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DIAGNOSTIC IMAGING OF SOFT TISSUE CAlCIFICATION& OSSIFICATION IN THE MAXILLOFACIAL REGION

A Project Submitted to

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بسماللهالرحمنالرحيم

قَالُواسُبْحَانَكَلَاعِلْمَلَنَاإِلَّا مَاعَلَّمْتَنَاإِنَّكَأَنتَالْعَلِيمُالْحَكِيمُ

صدقاللهالعظيم

سورةالبقره(آية ٣٢)

Certification of the Supervisor

I certify that this project entitled "DIAGNOSTIC IMAGING OF SOFT TISSUE CAlCIFICATION& OSSIFICATION IN THE MAXILLOFACIAL REGION"

under my)was prepared by the fifth-year student(Jomana Ibrahim Hamed supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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Certification of the Discussion Committee

We, the members of the discussion committee, certify that we have read and examined this graduation project and that in our opinion it of a graduation project. meets the standard.

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Signature

Approved by the head of Oral diagnosis department at the college of dentistry, University of Baghdad.

Signature

Dedication

We dedicate this project to God Almighty our creator, our strong pillar, our source of inspiration, wisdom, knowledge and understanding. He has been the source of our strength and on His wings only we have soared And with all the love and respect, we dedicate this project to our lovely mother, father, brother, sister and our friends for their great support and for always believing in us.

To our all friends and colleagues.
Finally, to our supervisor who encourages us to keep go.

Acknowledgement

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LIST OF ABBREVIATION	
DC	DYSTROPHIC CALCIFICATION
MMC	MONCKEBERG'S MEDIAL CALCINOSIS
HB	HETEROTOPIC BONE
OC	OSTEOMA CUTIS
MOT	LOCALIZED (TRAUMATIC) MYOSITIS OSSIFICANS
CT	COMPUTED TOMOGRAPHY

CBCT	CONE BEAM COMPUTED TOMOGRAPHY

INTRODUCTION

Heterotopic calcification refers to the deposition of calcium salts, especially calcium phosphate in a non organized form. They are often detected accidentally. Epidemiologically, such calcifications are often seen in patients over 40 years of age, although reports regarding their occasional detection in children also exist (Thakur, 2008 ; Çağlayan,2014)

Heterotopic calcifications may be divided into three categories:

- Dystrophic calcification
- Idiopathic calcification
- Metastatic calcification

Dystrophic calcification refers to calcification that forms in degenerating, diseased, and dead tissue despite normal serum calcium and phosphate levels. The soft tissue may be damaged by blunt trauma, inflammation, injections, the presence of parasites, soft tissue changes arising from disease, and many other causes. This calcification usually is localized to the site of injury(White and Pharoah, 2009).

Idiopathic calcification (or calcinosis) results from deposition of calcium in normal tissue despite normal serum calcium and phosphate levels. Examples include chondrocalcinosis and phleboliths. (White and Pharoah, 2009)

Metastatic calcification results when minerals precipitate into normal tissue as a result of higher than normal serum levels of calcium (e.g., hyperparathyroidism, hypercalcemia, of malignancy) or phosphate (e.g., chronic renal failure). Metastaticcalcification usually occurs bilaterally and symmetrically.(White and Pharoah, 2009)

While Heterotopic ossification (HO) is the presence of bone in soft tissue where bone normally does not exist. The acquired form of HO most frequently is seen with either musculoskeletal trauma, spinal cord injury, or central nervous system injury. (Shehab, 2002)

Many patients are referred to the radiology department for evaluation of a soft tissue lesion in daily practice. The vast majority of soft tissue lesions are benign, with a very good outcome after resection. Malignant soft tissue lesions are rare, but they are potentially life-

threatening and may pose a diagnostic and therapeutic challenge (Fletcher,2013).

It is the task of the radiologist to differentiate lesions that are certainly benign from those that are not, and to provide a differential diagnosis for lesions that appear malignant or are of unclear nature in terms of benignancy or malignancy on imaging(Wu ,2009).

Differentiation between calcifications and ossification is very important in making the correct (differential) diagnosis. Radiography is usually the initial imaging modality by which soft tissue calcifications and ossification are detected. Calcifications normally appear as mineralized densities, whereas mature bone shows an outer cortex and inner trabecular pattern.CT is more sensitive in detecting calcifications and ossification. Calcifications usually demonstrate uniformly low signal intensity on all MRI sequences. Sensitivity for the detection of small calcifications may be improved by using gradient echo and susceptibility-weighted imaging. Phase images from susceptibility-weighted imaging may also allow for a better distinction between calcifications and other causes of susceptibility variations .Therefore, it is important to correlate MRI with other imaging modalities (including radiography, CT, and ultrasound) when available.(Freire, 2018)

Aim of study

This review project designed to provide an overview about the scope of the soft tissue calssification& ossification in the maxillofacial region with sufficient knowledge that focusing on the diagnostic imaging modalities that arevaluable in the detection of them.

Chapter 1

Review of Literature

Chapter 1

1.1 **Dystrophic Calcification**

GENERAL DYSTROPHIC CALCIFICATION OF THE ORAL REGIONS

Definition

Dystrophic calcification occurs in soft tissue tissues that normally do not contain such deposits and result due to chronic inflammation, necrosis or scarring. The deposition of mineral salts in dead or degenerating tissues is referred to as dystrophic calcification(Shroff,2007)

CLINICAL FEATURES

- Soft tissue sites - gingiva, tongue, lymph nodes, and cheek
- No signs or symptoms
- Occasionally enlargement and ulceration of overlying soft tissues may occur
- A solid mass of calcium salts can be palpated.(Weissleder,2011)

Radiographic Features

Soft tissue calcifications in oral and maxillofacial region are relatively common. They are most often detected as incidental findings on routine radiographic examination. However, some soft tissue calcifications may be serious and require treatment or follow-up of the underlying cause. The anatomic location, number, distribution, and pattern of the calcifications are important interpretative criteria in radiographic evaluation of soft tissue opacities(Omami,2016).

The radiographic appearance of dystrophic calcification varies from barely perceptible, fine grains of radiopacities to larger,

irregular radiopaque particles that rarely exceed 0.5 cm in diameter. One or more of these radiopacities may be seen, and the calcification may be homogeneous or may contain punctate areas. The outline of the calcified area usually is irregular or indistinct. Common sites are long standing chronically inflamed cysts and polyps (White and Pharoah, 2009).

1.1.1. Calcified Lymph Node

Definition

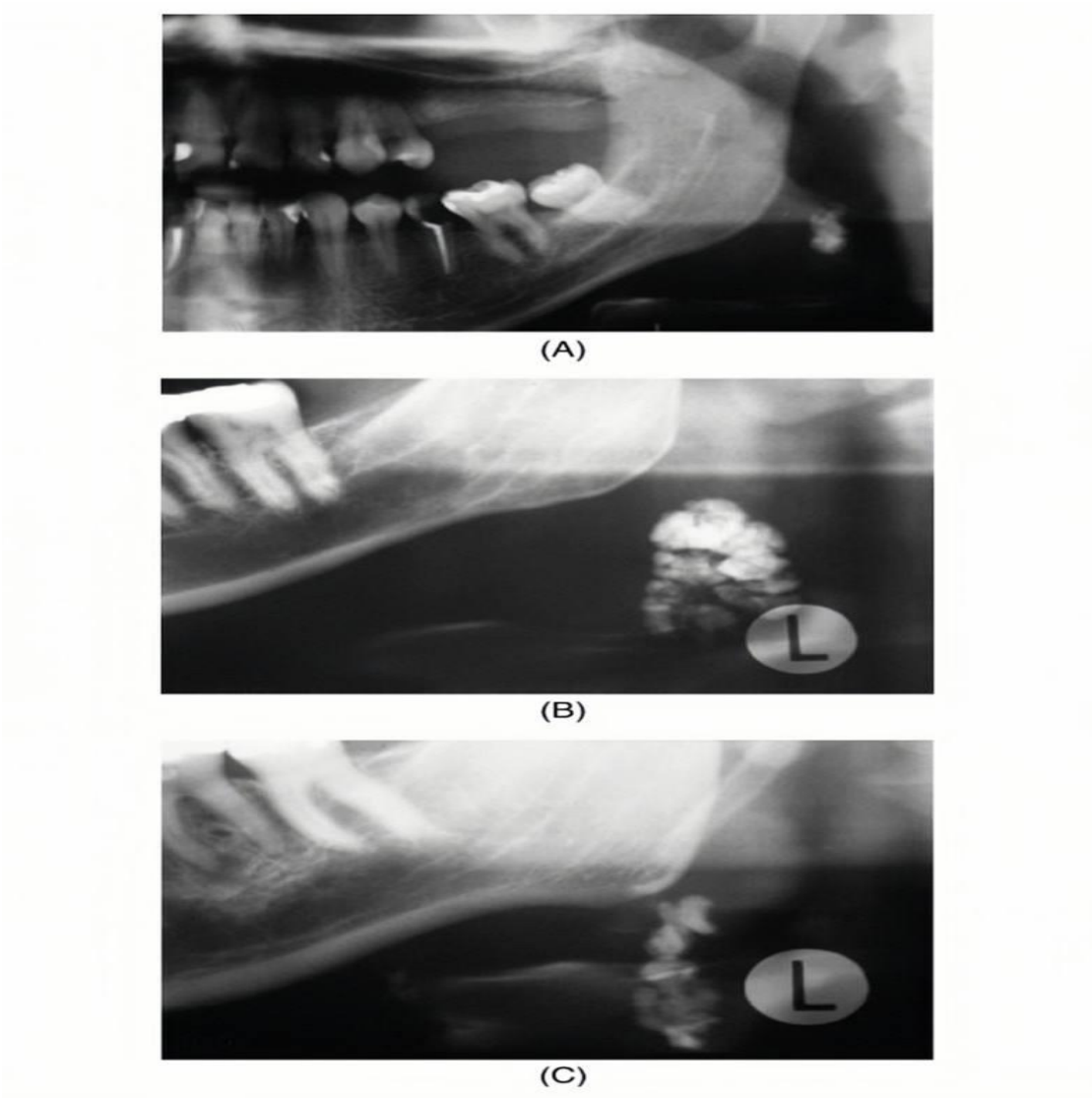
Lymph nodes in the head and neck are usually enlarged during inflammatory processes. Subsequently, the nodes become fibrous and foci of calcification start to develop. Tuberculous lymphadenitis (scrofula) is probably the most prevalent disease process associated with dystrophic calcification of sclerotic nodes.(Muto,1991)

CLINICAL FEATURES

A calcified lymph node usually is asymptomatic, but the clinician may be able to detect it on palpation. In many cases, patients who have a history of chronic inflammation in the area or patients who have been treated for lymphoma commonly present with calcified nodes.(Williams,1987)

Radiographic Features

Radiographically, these calcifications usually appear as distinct, irregularly shaped opacities. The irregular shape is a radiographic trademark and may be described as "cauliflower-like." In dental practice, they are most often observed on panoramic films, where they present below the inferior border of the mandible and near the mandibular angle(Williams,1987).



(Fig1-1):Calcified lymph nodes, cervical lymph nodes are cauliflowershaped and chain-like.(Ghom,2009)

Management

No treatment has been suggested for calcified lymph nodes other than noting its presence and radiographic and clinical monitoring(Williams,1987).

1.1.2. TONSILLITIS

Definition

Tonsillitis refers to inflammation of any of the tonsils and is one of the most common head and neck infections in adolescents and young adults.

Tonsilloliths range from small to very large areas of calcifications thought to beresulting from recurrent tonsillitis and retention of bacterial debris in the tonsillarcrypts.Others believe the etiology is due to stasis of saliva in the efferent ducts ofthe accessory salivary gland, secondary to mechanical obstruction arising from posttonsillectomyscars or chronic inflammation.(Cooper,1983)

CLINICAL FEATURES

The affected patient is usually a youngadult with a long history of recurrent sore throats. The patient may be asymptomatic or may complain of persistent throat irritation, foul taste and odor, otalgia, or foreign bodysensation. The mineralized material in tonsilloliths has been reported to be primarilycalcium hydroxyapatite and calcium carbonate apatite(Pruet,1987).

Radiographic features

Tonsilloliths may be discovered on routine films in asymptomatic patients.These calcifications are also oftenvisible on panoramic images as small opaque masses in soft tissues near the anteriorborder of the oropharyngeal airway space. Axial CT sections may demonstratethese lesions and may provide additional information when differentiation amongcalcification of the lymph nodes, salivary glands or tonsils, or other potentially calcifiedstructures in the region is difficult(Aspestrand,1987).

With regard to therapy, a tonsillolith can usuallybe removed by curettage under local anesthesia(Castellano 1966 ;Hiranandani, 1967).

(Fig 1-2):The arrows point to the tonsillolith located in the right ramus of the mandible.(Caldas,2007)

Manegement

An incision is often necessary toexpose it. Tonsillectomy is indicated for patients with chronic tonsillitis(Castellano 1966 ;Hiranandani, 1967).

1.1.3 CYSTICERCOSIS

Definition

Cysticercosis (i.e., tapeworm infection)The larval stage of the pork tapeworm, Taenia solium, causes the clinical syndrome of cysticercosis, with humans as deadend hosts after ingestion of T. solium eggs. Its clinical effects vary depending on site of larval lodging, larval burden, and host reaction. These effects include seizures, headaches, focal neurologic symptoms, visual disturbances, and localized skeletal muscle nodules and pain. Cysticercosis should be considered in any patient from an endemic area presenting with these symptoms.(Kraft,2008)

Clinical Features

Mild cases of cysticercosis are completely asymptomatic. More severe cases have symptoms that range from mild to severe gastrointestinal upset with epigastric pain and severe nausea and vomiting. Invasion of the brain may result in seizures, headache, visual disturbances, acute obstructive hydrocephalus, irritability, loss of consciousness, and death. Examination of the oral mucosa may disclose palpable,wellcircumscribed soft fluctuant swellings, which resemble a mucocele or benign mesenchymal neoplasm. Multiple small nodules may be felt in the region of the masseter and suprahyoid muscles and in the tongue, buccal mucosa, or lip.Calcifications of the atherosclerotic plaque is the form of a complicated atherosclerotic lesion. It is characterized by granular or massive deposits of calcium chloride inside the atherosclerotic plaque. It was found in at least one of the three main coronary arteries in 43 (86.00%) out of 50 autopsy cases(Kraft,2008).

Radiographic Findings

In skeletal muscles, cysticerci appear as oblong calcific specks in the skeletal muscles parallel to the muscle fibres, giving a characteristic appearance which has been termed rice-grain calcification owing to its resemblance to rice grains(Niknejad,2023).

- Location. The locations of calcified cysticerci include the muscles of mastication and facial expression, the suprahyoid

muscle, and the postcervical musculature, as well as in the tongue, buccal mucosa, or lip.

- Periphery and Shape. Multiple well-defined elliptic radiopaci- ties are viewed, resembling grains of rice.
- Internal Structure. The internal aspect is homogeneous and radiopaque. (White and Pharoah, 2009)

Treatment

Treatment varies with the clinical presentation. Parenchymal neurocysticercosis generally is treated with albendazole in conjunction with steroids to limit edema and with antiepileptic medications for seizure control. Ocular and extraocular muscle cysticercosis generally requires surgical intervention. Skeletal muscle cysts are surgically removed only if painful. Because cysts can lodge in multiple locations, all patients with cysticercosis should have an ophthalmologic examination to rule out ocular involvement, and all patients with extraneurologic cysticercosis should have computed tomography or magnetic resonance imaging of the brain to rule out neurocysticercosis(Niknejad,2023).

1.1.4. Arterial Calcifications

Two distinct patterns of arterial calcification can be identified both radiographically and histologically, Monckeberg's medial calcinosis and calcified atherosclerotic plaque.(White and Pharoah, 2009)

1.1.4.1.MONCKEBERG'S MEDIAL CALCINOSIS (ARTERIOSCLEROSIS)

It is a disease of unknown etiology, which consists in medial arterial calcification. This calcification is usually circumferential and may affect the vessel either focally or diffusely(Lanzer,2014).

Its incidence is higher in diabetics and elderly people, and its appearance predicts the risk of cardiac and peripheral vascular diseases, increasing the rates of limb amputations(Santos,2008).

Clinical Features

The clinical repercussion is scarce because the reduction of the lumen is minimal, unless it is overlapped with a process of atherosclerosis, where the clinical manifestations become more evident and serious(Ottillinger,2001).

Radiographic Findings

Knowledge of the radiographic appearance of this calcification is clinically useful in developing a differential diagnosis. The proper interpretation of radiographic images presupposes a thorough knowledge of the anatomy, distribution, number, size, and shape of the calcifications.Mönckeberg medial calcinosis is usually discovered incidentally upon imaging of the maxillofacial region. The calcified vessel appears as a parallel pair of thin, radiopaque lines that may have a straight course or a tortuous path, showing a pattern of blood vessels that looks like railroad tracks.(Kröger, 2006 ; Castling, 2015)

Carotid artery calcifications and phleboliths are calcifications that can be seen in the same location on a panoramic radiograph. Carotid artery calcifications radiographically appear as curvilinear irregular parallel radiopacities in the soft tissues of theneck at or below the third and fourth cervical vertebrae, and inferior and lateral to the hyoid bone.(Carter, 2000;Friedlander, 2006)

(Fig 1-3): A section of a panoramic image showing calcification of a blood vessel, probably the facial vein. (White and Pharoah, 2009)

Management

Evaluation of the patient for occlusive arterial disease and peripheral vascular disease may be appropriate. In addition, hyperparathyroid- ism may be considered because medial calcinosis frequently develops as a metastatic calcification in patients with this condition(White and Pharoah, 2009)

1.1.4.2CALCIFIEDATHEROSCLEROTIC PLAQUE

Definition

Atheromatous plaque in the extracranial carotid vasculature is the major contributing source of cerebrovascular embolic and occlusive disease. Dystrophic calcification can occur in the evolution of plaque within the intima of the involved vessel(White and Pharoah, 2009)

Calcifications of the atherosclerotic plaque is the form of a complicated atherosclerotic lesion. It is characterized by granular or massive deposits of calcium chloride inside the atherosclerotic

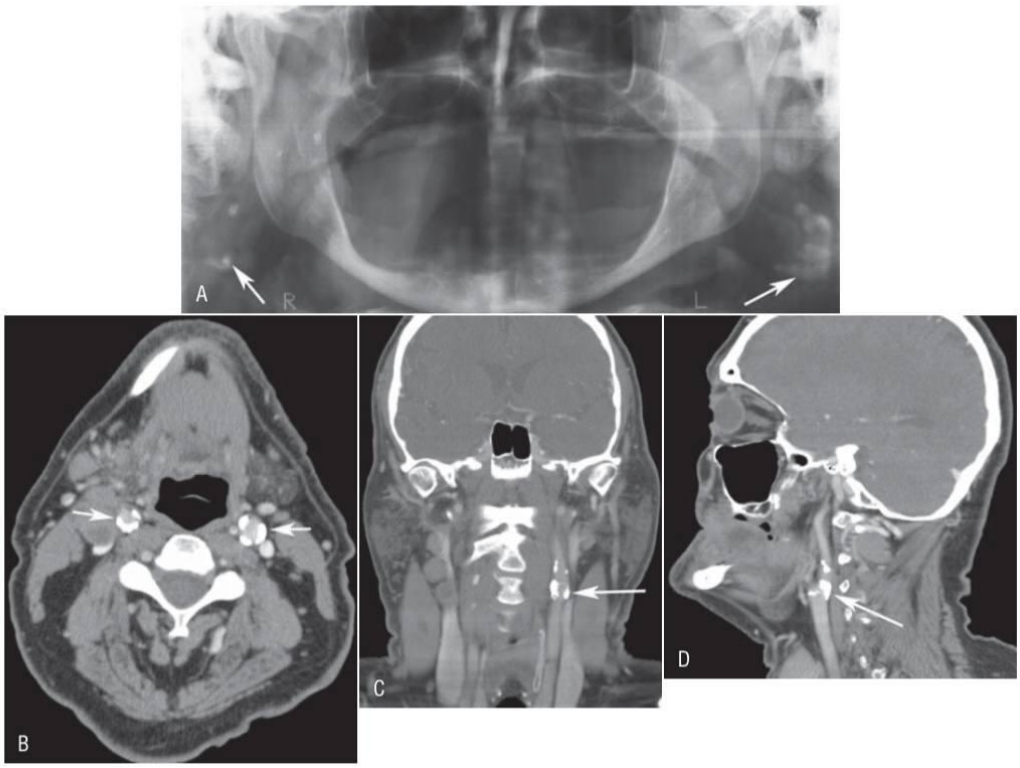
plaque. It was found in at least one of the three main coronary arteries in 43 (86.00%) out of 50 autopsy cases(Vucković,1996)

Clinical features

Arteriolosclerosis is a generalised systemic vascular disease which is characterised by hyalinisation of intima (hyalinosis) as well as proliferation and hypertrophy of the media in the arteriolar part of the arterial system (so-called benign arteriolosclerosis). However, the patients suffering from accelerated and malign hypertension develop also fibrinoid necrosis (so-called malign arteriolosclerosis, arteriolonecrosis). Arteriolosclerosis as well as other similar stenotic (obliterating, obstructive, occlusive) diseases of the arterial system, have one single common consequence--ischemia. Currently, angio-organic ischemic syndromes in the whole world most frequently result from atherosclerosis which, however, is not the only nosologic unit of the group of arterial diseases having the tendency to develop arterial wall sclerosis. The latter group is briefly referred to as arteriosclerosis. In addition to atherosclerosis, this group includes also Mönckeberg's medial arteriosclerosis,diabetic angiopathy and arteriolosclerosis(Gavornik,2001)

Radiographic Features

- Location:Medial calcinosis involving the facial artery or, less commonly, the carotid artery, may be viewed on panoramic radiographs.
- Periphery and Shape:The calcific deposits in the wall of the artery outline an image of the artery. From the side, the calcified vessel appears as a parallel pair of thin, radiopaque lines that may have a straight course or a tortuous path and is described as a "pipe stem" or "tram-track" appearance.
- In cross-section, involved vessels will display a circular or ringlike pattern.
- Internal Structure. There is no internal structure because the diffuse, finely divided calcium deposits occur solely in the medial wall of the vessels(White and Pharoah, 2009)



(Fig 1-4):A,Panoramic image with bilateral examples of calcifications associated with the carotid arteries (arrows). B, Axial CT image of the same case with soft tissue algorithm showing bilateral calcification with the walls of the carotid arteries (arrows). C and D, Coronal and sagittal CT images of the same case demonstrating the carotid calcifications (arrows)(White and Pharoah, 2009)

1.2. Idopathic Calcification

1.2.1.Sialolith

Definition

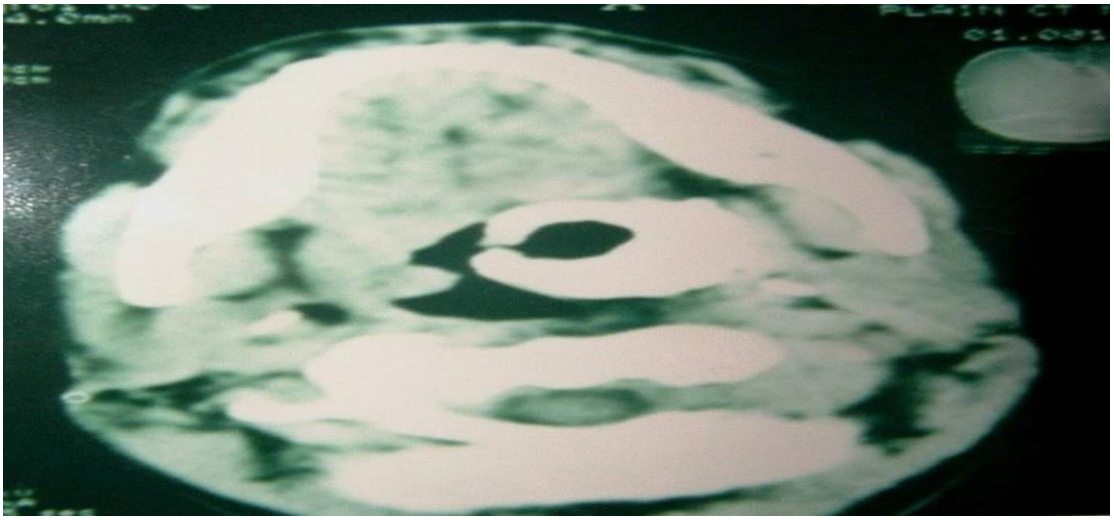
A sialolith is commonly defined as an aggregation of calcified material foundwithin the ducts or glandular tissue of salivary glands.It is also referred to as a salivarystone or salivary gland calculus. It is one of the most frequent disorders of salivaryglands, second only to viral parotitis (mumps). Patients can be afflicted any time fromthe first decade of life on, with the peak incidence occurring between the fourth and the sixth decades(Rabinov, 1984)

Clinical features

Submandibular gland sialolithiasis is generally asymptomatic in nature. The symptoms include pain and swelling of the involved gland caused by the accumulation of saliva due to blockage of the lumen of Wharton’s duct by a salivary calculus. Recurrent infections may occur due to the ascent of bacteria into the parenchyma of the gland. All our patients suffered from pain and infection for 1 week to as long as 2-3 years (Pachisia, 2019)

Radiographic features

Sialoliths may be discovered on routine films in asymptomatic patients.Submandibular sialoliths may appear on a periapical film as a radiopacity superimposedover the alveolar bone and possibly the roots of mandibular teeth. Submandibularsialoliths are difficult to see on panoramic films because most of Wharton's duct in notwithin the focal trough. If a sialolith is suspected, a mandibular occlusal film isindicated. Parotid sialoliths may be seen on a panoramic film superimposed over theramus .Detection of sialolithiasis can also be aided with the use of sialography.This procedure involves the injection of radiopaque contrast medium into the duct systemof a major salivary gland. Computed tomography is superior to sialography alone in theassessment of space-occupying lesions of salivary glands; however it may be used inconjunction with sialography(van den Akker,1988)



(Fig1-5):CT scan showing stone in oral cavity.(Thakur,2008)

Treatment

A tonsillolith can usuallybe removed by curettage under local anesthesia. An incision is often necessary to expose it. Tonsillectomy is indicated for patients with chronic tonsillitis(Hiranandani,1967)

1.2.2. Phleboliths

Phleboliths are literally "vein stones", and represent calcification within venous structures (Traubici,1999;Guest,2001).

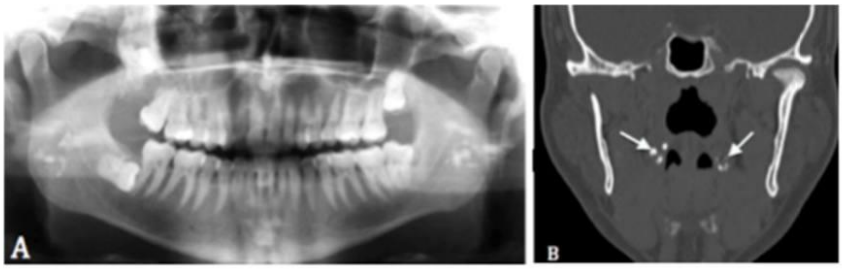
Phleboliths: are venous calcifications which, in the major- ity of cases, are observed in thrombosed veins, especially in the legs. In the head and neck region, phleboliths more frequently occur in association with vascular lesions, such as haemangiomas and arteriovenous malformations located within the soft tissues in this region(Ghom, 2009)

Clinical Features

The involved soft tissue may be swollen or discoloured by the presence of venous or a soft-tissue haemangioma. Applying pressure to the involved tissue should cause a blanching or change in colour if the lesion is vascular in nature..(Ghom, 2009)

Radiographic features

Phleboliths appear as focal calcifications, often with radiolucent centres (if present, a helpful sign to distinguish them from urolithiasis). This appearance is attributed to calcification peripherally within the vessel and is frequently seen on abdominal radiographs (66% of phleboliths 2). It can also be seen on CT provided thin sections are obtained at 5 mm thick slices, radiolucent centres will be inapparent in 99% of phleboliths .



(Fig 1-6) :Phleboliths. A; panoramic view demonstrate phleboliths seen as multiple regular faint radiopacities in the submandibu lar space. B; Coronal CBCT image of a 27-year-old asymptomatic female shows phleboliths associated with venous malfor mation in the cheek.

1.2.3. Rhinoliths

Definition

They are calcareous concretions that are formed by the deposition of salts on an intranasal foreign body. This intranasal foreign body which may incidently or accidently access the nasal cavity then act as the nucleus thus becoming a focal pointfor encrustation(Shah,2010)

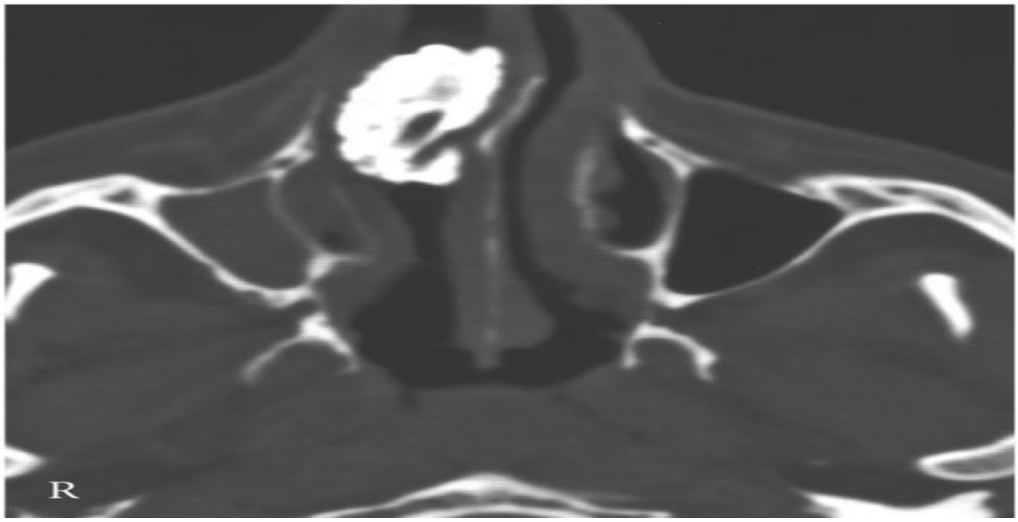
Clinical features

Rhinoliths occur in a variety of shapes and sizes and their internal structure may present as homogeneous or heterogeneous radiopacities with occasional laminations, depending on the nature of the nidus. The density occasionally exceeds that of the surrounding bone(Lin,2015 ; Adib,2018)

Radiographic Features

- Location; Rhinoliths develop in the nose, whereas antroliths develop in the antrum of the maxillary sinus
- Periphery and Shape.;These stones have a variety of shapes and sizes, depending on the nature of the nidus.
- Internal Structure; They may present as homogeneous or het erogeneous radiopacities, depending on the nature of the nidus, and

may sometimes have laminations. Occasionally the density will exceed the surrounding bone(White and Pharoah, 2009)



(Fig1-7):Axial CT scan showing the rhinolith in the right nasal cavity, with consecutive shadowing of the right maxillary sinus(Brehmer,2010)

Manegment

The treatment of choice is surgical removal under local or general anesthesia(Yaşar,2009).These rhinoliths were removed using zero° rigid nasal endoscope(AYUBE, 2012)

1.3. Metastatic calcification

In metastatic calcification, the calcium is deposited in normal tissues, as a result of abnormalities in calcium and or phosphate metabolism that leads to hypercalcaemia or hyperphosphataemia, Generally, there are widespread calcifications, affecting mainly blood vessels, kidneys, lungs and gastric mucosa, and cutaneous and subcutaneous tissues may be involved, but are frequently periarticular, therefore not involving the face. metastatic calcifications, and when this condition is sus pected in patients undergoing a dental assessment, they must be referred for a medical assessment. The most com mon cause of cutaneous metastatic calcification is chronic renal failure, resulting in secondary hyperparathyroidism(Ghom, 2009)

1.4. Heterotopic Bone

Heterotopic Ossification (HO), also known as paraosteoarthopathy, myositis ossificans, and heterotopic calcification1 among others, is a commonly occurring condition that refers to ectopic bone formation in soft tissues. HO can be subdivided into two major types: acquired and genetic, with acquired being the most predominate. Acquired HOis closely related to tissue trauma and can be seen after joint surgery, musculoskeletal trauma, central nervous system injury, and even burns. HOdevelops in up to 44% of patients undergoing hip arthroscopy or replacement, 10-20% of those with CNS injury, and 4% of those with burns covering greater than 30% of body surface(Cholok,2018)

OSSIFICATION OF THE STYLOHYOID LIGAMENT

Definition

The stylohyoid complex is composed of several structures such as the styloid process of the temporal bone, the lesser horn of the hyoid bone, and the stylohyoid ligament between these structures (Antić et al., 2016)

Stylohyoid ligament is a fibrous remnant of the Reichert's cartilage of the second pharyngeal arch. Its ossification is more common in Caucasians (Morrison,2012)

Ossification of the stylohyoid ligament usually extends downward from the base of the skull and commonly occurs bilaterally. However, in rare cases the ossification begins at the lesser horn of the hyoid and in fewer still in a central area of the ligament(White and Pharoah, 2009)

Clinical features

The ossified ligament usually can be detected by palpation over the tonsil as a hard, pointed structure. Only a minority of patients have symptoms and there is very little correlation between the extent of ossification and the intensity of the accompanying symptoms. Symp toms related to this ossified ligament are termed Eagle syndrome(White and Pharoah, 2009)

Eagle's syndrome is rare condition described in 1937 by W. Eagle, and is secondary to the elongation of the styloid process and/or calcification of the stylohyoid ligament. Although it occurs asymptomatically in the majority of cases, the pressure exerted by this alternative structure from an anatomical point of view against the neighbouring areas can trigger a great variety of symptoms. It is often wrongly diagnosed, leading to multiple interconsultations with different professionals. This means that the professional must take it into account in those cases of pain in the maxillofacial region without any clear aetiology(Aguaviva,2020)

Radiographical features

A 3-dimension cone beam computed tomography (CBCT) confirmed the clinical suspicions.(Aguaviva,2020).

Calcification of stylohyoid ligament is relatively a common incidental finding on panoramic radiograph . It appears as a thin, long, tapering radiopaque process extending downwards from the styloid process. The farther the mineralized ligament extends toward the hyoid bone, the more likely be interrupted by radiolucent junctions (pseudoarticulations) (Fig 1-8).(Omami, 2016)

(Fig 1-8) A 31-year-old asymptomatic male with calcified stylohyoid ligaments. Panoramic radiograph shows bilateral cal- cification of the stylohyoid ligaments (long arrows). Note the pseudoarticulated pattern of the calcification (short arrow) .(Omami , 2016)

Treatment

The treatment consisted of partial resection of both styloid processes(Aguaviva,2020)

1.4.1Osteoma cutis

Definition

Osteoma cutis or cutaneous ossification is a rare and benign dermatological disease characterized by bone formation in the dermis or subcutaneous tissue. It can be either primary when it occurs de novo without a preexisting disease or secondary when it develops in association with an underlying condition such as trauma, neoplastic orinflammatory diseases(Pinzón-Osorio,2020). Osteoma cutis can affect children as well as adults. Primary osteoma cutis accounts for 15% of the patients, whereas secondary osteoma cutis represents 85% of the cases. The histogenesis of this dermatological condition has not been fully established(Barolet ,2020)

Clinical features

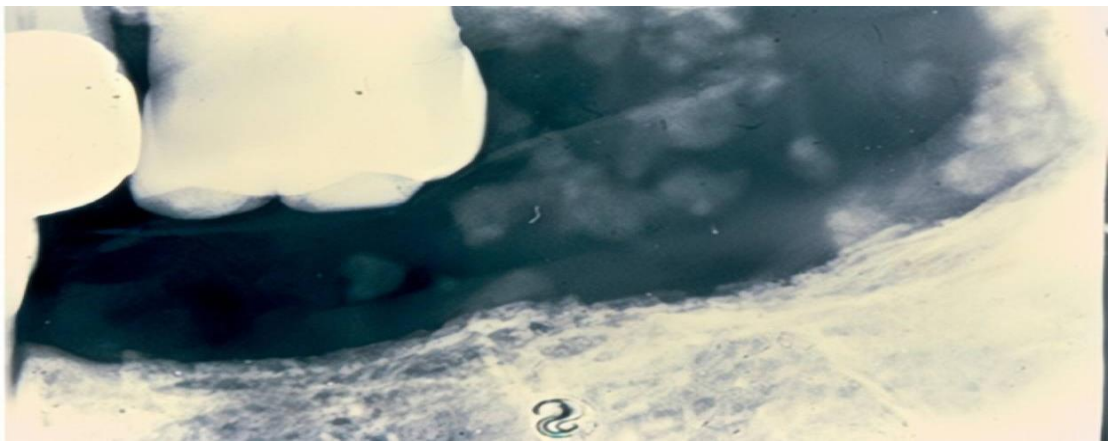
Osteoma cutis can occur anywhere, but the face is the most common site. The tongue is the most common intraoral site (osteoma mucosae or osseous choristoma). OC does not cause any visible change in the overlying skin other than an occasional color change that may appear yellowish white. If the lesion is large, the individual osteoma may be palpated. A needle inserted into one of the papules is met with stonelike resistance. Some patients have numerous (dozens to hundreds) of lesions, usually on the face in females and on the scalp or chest in males. This form is known as multiple miliary osteoma cutis(White and Pharoah, 2009)

Radiographical features

Osteoma cutis is a radiopaque regularly outlined lesion that can occasionally have a radiolucent center. The density of osteoma cutis is identical to the bone. Different shapes of OC are described, including donut-or snowflake-like or washer-shaped(Alhazmi ,2019)

- The conventional 2D radiograph is an imaging study that poses diagnostic difficulties, especially regarding the interpretation and the location of osteoma cutis(Alhazmi ,2019).
- Cone-beam CT, with its three-dimensional (3D) capabilities, is a beneficial and accurate imaging modality that helps to detect and establish the diagnosis of osteoma cutis(Alhazmi ,2019).

They also classified the imaging appearance of osteoma cutis into four distinct categories: single nodular, plate-like, transepidermal, and multiple military (Daniah, 2017)



(Fig 1-9)Osteoma cutis. Periapical radiograph shows calcified acne scars in the cheek(Omami , 2016).

Management

The treatment modalities of osteoma cutis depend on several factors, including its severity, extension, location, and etiology(Cohen ,2001)

Among the different treatment options, we can distinguish between non-invasive and invasive modalities.Non-invasive treatment options include the application of tretinoin cream with limited results essentially

in small and superficial lesions. Invasive treatment modalities include a combination of dermabrasion and punch biopsy, erbium:yttrium-aluminum-garnet (YAG) laser, scalpel incisions, curettage, and CO2 laser (Fulton,1987 ; cohen 2001)

Concerning secondary osteoma cutis, the associated metabolic abnormalities must be investigated and treated accordingly. For instance, patients with pseudohypoparathyroidism may need calcitriol and calcium replacement therapy when hypocalcemia occurs (Ward,2011)

1.4.2. Localized (Traumatic) Myositis Ossificans

Myositis ossificans is a self-limiting, benign ossifying lesion that can affect any type of soft tissue, including subcutaneous fat, tendons, and nerves. It is most commonly found in muscle as a solitary lesion. Ossifying soft-tissue lesions historically have been inconsistently classified. Fundamentally, myositis ossificans can be categorized into nonhereditary and hereditary types, with the latter being a distinct entity with a separate pathophysiology and treatment approach (Walczak, 2015). Myositis ossificans traumatica (MOT) is a rare musculoskeletal disorder in young children. Clinical and imaging presentation in the early stage of disease makes it difficult to differentiate between infection and musculoskeletal neoplasms, particularly in the absence of a history of trauma(Gindele,2000)

Clinical features

The overlying skin may be red and inflamed, and when the lesion involves a muscle of mastication, opening the jaws may be difficult. After about 2 or 3 weeks, the area of ossification becomes apparent in the tissues; a firm intramuscular mass can be palpated. The localized lesion may enlarge slowly, but eventually it stops growing. The lesion may appear fixed, or it may be freely movable on palpation(White and Pharoah, 2009)

Radiographic Features

- Location. The most commonly involved muscles of the head and neck are the masseter and sternocleidomastoid. However, other muscles of mastication may be involved, such as the medial and lateral pterygoid and the temporalis muscles. The anterior attachments of the temporalis as well as the medial pterygoid muscles are at risk of injury on administration of mandibular block anesthesia. Usually a radiolucent band can be seen between the area of ossification and adjacent bone, and the heterotopic bone may lie along the long axis of the muscle
- Periphery and Shape. The periphery commonly is more radiopaque than the internal structure. There is a variation in shape from irregular oval to linear streaks (pseudotrabeculae) running in the same direction as the normal muscle fibers. These pseudotrabeculae are characteristic of myositis ossificans and strongly imply a diagnosis.
- Internal Structure. The internal structure varies with time. Within the third or fourth week after injury, the radiographic appearance is a faintly homogeneous radiopacity. This organizes further, and by 2 months a delicate lacy or feathery radiopaque internal structure develops. These changes indicate the formation of bone; however, this bone does not have a normal appearing trabecular pattern. Gradually the image becomes denser and better defined, maturing fully in about 5 to 6 months. After this period the lesion may shrink(White and Pharoah, 2009)

(Fig 1-10)Myositis ossificans. Lateral oblique radiograph shows heavy ossification of the masseter, temporalis, and medial pterygoid muscles(Omami , 2016)

Chapter 2

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previous studies

2.1 Radiographic Characteristics of Soft Tissue Calcification on Digital Panoramic Images

This descriptive retrospective study evaluated 2027 panoramic radiographs. The type and location of calcifications and the age and gender of patients were evaluated by two radiologists. Data were analyzed via SPSS and the Chi-square, Fisher's exact and Kappa tests were used to compare the categorical demographic variables among the groups. The confidence interval was set to 95% and $p<0.05$ was considered statistically significant.

Results: The prevalence of calcified stylohyoid ligament was 11.24%. This value was 3.99% for tonsillolith, 1.33% for calcified carotid plaque, 0.69% for antrolith, 0.39% for calcified lymph node, 0.29% for phleboliths, and 0.19% for sialoliths. The prevalence of these conditions had no significant association with gender or age ($p=0.102$). The prevalence of bilateral calcified stylohyoid ligament, tonsillolith, and a calcified carotid plaque was significantly higher ($p<0.001$). The most prevalent type of calcified stylohyoid ligament, according to O'Carroll's classification, belonged to types 1, 4, 3 and 2 ($p<0.001$). The most commonly observed radiographic pattern was multiple, well-defined tonsilloliths (75.3%, $p<0.001$)(Samira,2020).

2.2 Radiographical characteristics of lingual tonsilloliths using panoramic radiography & Ct imaging

Objectives:

Lingual tonsilloliths are not as well-known to radiologists than palatine tonsilloliths, although they might be common in clinical practice. The aim of this investigation was to clarify the prevalence and imaging characteristics of lingual tonsilloliths using panoramic radiographs and CT images.

Methods:

This study included 2244 patients without pathology at the base of tongue who had undergone panoramic radiography and CT of the maxillofacial region. The size, number and position of lingual tonsilloliths relative to the mandible and tongue were evaluated.

Results:

Lingual tonsilloliths were observed in 33 (1.5%) and 108 (4.8%) of all patients on panoramic radiographs and CT images, respectively. The prevalence was higher in patients aged ≥40 years than in those aged < 40 years ($\chi 2$, $p < 0.01$). They appeared as small, round- or rod-shaped calcified bodies, and they always located closely anterior (1–17 mm) to the anterior border of oropharyngeal airway on panoramic radiographs. Lingual tonsilloliths were superimposed over the surrounding soft tissue inferior to the body of the mandible, posteroinferior to the angle of the mandible and posterior to the mandible in 16 (48.5%), 15 (45.5%) and 1 (3.0%) individual, respectively. A significant correlation was observed between the detectability on panoramic radiographs and size (Spearman's $r = 0.961$, $p < 0.01$) of tonsilloliths, as revealed by CT images.

Conclusion:

Lingual tonsilloliths commonly appear on CT. They also appear on panoramic radiography and may superimpose the surrounding soft tissue of the mandible. Although lingual tonsilloliths may resemble other pathological calcifications including submandibular sialoliths and lingual osseous cholistoma, they can be differentiated by carefully observing panoramic radiographs. When clinicians detect calcified bodies near the base of tongue, lingual tonsilloliths should be included in the differential diagnoses.(Takahashi,2017)

Chapter 3

CONCLUSION

CONCLUSIONS

1- panoramic imaging can help in primary assessment, epidemiologic and screening evaluation of the following classification(Dystrophic calcification,Idiopathic calcification,and Metastatic calcification)

2-CBCT imaging gives differential detailed information concerning the image characteristics of these calcifications.

3-The imaging presentation of soft tissue calcifications in the head and neck provide consistent spatial orientation.

4-Calcifications of the atheromatous plaque of carotid arteries can be accurately detected and characterized with CBCT.

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