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Research Paper

Odontogenic kerato-cyst, a known Aggressive Cyst of oral Cavity – Review Article

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Abstract: *Odontogenic keratocysts (OKCs) usually develop in tooth-bearing regions, and the mandible is more commonly affected than the maxilla. The most common locations of the mandible are the angle, posterior sextant, and ramus. In contrast, the anterior sextant and third molar regions are the most commonly affected regions in the maxilla. Due to its aggressive behavior, the biological nature of odontogenic keratocyst has been a matter of discussion for a long time and there has been always controversy regarding the cystic or the neoplastic behavior of the lesion. According to the 4th edition of the World Health Organization (WHO) Classification of Head and Neck Tumors published in January 2017, Keratocystic odontogenic tumors are now classified as odontogenic keratocysts. So, odontogenic keratocysts (OKCs) are now classified as benign cysts of odontogenic origin that represent about 10% of all odontogenic cysts. Since the lesion behaves aggressively, has very high chances of recurrence, is associated with PTCH gene mutations and nevoid basal cell carcinoma syndrome, it becomes one of the very important factors to know that it will determine the aggressive behavior of it. The use of radiological imaging, mainly computed tomography (CT) and magnetic resonance imaging (MRI) is important in diagnosing and managing OKCs. Thus, a review of the histopathological features, biological behavior, and a contemporary outline of molecular (growth factors, p53, PCNA and Ki-67, BCL-2) and genetic (PTCH, SHH) alterations associated with this cyst was done. These histological and molecular findings will further aid the clinician to plan appropriate surgical intervention and keep regular follow-ups to identify recurrences.*

Keywords *- Odontogenic Keratocyst, aggressive, recurrence, biological behavior, Computed tomography, Magnetic resonance imaging.*

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I. Introduction

Odontogenesis is one of the most complex of all processes in which the odontogenic cells act in a programmed and complex manner for the formation of odontogenic cysts and tumors; hence, these lesions form a unique group in the head and neck region.[1]

Philipsen first described the term "odontogenic keratocyst" in 1956.The essential features were explained by Hansen and Pindborg in 1963. In addition, the term keratocyst was coined because the cystic epithelium produces large amounts of keratin that almost fill the cystic cavity. [2] There have been many questions surrounding this lesion regarding its nomenclature, treatment modalities, and recurrence rates. Despite its aggressive nature, recurrence, and mutations in the PTCH gene, OKC was considered a cyst until 2005, when it was reclassified by the World Health Organization as the keratocystic odontogenic tumor. Because of the biological nature of KCOT, which presents morphologically like a cyst, it remains an enigma.[3] In 2017, however, the new WHO classification of head and neck pathology reclassified OKC back into the cystic lesions.[4]

The OKC still deserves special attention due to its high recurrence rate (25-60%), locally aggressive and destructive characteristics, chromosomal and genetic abnormalities, and high mitotic activity versus other cyst types, such as dentigerous and radicular cysts.[4]

OKC is a developmental odontogenic cyst that arises from the cells of the odontogenic apparatus. Its cystic lumen contains either clear fluid or white cheesy material that resembles keratin.[4] Epidemiologically, OKC affects approximately 7.8 % of all the jaw cysts and its incidence varies from 4-16.5%. It is mostly found in the 2nd and 4th decade of life, although it can occur in any age group.[5] It predominates in the white population with a male-female ratio of 1.6:1. Location wise it is twice more commonly seen in the mandible as compared to the maxilla, with the angle – ascending ramus (69-83%) region being most commonly involved.[5] Mandibular cyst usually cross the midline and maxillary cysts may involve the sinus and nasal floor, premaxilla, maxillary third molar region and TMJ. OKC is mostly an intraosseous lesion, though its peripheral counterpart has also been reported in gums, cheek tissue, and lateral facial deep regions.[5]

Etiology

The origin of KCOT may be linked to the development of the dental lamina and in particular to remnants left over after the organ has served its purpose.These epithelialislands derived from the dental lamina are mainly found inthe gingiva and periodontal ligament. This explains theclinical entity of lateral periodontal or lateral follicular presentationof these tumors. One of the enigmas dogging thisentity is explaining why they develop from such epithelialremnants or why they develop selectively from one suchepithelial island, while being dormant in the other areas. Theclinical implication of this lies in the fact that if one removessuch a lesion some of these epithelial residues may be leftbehind which may later give rise to a new one.[6]

The common presence of KCOT posterior to the 3rdmolar region is difficult to explain if dental lamina isbelieved to be the etiological derivative due to the unlikelypossibility of remnants or offshoots of this dental laminabeing located in the mucosa posterior to the last molar[7].It is therefore probable that offshoots of the basal layer ofthe epithelium of the oral mucosa may also be involved inthe etiology of KCOTs [8, 9]. One important consideration is the presence of theseislands in at least 50 % of the cases in the overlyingattached mucosa. This has great implications in managementwhere it becomes mandatory to excise that part of themucosa, in conjunction with enucleation. Failure to do sowill leave behind the potential source for recurrence of thelesion [10].

Pathogenesis

One of the characteristic features of the growth of OKCs pathophysiology is the tendency to grow along with the cancellous channels and cortical expansion. Various theories have been proposed to explain the expansion of OKCs. These include 1. Intraluminal hyperosmolarity, 2. Active epithelial proliferation 3. Synthesis of interleukin 1and 6 by keratinocytes and 4. The collagenolytic activity of cyst wall.[11,12]

Collagenase is an enzyme that was controlled by a complex regulatory system present in tissues, usually, dermatological studies have been demonstrated collagenolytic activity. Same as explants of OKCs and tissue cultures from OKCs contain collagen and collagenase activity in the presence of both epithelium and fibrous wall in the media.[13] There was no evidence of similar activity in other odontogenic cysts like dentigerous cysts, radicular cyst and it was tentatively proposed that enzymatic mechanisms might be important in the growth of OKCs.[13]

Interleukin (IL)1,6 and tumor necrosis factor (TNF) are known cytokines particularly seen in chronic inflammatory lesions and demonstrated that vital role in bone-resorbing activity attributed through osteoclast activating factor produced by mononuclear leukocytes.[14] The synthesis of interleukin 1 and 6 by keratinocytes which further induces the secretion of keratinocyte growth factor from interactive fibroblasts along with the tumor necrosis factor results in an increased level of prostaglandins and collagenase synthesis particularly type I and II collagenases almost in equal quantities all have potent bone-resorbing properties and there is no significant collagenase III synthesis.[14]

Immunohistochemical staining of cryostat sections of OKCs showed a strong reaction for IL-1 alpha and IL-6 in the cyst epithelial cells but not in other cells, and control gingiva and buccal mucosa were also negative, therefore that IL-1 alpha was the principal osteolytic cytokine produced by OKCs leading to bone resorption but that role of IL-6 was not clear and it might suggest that contribute to OKCs growth by promoting epithelial proliferation through an autocrine feedback mechanism.[15]Earlier studies have shown that levels of IL-1 alpha were significantly higher in the fluids of OKCs than dentigerous cyst and radicular cyst fluids.[15,16]

A series of papers reported the presence as well as the activation/ inhibition profile of matrix metalloproteins (MMPs) in the jaw cysts to determine their possible role among the complexity of molecular mechanisms associated with cyst enlargement.[17-19] MMPs were defined as a superfamily of 17 genetically distinct but structurally related neutral proteinases participating in both physiological tissues remodeling and in pathological tissue destruction.MMP-1 and MMP-9 were mainly associated with diseases like periodontitis,

rheumatoid arthritis, tumor invasion, and metastasis and they were also present in the jaw cyst tissue extracts both in latent and activated forms, but both MMP-2 and MMP-8 were also detected in lesser amounts.[17-19]

The presence of active forms of MMP-1 and MMP-8 in cyst extracts is demonstrated by western blotting and is activated by both proteolytic and thiol-group reactive activating agents. The immunohistochemical studies in cystic contents showing expression of MMP-1 in radicular cyst indicate that its play an important role regarded as a significant mediator of tissue destruction in cysts. Moreover, the presence of both MMP-2 and MMP-9 in cyst extracts, especially the proteolytically active forms of MMP-2 strongly demonstrated in cyst tissues and its active role in the expansion of cysts with multiple levels of proteolytic cascades.[17-19]

OKC fragments in explant culture showed the secretion of considerable amounts of IL-alpha than the other cyst types and spontaneously secreted both pro and active forms of MMP-9. The extracted epithelial cells from OKCs showed secretion of IL-1 alpha and proMMP-9 without stimulation.[20] Under cultivation on a fibronectin-coated dish, rhIL (Recombinant human inter -leukin)-1 alpha increased the secretion of proMMP-9 from epithelial cells in a dose-dependent method.[20] It also showed increased secretion of proMMP-3 and plasminogen activator urokinase(u-PA) from the epithelial cells and converted the secreted proMMP-3 to the active form in the presence of the plasminogen. The secreted proMMP-9 was also activated in the presence of IL-1alpha and plasminogen fluids.[20]

All these findings suggested that IL-1 alpha may up-regulate not only proMMP-9 secretion but also proMMP-9 activation by including proMMP-3 and u-PA production in the epithelial cells by autocrine/paracrine regulatory mechanism fluids and its responsible for the growth of OKCs.[20]

Genetics

Cell proliferation can be studied by immunohistochemical technique, which is a very easy and relativelyinexpensive method in comparison with other methods like flow cytometry.Immunohistochemicaltechnique maintains the cellular and tissue architectures, has a simple methodology and provides rapidresults. Therefore, it acts as a valuable method for showing the proliferative potential of cell.[21]

PTCH gene:

PTCH1 is a tumor suppressor gene, which encodes a member of the patched gene family.This encoded protein is the receptor for Sonic Hedgehog (SHH). SHH is a molecule which participates inthe formation of embryonic structures and also take part in tumor formation. The nevoid basal cell carcinoma syndrome (NBCCS) is a disease associated with mutations in the PTCH gene. In mammals, threeHedgehog (HH) proteins are known; one is known as Sonic HH, which helps in the formation of teeth.Normally, HH is not bound to PTCH and PTCH has a down regulatory effect on SMO (Smooth ended). Binding of HH toPTCH removes this down regulation on SMO and it starts behaving like an oncogene. 'Loss of functionmutations of PTCH and 'gain of function mutations' of SMO results in oncogenesis.[22]

It was found that there is a difference in cytokeratin, epithelial membrane antigen (EMA) and carcinoembryonicantigen (CEA) immunoreactivity between the parakeratinized and orthokeratinized variant. The orthokeratinized variant showed less aggressive behavior and therefore is considered a different lesionand is named as Orthokeratinized Odontogenic Cyst (OOC).[22]

p53, PCNA and Ki-67:

The proliferative activity of the lining epithelium of OKCcan best be studied bystudying the expression of p53, proliferating cell nuclear antigen (PCNA) and Ki67. These molecules arestrongly expressed in OKC than in other odontogenic cysts. No expression is seen in inactivecells andalso during DNA repair processes. Therefore, Ki- 67 antigen expression is a more reliableimmunohistochemical tool for measuring proliferative activity in human tissues.[23,24]

CD 10:

CD10 is a zinc-dependent, cell surface metallo-endopeptidase, which can be used as a progressionmarker. It works by deactivation and degradation of a wide variety of biologically active peptides. So, the expression of CD10 in the stroma of malignancies is associated with aggressive potential and increased riskof recurrence. CD10 expression in OKC is very high as compared to dentigerous and radicular cystwhich might be due to aggressive behavior and increased risk of recurrence in OKC.[25]

Clinical features

Just like other entities derived from tooth-bearing regions, OKCs also originate from tooth-bearing regions.They occur twice asoften in the mandible as in the maxilla.[26] When OKCs originatefrom the mandible,

the most common location is the posteriorsextant, the angle or the ramus.[27,28] Conversely, theanterior sextant, mainly between canine and lateral incisor, andthe third molar region are themost common sites of origin in themaxilla.[29,30] Large size lesions are particularly common atthe angle and ramus of the mandible.[31]

According to theliterature, OKCs may be located in a periapical position, in apericoronal position or in a lateral root position. In about 30% ofcases, they have no relationships with any dental structures.[29,32] In spite of their aggressive behavior, OKCs, in mostcause minimal bone expansion because of theirtendency to extend along the length of the bone in the intramedullary space.[33]

A systematic review of the literature published in2011 by MacDonald-Jankowski showed that patients of EastAsian origin may present symptoms early, characterized byswelling and pain, while discharge and numbness of the inferioralveolar nerve are described more frequently in LatinAmericans.[34] Unlike other odontogenic lesions having similaraggressive behavior such as ameloblastomas, OKCs infrequentlycause root resorption of adjacent teeth.[32]

OKCs represent approximately 10% of odontogenic cysts andthe reported age distribution is considerably wide (from 8 to82 years), with a peak of incidence in the third decade of life.[35,36,37] Most series have shown a slight preponderance inmales.[32]

The presence of multiple OKCs, also occurring in differentmoments during the lifetime of the patients, is typically associatedwith NBCCS, also known as Gorlin–Goltz syndrome, an autosomaldominant multisystemic disease. In these patients, themean age of incidence decreases to about 25 years old.[38,39,40]

Radiographic features

Among imaging tests, panoramic radiography is still the first option to perform an initial assessment of lesions involving gnathic bones. However, in order to obtain an image with better resolution and spatial dimensioning, with more accurate measurements and capable of showing the proximity of the lesion with adjacent anatomical structures, it is necessary to use computed tomography(CT) and magnetic resonance imaging (MRI). [41,42]

These imaging modalities differ significantly in their technical characteristics, acquisition methods, indications, and information provided. In addition, it is through it that it is possible to better assess tooth resorption and the expansion or rupture of the bone cortex caused by OKC.[41,42]Large lesions, causing significant erosion of the cortical plates and involvement of surrounding structures can be seen in asymptomatic patients.[43]

OKCs are radiographically defined as well-defined unilocular or multilocular radiolucencies surrounded by corticated margins. The unilocular lesions are predominant, whereas themultilocular variant is observed in approximately 30% of cases, most commonly in the mandible.[37,44] On panoramic radiography, mandibular unilocular OKCs may show few and in larger OKCs, incomplete septa are more common compared to smaller OKCs.About 30% of OKCs are associated with an unerupted tooth, most commonly the third molar. Younger patients are more likely to have this condition.[37,44]

The radiographic features ofOKCs are not pathognomonic, particularly in smaller unilocular lesions.[27] When a small unilocular OKC occurs in the anterior sextant of the maxilla, it may simulate other odontogenic and non-odontogenic cysts, such as radicular cyst, lateral periodontal cyst or nasopalatine cyst.[29,45]

Large mandibular OKCs tend to grow predominantly along the length of the bone with minimal bucco-lingual expansion, especially within the body.[27] On panoramic radiography,this peculiar pattern of growth may determine an extensive radiolucent lesion with considerable mesiodistaldimensions without significant cortical expansion.In contrast, large maxillary OKCs have a significant expansion of the alveolar bone and are usually associated with adjacent teeth.[27]

Radiographically, OKCs may present with tooth displacement and root resorption. The latter is a rare radiographic finding, with an incidence of 1.3-11%.[37] The literature reported that the perforation of the cortical bone is not an unusual feature of OKCs, with an intraoperative incidence varying from 39 to 51%. [37]However, such a finding can only be detected very rarely on panoramic radiographs, and it tends to occur only in the alveolar crest.[37]

A cone beam CT (CBCT) and a multi detector CT (MDCT) are two of the most common CT techniques commonly used to evaluate maxillofacial diseases in clinical practice.Due to their ability to generate high-quality multiplanar reconstruction (MPR) images in different planes, both CT modalities are usually considered adequate for diagnosing OKCs and preoperative planning.[46]

A major advantage of CBCT for the evaluation of maxillary and mandibular lesions is its higher spatial resolution when compared with MDCT. However, CBCT does not have a good contrast resolution, which makes it unsuitable for detecting soft tissue contrast. Therefore, CBCT cannot evaluate the extension into soft tissues and can't be used to inject contrast medium.[47]

CBCT is considered more effective at demonstrating bony changes of the jaw cortices (buccal, palatal, or lingual), whereas MDCT is more effective at evaluating internal density and extension into soft tissue in OKCs.With CT imaging, the main radiological features of an OKC can be depicted, such as size, shape (hydraulic or scalloped), margins (well-defined and corticated), internal appearance (uni- or multilocular), and effects on adjacent structures (tooth displacement, root resorption, maxillary sinus floor elevation, inferior displacement of mandibular canal). In addition, CT demonstrates otherfeatures of OKCs, such as bony changes (expansion inbuccolingual/palatal direction and erosion), internal densityand extension into the soft tissue.[47]

For the assessment of cystic lesions of the jaws, MRI is mainly used to complement CT (CBCT or MDCT), and it may be helpful in specific cases to show soft tissue involvement and internal features. MRI images of OKCs display different levels of signal intensity depending on what materials are contained within the lesions.Often, the lesions are represented by large amounts of keratin.[48]

Differential Diagnosis

OKC is associated with an impacted tooth; it may simulates a dentigerous cyst. When an OKC is multilocular and located in the posterior sextant or the ramus of the mandible, it may mimic an ameloblastoma, when an OKC has a periapical position or involves an edentulous area it may mistake for a radicular cyst.[26,47]
The imaging features that are more helpful for diagnosing dentigerous cyst as opposed to OKC are[26,47]

- Unilocular osteolytic lesion around the crown of impactedtooth
- No septa or loculation within the cyst
- More buccolingual expansion in mandible.On MRI, the signal is homogeneous and high in T2-weighting.
- The following imaging features are more effective for pointing to the diagnosis of ameloblastoma than of OKC:[26,47]
- Multilocular osteolytic lesion with multiple internal septa
- More buccolingual expansion in mandible
- More prominent tooth displacement and root resorption
- Post-contrast enhancement of septa and mural nodule(more easily detectable on MRI rather than on MDCT)
- Mean ADC value higher than 2.013 × 10− 3 mm2 s− 1 onDWI

Finally, the imaging features which are more effective for suggesting a diagnosis of radicular cyst rather than of OKC are:[26,27,47]

- Round or pear-shaped unilocular osteolytic lesion
- Epicenter at the apex of a non-vital tooth
- Iron-like density within the cyst (indicator of endodontic overfilling)

Syndromic and non-syndromic multiple OKCs

The presence of multiple OKCs is considered one of the majorcriteria for the diagnosis of NBCCS, and their occurrence maybe the first sign of the disease.[49] NBCCS,an autosomal dominant disease characterized by multiple NBCCS, multiple OKCs, palmar or plantar pits, and falx cerebri calcifications and skeletal defectssuch asbifid, fused or splayed ribs.[50,51]

Other features associated with NBCCS include craniofacial,neurological, sexual, ophthalmic and cardiac anomalies.[52] The literature reported that NBCCS is associated withmutations of a tumor suppressor gene, also called the PTCHgene. A few non-syndromic OKCs also exhibit PTCH gene mutations.[52]

Therefore, some authors suggest that abnormalities of the PTCH gene may contribute to the pathogenesis of OKCs.Additionally, there are multiple OKCs in other syndromes, such as Noonan syndrome, Ehlers-Danlos syndrome, and oral-facial-digital syndrome.[53]

Cysts in syndromic OKCs occur at an early age (first or second decades of life), originate in the posterior sextant of the maxilla, have a more aggressive behavior, and are more likely to recur.[51]

In rare cases, multiple OKCs can be observed without any signs of systemic disease.Multiple OKCs, however, may implicate a syndrome until the contrary is proven, and a patient with multiple OKCs should be followed regularly to assess the appearance of any other systemic manifestations.[54]

Histological features - Pindborg, phillipsen and Henriksen (Pindborg*et al.*, 1962) suggested series of histological features for the diagnosis of OKC which includes:[55]

1. Thin Stratified squamous epithelium lining with ribbon–like appearance typically 8-10 uniform layers thick.
2. Lacks of rete ridges/pegs.
3. Well defined basal cell layer having cuboidal orcolumnar cells arranged in palisaded fashion described as "picket fence or tombstone appearance"

4. A thin spinous cell layerwhich often shows direct transition from basal cell layer (artefactual separation of epithelium from basement membrane) and spinous cell layer intracellular edema.
5. Corrugated and rippled surface keratinization, and mostly parakeratosis (keratinized cells with nuclei).
6. Cystic wall composed of fibrous connective tissue which is thin and usually uninflamed.
7. Other findings are satellite cysts, daughter cysts (7-30%), solid epithelial proliferation, odontogenic rests basal layer budding may be seenfibrous connective tissue wall may get mineralized and may include cholesterol crystals and Rushton bodies.

Histological variants of OKC (based on lining and types of keratin produced)[55]

Parakeratinized	**Orthokeratinized**	**Combination**
Named askerato-cystic odontogenic tumor (KCOT) or True OKC	Orthokeratinizing odontogenic cyst (OOC)	--
Included in classification of Tumor by WHO	Not included	Not included
keratinized cells with nuclei	keratinized cells without nuclei	Both
Incidence-86%	12.2%	1.6
Recurrence rate 47.8 %	2.2%	--
Aggressive surgical required	Conservative treatment --	--

Treatment modalities for KCOT:

Treatment of OKC is usually based on the patient's age, size, and location of the cyst, soft tissue involvement, and histological variant of the lesion. Conservative treatments include Enucleation with or without curettage and marsupialization, while aggressive treatments include peripheral ostectomy with chemical curettage with Carnoy's solution, cryotherapy, or electrocautery.(Zhao *et al*., 2002).[56]

Enucleation:

Itrefers ‘‘to remove whole or clean, as a tumorfrom its envelope. ’Although enucleation helps to providecomplete specimen for histopathologic examination, but itshows recurrence rates as high as 30-60%. A high recurrence rate is attributed to minute satellitecytosis within the fibrous wall, a thin and friable wall of OKCT, and difficulty enucleating it from the bone at one go. of OKCT (Giuliani *et al*.,2006).[57]

Enucleation with Carnoy’ solution:

After enucleation, carnoy’s solution is applied into the cavity. This cauterizing agent contains 3 ml chloroform, 6 ml alcohol, 1 ml glacial acetic acid, and 1 gm ferric chloride. (Blanas*et al*., 2000; Stoelinga, 2003).[58,59]

Enucleation with Peripheral ostectomy:

Peripheralostectomy refers to reducing peripheral bone after enucleation with a powered handpiece and rotary instrument. After enucleation of the lesion,cystic cavity wallsperipheral bone was reduced with handpieces in caudal andcranial direction, followed by filing the defect with iodoform gauge (Stoelinga, 2003).[59]

Enucleation with Carnoy’ solution and Peripheralostectomy:

It has the combined effect of carnoy's solution and peripheral ostectomy. The cyst is first enucleated, then rinsed with saline and then packed with a gauze soaked with carnoy's solution and left for three minutes. It is then rinsed with saline again to see cystic wall remains, which will be dark brown in color and fixed, allowing a complete removal.After that peripheralostectomy is performed and overlying attached mucosa isexcised. Finally, defect is filled with Vaseline- iodoform gauze (Stoelinga, 2003).[59]

Enucleation + Cryotherapy:

Following enucleation of the KCOT, the cavity should be treated with an agent that kills remaining epithelial remnants or satellite cysts. Liquid nitrogen kills epithelial remnants and satellite cysts in the cavity without affecting the osseous inorganic framework. It causes cell death by direct intracellular and extracellular ice crystal formation. It also causes osmotic and electrolyte disturbances in the cell.Bone grafting can be donesimultaneously. (Schmidt and Pogrel, 2001; Jensen *et al*., 1988)Advantages of liquid nitrogen therapy is

that Bony matrix isleft in place to act as scaffold for new osteogenesis. Bone grafts can be implanted immediately to promote healing and reduce the risk of pathological fractures and act as hemostasis agent and also reduce scarring.[60]

Marsupialization (Decompression):

It initially used by Partsch in 1892, this method involves making a 1-cm window in a cyst and suturing the lining of the cyst to the oral mucosa in order to loosen the cyst and enable it to decompress and expose its lining to the oral environment.Mandibular cyst marsupialized into oral cavity and maxillary cyst marsupialized into maxillary sinus andnasal cavity. Cavity is then regularly packed open withiodoform gauze till end osseous healing. In Partsch I, marsupialization is used alone, while in Partsch II, enucleation with primary closure is used (Pogrel, 2005; Seward and Seward, 1969; Partsch, 1892). The effect of marsupialization was studied by Nakamura in 2002 and a formula was developed to determine the reduction rate (RR) on the basis of pixel count before and after marsupialization.RR (%)= X (Pixelcount Before marsupialization) – Y (Pixel count aftermarsupialization / X x 100.It showed greater the reduction rate, higher the success rate(Nakamura *et al*., 2002).[61]

Marsupialization with Cystectomy: (Waldron's method)

Itis a two staged technique. Firstly, the cystic cavity is marsupialized and packed with iodoform gauge. Later, when the cavity gets smaller, enucleation is performed and the complete tissue is sent for histological analysis.This techniqueis done in cases of large cysts and vital structure are presents nearby. To detect any occult pathology, to prevent pathological fractures, it fastens healing process. Disadvantage is that patienthas to undergo two surgeries (Tolstunov and Treasure, 2008)[62]

Resection:

Resection is to either segmental resection (surgicalremoval of a segment of the mandible or maxilla withoutmaintaining the continuity of the bone) or marginal resection(surgical removal of a lesion intact and a small area ofuninvolved bone, maintaining the continuity of the bone).Resection have the lowest recurrence rate (0%) but the highestmorbidity rate because reconstructive measures are necessaryto restore jaw function and aesthetics. (Blanas*et al*., 2000)

Recurrence of OKC/KCOT:

It has high recurrence rateranging from 25-60%. More meticulous surgical treatment reduces the chances of recurrence Most cases reported recurrence within 5 years of treatment The mean time between recurrence for males was 4 years and for females, it was 7 years.There have been few caseswhere recurrence was reported even after 10 years also. Solong term follow up in necessary. The causes and factorsresponsible for KCOT recurrence are:

1. Incomplete removal of cystic lining
2. The thin and friable nature of epithelial lining,
3. Higher level of cell proliferative activity in theepithelium.
4. Budding in the epithelium's basal layer
5. Bony perforation.
6. Adherence to adjacent soft tissue.
7. Separation of the epithelial lining into supra and subepithelial layers.
8. Parakeratinization of the surface layer
9. Remnants of the dental lamina epithelium not associated with original OKC and development in the adjacent area.
10. Growth of a new OKC from satellite cysts, daughter cysts, remnants, and cell rests.

1.enucleation 30 %
2.enucleation + carnoy's solution: 9 %
3.enucleation + peripheral ostectomy 18 %
4.enucleation + carnoy's solution + peripheral ostectomy 8%
5.enucleation + cryotherapy 38 %
6.marsupialization 33%
7.marsupialization + cystectomy 13
8.Resection 0%

II. Conclusion:

The odontogenic keratocyst (OKC) is a benign lesion that is of odontogenic origin and exhibits aggressive behavior. It accounts for about 10% of all odontogenic cysts. OKCs can be diagnosed and managed with the help of radiological imaging, mainly computed tomography (CT) and, in selected cases, magnetic resonance imaging (MRI). Although radiological imaging does not always provide a specific diagnosis, understanding atypical and typical radiological features of OKCs is essential to their diagnosis and treatment. In particular, the combination of clinical, radiological, and histological findings is useful for analyzing the extent of lesions and their relationships with neighboring structures. It is concluded that contrary to the majority of the literature available, odontogenic keratocysts can present with atypical behavior and characteristics, such as cortical bone expansion, displacement of the teeth, facial asymmetry, and painful symptoms. Despite the aggressive biological characteristics of the OKC, the best treatment for it was complete enucleation. In light of the relatively high recurrence rate, especially after conservative surgery, it is necessary to perform periodic radiographic monitoring on patients with surgically treated OKCs, at least for the first five years.

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