CT and MRI in Extracranial Head and Neck Lesions

J. S. Aswini Jyothi[1], D. Mounika[2], M. Vijaya Kumari[3], N. Jayalatha[4]

ABSTRACT

Introduction: The multiplanar imaging capabilities and superior contrast resolution of MRI allow more elegant demonstration of most lesions and can be beneficial for surgical planning. Study aimed to use of Computed Tomography and Magnetic Resonance Imaging in extra cranial head and neck lesions and to determine the site of origin of the lesion and to detect and characterize the lesions of different etiologies on MRI.

Material and methods: Total 150 patients with suspected extra cranial head and neck lesions (detected on clinical history, USG or CT scan) underwent MR imaging of the extra cranial head and neck, during a period of 2 years for the study. This study was a Prospective, observational study, conducted on patients of any age group of either sex, referred to the Department of Radiodiagnosis and Imaging, Osmania General Hospital/ Osmania Medical College and MNJ cancer Hospital, for MRI of extra cranial head and neck which was done after taking a written, informed consent.

Results: This study was performed on 150 patients with suspected extra cranial head and neck lesions. We studied the role of MR imaging in various extra cranial head and neck lesions. The prospective observational study carried out on 150 patients comprising 90 (60%) males and 60 (40%) females has slight male preponderance. Maximum numbers of patients were seen in age group of 41 to 60 years (38%) followed by 21-40 years (30%). All extra cranial head and neck lesions were divided into neoplastic and non-neoplastic lesions. Both neoplastic and non-neoplastic lesions were more prevalent in 4th to 6th decades, with the number of cases being 111 neoplastic (74% of all lesions) and 39 (34% of all lesions) non-neoplastic lesions respectively.

Conclusion: Most common neoplastic lesions were tongue carcinoma (27.02%) and most common non-neoplastic lesions were multinodular goiter (14.28%), most common extracranial head and neck lesions were malignant accounting for 60% (90 cases) of all the lesions included in the study.

Keywords: CT, MRI, Extracranial Head and Neck

INTRODUCTION

The use of MRI for the evaluation of head and neck lesions has not become widely accepted as the imaging modality of choice as rapidly as it has for brain imaging. In fact, many neck lesions are evaluated just as adequately with CT and are less prone to motion degradation artifacts created by swallowing. Patient motion can pose a significant problem with MR image quality in patients who have problem handling oral secretions. High quality MRI examinations of the head and neck are generally more time consuming compared to CT imaging and require patient cooperation for a longer period of time. However, there are instances where MRI provides more complete evaluation of the patient with a head and neck mass. MRI of head and neck lesions is clearly superior to CT for the evaluation of masses that traverse the skull base and exhibit intra-cranial or intra-orbital extension.[1-4] Subtle cranial nerve involvement is demonstrated more easily with MRI. Differentiating sino-nasal mass lesions from adjacent post obstructive sinus secretions is accomplished well with MRI. Oral cavity and tongue lesions frequently can be better demonstrated on MRI than on CT imaging. The multiplanar imaging capabilities and superior contrast resolution of MRI allow more elegant demonstration of most lesions and can be beneficial for surgical planning. MRI of the neck should be tailored for the anatomic region and process under evaluation. A standard head coil usually suffices for relatively localized examination of the supra-hyoid region and base of the skull. The infra-hyoid neck requires a neck coil. Surface coils may improve the signal-to-noise ratio (SNR) by almost 50% compared to standard head coils; however, anatomic coverage may be limited. Axial, coronal, and sagittal sequences are essential. Unenhanced axial T1-weighted images display anatomic relationships and can detect lesions (e.g., lymph node lesions) embedded within fat. T1-weighted coronal images can define the false vocal cords, true vocal cords, laryngeal ventricle and the floor of mouth. T1-weighted sagittal images provide helpful information about the pre-epiglottic space and nasopharynx.[5-8] T2-weighted axial images characterize tissue, detect tumor within muscle, demonstrate cysts, and assist differentiation of post-therapy fibrosis from recurrent tumor. Fast spin-echo (FSE) T2-weighted imaging has the added advantage of a relatively short acquisition time. Gradient moment nulling, flow compensation, cardiac gating, and pre saturation pulses minimize motion artifacts. Phase and coding gradients are best oriented in the anterior posterior direction to further reduce distracting artifacts. Gadolinium (Gd)-enhanced images improve delineation of margins in many lesions. Fat suppression techniques, such as short tau inversion recovery (STIR) and frequency - selected

[1]Associate Professor, Department of Radiology, MGMH/Osmania Medical College, [2]Postgraduate, Department of Radiology, Osmania Medical College, [3]Professor, Department of Radiology, Osmania Medical College, [4]Professor, Department of Radiology, MNJ Cancer Hospital, Osmania Medical College

Corresponding author: Dr. J. S. Aswini Jyothi, Flat:204, Vasavi Bhuvana Apts, H: 8-3-981/ 1,3,4,6,8,10,11, Srinagar Colony, Hyderabad- 500037, Telangana, India

How to cite this article: J. S. Aswini Jyothi, D. Mounika, M. Vijaya Kumari, N. Jayalatha. CT and MRI in extracranial head and neck lesions. International Journal of Contemporary Medical Research 2018;5(9):I1-I9.

DOI: http://dx.doi.org/10.21276/ijcmr.2018.5.9.31

fat suppression, may improve the conspicuity of soft tissue lesions embedded in fatty tissue by selectively diminishing the hyper-intensity of fat on T1-weighted images. Field inhomogeneity and artifactmay partially diminish the potential advantages of this technique. Moreover, the normal enhancement of the aero-digestive mucosa may conceal small mucosal tumors.

Technology assessment was based on the determination of how often and to what extent MRI versus CT provided valuable diagnostic information, and whether this information influenced patient management. They conclude that as MRI played a positive role in therapeutic management in 91% of the examinations, it is the method of choice for therapy planning and follow-up of head and neck neoplasm. However, when skull base infiltration is suspected, CT is preferred. MRI provides valuable information to support diagnosis of the disease. Magnetic resonance imaging (MRI) provides several advantages over computed tomography (CT) in the evaluation of head and neck region tumors. The improved soft-tissue contrast among normal and abnormal tissues provided by MRI now permits the exact delineation of tumor margins in the naso-pharynx, oro-pharynx, and skull base regions. In addition, the ability to depict cross-sectional anatomy and pathology in three planes without intravenous contrast, patient manipulation, or ionizing irradiation is a distinct advantage of MRI over CT scanning. Drawbacks of MRI include the detection of subtle osseous abnormalities, patient motion, and artifacts introduced by ferromagnetic dental appliances. These drawbacks appear minimal when compared to the benefits of improved soft-tissue contrast and the ability to image exact tumor volumes. MR imaging is a rapidly evolving field, which is replacing CT in the majority of lesions of the extracranial head and neck: tumors of the skull base, para-nasal sinuses, naso-pharynx, para-pharyngeal space, and carcinomas of the oral cavity, pharynx, and larynx. MR imaging is the method of choice for the detection and staging of skull base lesions because of its superior sensitivity in detecting small lesions and its superior accuracy in staging the lesion and narrowing the diagnostic possibilities.[9-10] MRI shows the extent of tumor in the para-nasal sinuses more precisely, and by multiplanar imaging it outlines intracranial extension. MR imaging has greater accuracy than CT in differentiating para-pharyngeal lesions and can detail the extent of tumor tissue in squamous cell carcinoma of the oral cavity, pharynx, and the larynx more accurately. It is more sensitive than CT in showing invasion by tumor tissue into the mandible or laryngeal cartilages.

Current study aimed to study, the use of CT and Magnetic Resonance Imaging in extra cranial head and neck lesions. Determine the site of origin of the lesion and to detect and characterize the lesions of different etiologies on MRI. Also to assess extension /spread into adjacent structures in case of neoplasm or infective pathology on MRI and also assess associated cervical lymphadenopathy.

MATERIAL AND METHODS

Total 150 patients with suspected extra cranial head and neck lesions (detected on clinical history, USG or CT scan) underwent MR imaging of the extra cranial head and neck, during a period of 2 years for the study. This study was a Prospective, observational study, conducted on patients of any age group of either sex, referred to the Department of Radio diagnosis and Imaging, Osmania General Hospital/ Osmania Medical College and MNJ cancer Hospital, for MRI of extra cranial head and neck which was done after taking a written, informed consent.

Inclusion Criteria being all patients in any age group and all patients with suspected extra cranial head and neck lesions**.**

Exclusion Criteria being all patients having MR incompetent intra-cardiac pacemakers and metallic clips in the body and with intracranial skull base and cervical spine lesions.

Instrumentation used was GE System and PHILIPS system with Specification being 1.5T, super conducting system. The approach was 1) A detailed history was taken. 2) As and when required, in un-cooperative patients-sedation was given, for which patient would be kept nil by mouth for 4 hours minimum. 3) CT is perfomed with puffed cheek technique in oral cavity lesions. 4) Multiplanar, multiecho, magnetic resonance imaging (MRI) of the extra-cranial head and neck with the following sequences were performed: STIR (axial, coronal and sagittal plane), T1W (axial, coronal and sagittal plane), T2W (axial, coronal and sagittal plane), pre-contarst T1W fat suppressed (axial and coronal plane) and post contrast T1W fat suppressed (axial, coronal and sagittal plane).

5) Imaging characteristics of extra cranial head and neck lesions were evaluated and correlated with the histopathology/ FNAC, postoperative findings wherever available.

Magnetic Resonance Imaging Technique used was as follows: On a 1.5 Tesla MR Scanner [GE and PHILIPS] using 16 channel NV-16 coil. The gradient strength of the magnet was 33 mT/m. MR imaging was performed by taking T1-weighted sequence (TR – 450 ms; TE - 15 ms; FOV: AP - 230 mm, RL -185 mm, FH –180 mm; Matrix - 256 x 150; Slice thickness - 5 mm; Slice gap - 1 mm; Flip angle - 90), T2-weighted sequence (TR – 6035 ms; TE - 100 ms; FOV: AP -230 mm, RL -185 mm, FH – 180 mm; Matrix - 256 x 150; Slice thickness – 5mm; Slice gap - 1 mm; Flip angle - 90) and short tau inversion recovery (STIR) sequence (TR – 4045 ms; TE - 90 ms; FOV: AP - 230 mm, RL -185 mm, FH– 180 mm; Matrix - 256 x 150; Slice thickness - 5 mm; Slice gap - 1 mm; Flip angle - 90).

RESULTS

150 patients with suspected extra cranial head and neck lesions were evaluated in this study. In our study maximum number of patients was in the age group of 41-60 yrs, followed by age group of 21-40 yrs and 61-80 yrs. In our study there was male predominance (60%) when compared to females (40%). Female: Male ratio is - 3:2.

The table-1 shows the distribution of neoplastic and non-neoplastic lesions in various age groups. It was observed that both were more prevalent in 4th to 6th decades, with the number of cases being 39 neoplastic and 18 non-neoplastic

Age	No. of patients (n = 50)		Total (Percentage)
	Neoplastic lesions	Non-neoplastic lesions	
0-20	9 (6%)	6 (4%)	15 (10%)
21-40	33 (22%)	12 (8%)	45 (30%)
41-60	39 (26%)	18 (12%)	57 (38%)
61-80	24 (16%)	3 (2%)	27 (18%)
81-100	6 (4%)	0	6 (4%)
Total	111	39	150

Table-1: Distribution of neoplastic and non neoplastic lesions according to age

Neoplastic lesion	No. of lesions	Percentage (%)
Laryngeal carcinoma	3	2.70%
Buccal mucosal carcinoma	15	13.51%
Gingivo-buccal mucosal carcinoma	3	2.70%
Mandibular alveolar carcinoma	9	8.10%
Retromolartrigone carcinoma	3	2.70%
Tongue carcinoma	30	27.02%
Lip carcinoma	3	2.70%
Mandibular carcinoma	3	2.70%
Palatal carcinoma	3	2.70%
Dentigerous cyst	3	2.70%
Maxillary alveolar carcinoma	3	2.70%
Sinonasal carcinoma	6	5.40%
Thyroid carcinoma	3	2.70%
Parotid carcinoma	3	2.70%
Orbital dermoid	3	2.70%
Orbital hemangioma	3	2.70%
Cystic Hygroma	3	2.70%
Malignant Lymphadenopathy	9	8.10%
Extra cranial dermoid	3	2.70%
Total	111	100%

Table-2: Distribution of neoplastic lesions

Non-Neoplastic Lesions	No. of lesions	Percentage (%)
Mucocele	3	7.14%
Multinodulargoitre	6	14.28%
Parotitis	6	14.28%
Submandibular sialadenitis	3	7.14%
Thyroid ophthalmopathy	6	14.28%
Orbital pseudotumour	3	7.14%
Orbital cellulitis	3	7.14%
Lymphadenopathy	6	14.28%
Adenoids	3	7.14%
Edema	3	7.14%
Total	39	100%

Table-3: Distribution of non-neoplastic lesions (infective / inflammatory and other lesions)

lesions respectively.

The table-2 shows the distribution of neoplastic lesions. The most common of all these were tongue carcinoma (27.02%) and buccal mucosal carcinoma (13.51%), followed by mandibular alveolar carcinoma (8.10%) and malignant lymphadenopathy (8.10%).

The table-3 shows the distribution of non-neoplastic lesions.

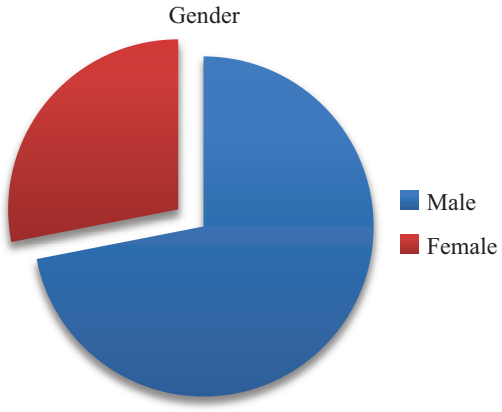

Figure-1: Gender wise distribution

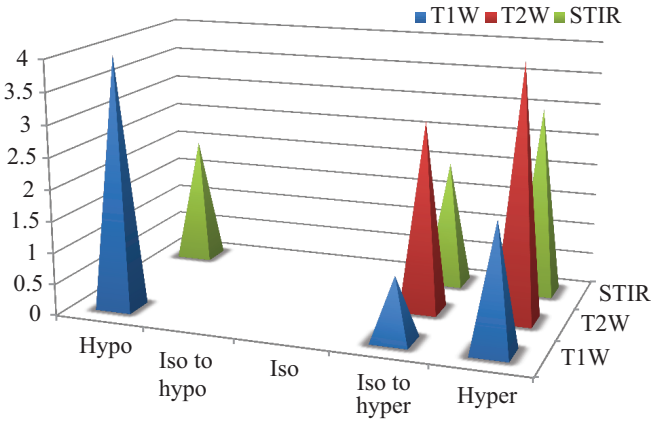

Figure-2: Distribution of signal intensity pattern of benign lesions

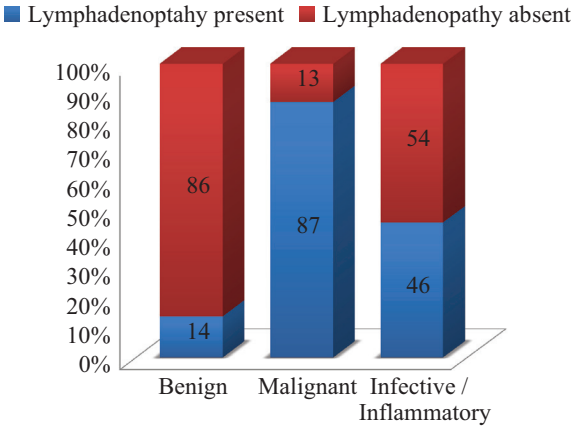

Figure-3: Association of lymphadenopathy in neoplastic and infective/ inflammatory lesions

The most common of all these were multinodular goiter (14.28%), parotitis (14.28%), thyroid ophthalmopathy (14.28%) and lymphadenopathy (14.28%). The study shows the distribution of malignant and benign lesions and Malignant lesions (81.08%) were the most common among all, in our study. The distribution of neoplastic and infective /inflammatory lesions was done according to morphology of the lesion. It was observed that majority of malignant lesions were solid and majority of infective/ inflammatory lesions were other.

The figure-2 shows the distribution of benign lesions according to signal intensity pattern of the lesion. It was

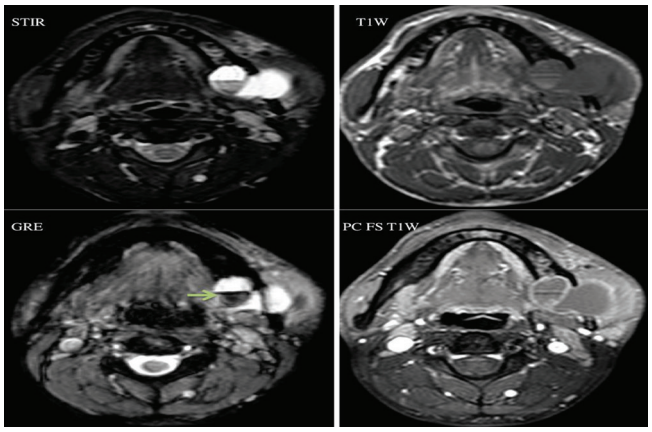

Figure-4: Aneurysmal bone cyst

observed that majority of benign lesions were appearing hypointense on T1W images and hyperintense on T2W and STIR images.

The study shows the distribution of malignant lesions according to signal intensity pattern of the lesion. It was observed that majority of malignant lesions were appearing hypointense on T1W images and hyperintense on T2W and STIR images.

When the distribution of infective/ inflammatory lesions according to signal intensity pattern of the lesion was done it was observed that majority of malignant lesions were appearing hypointense on T1W images and hyperintense on T2W and STIR images.

The distribution of post contrast enhancement patter of benign and malignant lesionswas done and it was observed that majority of benign lesions were showing heterogeneous and rim type of enhancement where as majority of malignant lesions were showing heterogeneous type of enhancement. It was observed that majority of infective/ inflammatory lesions show heterogeneous enhancement.

The table-5 shows associated of lymphadenopathy in benign, malignant and infective / inflammatory lesions. It was observed that lymphadenopathy was present in majority of lesions. It was observed that majority of benign lesions did not show lymphadenopathy and majority of malignant lesions show lymphadenopathy. It was observed that majority of infective/ inflammatory lesions did not show lymphadenopathy.

DISCUSSION

The present study was undertaken to study the role of "CT and MRI in extracranial head and neck lesions". A total of 150 patients were evaluated. The results of the present study are discussed as follows:

Age distribution

Patients of all age group (from 1 month to 85 years) were included in present study. In present study maximum number of patients was in the age group of41-60 years, with 38% of patients followed by age group of 21-40 years and61-80 years. According to the study done by Bhurgari Y et al[1], mean age of the patients was 53.0 years and peak incidence was at 64-69 years. Mahrotra Ret al[2] found highest prevalence in patients belonging to the 50-59 year age group. Both neoplastic (26%) and non neoplastic (12%) lesions were more prevalent in 4th to 6th decade.

Gender distribution

In our study there was male predominance (60%) when compared to females (40%) with Male: Female ratio being 3:2. Adeyami BF et al[3] reported male predominance in head and neck cancers with ratio being 1.8:1. Mahrotra R etal[2] reported 144 malignant lesions with 114 in males and 30 in females. According to Siddiqui MS et al[4], malignant cases more commoner in males than in females with Male:Female ratio being 3.1:1. The male predominance correlates well with our study.

Neoplastic andNon neoplastic lesions distribution

In our study there were 111 (74%) neoplastic lesions and 39 (26%) nonneoplastic lesions i.e. infective / inflammatory in etiology. Both types of lesions were more prevalent in 4th to 6th decade. Otto RA et al[5] reported that neck lesions in children are most likely to be inflammatory or congenital. In older patients (>40 years) neoplastic lesions are more likely. Incidence of non neoplastic lesions does not correlate with our study and this variation may be due to a larger older age patient sample size.

Benign and Malignant lesions distribution

Malignant lesions (81.08%) were the most common among all, in our study while benign lesions being 19%. Siddiqui MS et al[4] studied 455 head and neck neoplasms with 241 being benign and 214 being malignant.

Location of neoplastic lesions

In our study, the most common neoplastic lesion was tongue carcinoma (27.02%) and buccal mucosal carcinoma (13.51%), followed by mandibular alveolar carcinoma (8.10%) and malignant lymphadenopathy (8.10%). Commonest site for neoplastic lesions was oral cavity with 23 (46%) lesions. Siddiqui MS et al[4] found larynx was the commonest site for malignancy and supraglottic region being its most commonly affected subsite. Addala L et al[6] reported that tongue and buccal mucusa were the most common sites for both males and females. Amusa YB et al[7] reported that commonest site for head and neck malignancy was oral cavity 36.8%. This correlates with the findings in our study.

Larynx

There were three cases of laryngeal carcinoma in the supraglottic region, which accounted for 2.70% of all malignant lesions. Patient was 62-year-old male and presented with difficulty in breathing. It was biopsy proven case of squamous cell carcinoma. MR imaging revealed an ill-defined heterogeneously enhancing mass appearing hyperintense on STIR and T2W images and hypointense on T1W images with ipsilateral necrotic node. Our patient had paraglottic space invasion on MRI, which was confirmed at surgery. In a study conducted by Li G et al[8] on 59 cases of laryngeal cancer, MRI depicted the invasion of paraglottic space invasion by cancer accurately. This correlates well with our study.

Oral cavity

In present study, there were 69 (46%) cases of lesions involving oral cavity,10 cases of oral tongue carcinomas, 15 cases of buccal mucosal carcinomas, 9 cases of mandibular alveolar carcinoma, and 3 cases of gingiva-buccal carcinoma, retro molar trigone carcinoma, lip carcinoma, palatal carcinoma and aneurysmal bone cyst of mandible each respectively. In our study common estoral cavity lesion was carcinoma of tongue (43%). In a study conducted by Andisheh Tadbir A et al[9], they found that the tongue was the most commonly affected site (53%) which correlates with our study.

Buccal mucosa and Gingiva

In present study, there were 15 cases of buccal mucosal carcinoma and 3 cases of

Gingivo buccal mucosal carcinoma. All tumors were hypointense on T1Wimages, 12 were iso to hyperintense on T2W and STIR images while 6 were hyperintense on T2W and STIR images. 15 tumors showed heterogeneous enhancement and 3 tumors showed homogenous enhancement. 9 tumors showed extension into buccal and masticator spaces which MR demonstrated in all cases. These results were similar to studies done by Yasuo Kimura et al.[10] One case showed perineural spread along the left mandibular nerve, which was depicted by MR imaging. Hanna E et al[11] concluded that magnetic

resonance imaging has a higher sensitivity and specificity than CT in detecting perineural spread along the base of the skull.

Retro molar trigone

In present study, there were 3 cases of retro molar trigone carcinoma diagnosed on histopathology as squamous cell carcinoma. The tumor was hypointense on T1W images and iso to hyperintense on T2W and STIR images showing predominant peripheral enhancement with central non-enhancing areas. These non-enhancing areas were confirmed as necrosis on histopathology. MR indicated that pterygo mandibular raphe was not involved which was confirmed at surgery. Crecco M et al[12] found that MR showed high accuracy, specificity and sensitivity (>90%) in evaluating involvement of adjacent structures which correlates with our study.

Palatal tumor

There were 3 cases of carcinoma of hard palate, which was diagnosed on histopathology as squamous cell carcinoma. The tumor was hypointense onT1W images, intermediate on T2W and STIR images and showed heterogeneous contrast enhancement. According to study done by Fumiaki Ueda et al[13], adenoid cystic carcinoma and diffuse large B cell lymphoma showed homogenous signal intensity while other tumors like squamous cell carcinoma showed heterogeneous signal intensity. This correlates well with our case.

Mandibular lesions

In present study there were 3 cases of aneurysmal bone cyst of mandible. There was expansile, lobulated, multi septated lesion showing characteristic fluid-fluid levels on T1W, T2W and STIR images, showed GRE blooming in lower fluid level and rim enhancement pattern. The diagnosis was confirmed on histopathology. Mahnken AH et al[16] suggested that the ABC was significantly more often seen as circumscribed lesion with bone expansion, lobulation, septa, and pathological cortical bone reaction than those cases with different diagnoses and septal enhancement proved to be useful. Sullivan RJ et al[17] reported that double density fluid level, septation, and low signal on T1images and high signal on T2 images strongly suggest the bone cyst inquestion is an aneurysmal bone cyst, rather than a unicameral bone cyst. 21 cases showed involvement of mandible on MR imaging, 3 cases caused complete destruction of body of mandible, 6 cases caused erosion of the mandible and 12 cases showed loss of normal fatty marrow on T1W images and hyperintense signal on STIR images. Erosion of mandible was confirmed at surgery in both cases while 9 out of 12 cases with loss of normal fatty marrow signal on T1W images confirmed involvement of mandible on histopathology. Christianson R et al[14] found that MRI was able to demonstrate replacement of normal high signal bone marrow due to secondary involvement of mandible. Bolzoni A et al[15] concluded that MRI had had 93% sensitivity, 93% specificity

and 93% accuracy in detecting mandibular involvement and is technique of choice for treatment planning because of its accurate depiction of soft tissue involvement. This correlates well with our study.

Tongue carcinoma

In our study there were 30 cases of carcinoma of tongue. This was most common tumor of extracranial head and neck (20%) as well as commonest tumor of oral cavity (43%) in our study. All the tumors were hypointense onT1W images, hyperintense on T2W and STIR images. 24 cases showed heterogeneous enhancement and 6 cases showed homogeneous enhancement. 6 tumors caused secondary involvement of mandible, which was depicted on MRI as discussed earlier. Maximum transverse diameter given on MR roughly correlated well with surgical thickness, however this technique needs standardization to measures tumor thickness on MR imaging and histopathology for accurate staging as done in studies by Paul Lam et al[18] and Bashir U et al.[19]

Sinonasal complex

In present study there were 15 cases involving sinonasal complex, 3 cases of dentigerous cyst in maxillary sinus, 3 cases of maxillary alveolar carcinoma, 6 cases of sinonasal carcinoma and 3 cases of pyocele. Dentigerous cyst showed fluid intensity on all sequences i.e. hypointense onT1W, hyperintense on T2W and STIR images with rim enhancement pattern. Patient was 29 years old male with discharge from upper 2nd molar. Crown of malposed tooth was seen at the root of the cyst, which was very characteristic of the diagnosis that was removed at surgery. Xu GZ et al[37] reported 4 patients with dentigerous cyst in the maxillary sinus showing following, all thepatients were males at first 3 decades of age, swelling and/or yellow-green pus discharges

from pharyngeal cavity were common symptoms and the involved teeth in the DC were the maxillary third molar teeth and supernumerary teeth. This correlates well with our study. All 9 tumors showed hypo-intense signal on T1W and heterogeneously hyperintense signal on T2W and STIR images with heterogeneous enhancement patterns. Lloyd G A et al[38] found that tumor shows heterogeneous signal whereas thickened mucosa, polyps and retained secretions always show homogenous signal with or without contrast. Peter M Som et al[20] found that MR imaging provided accurate margins of the tumor. They concluded that nearly 95% of sinonasal tumors had intermediate signal (5% which had bright T2 signals were exclusively minor salivary gland tumors) whereas all inflammatory tissues had bright T2 signal. They concluded that distinction between sinonasal tumor and inflammatory tissue was best accomplished with T2W studies and MR was more accurate than CT. The heterogeneous T2W signal intensity and heterogeneous enhancement pattern consistent with our findings correlates well with studies done by Lloyd G A etal[38] and Peter M Som et al.[20]

In our study there were 3 cases of pyocele. The lesion was hypointense onT1W, hyperintense on T2W and STIR images with rim enhancement. The lesion caused expansion and thinning of the sinus walls. There are two MR appearances either moderate to marked signal hypointensity in expanded sinus on T1W and T2W images or moderate to marked signal intensity on T1W and T2W images representing inspissated or hydrated sinus contents respectively as reported by Pamela Van Tassel et al.[21] Lanzieri CF et al[22] found that on non contrast MR imaging tumors followed intermediate signal intensity on both T1W and T2W images whereas mucoceles showed increased signal on T2W images. They also reported that thin, regular rim of enhancement was suggestive of a mucocele whereas solid or homogenous enhancement was suggestive of neoplastic process. Findings of both these studies are well consistent with findings in our study.

Glandular lesions

In present study we found 18 cases of glandular lesions, 9 cases involved thyroid gland, 9 cases involved parotid gland and 3 cases involved submandibular gland.

Thyroid gland

In our study, there were 6 cases multinodular goiter. Both patients hadenlarged thyroid glands with heterogeneous signal intensity of the gland. Multiple nodules were seen appearing hypointense on T1W, heterogeneously hypointense on T2W images with areas of GRE blooming suggesting calcification / hemorrhage. These were confirmed on FNAC. In our study, there were 3 cases, which was diagnosed on sonography as multinodular goiter but turned out to be positive for malignancy on FNAC. MR showed well-defined lobule in right lobe of thyroid appearing hypointense onT1W, iso to hyperintense on T2W and STIR images with heterogeneous enhancement. Few areas of GRE blooming were seen suggesting calcification or hemorrhage. There was thin pseudocapsule all around. Noma S et al[23] found that pseudocapsules, smooth and lobulated margins were found in both adenoma and papillary carcinoma, whereas unclear margins were found only in papillary carcinoma. They found that hemorrhage (hemorrhagic degeneration) was often found in adenomatous goiter, papillary carcinoma and adenoma resulting in variable signal intensity. In another study the appearance of the pseudocapsule were classified by Noma S et al[24] into four types:

A, intact and even thickness around the tumor; B, only partially presentor even absent; C, intact but with uneven thickness; D, partially destroyed by tumor. They found that MR imaging corresponded precisely with those of gross pathologic examination in all cases but four of adenoma. They found that only adenoma showed type A pseudocapsules and only papillary carcinoma showed type D pseudocapsule. Findings in our case correlate well with studies and suggest histopathological diagnosis of adenoma, which was confirmed on histopathology.

Parotid gland

In our study, there were 9 cases involving parotid gland, 3 were mumps parotitis with associated involvement of submandibular gland as well, 3 cases were acute parotitis and 3 cases were diagnosed on MR imaging as parotid adenoma, which turned out to be parotitis on FNAC. In all cases gland was enlarged appearing hypointense on T1W, iso to hyperintese on T2W and STIR images with homogeneous enhancement pattern in mumps parotitis and heterogeneous enhancement pattern in other 6 cases of parotitis. Teresi L Met al[25] found that poor tumor margination was a clue to malignancy, this was not a consistent finding. Som PM et al[26] found that these benign masses typically have low T1-weighted and high T2-weighted signal intensities andhave clearly defined margins and patients with aggressive parotid tumors wereuncommon, usually have poorly defined margins, and have low T1- and T2-weighted signal intensities. Christe Aet al[27] concluded that low signal intensity on T2-weighted images and post contrast ill-defined margins of aparotid tumor were highly suggestive of malignancy. Considering these findings our all cases do not have features of malignancy.

Orbital lesions

In present study, there were 18 cases of orbital lesions, 3 cases of dermoid, 3 cases of orbital hemangioma, 6 cases of thyroid ophthalmopathy, 3 cases of orbital pseudotumor and 3 cases of orbital cellulitis. There were 3 cases of extra conal dermoid. The lesion was well defined showing hyperintense core and hypointense rim on T1W images and hypointense core and hyperintense rim on T2W images. Suppression of central signal is seen on T1W fat suppressed images. Correlation with CTshows fatty areas in the core with focal soft calcifications in the wall. No postcontrast enhancement was seen. Kaufmann LM et al[28] stated that on CT dermoid cysts appear as well-circumscribed, smoothly marginated, centrally non enhancing, low-density masses,

if fatty components predominate, the density is very low, equivalent to that seen in the subcutaneous fat and retrobulbar tissue. Dermoid cysts with significant intralesional fat are hyperintense on T1W MR images and intermediate intensity on T2W MR images. Dermolipomas demonstrate signal intensity similar to fat tissue. CT and MRI are both helpful in delineating and characterizing dermoid cysts. There was one case of orbital cellulitis. Patient had edema and STIR high signal along superior oblique and inferior rectus muscle on left side. Eustis HS et al[29] have divided the orbital and periorbital infectious in to inflammatory edema, preseptal cellulitis, postseptal cellulitis, subperiosteal abscess, orbital abscess and cavernous sinus thrombosis. Our case was pre and post septal orbital cellulitis. There were 3 cases of orbital hemangioma. There was well defined intraconal lesion appearing isointense on T1W images and hyperintense on T2Wimages with mild to moderate contrast enhancement. Mafee MF et al[30] stated that cavernous hemangioma of the orbit is the most common orbital vasculartumor in adults, tends to occur in the second to fourth decades of life. On CTand MR imaging, appear as well-defined masses, may be located any wherein the orbit but frequently (83%) occur within the retrobulbar muscle cone, always respect the contour of the globe and sometimes, calcification may be seen. This correlates well with our case. 3 cases were of orbital pseudo tumor. The tumors appeared isointense onT1W imaging, hyperintense on T2WI and STIR images with mild enhancement. In study by Cytrynet al[31] all pseudo tumors were isointense to muscle on T1Wimaging, approx 84% of the lesions were isointense to fat on T2W imagines. Only 15% lesions appeared brighter on T1W images than T2W images. All the lesions in their study showed enhancement on post contrast study. Similar results were observed in our case. There were 6 cases of thyroid ophthalmopathy. 3 patients had abnormal thyroid function test while other patients had normal thyroid function test. Bothcases show bilateral involvement of orbits. Inferior rectus, medial rectus, superior oblique and lateral rectus muscles were bulky with sparing of tendinous insertions. In one case inferior rectus and medial rectus showed hyperintense
signal on T2W images. In both cases there was proptosis. On MRI apart from muscle enlargement, the other notable feature was signal intensity of enlarged muscles on T2 W images. On T2W images there were areas of high signal intensity in enlarged eye muscles of 3 (60%) patients due to edema caused by acute inflammation. This correlated well with the study by Norbert Hosten et al[32] in which T2 hyperintensity was seen in 12 of 23 (52%) patients. These findings correlate well with our study.

Lymphadenopathy

In our study lymphadenopathy was the commonest associated pathology, which was seen in 99 (66%) cases out of 150. Lymphadenopathy was more common in malignant lesions accounting for 78 (87%) cases followed by 18 (46%) cases of infective / inflammatory etiology. Lymphadenopathy was seen in only 3 (14%) cases of benign lesions. In our present study there were 15 cases of isolated lymphadenopathy without any other associated primary lesion, 6 cases had no known primary, 3 cases were operated cases of buccal mucosal carcinoma who presented with recurrent nodal mass and 3 cases were known case of breast carcinoma. Our 3 cases had sub centimetric nodes so it was considered negative for lymphadenopathy. In all other 12 cases nodes were more than 1 cm in dimensions. In 9 cases, nodes showed heterogeneous T2W and STIR signal, heterogeneous contrast enhancement and areas of necrosis. In 3 cases therewere enlarged nodes appearing homogeneous on T2W and STIR images. Out of 78 malignant cases associated with lymphadenopathy,66 cases showed irregular margins, conglomerated nodes, heterogeneous T2W and STIR signal, and areas of necrosis with heterogeneous contrast enhancement. Out of 18 inflammatory cases with lymphadenopathy, all 18 cases showed homogenous T2W and STIR signal with no necrosis. 3 benign lesions also showed lymphadenopathy, which showed homogenous T2W and STIR signal with no necrosis. In a study done by de Bondt RB et al[33], they concluded that the morphological criteria border irregularity and heterogeneity of signal intensity on T2-weighted images in addition to size significantly improved the detection of cervical lymph nodes metastases. These findings correlated well with findings in our study.

Adenoid

In our study there were 3 cases of adenoid which was clinically diagnosed as
Naso-pharyngeal mass. MR imaging of 1-year-old male child revealed enlarged adenoid with striped symmetrical bulging causing obstruction of posterior choana on both sides appearing hypointense on T1W images, hyperintense on T2W and STIR images with homogenous contrast enhancement. Bhatia KS et al[34] concluded that nasopharyngeal hyperplasia has typical MR imaging appearances, including stripes in adenoid bulges and symmetry, which may be useful to differentiate this condition from nasopharyngeal malignancy. This correlates well with findings in our study.

Cystic hygrom

In our study there were 3 cases of cystic hygroma which appeared hyperintense on T2W and STIR images and hypointense on T1W images showingperipheral enhancement. Siegel MJ et al[35] suggested that lymphangioma inchildren showed hypointense signal on T1W images and hyperintense signal onT2W images due to the presence of ecstatic lymphatic channels containing clear fluid on histologic section. This correlates well with our study.

Dermoid

In our study there were 3 cases of dermoid that presented with congenital swelling at root of nose. MR imaging showed oval subcutaneous lesion appearing hyperintense on T1W images, iso to hyperintense on T2W imagesgetting suppressed on fat saturated images with no intracranial extension. Boom DC et al[36] concluded that MRI alone is the most cost effective and accurate means of evaluating nasal dermoids and is essential for preoperative planning. This

correlates well with our study.

CONCLUSION

In infective / inflammatory lesions, contrast was not needed for diagnosis and when contrast was needed heterogeneous enhancement pattern was commonest followed by homogenous and rim enhancement. Most common associated findings were lymphadenopathy accounting for 66% (99 cases) of all the lesions in this study. Lymphadenopathy was seen most commonly in 78 (87%) malignant cases, followed by 18 (46%) infective /inflammatory cases and only in 3 (14%) of benign cases. MRI has added advantage of better assessment of lesion for its site of origin, extent and spread in oral cavity. Spread of tumor across midline can be demonstrated with STIR images without need of gadolinium, which is helpful in surgical planning. Loss of normal high fatty marrow signal on T1W images indicates early mandibular invasion. Cortical erosion can also be assessed accurately with MR imaging. Intermediate T2 signal with heterogeneous contrast enhancement is pathognomic feature of malignancy. Erosion and remodeling of bones can be assessed on MR imaging but CT is better for evaluation of bones. Following typical MRI findings can differentiate orbital myositic pseudo tumors: enlargement of extraocular muscles, which extend to involve tendon insertions; ragged fluffy borders of involved muscles; infiltration and obliteration of fat in peripheral orbital space. Graves's ophthalmopathy is typically bilateral. In graves ophthalmopathy thyroid function tests can be normal or abnormal. Inferior rectus and medial rectus were most commonly affected muscles.

REFERENCES

1. Bhurgri Y, Bhurgri A, Usman A, Pervez S, Kayani N, Bashir I, Ahmed R, Hasan SH et al. Epidemiological review of head and neck cancers in Karachi. Asian Pac J Cancer Prev. 2006; 7:195-200.
2. Mehrotra R, Singh M, Gupta RK, Singh M, Kapoor AK. Trends of prevalence and pathological spectrum of head and neck cancers in North India. Indian J Cancer. 2005; 42:89-93.
3. Adeyemi BF, Adekunle LV, Kolude BM, Akang EE, Lawoyin JO. Head and neck cancer--a clinicopathological study in a tertiary care center. J Natl Med Assoc. 2008; 100:690-7.
4. Siddiqui MS, Chandra R, Aziz A, Suman S. Epidemiology and histopathological spectrum of head and neck cancers in Bihar, a state of Eastern India. Asian Pac J Cancer Prev. 2012; 13:3949-53.
5. Otto RA, Bowes AK. Neck masses: benign or malignant? Sorting out the causes by age-group. Postgrad Med. 1990; 88:199-204.
6. Addala L, Pentapati CK, Reddy Thavanati PK, Anjaneyulu V, Sadhnani MD. Risk factor profiles of head and neck cancer patients of Andhra Pradesh, India. Indian J Cancer. 2012; 49:215-9.
7. Amusa YB, Olabanji JK, Akinpelu VO, Olateju SO, Agbakwuru EA, Ndukwe N, Fatusi OA, Ojo OS et al. Pattern of head and neck malignant tumours in a Nigerian teaching hospital-a ten year review. West Afr J Med. 2004; 23:280-5.
8. Li G, Xu Y, Zheng Y. [Evaluation of magnetic resonance imaging in staging of laryngeal cancer]. Zhonghua Er Bi Yan HouKeZaZhi. 1998; 33:240-1.
9. Andisheh-Tadbir A, Mehrabani D, Heydari ST. Epidemiology of squamous cell carcinoma of the oral cavity in Iran. J Craniofac Surg. 2008; 19:1699-702.
10. Yasuo Kimura, Misa Sumi, Tadateru Sumi, Yoshiko Ariji, Eiichiro Ariji, and Takashi Nakamura et al. Deep Extension from Carcinoma Arising from the Gingiva: CT and MR Imaging Features. AJNR Am J Neuroradiol 2002;23:468–472.
11. Hanna E, Vural E, Prokopakis E, Carrau R, Snyderman C, Weissman Jet al. The sensitivity and specificity of high-resolution imaging in evaluating perineural spread of adenoid cystic carcinoma to the skull base. Arch Otolaryngol Head Neck Surg. 2007; 133:541-5.
12. Crecco M, Vidiri A, Angelone ML, Palma O, Morello R. Retromolartrigone tumors: evaluation by magnetic resonance imaging and correlation with pathological data. Eur J Radiol. 1999; 32:182-8.
13. Ueda F, Suzuki M, Matsui O, Minato H, Furukawa M. MR findings of nine cases of palatal tumor. Magn Reson Med Sci. 2005; 4:61-7.
14. Christianson R, Lufkin RB, Abemayor E, Hanafee W. MRI of the mandible. Surg Radiol Anat. 1989; 11:163-9.
15. Bolzoni A, Cappiello J, Piazza C, Peretti G, Maroldi R, Farina D, Nicolai Pet al. Diagnostic accuracy of magnetic resonance imaging in the assessment of mandibular involvement in oral-oropharyngeal squamous cell carcinoma: a prospective study. Arch Otolaryngol Head Neck Surg. 2004; 130:837-43.
16. Mahnken AH, Nolte-Ernsting CC, Wildberger JE, Heussen N, Adam G, Wirtz DC, Piroth W, Bücker A, Biesterfeld S, Haage P, GüntherRWet al. Aneurysmal bone cyst: value of MR imaging and conventional radiography. EurRadiol. 2003; 13:1118-24.
17. Sullivan RJ, Meyer JS, Dormans JP, Davidson RS. Diagnosing aneurysmal and unicameral bone cysts with magnetic resonance imaging. ClinOrthopRelat Res. 1999;366:186-90.
18. Lam P, Au-Yeung KM, Cheng PW, Wei WI, Yuen AP, Trendell-Smith N, Li JH, Li Ret al. Correlating MRI and histologic tumor thickness in the assessment of oral tongue cancer. AJR Am J Roentgenol. 2004; 182:803-8.
19. Bashir U, Manzoor MU, Majeed Y, Khan RU, Hassan U, Murtaza A, Aftab K, Hussain SR, Jamshed A, Uddin N, Faruqui ZS et al. Reliability of MRI in measuring tongue tumour thickness: a 1.5T study. J Ayub Med CollAbbottabad. 2011; 23:101-4.
20. Som PM, Shapiro MD, Biller HF, Sasaki C, Lawson W. Sinonasal tumors and inflammatory tissues: differentiation with MR imaging. Radiology. 1988;167:803-8.
21. Van Tassel P, Lee YY, Jing BS, De Pena CA. Mucoceles of the paranasal sinuses: MR imaging with CT correlation. AJR Am J Roentgenol. 1989; 153:407-12.
22. Lanzieri CF, Shah M, Krauss D, Lavertu P. Use of gadolinium-enhanced MR imaging for differentiating mucoceles from neoplasms in the paranasalsinuses. Radiology. 1991; 178:425-8.
23. Noma S, Nishimura K, Togashi K, Itoh K, Fujisawa I,

Nakano Y, Konishi J, Kasagi K, Iida Y, Itoh H, et al. Thyroid gland: MR imaging. Radiology. 1987; 164:495-9.
24. Noma S, Kanaoka M, Minami S, Sagoh T, Yamashita K, Nishimura K, Togashi K, Itoh K, Fujisawa I, Nakano Y, et al. Thyroid masses: MR imaging and pathologic correlation. Radiology. 1988; 168:759-64.
25. Teresi LM, Lufkin RB, Wortham DG, Abemayor E, Hanafee WN. Parotid masses: MR imaging. Radiology. 1987; 163:405-9.
26. Som PM, Biller HF. High-grade malignancies of the parotid gland: identification with MR imaging. Radiology. 1989; 173:823-6.
27. Christe A, Waldherr C, Hallett R, Zbaeren P, Thoeny H. MR imaging of parotid tumors: typical lesion characteristics in MR imaging improve discrimination between benign and malignant disease. AJNR Am J Neuroradiol 2011; 32:1202-7.
28. Kaufman LM, Villablanca JP, Mafee MF. Diagnostic imaging of cystic lesions in the child's orbit. RadiolClin North Am. 1998; 36:1149-63.
29. Eustis HS, Mafee MF, Walton C, Mondonca J. MR imaging and CT of orbital infections and complications in acute rhinosinusitis. RadiolClin North Am 1998;36:1165-83.
30. Mafee MF, Putterman A, Valvassori GE. et al. Orbital space occupying lesions: Role of computerized tomography and magnetic resonance imaging. RadiolClin N Am 1987; 25:529-59.
31. Cytryn, Albert S, Putterman, Allen M, Schneck, Gideon L, Beckman, Enrico. Predictability of Magnetic Resonance Imaging in Differentiation of Orbital Lymphoma from Orbital Inflammatory Syndrome. Ophthalmic Plastic and Reconstructive Surgery: 1997; 13-2.
32. Hosten N, Sander B, Cordes M, J. Schubert C, Schrner W, Felix R. Graves Ophthalmopathy; MR Imaging of the Orbits. Radiol 1989; 172:759-62.
33. deBondt RB, Nelemans PJ, Bakers F, Casselman JW, Peutz-Kootstra C, Kremer B, Hofman PA, Beets-Tan RGet al. Morphological MRI criteria improve the detection of lymph node metastases in head and neck squamous cell carcinoma: multivariate logistic regression analysis of MRI features of cervical lymph nodes. Eur Radiol. 2009; 19:626-33.
34. Bhatia KS, King AD, Vlantis AC, Ahuja AT, Tse GM. Nasopharyngeal mucosa and adenoids: appearance at MR imaging. Radiology. 2012; 263:437-43.
35. Siegel MJ, Glazer HS, St Amour TE, Rosenthal DD. Lymphangiomas in children: MR imaging. Radiology. 1989; 170:467-70.
36. Bloom DC, Carvalho DS, Dory C, Brewster DF, Wickersham JK, Kearns DB et al. Imaging and surgical approach of nasal dermoids. Int J Pediatr Otorhinolaryngol. 2002; 62:111-22.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 10-09-2018; **Accepted:** 21-09-2018; **Published:** 27-09-2018