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Research Article

Role of MDCT in Evaluation of Mandibular Lesions

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Abstract: ***Introduction:*** Timely and accurate diagnosis of mandibular pathologies is essential for guiding effective treatment. In many cases, computed tomography (CT) serves as the definitive imaging modality for identifying the nature and extent of mandibular lesions. This study aims to correlate clinical evaluations, MDCT imaging findings, and histopathological results to underscore the value of MDCT as a powerful diagnostic tool in mandibular pathology assessment.**Materials and Methods**:A total of 70 patients with suspected mandibular lesions underwent MDCT scanning. Imaging observations were recorded, and provisional diagnoses were formulated based on the CT findings. All cases were subsequently confirmed through intraoperative evaluation and histopathological (biopsy) analysis.**Results**:MDCT accurately diagnosed mandibular lesions in 61 out of 70 patients, with findings aligning with surgical and histopathological outcomes. In 9 cases, the preliminary CT-based diagnosis did not correspond with the final biopsy result. Additionally, in 25 patients, conventional radiographs (such as OPG) were insufficient in defining lesion characteristics, while MDCT provided detailed information regarding lesion morphology and spread. Notably, in 9 patients, OPG suggested a single lesion, whereas MDCT revealed multiple lesions.**Conclusion:**MDCT is a highly effective imaging modality for evaluating mandibular pathologies, offering detailed insights into lesion characteristics, multiplicity, and extent. It is recommended as the imaging method of choice for comprehensive mandibular assessment, particularly when conventional imaging is inconclusive.

Keywords: Multidetector CT Mandible, Mandibular Lesions, AV Malformation, Ameloblastoma, Odontogenic Keratocyst

INTRODUCTION

"The face is the mirror of the mind" — and any pathology affecting the face can disrupt both physical appearance and emotional well-being. Therefore, early detection, accurate characterization, and timely treatment of facial pathologies are essential not only for physical health but also for restoring confidence and peace of mind.

The mandible and associated dental structures are commonly affected by a broad range of lesions. These include both odontogenic and non-odontogenic pathologies, many of which present with overlapping clinical and radiological features. In such cases, advanced imaging plays a pivotal role in narrowing the differential diagnosis.

Multidetector Computed Tomography (MDCT) has emerged as a powerful diagnostic tool in evaluating mandibular lesions. While many lesions may still require histopathological confirmation through biopsy, CT imaging provides valuable insights into lesion morphology, extent, and involvement of adjacent structures—often offering critical secondary findings that help guide further diagnostic and therapeutic decisions.

Since the discovery of X-rays in 1895, imaging technology has continuously evolved, enhancing our ability to visualize and understand various diseases. In the past, Orthopantomography (OPG) was the primary imaging modality for mandibular evaluation—offering only limited information. It was a small vessel navigating the vast and complex ocean of mandibular pathology. The advent of CT scanning, however, has transformed this journey—introducing a much larger and more capable vessel to explore and understand these complex conditions.

Correlating MDCT findings with histopathological results is essential to assess the diagnostic value and clinical relevance of imaging features. Such correlation enhances diagnostic accuracy, informs treatment planning, and ultimately improves patient outcomes.

MATERIALS AND METHODS

This prospective study was conducted at B.J. Medical College, Ahmedabad, from June 2015 to January 2016. A total of 70 patients referred for mandibular CT scans were included in the study.

Inclusion Criteria:

- Patients with clinically suspected non-traumatic mandibular pathologies
- Patients referred for CT scan due to inconclusive clinical findings, particularly in cases of toothache

- Patients who had undergone OPG or conventional X-rays but required further evaluation

Exclusion Criteria:

- Patients with mandibular trauma (e.g., from road traffic accidents)
- Patients with metal prostheses that could interfere with imaging quality

All included patients underwent clinical evaluation followed by MDCT scanning of the mandible. Final diagnoses were established based on histopathological confirmation (biopsy) in all cases. CT findings were correlated with clinical assessments and intraoperative observations.

Out of the 70 patients:

- 54 underwent additional imaging with orthopantomography (OPG) or conventional mandibular radiography
- 52 underwent contrast-enhanced CT (CECT) of the mandible
- 18 underwent plain (non-contrast) CT scanning
- 2 patients had follow-up scans for monitoring lesion progression

There was no selection bias regarding patient age or sex.

CT Imaging Protocol:
All scans were performed using a SIEMENS SOMATOM DEFINITION 128-slice MDCT scanner. The scanning parameters were as follows:

- **Plain CT Scan:**
    - Collimation: 16 × 0.625 mm
    - Slice thickness: 5 mm
    - Pitch: 1.75
    - Table speed/gantry rotation: 55 mm / 17.5 mm
- **Contrast-Enhanced CT:** When indicated, contrast-enhanced scans were performed following an intravenous bolus injection of 100 ml non-ionic iodinated contrast using a power injector at a flow rate of 3.5 ml/sec. CECT procedures were conducted under the supervision of an anesthesiologist.

Data Collection and Analysis:
Detailed imaging findings were recorded for each patient, and a probable diagnosis or differential diagnosis was provided based on CT appearances. All cases were followed up with surgical findings and histopathological reports. The study results were analyzed and compared with findings from existing literature.

STATISTICAL ANALYSIS
SPSS version 21 was used to infer results. Results are based on descriptive statistics.

Diagnosis and Frequency (Total 70 Cases)	CT Appearance	No of cases	Percentage of CT Apperance
Ameloblastoma (17 cases = 24.28%)	Multiloculated lytic lesion with cortical erosion	14	82%
	Multiloculated lytic lesion with cortical erosion	3	18%
Keratocysticodontogenic tumor (KCOT) (14 cases = 20%)	Cyst with mild cortical expansion without destruction	12	86 %
	Cyst with cortical expansion and erosions	2	14%
Periapical cyst (12 cases=17.14%)	Cyst with sclerotic margins	10	80 %
	Lytic-Sclerotic lesion with soft tissue swelling	2	20%
Odontoma (10 cases=14.28%)	Opaque lesion with lucent rim	10	100%
Dentigerous cyst (6 cases =8.57%)	Expansile cyst with unerupted crown of teeth	6	100%
Osteomyelitis (5 cases=7.14%)	Lytic lesion with sequestrum	4	80%
	Lytic-Sclerotic lesion with soft tissue swelling	1	20%
Cementoblatsoma (2 cases =2.85%)	Well circumscribed radioopaque mass associated with root of tooth	2.	100%
Fibrous Dysplasia (2 cases =2.85%)	Lesion with ground glass density and expansion	2	100 %
Arteriovenous Malformation (1 case =1.42%)	Multiloculated cystic lesion with intense postcontrast enhancement	1	100%
Osteogenic Sarcoma (1 case==1.42%)	Aggressive destruction of bone with periosteal reaction and soft tissue mass	1	100%
Osteochondroma (1 case==1.42%)	Bony outgrowth with area of sclerosis	1	100%

Table-1: Frequency and MDCT apperance of mandibular pathologies

MDCT Diagnosis and Frequency	Diagnosis on Biopsy		Total no of case
	Same Diagnosis	Different Diagnosis	
Ameloblastoma	13	4	17
Keratocysticodontogen-ic tumor (KCOT)	12	2	14
Periapical Cyst	11	1	12
Odontoma	9	1	10
Dentigeous cyst	6	0	6
Osteomyelitis	4	1	5
	55	9	64

Table-2: Correlation of MDCT Diagnosis and Biopsy Diagnosis

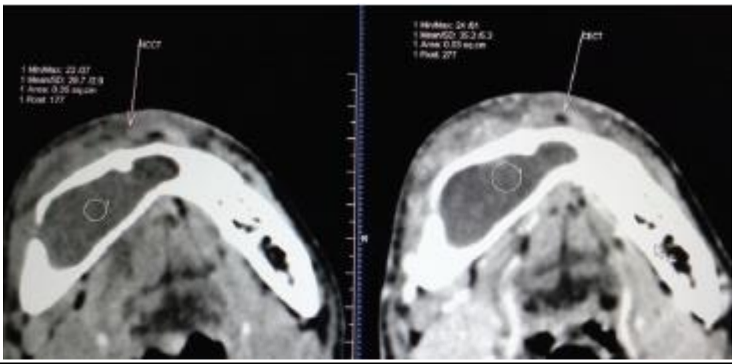

Figure-1: Plain and contrast axial CT Scan showing Amelobalstoma - buccolingually expanding enhancing lytic lesion with cortical destruction in body of mandible on right side

RESULTS

In this study, the most commonly diagnosed mandibular pathology was ameloblastoma, accounting for 24.28% of cases, followed by keratocystic odontogenic tumor (KCOT), which constituted 20%.

MDCT demonstrated high diagnostic accuracy: in 61 out of 70 patients, the diagnosis based on MDCT findings was consistent with intraoperative observations and histopathological (biopsy) reports. However, in 9 patients, the initial diagnosis suggested by MDCT did not match the final biopsy-confirmed diagnosis.

Among the 70 patients:

- Twenty-five patients had inconclusive findings on orthopantomography (OPG) or conventional radiographs, whereas MDCT successfully characterized the lesion type and extent.
- In nine cases, OPG revealed a single lesion, but MDCT imaging detected multiple lesions, highlighting the superior sensitivity of MDCT in assessing lesion multiplicity.

From the statistical analysis based on Table 2:

- The Chi-square value (χ^2) was 2.851 with 5 degrees of freedom (df).
- The χ^2/df ratio was 0.57, and the corresponding P-value was 0.7229.
- Since the P-value > 0.05, the correlation between MDCT-based diagnosis and biopsy-confirmed diagnosis is statistically not significant, but it still suggests a good diagnostic agreement overall.

Notably, discrepancies were observed in a few specific cases:

- In four patients, the MDCT diagnosis was reported as ameloblastoma, but biopsy revealed keratocystic odontogenic tumor (KCOT).
- Conversely, in two patients, lesions initially diagnosed as KCOT on CT were confirmed as ameloblastoma on histopathology.

These results reinforce the diagnostic utility of MDCT while emphasizing the continued necessity of histopathological confirmation for definitive diagnosis.

DISCUSSION

Conventional radiographs such as panoramic radiographs (orthopantomograms [OPGs] or panoramic X-rays) and intraoral dental radiographs are widely used for diagnosing mandibular pathologies due to their cost-effectiveness, ease of access, and low radiation exposure. However, since these provide only two-dimensional images of three-dimensional structures, they have limitations in assessing lesion size, margins, and extension into adjacent anatomical or soft tissue structures. These limitations can be overcome by newer imaging modalities, which provide enhanced diagnostic details and aid in better therapeutic planning.

The advent of multi-detector computed tomography (MDCT) has significantly transformed the imaging evaluation of mandibular lesions. Although Cone Beam Computed Tomography (CBCT) has gained popularity in recent years, its inability to visualize extraosseous structures may result in underestimation of lesion extent. Previously, conventional radiographs often made it difficult for dental professionals to assess whether sufficient jawbone was available for dental implants. With MDCT of the mandible, this evaluation has become much more accurate and reliable.

Compared to conventional X-rays, CT offers several advantages, including the ability to image both bone and soft tissue, superior tissue contrast resolution, and the ability to manipulate images for better evaluation. In our study, CT helped determine the exact extent of lesions, involvement of nearby anatomical structures, and supported surgical and biopsy planning.
When a benign lesion is suspected, it is crucial for the surgeon to assess the integrity of the inferior mandibular cortex, which influences the decision between curettage and resection. Additionally, identifying the relationship between the lesion and adjacent tooth roots helps determine the need for extraction of vital or non-vital teeth.

The most common lesion in our study was multicystic ameloblastoma, which typically appeared on CT as a multiloculated lytic lesion with cortical erosion. Solid or multicystic ameloblastoma is the most aggressive variant, accounting for approximately 85% of all ameloblastomas and demonstrating a high recurrence rate. Radiographically, this variant is characterized by a multilocular appearance with internal septations, often described as having a “honeycomb” or “soap-bubble” pattern. CT also proved useful in evaluating tooth root resorption, a hallmark feature of ameloblastoma.

Keratocystic odontogenic tumor (KCOT), formerly referred to as odontogenic keratocyst, has recently been reclassified as an odontogenic tumor. In our study, most KCOTs showed non-aggressive features with minimal cortical expansion. However, 2 out of 14 cases exhibited aggressive behavior with cortical destruction. KCOTs can present as multilocular lesions with cortical expansion, perforation, mandibular canal displacement, root resorption, and tooth extrusion. Two biopsy-proven KCOT cases showed recurrence. Differentiating KCOTs from ameloblastomas based on imaging alone can be challenging, though KCOTs typically show less root resorption and favor anteroposterior expansion, unlike ameloblastomas which tend to expand buccolingually.

Periapical (radicular) cysts are the most common odontogenic cysts. In our study, only 11 cases underwent CT scanning, likely because clinicians were confident in diagnosing these lesions using conventional radiographs. For straightforward cases like radicular cysts, additional imaging is often unnecessary. However, in one instance, a lesion presumed to be a periapical cyst was diagnosed as a KCOT upon biopsy.

Dentigerous cysts were consistently identified as well-circumscribed unilocular radiolucencies adjacent to the crown of unerupted teeth—most commonly the third molars. In our study, all six cases exhibited this pattern, with four associated with third molars.
Among the four osteomyelitis cases in our study, all were chronic and located in the mandibular body. CT findings included lytic lesions with sequestra; one case showed a sclerotic lesion with soft tissue swelling. The mandibular body is the most common site for osteomyelitis of the jaw.

Odontomas, the most common odontogenic tumors, initially appear radiolucent but eventually develop into radiopaque masses surrounded by a radiolucent rim. Due to their distinctive appearance on OPGs, most cases did not require CT imaging. Radiographically, odontomas are generally straightforward to diagnose.
Both cementoblastoma cases in our study presented as well-circumscribed radiopaque masses associated with tooth roots. However, the expected peripheral radiolucent rim was not observed in either case.
Two cases of fibrous dysplasia were observed, both showing the characteristic “ground-glass” bone appearance. This finding is consistent with previous studies, such as that by Subodh Arun Sontakke et al., where 100% of fibrous dysplasia cases demonstrated this appearance.

A single case of mandibular osteosarcoma was encountered in our study. CT imaging showed aggressive bone destruction, periosteal reaction, and a soft tissue mass with mild contrast enhancement. Malignant mandibular lesions often appear as soft tissue density masses with bone destruction and subtle contrast enhancement on CT.

We also identified a rare case of osteochondroma involving the body of the mandible. Osteochondromas in the mandible are extremely rare, with most cases occurring in the condyle and, less frequently, the coronoid process.

Contrast-enhanced CT (CECT) is particularly useful in identifying vascularized lesions. In one case, a lesion initially suspected to be an ameloblastoma was revealed to be an arteriovenous malformation (AVM) on CECT. This underscores the importance of ruling out AVMs using CT or MRI before performing biopsy or surgery in suspected cases of ameloblastoma or aneurysmal bone cyst, to prevent the risk of significant hemorrhage.

CONCLUSION

Multi-Detector Computed Tomography (MDCT) plays a crucial role in the accurate diagnosis, characterization, and treatment planning of mandibular lesions. It offers significant advantages over conventional radiography, particularly in terms of image clarity, multiplanar reconstruction, and the ability to assess both bone and soft tissue structures—though at a higher cost and with potential limitations due to metal artifact interference from prostheses.

The availability of multiplanar imaging with MDCT greatly enhances diagnostic precision. It is especially valuable in detecting soft tissue extension and identifying occult lesions in areas of the mandible that may not be visible on orthopantomograms (OPGs) or other conventional radiographs.

There is a strong correlation between MDCT findings and biopsy results, highlighting the reliability of MDCT in diagnostic evaluation. Furthermore, MDCT can often distinguish between benign, cystic, and malignant lesions, potentially reducing the need for invasive biopsy in certain cases.

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