CLINICOPATHOLOGICAL PRESENTATIONS OF ORO-FACIAL CYSTIC LESIONS AMONG PATIENTS ATTENDING TREATMENT AT MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM, TANZANIA

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By

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A dissertation Submitted in partial Fulfillment of the Requirements for the Degree of Master of Dentistry (Oral Surgery) of Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences the dissertation entitled **Clinicopathological Presentations of Oro-facial Cystic Lesions Among Patients Attending Treatment at Muhimbili National Hospital, Dar Es Salaam, Tanzania,** in partial fulfillment of the requirements for the Degree of Master of Dentistry (Oral Surgery) of Muhimbili University of Health and Allied Sciences.

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DECLARATION

AND

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I, Clemence M. J. Marcelli, declare that this **dissertation** is my own original work and has not been submitted for any or similar award at other University.

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ABSTRACT

Background

Cystic lesions are among the common causes of chronic swellings in the oro-facial region. They have the potential to grow to enormous sizes resulting in gross oro-facial tissues disfigurement and destruction. Oro-facial cystic lesions, when in the soft tissue, especially when infected can impair function such as breathing, mastication, swallowing and disfigure the face. To prevent such complications early diagnosis and adequate treatment is important.

Many patients with oro-facial cystic lesions have been reporting to MNH with big lesions some of which have various degrees of infections, pressure effects and pain. Shortage of data on the magnitude and clinicopathological presentations of these cystic lesions has resulted into inadequate management of these patients at different levels of health care.

Objective of the study

The aim of this study was to determine clinicopathological presentations of oro-facial cystic lesions among patients attending treatment at the maxillofacial firm of the department of Dentistry of Muhimbili National Hospital for 9 months from June 2008 to February 2009.

Study design

This was a prospective descriptive hospital based study, which involved patients who were attending treatment at the maxillofacial firm of the department of Dentistry of MNH during the study period of 9 months from June 2008 to February 2009, and were diagnosed histologically as having oro-facial cystic lesions.

Setting

This study was carried out at the maxillofacial firm of the department of Dentistry and histopathology Unit of MNH, Dar Es Salaam, Tanzania.

Study population

Study population was all patients who attended treatment at the maxillofacial firm of the department of Dentistry of MNH for 9 months from June 2008 to February 2009.

Methodology

Patients who attended treatment at the maxillofacial firm of MNH during the study period were clinically examined. Investigations did include plain radiographs and tissue biopsies or fine needle aspiration cytology for soft tissue cysts. For inconclusive fine needle aspiration cytology, tissue biopsy was taken from the lesions for histological evaluation.

After the biopsy taking, specimens were immediately fixed in a 10% phosphate buffered formalin in a broad bases container with a cover and within two days the specimens were sectioned, processed, paraffin embedded and stained using haematoxylin and eosin stains. After staining specimens were analyzed and reported by a pathologist.

Those patients who were diagnosed as having oro-facial cystic lesions were then informed about the study; those who agreed to participate were included in the study and were interviewed using prepared questionnaires. Those who refused to participate were excluded. After the interview patients were presented to the consultation clinic where they were scheduled for operations and follow up.

Results

During the study period of 9 months a total of 6,873 patients attended treatment at the maxillofacial firm of the department of Dentistry of MNH, where 41 (0.6%) were diagnosed as having oro-facial cystic lesions and all of them agreed

to participate in the study. Out of these 41 patients, 21 (51.2%) were males and 20 (48.8%) females, with a male to female ratio of 1.1:1.

The age of the patients with oro-facial cystic lesion in the present study ranged from 7 months to 75 years (mean age of 26.7 years).

From the questionnaires it was observed that majority 19 (46.3 %) of patients presented to MNH due to infection and pain, while 23 (53.7 %) reported due to other reasons such as increasing swellings, functional impairments and facial disfigurement. In this study 26 (63.4%) patients presented with lesions of more than 1 year and 17 (41.5%) had lesions of more than 2 years duration since was first noted. Out of all 41 patients with oro-facial cystic lesions 28 (68.5%) attended lower level health care facilities before coming to MNH, where 13 (31.7%) came directly to MNH.

Majority 27 (65.8%) of the patients reported with lesions of 3 - 4 cm in the greatest diameter and jaw bones were the most 22 (53.6%) affected followed by the soft tissue cysts 19 (46.3%).

Conclusion

From the present study it was observed that the situation for oro-facial cystic lesions in Tanzania is to some extent different from other countries where many patients presented with lesions of big size, high rate of infections, pain and significant facial disfigurement. This situation resulted in increased cost and complications of surgical interventions, prolonged morbidity and increased chances of postoperative recurrence of the lesions.

Therefore early correct diagnosis of oro-facial cystic lesions; preferably through histological diagnosis at different levels of the health care system, is an important step in making rational treatment planning, to execute adequate treatments or referrals to consultant hospitals.

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LIST OF ACRONYM/ABBREVIATION

AIDS	Acquired Immunodeficiency Syndrome
AgNOR	Silver stained argyrophilic Nuclear Organizer Regions
BCL-2	B-cell lymphoma/leukemia-2
BAX	B-cell lymphoma/leukemia-2 Antagonist-X
Caspases	**C**ystein active site, **Asp**artate cleavage site**proteases**
CK7, CK19, CK20.	Cytoke**r**atine (7, 19, 20)
CT	Computerized Tomography
CD	Cluster Designation
Cm	Centimeter
FOD	Florrid Osseous Dysplasia
DO- 7	Clone for p53.
Fas	CD95; a member of the TNF- receptor family
FasL	Fas- Ligand (CD95Ligand)
GOC	Glandular Odontogenic Cyst
HIV	Human Immunodeficiency Virus
HLA-DR	Human Leukocyte Antigen Class II region DR
IL-1	Interleukine-1

IL-1*a*	Interleukin-1*a*
LEC	Lymphoepithelial cyst
LPC	Lateral Periodontal Cyst
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of Health and Allied Sciences
MNH	Muhimbili National Hospital
MRC	Mucous Retention Cysts
MEC	Mucous Extravasations Cysts
MDM2	Murine double minute 2. (Oncogene on chromosome 12q 13-14 disrupting p53)
NK	Natural Killer Cell
NBCCS	Nevoid Basal Cell Carcinoma Syndrome
KCOT	Keratocystic odontogenic tumor
COC	Calcifying Odontogenic Cyst
HSP-27	Heat shock protein -27
PGE2	Prostaglandin E2
PG	Prostaglandin
p^{53}	Protein 53, or tumor protein 53 a gene on short arm of chromosome 17 (17p13).
p^{16}	Protein 16
PTCH	Patched gene

TGF	Transforming Growth factor
TNF	Tumor Necrosis Factor
TNF- α	Tumor Necrosis Factor- Alfa

CHAPTER 1

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

A cyst is an epithelium lined pathologic space in a tissue usually containing liquid, semisolid and gaseous substances[1,2]. However, a cyst without epithelium lining is reffered as pseudocysts[1,2]. Cystic lesions in the oro-facial (oral and maxillofacial) region are not uncommon. They constitute chronic pathologic processes resulting in tissue destruction that is often accompanied by complications such as infection, airway obstruction, impaired function, bone fractures and disfigurement of the face.

Cystic lesions occur in the hard and soft tissues of the oro-facial region. They are either developmental or inflammatory. Developmental cystic lesions of the oro-facial region are derived from developmental process taking place in this region such as entrapment of epithelial cells during fusion of five facial and palatal primordia namely single frontonasal, paired maxillary, paired mandibular prominences, and palatal primordia (primary and secondary palates). Epithelial remnants associated with teeth development and remnants of the thyroglossal duct also contribute to the developmental cysts in this region. Other developmental cysts in this region are derived from inclusion of the ectodermal layer and its appendages such as nails, hair, hair follicles, sebaceous glands and sweat glands The remnants of the epithelium that is involved in the teeth formation, when stimulated by factors like inflammatory process, may become mitotically activated forming entrapped epithelial solid mass within the bone or soft tissue[1,4]. Degeneration of the central part of such sphere due to many factors like hypoxia often results into a cyst[1,3,4].

Cystic lesions of the oro-facial region vary in their frequency of occurrence, histopathological characteristics and clinical behavior. The mechanisms responsible for their growth are not yet fully established. However, cyst enlargement is accompanied and probably governed by, the rate at which the surrounding tissues are compressed or destroyed.

Production of prostaglandins, leukotrienes and collagenase by the cystic wall, has clarified the role of biochemical substances in cyst growth especially in hard tissues[3,4].

Prostaglandins (PG) especially prostaglandin E2 (PGE2) have been considered as the local mediators of osteolysis since they are potent stimulators of osteoclastic bone resorption and are synthesized in increased amounts by cysts. Several macromolecular bone resorbing factors such as cytokines including Tumor Transforming Growth Factors (TGF), Interleukines-1 (IL-1) and Tumour Necrosis Factor (TNF) have been identified[5,6].

Expansion of developing cyst depends on the osmotic pressure of accumulated desquamated epithelial cells, fibrin, serum and inflammatory cells in the cavity[2,4]. Different authors described increased activity of pentose shunt and ribonucleoproteins synthesis as factors that produce increased epithelial formation. If the mitotic activity results in the cystic expansion; the cyst is then considered as a neoplastic cyst rather than a simple cyst[2,3,4,6].

Cystic lesions are generally slow growing and painless, gradually attaining considerable size without showing any symptom. They only become symptomatic when they have attained enormous size, compressing vital structures or when they become inflamed due to trauma or infection. Infection of a cyst can result from trauma or spread of infection from a local focus in the oro-facial region leading to acute or chronic infection of the head and neck region with life threatening consequences. Many patients in the developing countries including Tanzania seek for medical care at this advanced stage of the lesion. This delay in seeking health care complicates management and increases the resulting morbidity. Complications associated with cystic lesions can be prevented when early correct diagnosis, and adequate treatment is given.

Several studies have been carried out using different methods in trying to characterize clinical and pathologic presentations of different oro-facial cystic entities. However, studies on clinicopathologic presentation of oro-facial cystic lesions in the developing countries especially in Sub Saharan Africa are scanty, where the situation may be different from those in Western and Asia countries. Many patients in the developing countries tend to present late with relatively large, symptomatic or infected cystic lesions. The size and presence of inflammatory processes in most cases influence clinical and pathologic presentation and hence affect diagnosis. In this case an adequate tissue

biopsy with correlation of histological features to reach an accurate diagnosis is advocated for adequate management of the patient.

The aim of the present study, therefore, was to determine relative frequency and to describe clinicopathologic presentation of oro-facial cystic lesions in patients attending treatment at the maxillofacial firm of the department of Dentistry of MNH for 9 months from May 2008 to February 2009.

1.2. LITERATURE REVIEW

Different studies have been carried out aimed at adding knowledge and information on the clinical, histopathological presentations and management of oro-facial cystic lesions[1,2,3]. These studies focused more on aggressive and neoplastic cysts due to challenges in their management and high risks of reccurences[7]. Studies did on these lesions included etiology, clinical, histological, immunohistochemical analysis, genetic, treatment modalities and prognosis[6,8,9,10,11].

Different surgical approaches are available and many others are being studied to improve management of these lesions, especially aggressive types. These approaches are based on the clinical, radiologic, behavioral and histological characteristics of each cystic lesion[12,13]. Advances in management techniques and laboratory investigations, such as microscopic, immunohistochemistry and genetic analysis will continue to facilitate improvement for diagnosis, patient management, and clinical outcomes[6,8,9,10,11].

1.2.1 Pathogenesis of oro-facial cysts

Induced proliferation of entrapped epithelial cells or epithelial remnants such as rests of Serres or Malassez, plays an important role in the pathogenesis of oro-facial cystic lesions[1,3,14]. Inflammation and trauma stimulate epithelial rests to proliferate sealing off the traumatized or inflamed tissue from the surrounding healthy tissues[5,6,15]. Irritants from the dead pulp go through the apical foramen of the root of the tooth into the periapical region. In the process of containing the infection within the periapical bone, an inflammatory reaction in form of a periapical granuloma forms. This is composed of inflammatory cells and dead cells. Necrotic material from dead cells in the periapical lesions contributes to the formation and expansion of cysts by increasing osmotic

pressure within the lumen of the newly formed cyst[4,5]. Cyst expansion appears to involve IL-1*a*[5,8], which is expressed in the lining epithelium and cyst cavity. The role played by apoptosis in the pathogenesis of cysts has not been elucidated.

Different authors have reported the role of apoptosis in periapical cysts, which appear to involve the proapoptosis protein of BAX, Fas and FasL. Recent studies indicated that p^{53}, BAX, BCL-2 and caspase -3 were involved in the pathophysiology of radicular cysts. HSP27, an inhibitor of cell death was found to be over expressed in epithelial rests; islands of epithelium and epithelial lining of microcysts, suggesting that HSP27 may be involved in increased resistance of epithelial cell to cell death[14,15,16].

Immunohistochemical analysis done by Carvalhais *et al.* in 1999 on 51 paraffin fixed specimens of odontogenic cysts and tumors, observed that murine double minute 2 (MDM2) expressions was high in ameloblastoma and KCOT (OKCs)[17]. They concluded that over expression of MDM2 may be involved in the pathogenesis of some of the aggressive odontogenic cystic lesions[17]. AgNOR count and p53 protein detection in cysts has been used to predict biological behaviour of KCOTs (OKCs) [9,18].

A number of tumor suppressor genes, like p^{16}, p^{53}, and cyclin D1 are inactivated in keratocystic odontogenic tumor[14,19,20]. This inactivation process of tumor suppressing genes supports a cellular neoplastic change rather than developmental pathogenesis of keratocystic odontogenic tumor.

Several studies have also shown that the increase in size of the KCOTs is due to high proliferative rate compared to other cysts, filling the lumen of the cyst with desquamated apoptosed keratinocysts that increase protein contents of the cyst lumen resulting in raised osmotic pressure. Apoptosed cells in the epithelium of odontogenic cysts may undergo intracellular dystrophic calcification to form Rushton's hyaline bodies. The high proliferative rate and apoptotic activity in keratinocytes in a confined area may contribute to the aggressiveness of KCOTs[16,17,20,21].

Inflammation as one of the factors which facilitate increase in size of cystic lesions was identified using tumor necrosis factor alfa (TNF-*a)* on radicular cysts[5,22]. The result of this study showed that values of TNF- *a,* is associated with small radicular cysts, and is accompanied by a higher degree of fluid opalescence representing the total amount of protein, detritus and other cytokines. Determination of TNF-*a* in a fluid together with

other parameters has been documented as additional method for clinical diagnosis of inflamed cysts[5,22].

TNF-*a* is a cytokine secreted by macrophages, monocytes and natural killer cell (NK) initially identified as a cause of hemorrhagic necrosis in certain tumors. It triggers apoptosis and necrosis in sensitive tissues and can be linked to osteomyelitis, apical periodontitis, osteoclast formation and bony resorption. TNF-*a* has also been associated with multiple effects in cyst pathogenesis and pathophysiology such as pericystic tissue vascularisation, bone resorption and osteoclastic activity[6,9,18].

Studies on cyst infections give an avenue for identification of cystic inflammation. Inflammatory condition in the cyst was also associated with the changes in the glycan moiety and their specific binding partners such as lectins in the cystic lining epithelium[23].

Another study on cystic pathogenesis and pathophysiology showed that the basement membrane apart from mechanical function also influenced or modulated behaviour of the cells that were present[1]. Components of cystic basement membrane includes collagen type I, III, IV, V, VII, and XVII and laminin 1, 5 and 6, fibronectin, heparin sulphate and proteoglycan. Separation of the epithelial lining from underlining connective tissue wall is frequently observed in KCOTs[23,24]. These features were not seen in other odontogenic cysts[11]. Besides the distinct histopathologic features, KCOTs have also a relatively high rate of recurrence compared to other odontogenic cysts[1,14,19].

Soft tissue and the so-called fissural cysts develop through a mechanism related to embryologic development. These developmental processes are for example submergence of ectodermal cells that were pinched off at the time of closure of the anterior neuropore, entrapment of ectodermal rests during closure of the first or second branchial arches at the midline position, remnants of the anterior tongue precursor, the tuberculum impar and misplacement of adjacent embryologic tissue[1,25].

Cysts such as dermoid cyst can occur anywhere in the body at the embryologic fusion area, but about 6.9% of dermoid cysts occur in the head and neck region, where 25% of them occur in the oral cavity. These congenital cysts were categorized into epidermoid, dermoid and teratoid. Epidermoid contains stratified epithelium without adnexal structures and usually show keratinization[1,2,25]. The dermoid cyst usually contains dermal appendages (hair follicles, sebaceous and sweat glands) and has keratinized stratified

squamous epithelium; the lumen is filled with keratinized and sebaceous materials. Teratoid cyst has squamous epithelium and respiratory type epithelium and contains dermal appendages and mesodermal components (muscles, bones, and blood vessels) [25].

Recent studied was the association of cysts in the oro-facial region with systemic diseases. The previously rare lymphoepithelial cyst has been observed to have an increased rate of occurrence of up to 6% in HIV positive patients. This association is more frequent during early HIV infection[26,27]. The pathogenesis of parotid lymphepithelial cyst (LEC) in HIV positive patients is not yet clear. However, different authors reported that LEC formation is secondary to obstruction of salivary gland ducts by exuberant lymphoid infiltration[26,27,28,29]. Coexistence of LEC with other cysts in the floor of the oral cavity was reported by Smith et al. (1990) where LEC coexisted with dermoid cysts[12]. This coexistence was related to accidental trauma that accompanied inflammation[26,27,28,29].

1.2.2 Prevalence of Oro-Facial Cystic lesions

A retrospective histological audit by Dimba et al. (2007) on oral diseases of patients who attended oral health services at Nairobi, Kenya from 2000 to 2004 showed that 14.9% of patients presented with head and neck cysts[30].

Das et al. (1994) in a survey of 4478 biopsy specimens of oral lesions in India reported a prevalence of oro-facial cysts of 14.4% of which radicular cysts comprised 7.1% while hydatid cyst was only one case[31]. Balanchard (1997) in the USA, from a review of literature found that the prevalence of KCOT (OKCs) was 10% of all oro-facial cysts, while Kondell and Wiberq (1988) in Sweden in 531 cases found a prevalence of KCOT (OKCs) of 5.4% of all oro-facial cysts[32,33]. Ledesma-Mantes and his colleagues in Mexico in 1999 showed the prevalence of periapical cyst of 38.8%, followed by dentigerous cyst 35.5% and KCOTs (OKCs) of 18.8%[34]. Jones and Franklin (2006) in the United Kingdom analyzed oral pathology in adults 17 years old and above from 1973 to 2002 where he found that odontogenic cysts contributed 13.8% of oral lesions.

Studies in oral lesions of children under 16 years of age at Sao Paulo – Brazil by Sousa et al. from 1985 to 2000 showed that the most common lesion was mucocele (13.5%) followed by dentigerous cyst (6.5%)[33]. A study on 5457 children biopsies by Shah et al. (2009) in San Francisco-USA showed prevalence of dentigerous cysts of 80%[35]. Lima et

al. (2008) in Brazil analyzed children's oral biopsies from 1983 – 2002 and showed a prevalence of 17.2% of mucocele followed by 8.6% for dentigerous cyst[36]. In Iran in 2009 Seyedmajid and Nosrati reported prevalence of calcifying odontogenic cyst of 1%[37].

Another study on oro-facial cysts in the general population by Khan et al. (2008) in Bangaladesh showed prevalence of dentigerous cysts of 0.15% to 1.9%[38].

Observation from these studies shows that there are variations of the prevalence of oro-facial cysts in different countries and in different groups of the population.

Thefore aim of this study is to determine the clinical and pathologic presentation of different oro-facial cystic lesions among patients attending treatment at the maxillofacial firm of the department of Dentistry of MNH from May 2008 to February 2009.

1.2.3. Classification and clinicopathological presentations of oro-facial cysts

Cysts are generally classified according to the pattern or differentiation they exhibit on histological examination; many are difficult to differentiate clinically.

Majority of cystic lesions of the oro-facial region are true cysts; they have an epithelial lining some are not epithelium-lined (pseudocyst) and others have benign neoplastic behavior.

There are different classifications of cystic lesions; such classifications are based on origin of cystic epithelium and pathogenesis of individual cystic entity. Classification on the epithelial origin; cysts are classified into odontogenic and non-odontogenic types. Pathogenetically cysts are classified into either inflammatory or developmental origins.

WHO in 1992 in the classification of jaw cysts; classified cysts of the maxillofacial region into odontogenic, non-odontogenic and soft tissue cysts[39,40]. Some authors also included neoplastic cysts in this classification due to their clinical and radiographic resemblance with simple cysts[1,39]. In 2005 WHO modified classification of the head and neck tumors where former OKCs was classified as benign odontogenic tumor, which was termed as keratocystic odontogenic tumor (KCOT) due to its close correspondence to neoplastic behavior[39,40].

Jaws are hosts to a wide variety of cysts and neoplasia, due in large part to presence of remnants of cells involved in tooth formation, which when stimulated can be

transformed into jaw cysts or tumors. Many benign jaw tumors and several cysts, of both odontogenic and non-odontogenic origin can exhibit a biologically aggressive course and can be diagnostically difficult[8,14,41].

There are many challenges in the clinical and histological diagnosis of oro-facial cystic lesions. However, traditional history of the lesion, clinical examinations, radiographic imaging and histopathological analysis will continue to be the main stay for the diagnosis of these lesions provided that appropriate representative pathologic tissues are obtained and properly processed; immunohistochemistry, genetic and molecular techniques have had as yet, little impact in this area.

In the process of simplifying identification and classification of each tumor entity and cystic lesions in that matter, WHO in 2005; introduced approach to be used in the characterization of these lesions using subtitles, which include; definition, epidemiology, etiology, clinical features, gross and microscopic description, precursor lesions, differential diagnosis, immunohistochemistry, electron microscopic features, molecular biology, genetics, prognosis and predictive factors.

Currently there are different methods for the diagnosis of oro-facial cystic lesions. They include staining using monoclonal antibodies CK7, CK19, CK20 for cytokeratines[10,42].

A number of standard histopathological and cytological methods are also available for the investigation of oro-facial cystic (OFC) lesions. These include light and electron microscopy, and immunohistochemical analysis[21,43]. Electron microscopy provides ultrastructural cellular appearance and transmission modes and is utilized whenever fine structural details of cells and tissue are required. Haematoxylin and Eosin (H&E) are universally used stains for tissue staining for diagnosis and classification.

Immunohistochemical method utilizes monoclonal antibodies, which detect and bind to tissue specific receptors. The resulting Antigen-Antibody complexes are detected by colour changing compounds indicating positive staining as in immunoperoxide technique[21,44].

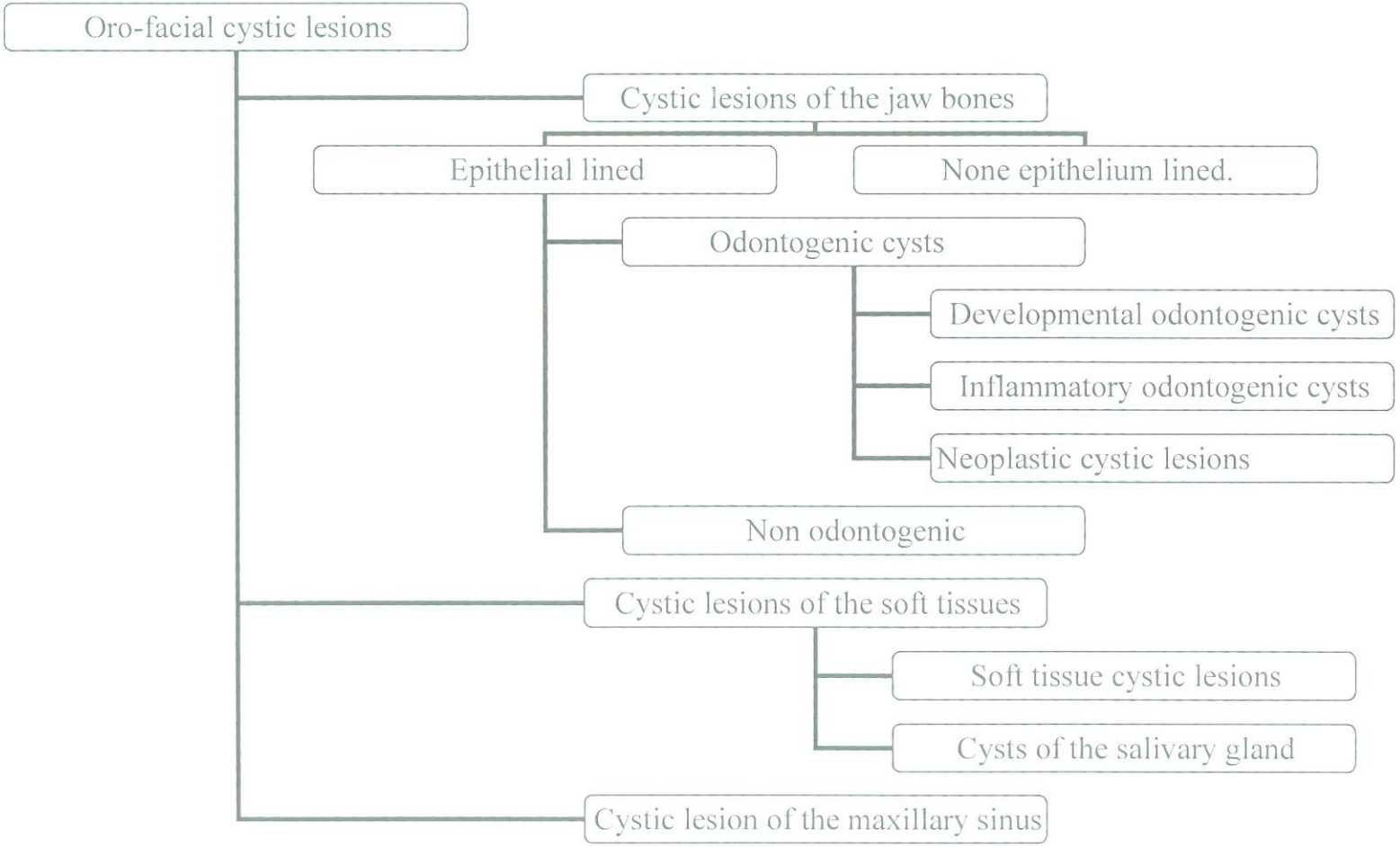
Since immunohistochemical method applying anticytokeratine monoclonal antibodies and p^{53} antibody is not widely used in Tanzania, histopathological diagnosis is made basing on light microscopy using H&E staining methods[44].

Early diagnosis and adequate treatment is one of the most important steps in preventing complications associated with these lesions. Cysts that are not treated on time pose a

danger of gross expansion compromising and displacing adjacent structures such as nerves, teeth, soft tissue and pathologic bone fracture can occur when the bone is weakened or on pressure. When infected, oro-facial cystic lesions can become a chronic focus for infection, of soft tissues and bone leading to chronic osteomyelitis and subsequently pathologic bone fractures[1,2].

Clinical findings and different imaging techniques such as plain radiographs, CT scan and MRI are useful tools in reaching the clinical diagnosis of the lesions prior to histological analysis. Radiographic examination is useful in providing the characteristics and roughly the growth rate but rarely provides a conclusive diagnosis of the radiolucency since majority of the lesions share common radiological features[12]. Because of their capacity to destroy adjacent tissues and a high rate of recurrence aggressive oro-facial cystic lesions such as KCOT, COCs, unicystic ameloblastoma, botryoid odontogenic cysts, and glandular odontogenic cysts need an early diagnosis and adequate treatment[13, 46,47,48].

Chart I: Classification of oro-facial cystic lesions



This classification is based on WHO 1992 jaw cysts and 2005 head and neck tumor classifications (Chart I). Oro-facial cystic lesions are further subclassifications as follows:

1. Cystic lesion of the jaw bones

These cystic lesions are subclassified into epithelium and non –epithelium lined

A. Epithelium lined cystic lesions

Epithelium lined cysts are subclassified into odotogenic and non-odontogenic cystic lesions. Odontogenic cysts are further subclassified into developmental, inflammatory and neoplastic cystsic lesions

I.Odontogenic cystic lesions

a) Developmental odontogenic cysts

Gingival cyst of infants
Gingival cyst of adults
Lateral periodontal cyst
Botryoid odontogenic cyst
Glandular odontogenic cyst
Dentigerous (follicular) cyst
Eruption cyst

b) Inflammatory odontogenic cysts

Radicular cyst
Residual cyst
Paradental cyst

c) Neoplastic cystic lesions of odontogenic origin

Unicystic ameloblastoma
Keratocystic odontogenic tumor
Calcifying odontogenic cyst

II.Non-odontogenic cysts

Nasopalatine cyst
Nasolabial (Nasoalveolar) cyst
Midpalatal cyst
The so-called fissural cysts
Median palatine cyst

Median alveolar cyst

Median mandibular cyst

B. Non-epithelium lined cystic lesions

Simple bone cyst

Aneurysmal bone cyst

2. Cystic lesions of the soft tissues

a) Developmental cysts

Branchial cleft cyst

Thyroglossal duct cyst

Cystic hygroma

Cysts of the skin

Dermoid cyst

Epidermoid cyst

b) Inflammatory cysts

Hydatid cyst

Lymphoepithelial cyst

c) Cysts of the salivary glands (Mucocele)

Mucous extravasation cyst

Mucous retention cyst

3. Cystic lesions of the maxillary sinus

Surgical ciliated cyst

Mucous retention cyst

Pseudocyst of the maxillary sinus

Globulomaxillary cyst which has been classified as fissural cyst is no longer recognized as cystic entity. Christ (1970), Wysocki (1981) and Shear (1992) have reviewed previously reported globulomaxillary cyst and found that these are collection of odontogenic cysts, giant cell granuloma, myxoma and hamartomous bone cysts.

1.2.3.1. Cysts of the jaw bones

These are cysts which develop in the jaw bones; they are classified into epithelium, non-epithelium lined.

1. EPITHELIUM LINED CYSTIC LESIONS

These are cystic lesions which are lined by an epithelium. They are subclassified into odontogenic and non-odontogenic.

I. Odontogenic cysts

These are oro-facial cysts which their development is associated with the process of teeth formation (odontogenesis) and are found in the teeth bearing areas of the jaws. They are classified into developmental, inflammatory and neoplastic types.

a) Developmental odontogenic cysts

These are cysts where the development is associated with the cells responsible for the development of teeth[1, 2, 11].

Gingival cyst of infants

The gingival cyst of the newborn (Dental lamina cyst) appears as multiple nodules along the alveolar ridge in neonates. It is believed to originate from remnants of dental lamina after tooth formation. The remnants of the dental lamina proliferate to form small keratinized cysts. These cysts either involutes or rupture[1,2,3].

Gingival cyst of the adults

A gingival cyst of the adults is an extraosseous cyst that arises from epithelial cell rests in the gingiva of an adult. It resembles the dental lamina of newborn[1,2,3,4]. It is also considered as an extraosseous variant of the lateral periodontal cyst. The etiology of the gingival cyst of the adults is thought to be associated with traumatic implantation of epithelium[1,2,3,4]. It is commonly located in the mandibular cuspid and first premolar region. Gingival cyst of the adults present as a small cystic swelling of the gingiva[1,2,43].

The epithelial lining of gingival cyst of the adults is of several types. The most common type is a thin, flattened lining with localized thickening. Other types include nonkeratinized stratified squamous epithelium, keratinized stratified squamous epithelium and parakeratinized epithelium with palisading basal cells[3,4].

Lateral Periodontal Cyst

Lateral periodontal cyst is a rare asymptomatic non keratinized developmental cyst arising from a periodontal membrane, lateral to the root of a vital tooth, affecting adults over 30 years old. It is histologically related to gingival cyst of adults[1,2,4] .

The origin of LPC is believed to be related to proliferation of dental lamina and remnants within the bone and periodontal ligament[1,2,3,4]. This cyst is said to occur more frequently in the mandibular premolar, cuspid and incisor regions[1,2,3,4]. In the maxilla the LPC usually occurs in the lateral incisor region. The cyst has a male predilection with a male: female ratio of 2:1 and more commonly occur between the ages of 20 years to 85 years but reaches a peak at 5th and 6th decades of life[1,2,3].

Diagnosis of LPCs is based on clinical, radiographic and histological findings. Treatment of LPCs is by cyst enucleation.

Botryoid Odontogenic Cyst

Botryoid odontogenic cyst (BOCs) is a slow growing painless lesion, believed to be a variant of lateral periodontal cyst, derived from dental lamina[1,2,3,4]

The botryoid odontogenic cysts occur at a similar site to that of the lateral periodontal cyst that is mandibular canine, premolar regions and maxillary lateral incisor area; but multiple loculi present may envelop adjacent teeth. BOCs mostly affect adults older than 50 years.

Radiologically botryoid odontogenic cysts present as multilocular grapelike cluster of radiolucent lesions[49]. This multilocularity may be seen during surgical exploration of the cyst. The multilocular nature may be due to slight growth potential of the dental lamina[1,2,50]. Some authors demonstrated that this lesion frequently presents with unilocular radiographic features, resembling a variety of other odontogenic cysts or neoplastic conditions.

Histologically BOCs are characterized by multiple cystic spaces and variations in the thickness of the epithelial lining accompanied by epithelial protrusions into the lumen, mainly squamous cuboidal epithelium. Glycogen – containing clear cells may also be present.

Treatment of BOC is by cystic enucleation. Recurrence of up to 40% has been reported, hence close follow up of the patient is recommended. High recurrence is believed to be due to polycystic nature of BOC.

Glandular odontogenic cyst

Glandular odontogenic cysts are rare slow growing, usually painless cysts of odontogenic origin with unique histopathologic features and an unclear histogenesis, occurring in the jaw bones[1,2,3,4]. In 1987 Padayachee and Van Wyk reported two multilocular mandibular lesions with features of both botryoid odontogenic cyst and mucoepidermoid tumor, which they termed as sialo-odontogenic cyst[51]. The cyst has some common features with botryoid odontogenic cyst and mucous producing salivary gland tumors[1,2,3,4].

In 1988 Gardner and his colleague reported series of these cysts and used the name glandular odontogenic cyst. In 1992 WHO described this pathologic entity, and was classified as a developmental odontogenic cyst; although controversy still exists regarding terminology and origin.

Glandular odontogenic cyst occurs in the mandible and maxilla, with predilection of anterior region of mandible. They occur over a wide age range from 19 to 85 years with mean age of 50 years with no gender, race, or ethnic predilection[41].

Clinical findings of GOCs are not specific but radiographically the lesion is well defined unilocular or multilocular radiolucency with scalloped sclerotic borders[1,2,49]. Around 53.8% of all GOC are unilocular and 46.2% are multilocular lesions.

Histologically GOC have a cystic structure with a thin wall of fibrous connective tissue, epithelium lining is of varying thickness and is made up of squamous, mucous cells and area of eosinophilic cuboidal cells.

There are different treatment modalities for GOC comprising of enucleation or curettage, which is associated with high risk of recurrence, especially in large and multilocular lesions. Peripheral osteoectomy or marginal resection can eliminate risk of recurrence.

Dentigerous cyst

Dentigerous (follicular) cyst is the second most common odontogenic cyst after the radicular cyst, accounting for 15% of all jaw cysts and is mostly seen in association with third molars and maxillary canines[3,4,52]. It is formed around the crown of an unerupted, developing, or impacted tooth and sometimes from an odontoma where fluid accumulates in the layers of reduced enamel epithelium or between the epithelium and the crown or between epithelium and unerupted tooth[2,3]. The fact that the cyst is attached to the cementoenamel junction (cervix) of the tooth is evidence that it originates from the enamel organ[1,2,4] . Dentigerous cyst is believed to be a result of degenerative changes in the reduced enamel forming epithelium after the completion of amelogenesis[1,2,4].

Dentigerous cyst is commonly seen associated with mandibular 3rd molar tooth and maxillary canine, during the second and third decades of life; generally it is symptomless unless when secondarily infected[4,7]. The involved tooth is either unerupted or impacted.

Dentigerous cyst can attain considerable size; expanding cortical bone, predisposing to occurrence of pathologic fracture, and can displace or resorb roots of adjacent teeth.

Most dentigerous cysts are solitary lesions, bilateral and multiple cysts are usually found in association with a number of syndromes including cleidocranial dysplasia and maroteaux-lamy (mucopolisaccharidosis typeVI) syndrome[50]. Radiographically dentigerous cyst is a well-defined radiolucent lesion around an impacted tooth, supernumerary or odontoma with a circular cortical outline[53].

Histologically connective tissue of the cyst is lined by stratified squamous epithelium, in a uninflammed dentigerous cyst the epithelial lining is nonkeratinized and 4-6 cell layer thick. When inflamed, epithelial hyperplasia can also be noted[1,2,4].

Dentigerous cysts are treated by enucleation of the cyst with removal of the associated tooth or odontoma. Marsupialization is done to temporarily decompress exceptionally large cyst followed by cystectomy later. Complications of untreated dentigerous are considerably significant including transformation of the cystic epithelium to ameloblastoma, rarely to carcinoma, and bone weakening and fracture may occur.

Eruption cyst

An eruption cyst lies superficial to the crown of an unerupted tooth and is essentially a dentigerous cyst that results from fluid accumulation within the follicular space of an erupting tooth; and is lined by reduced enamel epithelium[1,2,3,4]. With trauma blood may appear within the tissue space, forming an eruption hematoma.

b) **Inflammatory odontogenic cysts**

Radicular Cyst

The radicular cyst is the most common cyst of the jaws contributing 65%-70 % of all jaw cysts[1,2,3]. It is a cyst that arises from the epithelial rests of Malassez in the periodontal ligament[1,3]. The cells are stimulated to proliferate and undergo cystic degeneration by inflammatory products from a non-vital tooth[1,3,11,21]. Radicular cyst is a slow growing, symptomless, bony hard swelling of varying sizes. When infected it becomes painful and rapidly increases in size[11,21]. The cyst is usually located epicenter to the apex of a non-vital tooth, but occasionally it appears on the mesial or distal surface of the root apex[1,2,3]. Majority (60%) of radicular cysts are found in the maxilla than mandible especially around incisors and canines. Those that arise from the maxillary lateral incisors, canines, and molars may invaginate into the maxillary antrum. Radiographically radicular cyst is a well-circumscribed radiolucent lesion located at the apex of the non vital root[1,2,49].

When infected; the inflammatory process destroys this cortical border and increases rate of expansion[11,21]. The increase in size can either displace or resorb roots of adjacent teeth[1,2]. The vitality test in single rooted teeth is always negative. In multirooted teeth it is defferent because the contents of one root might be necrotic while the other roots remain vital[1,2,21].

Radicular cyst occurs rarely before the age of 10 years and is considered to be rare in the primary dentition comprising only 0.5 – 3.3% of the total radicular cysts in both dentition[21]. Radicular cyst is most often found between the ages of 20 – 60 years more commonly in males than in females at a ratio of 3:2. The reasons for this gender predilection are not clear. The swelling, when clinically visible, is round and hard but when the bone has been reduced to eggshell thickness, a cracking sound feeling may be felt on pressure. Finally, if not treated part of the cortical wall is resorbed completely[1,2,51,57]. The cyst capsule and wall consist of collagen fibres, connective tissue

and osteoclasts. Cystic fluid is watery and opalescent with cholesterol[51,57]. Radicular cysts are lined by nonkeratinizing stratified squamous epithelium of variable thickness. Inflammatory cells are commonly found in the epithelium with a large numbers of polymorphonuclear leukocyts. Plasma cells and spherical Russell bodies are also frequently seen. Radicular cyst is treated by either surgical or non surgical procedures. Non surgical procedures include endodontic treatment, where majority of the radicular cyst undergo resolution following root canal treatment. Surgical procedures include; extraction of nonvital tooth, root canal treatment followed by enucleation of the cyst and apicectomy. Marsupialization surgical procedure is used for temporary decompression of exceptionally large cyst where fracture of jaw is a risk factor. When enough bone has been formed cyst can be enucleated[2,49]. Prognosis depends on particular tooth, the extent of bone destroyed and accessibility for treatment. Operation complications include pathologic fracture, infection and rarely neoplastic changes.

Residual Cyst

Residual cyst is a cyst or its material that remained when a tooth with a radicular cyst is extracted and the cyst is left behind[3,54,58]. It is most often discovered accidentally; affecting adults aged 20 years or above[2]. It is asymptomatic and is usually diagnosed after taking a radiograph for other purposes.

A residual cyst occurs in both jaws but tend to occur more often in the mandible than in the maxilla. In the maxilla the cyst can easily expand into the maxillary antrum, sometimes filling a big portion of the sinus.

Radiographicaly it has a well-defined margin, unless when infected. Residual cyst is a common cause of swellings of edentulous areas on the tooth-bearing areas of the jaws. It often attains big sizes which may lead to confusing them with other pathologic lesions such as ameloblastoma, myxoma, primordial cyst or central giant cell granuloma[1,2,50,59]. Treatment of residual cyst is by enucleation.

Paradental Cyst

Paradental cyst is an odontogenic cyst of inflammatory origin, which occurs on the buccal, distal and rarely mesial aspect of partially erupted mandibular 3rd molar[1,3,60]. The

cyst is associated with recurrent pericoronitis[60]. It accounts for 3% to 5% of all odontogenic cysts[1,2].

Paradental cysts affect males predominantly, usually between the ages of 20 and 25 years. Radiographically it is a well-circumscribed radiolucent lesion[60].

Histologically a paradental cyst resembles other inflammatory cysts like radicular cyst and its formation is a result of unilateral expansion of the dental follicle secondary to inflammatory destruction of the periodontium. Treatment of paradental cyst is by enucleation[60].

c). Neoplastic cystic lesions of odontogenic origin

These lesions resemble simple cystic lesions clinically and radiographically[1,2,3]. Among the neoplastic cystic lesions of the oro-facial region KCOTs and unicystic ameloblastoma have been reported as the most common benign cystic tumors of jaw bones. The epithelial lining of unicystic ameloblastoma frequently resembles that of dentigerous cyst[3]. Other lesions in this group are some of calcifying odontogenic (Gorlin) cysts

Unicystic ameloblastoma

Uniystic ameloblastoma is a subtype of ameloblastoma contributing between 1% and 20% of all four types of ameloblastomas namely solid/ multicystic, extraosseous/peripheral, desmoplastic and unicystic[3,7]. It was first described by Robinson and Martinez in 1977 as a special type of ameloblastoma. Several authors suggested different nomenclature such as mural, monocystic, intracystic, cytogenic, and plexiform unicystic ameloblastoma[12]. Proposed various etiologic factors for unicystic ameloblastoma includes[43]:

- Non specific irritation factors such as extractions, caries, trauma, inflammation, tooth eruption.
- Nutritional deficiency disorders.
- Viral infection

In 1988 Ackerman and his colleagues modified the diagnosis and reclassified unicystic ameloblastoma into 3 histological subtypes with prognostic and therapeutic significants[7]:

- The first is luminal ameloblastoma, where the tumor is confined to the luminal surface of the cyst.
- The second intraluminal amelobastoma where the tumor nodules project from the cystic lining into the lumen.
- Third type is mural ameloblastoma where the fibrous wall of the cyst is infiltrated with tumor nodule; this is the most aggressive type of unicystic ameloblastoma.

Unicystic ameloblastoma is separated from solid type because it occurs at relatively younger age, lower recurrence rate and seems to require less aggressive surgery. Recent evidence, however, indicates that unicystic ameloblastoma can be destructive and often recur after simple curettage.

Unicystic ameloblastoma occurs within a wide age range, but is more common in the 2nd and 3rd decades with predilection of mandibular molar area. Maxillary lesions are very uncommon, no gender differences has been reported. The lesion is entirely cystic and consists usually of a single space, although may have cystic loculation.

Radiographically, the lesion is lucent with well- defined margins and it can become very big with unilocular or multilocular appearance; expanding or perforating jaw cortex. It may appear at the apex of a tooth or around the crown of an impacted tooth.

Microscopically it is often diagnosed as simple odontogenic cyst. Unicystic ameloblastom is lined by epithelium with palisading basal cell[47]. It resembles other non neoplastic odontogenic cysts clinically and radiographically. Saku and his colleagues in 2006 suggested use of lectin staining for ulex europaeus agglutinin 1 (UEA-1) and Bandeirea simplicifolia agglutinin1 (BSA-1) in differentiating unicystic ameloblastoma from non neoplastic jaw cysts[13].

Various treatment modalities for unicystic ameloblastoma have been used; such as segmental or marginal resection as in conventional ameloblastoma. More conservative treatment used includes enucleation and curettage. Some clinicians used marsupialization to reduce the size of the lesion followed by second stage surgery. This conservative treatment can be followed by adjunctive therapy including cryotherapy, thermal or chemical cauterization. Recurrence reported are 3.6% for resection, 16% for enucleation followed by application of Carnoy's solution, 18% for marsupialization with or without other treatment in second phase and 30.5% for enucleation alone[71].

KCOTs rapidly penetrate bone rather than expanding it; but the mechanism for this behavior is unclear[4,14,16,44]. Pressure resorptions of bone by an expanding mass, collagenase production, prostaglandin production and highly active oxidative enzymes have been implicated[8,44]. The clinical importance of KCOTs is their high potential of recurrence after enucleation, because small foci or fragments of the epithelium left behind can proliferate into a cyst. Emerson and colleagues in 1972 reported two cases of recurrence in soft tissue following mandibular resection[79]. Its high recurrence is comparable to that of tumors[14]. The recurrence rate reported for KCOTs varies between 3% and 62% and occurs at all sites[1].

Although resection may be the only possible treatment for multilocular cyst with soft tissue spread, adjacent soft tissue in contact with the cyst should be removed[4,20].

Radiographically, KCOTs may appear as a well-circumscribed, round or ovoid, radiolucent lesions with often scalloped and multilobulated margins[78]. Large size KCOTs are particularly common at the angle of mandible and ascending ramus. True multilocular presentation is rare. Expansion of cortical bone is less common than in ameloblastoma. In 25% to 40% of cases unerupted tooth is involved. Multilocularity is often present and is seen more frequently in larger lesions. Approximately 30% of maxillary and 50% of mandibular lesions produce bucall expansion[1,53].

KCOTs have been associated with Nevoid Basal Cell Carcinoma Syndrome (NBCCS)[80]. When multiple/bilateral keratocysts are found in the jaws; NBCCS appear to be involved in about half of the cases[80]. Some studies have suggested that parakeratinization, intramural epithelial remnants and satellite cysts are more frequently observed among KCOTs associated with NBCCS.

Other tumors that have been associated with KCOTs apart from NBCCS are basal cell carcinoma, meningioma, medulloblastoma and fibroma.

Histological features defined by the WHO in 2005 enable to differentiate KCOTs from jaw cysts with keratinization. These features include;

- Well defined, often palisade, basal layer of columnar or cuboidal cells.
- Intense basophilic nuclei of the columnar basal cells oriented away from basement membrane.
- Parakeratotic layers with an often corrugated surface.
- Mitotic figures frequently present in the suprabasal layer.

Keratocyst Odontogenic tumor

Keratocystic odontogenic tumor (KCOT) formerly referred to as odontogenic keratocyst (OKCs); is a benign neoplasm of odontogenic origin, which presents with an aggressive infiltrative behaviour leading to high recurrence rate. KCOT (OKCs) have been one of the controversial pathological entities of the maxillofacial region since Philipsen first described it in 1956[46]. The World Health Organization (WHO) in 2005 classification of head and neck tumors reclassified the OKCs as a benign neoplasm, recommending the term Keratocystic odontogenic tumor (KCOT). The former orthokeratinized variant of the OKCs is at present not recognized as being part of the spectrum of KCOTs. The etiology of this tumor which comprises approximately 10 % of all cystic lesions in the maxillofacial region is uncertain[46,52,72].

KCOTs are non-inflammatory clincopathologically distinct tumors that arise from the dental lamina, but there is little actual proof of this origin[107]. It affects different age groups with peak at 2nd and 4th decades with a slight male predilection. Unlike other cystic lesions which grow by osmotic pressure; KCOTs appear to have innate growth potential like a benign tumor, this gives its characteristic radiographic appearance[20,46,73,74,75].

The epithelial lining of this tumor is keratinized and thin between 5 –10 cells thick. It has a rete peg like projection from the basal layer into the adjacent connective tissue[16,45,76,77]. Inside the cyst often contains a keratin material derived from the epithelial lining. Early studies reported evidence of high mitotic activity, high epithelial turn over rate, prostaglandin induced bone resorption and active collagenases in the fibrous tissue lining.

The most common location of KCOTs is the posterior border of the mandible posterior to the canine 90%[1]. Infection changes the cystic lining to non-keratinized stratified squamous epithelium like that of inflammatory cyst. Forty percent of KCOTs form around an un-erupted tooth as a symptomless swelling, pain occurring only when it is secondarily infected[4,22].

Sometimes KCOTs have curved internal septa giving the cyst a multilocular appearance, and have a propensity to grow along the internal aspect of the jaws, causing minimal expansion. KCOTs have a tendency to displace and resorb teeth but with less degree compared to the dentigerous cyst. Inferior alveolar nerve may be displaced inferiorly[78].

KCOTs rapidly penetrate bone rather than expanding it; but the mechanism for this behavior is unclear[4,14,16,44]. Pressure resorptions of bone by an expanding mass, collagenase production, prostaglandin production and highly active oxidative enzymes have been implicated[8,44]. The clinical importance of KCOTs is their high potential of recurrence after enucleation, because small foci or fragments of the epithelium left behind can proliferate into a cyst. Emerson and colleagues in 1972 reported two cases of recurrence in soft tissue following mandibular resection[79]. Its high recurrence is comparable to that of tumors[14]. The recurrence rate reported for KCOTs varies between 3% and 62% and occurs at all sites[1].

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- Intense basophilic nuclei of the columnar basal cells oriented away from basement membrane.
- Parakeratotic layers with an often corrugated surface.
- Mitotic figures frequently present in the suprabasal layer.

Treatment of KCOTs remains controversial. The treatments are generally classified as conservative or aggressive. Conservative treatment includes simple enucleation with or without curettage and adjunctive therapies such as use of Carnoy's solution. Aggressive treatments generally include peripheral ostectomy, chemical curettage using Carnoy's solution, and marginal or segmental resection followed with bone grafting for large lesions[80].

Calcifying Odontogenic Cyst

Calcifying odontogenic (Gorlin) cyst is an uncommon, slow growing, benign odontogenic lesions, which was first described by Gorlin in1962, but the lesion had previously been described in German literature in 1932 by Rywkind. The lesion account for 1% of all odontogenic jaw cysts.

Calcifying odontogenic cyst occupy a spectrum ranging from a cyst to a solid odontogenic tumor, where 86% show cystic features and 14% have behavior similar to neoplastic lesions[40,70]. Calcifying odontogenic cyst shows considerable amount of histopathological diversity, and variable clinical behaviours such as cystic, neoplastic, and infiltrative characteristics. WHO consider calcifying odontogenic cyst as a benign tumor[40]. The lesion produces calcified tissue as dysplastic dentine.

Ten percent of calcifying odontogenic cysts are associated with odontomas or other odontogenic tumors, and is believed to be derived from epithelial remnants within the gingiva or jaw bones.

Various terminologies have been proposed due to its different histopathological characteristics; these terminologies include calcifying ghost cell odontogenic tumor, and cystic calcifying odontogenic tumor. Solid neoplastic variant of COCs have been termed as dentinogenic odontogenic ghost cell tumor, epithelial odontogenic ghost cell tumor and odontogenic ghost cell ameloblastoma proposed by Shear in 1974.

Calcified odontogenic cyst occurs in a wide age range from 1 year to 82 years with peak incidence in the 2nd decade. More than 75% of the calcified odontogenic cyst occurs in the maxilla and 25% are extraosseous occurring in the gingiva[1,2,3].

COCs are usually asymptomatic swellings causing bony expansion, it rarely affect the lingual plate of alveolar bone. The enlarging swelling occasionally perforates the cortical

plate and cause displacement of adjacent teeth, root tipping and resorption of teeth adjacent to the lesion.

Radiographically, calcifying odontogenic cyst presents as a unilocular or multilocular radiolucent lesion with discrete, well-demarcated margins. Within the lesion there are scattered and irregular calcifications of variable sizes from small flecks to solid calcified areas[78].

Histologically calcified odontogenic cyst presents a fibrous connective tissue wall lined by odontogenic epithelium. Epithelial lining is of variable thickness. The most prominent and unique microscopic feature is the presence of ghost cell keratinization. These cells are anucleated and retain the outline of the cell membrane. Due to the unpredictable behavior of calcifying odontogenic cyst its treatment is more aggressive than simple enucleation[1,41,70].

The treatment of choice for COCs involves enucleation with a long term follow up. Recurrence depends on incomplete removal of a cyst.

II. Non-odontogenic cysts

These are cysts associated with the development of the oro-facial region and are not related to the process of teeth formation. They are classified into fissural and soft tissue cysts.

Nasopalatine duct cyst

Nasopalatine duct cyst is also called nasopalatine canal cyst, incisive canal cyst, median palatine cyst, and anterior maxillary cyst[1,2,54]. Nasopalatine duct cyst (NPDC) is a most common developmental non-odontogenic cyst in the oral cavity. It develops from epithelial remnants of nasopalatine duct or incisive canal, and has been detected in 1% of the population between ages of 40 and 60 years old[1,2,55].

Nasopalatine duct cyst is formed by the proliferation and cystic degeneration of the embryonic epithelial remnants of the nasopalatine duct, a primitive organ of smell as well as nasopalatine vessels and nerves[54,55]. The stimulus for cyst formation from the epithelium remnants of the nasopalatine canals is uncertain, although bacterial infections and or trauma are thought to have a role[1]. Nasopalatine duct cyst accounts for 10% of the jaw cysts[54,55].

NPDC is a symptomless lesion and often observed during routine radiographic examination during dental treatment. Conventional radiographs commonly used to study NPDC are panoramic and occlusal radiographs; which show rounded or heart-shape and well-defined radiolucent lesion in the anterior maxilla involving the apex of central incisors[50]. The lesion shows some divergence and root resorption of central incisors. Larger lesion resorbs the surrounding maxillary cortex and shows the palatal swellings with fluctuation. NPDC extending towards the labial side causes facial disfigurement such as the nasolabial protrusion, but there have been only a small number of reported cases with this clinical feature[2,55]. Most common symptoms have been reported as palatal and/or labial swelling and lager lesions often cause dislocations of neighboring incisors, but seldom cause root resorption[55].

Cystic fluid is usually serous and the cyst wall consisted of almost the same amount of degenerating stratified squamous epithelium and respiratory epithelium[55].

Nasopalatine duct cyst is treated by surgical enucleation. In case of large cysts marsupialization may be done followed by enucleation. Recurrence is very rare[1,2].

Nasolabial cyst

Nasolabial (nasoalveolar) cyst is thought to arise from the remnants of the nasolacrimal rod. This cyst involves soft tissue with occasional bony cupping, which is a result of pressure resorption[1,2].

The nasolabial cyst is found along the nasolabial fold and may distort the ala. Extension with the nasal and/or labial vestibule is also possible. Clinically the cyst presents as a smooth, fluctuating, and painless swelling unless when infected[1,2,3]. It is not seen radiologically because it is within soft tissues but a depression on the alveolar ridge may be confused with a bone lesion.

Histologically the nasolabial cyst presents with pseudostratified columnar epithelium, but stratified or cuboidal epithelium may also be present. An inflammatory infiltrate may also be present. Some cysts have an eosinophilic hyalinized area of the connective tissue adjacent to the epithelium, which is of unknown origin. Treatment of nasolabial cyst is by surgical excision, recurrence is uncommon[1,2].

Fissural cysts

These cystic lesions develop from proliferation of entrapped epithelial cells during fusion of the developing facial processes. Fissural cysts are usually found at the sites of fusion of the facial process[25].

Median palatine cyst

Median palatine cyst is a bone cyst that forms in a median fissure of the palate from embryonic remnants. Median palatine cyst arises from epithelium trapped during fusion of palatal processes of the maxilla. It is a true fissural cyst. It is differentiated from incisive canal cyst by posterior location in the palate. It usually presents as asymptomatic, fluctuating swelling. Radiographically median palatine cysts are ovoid or circular in appearance. Histologically they are composed of a fibrous collagenous tissue wall with infiltration of chronic inflammatory cells, and are lined by stratified squamous and/or respiratory epithelium. Median palatine cyst treatment is mainly by surgical excision after reflecting a mucoperiosteal flap[1, 2,56].

Median mandibular cyst

Median mandibular cyst is a cyst that may present as a developmental cyst that results from the inclusion of epithelium trapped in the central groove of mandibular process. On the other hand it may arise from cystic degeneration of supernumerary tooth germ.

The cyst is located within the mandible below the apices of the central incisors. Radiographically, the cyst is oval, round, irregular and even multiloculeted. Microscopically, the cyst is lined by the stratified squamous epithelium or a combination of this type and ciliated columnar epithelium.

2. NON-EPITHELIAL LINED CYSTS

These are cysts which microscopically exhibit no epithelial lining (Pseudocysts)[1,2]. They include; Idiopathic bone cyst (traumatic bone cyst, simple bone cyst).

Simple bone cyst

Simple bone cysts are benign non neoplastic fluid filled cavity in the bone. It was first described by Lucas in 1929, since then has been reported under many names such as solitary bone cyst, hemorrhagic bone cyst, Idiopathic bone cyst, unicameral bone cyst, traumatic bone cyst, and extravasation bone cyst [61,62,63]. Simple bone cyst is a fluid filled cavity in the bone lined by compressed fibrous tissue, occurring in the long bones of a growing child; the upper part of the humerus contributes 50% – 60% of all simple bone cysts.

In 1946 Rushton described the simple bone cyst as a single, fluid filled cystic lesion surrounded by a hard bony wall with no epithelial lining and no evidence of infection[1,90]. Simple bone cyst/traumatic bone cyst is an intrabony dead space that lacks an epithelial lining and forms about 1.2% of all jaw cysts. The designation of pseudocyst relates to its radiographic appearance and its gross surgical presentation. Unlike in long bones the simple bone cyst is uncommon in the jaw bones[1, 2].

Different theories has been proposed regarding the etiology and pathogenesis of simple bone cyst; from these theories simple bone cyst was considered to be a result of disorder of the growth plates, or problems associated with circulation that are caused by a developmental anomaly in the veins of the affected bone. The role played by trauma in the development of these cysts is unknown; some speculate that repeated trauma puts the bone at risk of developing simple bone cyst[64]. It is also believed that pathogenesis of simple bone cyst is associated with break down of blood clot in trauma leaving an empty bone cavity or is a result of cystic degeneration of primary tumor of bone such as central giant cell granuloma, disorder of calcium metabolism and ischemic necrosis of bone marrow[1,64].

Simple bone cyst occurs exclusively in the mandible in either posterior or anterior regions[61,62,63]. All cysts are asymptomatic and are found incidentally on radiographic examination. In some cases there is bony expansion associated with trauma. In older age groups simple bone cysts are associated with florrid osseous dysplasia (FOD) an association that is not well understood[1,2, 64].

Radiographically; the cyst presents as a well defined radiolucent lesion with irregularly defined margins, absence of peripheral sclerosis and slight root resorption[49].

Microscopic presentation of the lesion may occasionally contain blood or serosanguinous fluid and a delicate well-vascularised fibrous connective tissue without evidence of epithelial component[1,2].

Although simple bone cysts may heal spontaneously, operation is generally advisable to confirm the diagnosis and this in itself constitutes definitive treatment. Curettage of the bony walls is generally recommended, although some authors avoid curettage of the roof of the cyst[61,62,63] .

Aneurysmal bone cyst

An aneurysmal bone cyst (ABC) is a benign non-neoplastic expansile osteolytic lesion with a thin wall containing blood filled cavity[1,2]. The cystic lesion was first described by Jaffe and Lichtenstein in 1942[65]. Since then, much debate and confusion has ensued regarding its nature and pathogenesis until when it was defined by WHO as expansive osteolytic lesion consisting of blood filled spaces and channel divided by connective tissue septa that can contain osteoid tissue and osteoclast-like giant cell[66]. ABC can arise in any bone in the head and neck and it constitutes about 5% of all bone lesions affecting mainly the mandible and maxilla in individuals below 30 years of age without sex predilection[65].

Etiology of aneurysmal bone cyst is unknown; however, it is believed to be a component of, or arises with a preexisting bone tumor in about one third of cases; Aneurysmal bone cyst can arise from reactive process associated with trauma, preexisting primary bone lesions such as ossifying fibroma, a chondromyxoid fibroma, an osteoblastoma, fibrous dysplasia, central giant cell granuloma and chodroblastoma and some malignant bone tumors such as osteosarcoma, chondrosarcoma and haemangioendothelioma[1,65,66]. Local haemodynamic alteration related to venous obstruction or arteriovenous fistula that occurs after an injury is important in the pathogenesis of an aneurysmal bone cyst[67]. Aneurysmal bone cyst may be purely intraosseous, arising from the bone marrow cavity. In this case, they are primarily cystic and slowly expand into the cortex. They may be extraosseous, arising from surface of bone, eroding adjacent cortex and extending into the marrow space. ABCs can affect any bone, in the jaws ABCs account about 1.9% of all ABCs and make about 1.5% of all non-odontogenic cysts of the jaws with slight female predilection (2:1)[67,68,69]. It affects individuals of between 10 to 30 years of age,

with a peak incidence at 16 years. About 75% of patients are younger than 20 years. The swelling is usually painless but in some cases it is associated with pain. There is no bruit on auscultation. Other common clinical presentations include pain of acute onset in some patients which increases in severity over 6 – 12 weeks, local skin temperature increase and joint movement may be restricted.

Aneurysmal bone cyst is usually a unilocular radiolucent lesion; however, the presence of ridges and new bone septa often gives it a multilocular or soap-bubble appearance. Radiographically, it resembles KCOT, central giant cell granuloma, and ameloblastic fibroma.

Histologically, aneurysmal bone cyst consists of a fibrous connective tissue stroma containing numerous blood-filled sinusoid spaces. There are also multinucleated giant cells, areas of osteoid and new bone formation[65].

Modes of treatment of ABC vary depending on the location and aggressiveness of the lesion. However, treatment of choice is curettage or en bloc resection with reconstruction, other treatment modalities includes radiation, cryotherapy, and percutaneous intralesional injection of fibrosing agents, calcitonin therapy, and embolization[70].

1.2.3.2. Cysts of the Soft Tissues

These are cysts, which form in the soft tissues of the oro-facial (oral and maxillofacial) region during developmental process, inflammation, trauma or obstruction of the glandular ducts. They include:

a) Developmental cysts

Branchial cleft cyst

Branchial cleft cysts are congenital epithelial cysts, which arise on the lateral part of the neck as a result of a failure of obliteration of the 2nd branchial cleft during embryonic development[25,81].

Branchial cleft cyst arises when the second branchial cleft fails to close at about fourth week of embryonic life. During the development of the neck the 2nd branchial arch grows downwards and ultimately covers the 3rd and 4th arches. The buried clefts normally

Thyroglossal duct cyst

Thyroglossal duct cyst is the most common non-odontogenic developmental cyst of the neck[1,2,3]. It is related to the development of the thyroid gland during the 4th week of embryonic life where the 1st and 2nd branchial arches form the posterior part of the tongue in the region of the foramen caecum[81]. The thyroid anlage grows downward to its permanent location in the neck from the foramen caecum. Between the foramen caecum and the cervical location of the thyroid gland is the embryonic tract of the thyroid tissue. The developing gland passes through the base of the tongue and the hyoid bone to the midneck. The tract or duct breaks up or involute by the 10th week of gestation[25,81,83].

Residual epithelial elements that do not completely atrophy may give rise to a cyst in later life. Different theories have been postulated to explain the proliferation of the thyroglossal tract remnants to form a cyst; inflammatory theory has gained substantial support. This theory was based on evidence that lymphoid tissue of the neck close to the thyroglossal structures react to repeated upper respiratory infections, and that infectious irritants may stimulate epithelial remnants of the thyroglossal tract to undergo cystic changes. This could explain the high frequency of thyroglossal duct cysts in infants and children who more frequently have infectious diseases. Thyroglossal duct cysts may occur in the posterior portion of the tongue (lingual thyroid), in the neck or any portion of the thyroglossal duct[1,83,84].

Approximately 30% of thyroglossal duct cysts are found in patients older than 30 years of age and 30% are found in patients younger than 10 years. Most of the cysts occur in the midline, with 60% over the thyroid membrane and only 2% within the tongue itself. Majority (70%-80%) of thyroglossal duct cyst occur below the level of the hyoid bone[81].

Thyroglossal duct cysts are generally asymptomatic but when attached to the hyoid bone and tongue they may retract on swallowing or extension of the tongue. If infected they may become large, painful and discharge pus.

Microscopic findings vary depending on the location of the cyst. Lesions occurring above level of the hyoid bone are chiefly lined by stratified squamous epithelium. Ciliated or columnar types of epithelium lined cysts occur below the hyoid bone. Malignancy, commonly papillary adenocarcinoma, may arise within the thyroglossal duct cysts.

Thyroglossal tract cyst clinically resembles dermoid cyst, thyroid neoplasm, branchial cyst and sebaceous cyst.

Sistrunk's operation is the treatment of choice for thyroglossal duct cyst. In the 18th and 19th century treatment of thyroglossal duct cyst was simple incision and drainage; where recurrence was unacceptably high; until when Sistrunk introduced type of operation to reduce risk of recurrence. In this operation; excision of a block of tissue between the hyoid bone and the foremen cecum is done in order to obtain complete removal of thyroglossal tract remnants[83].

Cystic hygroma

Cystic hygroma (macrocystic lymphangioma) are anomalies of lymphatic system characterized by single or multiple cysts within the soft tissue usually involving the neck. In the embryo, the lymphatic system drains into the jugular lymphatic sac. A communication between this primitive structure and jugular vein is formed 40 days after gestation. Failure of development of this communication results in lymphatic stasis. Dilatation of the lymphatic channels leads to the clinical manifestations of the jugular lymphatic obstruction sequences. Dilatation of the jugular lymphatic sac leads to the formation of a cystic structure in the cervical region. Cystic hygroma occurs in 1 in 12,000 live births[81,85,86].

Cystic hygroma can occur anywhere, the most common sites are the posterior triangle of the neck, axilla, groin, and mediastinum. It is frequently associated with chromosomal aberration and anatomical defects[61].

The cysts are lined by endothelium and filled with a clear or cloudy fluid-like lymph[62]. Occasionally unilocular cysts occur, but more often are multiple cysts infiltrating the surrounding structures and destroying the local anatomy[1,81,86]. A most troublesome variant of cystic hygroma is that which involves the tongue, floor of the mouth and structures deep in the neck.

The mass may appear at birth or may appear and enlarge rapidly in the early weeks or months of life as lymph accumulates. Ultrasound or CT scan can demonstrate the extent of the lesion.

Cystic hygroma occasionally contain nests of vascular tissues. These poorly supported vessels may bleed and produce rapid enlargement and discoloration of cystic hygroma.

Infection usually caused by streptococcus or staphylococcus may occur. Surgical excision is the treatment of choice[86].

b) Cysts of the skin of the oro-facial region

Cutaneous cyst may be located either intradermally or wthin subcutaneous tissue. These general spherical growth contain a cavity that may be filled with fluid or contain cellular products or debris. A true cyst has an epithelial lining, whereas a pseudocyst lacks such an organized epithelium. They are classified according to the patterns of histological presentations.

Dermoid Cyst

The dermoid cyst is a developmental keratin filled cyst, lined by stratified squamous epithelium containing dermal appendages such as hair follicles, sebaceous and sweat glands. Dermoid cysts occur in many areas of the body[1,2]. In the head and neck; dermoid cysts account for less than 2% of all dermoid cysts and 7% of all cysts of the oro-facial region[87,88,89,90]

In the oro–facial region the dermoid cyst is believed to be an entrapment of multipotential cells or implantation of epithelium. In the oral cavity the dermoid cysts may occur on soft palate, the dorsum of the tongue, or more commonly on the floor of the mouth[87,88].

The location of the cyst in relation to the musculature of the floor of the mouth is important as it determines the clinical signs and surgical approach[91]. On the floor of the mouth the dermoid cyst may be superficial to the geniohyoid muscle with submental swelling.

Different hypothesis have been formulated regarding to the origin of dermoid cysts. The most accepted one state that congenital lingual dermoid cysts arise from sequestration of dermal and epidermal cells during the midline fusion of the branchial arches. A second hypothesis states that acquired dermoid cysts are formed by trapping of epidermal and dermal cells following trauma.

Dermoid cysts are generally quiescent until when they become infected. When located above the mylohyoid muscle, displaces the tongue superiorly and posteriorly with difficulties in swallowing, eating and sometimes breathing. When located below the

mylohyoid muscle, a midline swelling of the neck occurs. These cysts grow slowly and are painless; on palpation they are soft and doughy owing to keratin and sebum in the lumen[89,90,92]. Other signs and symptoms include asypmtomatic tongue enlargement, difficult feeding and recurrent infections. The cyst can attain considerable size to a point of making the patient unable to close the mouth, chew or speak normaly.

Microscopically dermoid cysts are lined by stratified squamous epithelium supported by a fibrous connective tissue wall. Numerous secondary skin structures, including hair follicles, sebaceous glands and sweat glands (and occasionally teeth) may be found[1,2,3].

Surgical excision is the treatment of choice with little risk of recurrence[1]. Dermoid cysts superficial to the geniohyoid muscle are best approached through an extraoral incision, and those deeper to the geniohyoid are best-approached intraorally[93].

Epidermoid cyst

Epidermoid cysts are true cysts. The lining of these resembles that of normal epidermis. This lining produces fully matured, keratinized cellular debris, which fills the cavity of the cyst. Epidermoid cysts are thought to originate from the follicular infundibulum of hair shafts and may arise either spontaneously or as a result of inflammation or trauma to the area. Injection of surface epidermal material to deeper dermal or subcutaneous layers as a result of penetrating trauma has been postulated. These cysts are rarely found before puberty, but they have been reported in all age groups after this period. If these cysts appear before purberty or in large numbers, they may be an indication of Gardner's syndrome, which is an autosomal dominant condition that predisposes the patient to intestinal cancer.

Epidermal cysts can present a cosmetic problem, and if they rupture or become infected, they may cause severe pain and scarring.

Some of these lesions respond well to intracystic injections of triamcinolone. However, surgical excision is the treatment of choice. It is necessary to carefully dissect and remove the entire cyst wall, because retained segments may lead to recurrent growth of the cyst.

c) Inflammatory cysts of the soft tissues of the oro-facial region

Lymphoepithelial cyst

This is one of the benign Lymphoepithelial lesions of the salivary glands: commonly found in the parotid gland. Other lesions in this group include Lymphoepithelial sialadenitis (LESA) of Sjogren Syndrome and both HIV-related and unrelated cystic lymphoepithelial hyperplasia (CLH). They share a common microscopic appearance characterized by epimyoepithelial islands and/or epithelium lined cyst in a lymphoid stroma. However, they differ greatly regarding to their etiology, clinical presentations and treatment[94]. Cystic Lymphoepithelial lesion is an infrequent disorder involving the mouth, major salivary glands, neck, and other lymphoid tissues in the body; currently its frequency has increased coinciding with the epidemics of HIV/AIDS infections[26,27]. The lesion is painless, slow growing with no history of inflammation[95]. The cause of this lesion is obscure; there are several studies done on the role of microorganisms in the pathogenesis of LEC. One of these studies was that of Thomas and his colleagues (2009) on the role of cytomegalovirus (CMV), Epstein-Barr-Virus (EBV) and Human Herpes Virus-8 (HHV-8). The results showed that EBV was frequently found more in benign lymphoepithelial cyst than in normal parotid gland and is thought to be a contributing factor to epithelial proliferation resulting in a clinically evident lesion. However, they recommended more studies to elucidate the role of EBV in the pathogenesis of LEC[77]. Therefore; most possibility of the pathogenesis of LEC is associated with cell mediated immune mechanism; where lymphocytes infiltrate and replace the acini[28,29,56]. Ductal elements are stimulated to undergo hyperplasia forming irregularly shaped islands of squamous epithelium.

Histologically LEC is lined by parakeratotic stratified squamous with or without pseudostratified columnar or mucous cells. The cyst wall may contain proportions of lymphocytes, macrophages, plasma cells and giant cells.

Different treatment modalities of LEC of the parotid gland have been studied. Berg and his colleagues in 2009; did the study on sclerotherapy for treatment of LEC in HIV positive patients, where they injected sodium morrhuate in the lesion after the fluid has been aspirated; the results of this study showed that aspiration of fluid followed by intralesional injection of sodium morrhuate was a safe, minimally invasive and

efficacious technique in the treatment of LEC of the parotid gland in HIV positive patients. Other recommended treatment includes cyst enucleation[1,26,27,96].

Parasitic/ Hydatid cyst

This is a very rare type of cyst and is caused by *Echinococus granulosa*, a parasitic worm. The commonest location of this cyst is in the liver and lungs. Few cases have been reported in the oro-facial region[97]. Hydatid cyst is commonly seen in people in the sheep and cattle raising regions of the world[98].

The definite host of this cyst is a dog who harbors the adult worm in the intestinal tract. Humans acquire infection by swallowing eggs of *E. granulosa*, through association with dogs, sheep, and goats or through contaminated foods. Infection usually occurs in childhood, but clinical symptoms occur 5 – 20 years later when the cyst enlarges compressing other tissues. It is rare in bones, but when it occurs in bone it causes erosion of a bone[97,98].

Hydatidosis commonly appear as cystic lesion and grow slowly; the location and pressure caused by enlarging cyst define the symptoms.

Diagnosis of hydatidosis is through history of the patient, physical examination, aspiration, serological testing and diagnostic imaging mainly CT scan and MRI.

There is no effective medical treatment for hydatidosis; surgical excision with prevention of any spillage of the hydatid cyst's content is still the most effective medical treatment. If surgical excision is not performed the cyst is more likely to transform into untreatable multiple hydatidosis or anaphylactoid reaction.

d) Cysts of the salivary glands and ducts

Cystic lesions of the salivary glands also known as mucous cysts are common[1,2,3]. They are clinically and collectively referred to as mucoceles. Mucoceles are either extravasation or retention type. The term mucous extravasation phenomenon is used when mucous has been extruded into the connective tissues and is surrounded by a granulation tissue envelope. On the other hand the term mucous retention cyst is used to describe a cyst with retained mucin that is lined with ductal epithelium that may have undergone squamous or oncocystic metaplasia[56,60].

The lesion can be located directly under the mucosa, upper submucosa or in the lower corium. Basing on the histological features of cyst wall there are two types of mucous cyst:

- Mucous extravasation cysts
- Mucous retention cysts.

The mechanism of mucous cyst formation is unclear, however, a traumatic etiology rather than an obstructive phenomenon is considered more likely. Chaudhry and his colleagues in 1960 showed that the escape of mucous into the surrounding tissues after severing the excretory salivary ducts led to mucous cyst formation. The most frequent location of the mucous cyst is the lateral aspect of the lower lip which supports the role of trauma as an etiologic factor. Obstruction may also play a role in the etiology of the mucous cyst.

Collectively, the mucoceles, the oral ranula, and the cervical or plunging ranula are clinical terms for a pseudocyst that is associated with mucous extravasation in the surrounding tissues. These lesions occur as the result of trauma or obstruction to the salivary gland excretory duct and spillage mucin into the surrounding soft tissues. Ranula is mucoceles that occur in the floor of the mouth and usually involve the major salivary gland. Specifically ranula originates in the body of the sublingual gland, in the duct of Rivini of the sublingual gland and in the Wharton duct of the submandibular gland. These lesions are devided into two types:

- Oral ranula.
- Cervical or plunging ranula

The development of mucoceles and ranulas depend on the disruption of the floor of saliva from the secretory apparatus of the salivary glands.

The lesions are most often associated with mucous extravasation into the adjacent soft tissues caused by traumatic ductal insult. The rupture of an acini structure caused by hypertension from the ductal obstruction is another possible mechanism from the development of such lesions. Trauma that results in damage to the glandular parenchymal cells in the salivary gland lobule is another potential mechanism.

Inflammation that involves the minor salivary gland duct resulting in blockage, dilatation and rupture of the duct with subepithelial spillage of fluid. Changes in minor salivary

gland function and composition of the saliva may contribute to their development. In some cases an immunological reaction may be the cause.

Studies revealed increased level of matrix metalloproteins, tumor necrosis factor –alpha, type IV collagenase and plasminogen activators in mucoceles compared with that of whole saliva. These factors are further hypothesized to enhance the accumulation of proteolytic enzymes that are responsible for the invasive characteristic of extravasation mucin.

In the USA study in 23,616 white adults older than 35 years, mucoceles represented the 17th common oral mucosal lesion with a prevalence of 2.4 cases per 1000 people.

In a study of 30,000 Swedish individuals aged 15 years or older, the prevalence of mucoceles was 0.11%. In Brazilians study of 1200 children seen at a pediatric clinic, the prevalence of mucoceles was 0.08%.

Mucoceles tend to be relatively painless with no associated morbidity or mortality. Depending on the size and location, some mucoceles may interfere with mastication. Oral ranula and plunging ranulas, if large, may affect swallowing, speech or mastication and may result in airway obstruction.

Most mucoceles occur in young individuals, with 70% of individuals being younger than 20 years; the peak prevalence occurs in persons aged 10 – 20 years.

Mucous Extravasation Cyst

The mucous (saliva) extravasation cyst is associated to mechanical trauma with the minor salivary gland excretory ducts resulting into a severance which causes spillage or extravasation of mucous into the surrounding connective tissue stroma. It then induces a secondary inflammatory reaction that is followed by granulation tissue response around a mucin pool[1,3,61]. This inflammatory process ultimately leads to scaring around the gland[56].

Superficial mucocele is a result of increased pressure on the ductal component situated within the overlying epithelium[1,2,29,79].

Mucous extravasation cysts commonly affect the lower lip, buccal mucosa, and ventral surface of the tongue, floor of the mouth or the retromolar region[1,2,3]. This lesion is usually painless, bluish in colour and smooth surface. Mucous extravasation cysts are

also frequently found in other parts of the oral cavity where minor salivary glands are located.

Histologically mucous extravasation cyst is a well circumscribed cavity filled with mucin lined by granulation tissue infiltrated by inflammatory cells mainly neutrophils, macrophages, lymphocytes, and occasionally plasma cells. The treatment of choice of mucous extravasation cyst is surgical excision.

Mucous Retention Cyst

Mucous (saliva) retention cysts result from obstruction of salivary flow because of a sialolith, periductal scar, inflammatory proces or tumor. The retained mucin is surrounded by ductal epithelium, giving the lesion a cystic-like appearance. Mucous retention cysts are less common than mucous extravasation phenomenon, affecting older age groups.

The mucous retention cyst usually appears in old age and is most commonly found in the upper lips, palate, cheek and floor of the mouth as well as the maxillary sinus[99,100] . It rarely occurs in the lower lip[1,2].

Mucous retention cyst is an asymptomatic swelling, usually without antecedent trauma. The lesion varies in size from 3 mm to 10 mm, and is mobile on palpation, non tender and without peripheral inflammatory changes. The overlying mucosa is intact and of normal colour. Deeper lesion is firmer and more diffuse[1,99].

The cavity of the mucous retention cyst is lined by ductal epithelium which is of pseudostratified, columnar or cuboidal cells. Its treatment is by cyst excision together with lobules of minor salivary glands elements. Recurrence is not expected if the associated gland is removed together with the cyst[99,100].

Ranula is a clinical term which includes mucous extravasation cysts and mucous retention cyst, occurring in the floor of the mouth usually associated with sublingual gland, however, submandibular salivary glans can also be involved[101,102,103,104].

Trauma of the duct and ductal obstruction are responsible for the formation of ranula. Obstruction is usually due to salivary stones (sialolith) that may occur anywhere along the ductal system from the gland parenchyma to the ductal orifice. Trauma in the floor of the mouth can be accidental or as a result of surgery where damage to the ductal system result in exudation of mucous into the surrounding interstitial tissues. In the current

literature association between ranula and HIV/AIDS has been reported, however, the reason for the association is not clear[3,14].

Clinically ranula presents as a fluctuant, unilateral, soft tissue swelling in the floor of the mouth. It has a bluish appearance that has been compared to a frog's belly (Ranula). It has a wide variation in size and site of occurrence. When it is significantly large it can cross the midline and when it is deeper in the connective tissue, the typical bluish translucent character may not be evident. In case the blockage is due to sialolith, an occlusal radiograph may show the stone[49]. As it increases in size often spontaneous ruptures and emptying of the ranula occurs. However, once the opening closes the ranula refills.

The deeper (plunging) ranula develops as a result of mucous herniation through the mylohyoid muscle and along the fascial planes of the neck[102.,103,104]. It rarely progresses into the superior mediastinum; its diagnosis becomes difficult when there is no associated ranula in the floor of the mouth.

Histological features of ranula depend on the pathogenesis. It is the same as mucous extravasation phenomenon and mucous retention cyst. The majority of the mucous extravasation specimens are characterized by thick mucoserous fluid surrounded by granulation tissue. The retention mucocele features a lining derived from ductal epithelium with acellular calcified salivary stone[1,2,49].

Various methods have been used in the treatment of ranula. However, the most appropriate treatment protocol has not been established, particularly for pediatric patients[105,106].

Currently ranula is being treated by both surgical and non-surgical procedure. Surgical procedures include resection of the ranula together with ipsilateral sublingual gland. Marsupialisation with or without open packing have been used, but has been associated with recurrence and high risk of converting non-plunging ranula into plunging after simple or multiple attempts of marsupialization. Non surgical procedures include sclerotherapy for simple ranula and carbon dioxide laser excision and vaporization[105,106].

1.2.3.3. Cystic lesions of the Maxillary Antrum

Cysts arising from the sinus mucosa are non-secreting and secreting (retention/glandular and mucocele)[100,107,108]. The non-secreting cysts are not lined with epithelium

(pseudocyst) and have been given different names including mesothelial cysts, interstitial cysts and lymphangiectatic cyst. The secretory (retention/glandular) cyst represents dilation of the duct of a seromucinous gland and is therefore lined with epithelium[107,108]. Since different confusing names have been used to describe cysts of the maxillary sinus, Gardner suggested classification for cysts and cyst like processes arising from the sinus mucosa as pseudocyst, retention cyst and mucocele.

Surgical ciliated cyst of the maxillary sinus

Surgical ciliated cyst (SCC) is a very rare cyst of the maxillary antrum; it was first described by Kubo in Japan in 1927. It is a late complication occurring years after surgical intervention into the maxillary sinus; is also known as postoperative maxillary cyst or postoperative paranasal sinus cyst; accounting for about 1.5% of all oro-facial cysts[109]. The most common symptoms SCC are swelling, tenderness or pain of the cheek or mucogingival fold, on aspiration; the cyst usually yields thick viscous straw colored fluid. This cyst has also been reported to occur after LeFort I, II, III fractures, midface osteotomies, traumatic extractions and complication of Cald-Well luc procedures[109].

Surgical ciliated cyst has been suggested to result from mucosa of the maxillary sinus being entrapped in the wound during closure. It is an implantation phenomenon in which the epithelium entrapped along the line of surgical intervention into the antrum proliferates to form a cystic cavity separate from maxillary sinus. The duration from the surgical procedure until cyst development ranges from 6 months to 50 years with mean age of 18.3 years[109]. In those cases where the cyst has occurred in a much shorter time, infection is one of the precipitating factors.

Radiographically, the cyst show radiolucent area with well defined radiopaque borders clearly demarcated from the floor of the sinus with expansion of the cortical plates.

Histologically, the cyst is usually lined by a pseudostratified ciliated columnar epithelium of respiratory type; but this may be replaced focally or totally by squamous cuboidal or columnar epithelium. The wall of the cyst is composed of fibrous connective tissue with or without inflammatory cell infiltration.

Preferred treatment is surgical enucleation; other surgical treatments include Cald-Well luc operation, enucleation with primary closure, pack open and marsupialization.

Recurrence is not common and is seen only in cases where there is infection, thin wall cyst and perforation of bone[109].

Mucous retention cyst of the maxillary sinus

Retention cysts are caused by blockage and subsequent dilatation of ducts resulting in the formation of ductal epithelium lined cyst filled with mucin[109,110]. Majority of these cysts are asymptomatic, slight tenderness and buccal expansion may occur.

This benign mucosal cyst of the antrum is a well documented finding in panoramic radiographs. The occurrence of these cysts has been reported by Paparella to range from 1.9 % to 9.6% with a higher incidence in males (65%) as compared to females, reasons for male predilection is not clear. These cysts are described as well-delineated, radiodense shadow originating from a wall or the floor of the sinus[107]. This cyst is relatively radiopaque because it is seen against the surrounding air of the sinus. Histologically, these cysts are lined by pseudostratified columnar epithelium occasionally mixed with mucous secreting cells.

Seromucinous glands are normally found in the ostium of the maxillary sinus and retention cysts could therefore occur in that region. These glands proliferate markedly throughout the sinus lining in prolonged infection and are often found in antral polyps[108,118].

Mucous retention cysts may also occur in sinuses other than the maxillary antrum. Since mucous retention cysts have limited growth and are not destructive; when predisposing factors such as infections are controlled, they are generally left untreated with periodic observation[1,2].

Mucoceles of the maxillary sinus are chronic cystic, expansile, destructive lesions that represent herniations of the antral lining through the wall of the sinus. Mucoceles of the maxillary sinus was first described by Langenbeck in the 19th century. They are lined by epithelium and contain mucoid material[1,2,110,111,112].

Mucoceles are caused by poor drainage or obstruction of the sinus, especially obstruction of the ostium causing accumulation of secretions into an expanding mass. Expansion and inflammation lead to remodeling and erosion of the bone, which changes the bony architecture significantly. Some of the primary type, result from inflammatory, allergic, or malignant disease, others are secondary to surgery, usually the caldwell- luc

procedures[111,112]. Mucoceles can affect any age group and there is no gender bias. Patients with paranasal sinus mucoceles can present with a variety of signs and symptoms. These can be as dramatic as facial deformity, proptosis, enophthalmos, and loss of vision or diplopia. The sign and symptoms may be non specific and subtle such as facial pain, headache or nasal obstruction.

Clinically, histologically and radiographically mucoceles can resemble other expansile process of the paranasal sinuses such as neoplasia or nasal polyposis[111,112].

On radiograph the mucoceles may appear as a clouding of the involved sinus, the normal thin mucoperiosteal white line becomes attenuated. CT scan is the preferred imaging modality for evaluating mucoceles, where mucoceles appear as expanded, airless sinus filled with homogenous materials.

Histologically mucoceles are lined by flattened, pseudostratified, ciliated columnar epithelium. There is reactive bone formation, reactive changes such as fibrosis, granulation tissue, haemmorrhage, and cholesterol granuloma[111,112].

Treatment of mucocele is either by radical or conservative surgery. Radical surgery involve complete extirpation of the mucous membrane with obliteration or cranialization especially for the frontal sinus. Conservative surgery involves marsupialization of the mucocele with creation or preservation of adequate sinus drainage in order to minimize risk of recurrence[110,111,112].

Pseudocyst of the maxillary sinus

These lesions represent focal accumulation of inflammatory exudates that lift the antral mucosa away from the underlying bone to form the characteristic dome shaped faintly radiopaque structure frequently seen on the floor of the sinus[110]. Pseudocysts of the maxillary sinus are estimated to occur in 1.5 to 10 percent of the population, can be seen in any age affecting more males than females; the reasons for this male predilection is not clear.

Pseudocyst of the maxillary sinus is an asymptomatic lesion characterized by a very thin membrane. The membrane is microscopically covered by a pseudostratified columnar ciliated epithelium with goblet cells on the superficial layer of loose connective tissue that sometimes exhibits chronic inflammatory process. Beneath the loose connective tissue and lining the lumen of the pseudocyst, is a denser, compact layer of fibrous

connective tissue which lines a pseudocyst and which appears to be periosteum. Overtime; these pseudocysts may remain stationary, increase or decrease in size, or disappear spontaneously.

Pseudocyst of the maxillary sinus is best demonstrated on a panoramic radiograph and is often discovered during routine radiographic examination. Radiographically; this cyst appears as a dome-shaped radiopaque lesion extending from the floor of the maxillary sinus. It can be seen on maxillary periapical, Water's and postero-anterior radiographs[49]. The location and radiographic appearance of the pseudocyst of the maxillary sinus are considered diagnostic. Basing on the radiographic appearance, other lesions that may be confused with the pseudocyst of the maxillary sinus; include tooth related cysts, sinus mucoceles and malignant tumors of the sinus. Clinically a pseudocyst of the maxillary sinus resembles polyps, hyperplasia of the sinus lining secondary to odontogenic infection, maxillary sinusitis or a neoplasm[113].

Histological appearance of the wall of these pseudocysts is that of normal or inflammed antral lining[110].

Pseudocyst of the maxillary sinus usually persists unchanged or disappears spontaneously. Therefore no treatment is necessary because the lesion is limited in growth and not destructive. Teeth adjacent to the pseudocyst should be thoroughly evaluated and any area of odontogrenic infection should be eliminated[101].

1.3 STATEMENT OF THE PROBLEM

Observations during the clinic shows that majority of patients with oro-facial cystic lesions present for treatment at the maxillofacial firm of the department of Dentistry of Muhimbili National Hospital; with oro-facial cystic lesions of enormous sizes and with different complications such as infections, gross bone destuction prolonged morbidity and impaired function of the oro-facial structures such as mastication, swallowing and breathing. However, the magnitude of the problem, clinicopathologic presentations and associated complications are not well understood due to scanty reports on these cystic lesions in Tanzania.

The Tanzanian situation of oro-facial cystic lesions may be different from those reported from other parts of the world, in that many patients present for medical care with lesions of considerable sizes and have developed other symptoms. The reasons for the delay in

seeking for medical care especially at referral hospitals is also not clear, however, it is contemplated to be due to the fact that at early stages, oro-facial cystic lesions are innocent looking, small size, painless, and slow growing lesions, causing less concern to the patients and relatives. Lack of regular health checks might have also contributed to the delays for seeking adequate diagnosis and treatment. Other factors which are not yet determined might have also contributed to the delays in seeking for medical care.

Inadequate reports on the clinicopathological presentation and prevalence of different oro-facial cystic lesions might have also caused these lesions to be wrongly diagnosed and inadequately treated at the lower level health care facilities with devastating outcome such as fast growth and infections.

The existing referral system from the dispensary through the various health care levels and socio-economic status of many patients might have also complicated the situation.

Delay in the treatment of oro-facial cystic lesions lead to big lesions and complicate surgical procedures that demand a lot more resources. For example a small radicular cyst can be easily enucleated under local anaesthesia. The same cyst may require marsupialization or enucleation under general anaesthesia when the treatment is delayed. Additionally the chances of recurrence of a cyst increases with the size of the cyst at the time of surgical procedure due to the difficulties in complete removal and hence increased chance of leaving behind cystic components. The bigger the size of the cystic lesion, the more the destruction of surrounding tissue, this increases risk of having remnants of cystic tissue during surgical intervention.

Scanty reports in Tanzania on prevalence and clinicopathological presentation of oro-facial cystic lesions in different groups of the population as well as inadequate diagnostic facilities might have also aggravated the situation. Lack of this important information in the planning of medical care, make it difficult or rather impossible for the government to have an evidence based plan on how best to deal with the situation in the community, such as on job training for health personnel, community awareness creation and provision of basic diagnostic facilities for oro-facial cysts and allied swellings to the regional hospitals.

Therefore the aim of the present study was to determine the magnitude and clinicopathological presentations of oro-facial cystic lesions among patients attending treatment at MNH.

1.4 RATIONALE OF THE STUDY

Health system research, apart from updating or adding information is also expected to improve health care delivery, create community awareness and find solutions to identified problem(s) such as treatment failures, recurrences, complications, morbidity, mortality and delays in seeking for medical care in the community.

This is among the first few studies done in Tanzania aimed at determining clinical and pathological presentations of oro-facial cystic lesions.

This study will improve the level of understanding of health personnel and the community on the magnitude of different oro-facial cystic lesions and their clinical and pathological presentations in Tanzanian setting, so that appropriate measures can be taken at different levels of health care systems in the management of these cystic lesions.

It is envisaged that the results of this study will facilitate improvement in early diagnosis and treatment of oro-facial cystic lesions as well as community awareness creation especially on importance of early treatment of these innocent looking lesions with prolonged morbidity and life threatening consequences when secondarily infected. This will improve quality of care and prevent complications associated with these cystic lesions such as gross tissue destruction, infection, postoperative defects, long hospital stay and cost of reconstruction. It is also expected that this study shall stimulate further studies in this area in the different groups of the population in Tanzania.

Apart from providing more information on oro-facial cystic lesions this study was also carried out as a requirement for the award of Masters of Dentistry in (Oral Surgery).

1.5 OBJECTIVE OF THE STUDY

Main Objective

To determine clinicopathological presentations of oro-facial cystic lesions among patients attending treatment at the maxillofacial firm of the department of Dentistry of Muhimbili National Hospital from June 2008 to February 2009.

Specific objectives

- To determine the prevalence of oro-facial cystic lesions among the study population.
- To determine the relative frequency of different types of oro-facial cystic lesions.
- To describe clinical presentations of oro-facial cystic lesions.
- To describe histological presentations of oro-facial cystic lesions.

CHAPTER 2

2.0 METHODOLOGY

This study involved patients with oro-facial cystic lesion, who attended treatment at the maxillofacial firm of the department of Dentistry of MNH for 9 months from June 2008 and February 2009

2.1 Ethical clearance

This study was approved by the Ethics and Research Committee of Muhimbili University of Health and Allied Sciences, by approval, Ref. No. MU/PGS/SAEC/Vol.11/86, of 5th June 2008.

2.2 Study Design

This is a prospective descriptive hospital based study, which involved patients who attended treatment at the maxillofacial firm of the department of Dentistry of MNH and were diagnosed histopathologically as having oro-facial cystic lesions.

2.3 Study instruments

Instruments used in this study were plain radiographs of the head and neck of patients with OFC lesions of the jaws and salivary glands. These radiographs were interpreted using a viewing box and findings recorded for analysis. Slides were prepared from tissue biopsy, surgical specimen or fine needle aspiration smears which were interpreted under a light microscope after staining with H&E.

2.4 Study area

This study was conducted at the maxillofacial firm of the department of Dentistry and histopathology unit of Muhimbili National Hospital Dar – Es-Salaam, Tanzania.

2.5 Study population

Muhimbili National Hospital receives patients from different parts of the United Republic of Tanzania on formal and informal referrals. Therefore the studied population

consisted of patients who attended treatment at the maxillofacial firm of the department of Dentistry of Muhimbili National Hospital for 9 months from June 2008 to February 2009.

2.6 Inclusion criteria

All patients who were diagnosed histologically as having oro-facial cystic lesions and agreed to participate were included in this study.

2.7 Exclusion criteria

Patients who were diagnosed as having oro-facial lesion and either refused or withdrew from the study due to different reasons were excluded as stipulated in the patient's rights to participate, not to participate or to withdraw from any research. Those patients with soft tissue cysts which were diagnostically inconclusive were also excluded.

2.8 Sample size

A retrospective study done in Nairobi Kenya from 2000 to 2004 (Dimba *et al.*2007) showed that 14.9% of patients who attended Oral Health Services there presented with oro-facial cysts[56].

With the maximum likely error of 11%, hence the minimum sample size basing on Nairobi study was:-

$$n = \frac{z^2 \pi (100 - \pi)}{\xi^2}$$

π = proportion of the total population with the characteristic was 15% basing on retrospective study done at Nairobi Kenya from 2000 to 2004 (Dimba *et al*) with the assumption based on the fact that both studies were done in East African region.

z^2 = Standard value which correspond to 1.96 (at 95% confidence level)

n = sample size

ξ = Maximum likely margin of error was11% (Power of 89%)

$$n = \frac{1.96^2 \times 15 \times 85}{11^2}$$

n = 40

The calculated minimum sample size for the study was 40.

2.9 Patients recruitment and data collection

Before data collection, pretesting of questionnaire was carried out by administering it to 10 people of different age groups to check for accuracy, consistency, coherent and validity. After history taking Patients were clinically examined, and investigations done. Those who were histopathologically diagnosed as having OFC lesions were included in the study. Those patients with inconclusive histopathological findings and those who refused to participate were excluded from the study.

Data collection was done by face-to face interview using structured questionnaire with both closed and open ended questions. Responses given were recorded for analysis. Questionnaire covered different clinical information including the duration of the lesion, size, site, and presence of other accompanying symptoms such as pain, ulceration and fluid leakage, and effect on adjacent structures.

2.9.1 Clinical examination

Clinical examination was carried out by the investigator under the supervision of the study supervisors. During the clinical examination the patient sat on a dental chair fitted with artificial light.

Clinical examination covered site, size, consistency, tenderness and sometimes cystic contents were aspirated to facilitate clinical diagnosis. Oro-facial region and other parts of the body were also examined for similar swellings. Submandibular, submental, cervical, and parotid groups of lymphnodes were examined for lymphadenopathy. The examination findings were recorded for analysis.

After the examination; patients were presented to the panel of specialist oral surgeons at the consultation clinic for discussion on the clinical findings, clinical diagnosis and plan for further investigations and treatment.

2.9.2 Radiographic evaluation

Radiographs were taken for those who presented with cystic lesion of the jaw bones and salivary glands. These radiographs were evaluated by the investigator using viewing box and were then presented at the consultation clinic together with the patient for further evaluation by supervisors and other specialist oral surgeons. Radiographs used included panoramic, occlusal, lateral oblique of mandible, water's and periapical views. Radiological features regarding the size, shape of the lesion, border definition and state of the surrounding tissue were evaluated and recorded for analysis. Radiographic patterns of the lesions were classified according to the appearance into multilocular or unilocular radiolucency. The status of the margins was classified into well-defined and poorly-defined.

2.9.3 Histological/cytological analysis

Representative tissue biopsies were taken under aseptic techniques using surgical instruments by either incision or excision procedures by the investigator assisted by intern doctors, a nurse and under supervision of study supervisor(s) and other specialist oral surgeons. The specimens were immediately fixed in a 10% phosphate buffered formalin in a broad based container with a cover and within two days specimens were prepared, embedded, sectioned, mounted on a microscope glass slides and stained with hematoxylin and eosin (H&E) and were evaluated using light microscope; this was done at the histopathology unit by the investigator and a laboratory technician and slides were analyzed by one pathologist. Fine needle aspiration procedures and interpretations were carried out for patients with soft tissue cysts such as cysts of the salivary glands and dermoid cysts, for inconclusive fine needle aspiration cytology; incision or excision biopsy was done and the specimens analyzed after H&E staining.

Diagnosis was done basing on the Histopathological features of the specimen according to WHO 1992 classification of jaw cysts and 2005 classifications of head and neck tumors.

After the results patients were presented again to the panel of specialist oral surgeons at the consultation clinic for treatment planning and follow up.

Those patients in need of major elective operations were scheduled for operation dates. Operations and follow up of patients were done by the investigator under supervision of the study supervisors and other oral surgeons.

2.10 Reproducibility

After taking representative specimen of the lesion, they were immediately fixed in 10% phosphate buffered formalin and sent for slides preparation and histopathological analysis. Preparation of the specimens was done under supervision of experienced laboratory technician and specimen analysis was done by one pathologist.

2.11 Scoring criteria

Different variables were used in data collection. These variables included demographic (age, gender), clinical features (pain, swelling), duration of the lesion (month, year), anatomical location (mandible, maxilla, ramus, floor of mouth, skin of the face), previous treatment (incision, drainage, medicine), radiographic features (radiolucent, radiopaque) and histological/cytological presentations and diagnosis.

2.12 Data Analysis

Data was analyzed using Epi info 6 computer programs.

Chi-square ($\chi 2$) was used to compare the proportion of two categories.

A p-value of ≤ 0.05 was considered to be significant. Chi-square ($\chi 2$) was used to calculate p-value whenever less than 20% of cells had expected count less than 5. However, due to the study design (non probability sampling), significant testing may not be conclusive.

CHAPTER 3

3.0 RESULTS

3.1 Socio- demographic characteristics of patients with oro-facial cystic lesions

During the study period of 9 months a total of 6,873 patients attended the maxillofacial firm of the department of Dentistry of MNH. where 2988 (43.5%) were males and 3885 (56.5%) females; with male to female ratio of 1:1.3. Out of these patients, 41 (0.6%) were histologically diagnosed as having oro-facial cystic (OFC) lesions. Twenty one (51.2%) of these were males and 20 (48.8%) females, with a male to female ratio of 1.1:1. the difference between males and female was not statistically significant. (p-value = 0.653) (**Table 1).**

From the questionnaires it was observed that majority 19 (46.3 %) of the patients presented with infected and painful lesions, while 23 (53.7 %) presented with other symptoms such as increasing swellings and functional impairment. Majority 26 (63.4%) presented with lesions of more than 1 year and 17 (41.5%) had lesions of more than 2 years duration from when it was first noticed. Out of 41 patients, 28 (68.5%) attended lower level health care facilities before coming to MNH.

Table 1: Frequency distribution of patients with oro-facial cystic lesions by gender

Age (Years	**gender**		
	Males	Females	Total
	n (%)	**n (%)**	**n (%)**
0 – 9	2 (4.9)	2 (4.9)	4 (9.8)
10 – 19	5 (12.2)	5 (12.2.)	10 (24.4)
20 – 29	5 (12.2)	7 (17.1)	12 (29.3)
30 – 39	3 (7.3)	4 (9.8)	7 (17.1)
40 +	6 (14.6)	2 (4.9)	8 (19.5)
Total	**21 (51.2)**	**20 (48.8)**	**41 (100.0)**

p-value = 0.653

The present study included 41 patients with OFC lesions, the most affected age group being 20 – 29 years. There was a gradual increase of patients affected from age group 0 – 9 up to a peak at 20 – 29 years and followed by decreasing frequency of those affected towards older age (**Table 1**).

The age of the sample studied ranged from 7 months to 75 years (mean age of 26.7 years) where male age ranged from 7 months to 75 years (mean age of 29.3 years), and that of female from 3 years to 56 years (mean age of 24.1 years).

3.2 Clinical and radiographic Presentations of oro-facial cystic lesions

Dentigerous cyst was found to be the cystic lesion with the highest relative frequency and most common clinical features observed for dentigerous cyst was its slow growth, painless nature and association with impacted/unerupted tooth. Radiographically the lesion was a well defined pericoronal radiolucency attached to the cervical area of unerupted tooth with marginal cortication in 12 (92.3%). Dentigerous cyst was found more in males than females with male to female ratio of 1.2:1.

The lesion with 2nd highest relative frequency was mucous retention cyst and the most common clinical features for mucous retention cyst was slow growing painless lesion with history of occasional rupture and recurrence in the majority 6 (66.7%) of the patients. Mucous retention cyst was observed more in females than males with male to female ratio of 1:1.3. In 3 (33.3%) patients the lesion was associated with pain especially during meals.

Mucous extravasation cyst was the 3rd most common cystic lesion observed. It was observed in 6 patients, where 3 (50.0%) had slow growing painless lesions, in 2 (33.3%) patients the lesions were associated with pain and in 1 (16.7%) there was infection. Majority (83.3%) of the patients were females and only 1 male: with male to female ratio of 1:5.

Radicular cyst was the 4th in relative frequency with the common clinical feature of slowly increasing painful swelling at the apex of discoloured and nonvital tooth. Radiographically, the lesion showed a well defined radiolucency at the apex of the non vital tooth **(Table 6 and Chart II).**

In this study 2 patients were histologically diagnosed as having keratocystic odontogenic tumor, both with swelling in the mandible premolar – molar region with minimal expansion of the bone. Panoramic radiographs revealed large radiolucent lesions in the mandible with well defined, smooth, corticated margins. In both patients the radiolucencies were associated with unerupted/impacted molar teeth. Histological examination demonstrated a fibrous cyst wall with a uniform thin stratified squamous epithelium. The epithelium had distinctive layer of columnar, palisading, hyperchromatic basal cells. The luminal surfaces were parakeratotic with corrugated appearance. During open biopsy taking the lumen had cheese like materials that were not pus.

Chart II: **Clinical and radiographic presentations of oro-facial cystic lesions on reporting to MNH**

Clinical and radiographic presentations of oro-facial cystic lesions
Dentigerous cyst (13 patients)
• Slow growing painless swelling in 9 (69.2%) patients
• Slow growing and painful swelling especially during chewing in 3 (23.1%) patients.
• Ovoid in shape in 12 (92.3%) patients and spherical in1 (7.7%) patient
• Variable size from 3 cm to 6 cm in 13 (100%) patients
• Hard swelling in 13 (100%) patients
• Normal overlying mucosa in 13 (100%) patients
• Well-defined unilocular radiolucent lesion with impacted tooth in 12 (92.3%) patients
• Fluid discharge was observed in 2 (15.4%) patients
• Age varied from 5 years to 47 years.
• The gender was 8 (61.5%) males and 5 (38.5%) females

- Out of 13 patients with dentigerous cyst, 6 (46.2%) were in the maxilla and 7 (53.8%) were in the mandible.

Mucous retention cyst (9 Patients)

- Duration of the lesion on reporting 1 month to 26 months.
- Gradually increasing painless lesion with collection of mucus in the submucosa producing well defined, mobile, dome-shaped swelling in 6 (66.7%) patients
- Gradually increasing painful lesion in 3 (33.3%) patients
- Soft swelling in 9 (100%) patients
- Ovoid shape swelling in 9 (100%) patients
- Swelling of sudden onset in 2 (22.2%) patients
- Normal overlying mucosa/skin in 9 (100%) patients
- Radiopaque mass along the duct of the gland in 1 (11.1%) patients
- Age of the patients varied from 7 months to 37 years.
- The gender of patients with this lesion was 4 (44.4%) males and 5 (55.5%) females
- Out of 9 patients with mucous retention cyst, 4 (44.4%) were in the submandibular region and 5 (55.6%) were in the floor of mouth.

Mucous extravasation cyst (6 patients)

- Duration of the lesion on reporting to MNH was 6 months to 24 months.
- Gradually increasing painless swelling in 3 (50.0%) patients.
- Gradually increasing painful swelling in 2 (33.3%) patients
- Sudden onset swelling associated with pain in 1 (16.7%) patient
- Ovoid shaped swelling in 3 (50.0%) patients
- Spherical shaped swelling in 3 (50.0%) patients
- Normal overlying mucosa/skin in 5 (83.3%) patients
- Inflammed overlying skin in 1 (16.7%) patient.
- Age of the patients ranged from 4 years to 56 years with mean age of 30 years.
- The gender of the patients was 1 male (16.7%) and 5 (83.3%) females
- Out of 6 patients 1(16.7%) had a lesion on the lower lip and 5 (83.3%) were in the floor of the mouth.

Radicular cyst (4 patients)

- Duration of the lesion on reporting to MNH was 6 months to 24 months.
- Gradually increasing painless swelling in 1 (25.0%) patients
- Gradually increasing painful swelling at the apex of tooth in 3 (75.0%) patients
- Ovoid swelling at the apex of non vital and discoloured tooth in 3 (75.0%) patients
- Spherical swelling in 1 (25.0%) patient
- Well- defined radiolucent lesions associated with non-vital teeth (carious/ involved in accidents) in 4 (100%) patients.
- Hard in 4 (100%) patients
- Variable in sizes 2 cm to 4 cm.
- Age ranged from 12 years to 44 years.
- Normal overlying mucosa in 4 (100%) patients
- The gender of the patients with this lesion was 3 (75.0%) and 1 (25.0%) female.
- All 4 (100.0%) lesions were in the maxilla.

Dermoid cyst (2 patients)

- Duration of the lesion on reporting to MNH was 12 months to 36 months.
- Gradually increasing painless swelling in 2 (100 patients
- Soft consistency in 2 (100%) patients
- Ovoid shaped swelling in 2 (100%) patients
- Whitish, thick fluid aspirant in 2 (100%) patients.
- Affect midline floor of mouth/ ventral surface of the tongue or both submandibular spaces (midline swelling of the neck) in 2 (100%) patients.
- Age vary from 1month to 31 years.
- Size variable 3 cm to 6 cm.
- Impairing function of the airway and esophagus in 1 (50.0%) patient.
- The gender of the patients with this lesion was 1 (50.0%) male and 1 (50.0%) female.
- Out of 2 lesions 1(50.0%) was in the floor of mouth and 1 (50.0%) was in the left infraorbital region.

Keratocystic odontogenic Tumor (2 patients)

- Duration of the swelling on reporting to MNH was 4 months to 12 months.
- Gradually increasing painless swelling in 2 (100%) patients.
- Affected premolar-molar area of maxillar and mandible in 2 (100%) patients.
- Size ranged from 4 cm to 5 cm.
- Ovoid in shape in 2 (100%) patients
- Hard in consistency in 2 (100%) patients.
- Well-defined radiolucent lesion around impacted tooth with minimal bone expansion in 2 (100%) patients.
- Ages of the patients were 10 and 12 years.
- The gender of the patients with this lesion was 2 (100.0%) females.
- Main complains were swelling of the mandible in 2(100.0%) patients.

Lymphoepithelial cyst (2 patients)

- Duration of the lesion on reporting to MNH was 12 months to 36 months.
- Gradually increasing painless swelling in 2 (100%) patients one in the submandibular region and one in the parotid gland.
- Ovoid in shaped swelling in 1 (50.0%) patient
- Spherical swellings in 1 (50.0%) patient.
- Soft in consistency in 2 (100%) patients.
- Variable sizes from 4 cm to 8 cm
- Age varied from 6 years to 56 years.
- The gender of the patients with this lesion was 1 (50.0%) male and 1 (50.0%) female

Residual cyst (2 patients)

- Duration of the lesion on reporting to MNH was 8 months to 60 months.
- Gradually increasing painless swelling in 1 (50.0%) patient
- Gradually increasing painful swelling in 1 (50.0%) patient
- Hard in consistency swelling in 2 (100%) patients.
- Ovoid swelling in 2 (100%) patients
- Well defined radiolucent lesion on post extraction site in 2 (100%) patients
- Normal overlying mucosa in 2 (100%) patients.
- All 2 patients the lesions were in the mandible.

- The gender of the patients with this lesion was 2 (100.0%) males.

Calcifying Odontogenic cyst (1 patient)

- Duration of the swelling on reporting to MNH was 12 months.
- Gradually increasing painless swelling on the body of maxilla between teeth number 21-26.
- Size 4 cm.
- Slight root resorptions.
- Age of the patient was 41 years.
- Well-defined radiolucent with increasing opacity in the antrum.
- The gender of the patients with this lesion was 1 (100.0%) male.
- The lesion was in the maxilla.

The size of the cystic lesions during presenting at MNH ranged from 2 – 6 cm in the greatest diameter with mean size of 3.7 cm. Twenty seven (65.8%) of the patients reported with a cystic lesion of between 3 – 4 cm; followed by 9 (21.9%) with 5 – 6cm (**Table 2).**

Table 2: Distribution of size of the cystic lesion on reporting to MNH

Type of cystic lesion	Size of lesion (cm)				
	1 – 2	3 – 4	5 – 6	7 ≤	Total
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Dentigerous cyst	-	7 (17.1)	6 (14.6)	-	13 (31.7)
Mucous retention cyst	2 (4.9)	6 (14.6)	1 (2.4)	-	9 (21.9)
Mucous extravasation cyst	1 (2.4)	5 (12.2)	-	-	6 (14.6)
Radicular cyst	1 (2.4)	3 (7.3)	-	-	4 (9.8)
Dermoid cyst	-	2 (4.9)	-	-	2 (2.4)
KCOTs	-	2 (4.9)	-	-	2 (2.4)
Lymphoepithelial cyst	1 (2.4)	1 (2.4)	-	-	2 (2.4)
Residual cyst	-	-	2 (4.9)	-	2 (2.4
Calcifying odontogenic cyst	-	1 (2.4)	-	-	1 (2.4)
Total	**5 (12.2)**	**27 (65.8)**	**9 (21.9)**	**-**	**41 (100)**

p-value = 0.134

In the present study the site most affected by cystic lesions was the jaw bones 22 (53.6%), followed by the floor of the mouth 12 (29.3%), submandibular region 4 (9.8%) and other parts (lips, skin and glands) of the oro-facial region were 3 (7.3%). Both jaw bones were equally affected with 11 (26.8%) in the mandible and 11 (26.8%) in the maxilla **(Table 3).**

Table 3: Frequency distribution of oro-facial cystic lesions by type and site

Cystic lesion	Jaws Bones n (%)	Submandibular Region n (%)	Floor of mouth n (%)	Other part n (%)	Total n (%)
Dentigerous	13(31.7)	-	-	-	13(31.7)
Mucous Retention	-	4(9.8)	5(12.2)	-	9(21.9)
Mucous Extravasations	-	-	5(12.2)	1(2.4)	6(14.6)
Ridiculer	4(9.8)	-	-	-	4(9.8)
Dermoid	-	-	1(2.4)	1(2.4)	2(4.9)
Keratocystic Od.Tumor	2(4.9)	-	-	-	2(4.9)
Lymphoepithelial	-	-	1(2.4)	1(2.4)	2(4.9)
Residual	2(4.9)	-	-	-	2(4.9)
Calcifying Odont	1(2.4)	-	-	-	1(2.4)
Total	**22(53.7)**	**4(9.8)**	**12(29.3)**	**3(7.3)**	**41(100)**

Cystic lesions found in the maxilla were dentigerous, radicular, and calcifying odontogenic cysts. Those found in the mandible were dentigerous, keratocystic odontogenic tumor, and residual cyst. Cystic lesions found in the submandibular region were mucous retention cyst. Cystic lesions found in the floor of the mouth included mucous retention, mucous extravasations, dermoid and Lymphoepithelial cysts. Cystic lesions found in the other parts of the oro-facial region were mucous retention, dermoid, and Lymphoepithelial cysts (**Table 3**).

Out of 41 patients, 19 (46.3%) patients were clinically and histologically/cytologically confirmed as having cystic lesions with infection. A cystic lesion with highest frequency of infection was the mucous retention cyst 6 (31.6%), followed by dentigerous cyst 5 (26.3%), the difference between infected and non-infected lesions was not statistically significant ($p = 0.881$) **(Table 4)**

Table 4: Incidence of Oral facial cystic lesions with infection on reporting to MNH

Cystic lesion	Infection		
	Yes	No	Total
	n (%)	**n (%)**	**n (%)**
Dentigerous cyst	5 (12.2)	8 (19.5)	13 (31.7)
Mucous retention cyst	6 (14.6)	3 (7.3)	9 (21.9)
Mucous extravasations cyst	4 (9.8)	2 (4.9)	6 (14.6)
Radicular cyst	4 (9.8)	-	4 (9.8)
Dermoid cyst	-	2 (4.9)	2 (4.9)
Keratocystic odontogenic tumor	-	2 (4.9)	2 (4.9)
Lymphoepithelial cyst	-	2 (4.9)	2 (4.9)
Residual cyst	-	2 (4.9)	2 (4.9)
Calcifying odontogenic cyst	-	1 (2.4)	1 (2.4)
Total	**19 (46.3)**	**22 (53.7)**	**41 (100)**

P-value of 0.881

The age groups most affected by oro-facial cystic lesions in the present study was 20-29 where 12 (29.3%) had cystic lesions. Dentigerous cyst mostly affected age group of 10-19 years 4 (9.8%) **(Table 5).**

Table 5: Frequency distribution of oro-facial cystic lesions by age groups of affected patients

Cystic lesions	Age groups of patients with cystic lesions (Years)					
	0-9	10-19	20-29	30-39	40+	Total
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Dentigerous	1(2.4)	4 (9.8)	3 (7.3)	3 (7.3)	2 (4.9)	13 (31.7)
Mucous retention	2 (4.9)	1 (2.4)	4 (9.8)	2 (4.9)	-	9 (21.9)
Mucous extravasations	1 (2.4)	1 (2.4)	2 (4.9)	-	2 (4.9)	6 (14.6)
Radicular	-	1 (2.4)	2 (4.9)	1 (2.4)	-	4 (9.8)
Dermoid	-	-	1 (2.4)	1 (2.4)	-	2 (4.9)
Keratocystic odont.Tumor	-	2 (4.9)	-	-	-	2 (4.9)
Lymphoepithelial	-	1 (2.4)	-	-	1 (2.4)	2 (4.9)
Residual	-	-	-	-	2 (4.9)	2 (4.9)
Calcifying odontogenic	-	-	-	-	1 (2.4)	1 (2.4)
Total	**4 (9.8)**	**10 (24.4)**	**12 (29.3)**	**7 (17.1)**	**8 (19.5)**	**41 (100)**

Radiographic Presentations of oro-facial cystic lesion

Twenty three (56.1%) plain radiographs were taken for analysis for those patients with cystic lesions of the jaws and salivary gland or ducts. For 18 (43.9%) patients with other soft tissue cystic lesion there was no indications for plain radiographs. Radiographic features observed include; well defined radiolucents, ill defined margins, and radiopaque mass in the gland duct

Well defined radiolucent lesions with impacted tooth/teeth were seen in 14 (60.9%); where the dentigerous cyst contributed 12 (52.2%) of them. Well defined radiolucency at the apex of non vital tooth/teeth were 4 (17.5%), well-defined radiolucency in post extraction area were 2 (8.7%), ill-defined margins with impacted tooth was found in1 (4.3%), well-defined radiolucency with root resorption 1 (4.3%) and soft tissue with radiopaque mass along the salivary gland duct was 1 (4.3%) (**Table 6**).

Table 6: Radiolographic presentations of different oro-facial cystic lesions

Radiological features	Frequency n (%)
Well defined radiolucency with tooth/teeth impaction	**14 (60.9)**
Ill defined margins with tooth/teeth impaction	**1 (4.3)**
Well defined radiolucency around apex of non vital tooth/teeth	**4 (17.5)**
Well defined radiolucency in post extraction areas	**2 (8.7)**
Well defined radiolucency with root(s) resorption	**1 (4.3)**
Radiopaque mass along the gland duct	**1 (4.3)**
Total	**23 (100.0)**

3.3 Histological presentations of oro-facial cystic lesions

Histopathologic/cytological features of the specimens were analysed according to WHO 1992 classification of jaw cysts and 2005 classification of head and neck tumors **(Chart III)**

Chart III: Histological/cytological presentations of the cystic lesions on reporting to MNH

Histological/cytological presentations of oro-facial Cystic lesion
Dentigerous cyst (13 patients):
Tissue section showed ;-
• Cyst lined with stratified squamous non-keratinized epithelium in 5 (38.5%) patients
• Fibrous wall lined by odontogenic epithelial remnants associated with mixed inflammatory cells in 3 (23.1%) patients

- Cyst lined by odontogenic epithelial remnants, aberrant keratinization and prominent basal layer in 4 (30.8%) patients.
- Cyst lined by cuboidal squamous epithelium, the wall comprised of bone with several calcifying spicules and an isolated odontogenic epithelial rests in1 (7.7%) patient.

Mucous retention cyst (9 patients):

A smear showed:-

- Salivary gland cyst lined by flattened epithelium, some amorphous basophilic contents in 6 (66.7%) patients
- Cystic wall with inflammatory infiltrate and haemorhage in 1 (11.1%) patients.
- Mucoid proteineceous background, mild inflammatory infiltrate in 1 (11.1%) patient.
- Fluid background with few scattered histiocytes, neutrophils and lymphocytes in 1 (11.1%) patient.

Mucous extravasations cyst (6 patients):

Tissue section showed:-

- Gland cavity containing distended mucin-laden histiocytes in 1 (16.7%) patient
- Many glands with mucin in the lumen in 1 (16.7%) patient.
- Thick fibrous capsule wall with chronic inflammatory reaction in 3 (50.0%) patients.
- The cystic wall extravasated by red blood cells, perforated blood vessels, prominent vascular congestion and muscle tissue in 1 (16.7%) patient.

Radicular cyst (4 patients)

Tissue showed

- Foci of cholesterol in 1 (25.0%) patient.
- Granulation tissue with inflammatory cells composed of lymphocytes, plasma cells in 2 (50.0%) patients
- Epithelial lining was of non-keratinizing stratified type in 1 (25.0%) patient.

Dermoid cyst (2 patients):

Tissue showed:-

- Amorphous eosinophilic materials with epithelial squamous in 2 (100%) patients.
- Abundant accumulated horny materials in 1 (50.0%) patient.

Keratocystic odontogenic tumor (2 patients)

Tissue showed.

- A fibrous cyst wall lined by squamous epithelial with keratin flakes in all patients.
- There were hyperchromatic basal cells in all patients.
- No rete pegs in all patients

Lymphoepithelial cyst (2 patients)

Smear showed.

- Mucoid materials containing oesinophils and lymphocytes infiltrate in all patients.

Residual cyst (2 patients)

Tissue showed:-

- Cystic wall lined by squamous epithelium in all patients.
- Cystic wall of fibrous tissue with chronic inflammatory cells and foreign body giant cells in all patients.

Calcifying Odontogenic cyst (1 patient).

Tissue showed.

- Epithelial lining with ghost cells and some osteoid foci
- The base has long palisading columnar cells and the walls contained mainly foreign body giant cells with clefts.

Diagnosis was made or confirmed histologically or cytologicaly, where 33 (80.5%) of the specimen were diagnosed histologically. The cystic lesions that were diagnosed histologically included all dentigerous cysts, mucous extravasation cysts, radicular cysts, KCOT, residual cysts, calcifying odontogenic cysts, 1 dermoid cyst, 1 lymphoepithelial cyst, and 3 mucous retention cysts. Eight (19.5%) of the specimens were diagnosed cytologically; those diagnosed cystologically included 6 mucous retention cysts, 1 dermoid cyst, and 1 lymphoepithelial cyst) **(Table 7).**

Table 7: Frequency distribution of oro-facial cystic lesions by gender

Cystic lesion	**Male**	**Female**	**Total**
	n(%)	n(%)	n(%
Dentigerous cyst	8(19.5)	5(12.2)	13(31.7)
Mucous retention cyst	4(9.8)	5(12.2)	9(21.9)
Mucous extravasation cyst	1(2.4)	5(12.2)	6(14.6)
Radicular cyst	3(7.3)	1(2.4)	4(9.8)
Dermoid cyst	1(2.4)	1(2.4)	2(4.9)
KCOTs	-(-)	2(4.9)	2(4.9)
Lymphoepithelial cyst	1(2.4)	1(2.4)	2(4.9)
Residual cyst	2(4.9)	-	2(4.9)
Calcifying odontogenic cyst	1(2.4)	-	1(2.4)
Total	**21(51.2)**	**20(48.8)**	**41(100.0)**

P = 0.235

'he deference between oro-facial cystic lesions in males and females in this study was not :atistically significant (p = 0.235, degree of freedom of 8).

CHAPTER 4

4.0 DISCUSSION

The present study involved 41 patients with oro-facial (Oral and Maxillofacial) cystic lesions, who attended treatment at the maxillofacial firm of the department of Dentistry of MNH on self-referral or referral from lower level health care facilities during the study period and agreed to participate in the study. It was a hospital based study, which might have missed those patients with oro-facial cysts who did not present for medical care during the study period because of different reasons. However, since MNH is the only health institution with maxillofacial surgery centre in the country, majority of patients with oro-facial cystic lesions who attend health care and needed specialists care were seen at this centre. Therefore, despite the above mentioned shortcomings the findings of this study could provide valid information of the current situation on oro-facial cystic lesions in Tanzania.

Oro-facial cysts are described as slow growing lesions and generally symptomless. However, in the present study it was noted that as the lesion increased in size and especially when it is secondarily infected could present with other symptoms such as pain, pressure effect and disfigurement of the face. Pain and infections were observed in 19 (46.3%) patients. Ulceration, fluid leakage, teeth mobility, impaired functions and disfigurement were among the other complaints patients presented.

During the present study 41 (0.6%) out of 6,873 patients who attended treatment at the maxillofacial firm MNH were diagnosed as having oro-facial cystic lesions (**Table 1).** The reason for this low prevalence might be due to the fact that cystic lesions at early stages are innocent looking and symptomless; hence many patients ignore it and do not present to hospital at all or only present when the lesion have reached enormous size, is infected, painful or when other symptoms have developed. Also, it might be due to the fact that those who reported do so after unsuccessful attempted treatment at lower level health care or complications such as pain, infections and massive increase in size have developed.

Patients most affected by oro-facial cystic lesions in this study were 20 – 29 years old. This finding is in agreement to what have been reported by several other authors. A decrease of the prevalence with increasing age was also observed in this study as reported earlier[1]. This might be due to the etiology and pathogenesis of oro-facial cystic lesions especially those of the jaw bone such as dentigerous cyst which tend to occur in the 2nd and 3rd decades and majority (70%) of the mucous cysts occur in individual younger than 20 years[38]

The site in the oro-facial region most affected by cystic lesions in the present study was the jaw bones 22 (52.6%), followed by the lesions on the floor of the mouth 12 (29.3%), submandibular region 4 (9.8%) and other parts of the oro-facial region contributed 3 (7.3%). The cystic lesion with highest relative frequence in this study was dentigerous cyst in 13 (31.7%) patients, followed by mucous retention cyst in 9 (21.9%) patients and mucous extravasations cyst in 6 (14.6%) patients. These results are in agreement to those reported by other authors[1,2]. Chaudhry and his colleague (1960) reported a high prevalence of mucous extravasation cysts of 92% and mucous retention cysts of 8% unlike in the present study where the prevalence of mucous extravasation cyst was 40% and mucous retention cyst 60%. The reason for this difference could be due to the small number of patients with mucous cysts who presented during the study **(Table 7).**

Majority 17 (41.5%) of the patients presented to MNH for treatment after 20 months and above have elapsed since the lesion was first noted, with mean period of reporting to MNH of 31.9 months. This mean that majority of these patients reported late and with symptomatic lesions of considerable sizes and several other complications such as pain, infection, functional impairement and disfigurement of the face. The reason for this delay could be attributed to factors related to the cystic lesions, patients and the environment. Slow growth and painless nature of majority of oro-facial cystic lesions contributed to the delay in seeking for medical care by the patients. From the interview it was observed that pain, discomfort due to infection/pressure effect, impairment of function and disfigurement of the face were among the factors that prompted majority of patients to seek for medical care. Factors related to the patients and their environment included ignorance on availabity of treatment, fear of operations/radiotherapy, poverty among the patients and a cumbersome referral system which might have also contributed

to the delay in seeking medical care. Other reasons for the delay could be incorrect diagnosis, delayed referral from health facilities and the use of alternative treatment such as traditional medicine as reported by some of the patients in this study.

Infection of oro-facial cystic lesion makes it resemble an abscess clinically and histologically/cytologically. These pose challenges in the diagnosis and treatment planning especially at the lower level health care system where there is a shortage of diagnostic facilities.

Clinical and histological/cytological findings of the cystic lesions in the present study were in agreement with the reported studies by other authors[1,39,58]. Out of 41 patients who presented with oro-facial cystic lesions in the present study, 36 (87.8%) presented with lesions of more than 3 cm in the greatest diameter, and 19 (46.3%) presented with infections. Some of these infections resulted from attempted symptomatic treatment at lower level health care centres.

Dentigerous cyst was the cyst with highest relative frequency of 13 (31.7%) patients with age range of 5 years to 47 years and a male to female ratio of 1.2:1. This is in agreement with that reported by Regezi et al [1] and Whaites[78]; however, they observed a male to female ratio of 1.6:1. This difference could be due to few patients with this cystic lesion who presented during the study period. The prevalence of dentigerous cyst in this study was 0.2 % (13/6873) of the study population. This is in agreement with the results observed by Khan et al. (2008) in Bangladesh; who reported a prevalence of 0.15% to 1.9%[38], but different from those reported by Lima et al. (2008) [33] and Sousa et al. (2002) [36] in children under 16 years old in Brazil, where they reported prevalence of 8.6% and 6.5% respectively. Shah et al. (2009) [35] in the USA reported a prevalence of dentigerous cyst of 80% and 20%. The difference between these studies and the present study could be due to the sample size, difference in health seeking behavior in different countries, adequacy of diagnostic facilities and the age of the study population might also have contributed to the difference.

Clinical, radiographic and histological presentation of dentigerous cyst in this study is in agreement with that reported else, except many patients in this study reported with big

cystic lesions and high rate of infection where 5 (38.5%) of those with dentigerous cyst reported with infected lesions **(Chart II and III)**[1].

A mucous cyst is a benign, mucous-containing cystic lesion of salivary glands in the oral cavity and maxillary sinus. Some authors prefer the term mucocele since most of these lesions are not true cysts in the absence of epithelial lining. Basing on the histological features of the cystic wall there are two types of mucous cysts[38].

- A mucous extravasations cyst formed by mucous pools surrounded by granulation tissues (92%).
- Mucous retention cyst with epithelial lining (8%)[102,103].

The most frequent location of mucous cyst is the lateral aspect of the lower lip which is mainly due to trauma in this area. Study done in the USA showed the prevalence of mucous cyst of 2.5 lesions per 1000 population, and was observed more in whites, equally affecting males and females. Patients of all age groups can be affected by mucous cysts, however, more than half of mucous cysts cases are in those below 30 years. In the present study patients below 30 years old affected by mucous cysts (mucous retention and extravasations cysts) were 12 (80.0%) of all patients with this lesion, which is in agreement with the study done in the USA[114].

In the present study mucous retention cyst was the most prevalent mucous (salivary glands) cyst where it was observed in 9 (0.13%) patients, while the mucous extravasation cyst was seen in 6 (0.09%) patients. Regarding relative frequency, mucous retention cyst was seen in 60.0% and mucous extravasation cyst in 40.0% of all patients with mucous cysts. These results are in agreement to a retrospective study of 11 years on review of oral mucocele in the USA where mucous retention phenomenon was found to be the most (91%) prevalent. In different histopathological studies it was documented that mucous retention cyst accounted for 3-18% of all oral mucous cysts[114].

In the present study mucous cysts affected more females than males, with males-to-female ratio of 1:2, which is different from documented results of a study done in Minnesota - USA where a male predilection was observed with a male- to- female ratio

of 1.3:1. The difference might be due to few patients who presented with this cystic lesion during the study.

The relative frequency of radicular cyst in this study was 4 (9.8%) with prevalence of 0.06 % (4/6873) of the study population and is different from 50% to 75% prevalence that was reported by Regezi et al. (2003)[1] and 70% reported by Whaites (2002)[60]. Other authors have also reported radicular cyst as being the most common cysts followed by the dentigerous cyst[1,2]. This is most possibly because in Tanzania fewer patients undergo regular routine radiological examination compared to Europe and America. When they have dental problems they seek care only when they have severe pain. In this situation clinical diagnosis alone is adequate to make treatment plan which in most cases is tooth extraction. Also, prevailing socio-economic circumstances do not allow for routine x-ray examination of every patient with periapical lesion as observed in the present study. Most of these patients will therefore be treated without radiographic and histological examination. At the maxillofacial firm of the department of Dentistry in Muhimbili less than 10% of patients treated on emergency basis undergo a radiological examination. This might have led to the missing of any radicular cysts that might have been associated with carious lesions or non vital teeth. On the other hand in developed countries radiological examinations are routine, which make it easy to diagnose radicular cysts associated with carious teeth at any stage of development and hence they observe higher prevalence. The clinical presentations of radicular cyst observed in this study are in agreement with those reported by Regezi et al. (2003)[1].

Dermoid cysts are relatively rare lesions, only 1% to 3.5% affecting head and neck. In the oral cavity dermoid cysts contribute 8.3% of all dermoid cysts. In the present study the most frequent location was in the floor of mouth (50.0%) and the other 50% occurred in other parts of the oro-facial region. Dermoid cysts are postulated to arise from ectodermal elements entrapped during the midline fusion of the 1st and 2nd branchial arches between the 3rd and 4th weeks of intrauterine life. In this study dermoid cyst affected relatively young patients aged between 20 and 39 years. This is in agreement with other studies done by other authors[1,89,90,91]. Reported infection of dermoid cyst in the head and neck was 2.5% of the cases. Infection of dermoid cysts observed in this study was 1 (50.0%) of the patients which was more than the reported rate of infection in

other studies. This might be due to the delay by the patient in seeking curative care or attempted symptomatic treatment at the lower level health care. However, due to few patients with dermoid cyst in this study, no conclusive explanation on the difference can be made.

Keratocystic odontogenic tumor formerly known as odontogenic keratocyst received its new designation in order to convey its neoplastic nature. It is a benign odontogenic tumor with distinguishing clinical and histological features. Among these features are a potential for locally distructive behaviour, relatively high recurrence rate, and designation as a consistent finding in the nevoid basal cell carcinoma syndrome, or Gorlin syndrome.

Keratocystic odontogenic tumor is believed to arise from dental lamina and represent between 4 – 12% of all odontogenic cysts; in this study the prevalence of keratocystic odontogenic tumor was 0.03% (2/6873) of the study population which is different from the reported results by other authors. Among the oro-facial cystic lesions in the present study keratocystic odontogenic tumor affected 2 (4.9%) patients all being females, and were on the premolar- molar region of mandible, this location is in agreement with results reported by other authors. The lesion occurs over a wide age range, with a peak in the 2nd and 3rd decades and demonstrates a predilection for males unlike in this study. The mandible is more commonly involved than the maxilla (65 – 83%). The age of the patients who presented with odontogenic keratocysts in this study was 10 and 12 years old (with mean age of 11 years old), which is also in agreement with reported age range in the literature. Habibi and his colleague (2007) in Iran observed that 33.7% of all keratocystic odontogenic tumors were associated with impacted teeth. In this study both lesions presented with unerupted/impacted teeth and patients main complain were jaw swellings and disfigurement.

Lymphoepithelial cyst in this study was observed in 2 (4.9%) patients; 1 male and 1 female. One lesion was in the parotid gland and the other in the submandibular region. The ages of the patient were 56 (for parotid gland lesion) and 12 (for submandibular region). In this study male to female ratio was 1:1, due to few patients with this cystic lesion who reported during the study period it is not possible to make any conclusive

explanation for the difference. However, the age affected is in agreement with that reported by Regezi et al. (2003) and Smith (1990)[1,59]. The clinical and histological presentation of LEC is in agreement with those reported by others authors[1,9].

Residual cyst arises as a consequence of an improper surgical elimination of a radicular cyst. Its clinical and histological characteristics are identical to those of a radicular cyst; its epithelial lining is of stratified squamous type. Radiologically it showed a radiolucency of variable sizes at the site of previous teeth extractions. In the present study there were 2 (4.9%) patients with oro-facial cystic lesions. The ages of these patients were 24 and 46 years (mean age of 35 years old). One lesion was in the maxilla between teeth number 14 to 16 and in the mandible the lesion was in the molar-premolar region; all lesions occurred at the post extraction sites. Both patients reported with infected lesions. This result is in agreement with those reported by other authors[1,2].

Calcifying odontogenic cyst arises from odontogenic epithelium with abundant production of keratin containing ghost cells and areas of dystrophic calcification. This lesion has a predilection for young adults. Calcifying odontogenic cyst affects anterior areas of the jaws. It is most common in people of 2nd and 3rd decades of life but can be seen at almost any age. In the present study there was only one male patient aged 44 years old who reported with the cyst in the body of maxilla from tooth number 21 to 26. The main complain of this patient was swelling on the maxilla interfering with the functions of the nose and left maxillary sinus. Histologically, the lesion showed epithelial lining with ghost cells, some osteoid foci and the base with long palisading columnar cells, these findings are in agreement with those reported by other authors[1,2,70].

4.1 CONCLUSION

In this study the prevalence of oro-facial cystic lesions was low (0.6%); mainly affecting 20 – 29 years old group. Dentigerous cyst was the most common cystic lesion observed in this study.

Although histological presentations of many cystic lesions in this study are in agreement with the reported results, many specimens showed presence of inflammatory cells, this

was also observed in clinical presentations. Clinically, many patients presented with symptoms of long duration with significant disfigurement of the facial region and had different complications such as big cystic lesions, impairement of functions or infections. This could be due to inadequate or more symptomatic treatment given at lower level health care centres or delay in reporting to referral hospitals by the patients themselves. Therefore early correct diagnosis of oro-facial cystic lesions at all levels of health care systems is an important step in the prevention of observed complications through a rational treatment planning, to execute adequate treatment or referral.

From the present study it can also be concluded that the situation of oro-facial cystic lesions in Tanzania is to some extent different in that many patients presented to hospital with lesions of considerable size, high rates of infection, pain, impaired functions and significant facial disfigurement. This condition contributes to costly surgical interventions, prolonged morbidity and high chances of post operation recurrence of the lesions.

4.2 RECOMMENDATIONS

- More studies on oro-facial cystic lesions in Tanzania are needed, aiming at improving quality of diagnosis and treatment at all levels of health care systems.

- Review of the health care policies to provide for transport assistance to patients who are referred from the regions and are incapable would reduce burden of these innocent looking lesions but with devastating complications especially when secondarily infected.

- To improve histological diagnosis of oro-facial cystic lesions and similar swellings at the lower level health care facilities it is important to establish professional training, create community awareness and improve the diagnostic facilities at the regional hospitals. Establishing or strengthening communication between referral and regional hospitals is also important. This endeavor will improve quality of

medical care through early diagnosis and treatment of oro-facial cystic lesions and allied diseases.

4.4 LIMITATIONS OF THE STUDY

- Time of 9 months for the study was very short considering the low prevalence of the oro-facial (oral and maxillofacial) cystic lesions.
- This was a hospital based study; it captured only those patients who reported to MNH during the study period; it might have missed those who did not report due to different reasons.
- Majority of the up country patients became out of contact after being discharged from MNH.
- Due to shortage of periapical/occlusal films, it was not possible to screen every patient with periapical lesion for radicular cyst.

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