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Original Article

Prevalence of cysts and tumors around the retained and unerupted third molars in the Indian population

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ABSTRACT

Aim: Tooth impaction is a frequent phenomena and surgical removal of these teeth are the commonest of the dental surgical procedures. The debate over the removal of asymptomatic impacted third molars still continues. The aim of this retrospective study was to determine the incidence of development of cysts and tumors around the retained and unerupted third molars in the Indian population.

Material and methods: 5486 impacted third molars of 4133 patients were studied through the panoramic radiographs for the presence of associated cysts and tumors. The ages of the patients ranged from 17 to 67 years, with a mean of 33.7 years. The results were evaluated using the Pearson chi-square test. P-values less than 0.05 were considered to be statistically significant.

Results: There were 134 cysts (2.24%) and 63 tumors (1.16%) found that were associated with impacted third molars, of which 3 were malignant (0.05%). 143 patients had symptoms such as swelling or pain due to cystic or neoplastic lesions. The remainder 54 patients had no symptoms suggestive of pathology. The most common cyst was dentigerous cyst and the most common tumor was ameloblastoma.

Conclusion: The results indicate that cysts and tumors do develop in a relatively small but still considerable minority of patients. The fact that a considerable number of patients had no signs or symptoms indicating pathology is certainly worth considering. Consultation should be sought from dental specialists if there are symptoms in the third molar region.

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Introduction

The third molar teeth are the last to erupt with a relatively high chance of becoming impacted. Hence, the surgical extractions of these impacted teeth have become the most common dentoalveolar surgeries.¹ The retained, unerupted mandibular third molars are often associated with varied pathologies such as pericoronitis, caries, periodontitis, cystic lesions, benign and malignant tumors, pathologic root resorption along with detrimental effects on adjacent tooth.²

In 1979, the NIH Consensus Development Conference agreed on a number of indications for removal of impacted third molars, which included infection, non restorable carious lesions, cysts, tumors, and destruction of adjacent teeth and bone.³ Various retrospective studies have revealed that asymptomatic, “nonfunctional”, unerupted third molars were removed to prevent the associated pathologies, in one-third of the total reported cases. The controversy over the risks and advantages of the removal of these teeth still exists. Some authors reported the absence of any associated problems over a period of several years due to the impacted third molars in edentulous patients.⁴ Stephens et al however overemphasized the development of dentigerous cysts due to impacted third molars.⁵

No general indication for the need of surgical removal of all asymptomatic impacted third molars has been agreed upon till date.^{6–8} The surgical extraction of many impacted mandibular third molars which have been asymptomatic for years are often carried out to prevent development of any future complications and pathologic conditions.⁹ Although removal of such unerupted and retained third molars is the most common oral surgical procedure, many investigators have questioned the necessity of removal for patients who are asymptomatic or have no associated pathologies. These may be based on the view that retention of impacted teeth for a longer duration has less chances of pathological change in the tooth itself, or of deleterious effects on adjacent tooth and associated structures. Some authors have argued that all impacted third molars should be removed regardless of being asymptomatic.^{10,11} Other are of the view that removing such impacted third molars without any symptoms is questionable in the light of the present lack of knowledge about the incidence of associated pathology.⁸ Yet other authors consider that prophylactic surgical removal of impacted third molars is not obligatory as the risk of development of pathological conditions in or around follicles of third molars is apparently low.^{12,13} The objective of the present study was to determine the incidence of the development of cysts and tumors around the impacted third molars.

Material and methods

The records of 4133 patients attending the Department of Oral Medicine and Radiology, Jodhpur Dental College General Hospital between September 2008 to December 2012 were investigated using panoramic radiographs to determine whether the chief complaints were related to impacted teeth and/or associated cysts and tumors. All patients aged 17 years

and older were included in the study keeping in view the normal age of eruption of the third molars. The ages of the patients ranged from 17 to 67 years, with a mean of 33.7 years. The ratio of male to female patients was 1.8:1. The ratio of maxillary to mandibular molars was 1:1.6. Ethical clearance was obtained from the Institutional Ethical Committee. A written informed consent was obtained from the patients prior to the inclusion in the study.

All panoramic radiographs were taken with the Dentsply Gendex Orthoralix 9200 (Dentsply Asia, Milford, US), and the magnification factor was 1.23. All reported measurements were adjusted according to this factor. One group of researchers examined the radiographs at the same time on standard light boxes to determine the number and types of impacted teeth, and the presence of associated pathologies. A tooth was defined as impacted when the tooth was obstructed on its path of eruption by an adjacent tooth, bone, or soft tissue. A healthy finding without pericoronal radiolucency was defined by a uniform line without a rupture or a diffuse lucent area below the crown. A radiolucency in excess of 4 mm was regarded as a cyst. The tumors were diagnosed based on the clinical records and specific radiological and histopathological features (Figs. 1 and 2). The hyperplastic dental follicle was differentiated based on the histopathological and macroscopic findings. The data for these 4133 patients were evaluated to determine the incidence of cysts and tumors around third molars. The observations were entered and analyzed using the computer program, SPSS 12 (SPSS Inc. Chicago, USA). The results were evaluated using the Pearson chi-square test. P-values less than 0.05 were considered to be statistically significant.

Results

143 patients were symptomatic with complaints of pain and swelling due to cystic or neoplastic conditions. 2135 patients had symptoms such as swelling, pain, trismus or fever due to pericoronitis. The remaining 1998 patients were asymptomatic. The impacted molars and/or associated pathology in these patients were diagnosed during routine clinical and radiographic examination. There were 134 cysts (2.24%) and 64 tumors (1.16%) found that were associated with 5486 impacted third molars, of which 3 were malignant (0.05%). 143 patients had symptoms such as swelling or pain due to cystic or neoplastic lesions. The remainder 54 patients had no symptoms suggestive of pathology, which included mainly the dentigerous cysts, keratocystic odontogenic tumor, hyperplastic dental follicles and odontoma. Of the 134 patients who had associated cysts with an impacted third molar, 45 (33%) were women and 89 (67%) men. Their ages ranged from 20 to 64 years with a mean of 31.8 years. There were 28 cysts (20%) localized in the maxilla and 106 (80%) in the mandible (Table 1). 132 cysts (99%) were found to be dentigerous and 2 cysts (1%) were calcifying odontogenic cysts. The 64 patients who had an associated tumor with the impacted third molar, consisted of 40 women (64%) and 23 men (36%), aged 17–54 years with a mean of 29.6 years. 3 of these tumors (5%) were localized in the maxilla (1 in male and 2 in females) and 60 (95%) in the mandible (22 in males and 38 in females). There

Fig. 1 – Figure showing histopathologic appearance of various tumors (a) Follicular ameloblastoma; (b) Plexiform ameloblastoma; (c) Complex odontoma; (d) Keratocystic odontogenic tumor; (e) Squamous cell carcinoma and (f) Mucoepidermoid carcinoma.

Fig. 2 – Histopathologic features of central odontogenic fibroma.

were 31 ameloblastomas (48%), 16 keratocystic odontogenic tumors (25%), 5 hyperplastic dental follicles (8%), 3 odontogenic fibromas (5%), 6 odontomas (10%), 2 squamous cell carcinoma (SCC) (3%) and 1 mucoepidermoid carcinoma (1%) (Table 2). Overall, the incidence of cysts around impacted third molars was 2.24% whereas the incidence of tumors around

Table 1 – Distribution of cysts according to gender and site.

Gender	Maxilla No. of patients	Mandible No. of patients	Total (%)
Male	8	37	45 (33%)
Female	20	69	89 (67%)
Total	28	106	134 (2.24%)
*No. = Number.			

Table 2 – Distribution of tumors according to type.

Type	No. of patients	%
Ameloblastoma	31	48%
Keratocystic odontogenic tumor	16	25%
Hyperplastic dental follicle	5	8%
Odontogenic Fibroma	3	5%
Odontoma	6	10%
Squamous Cell Carcinoma	2	3%
Mucoepidermoid carcinoma	1	1%
Total	64	1.16%

*No. = Number.

impacted third molars was 1.16%. The most common cyst was dentigerous cyst and the most common tumor was ameloblastoma.

Discussion

Impacted wisdom teeth account for 98% of all impacted teeth.¹ The surgical removal of impacted third molars is widely carried out in routine dental practice. Well-defined guidelines have been established for the removal of pathologically symptomatic impacted third molars.³ However, in a large percentage of cases, asymptomatic third molar are universally removed for various reasons. A few reports have estimated that 18% and 50.7% impacted third molars are removed when no clinically sound justification for surgery is present.¹⁴ Indications for prophylactic surgery include prevent crowding of the dentition, the need to minimize the chances of development of cysts and tumors, prevention of resorption of adjacent teeth, increased difficulty of surgery with age, reduction of the risk of angle fracture in the mandible, and that there is no significant role of third molars in the mouth. Factors that influence third molar eruption are skeletal growth pattern, direction of eruption of the dentition, dental extractions as well as root configuration and maturation of the third molar.⁹ Enlargement of the size of pericoronal radiolucency is an important finding for removal of an asymptomatic impacted tooth. In the presence of pathological changes and/or severe symptoms, such as infection, non-restorable carious lesions, cysts, tumors, and destruction of adjacent teeth and bone, there is no argument about the need for tooth extraction.

Hashemipour et al showed that impacted third molars were 1.9 times more likely to occur in the mandible than in the maxilla, while Capelli noted preponderance in the maxilla.^{15,16} Whereas, Dachi and Howell while examining the radiographs of 1685 students at the University of Oregon found 63.7% of molar impactions in the maxilla and 36.5% in the mandible.¹⁷ The findings of the present study were similar to Shah et al and Van der Linden et al who reported a higher prevalence in the mandible.^{13,18} This predilection for impaction in third molars of the lower jaw has not been reported in studies of other ethnic groups. Clinically, a combination of erupted upper and impacted lower third molars requires special attention because of the risk of overeruption of 'unopposed' upper third molars. Additional or pre-existing pericoronitis associated with the lower third molars may exacerbate the discomfort

experienced by patients, unless extraction or occlusal adjustment is attempted for the upper third molars.

The incidence of large cysts and tumors occurring around impacted third molars differs greatly in various studies. Prevalence of cyst formation shows a wide range from 0.001% when a biopsy was indicated to 11% when the diagnosis was clinically established.⁵ Dachi and Howell reported a high incidence of 11% of cysts around the impacted third molars.¹⁷ Bruce et al reported an incidence of 6.2% of cysts and tumors developing around impacted third molars, with the incidence being notably highest (13.3%) in the oldest age group (mean age 46.5 years) and lowest (1.5%) in the youngest age group (mean age 20 years).¹⁹ The present study showed an incidence of cyst formation associated with impacted third molars of 2.24%. These results were in conjunction with the findings of Lysell and Rohlin, Samsudin and Mason and Guven et al who reported the incidence to be 3%, 3.3% and 2.31% respectively.^{20–22} The incidence of cysts and tumors associated with impacted third molars has been reported by Osborn et al as 3%, which is also similar with the findings of the present study.²³ In neither of these studies the diagnosis of cyst was reconfirmed by histologic examination. The diagnosis was presumably due to arbitrarily defined radiographic findings in all cases. The only study where the diagnosis of a dentigerous cyst was confirmed by histologic examination of the removed tissue was the epidemiologic study by Shear and Singh, who reported a much lower incidence of 0.001% of cysts and tumors associated with the impacted third molars.²⁴ It has been reported that the development of large cysts around impacted third molars took 2–13 years.²⁵ It seems, therefore, that the longer an impaction exists, the greater the risk of development of cysts and tumors. Majority of the patients of the present study were of 19–30 years age group. This may reflect increased dental awareness in this group of patients.

There also exists a controversy in the literature about the criteria to establish differential diagnosis between early dentigerous cyst and hyperplastic dental follicle. According to some, a definitive diagnosis of dentigerous cyst can only be made based on the identification of a pathological cavity between the tooth crown and ectomesenchymal portion during surgery. They further emphasize that differentiation between the two entities cannot be established by histomorphological analysis. Few authors are of the view that differential diagnosis can be made based on mainly the type of epithelium identified by the pathologist. Whereas some emphasize the fact that the presence of squamous metaplasia in the lining of the dental follicle is not sufficient to diagnose dentigerous cyst, others are of the view that it is the initial stage of the lesion as it presents greater cell proliferation when compared to healthy follicular tissue.²⁶

In a similar study of 120 impacted third molars in 115 healthy and asymptomatic patients, dentigerous cysts were present in 1.1% of patients, calcifying odontogenic cysts were present in 6.6% patients, and keratocystic odontogenic tumors were present in 2.5% of patients. In the remaining patients, follicular epithelium was normal.²⁷ The incidence of a tumor associated with an impacted third molar was 1.16% in the present study. Lysell and Rohlin reported that the incidence of the development of a tumor around impacted third molars was lower than 1%.²⁰ The incidence of ameloblastoma

associated with the impacted third molars has been reported to be 0.14% by Regezi et al 2% by Shear and Singh and Weir et al^{24,28,29} The incidence of 0.58% in the present study is similar with these findings. The occurrence of unicystic ameloblastoma in a dentigerous cyst around an impacted third molar has been reported before.²² Ameloblastomas and KOT tend to occur in the posterior areas of the jaws not because they develop from the lining of a dental follicle, but from pre-functional dental lamina that persists in that region and that when it develops an ameloblastoma, the chances of this neoplasm to surround an impacted third molar is extremely high. Although it is unusual, odontogenic fibroma (8 cases) were reported more in the present study. The exact reason for this high prevalence could not be established. This could be possibly attributed to the fact there exists confusion between odontogenic fibroma and hyperplastic dental follicle, the latter being more common. The final diagnosis is based solely on the histopathological and microscopic analysis, with Picrosirius red and polarizing microscopy.³⁰ However, after a careful review and microscopic analysis using Picrosirius red, 5 of them were re-classified as hyperplastic dental follicle.

The incidence of malignant tumors around impacted third molars is reported to be quite low. However, there are cases reporting the development of squamous cell carcinoma from a dentigerous cyst around an impacted third molar. Yoshida et al reported a case of oral squamous cell carcinoma developing from a keratocystic odontogenic tumor associated with an impacted third molar.³¹ Eversole et al reported that approximately 50% of central mucoepidermoid carcinomas are associated with a cyst or an impacted tooth.³² Verrucous carcinoma developing in an odontogenic cyst has also been reported.³³ The incidence, multiple presentation and recurrence of aggressive cysts of the jaws and the malignant transformation of cysts has been discussed by Stoelinga and Bronkhorst.³⁴ According to their study it seems justified to estimate the incidence of malignant change, including squamous cell carcinoma and mucoepidermoid tumor, as varying from 1 to 2%. However, they recommended further epidemiological studies to reconsider this figure. The present study also showed the squamous cell carcinoma and mucoepidermoid carcinoma developing from an associated cyst or tumor around the impacted third molar.

At present, there are about 60 well documented cases reported in the literature of SCC developing in an odontogenic cyst.³⁵ Many authors suggest that SCC's arising in an odontogenic cyst is more common in the mandible than in the maxilla, with a predilection for the posterior region of the mandible.^{22,35} It may be very difficult to distinguish between a simple odontogenic cyst and a malignant lesion by radiographic examination. The study of Stoelinga and Bronkhorst revealed that most keratocysts occurring in the third molar area are not really associated with the follicle of an impacted third molar.³⁴ The pathological changes of remnants of the dental lamina or epithelial proliferations of the overlying mucosa results in the formation of the keratocysts.

The findings from the various studies in the literature indicate that cysts and tumors do develop in a relatively small but still significant minority of patients. With increased age the morbidity associated with infection, local anesthesia, and surgery is likely to increase. These factors need to be

considered when patients are advised about the advantages and disadvantages of third molar removal. It has been suggested by few authors that a computer-based neural network could play a useful role in supporting clinicians making third molar referral decisions.¹² They suggested that a strong indication for removal should be complemented by a strong contraindication to its retention and vice-versa.

There is no universally accepted treatment concept for asymptomatic, impacted third molars. The argument over removal of impacted third molars in absence of symptoms is still going on, while others have suggested a not so necessary prophylactic removal of these retained and unerupted third molars in the light of the fact that the risk for development of cysts and tumors is quite low. No guidelines have yet been established to predict, in an individual case, whether cyst development is likely. A recent study showed that pericoronal changes in third molars seem to be unpredictable and that guidelines cannot easily be established.³⁶ The surgical treatment of these large cysts is often associated with considerable morbidity. Third molar surgery is not risk free, the complications and suffering following surgery may be considerable. The risk of permanent damage to the mandibular nerve is increased, and often bone grafts or immobilization of the mandible for several weeks may be necessary.

It can be concluded from the above findings that the incidence of cysts and tumors developing around third molars is relatively low, but still suggests that considerable pathology may occur in a relatively small proportion of patients, as mentioned in the literature. The fact that a certain number of the patients had no signs or symptoms indicating pathology is certainly worth considering. This fact alone provides sufficient evidence that regular radiographic follow-up is necessary so as to be able to surgically intervene when pathology arises. However, radiographic findings are not alone sufficient to determine the actual frequency of the associated diverse pathological entities with the impacted third molars and hence, clinico-pathological analysis should be performed. The profession needs to consider all associated factors when formulating an evidence-based policy towards asymptomatic third molars.

Conflicts of interest

All authors have none to declare.

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