

Lesions Associated with Impacted Tooth

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ABSTRACT

Impacted teeth have been associated with various pathological conditions such as cysts, tumors, pericoronitis, periodontitis, and pathological root resorption. This review is intended to introduce lesions associated with the impacted tooth. From the literature review following 12 lesions was found to be associated with impacted tooth which are dentigerous cyst, odontogenic keratocyst, calcifying odontogenic cyst, central mucoepidermoid carcinoma, unicystic ameloblastoma, calcifying epithelial odontogenic tumor, adenomatoid odontogenic tumor, squamous odontogenic tumor, ameloblastic fibroma, ameloblastic fibro odontoma, odontoma, central odontogenic fibroma. These entities can be considered in differential diagnosis when clinicians encounter a lesion in intimate association with impacted tooth thus helping in formulation of diagnosis and to develop an appropriate treatment plan.

Keywords: associated lesions, impacted tooth, unerupted tooth

INTRODUCTION

Peterson characterized impacted teeth as those teeth that fails to erupt into the dental arch within the expected time.¹ Lack of an adequate dental arch length and space in which tooth erupts into is the main reason for impaction.² The maxillary and mandibular third molars are most commonly impacted teeth which account for 98% of all impacted teeth. This is followed by the maxillary cuspids, premolars and supernumerary teeth.^{3,4} According to the literature, the prevalence of impacted tooth has been estimated to be between 8% and 33% in different countries.⁵⁻⁷

Disease associated with impacted teeth may be clinically obvious or occult.⁸ Impacted teeth have been associated with various pathological conditions such as cysts, tumors, pericoronitis, periodontitis, and pathological root resorption along with adverse effects on the neighboring teeth and bone. According to different studies the prevalence of cystic and neoplastic changes associated with impacted teeth ranges from 3 to 16%.^{4,9} The objective of this review is to identify different lesions associated with impacted teeth.

MATERIALS AND METHOD

Literature were reviewed through various search engines like Google, Google Scholar, PubMed, Med-Line as well as standard textbooks to find relevant studies using keywords such as “impacted tooth”, “associated lesions”, “unerupted tooth”. Among the obtained result, approximately 70

papers broadly suitable to the topic were found. We ultimately integrated 33 articles that were closely related to the topic of interest. Following 12 lesions were found to be associated with impacted tooth: dentigerous cyst, odontogenic keratocyst, calcifying odontogenic cyst, central mucoepidermoid carcinoma, unicystic ameloblastoma, calcifying epithelial odontogenic tumor, adenomatoid odontogenic tumor, squamous odontogenic tumor, ameloblastic fibroma, ameloblastic fibro odontoma, odontoma, central odontogenic fibroma.

RESULT

Dentigerous cyst : Dentigerous cyst can be defined as an odontogenic cyst that surrounds the crown of an impacted tooth.³ It is the second most common cystic lesion of the jaw, after radicular cysts. They usually present in the second or third decade of life with a slight male predilection and are rarely seen in childhood.¹⁰ Dentigerous cysts most often involve the mandibular third molars (65%), followed by the maxillary canines.¹¹ Study has shown that 93% of cysts associated with the mandibular third molar comprise of dentigerous cyst.¹² Most dentigerous cysts are solitary. Bilateral and multiple cysts are usually found in association with syndromes like Cleidocranial dysplasia and Maroteaux-Lamy syndrome.³

On radiographic examination, dentigerous cysts appear as unilocular radiolucent cysts of varying sizes, with well-defined sclerotic borders, associated with the crown of an

unerupted tooth. A critical diagnostic fact is that this type of cyst attaches at the cemento-enamel junction.¹³ The relationship between dentigerous cysts and the crown of the impacted tooth shows 3 types of radiographic patterns: central, lateral, and circumferential. The central variety is the most common type. The lateral variety is usually associated with a mesioangular impacted mandibular third molar. In the circumferential variant, the dentigerous cyst surrounds the crown and extends for some distance along the root. Displacement of the involved tooth and root resorption of the adjacent erupted tooth have been reported.¹³ Histologically, dentigerous cysts are lined by a layer of nonkeratinized stratified squamous epithelium, with a surrounding wall of thin connective tissue containing odontogenic epithelial rests. Tumors such as ameloblastoma, mucoepidermoid carcinomas or squamous cell carcinoma occasionally arise from the lining of the dentigerous cyst.¹¹

Odontogenic keratocyst (OKC): Odontogenic keratocyst was first described by Philipsen in 1956 which shows bimodal age distribution with the peak incidence occurring in the second and fifth decades of life. The mean age of patients is 42 years with a slight male predilection.^{9,14} More than 80% of cysts have been reported in the mandible, most commonly in the body (20%), angle (18%), and vertical ramus (10%). Only 16% of cases have been reported to occur in the maxilla, frequently in the posterior region.^{14,15} Approximately 82% of these lesions occur in tooth bearing areas and roughly 27% of cases show an association with impacted tooth especially impacted third molar. Multiple OKCs are found to be associated with nevoid basal cell carcinoma syndrome (NBCCS).³

Radiographically, Odontogenic keratocyst demonstrate a well-defined unilocular or multilocular radiolucency with smooth or scalloped and often corticated margins. OKC tend to grow in an anteroposterior direction within the jawbone without causing considerable cortical plate expansion.³

The histopathological feature of OKC is a characteristic thin epithelial layer, composed of 8 to 10 cell layers. The basal layer shows palisade organized cells with a uniform nucleus. These cysts are lined by stratified squamous epithelium that produces orthokeratin (10%), para keratin (83%), or both types of keratin (7%). No rete ridges are present; therefore, the epithelium often sloughs from the connective tissue (94% of the time).³ The connective

tissue wall often shows small islands of epithelium similar to the lining epithelium; some of these islands may be small daughter cysts.¹⁴

Calcifying odontogenic cyst (COC): Calcifying odontogenic cysts (COC) is an uncommon odontogenic lesion accounting for about 3% of oral lesions and 1% of jaw cysts.¹⁶ COC may be seen in any decade of life, but common in second and third decade. Approximately 65–67.5% of cases are seen in the anterior jaws with equal frequency in maxilla and mandible.^{17,18} Male and female are affected with almost equal frequency. COCs are associated with impacted teeth (mostly canines) in 10%-32% of cases.¹⁶

Radiographically, radiolucent unilocular occasionally multilocular images are seen with well circumscribed limits containing diffuse opacification areas, associated to impacted or unerupted teeth or another odontogenic tumor.¹⁷ Histologically, COC is usually composed of a cystic cavity with fibrotic capsule lined by an odontogenic epithelium. The typical microscopic feature of this lesion is the presence of variable amount of aberrant epithelial cells without nuclei, which are called “ghost cells. At times, a “product” may be identified in juxtaposition to the proliferative lining epithelium or intermixed with the ghost cells called “dentinoïd.” The COC often is encountered in association with an odontoma.¹⁹

Central Mucoepidermoid carcinoma: Mucoepidermoid carcinoma generally arises from salivary glands, representing 5-10% of all salivary gland tumors.²⁰ Central mucoepidermoid carcinoma represents 4.3 percent of mucoepidermoid carcinomas from all sites.²¹ It affects females twice more frequently than males and involves the mandible twice more often than the maxilla.^{20,21} The most common site of occurrence is the premolar-molar area and the angle of the mandible.²⁰ It has been reported in ages ranging from 1 to 78 years, with the majority of cases occurring in 4th and 5th decades of life. Eversole et al. found approximately 50% of the mandibular tumors associated with dental cysts and/or impacted teeth, while Brookstone and Huvos reported a rate of 32% association with impacted tooth.²⁰ Previous history of a cyst or impacted tooth gives acceptance to the theory that odontogenic epithelium is capable of giving rise to mucous secretory cells which may undergo neoplastic transformation to mucoepidermoid carcinoma.²⁰ The radiological features are well circumscribed unilocular or multilocular radiolucent

lesions.²¹ Most central mucoepidermoid carcinomas are low grade lesions but only few cases with long term follow up have been reported to confidently characterize their clinical behavior.²¹

Unicystic ameloblastoma: Unicystic ameloblastoma (UA) is a rare growth pattern seen in intraosseous ameloblastoma. This growth pattern is seen in approximately 6% of ameloblastomas. It tends to occur in a younger population with an average age of 25 years.^{9,22} UA shows a male to female ratio of 1.6:1. 50-80% of UA are associated with an impacted tooth.^{9,23} More than 90% of lesions are found in the posterior mandible with mandibular third molar being most commonly involved tooth.⁹ The etiology is unknown and the pathogenesis is poorly understood. They may arise from preexisting odontogenic cysts, in particular a dentigerous cyst or may arise de novo.²³ The predominant radiographical patterns of unicystic ameloblastoma are unilocular, scalloped multilocular, pericoronal, interradicular, or periapical radiolucencies.²²

The unicystic ameloblastoma grows predominantly as a cystic lesion. The epithelium lining the cystic cavity shows typical cytomorphic features that are recognizable as ameloblastoma, with a basal cell layer composed of columnar cells displaying hyperchromatic palisaded nuclei with reverse in polarity, and a subnuclear vacuole usually is noted. Ackermann et al. have described three histological variants luminal, intraluminal and mural.²³ In some instances, the ameloblastic epithelium may be proliferative, with extension of the ameloblastic epithelium into the lumen of the cystic cavity termed intraluminal proliferation. The epithelium may remain in direct contact with the cystic lining known as luminal or it may appear as separate islands of tumor in the connective tissue wall termed as mural (or intramural) growth.^{22,23}

Calcifying epithelial odontogenic tumor (CEOT): The calcifying epithelial odontogenic tumor or Pindborg tumor is generally considered as uncommon to rare odontogenic neoplasm that accounts for less than 1% of all odontogenic tumors.⁹ The average patient age for this lesion is variable within the range of 37-43 years with slight male predilection.²⁴ Pindborg tumor presents most often (75%) as an intrabony mandibular lesion and when in the mandible 60% cases is found in the posterior body to ascending ramus.²⁴ About 53%, CEOTs have a definite association with an unerupted tooth (or odontoma) and

among these 52% of the teeth are mandibular molars.²³ A mixed radiolucent radiopaque pattern is the most common pattern (65%), followed by radiolucent areas (32%), and radiopaque cases (3%).^{9,24}

Histologically, Pindborg tumor is characterized by proliferation of a squamous odontogenic epithelium with well-defined individual cell morphology and intercellular bridging. Some tumor cells vary from polygonal to round to oval in shape, while others may be highly irregular, pleomorphic, and ominous in morphology which still remain consistent with a benign diagnosis. A characteristic feature is an amyloid like material formed intraepithelially that may become calcified and may be liberated as the cells break down.²³

Adenomatoid odontogenic tumor (AOT): AOT accounts for approximately 3-7% of odontogenic tumor which makes it the fourth most frequent odontogenic tumor.^{23,25} It is unique among odontogenic tumors and unexplainable that 88% are diagnosed in the 2nd and 3rd decades.²⁵ They are more common in female.²³ AOTs are asymptomatic; however patients may be aware of a gingival swelling or an area of jaw enlargement. Maxillary anterior region is the most common site of occurrence.²⁵ AOT occurs in intraosseous and peripheral forms. Intraosseous tumors account for 95.6% of all AOTs. Intraosseous variant can arise in follicular and extrafollicular forms. The follicular variant is three times as frequent as the extrafollicular variant. The follicular variety of central AOT is associated with unerupted tooth.²³

Radiographically, it is seen as unilocular radiolucency associated with the crown and often part of the root of an unerupted tooth which mimics dentigerous cyst. Among the impacted or unerupted teeth associated with AOT all four canines account for 59% cases, maxillary canines alone accounts for 40% cases while unerupted first and second molars are rarely involved. Unerupted deciduous teeth involvement is rare with only two cases been published.²³ AOT is microscopically defined by the WHO (1992) as a tumor of odontogenic epithelium with duct like structures and with varying degrees of inductive change in the connective tissue. The tumor may be partly cystic, and in some cases the solid lesion may be present only as masses in the wall of a large cyst.²⁵

Squamous Odontogenic tumor (SOT): Squamous odontogenic tumor (SOT) is a benign but locally infiltrative

neoplasm which belongs to the family of epithelial odontogenic tumor.²³ Mobility of the teeth, swelling of the alveolar process and moderate pain are the possible clinical features of underlying disease.^{23,26} SOT occurs over a wide age range, with the reported incidence peak in the third decade of life. There is a slight male preponderance.²⁷ However, lesions of the maxilla tend to occur more often in the anterior regions, while mandibular cases are more often found in the posterior areas.²⁶ The radiographic lesion is usually described as well-defined unilocular and triangular radiolucency between the roots of the adjacent teeth.^{26,27} SOT seems to be rarely associated with impacted teeth compared to other odontogenic tumors. Few cases have been reported to be associated with erupting maxillary canine and impacted mandibular third molar.²⁶

Histologically, SOT consists of numerous islands of proliferative squamous epithelium dispersed uniformly in a connective tissue stroma. The islands are numerous and easily recognized, being sharply demarcated from the surrounding stroma by a flattened layer of cells at their periphery. They tend to vary somewhat in shape, but, as a rule, round to oval islands are always seen. The epithelium in these rounded islands often shows a swirling or “whirlpool” pattern to the central squamous cells. Areas of cystic change centrally within the islands are also a frequent finding, and keratinization of the central cells may be present too.^{23,27}

Ameloblastic fibroma (AF): Ameloblastic fibroma (AF) is a relatively rare true mixed odontogenic tumor characterized by the simultaneous neoplastic proliferation of mesenchymal and epithelial components without formation of dental hard tissues.²⁸ These neoplasms occur predominantly in children and young adults usually within an age range of 6 months to 42 years (mean 14.6–15.5 years) with slight male predilection. The posterior mandible is the most common site, and about 80% of cases are located in the first permanent molar and second primary molar area.²⁸ Impacted or unerupted teeth are associated with AFs in three quarters of the cases. AF can also develop in the areas of congenitally missing teeth.²³

The neoplasm appears as a well-defined, unilocular or multilocular radiolucency with a smooth, well-defined outline and often with a sclerotic opaque border radiographically. Smaller lesions reveal unilocular patterns while larger lesion tends to have multilocular appearance. Histopathologically, the epithelial component

is characterized by proliferating islands, cords, and strands of odontogenic epithelium exhibiting a peripheral layer of cuboidal or columnar cells, and the central area resembles the stellate reticulum of the embryonic enamel organ. The ectomesenchymal component is that of an embryonic, cell rich mesenchyme that mimics the dental papilla.^{23,28}

Ameloblastic Fibro-odontoma (AFO): According to World Health Organization (2005), AFO is a neoplasm composed of proliferating odontogenic epithelium embedded in cellular ectomesenchymal tissue that resembles dental papilla, with varying degrees of inductive change and dental hard tissue formation. AFO usually is diagnosed in the first two decades of life, and about 98% occur before the age of 20 years. There is a slight male predilection. Most tumors are found in the posterior mandible; the second most popular location being the posterior maxilla.²⁸ It usually presents as a painless, slow growing, expansile swelling and may inhibit tooth eruption or displace involved teeth without altering their vitality.^{28,29} In majority of cases (83%) AFO is associated with an unerupted tooth.²³ Radiographically, AFO presents as a uni or multilocular radiolucency with a well delineated radiopaque border. The central part of the tumor reveals radiopacity, the density of which resembles that of dental hard tissue. In cases of association with an unerupted tooth the AFO is usually located coronally to the crown of the tooth.^{23,29}

Histologically, AFO show the characteristic structure of an immature complex odontoma consisting of irregularly arranged enamel, dentinoid, cementum, and pulplike ectomesenchymal tissue. At the tumor periphery next to the fibrous capsule, there is a zone of strands and islands of odontogenic epithelium embedded in cell rich ectomesenchyme. The dentin may vary structurally from dentinoid to tubular dentin. Approaching the tumor center, enamel matrix is laid down by the odontogenic epithelium and may appear columnar or preameloblast like. The amount of ectomesenchyme gradually decreases as the hard tissue mass dominates the central part of the lesion.²³

Odontoma: Odontomas are most common variety of mixed odontogenic tumors, in which enamel and dentin are formed when both the epithelial and mesenchymal components undergo functional differentiation. The abnormal pattern of enamel and dentin are laid down because the organization of the odontogenic cells fails to

reach a normal state of morphodifferentiation.³⁰ They are hamartomatous lesions rather than true neoplasms.^{23,30} Two types of odontomas have been identified the complex and compound odontoma. The distinction between the two types is based on either the appearance of well-organized tooth like structures (Compound odontomas) or a mass of disorganized odontogenic tissue (Complex odontoma). Compound odontomas appear twice more frequently than complex odontomas.³⁰ They are more commonly seen in the second decade of life (75% of cases) with slight male predilection.^{9,23} They occur predominantly in the anterior maxilla and mandibular molar areas. In 40-50% of cases, an impacted permanent tooth is associated with the compound odontoma. Complex odontomes are located in the mandible especially in the posterior areas.³⁰

On radiographic examination, odontomas exhibit three characteristic stages of development. In the first stage, they exhibit radiolucency due to a lack of calcification, in the intermediate stage partial calcification may be observed, and in the third stage, the lesion usually appears as radiopaque masses surrounded by radiolucent areas.^{9,30} Histopathologically, odontomas are composed essentially of mature dental tissues that is enamel, dentin, cementum, and pulp tissue and may be arranged (compound odontoma) or unstructured sheets (complex odontoma).³⁰

Central Odontogenic fibroma (COF): Central odontogenic fibroma (COF) has been defined as a benign neoplasm in the jaw bones, representing the intraosseous counterpart of a peripheral odontogenic fibroma.^{31,32} COF appears as an asymptomatic expansion of the cortical plate of the mandible or maxilla with equal frequency. The lesion may evolve from a dental germ (dental papilla or follicle) or from the periodontal membrane, and therefore is invariably related to the coronal or radicular portion of teeth.³³ The most common site of presentation in the mandible is the posterior area, while in anteriorly in the maxilla. It seems to arise in a wide age group with predilection for females. In an extensive review of the literature regarding odontogenic fibromas, Kaffe and Buchner found that 27% were associated with the crown of an unerupted tooth.³²

COF radiologically presents as uni or multilocular radiolucencies with well-defined borders. In some rare cases, it might present mixed radiolucent and radiopaque features and ill-defined borders. Root resorption and displacement have been reported in cases of more severe lesions.³³ Histologically, COF is a non-encapsulated tumor

characterized by the admixture of connective tissue (acellular, loose, myxomatous or markedly cellular) and islands of odontogenic epithelium associated dysplastic dentin, amorphous ovoid cementum like calcifications and trabeculae of osteoid. Sometimes it is associated to a prominent giant cell granuloma like histopathologic component.³³

DISCUSSION

This review proposes a group of jaw lesions that occur in association with impacted tooth. There are 12 lesions which include cysts and tumors of odontogenic origin and salivary gland tumors. General features of these lesions are given in Table 1.

Among these lesions' highest frequency of association with an impacted tooth is seen in ameloblastic fibro odontoma, unicystic ameloblastoma, dentigerous cyst and adenomatoid odontogenic tumor. Lowest frequency of association is seen in squamous odontogenic tumor, odontogenic keratocyst and central odontogenic fibroma. Mandibular third molar is most commonly associated tooth in these lesions except for adenomatoid odontogenic tumor, calcifying odontogenic cyst and compound odontoma for which the anterior maxillary teeth are most commonly involved. Adenomatoid odontogenic tumor has unique tendency of most commonly being associated with impacted cuspids.

These lesions usually occur in 2nd and 3rd decade of life except for central mucoepidermoid carcinoma and calcifying epithelial odontogenic tumor which occurs in 4th and 5th decades of life. Odontogenic keratocyst has bimodal distribution of age occurring in 2nd and 5th decade of life.

Most of the lesions associated with impacted tooth are commonly seen in male while adenomatoid odontogenic tumor, central mucoepidermoid carcinoma and central odontogenic fibroma are more common in females. There is no gender predilection in calcifying odontogenic cyst and odontoma.

Although various radiographic features have been described in jaw lesions associated with impacted tooth, most of them first appear as unilocular radiolucency with the potential to evolve into multilocular lesions with well-defined borders. Some lesions like calcifying odontogenic cyst, adenomatoid odontogenic tumors,

Table1: General features of the lesions associated with impacted tooth

Lesion	Age	Sex	Association with impacted tooth	Predominantly impacted tooth	Predominantly associated jaw	Common location
Dentigerous cyst	2nd and 3rd decade	M>F	65%	Third molars	Mandible	Posterior
Odontogenic Keratocyst	2nd and 5th decade	M>F	27%	Third molars	Mandible	Posterior
Calcifying Odontogenic Cyst	2nd and 3rd decade	M=F	10-32%	Canine	Mandible = Maxilla	Anterior
Central Mucoepidermoid carcinoma	4th and 5th decade	M<F	32-50%	Premolar and Molar	Mandible	Posterior
Unicystic ameloblastoma	2nd decade	M>F	50-80%	3rd molar	Mandible	Posterior
Calcifying epithelial odontogenic tumor	4th and 5th decade	M>F	53%	Molars	Mandible	Posterior
Adenomatoid odontogenic tumor	2nd decade	M<F	53%	Canine	Maxilla	Anterior
Squamous odontogenic tumor	3rd decade	M>F	Rare	Canine and 3rd molar	Mandible	Maxilla-Anterior Mandible-Posterior
Ameloblastic fibroma	2nd decade	M>F	75%	1st permanent molar Second primary molar	Mandible	Posterior
Ameloblastic fibro odotoma	1st and 2nd decade	M>F	83%	None	Mandible	Posterior
Odontoma	2nd decade	M=F	40-50%	None	Maxilla(Compound Odontoma) Mandible(Complex Odontoma)	Maxilla-Anterior Mandible-Posterior
Central Odontogenic fibroma	Wide age group	M<F	27%	Molar, Premolar, Incisor	Mandible	Maxilla-Anterior Mandible-Posterior

calcifying epithelial odontogenic tumors, ameloblastic fibro odontomas and odontomas contain radiopaque foci within the radiolucency.

These entities can be considered in the differential diagnosis whenever clinicians encounter a lesion in intimate association with impacted tooth which might

help in making more accurate diagnosis based on clinical and radiographical features as well as in forming proper treatment plan.



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