ORIGINAL RESEARCH ARTICLE

A Prospective Study of HRCT Evaluation of Pathologies of Temporal Bone

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A B S T R A C T

Introduction: Diagnostic approach to pathology of the brain has been changed with the availability of non invasive imaging of central nervous system. Current research aimed to study the incidence of lesions of temporal bone and their clinical features.

Material and methods: The cases were selected based on all patients referred to Department of Radio-Diagnosis with clinically suspected pathologies of the temporal bone.

Results: 100 patients were evaluated with male preponderance (68%) noted in the study. Infections and trauma were found to be the commonest lesions. Most of the affected patients were adolescents and young adults. The chief presenting symptoms were ear discharge and otalgia. Chronic otitis media and mastoiditis were the commonest forms of infections.

Conclusion: The temporal bone which is a relatively inaccessible area of the human anatomy, HRCT is the imaging modality of choice. Radiation to the eye can be reduced by using anorthogonal plane of 30° without compromise in the image quality. By that proper and adequate treatment or timely surgery can be started so that complication can be prevented. HRCT is a valuable tool in diagnosis and treatment. It helps in planning procedure like cochlear implantation, treatment of aberrant ICA etc, so that essential structure of temporal bone can be preserved.

Keyword: High Resolution Computed Tomography, Temporal Bone, Cholesteatoma, Mastoiditis.

INTRODUCTION

Temporal bone imaging is extremely challenging, as the normal anatomy includes many small but clinically important structures, and a significant abnormality in this area maybe less than 1 mm in size. These are close to the limits of resolution by imaging.

Good spatial resolution and discrimination of 24 line pairs per cm is essential which can be achieved by latest CT scanners. Bone details can be explained by CT and for details of inner ear and its connection MRI required.[1] CT excels in the evaluation of disorders that primarily affect air spaces or cortical bone.[2] HRCT can directly visualize temporal bone minute details. It has excellent topographic visualization and devoid of artifacts from superimposition of structures. Location, extent and complication of the disease can be explored before surgery for accurate assessment of pathology. The main disadvantages of CT are poor soft-tissue definition within the bony labyrinth and internal auditory canal (IAC) and radiation exposure for the patient.

Current research aimed to study the incidence of lesions of temporal bone and their clinical features.

MATERIAL AND METHODS

The study was carried out in the Department of Radio Diagnosis, Konaseema Institute of Medical Sciences & research foundation. The period of study was Feb 2020 to June 2020. The cases were selected based on all patients referred to Department of Radio-Diagnosis with clinically suspected pathologies of the temporal bone. Clinical history of all was taken in detail.

Imaging technique:- All selected patients were scanned in GE Revolution series 16 slice spiral CT scanners. The scanning was done in both axial and coronal planes. All scans were obtained at an average of mA 100 and 140 KV. Initially a scout view or topogram was taken. The scan parameters were-

- Mode: Sequence
- Slice: 0.625 mm in axial and 0.625 mm in coronal plane
- Pitch: 1.25 for both axial and coronal plane.
- **Scan orientation:** Cranio-caudal for axial plane and anteroposterior for coronal plane.
- FOV: 10 cm.
- Filter: SS 40.
- Window settings: Bone.
- Width / Centre: 2000/500

The axial scans were obtained in a plane 30 degree to the anthropological base line. The coronal sections were taken at 105 degree to this base line. The line joining the midpoint

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of the external auditory canal to the infra orbital rim is the anthropological base line.

For the axial scans the patient was made to lie supine, with the head resting on the head rest. A lateral tomogram was taken and the above mentioned plane was selected. The angulation of the gantry helped to achieve the correct plane.

The coronal scans were done in the prone position. The patient was placed on the head rest with a chin support and positioned to maximum extensible position.

The axial scans were taken 2-3mm below the level of the round window (mid plane of external auditory canal) upwards till we reach the level of the superior semicircular canal above. The coronal scans were taken from the level of the geniculate ganglion to the descending limb of the facial canal. Findings of the images of both planes were evaluated. Filming was done.

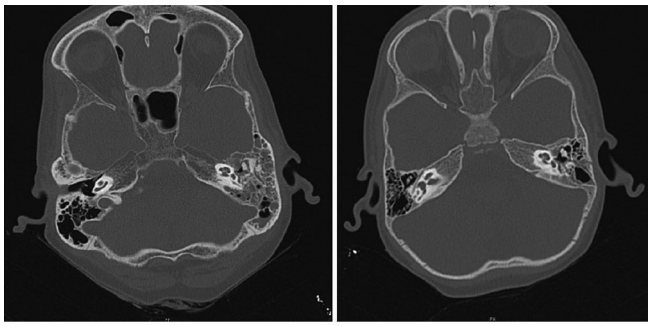

Figure-1: HRCT Temporal bone fluid collection in left mastoid and middle ear cavity without bony destruction suggestive of acute mastoiditis on Left side and longitudinal fracture of right mastoid bone with fluid collection in middle ear.

RESULT

During the period of study 100 patients were enrolled for this study. Most of the patients were between 21 to 40 years of age and there was female predominance. Ear discharge was most common clinical presentation flowed by Otalgia.

Out of 71 patients diagnosed to be infection, chronic otitis media was preset in 52 patients, Cholesteatoma was present in 26 patients, and mastoiditis was present in 50 patients. We have observed trauma in 18 patients an tumour was present in 7 patients out of that 6 have acoustic neuromas and paraganglioma was present in one patient. Congenital anomalies and dysplasia was present in 4 patients.

DISCUSSION

As there are verities of imaging modalities are available present study has been designed to develop a proper method to evaluate temporal bone. For that factors are considered like dose of radiations, ability to visualize small structures, technical factors, positioning of patients, interpretations and cost. HRCT can directly visualize temporal bone minute details. It has excellent topographic visualization and devoid of artifacts from superimposition of structures. Location, extent and complication of the disease can be explored before surgery for accurate assessment of pathology.

Variables		Number	Percentage
Age in years	Less than 20	34	34
	21 to 40	49	49
	41 to 60	14	14
	More than 60	7	7
Sex	Male	68	68
	female	32	32
Clinical presentation	Hearing loss	45	45
	Ear discharge	75	75
	Otalgia	73	73
	Headache	21	21
	Tinnitus	8	8
	Facial nerve weakness	6	6
	Fever	17	17
	Cerebellar signs	10	10

Table-1: clinicoepidemiology of patients

Diseases		No. of patients	Percentage
Infections (n= 71)	Chronic otitis media	52	73
	Cholesteatoma	26	36
	Mastoiditis	50	70
	Acute otitis media	12	16
Trauma		18	18
Tumors (7)	Acoustic neuroma	6	6
	Paraganglioma	1	1
Congenital anomalies and dysplasias		4	4

Table-2: Distribution of disease in patients underwent HRCT

Infection

Infections were the most common cases studied. The range of age was from 5 to 45 years, 65 cases were studied and out of which otitis media were 64, mastoiditis were 50 and cholesteatoma 26.

Study by GAS Lloyd et al(1980) in 30 patients with CT showed that 3rd most common cause of temporal bone lesion was infection. (Lloyd, 1980.). 1st and 2nd were tumor and temporal bone trauma respectively. This variation could be due to late presentation of the disease leads to complications in our study which could be attributed to the low socioeconomic strata and illiteracy of the patients.[1]

Mohammad F. Mafee et al studied cholesteatoma in 48 patients with Computed Tomography preoperatively (Mafee, 1988). Operative reports of these patients were correlated with CT findings in all the patients. The hallmark of cholesteatoma on CT scans are a soft tissue mass in attic and mastoid antrum associated with smooth bony expansion, scalloping of the mastoid, erosion of lateral wall of attic and erosion of ossicles. Comparing the imaging changes in the attic with findings at operation they found agreement between the radiographic interpretation and surgical findings in 90% of the cases.[2]

The sex ratio in the present study is 1.6 : 1 which correlates with the study of Paparella and Kim (1977) (Paparella MM K. C., 1977;87(12)).[3]

Out of 26 patients in the present study 22 belonged to low socio economic groups. This is accordance with studies and a well acknowledged fact. Lack of good nutrition and hygiene with illiteracy perhaps plays a major role as most patients because of illiteracy and ignorant about ear disease. Most patients sought medical advice very late.

5 patients were studied for postoperative assessments

Type of surgery	No. of cases	Residual disease	Dural erosion	Labyrinth
Modified Radical Mastoidectomy	4	1	1	Intact
Simple Mastoidectomy	0	-	-	-

Trauma

They constituted 18% of our study, forming the second largest group in our study. Majority of the patients were males. Age group of the patients in our series varied from 2 to 60 years with majority of the patients being young adults and middle aged.

Distribution of types of temporal bone fractures

Longitudinal fracture was found to be the commonest type of fracture in our study. Longitudinal fractures traverse through middle ear cavity causing disruption of the ossicles and resulting in conductive loss of hearing. The fracture plane is usually extra labyrinthine and anterior to the labyrinthine structures, toward the eustachian tube and middle cranial fossa. The involvement of the EAC, tegmen tympani, and squamosal temporal bone is found common. First genu or anterior tympanic segment of the facial nerve was involved in longitudinal fracture of bone. In transverse fractures, fracture plane extends from the jugular foramen and foramen magnum to the middle cranial fossa, passing through or near the vestibular aqueduct and involve otic capsule (Swartz JD, 2001 Jun;22(3)).[4] SNHL in the setting of a transverse fracture can occur due to transection of the cochlear nerve or involvement the bony labyrinth.

All type of hearing loss with temporal bone fractures. Conductive hearing loss is caused by hemotympanum, disruption of the tympanic membrane, or disruption of the ossicular chain. Incus is the most vulnerable to injury. As a result, most ossicular dislocations or subluxations involve the incus (Saraiya PV A. N., 2009;16(4)).[5] Incudostapedial joint subluxation, malleoincudal subluxation, incus dislocation, and dislocation of the malleoincudal complex are common injury. stapedial and mallear fractures are relatively less common.

Neoplasms

They constitute 7% of our study which is not correlated with the study of GAS Lloyd et al (1980) which claimed neoplasms to be the most frequent lesions.[1]It is common in all age group from 6 years to 65 years with male preponderance.

Acoustic neuroma:-

Out of 7 neoplastic lesions (7%) that were scanned 5 were acoustic neuromas. There was right CP angle predominance. All cases were hypodense to isodense to the surrounding brain with dense enhancement on contrast administration and depicted internal auditory canal erosion. Taylor S(1982), in his study had reported bony erosion on CT in upto 87% of the cases.[6] This difference can be because we encountered all large size acoustic neuromas. P Wolf et al has reported that Acoustic neuroma was the most common internal auditory canal and/or CP angle lesion in his study.[7]

Jackson CG has reported that chemodectomas, are the second most common tumor to involve the temporal bone and the most common tumor of the middle ear.[8] We found one case of chemodectomas in our study which originate from paraganglia along the tympanic branch of the glossopharyngeal nerve and the auricular branch of the vagus nerve.

We had also found one case of a chondroid tumor in our study. CT features revealed mass lesion in the middle cranial fossa arising from left posterior clinoid process, sphenoid and part of petrous temporal bone with thinning and breach of squamous part of temporal bone with dense speckled calcification within.

Congenital anomalies and dysplasias

Mayer TE B. H et al has reported that the prevalence of atresia of the EAC is approximately one in 10,000.[9] Yuen et al has reported that Imaging of the temporal bone aids in surgical planning by allowing assessment of the size and pneumatization of the middle ear, potential associated abnormalities of the ossicles and Swartz JD F. E et al has reported that the location of the mastoid segment of the facial nerve, which is often displaced anteriorly.[10,11] Our study diagnosed 3 patients with abnormalities involving external ear, EAC and the middle ear. One of them had the findings as a component of other features of hemifacial microsomia.

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CONCLUSION

HRCT is superior to conventional method of investigations and provides higher spatial resolution and better soft tissue contrast. There was male preponderance in our study.

Most common lesion in our study was infection. A close clinical correlation is essential for evaluation of middle ear masses. In case of infections common presenting symptoms were otorrhea, otalgia, hearing loss and headache.

Identification of injury to critical structures is important to guide further management and predict prognosis. A neoplastic disease of the middle ear is best staged with HRCT. Post-contrast scan is required for evaluation of neoplasm. Most common tumour was acoustic neuroma.

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