised of doctors clinical officers and nurses working in the hospital. Any person willing to participate was given the questionnaire.

Participant's demographics

The hospital has a high number of young doctors and nurses who are commonly in training. This is reflected by the results where most of the participants were between the ages of 26 and 35 years (Figure 2).

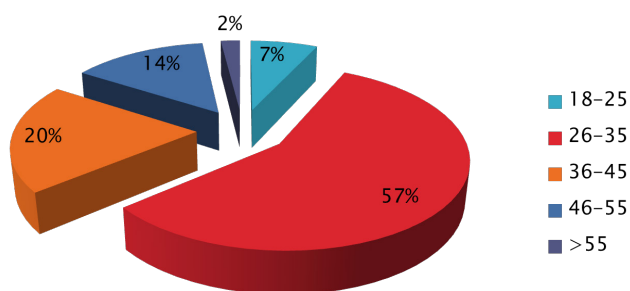


Figure 2: Pie chart showing the different age groups of respondents

Qualifications of participants

Majority of our respondents were nurses who are the main people involved in the care of patients under the guidance of doctors especially the senior house officers who are the first on call in most departments. The diploma nurses are the most common as shown in the results (Figure 3).

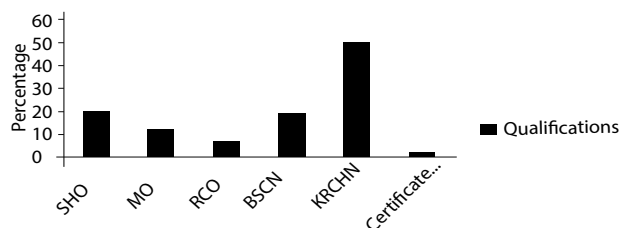


Figure 3: Bar graph showing different qualifications of the respondents

Departments audited

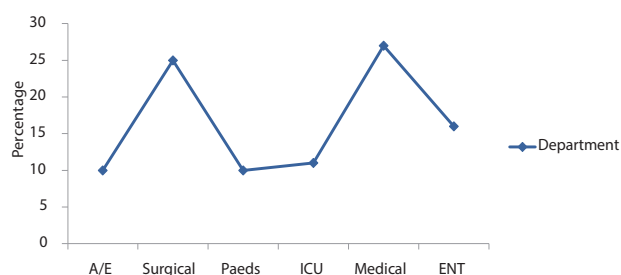


Figure 4: Number of respondents from each department

Majority of the patients with a tracheostomies land in the surgical unit or in the accident and emergency. A number of the consults on tracheostomy care came from the medical wards. Thus the audit tried to get most of the respondents from these departments.

Work experience

As the majority of the respondents were young the work experience was between 5 and 10 years (Figure 5).

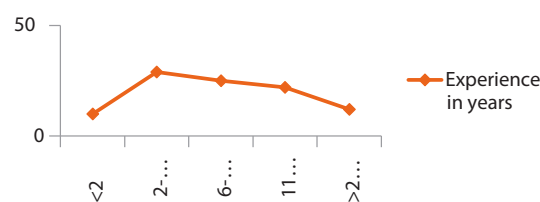


Figure 5: Line graph showing level of experience in years

Level of knowledge

Contrary to the set standard of 60% the audit majority of the workers scored 50% but those from ICU and ENT met the standard of the audit and scored 80%. This shows that only the people working in ICU and in the ENT department have enough knowledge on tracheostomy care (Figure 5).

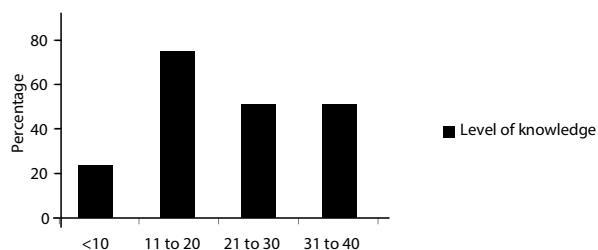


Figure 6: Bar graph showing the score assessing the level of basic knowledge on tracheostomy care

Level of competence

Forty three percent of the health workers did not feel competent enough to handle a patient with a tracheostomy while 33% felt they needed supervision with the minority being competent. These comprised of ICU and ENT nurses mainly. There was no difference in the age or the level of qualification all respondents who were not from ENT or ICU were not comfortable taking care of a patient with a tracheostomy tube (Figure 7).

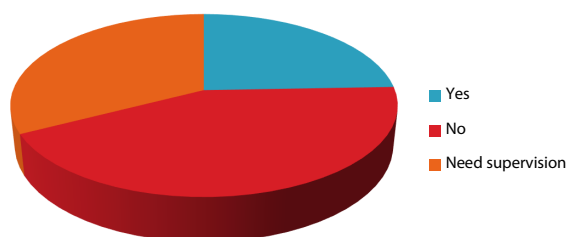


Figure 7: Pie chart showing the level of competence in handling a patient with a tracheostomy

Picture recognition

The last section was Figure 8. Health workers were required to identify the problem with the photo but only 62% got it right. Figure 8 shows that a majority of health workers in the hospital would not know how to appropriately administer oxygen to a patient with a tracheostomy tube.



Figure 8: Showing a patient with a tracheostomy tube having oxygen being administered

DISCUSSION

Tracheostomy is the most common emergency ENT procedure, all individuals involved in patient care should have some level of knowledge on tracheostomy care. This audit was performed in a National Teaching and Referral Hospital hence the majority of respondents were young and undergoing training. More than half of the respondents were nurses which was better as they are mostly involved in the patient care.

A patient with a tracheostomy tube can present to any speciality of medicine thus personnel from every department should know how to handle one. From this audit it is evident that only people from ENT and ICU have the required knowledge to handle these patients and only half of the respondents are comfortable to handle them without supervision. This shows a gap in patient care that is important especially among staff from the accident and emergency department who will often meet these patients as an emergency.

Generally only seventy five of the respondents met the audit standard. This puts emphasis on the need for continuous medical education especially on tracheostomy care in all departments. This can be conducted in the morning or weekly meetings with practical demonstrations and regular assessments. With this we can easily decongest patients who do not require ENT care from the ENT wards and help reduce morbidity and mortality among patients with tracheostomies.

CONCLUSIONS

- (i) Seventy five percent of the respondents did not meet the standard of our clinical audit.
- (ii) Huge gap exists on the level of knowledge on tracheostomy care among KNH clinical workers.
- (iii) Majority of the respondents are not comfortable participating in tracheostomy care.

RECOMMENDATIONS

- (i) Standard protocols or ENT guidelines on tracheostomy care should be developed in the hospital.
- (ii) Frequent CMEs and trainings on tracheostomy care especially on nurses in various departments.
- (iii) Introduction of a tracheostomy care checklist to ensure standard quality care.
- (iv) Incorporation of tracheostomy care in life support courses.
- (v) Repeated audits and assessments on tracheostomy care and complications in the hospital.

REFERENCES

1. Macharia M. Tracheostomy at Kenyatta National Hospital a 5 year study 1983-1997. MMed Dissertation. UoN 1990.
2. Karuga C. Risk factors for early complications of tracheostomies at Kenyatta National Hospital. MMed Dissertation. UoN 2011.
3. Ongulo O. Quality of tracheostomy care; A case of Kenyatta National Hospital. MMed Dissertation, UoN 2013.

HYPOPHARYNGEAL CANCER IN AN ADOLESCENT MAASAI MALE: AN UNUSUAL CASE REPORT

Chumba U¹, Okerosi S¹, Gitonga S²

¹Department of Surgery (ENT), School of Medicine, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya

³ENT Department, Kenyatta National Hospital, Nairobi, Kenya

Address for correspondence: Dr. Uhenya Chumba, Department of Surgery, School of Medicine, College of Health Sciences, University of Nairobi, P.O. Box 19676-00202, Nairobi, Kenya. Email: uhenyachumba@gmail.com

ABSTRACT

Hypopharyngeal cancer forms 3-5% of all head and neck cancers. It predominantly affects elderly males, above the fifth decade of life with a male to female preponderance of 2-20:1. Post cricoid hypopharyngeal tumours occur more commonly in younger females with Plummer- Vinson syndrome being a risk factor. We however report a rare case of hypopharyngeal carcinoma occurring in a 19 year old adolescent Maasai boy who did not present with any of the common risk factors attributed to this carcinoma. Our aim is to review the risk factors for this disease and generate the desire for public awareness in improvement of diets especially for ethnic groups.

Key words: Hypopharynx, Maasai, Squamous cell carcinoma

INTRODUCTION

The hypopharynx is the region between the oropharynx above (at the level of the hyoid bone) and the esophageal inlet below (the inferior level of the cricoids cartilage). Cancers that arises in the hypopharynx represents approximately 3-5% of all cancers of the upper aerodigestive tract¹. Hypopharyngeal cancers are malignancies that are located in the various subsites of the hypopharynx. These subsites include: pyriform sinus, lateral pharyngeal wall and the posterior pharyngeal wall, or post-cricoid pharynx². As in other head and neck cancer sites, more than 95% of hypopharyngeal malignancies arise from the epithelium of the mucosa and, therefore, are squamous cell cancers¹. Premalignant mucosal lesions evolve into hyperproliferative lesions that develop the capacity to enlarge, to invade local structures, to invade lymphatics to spread to regional lymph nodes, and to invade vascular channels and eventually to metastasize to other organs².

Hypopharyngeal cancers predominantly affect the elderly males, with a male to female preponderance of 2-20:1 above the fifth decade of life^{2,3}. Post-cricoid hypopharyngeal tumours are more frequent in younger females with a risk factor being Plummer-vinson syndrome³. Hypopharyngeal squamous cell carcinomas are closely related to tobacco and alcohol exposure, typically affecting those over the age of 60 years³.

CASE REPORT

A 19 year old male, a class 8 Maasai student and pastoralist presented to the Kenyatta National Hospital Emergency room with a history of progressive dysphagia for 5 months. The dysphagia was first to solid foods then gradually progressed to liquids. Voice hoarseness, dyspnoea and stridor later appeared a month prior to presentation which also progressively worsened from dyspnea on exertion to dyspnea at rest. There was no past medical history of gastroesophageal reflux disease, anaemia, blood transfusion, prior hospitalization for any chronic illness or having been irradiated for any malignancy. He denied a history of tobacco use, alcohol consumption or exposure to tobacco smoke in his homestead. His diet consisted mainly of meat with little fruits and vegetables. He had no family history of malignancy.

On clinical examination, he was dyspnoeic, in respiratory distress having an inspiratory stridor and was cachexic. His oxygen saturation at room air was 60%, and he had no features of anaemia. The neck examination revealed a widened laryngeal framework, absent laryngeal crepitus with 3 palpable level II and III lymph nodes on the right side of his neck. The largest lymph node measured about 4cm. His laboratory work-up revealed a haemoglobin level of 16.1g/dL with a normal Mean Corpuscular Volume (MCV). He had a mild albuminemia with acute kidney

injury due to dehydration. He was taken to theatre for an emergency tracheostomy, feeding gastrostomy tube fashioning, direct laryngoscopy, esophagoscopy and biopsy of the tumour.

The findings on direct laryngoscopy and esophagoscopy were; a friable mass involving the lingual surface of the epiglottis, bilateral valleculae and filling up the 3 subsites of the hypopharynx and the esophageal inlet. The site having the bulk of the tumour was in the hypopharynx but it was difficult to assess which hypopharyngeal sub-site had the bulk of the tumour. The tumour had completely obscured all the laryngeal structures. Biopsies of the tumour were obtained and the histological report was a well differentiated squamous cell carcinoma of the hypopharynx. Human papilloma virus test done was negative.

Post operatively, a CT scan of the neck was done which showed a soft tissue density extending from the level of the oropharyngeal airway, with complete obliteration of the airway up to the level of the subglottis (Figure 1).

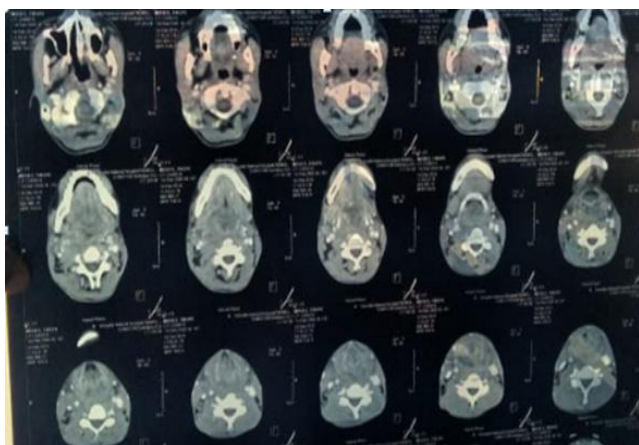


Figure 1: CT scan images show a bulky soft tissue mass in the hypopharynx extending to the oropharynx and the larynx

A final diagnosis of a well differentiated squamous cell carcinoma of the hypopharynx with oropharyngeal Extension Staged as T4a N2b M0 was made.

The patient underwent 2- dimensional radiotherapy receiving a total of 66 grays radiation aimed at the primary site and neck with no concomitant chemotherapy due to financial constraints. Subsequently he developed post radiation complications which included neck fibrosis, facial edema, and pain. He was on follow-up at the ENT clinic and Radio-oncology clinic at the Kenyatta National Hospital. While on follow-up, he was found to have residual tumour which was inoperable and he died six months later.

DISCUSSION

The above case is an unusual presentation of an advanced hypopharyngeal cancer occurring in a teenage boy who presented at Kenyatta National Hospital, the largest referral hospital in Kenya. In Africa and generally the world over, there are no known or documented statistics showing the prevalence of hypopharyngeal cancers in adolescents. The 19 year old Maasai patient being presented here did not have any of the conventional risk factors for head and necks cancers. He did not take alcohol, did not smoke or chew tobacco, was not exposed tobacco smoke and neither was he infected with HPV^{1,3}.

Other risk factors include inadequate fruit and vegetable intake, workplace inhalants such as asbestos, poor oral hygiene, gastroesophageal reflux disease and male sex. Literature shows that hypopharyngeal cancer usually occurs in people who are above 40 years old. In people younger than 30 years, it is rare let alone adolescents^{1,4-6}. The usual presentation is men aged 55-70 years with a history of tobacco and/or alcohol use and ingestion respectively³. Among Scandinavian women the Plummer Vinson syndrome is a risk factor and genetic predisposition is a risk factor that has not been thoroughly studied.

The pathophysiology of this cancer like other cancers involves the initiation stage when the initial genetic structure of any cell is changed due to chemicals altering DNA genes⁷. This leads to the formation of an immortalized cell which has defects in terminal differentiation, growth control and apoptosis^{7,8}. Furthermore, consideration of the potential biological effects of various constituents of fruits and vegetables suggest plausible mechanisms for their protective effects, such as by reducing oxidative damage of DNA or increasing the activity of enzymes able to detoxify carcinogens⁹.

There is a varied position on the effect of fruit and vegetables on carcinogenesis. This view was consolidated by an expert panel report published in 1997, which stated that there was 'convincing' evidence that high intakes of fruit and/or vegetables decrease the risk for cancers of the mouth and pharynx, oesophagus, stomach, colorectum and lung¹⁰. However, within another 10 years, an updated report coordinated by the same organisation downgraded these previous conclusions from 'convincing' to either 'probable' or 'limited-suggestive'¹¹. The principal reason for this change in judgment was that the newer results from

large prospective studies did not confirm the earlier results, which had come mostly from case-control studies. There is now a 2018 update of the World Cancer Research Fund/ American Institute for Cancer research, appears to say fruits and vegetables have no role in pharyngeal cancers¹¹. The Maasai ethnic groups have a diet which consists of milk, meat and blood and very little fruits and vegetables and thus, for this young man, may have been a risk factor to developing this cancer. Genetic predisposition may be another risk factor¹². However, the aetiology of head and neck cancers in young adults is still unclear³.

CONCLUSION

Hypopharyngeal cancer though commonly occurring in the elderly with the risk factors highlighted, can occur in the young as shown by this index case at Kenya's largest referral Hospital. It is however not clear whether this is an isolated case. Awareness of this cancer is vital with more studies needed to evaluate the risk factors which may be associated with head and neck malignancies occurring in adolescents. If a diet poor in vegetables and fruit is the reason for this young man presenting with such an extensive tumour, public health education initiatives ought to be undertaken in these communities.

REFERENCES

1. Kuo P, Chen MM, Decker RH, *et al.* Hypopharyngeal cancer incidence, treatment, and survival: temporal trends in the United States. *Laryngoscope*. 2014; **124**(9):2064-69.
2. Pignon JP, Bourhis J, Domenge C, *et al.* Chemotherapy added to locoregional treatment for head and neck squamous-cell carcinoma: three meta-analyses of updated individual data. MACH-NC Collaborative Group. Meta-Analysis of Chemotherapy on Head and Neck Cancer. *Lancet*. 2000; **355**(9208):949-955.
3. Rodriguez T, Altieri A, Chatenoud L, *et al.* Risk factors for oral and pharyngeal cancer in young adults. *Oral Oncol*. 2004; **40**:207-213.
4. Macfarlane TV, Macfarlane GJ, Oliver RJ, *et al.* The aetiology of upper aerodigestive tract cancers among young adults in Europe: the AR-CAGE study. *Cancer Causes Control*. 2010; **21**:2213-2221.
5. Saleh EM, Abdullwahab AA, Kammal MM. Age and sex incidence of hypopharyngeal tumours in upper Egypt: Assuit University experience. *J Laryngol Otol*. 1995; **109**(8):737-740.
6. Joo YH, Lee YS, Cho KJ, *et al.* Characteristics and prognostic implications of high-risk HPV-associated hypopharyngeal cancers. *PLoS One*. 2013; **8**(11):e78718. Published 2013 Nov 11. doi:10.1371/journal.pone.0078718.
7. Langley R, Fidler L The seed and soil hypothesis revisited - the role of tumor-stroma interactions in metastasis to different organs. *Int J Cancer*. 2011; **128**(11): 2527-2535.
8. Riaz N, Morris LG, Lee W, Chan TA. Unraveling the molecular genetics of head and neck cancer through genome-wide approaches. *Genes Dis*. 2014; **1**(1):75-86. doi:10.1016/j.gendis.2014.07.002.
9. Steinmetz KA, Potter JD. Vegetables, fruit, and cancer. II. Mechanisms. *Cancer Causes Control*. 1991; **2**(6):427-442.
10. World Cancer Research Fund/American Institute for Cancer Research. Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective. AIRC: Washington, DC; 1997.
11. World Cancer Research Fund/American Institute for Cancer Research. Food, Nutrition and the Prevention of Cancer: A Global Perspective. AIRC: Washington
12. Interactive Cancer Risk Matrix (Internet). World Cancer Research Fund. 2020 [Cited 22 March 2020].

NOVEL TECHNIQUE FOR TONGUE SUSPENSION: A CASE REPORT

Musyoka DM

Department of Surgery, The Aga Khan University Hospital Nairobi, Kenya. Email: totondux@yahoo.com

ABSTRACT

Obstructive sleep apnea has serious detrimental effects on health. It should therefore be managed as soon as a diagnosis is made. Surgery that is directed to the exact site of obstruction is part of management of some of these patients. Tongue suspension for patients with prolapse of the base should be considered for good outcome. The instrument used for this is expensive and largely unavailable in most countries. A novel technique of tongue suspension is herein described using cheap and widely available material. Two patients with severe obstructive sleep apnea were managed by uvulopalatopharyngoplasty and tongue suspension using a novel technique using material widely available and cheap. Pre and postoperative polysomnography were taken revealing improvement after surgery. There was improvement in sleep, reduction of daytime somnolence and fatigue in the postoperative period. Proper evaluation of the patient with obstructive sleep apnea is mandatory for success of surgery. Tongue suspension using this novel technique can be used to achieve good results. It is recommended that this new technique can add to the sleep surgery armament of the otolaryngologist.

Key words: Obstructive, Apnea, Uvulopalatopharyngoplasty, Tongue, Suspension

INTRODUCTION

Obstructive sleep apnea (OSA) is becoming common in the developing world going by the increasing number of cases seen in the Otolaryngology Department. Immediate management of the condition is warranted to prevent detrimental effects on the health of the afflicted individual. Continuous Positive Airway Pressure (CPAP) machine use is the first line in the management of OSA. However, poor compliance of CPAP has been reported in a proportion of patients due to various factors exposing the patient to adverse events due to the condition¹. Alternative management in the form of surgery and lifestyle modification is warranted in these patients. Various surgical options are available with uvulopalatopharyngoplasty (UPPP) being the most common. However, UPPP has poor results if obstruction is due to prolapse of the tongue base. Suspension of the tongue with Kit Repose is designed to anchor the tongue base using a suture that is based on a titanium screw in the inner surface of the mandible at the geni apophysis. This prevents the base of tongue from prolapsing during sleep thus reducing obstruction². The kit is however expensive despite the procedure being mini invasive and quick to perform. The Kit Repose is largely unavailable in most developing countries denying the otolaryngologist a vital item necessary for sleep surgery. This study reports tongue suspension using widely available items to achieve decent results in two patients with obstructive sleep apnea.

CASE REPORTS

Two patients presented to the ENT outpatient clinic with symptoms of obstructive sleep apnea. Comprehensive

history and examination was done. Polysomnography was requested as part of the initial work up to confirm the diagnosis and establish severity. Options of management were discussed with the patients after confirmation of the condition. Reluctance of CPAP use was expressed in both patients. After undergoing a routine uvulopalatopharyngoplasty, the patients had the mandible and submandibular region cleaned and draped. Lignocaine/Adrenaline solution 1:100,000 was then infiltrated in the region posterior to the mentum around the posterior border of the mandible. An incision was then made about 2 cm along the posterior border of the mandible. The mandible was then exposed and the skin dissected superiorly to expose the lower 1cm of the mentum on the anterior aspect. A rotating drill with a burr 1mm diameter was used to drill through the bone about 0.5cm above the lower edge of the mandible in the midline beginning on the anterior surface to exit posteriorly. The stylet of a gauge 16 intravenous cannula was then inserted through the submental incision posterior to the mandible and advanced towards the base of tongue to exit about 1.5cms lateral to the midline in the oropharynx. A finger placed in the mouth was used to support the base of tongue and to ensure precision as the stylet is directed towards it. A 2.0 nylon suture with a needle was then guided through the opening of the stylet in the oropharynx and tunneled to exit in the submental region. The stylet was then withdrawn leaving the suture in place. The needle of the suture which was at this point in the oral cavity was used to bury the suture in the tongue base starting at the point of origin to exit about 1.5cm lateral to the midline on the contralateral side. The stylet was then reintroduced in the submental region and advanced to exit at the tongue base exactly at the point of exit of

the suture. A finger in the oropharynx supporting the tongue base was used to ensure precision. The needle was then cut off and the suture in the oropharynx was guided through the opening of the stylet to exit in the submental region. The stylet was again withdrawn leaving both ends of the suture in the submental region. One of the sutures was then passed through the hole in the mandible and the ends are tied together. A finger in the mouth is used to gauge the amount of tension necessary to support the base of tongue. About

four knots were thrown to prevent suture slipping. The submental incision was then closed in layers. Analgesics were given in the postoperative period. Both patients had an uneventful postoperative recovery. Both patients reported improvement of sleep, reduction of daytime sleepiness and fatigue. Postoperative polysomnography was repeated 5 and 2 and half months for patient A and B respectively.

Table 1: Pre- and postoperative polysomnography results of two patients

Patient	A Preoperation	A Postoperation	B Preoperation	B Postoperation
BMI [kg/m ²]	31.4	28.7	41.9	40.6
TST	5.43	7.05	6.48	7.11
Sleep efficiency	71.3	88.4	85	89.7
Position: supine %	53.7	96.7	8.1	29.1
Position: not supine %	46.3	3.3	91.9	70.9
Number of desaturations: supine	329	194	72	61
Number of desaturations: not supine	53	15	241	71
Baseline oxygen %	92	91	88	90
Minimum oxygen %	75	77	77	81
Apnea hypopnea index	34.1	30.1	35.4	15.9



Surface marking of mandible and site of incision



Exposed and drilled mentum



Gauge 16 needle inserted through mentum to exit at the base of tongue



Nylon 2'0 threaded through the needle end to exit in the mentum incision



Needle of Nylon 2,0 in oropharynx after 1.5 cm threading the suture



Suture threaded through needle which is the withdrawn leaving both ends in the submentum



Buried needle exiting about lateral to the midline



Sutures tied together through the hole suspending the tongue base



Reinserted gauge 16 needle exiting at the site point of suture

DISCUSSION

Obesity is becoming more prevalent in Africa despite being considered a western phenomenon previously³. This carries with it the attendant risk of various health risks including obstructive sleep apnea. There is in addition increased awareness due to improvement of information dissemination resulting in a greater number of patients with sleep disorders seeking treatment. Use of CPAP machine is the first line of management for obstructive sleep apnea. It is recommended that patients use the CPAP machine at least 4 hours a night and a minimum of 5 days a week to reap benefits. This is however not achieved in a large proportion of patients due to various reasons ranging from ill-fitting masks to claustrophobia. Prohibitive cost of the machine also makes most patients unable to acquire it for use. These patients and those with obvious structural causes of obstruction should be offered surgery as an option of

management. Brian *et al*⁴ made a case for consideration of surgery as first line in management of patients with OSA. Surgery had better outcomes compared to CPAP with a lower mortality over long term follow up. They noted that inconsistent use of CPAP exposed the patients to cardiovascular risk unlike surgery that confers a permanent solution⁴.

Surgery for sleep apnea is aimed at reduction of airway obstruction and the detrimental effects it has on the patient. UPPP is the most common such operations performed. The success rate of UPPP as a standalone procedure has been quoted as 36.6% while this increases to 62.3% when combined with tongue suspension⁵. Modification of two anatomical sites confers better outcome especially in moderate and severe OSA. Poor outcomes from sleep surgery has been associated with poor selection of patients. Thorough assessment for structural obstruction in the airway is mandatory for selection of the patients who would benefit from surgery. Clinical examination may reveal such anomalies like enlarged tonsils, an elongated uvula or soft palate or enlarged turbinates. Dynamic obstruction on the other hand is best demonstrated at sleep endoscopy where the exact site of structural obstruction is located. This allows for appropriate tailoring of surgery according to the site of obstruction. Antero-posterior narrowing at the oropharynx suggests tongue collapse. The larynx will be poorly visible in this scenario.

Different surgical techniques have been designed for tongue base prolapse. Radiofrequency reduction of the tongue base, geniohyoid advancement and hyoid suspension are some of the procedures that are aimed at reducing tongue base prolapse during sleep. Patients with tongue base collapse will not benefit from UPPP alone. Tongue suspension improves the outcome of sleep surgery when performed in addition to UPPP. Tongue base suspension using the Kit Repose is a relatively recent entrant in sleep surgery that gives good results. The technique uses a disposable kit that anchors a non- absorbable suture that has been passed through the tongue base to a titanium screw positioned on the geni hypophysis of the mandible. There was overall good outcomes on the polysomnography examination with reduction of the Respiratory Disturbance Index reducing 44.5 to 24.2 (average 45% reduction). All the 20 patients underwent UPPP in addition to tongue suspension as in our patients. This suspension prevents prolapse of the tongue associated with gravity and hypotonicity of the muscles during sleep. This suspension is relatively non-invasive when compared to Genioglossus advancement where mandibular osteotomies are involved. The Kit is however expensive and unavailable in most parts of the world⁶.

This deficiency encouraged improvising of the technique using widely available and cheap material to achieve decent tongue base suspension. The technique

described above is based on a similar one used in lateralization of the vocal cord where an intravenous cannula and suture are used. While only two patients are reported herein, the favorable outcomes as can be seen in the polysomnography results is an indication that this technique can be used in place of the Repose kit techniques. Both patients reported reduced daytime sleepiness and reduction in snoring which is a clear evidence of efficacy of surgery. The individual degree of effect of UPPP and tongue suspension on the outcome of sleep can only be elaborated by conducting a randomized clinical trial. No drug induced sleep endoscopy was done preoperatively to determine anatomical sites of obstruction in these patients and hence since two surgical interventions targeted at different anatomical sites, it is not possible to determine with certainty the relative contribution of each intervention to the post op improvement.

CONCLUSION

This technique is cheap, easily reproducible and has a short learning curve. It can thus be adopted by Otolaryngologists in developing countries enabling them offer OSA patients an option for tongue base suspension where the Kit Repose is unavailable.

PATIENT CONSENT

Both patients gave signed informed consent for use of their medical information in the journal.

CONFLICT OF INTEREST

The author declares no conflict of interest.

REFERENCES

1. Catcheside PG. Predictors of continuous positive airway pressure adherence. *F1000 Med Reports*. 2010; 2:1470-82.
2. Sorrenti G, Picin O, Latini G, Scaramuzzino G, e. Tongue base suspension technique in obstructive sleep apnea: personal experience. *Acta Otolaryngology Ital*. 2003; 23(4): 274-280.
3. Danquah F, Ansu-Mensah M, Kuupiel D, Bawontuo V. Risk factors and morbidities associated with childhood obesity in sub-saharan Africa: a systematic scoping review. *BMC Nutrition*. 2020; 6: 37.
4. Brian W, Claudio V, Edward B, Kenny P. Reconsidering first-line treatment for obstructive sleep apnea: a systematic review of the literature. *J Otolaryngology –Head and neck Surg*. 2016; April 6; 45(23).
5. Handler E, *et al*. Tongue suspension: an evidence-based review and comparison to hypopharyngeal surgery for OSA. *Laryngoscope*. 2014; 124(1): 329-336.

HOW BUSINESSES HAVE KEPT AFLOAT DURING COVID-19 AND LESSONS LEARNT FROM THE PANDEMIC

Steve Muga

Managing Director, Italian Kitchens Limited, Second floor, Western Heights Building, Westlands, Nairobi, Kenya.
Email: smuga@italiankitchens.co.ke

The world has just gone through a severe global pandemic which has in some ways been compared to the 1918-1919 influenza pandemic given the moniker “the Spanish flu” caused by the H1N1 virus that originated from birds. An article published in the journal *Bio Space* in April 2020 drew numerous comparisons and commonalities between the two which among other things compared the fatality rates as well as the fact that both were considered “novel” which is to say they are so new nobody in either era had any immunity to them. In Africa, we are just emerging from the other end of the tunnel and even though the recorded deaths and number of confirmed cases may not have been as debilitating here as they were in Europe and America, we all agree that the Covid-19 pandemic has reshaped the world in more fundamental ways than we realize. The impact of the pandemic on businesses has been brutal. Its micro and macro-economic effects on economies crippling. These will likely be felt for years to come. Most businesses have gone into survival mode and have been forced to find ways to adapt and reinvent. Or else perish. According to some estimations made by the World Bank, the pandemic will cost sub Saharan Africa (SSA) between USD 37 billion and USD 79 billion in output losses for 2020. Following this report, an opinion piece published by the United Nations Industrial Development Organization discussing the likely effects of the Covid-19 pandemic on industry and economy of SSA countries stated that SSA industries will not only be heavily impacted by Covid-19 containment measures at home but also by those that have been implemented abroad. Due to lower global demand, the region will likely see a reduction in key industrial inputs and outputs. This means that industrial firms will experience a drop in domestic sales and exports due to among other factors lower demand, reduced prices for commodities and reduced investments due to a higher risk aversion from foreign investors. The impact on local industries thus will likely be significant particularly on small and medium enterprises. Therefore, the measures businesses are

taking to stay afloat and institutions and governments are taking through policy to mitigate the negative effects of the pandemic is an important conversation to have right now. We will look at a few.

A lot of companies have used this lockdown period as an opportunity to re-imagine how they run their businesses. Not only because they have to think about their bottom-line due to significant revenue losses but also in an effort to comply with social distancing regulations. Whilst most businesses have traditionally followed the normal rulebook in their growth trajectory of moving from a smaller brick and mortar officespace into a large office block with a plethora of workstations and centralizing their operation in such enclosed office spaces, the new trend now is the reverse where they are downsizing. Companies that previously occupied a full floor are now shrinking their offices to just a room. Their employees are working from home and only one or two critical functions are performed in the small office. For some, they have had to renegotiate their rents with their landlords although many landlords will also tell you that they are paying bank loans on properties making the room to renegotiate very small. Some companies have had to review their hiring policies. I know of an American security software company whose CEO is a friend of mine which has discharged all its onshore Business Development Representatives (BDRs) and now they have gone offshore to India and Kenya for remote work positions. It costs them a fraction of what it did with the onshore staff to pay the salaries of the remote staff. Also the remote staff have no medical cover, they are paid through PayPal so zero tax obligation on the company, they have no benefits since they are not in America, they don't have employee contracts since they are hired as consultants and therefore they have no claim to retirement benefits.

One of the other fundamental ways in which we have seen businesses adapt to Covid-19 is through an increased uptake of communication sites and tools like Zoom. Zoom is a video conferencing platform and even though it was founded in 2011, it has only gathered

considerable popularity and truly entered the public consciousness during the Covid-19 pandemic, as a tool for users across the globe to stay in touch during the lockdown. This is evident from the statistics of its usage: In December 2019 Zoom was hosting 10 million daily meetings. In March of 2020 they saw the figure rise to 200 million. The following month, this figure had risen to 300 million. The App's daily downloads in January 2020 was 56,000. By March 2020 the figure had shot up to 2.13 million! My Kenyan and expatriate friends who work in Nairobi in institutions such as the United Nations and The European Union have since been conducting their work almost entirely using such communication platforms. A lot of them travelled back to their home countries at the onset of the pandemic and have since been advised by their employers that they need not report to work physically indefinitely.

While still on technological shifts, institutions and governments have not been left behind. In Australia, a country whose top foreign exchange earner is offering higher education to foreign students, edtech has become key. According to the Australian government official website, colleges in Australia now must have a Moodle which is an open source learning platform that is essentially a course management system. So they are putting their programs on this platform where students are now able to take online courses. Some campuses previously had platforms students had to pay for but in an effort to balance the national interests of containment for the pandemic whilst not wiping out their revenues they have been forced to make this freely accessible.

Speaking of Australia we can also look at the fundamental ways in which Covid-19 has impacted government policies. Australia is a country which has historically had one of the most coveted vocational training institutions. This covers sectors such as welding, joinery, masonry etc. Over time due to the forces of globalization they started importing these items and skills from China. The disruption in supply chain that Covid-19 caused made them realize their over-reliance on China for such and consequently they have since allocated a huge budget to correct this imbalance in the Technical and Further Education institutions programme (TAFE) under the national Australian qualification frameworks.

Some of the other ways in which I have seen businesses adapt is through innovation. They say in every crisis there is an opportunity and some have innovated to try and tap into emergent opportunities from the crisis. A close friend of mine who recently

went to one of the local furniture shops to purchase a work-from-home work station for herself noticed a new range of products that were prominently displayed at the shop. One of the items that stood out were the small colourful desks and miniature chairs for small kindergarten kids. The demand for this must have soared as e-learning took hold and this company was swiftly able to respond to demand and probably make a kill. The other items my friend noticed were screens that are now used at reception desks to shield and social distance office receptionists from the person standing on the other side. The same screens are also used to separate work stations between co-workers that are sitting adjacent to each other. I remember having a chat recently with a roadside furniture artisan near my house who is a friend of mine and he told me something that left me in stitches. He said while everyone else decried the poor state of the economy and the scarcity of money, Covid-19 had brought him unprecedented success. He attributed it to the fact that most of his clients happened to be young professionals at entry and middle level employment. Since majority are still bachelors, they had not thought of furnishing their apartments and because of zoom meetings that they now must conduct while working from home, they had rushed to buy furniture in order not to suffer the embarrassment of their colleagues and bosses seeing their empty houses and wondering why they drive fuel-guzzlers and dress in sharp suits yet sit on the floor in their homes. So yes there have been opportunities for some businesses. Businesses like ours have even used this time to re-organize, re-tool and update our workspace and showroom.

Finally it would not do justice to this article to end it without highlighting some of the worst pain points that businesses continue to grapple with. For instance the fact that some commercial buildings in Nairobi's commercial areas have been turned into ghost towns. Tenants have either faced closures themselves or vacated due to their inability to pay the rent. Cab hailing service companies were badly hit. A report published by the Daily Mail in the UK for instance, talked about how Uber drivers had been adversely affected by the Corona virus and the high fatality rate among them. Several of them plying the Heathrow airport route had succumbed and this was said to be due to the exposure to potentially infected passengers since they couldn't social distance inside the confined spaces of the cars. This meant that there was no work for taxi services since everyone shunned them. Also, as

a social distancing measure, Uber taxis had to install a dividing screen between the driver in front and the passenger at the back. The Ubers also had to follow a sanitization regime. When you look at all this additional costs which were borne by the drivers against the loss of revenue then it's easy to see how crippling this can be for a small business. Our auditor who has some hotel clients told me recently that the hotel industry in Kenya is on its knees. Hotels now have to up their cleaning regime to hospital standards. No more breakfast buffets, except in social distance restaurant settings or in the rooms. They can no longer have back to back bookings because of the sanitation regime since the room must be fallow for 72 hours before someone else can occupy it. So while their occupancy was before based on availability of rooms now it's based on Covid-19 regulations. This has redefined the entire setup of the hospitality sector. Look at what is happening with the Airlines. Domestic flights in many countries have been forced to give discounts on flights in an effort to try and woo people to go back to flying. When it comes to the education sector we will see closures of many educational institutions. There is now a directive to have a maximum of twenty students per class due to social distancing. Whereas before classes would take up to sixty, the capital investment involved in constructing additional classrooms particularly for small private schools might prove to be prohibitive for some. We have already seen cases in Uganda where school owners are looking for tenants who can rent their school facilities as children's homes and NGOs. This would be a sad state of affairs particularly for the children affected.

In all these we have not even discussed the socio-economic and psycho-social impact on society of the pandemic. The unwanted pregnancies amongst teenage girls who have been out of school for so long. Teachers in schools on half pay who lack morale. What is the quality of output they are delivering to our children on e-platforms? How about capacity challenges? Were our teachers trained well enough in IT to be able to disseminate knowledge to the children using online platforms? While we discuss online platforms, are children in the remote villages of Nyeri and Siaya counties able to access e-learning? Do they have laptops that they use to follow the instructions of their teachers? And if not is this pandemic going to widen the inequality gap?

When all is said and done what tips can we use as entrepreneurs to survive post-Covid-19 I have found a few useful ones for my own business which I can share:

- (i) Manage your costs until your business is out of the woods. Do not be scared of keeping your staff on half pay for instance until your revenues have normalized. Have a candid conversation with your employees, I have found that mine have in general been very empathetic and understanding. We have now come up with certain financial objectives and milestones which will help us restore our revenues back to what they were pre-Covid-19. Upon hitting these milestones then we restore their salaries back to 100%.
- (ii) This is the time to increase your marketing spending not cutting it down. Use this time to shout more, brand yourself better. Remember that you still provide a service that the market needs. Your business is still providing a solution to a problem that likely still exists. The only difference now is that you need to give the market more reasons to come to you instead of the competition with the scarce resources at their disposal. So this is the time to convince them that you will give them best value for money.
- (iii) Try and reinvent your business. This is the time to tap into a new market. In our case we are trying to talk to doctors a bit more than we have done in the past hence the reason why I am writing this article to be published in a medical journal. Our range of products are high-end with a specific market target and we have realized that most doctors who have practised for a number of years easily fall within that target market. However since they are such busy professionals they rarely have time to fully venture out and see what's out in the market particularly while building their homes or even their clinics. Hence our decision to reach out directly to them.
- (iv) Lastly, remain steadfast. Stay laser-focussed on surviving past the choppy waters post-Covid-19. You are the captain of your business and when the waters are rough out in the sea, your employees, suppliers and clients will look up to you to steady the ship and keep it afloat. Their livelihoods depend upon the decisions that you take.

At the end of the day, each business and institution must take some bold decisions and steps to help it navigate this treacherous period post-Covid-19. The quality of the decisions it takes with the aim of reinventing itself might ultimately be the determining factor for its future.

*The writer is the founder and Managing Director of **Italian Kitchens Limited**, an interior design and fittings company headquartered on the second floor of Western Heights building in Westlands. During his assignment in Europe about ten years ago, Stevens identified a gap in the local offering for space transformation. Three things stood out: quality, value for money and customisation. On these grounds, coupled with his love for the best things in life, Italian Kitchens was founded, and has been in operation for over eight years now.*

“The struggles have been immense.” he says. “From challenges in accessing credit, to the high cost of it and so on. It has not been an easy journey, but it’s been worth every step of the way. It gives me great joy to see my clients mesmerized by the kind of high quality space transformation they get when they engage us in their projects. Be it fully fitted kitchens, or wardrobes, or bathroom fit outs or walling and tiling solutions, and so on, at optimized rates” He closes.

1. **Dr. Samuel Nyagah**, MBChB, MMed (ENT), Diploma Allergy, Kenyatta National Hospital and Nairobi ENT Clinic, Kenya
2. **Prof. Isaac Macharia**, MBChB, MMed (ENT), Senior Lecturer, University of Nairobi (School of Medicine), Nairobi ENT Clinic, Kenya
3. **Dr. Clemence Chidziva**, MBChB, FC ORL, Department Of Surgery, Faculty of Medicine, University of Zimbabwe and Harare Eye, Ear, Nose And Throat Institute, Zimbabwe
4. **Dr. Joyce Aswani**, MBChB, MMed (ENT), Head and Neck Fellowship (University of Cape Town), Senior Lecturer and Head of ENT Department, University of Nairobi, Kenya
5. **Dr. Asmeeta Patel**, MBBS, MS (ENT), Department of Surgery (ENT, Head And Neck Surgery Section) Aga Khan University Hospital Nairobi
6. **Dr. Wakisa Mulwafu**, PhD (University of Bergen), FCORL (SA), MBBS (Malawi), Associate Professor, College of Medicine, Blantyre, Malawi
7. **Dr. Mukara Kaitesi**, MBChB, MMed (ENT), MSc Audiology (UK), Visiting Senior Lecturer, University of Rwanda, Humanhood Clinics, Kigali, Rwanda
8. **Dr. Cyrus Gakuo**, MBChB, MMed (ENT), Lecturer Jomo Kenyatta University of Science and Technology and Prodigy Ear Nose and Throat Clinic, Kenya
9. **Dr. Ian Macharia**, MBChB, MMed (ENT) Machakos Level 5 Hospital and Nairobi ENT Clinic, Kenya
10. **Dr. Samuel Okerosi**, MBChB, MMed (ENT), Machakos Level 5 Hospital, Kenya
11. **Dr. Peter Ochungo**, Assistant Editor, MBChB, MMed (ENT), Wote District Hospital and Hope ENT Centre, Kenya

Authors guidelines

East & Central Africa Journal of Otolaryngology Head & Neck Surgery is published biannually by the Kenya Ear Nose Throat Surgeons (KENTS). The journal is peer reviewed and accepts the following categories of submissions; Original research papers, Reviews and Case reports.

Submitted manuscripts should follow the guidelines below;

- (i) *Original research*: Should follow the IMRAD format ie Abstract, Introduction, Methods, Results, Discussion. The abstract should be structured with the following sub-headings; Background, Objective(s), Design, Methods, Results, Conclusion(s). The manuscript should have about 3000 words and not more than 30 references.

- (ii) *Review articles*: Should be written by an authority in a particular area. The abstract should be structured with the following sub-headings; Background, Objective(s), Data source, Data synthesis, Conclusion(s). The review should have about 5000 words with not more than 50 references.

- (iii) *Case reports*: Should have a brief summary, introduction, case report description and a discussion. The case report should have not more than 2000 words and about 15 references.

Note that the submitted manuscripts should follow the Vancouver style and references should be numbered in order of appearance and only those cited should appear in the reference list.

