Original Research Article

Comparative evaluation of MDCT and 3T MRI in radiographically detected jaw lesions

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Abstract

Background: Jaw lesions comprise a broad spectrum of odontogenic and nonodontogenic lesions. They may be cysts, tumors, or tumor-like lesions. Clinical presentation of this vast spec- trum of pathology is nonspecific. On imaging, they may be classified as radiolucent, mixed, or radioopaque. Based on this broad categorization of imaging appearances and few specific imaging characteristics if present, it may be possible to diagnose a particular jaw lesion or at least reach a narrow differential diagnosis. **Aim & Objective:**1. Comparative evaluation of MDCT and 3T MRI in radiographically detected jaw lesions.2. Study roll of MDCT and 3t MRI in diagnosis of jaw lesions **Methodology: Study design:** A Prospective Study. **Study setting:** Radio diagnosis department of Dr. D.Y Patil Medical College and Research Institute, Kolhapur. **Study duration:** from March 2022 to March 2023. **Study population:** The study population included all the cases with jaw lesions patients admitted at a tertiary care center **Sample size:** 50 **Results:** Majority of cases found in 46-65 years age group 17 (34%) followed by above 65 years age group 15 (30%), 31-45 years 13 cases (26%) and 5 cases in 18-30 years age group. Most of cases were males 30 (60%) and 20 females (40%). MDCT shows most of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 10, Periapical cyst 7, Osteomyelitis 6, Dentigerous cyst 4, Odontoma 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2. 3T MRI shows majority of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 9, Periapical cyst 8, Osteomyelitis 6, Odontoma 5, Dentigerous cyst 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2. **Conclusions:** MRI could be effectively useful to the typing of different expansive lesion, and to evaluate the possible infiltration of the soft tissue. These informations are decisive in the differential diagnosis between the benign lesions and major aggressive odontogenic tumours and in the surgical planning.

Keywords: MDCT,3T MRI, Jaw lesions.

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Received Date: 23/04/2023 Revised Date: 19/05/2023 Accepted Date: 17/06/2023

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Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: https://doi.org/10.26611/10132711

INTRODUCTION

Benign odontogenic tumours and cysts are asymptomatic intraosseous lesion that can affect the bones of the maxillomandibular complex. Ameloblastomas and keratocystic odontogenic tumours are major aggressive odontogenic tumours.[1] These tumours are characterized by a low speed expansion and they are frequently associated to a local invasion of the contiguous epithelial areas.[2]
Both tumours show more frequently a localization at the angle of the mandible, extending anteriorly and superiorly, and common radiologic features such as unilocular or multilocular radiolucencies with a characteristic "soap bubble" shape.[2] A radiological differentiation between ameloblastomas and keratocystic odontogenic tumours lesions is not difficult if the lesions show their characteristic aspect. However, some time, these tumours appear as unilocular and the differential diagnosis with the other damages is difficult. The pre-operative evaluation in

How to cite this article: Yash Hemant Nagaria, Pradeep Patil, Tejaskumar Modi, Utsavi Modi. *MedPulse International Journal of Radiology*. July 2023; 27(1): 01-06. http://www.medpulse.in/Radio%20Diagnosis/

oral and maxillofacial surgery is currently performed by several imaging methods. One of the principal difficulties in the planning of surgery is to define the anatomic relation between the lesion and peripheral nerves. In particular, the evaluation of the spatial relationship between the inferior alveolar nerve (IAN) and a mandibular lesion is important to avoid injuries of this anatomic structure.[3-5] Both panoramic radiography (OPT) and computerized tomography (CT) can be used to detect the bone structures. However, the efficacy of these imaging methods in the IAN detection is lower than magnetic resonance imaging (MRI). In fact, while CT and OPT depict the bone of the mandibular canal, MRI allows a significant appreciation of its contents.[6-9] Matsuzaki *et al.*[10] also showed the utility of the MRI in the pre-surgical approach, especially in the evaluation of soft tissue invasion in ameloblastic carcinoma in the right anterior maxillary sinus.

CT Imaging

CT examinations were performed in high resolution helical CT machines (CT scan Siemens Somatom, Erlangen, Germany) using a bone algorithm, 0.6 mm slice collimation, 24 cm field of View (FOV), 512 × 512 matrix, 120 kV and 150 mAs. The data were transferred to the workstation for post-processing. Three sets of reconstruction images were displayed: Axial, Sagittal and Coronal.

MR Imaging

MRI scan with a 3.0 T machine (Discovery 750 General Electric, Milwaukee, WI, USA) was performed with head-neck coil. Since the maxillofacial area is composed by a high percentage of fat and fluid, the study of this region could not be performed by means of routine conventional techniques of MRI. Consequently, our protocol was carried out using the following sequences:

1. T2-weighted axial images acquired with a fast spin echo interactive decomposition of water and fat with echo asymmetry and least-squares estimation (FSE IDEAL) using a repetition time (TR) of 3038 ms, echo time (TE) of 124 ms, field of view (FOV) of 24 × 24 cm, slicethickness (SL) of 4 mm, and number of excitations (NEX) of 3
2. T1-weighted axial images fat-saturated fast spin echo pre-contrast administration (Ax T1 Fs FSE pre-CE) and post-contrast administration (Ax T1 Fs FSE post-CE) using a repetition time (TR) of 418 ms, echo time (TE) of 8 ms, field of view (FOV) of 25 × 25 cm, slicethickness (SL) of 4 mm, and number of excitations (NEX) of 2 to evaluate the potential enhancement of the mass. The contrast index (CI) pre- and post-contrast administration was calculated using one region of interest (ROI) in the centre of the tumour mass (a ROI in the muscular tissue was used as a control-image). Contrast-enhanced MRI (CE-MRI) with gadoteric acid (Dotarem, 12 ml) was performed to evaluate possible soft tissue invasion and to investigate the benign nature of the lesion.
3. Diffusion weighted imaging (DWI b = 800) using a repetition time (TR) of 4375 ms, echo time (TE) of 72 ms, field of view (FOV) of 23 × 23 cm, slice-thickness (SL) of 5 mm, bandwidth (b) of 800 s/mm2 and number of excitations (NEX) of 1.
4. T1-weighted fast imaging employing steadystate acquisition (FIESTA) using a repetition time (TR) of 4.6 ms, echo time (TE) of 2.2 ms, field of view (FOV) of 24 × 24 cm, slice-thickness (SL) of 0.6 mm and number of excitations (NEX) of 1 and T1-weighted fast spoiled gradient-recalled echo (fast SPGR) using a repetition time (TR) of 7.8 ms, echo time (TE) of 3.2 ms, field of view (FOV) of 23.5 × 23.5 cm, slice-thickness (SL) of 0.6 mm and number of excitations (NEX) of 2.

Table 1: Radiolucent lesions of the jaw

Well-defined margins		
	Odontogenic	Non-odontogenic
Cystic	Radicular cyst	Stafine cyst/ static bone cavity
	Residual cyst	Simple bone cyst
	Dentigerous cyst	Nasopalatine cyst
	Odontogenic keratocyst	
Solid	Ambeloblastoma	Central giant cell granuloma
		Venous malformation
		Langerhan cell histocytosis
Illl-Defined margins		
	Malignant odontogenic tumor	Osteomyelitis
	Odontogenic carcinoma	Osteonecrosis
	Odontogenic carcinosarcoma	Malignant non-odontogenic tumors
	Odontogenic sarcoma	Squamous cell carcinoma of the oral cavity invading the jaw
		Metastases

	Hematological malignancy Sarcoma (Osteosarcoma/ chondrosarcoma/ Fibrosarcoma) Malignant transformation of intraosseous salivary epithelial tumor

Odontogenic lesions usually occur in relation to one tooth or a component of tooth. For example, radicular cysts develop around the tooth apex while dentigerous cysts surround the tooth crown. Nonodontogenic lesions usually have either no relation with teeth or may involve a large part of the bone in close proximity to two or more teeth. While odontogenic lesions usually are seen above the level of the alveolar canal, lesions below the level of the canal are nonodontogenic in origin.[3] cyst helps differentiate it from apical periodontitis due to endodontal disease. There may be mild accompanying tooth resorption and displacement of adjacent roots if the cyst is large. Treatment options include endodontic treatment with extraction and cyst wall enucleation.[4] *Imaging Features* Well-defined cyst with a thin sclerotic rim around the root apex of a carious tooth, particularly upper lateral incisor. Residual Cyst A residual cyst is an inflammatory cyst that presents on a postextraction site. It is usually asymptomatic and is seen as a well-defined lesion, mostly measuring less than 1 cm in size. Imaging Features Well-defined cyst with a thin sclerotic rim with missing overlying tooth. Dentigerous Cyst (Follicular Cyst) Dentigerous cyst is the most common noninflammatory cystic lesion of the jaw. On imaging, it is seen as a well-defined unilocular round/ovoid cystic lesion with smooth margins with the crown of the tooth seen projecting within the cyst. On MRI, dentigerous cysts are typically hypointense on T1-weighted (T1W) and hyperintense on T2W images. They usually show a thin enhancing rim. Proteinaceous contents within the cysts may increase signal intensity on T1W images.

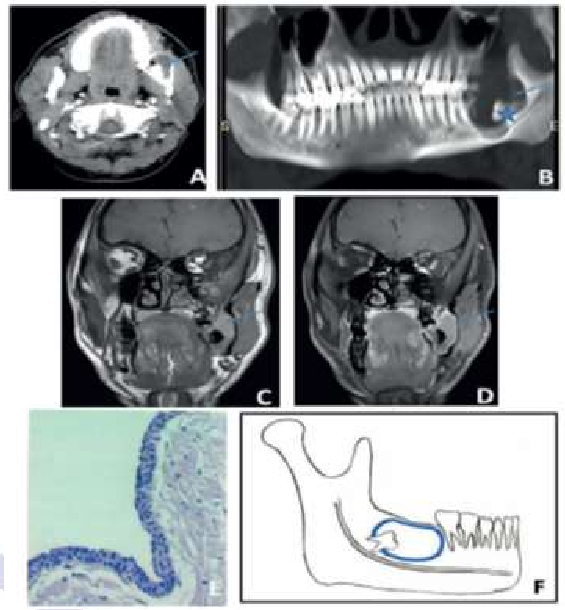

Figure 1

Dentigerous cyst: axial postcontrast (**A**) and panoramic reconstructed computed tomography (CT) images (**B**) show a well-defined, unilocular, lytic lesion (blue arrow) involving angle and ramus of left mandible with impacted third molar tooth (blue star). Coronal T1-weighted magnetic resonance (MR) image (**C**) shows a mildly hyperintense lesion with thin rim of enhancement (blue arrow) on contrast enhanced image (**D**). Microscopy (**E**) shows 2 to 4 cells layered nonkeratinizing enhanced odontogenic epithelium with a flattened interface. Schematic diagram (**F**) shows pericoronal relationship of dentigerous cyst (blue circle) with respect to impacted tooth.

OKC is lined with odontogenic para keratinizing squamous epithelium and thin fibrous wall with cheese-like contents within. This is most often seen in the second to fourth decades of life. It is more aggressive than other odontogenic cysts, as it shows basal layer budding and formation of daughter cysts that lie outside the primary cyst. On MRI, these cysts can show heterogeneous intermediate-to-high signal on T1W images and low-to-high signal on T2W images owing to keratinaceous contents within. Thin or thick rim enhancement may be seen on postcontrast images. Diffusion restriction of the proteinaceous contents of the cyst is a feature characteristically seen in OKC.

Ameloblastoma is a benign but locally aggressive odontogenic tumor that arises from the enamel forming cells of odontogenic epithelium and less commonly from the lining of a dentigerous cyst. CT and MRI are useful in delineating internal cystic and solid components, cortical breach, soft-tissue extension, relationship to inferior alveolar canal, and enhancement of solid component/septations. The cystic component of ameloblastoma shows low T1 and bright T2 signal, unlike OKC which shows intermediate to bright T1 signal and low to high T2 signal. On DW images, the solid component of ameloblastoma shows restricted diffusion, while the cystic component has facilitated diffusion.

Figure 2: Ameloblastoma jaw MRI

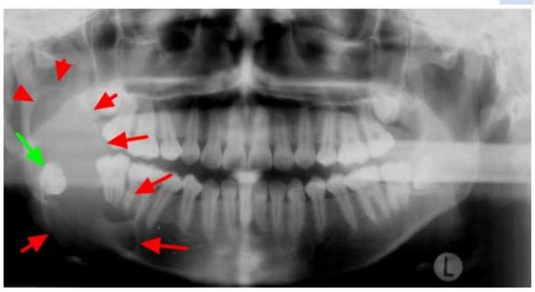

Figure 3: Ameloblastoma jaw CT

AIM AND OBJECTIVE

OBJECTIVE:

1. Comparative evaluation of MDCT and 3t MRI in radiographically detected jaw lesions.
2. Study roll of MDCT and 3T MRI in diagnosis of jaw lesions

MATERIAL AND METHODS

Study design: A Prospective study

Study setting: Radio diagnosis department of Dr. D.Y Patil Medical College and Research Institute, Kolhapur

Study duration: From March 2022 to March 2023

Study population: The study population included all the cases with jaw lesions patients admitted at a Radio diagnosis department of Dr. D.Y Patil Medical College and Research Institute, Kolhapur

Inclusion criteria:

1. All patients with jaw lesions admitted in Radio diagnosis department of Dr. D.Y Patil Medical College and Research Institute, Kolhapur

Exclusion criteria:

1. Metallic implant
2. Traumatic injury to jaw
3. Claustrophobia
4. Contrast allergy
5. Not willing to participate in the study.

Approval for the study: Written approval from Institutional Ethics committee was obtained beforehand. Written approval of Radio diagnosis department was obtained. After obtaining informed verbal consent from all patients with jaw lesions admitted in radio diagnosis department of Dr. D.Y Patil Medical College and Research Institute, Kolhapur such cases were included in the study.

Sample Size: 50

Sampling technique: Convenient sampling technique used for data collection.

Methods of Data Collection and Questionnaire-

Predesigned and pretested questionnaire was used to record the necessary information. Questionnaires included general information, such as age, sex, religion, residential address, and date of admission. Medical history- chief complain, past history, general examination, systemic examination. Selection of the patients was patients having non traumatic clinically suspected jaw pathologies, patients refereed for MDCT,3T MRI Scan due to inconclusive clinical diagnosis in toothache, patients with OPG or X rays done and were referred for further evaluation. Data on demographic profile of jaw lesions patients, investigation, personal history, medical past history data collected from patients admitted in radio diagnosis ward. MDCT finding of jaw lesions compared with 3t MRI findings. All the procedures and investigations conducted under direct guidance and supervision of PG guide. Proforma of jaw lesions notes maintained.

Data entry and analysis

The data were entered in Microsoft Excel and data analysis was done by using SPSS demo version no 21 for windows. The analysis was performed by using percentages in frequency tables and correlation of stroke. $p<0.05$ was considered as level of significance using the Chi-square test

RESULT AND OBSERVATION

Table 1: Distribution of Cases According to Age

Age in years	Frequency	Percentage
18-30	05	10%
31-45	13	26%
46- 65	17	34%
Above 65	15	30%
Total	**50**	**50 (100%)**

The above table shows majority of cases found in 46-65 years age group 17 (34%) followed by above 65 years age group 15 (30%), 31-45 years 13 cases (26%) and 5 cases in 18-30 years age group.

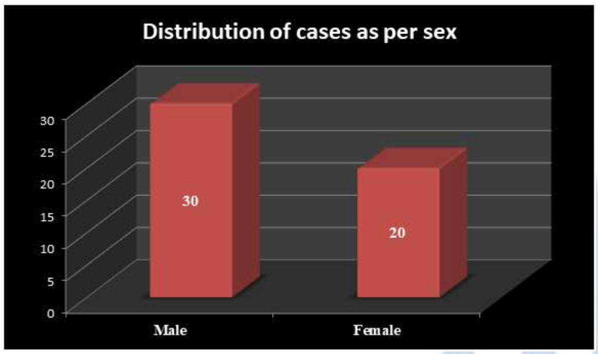

Figure 4

Majority of cases were males 30 (60%) and 20 females (40%)

Table 2: Distribution of cases according to MDCT Diagnosis

MDCT Diagnosis	Frequency	Percentage
Ameloblastoma	**12**	**24%**
Keratocysticodontogenic tumor	**10**	**20%**
Periapical cyst	**07**	**14%**
Odontoma	**04**	**8%**
Dentigerous cyst	**05**	**10%**
Cementoblatsoma	**02**	**4%**
Osteogenic Sarcoma	**02**	**4%**
Osteochondroma	**02**	**4%**
Osteomyelitis	**06**	**12%**
Total	**50**	**50 (100%)**

The above table shows majority of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 10, Periapical cyst 7, Osteomyelitis 6, Dentigerous cyst 4, Odontoma 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2.

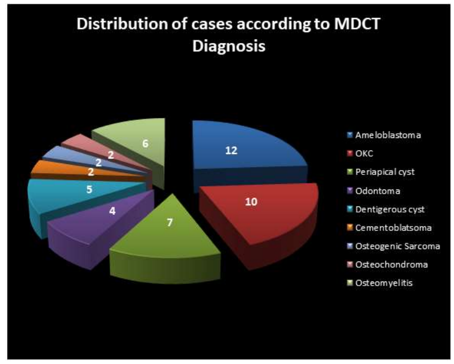

Figure 5

Table 3: Distribution of cases according to 3T MRI Diagnosis

3T MRI Diagnosis	Frequency	Percentage
Ameloblastoma	**12**	**24%**
Keratocysticodontogenic tumor	**09**	**18%**
Periapical cyst	**08**	**16%**
Odontoma	**05**	**10%**
Dentigerous cyst	**04**	**8%**
Cementoblatsoma	**02**	**4%**
Osteogenic Sarcoma	**02**	**4%**
Osteochondroma	**02**	**4%**
Osteomyelitis	**06**	**12%**
Total	**50**	**50 (100%)**

The above table shows majority of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 9, Periapical cyst 8, Osteomyelitis 6, Odontoma 5, Dentigerous cyst 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2.

DISCUSSION

As cost effective and easily accessible as well low radiation dose, conventional radiographs such as panoramic radiographs (orthopantomographies [OPTs] or panoramic X-rays) or dental intraoral radiographs are commonly used for the diagnosis of pathology of the mandible.[11] However conventional radiographs having two-dimensional projections of three-dimensional structures, have a limited role for the assessment of lesion size, lesionmargins, as well as extension into important anatomic structuresor soft tissues. CT plays an important role in the study of intraosseous lesions and in the evaluation of adjacent bone destruction.[12] The ability of this x-ray method to eliminate image superimposition, to present real dimensional values, to reconstruct high resolution images in different planes including 3 dimensions, has established CT as the gold standard in diagnosis and treatment planning of this lesions;[13,14] In current study MDCT diagnosis shows majority of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 10, Periapical cyst 7, Osteomyelitis 6, Dentigerous cyst 4, Odontoma 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2. MRI has been infrequently used for oral and maxillofacial imaging because the acquisition of the sequences can be invalidated by motion of the body, respiration, air in the oral cavity and nasal cells, implants and metal materials.[15] However, the utilization of MRI, allowed us a careful evaluation of spatial relationship between anatomic structures and intraosseous jaws lesions when CT imaging has provided unclear depiction of the mandibular canal. In current study MRI shows majority of cases were Ameloblastoma 12 followed by Keratocysticodontogenic tumor 9, Periapical cyst 8, Osteomyelitis 6, Odontoma 5, Dentigerous cyst 4, Cementoblatsoma 2, Osteogenic Sarcoma 2, Osteochondroma 2.

CONCLUSION

MRI could be effectively useful to the typing of different expansive lesion, and to evaluate the possible infiltration of the soft tissue. These informations are decisive in the differential diagnosis between the benign lesions and major aggressive odontogenic tumours and in the surgical planning.

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Source of Support: None Declared
Conflict of Interest: None Declared