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Demographic variations in maxillary pathologic lesions - an institutional study

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Abstract: A variety of benign and malignant lesions involve the maxilla and maxillary sinus. The presenting features, symptomatology and advanced diagnostic imaging techniques help in achieving a differential diagnosis however histopathological examination remains the mainstay of definitive diagnosis. This study aims to identify the frequency of isolated maxillary pathologic lesions (benign and malignant) and its gender and age distribution. After clearance from the institutional ethical committee, a retrospective study was performed for a period of ten months from June 2019 to March 2020 in our institution. 90 cases of pathology were reviewed out of which 29 were included in the study based on the inclusion criteria. 68.97% males and 31.03% females reported with pathologic lesions of the maxilla alone in our center. Malignant maxillary lesions show the highest frequency of occurrence in 17.24% in the 41-60 age group (p value-0.233). Treatment modalities used for various lesions diagnosed in the maxilla showed the highest degree of association with surgical excision being the most commonly performed for malignant lesions and enucleation for cysts and benign tumors (p value- 0.000). Maxillary benign pathological lesions have a tendency to mimic malignant lesions. Hence it is important to document and identify lesions most commonly encountered in a particular population to provide for adequate and appropriate treatment care needs.

Keywords: Maxilla; Pathology; Malignant; Benign; Cysts; Tumors innovative technique

INTRODUCTION

Maxilla has a complex structure and is the most important bone of the midface. Due to its central location it provides functional support to the viscerocranium. It also plays a fundamental role in facial architecture, separating nasal and oral cavities, forms the upper jaw and contains the maxillary sinus (Dalgorf and Higgins, 2008; Fehrenbach and Herring, 2013; Kühnel and Reichert, 2015). Each maxillary body contains an air filled hollow cavity called the maxillary sinus which is the seat of resonance of voice and provides pneumatization of maxilla thereby reducing the weight of the skull (Cunningham, 1818; Larrabee, Makielski and Henderson, 2004; Lev and Artzi, 2020; Morris and Tadi, 2020).

The lesions encountered in the maxilla or mandible include cysts of odontogenic and non-odontogenic origin, tumors of odontogenic origin, giant cell lesions, salivary gland diseases and tumors, vascular anomalies, osteomyelitis, osteoradionecrosis, secondarily infected cystic lesions, benign and malignant neoplasms. (Regezi, Sciubba and Jordan, 2012; Carton, 2017; Thompson and Bishop, 2017; Alramadhan *et al.*, 2020; Banasser *et al.*, 2020). Epidemiological data for pathological lesions affecting mandible or maxilla is helpful in determination of demographic characteristics of oral lesions.

There are numerous pathological lesions affecting the maxilla and maxillary sinus, treatment of which leaves a midfacial defect which needs to be addressed while forming a treatment plan. Predominantly the pathological lesions found to be reported in the literature majorly in maxilla include - Adenomatoid odontogenic tumor (Adisa *et al.*, 2016; Dhupar, Akkara and Khandelwal, 2016; Katiyar *et al.*, 2019; Mohanty *et al.*, 2019), Ossifying Fibroma (Thakur *et al.*, 2011; George *et al.*, 2017; Muthu, 2017; Seo *et al.*, 2019; Almeida Júnior *et al.*, 2020; Macedo *et al.*, 2020), Odontoma (Christensen, 1956; Wanjari, Wanjari and Bhowate, 2011; Murphy *et al.*, 2014; Lee *et al.*, 2016; Kalra *et al.*, 2018; de Oliveira *et al.*, 2019; Zhuoying and Fengguo, 2019), Fibrous dysplasia (Ward, Alley and Owen, 1969; 'Monostotic Type of Fibrous Dysplasia of Maxilla', 2016; Kochanowski *et al.*, 2018; Shanmugam *et al.*, 2018; Su *et al.*, 2019), Paget's disease (Mooney *et al.*, 2003; Karakida *et al.*, 2010), ghost cell odontogenic carcinoma(de Arruda *et al.*, 2018), surgical ciliated cyst (Leung, Wong and Cheung, 2012; Chee *et al.*, 2014; Nogueira *et al.*, 2014), osteomyelitis (Himalstein, 1967; Meethal, 2016; Pattnaik *et al.*, 2017;

Antunes *et al.*, 2018; Arani, Shareef and Khanam, 2019; Sadaksharam and Murugesan, 2019), osteonecrosis (Seehra, Sloan and Oliver, 2009; Kolur, Nair and Kumar, 2015).

The sparsity of epidemiological data on pathological lesions predominantly affecting the maxilla was the reason for formulating this study in a south indian sample population.Till date the institutional team has conducted several clinical trials (Jesudasan, Wahab and Sekhar, 2015; Christabel *et al.*, 2016; Kumar, 2017b; Packiri, Gurunathan and Selvarasu, 2017; Patil *et al.*, 2017; Rao and Santhosh Kumar, 2018; Abhinav *et al.*, 2019; Jain *et al.*, 2019; Sweta, Abhinav and Ramesh, 2019),genetic studies (Marimuthu *et al.*, 2018), various surveys (Kumar and Sneha, 2016; Patturaja and Pradeep, 2016; Kumar, 2017a; Kumar and Rahman, 2017) and literature update (Kumar, 2017c) over various topics of surgical interest.

Our department is passionate about research we have published numerous high quality articles in this domain over the past years (Abraham *et al.*, 2005; Devaki, Sathivel and BalajiRaghavendran, 2009; Neelakantan *et al.*, 2010, 2015; Arja *et al.*, 2013; Ramshankar *et al.*, 2014; Sumathi *et al.*, 2014; Surapaneni and Jainu, 2014; Surapaneni, Priya and Mallika, 2014; Ramamoorthi, Nivedhitha and Divyanand, 2015; Manivannan *et al.*, 2017; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; J *et al.*, 2018; Ravindiran and Praveenkumar, 2018; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Krishnaswamy *et al.*, 2020; Samuel, Acharya and Rao, 2020; Sathish and Karthick, 2020)

The aim of this study was to identify the frequency of isolated maxillary pathologic lesions (benign and malignant) and its gender and age distribution.

MATERIALS AND METHODS

A retrospective study on prevalence of maxillary pathological lesions treated under general anesthesia was done in our institution over a period of ten months from June 2019 to March 2020. Institutional ethical clearance was obtained for data retrieval and usage as required for the study(SDC/SIHEC/2020/DIASDATA/0619-0320).

A total of 485 patients had undergone surgical intervention under general anesthesia during the study period. Among them ninety patients were treated for benign or malignant pathologies. The other treatments including those for trauma, congenital deformities, cleft lip/palate, orthognathic corrective surgeries, TMJ surgeries, preprosthetic surgeries and disimpactions were excluded. Among the ninety case sheets of patients undergoing treatment for pathological lesions, sixty one pathologies were in other anatomical sites not involving maxilla. Case sheets of all relevant patients with pathologies involving maxilla alone exclusively were identified and reviewed for inclusion in the study. After taking into consideration the inclusion and exclusion criteria, it was found that a total of 29 patients met our inclusion criteria.

All patients from 0 to 80 years old irrespective of their medical conditions who underwent primary surgical management of histopathologically proven maxillary pathological lesions were included as study subjects. The lesions included were benign or malignant tumors of maxilla, minor salivary gland pathology involving maxilla, developmental or inflammatory cysts in the maxilla which had complete preoperative, intraoperative and postoperative data available. Exclusion criteria were all pathological lesions involving mandible, buccal mucosa, tongue, major salivary gland pathologies, congenital deformities and incomplete data.

Data collection was performed to include demographic details along with the histopathological diagnosis and treatment done. Parameters evaluated were age, gender, diagnosis, treatment done dependent variable and maxillary pathological lesions with the independent variable. Data was analyzed using SPSS version 20 statistical software.The collected data was analysed using SPSS software version 20. Chi square test was used and p - value of <0.05 was taken as statistically significant.

RESULTS AND DISCUSSION

Upon data analysis, there were a total of 29 patients out of 90 identified (32%) as isolated maxillary pathological lesions treated under general anaesthesia. Out of which 68.97% (n=20) were males and 31.03% (n=9) were females (Graph 1) which is the general trend worldwide (Ghazawi *et al.*, 2020; Kammer, Mello and Rivero, 2020). Amongst males the lesions involving the maxilla reported with the highest frequency of 20.69% (n=6) were malignant tumors, followed closely by inflammatory lesions including osteomeylitis 17.24% (n=5), 13.79% (n=4) of developmental cysts , 10.34% (n=3) of inflammatory cysts and 6.90% (n=2) benign tumors. Females present with the highest frequency of inflammatory cysts of 13.79% (n=4) and equal frequencies of 6.90% (n=2) benign and malignant lesions, with least reported lesion being developmental cysts with a frequency of 3.45% (n=1) (Graph 2).

Males are generally more commonly affected by malignancies such as squamous cell carcinoma(Serindere *et al.*, 2019; Ghazawi *et al.*, 2020), developmental and inflammatory cysts (Tamiolakis *et al.*, 2019; Kammer, Mello and Rivero, 2020) which was consistent with our study. However, in the population studied by (Kilinc *et al.*, 2017; Silva *et al.*, 2018; Farias *et al.*, 2019) females were more commonly affected by developmental cysts and tumors, which was not the same in our study population which could be due to certain reasons like, asymptomatic lesions going unnoticed and undetected for several years in the absence of imaging by the clinician or in the absence of any clinical signs - like expansion of bone, mobility of tooth, paresthesia etc to suggestive of a pathology (Dong

et al., 2020; Goto *et al.*, 2020; Li *et al.*, 2020; MacDonald, Martin and Nguyen, 2020; Maruyama *et al.*, 2020; Shimmura *et al.*, 2020; Xia *et al.*, 2020).

Graph 3 shows the distribution of maxillary pathological lesions amongst the different age groups, divided as below 20 years old, 21-40 years old, 41-60 years old and above 60 years old for the purpose of this study. 21-40 age group individuals reported with the highest frequency of maxillary pathological lesions 37.93% (n=11); followed by 41-60 age group individuals with 34.48% (n=10) lesions, below 60 age group individuals with 17.24% (n=5) maxillary pathologic lesions and 10.34% (n=3) pathologic maxillary lesions reported in the below 20 age group. According to literature, most commonly pathologic lesions are presented in 4 to 6th decade of life(Tamiolakis *et al.*, 2019). However, in our study there was an almost equal frequency of maxillary pathological lesion seen from the second to fourth decade .

We also studied the relationship of the most common lesions of the maxilla being diagnosed in particular age groups (Graph 4). In the 20 years age group, all three lesions that is- developmental cysts, inflammatory lesions and benign tumors of maxilla - were diagnosed with an equal frequency of 3.45% (n=1). 21-40 age group shows the highest frequency of being diagnosed with inflammatory lesions of the maxilla with a frequency of 13.79% (n=4), followed by inflammatory cysts with a frequency of 10.34% (n=3), with an equal frequency of 6.90% (n=2) being diagnosed with developmental cysts and benign tumors. However, the bulk of maxillary pathologic lesions, that is malignant lesions are found in the 41-60 year olds with a frequency of 17.24% (n=5) in our study, followed by equal frequency of 6.90% (n=2) for diagnosis of developmental or inflammatory cysts and least frequency of benign tumor of 3.45% (n=1) in this age group. According to previously published literature patients presenting with developmental cysts were older than 20 years of age, which is consistent with our results (Sriram and Shetty, 2008; Luo and Li, 2009; Rajendran and Sivapathasundharam, 2014).

We studied the distribution of maxillary pathological lesions amongst the sample population. 27.59% (n=8) were malignant tumors , 24.14% (n=7) inflammatory cysts , 17.24% (n=5) developmental cysts, 17.24% (n=5) inflammatory lesions and 13.79% (n=4) benign tumors of the maxilla were diagnosed in our study (Graph 5). Graph 6 shows the distribution of treatment done where enucleation is the most commonly used treatment modality with a frequency of 62.07% (n=18), followed by surgical enucleation 31.03% (n=9) and equal frequency of 3.45% (n=1) marsupialization and sequestrectomy. The association of diagnosis and treatment are significant statistically with a p value-0.000 on Chi Square test. Malignant lesions were treated by using surgical excision most commonly in all 27.59% (n=8) cases. Inflammatory cysts were treated by enucleation in all 24.14% (n=7) cases. Benign lesions were treated using both marsupialisation and surgical excision with equal frequency of 3.45% (n=1). Inflammatory lesions were treated using sequestrectomy in 3.45%(n=1) and enucleation in 13.79% (n=4) cases (Graph 7).

In our knowledge this study is the first of its kind to describe oral pathological lesions with site/location as the primary variable of interest followed by frequency of these lesions reported in the maxillary arch alone. Due to the complex anatomy and function of maxilla, it is important to define the commonly encountered lesions in a given population over a certain period of time.

The study endeavoured to collect epidemiological data from a sample south Indian population to study the prevalence or frequency of involvement of maxilla in oral pathological lesions and as consistent with the literature, the maxilla is less frequently involved, but lesions become more aggressive and require more aggressive treatment course due to close affinity with the surrounding structures such as nasal cavity, antrum of highmore, cavernous sinus, etc. Also all lesions associated with extracted teeth like radicular cyst, pyogenic granuloma etc may not be reported to the histopathologist, leading to some deficiency in number of oral pathological lesions in the maxilla. We believe that epidemiological analysis can be continued for a longer duration of time and using a wider community to acquire certain definitive perspectives on the lesions involving the maxilla. Maxillary lesions, although infrequent and rarer than mandibular lesions, require aggressive treatment which can be debilitating due to the close approximation with vital anatomic structures thereby compelling prolonged follow up.

CONCLUSION

This study concludes that more than one quarter of the pathologic lesions identified in the oral and maxillofacial region were isolated maxillary pathologies with a gender predilection to males. Benign pathologies were more common in the second to third decade and malignant pathologies more common in the fourth to sixth decade of life. However, malignant pathologies encountered in maxilla were comparable to or more than benign and inflammatory pathologies. This emphasises the need for early diagnosis and treatment protocols without undue delay in maxillary pathologies. Due to the occult nature of lesions of the maxilla, it is difficult to detect these at an early stage. Hence, identification of most commonly encountered lesions affecting the maxilla in a particular geographic distribution will aid the clinician to formulate diagnosis with ease and predictability and choose appropriate treatment course depending upon the needs of the individual.

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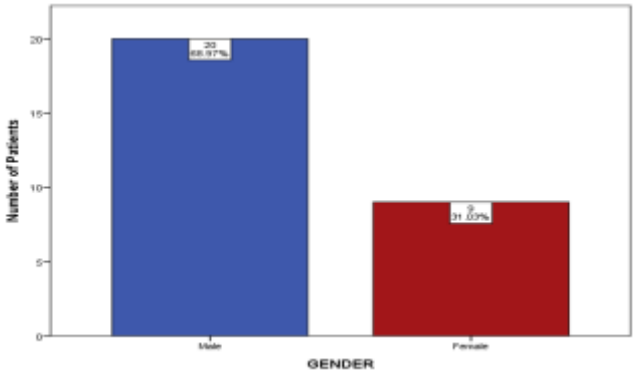
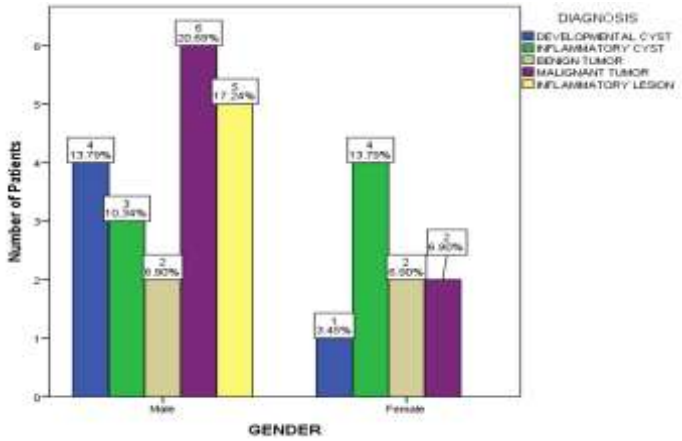
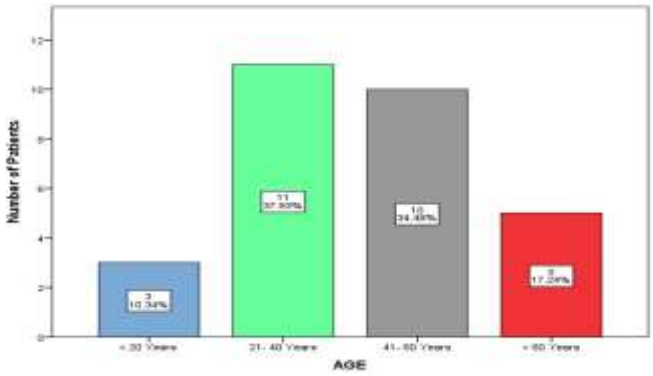
GRAPHS



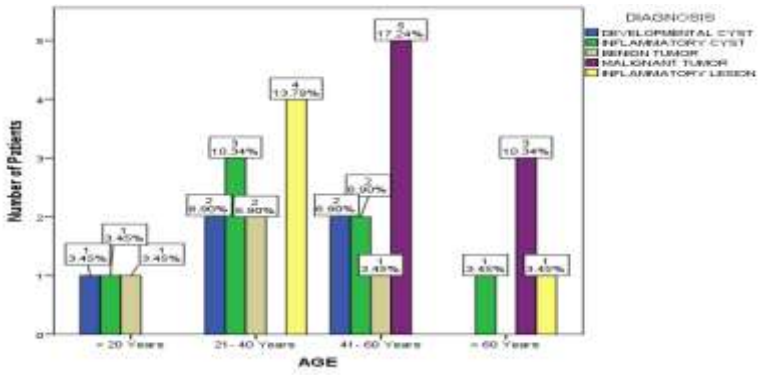
Graph 1: Bar graph showing the distribution of maxillary pathological lesions amongst the genders. 68.97% males (blue) and 31.03% females (brown) reported with pathologic lesions of the maxilla in our center



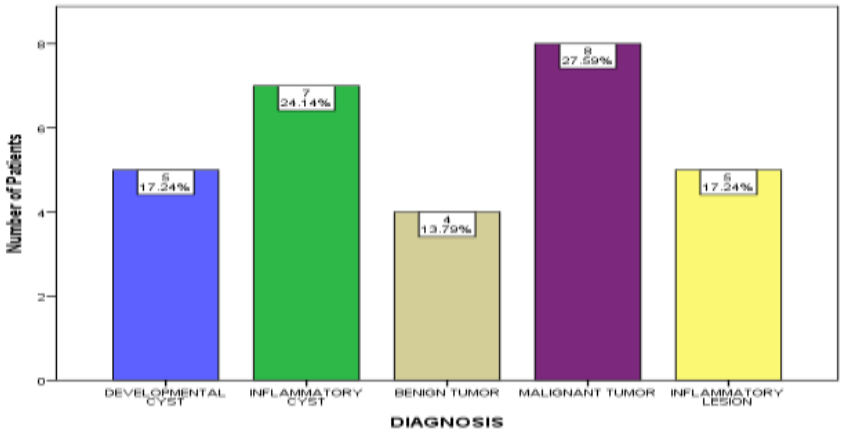
Graph 2: Bar graph illustrating the relationship of gender with the lesions diagnosed in the maxilla where X axis represents gender, Y axis represents total number of patients treated for maxillary pathologic lesions. Males report with the highest frequency of 20.69% malignant tumors (violet), followed by 17.24% inflammatory lesions (yellow). Females present with the highest frequency of 13.79% inflammatory cysts (green). These associations are however not significant statistically (p value-0.233 on Chi Square test)



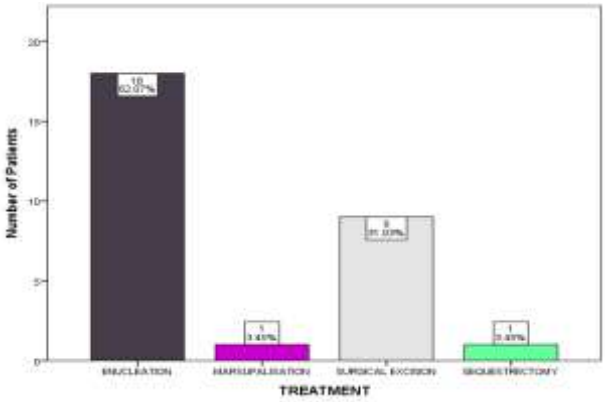
Graph 3: Bar graph showing the distribution of maxillary pathological lesions amongst the different age groups, where X axis represents the age and Y axis represents the number of patients. 21-40 age group individuals (teal) reported with the highest frequency of maxillary pathological lesions 37.93% , followed by 41-60 age group individuals (grey) with 34.48% lesions, >60 age group individuals with 17.24% lesions. 10.34 % lesions reported were reported in the <20 age group (light blue)



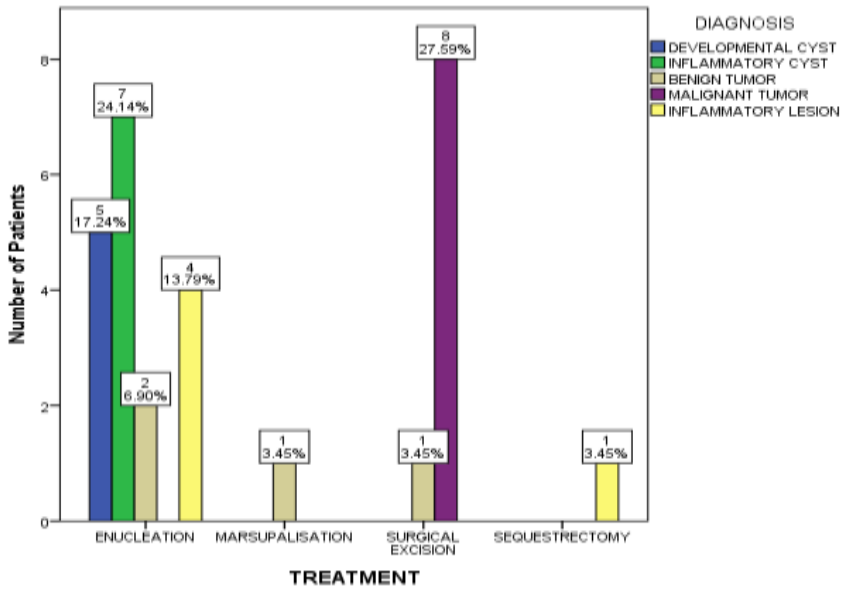
Graph 4: Bar graph illustrating relationship of age with the lesions diagnosed in the maxilla where X axis represents age group, Y axis represents total number of patients treated for maxillary pathologic lesions. Malignant lesions (violet) show the highest frequency of 17.24% in 41-60 and 10.34% in >60 age groups. Inflammatory cysts (green) occur 10.34% in the 21-40 age group. These associations are however not significant statistically (p value-0.211 on Chi Square test)



Graph 5: Bar graph showing the distribution of maxillary pathological lesions amongst the sample population, where X axis represents the type of pathology and Y axis represents the number of patients. Lesions are distributed as 27.59% malignant tumors (violet), 24.14% inflammatory cysts (green), 17.24% developmental cysts (cobalt blue) and inflammatory lesions (yellow) respectively and 13.79% benign tumors (beige)



Graph 6: Bar graph showing the distribution of treatment done for maxillary pathological lesions amongst the sample population, where X axis represents the varied treatment and Y axis the number of patients. Enucleation (black) is the most commonly used treatment modality with a frequency of 62.07%, followed by surgical enucleation (light grey) with a frequency of 31.03% and equal frequency of 3.45% marsupialization (pink) and sequestrectomy (green).



Graph 7: Bar graph illustrating the spectrum of treatment performed for various lesions diagnosed in the maxilla, where X axis represents treatment, Y axis represents total number of patients treated for maxillary pathologic lesions. Surgical excision is the most commonly performed treatment 27.59% for malignant lesions (violet). Inflammatory cysts (green) are treated by enucleation in all 24.14% cases. The association between the type of pathology and the treatment done was highly significant statistically with p value = 0.000 < 0.05 on Chi Square test.