Differential diagnosis of radiolucencies of mandibular condyle

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Abstract
The mandibular condyle is a region in which tumor/tumor-like lesions rarely form; osteoma, osteochondroma, chondroma, and synovial chondromatosis being the most common pathologic enities. However these lesions are more radiopaque than radiolucent. This review and flowchart will help the readers to develop a differential diagnosis for radiolucencies of the mandibular condyle with prevalence of this conditions which rarely affect condyle.

Keywords: Mandibular condyle, Radiolucencies, Preauricular swelling.

Introduction
Pain and dysfunction in the temporomandibular joint (TMJ) region represents a diagnostic challenge. Tumours of the TMJ both benign and malignant are rare but difficult to diagnose In view of the fact that, these lesions usually resemble common temporomandibular disorders, and often mislead the specialist in making correct differential diagnosis.

The mandibular condyle is a region in which tumor like lesions rarely form; osteoma, osteochondrama, chondroma, and synovial chondromatosis being the most common pathologic entities. However, these lesions are predominantly radiopaque rather than radiolucent lesions. This review and flowchart will help the readers to develop a differential diagnosis for radiolucencies of mandibular condyle with prevalence of this conditions which rarely affect condyle.

Differential diagnosis of radiolucencies of mandibular condyle.

It can be broadly divided into

I. Pathologic
1. Tumors and cysts
2. Metastatic disease
3. Metabolic disease
4. Degenerative bone disease
5. Inflammatory
6. Others

II. Non pathologic
1. Bifid Condyle
2. Pseudocysts of condyle
3. Air cell defects

1. Tumors :
   - a. Odontogenic tumor eg. Odontogenic myxoma
   - b. Non Odontogenic tumor

b. Non Odontogenic Tumors

i. Benign
1. Central giant cell granuloma
2. Haemangioma
3. Eosinophilic granuloma
4. Non ossifying fibroma
5. Chondromyxoid fibroma
6. Chondroblastoma
7. Desmoplastic fibroma
8. Osteochondroma
9. Benign fibrous histiocytoma
10. Lipoma

ii. Malignant
1. Chondrosarcoma
2. Ewings sarcoma

3. Multiple myeloma

iii. Cysts
1. Aneurysmal cyst
2. Simple bone cyst

iv. Inflammatory
1. Eg. Tuberculosis, Actinomycosis

v. Others
1. Villonodular synovitis
2. Intraosseous ganglion
3. Synovial cysts

It can also be classified as radiolucencies

I. Unilocular
1. Pseudocyst
2. Osteochondroma
3. Non ossifying fibroma
4. Intraosseous ganglion
5. Simple bone cyst
6. Multiple myeloma
7. Metastatic lesion
8. Eosinophilic granuloma
9. Aneurysmal bone cyst
10. Chondroblastoma
11. Benign fibrous histiocytoma
12. Desmoplastic fibroma

II. Multilocular
1. Central giant cell granuloma
2. Aneurysmal bone cyst
3. Haemangioma
4. AV malformation
5. Pigmented villonodular synovitis
6. Non ossifying fibroma
7. Desmoplatic fibroma
8. Osteosarcoma
9. Chondrosarcoma
10. Ewings sarcoma
11. Benign fibrous histiocytoma

Non pathologic radiolucencies of mandibular condyle

1. Bifid condyle: Bifid condyle was first reported by Hrdlicka in 1940. It can affect unilateral or both the condyles and it can present as dicrete grooving to deep groove oriented mediolaterally or anterioposterior presently 40 cases reported in English literature.[(1)] It can be differentiated on careful observation of radiographs where anatomy of condyle can be visualised clearly.

2. Pseudocyst of mandibular condyle: Pseudocysts of the mandibular condyle are seen as well-circumscribed radiolucencies in the anterior aspect of the condyle. They are anatomic variants that are accentuated and distorted during panoramic radiography. The distortion occurs because the central X-ray beam does not pass through the condyle at a right angle; rather it passes obliquely in the horizontal plane and superiorly in the vertical plane. The beam's angle causes the medial ridge of the mandibular neck to be projected posterosuperiorly and the lateral ridge to be projected anteroinferiorly. These ridges then appear radiographically as corticated margins that envelop the radiolucent cystlike pterygoid fovea. Computerized tomography scans confirm that the radiolucent portion of the pseudocyst is caused by cupping of the pterygoid fovea, whereas the radiopaque borders are due to the dense medial and lateral ridges of the condyle. The diagnostic criteria given by Friedlander and colleagues used to describe mandibular condylar pseudocysts had to meet the following criteria: should be located in the anterior aspect of the condyle (as seen on the panoramic radiograph); measure at least 0.5 centimeters x 0.4 cm; be either completely or partially (more than 80 percent) circumscribed by a discrete sclerotic margin.[(2)]

3. Zygomatic air cell defect: Pneumatisation may develop in numerous locations like in the temporal bone including root of zygomatic arch and articular eminence. A non expansile non-destructive cyst like radiolucency in the zygomatic process of the temporal bone which appears similar to the mastoid cells and which does not extend further anteriorly than the zygomaticotemporal suture is known as zygomatic air cell defect. They can be unilateral or bilateral. They can be differentiated well on OPG or CBCT for more diagnostic accuracy. They can be differentiated from other pathologies by careful observation and non-symptomatic history and non expansile lesion.[(3)]

Pathologic radiolucencies of mandibular condyle

1. Cysts

a. Aneurysmal bone cyst: Aneurysmal bone cyst (ABC) is an expansile osteolytic lesion often multilocular, with blood filled spaces separated by fibrous septa containing osteoclast type giant cells and reactive one. Nine cases of ABC of mandibular condyle published in peer-review English literature (Toljanic et al., 1987; Svensson and Isacsson, 1993; Motamedi and

Stavropoulos, 1997; Gadre and Zubairy, 2000; Motamedi, 2002; Rapidis et al., 2004; Park et al., 2008; Ettl et al., 2009; Pelo et al., 2009). Aneurysmal bone cyst of condyle is seen in younger patients less than 20 yrs of age. It commonly presents as swelling or asymmetry (100%) associated with pain (70%) with equal gender prevalence and higher rate of recurrence.

Aneurysmal bone cyst has radiological features as unilocular or multilocular radiolucency with illdefined borders and has coarse septa. In the condylar region ABC frequently causes fracture of the condyle. Bone-targeting CT shows the characteristic feature, which reflected the histopathological appearance of a partially cystic meshwork divided by coarse septa. MRI shows almost homogeneous intermediate signal intensity, including a partial slight low-signal-intensity area on the T1-weighted image, and homogeneous high signal intensity, which showed a 'bubbly' appearance, on T2-weighted image. On the enhanced T1-weighted image, the intermediate signal intensity areas apart from the areas that showed slight low-signal intensity on the non-enhanced T1-weighted image, were well enhanced. This creates a 'honeycomb' appearance. The 'meshwork' appearance on bone-targeting CT, the 'bubbly' appearance on the T2WI and the 'honeycomb' appearance on Gd-T1WI may be the characteristic features of ABC.[4]

b. Traumatic bone cyst: Traumatic bone cyst was first described by Lucas. It commonly occurs in jaw bones in mandible in mandibular symphysis and body commonly and rarely in mandibular condyle. (10 cases) being reported.[5] The lesion is mainly diagnosed in young patients most frequently during the second decade of life with male predilection. Traumatic bone cyst in mandibular condyle in reported cases causes facial asymmetry, pathologic fracture, and pain more common with location in condyle than other parts in mandible. Radiographically it is seen as well-defined radiolucent lesion in mandibular condyle causing significant expansion and occasionally pathologic fracture. In CT scan the exact extent of the lesion can be appreciated is seen as radiolucent lesion with well-defined borders and causing significant expansion and pathological fracture of mandibular condyle. Magnetic resonance imaging (MRI) is the most useful modality for evaluating the internal structure of lesions and may have the ability to distinguish SBCs from other lesions. Traumatic bone cyst revealed homogeneous intermediate signal intensities (SI) on T1-WI and high SI on T2-WI in all cases. Enhancement of internal structure in traumatic bone cyst on contrast enhanced MRI helps to distinguish traumatic bone cyst from other cyst and benign tumors which do not enhance completely. H. Matsuzaki et al. suggested that dynamic MRI is useful to diagnose solitary bone cyst in unusual location.[6]

Primary tumors of mandibular condyle

1. Odontogenic primary tumor of mandibular condyle

a. Odontogenic myxoma: It was first described in jaws by Thoma in 1954. They are seen more in females, in second to fourth decade in life. Presently 3 cases of odontogenic myxoma in mandibular condyle are reported.[7] Odontogenic myxomas are benign, insidious lesions, often largely asymptomatic. Thus they most commonly appear as a painless swelling which can attain a large size before diagnosis. Temperomandibular joint problems can be presenting sign. Stress fractures in anteromedial aspect of condyle can cause pain. Increasing pain, swelling, crepitus, mandibular asymmetry, associated paraesthesia can be present. Odontogeinc myxoma on conventional radiographs is seen as well-defined unilocular or multilocular lesion showing expansion of mandibular condyle with straight septa on CT scan internal structures is clearly seen, straight septae are seen. CT shows low density mass clearly distinguished from surrounding muscles. Enhanced CT scan shows partially enhanced areas within tumor mass. MRI shows on T1 weighted images intermediate signal and T2 weighted images showed high signal intensity.[8]

2. Non odontogenic primary tumors of mandibular condyle

a. Vascular malformation: Vascular malformation is rarely seen in mandibular condyle with only 3 cases reported till present. Vascular malformation is seen more commonly in first to second decade of life, with female predilection. Vascular lesions are classified according to the type of vessel affected and the flow intensity. Hemangiomas are present since birth and have tendency towards fast growth and decrease during adolescence, whereas vascular malformations present after birth and increase in size after trauma or endocrine alterations. Clinical findings in vascular malformations affecting condyle are preauricular swelling, impaired mouth opening, pain or may be asymptomatic discovered on radiograph. Vascular malformations of the condyle most often present as firm, slow-growing, and asymmetric expansile masses with joint pain aggravated by movement of the lower jaw. Clinical examination often reveals tenderness over the affected joint and occasionally limited mouth opening. Furthermore, these lesions are not associated with teeth, are difficult to visualize, and are not associated with a history of bleeding.on conventional radiographs condyle appears to be enlarged, it has indistinct cortical borders which can be unilocular or multilocular with smaller fine trabeculations (spoke like, sunray appearance) than seen with central giant cell granuloma, aneurysmal bone cyst. On CT Scan these fine trabeculations and exact extent of the lesion can be appreciated contrast enhanced CT is diagnostic for vascular lesions which invariably enhance on contrast can help to distinguish it from other lesions.[9]

b. Central giant cell granuloma: CGCG was first described by Jaffe in 1953.It can be aggressive or nonaggressive in behaviour. Agressive one seen in younger patients, with fast growth and tendency to recur.it can be symptomatic or asymptomatic and in condyle can produce painless slow growing preauricular swelling, and temperomandibular joint symptoms. 4 cases reported in mandibular condyle till now.[10] On radiographs it is seen as well-defined unilocular or multilocular radiolucency with coarse septa and undulating borders. On CT scan soft tissue algorithm coarse septa is seen with remodelling of mandibular fossa to accommodate enlarged condyle, and presence of granular pattern at periphery.

Non odontogenic primary malignant tumors

Multiple myeloma, chondrosarcoma, ewings sarcoma are reported to affect mandibular condyle. Most common amongst them is chondrosarcoma with 18 cases reported in English literature. They are seen as expansile lytic lesion with destruction of borders and infiltrating the surrounding area.[11]

1. Metastatic lesions: Till present date 19 cases of metastasis to condyle are published. The primary tumors were diagnosed in breast 5 cases, lung 5 cases, prostate, colon, kidney 2 cases respectively. In ten cases lesion in condyle was found before primary lesion was recognised. The symptoms can mimic TMD but on imaging destructice lesion affecting condyle can be seen.[12]

2. Degenerative diseases: Erosion, sclerosis, osteophytes, flattening, subchondral cysts (elys cyst) and reduced joint space are other radiographic findings which will be seen in osteoarthritis of TMJ and differentiate to rule out other pathologies causing radiolucencies in condyle.

3. Inflammatory: 18 cases of osteomyelitis of mandibular condyle are reported in English literature. Odontogenic, otologic and tubercular are most common causes. Radiologically condyle appears osteolytic and eroded. Higher imaging will reveal presence of oedema besides bone erosive areas. Radionucleotide scans will be useful for loactiong inflammation site.[13]

4. Others

a. Pigment villonodular synovitis: Pigmented villonodular synovitis is an uncommon lesion of synovium that affects joints, and tendon sheaths it's a proliferative locally aggressive growth with invasion of bone. It most commonly affects knee joints. 60 cases involving TMJ arereported till date in English literature. Conventional TMJ view shows erosion of the lateral surface of the right condyle, condylar expansion and sclerotic change in the condylar neck. Computed tomography reveals araes of lytic bone erosion and sclerosis and defines exact extent of tumor with focal areas of hyperdensity within the soft tissue mass. MRI show profound hypointensity on both T1 and T2 weighted sequences due to hemosiderin pigmentation. High signal intensity on T2 weighted images may indicate cystic loculation of the joint fluid. Appearance on MRI can be variable depending on relative proportion of lipids, hemosiderin, fibrous stroma, fluids and cellular elements.[15]

b. Intraosseous ganglion and synovial cyst: ganglion and cysts are expansile fluid filled lesions of the joints located in periarticular areas of wrists, knees and feet. They occur rarely in TMJ area with 49 casesreported so far in literature. Conventional radiograph reveals contour defect in lateral aspect of condyle and condylar erosion. A computed tomography will help as it determines relationship of lesion with TMJ and MRI reveals anatomic relation and helps to differentiate among ganglion, synovial cyst and parotid gland lesion.[16]

Conclusion

The lesions affecting condyle producing radiolucencies present as a enigamatic finding to the diagnostician as they are very rare. This review intends to help the reader to develop differential diagnosis and consider all possibilities even of the rarest lesions affecting condyle.

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