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HRCT IN TEMPORAL BONE

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ABSTRACT HRCT, a modification of routine CT, provides a direct visual window into the temporal bone providing minute structural details. Purpose of the present is to evaluate the normal variations, pathological process (infections, tumours and congenital anomalies), trauma and their extent involving the temporal bone. A prospective correlational study of 50 cases in patients with signs and symptoms of temporal bone pathology was done from March 2018 to may 2019. Patients were scanned in both the coronal and axial planes with thin 0.6 mm sections using ultra high algorithm obtaining both contrast and nonenhanced images. Results were tabulated using percentages. Amongst the 50 cases which were studied, infection was found to be the most common pathology affecting the temporal bone with increasing preponderance in the younger age group. Trauma found to be second largest group with longitudinal fractures being most common with increasing incidence in younger age male group. Neoplasms formed the third largest group of lesions with acoustic neuroma being the most common tumour. HRCT is a revolutionary imaging modality that helps in evaluating the distribution, features, localization and assessing the extent of various pathologies affecting the temporal bone. Hrct is helpful modality in assessing the need for surgery in syndromic patients, in treatment approach and road mapping for surgical planning for temporal bone pathologies.

KEYWORDS : Hrct, Tumors Of Temporal Bone, Tumors Of Middle Ear, Otitis Media, Cholesteatoma

The major functions of HRCT in the valuation of tumours of the temporal bone are :-

1) When tumours present in the middle ear, HRCT serves to differentiate tumour from vascular anomalies and to determine the extent of deep involvement, often obviating the need for angiography.
2) Where tumours present by tinnitus or cranial nerve deficit without mass in the middle ear, HRCT serves to differentiate tumour from other benign and malignant lesions. When a lesion is large or appears atypical, angiography is of complementary value. Otherwise, unless embolisation is contemplated, angiography is not always necessary.
3) By precisely defining intratympanic, mastoid, jugular wall, infralabyrinthine and petrous apical involvement as well as posterior, middle and infratemporal fossa extension. HRCT provides essential information for planning the surgical approach.

In Trauma to temporal bone is best assessed with hrct for identifying disabling complications, for planning surgical approach and predicting future outcome based on the pattern of bone involvement

1) Emergent intervention is necessary in two situations following temporal bone trauma. Obvious brain herniation (encephalocele) into the middle ear, mastoid, or external acoustic meatus requires immediate neurologic and medical stabilization, and CT scanning to allow planning for emergent surgical correction.
2) The second situation is massive bleeding from intratemporal carotid artery laceration and is an uncommon complication of temporal bone trauma. Balloon occlusion of the vessel by an interventional radiologist is generally faster than surgical ligation and repair in this situation.
3) HRCT has important role in identification of facial nerve injury and in localizing the segment of facial nerve involvement whether proximal or distal to geniculate ganglion for road mapping of surgery .

In evaluation of syndromic patients cochlear itactness in crucial for planning implantation planning which can be clearly depicted by HRCT technique.

Therefore High Resolution Computed Tomography has useful in planning more direct procedures like cochlear implantation, avoiding fatal surgical interventions on aberrant ICA etc, preserving function of the essential structures of the Temporal bone.

Hence High Resolution Computed Tomography has helped to define accurate planes that enable the diagnosis, characterization and treatment of pathological processes affecting the temporal bone.

AIMS AND OBJECTIVE

1. To assess the normal anatomy and variations in the structure of temporal bone.
2. To study the congenital anomalies of the ear according to compartment involvement.
3. To study the extent of ear infections and their complications.
4. To evaluate neoplasms involving temporal bone.
5. To evaluate temporal bone trauma.

METHODOLOGY

This prospective correlational study study evaluating the efficacy of HRCT in the diagnosis of temporal bone pathologies was done on 50 cases. This study was conducted during the period between March 2018 to May 2019 in the Department of Radio diagnosis, Alluri Sita Rama Raju Academy of Medical Sciences, Eluru

SELECTION OF PATIENTS:

INCLUSION CRITERIA;

Patients who were clinically suspected of having symptoms related to the temporal bone were referred and subjected to HRCT of the temporal bone.

EXCLUSION CRITERIA :

Patients with electric devices at the skull base, such as cochlear implants,were excluded from study.

RESULTS AND DISCUSSION

INFECTION :

Patient with infection form the largest proportion of cases studied. The

age range was from 15 months to 45 years, 23 cases were studied and out of which mastoiditis were 9, cholesteatoma are 13and 1 were malignant otitis externa.

Study by GAS Lloyd et al(1980) in 30 patients with CT showed infection as the 3rd most common cause of temporal bone lesion. 1st and 2nd were tumor and temporal bone trauma respectively. This variation could be due to the increasing number of complications associated with the infections because of the late presentation of the disease in our study which could be attributed to the low socio economic strata and illiteracy of the patients.

Table Showing Age Distribution in Infections

Age in Years	Gupta et al (%)(1998)	Present Study (%) 2018 T0 2019
0-10	11.46	18.6
11-20	30.57	24.5
21-30	33.12	38.3
31-40	16.56	14.4
41-50	8.28	4.2

Mohammad F. Maffee et al(1988) studied cholesteatoma in 48 patients with Computed Tomography preoperatively. Operative reports of these patients were correlated with CT findings in all the patients. The hallmark of cholestetoma 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.

The incidence of cholesteatoma could not be estimated in the general population. In a study of the general population in Iowa, Horker and Koontz (1977) reported the overall incidence of cholesteatoma to be 6 per1,00,000 it is however estimated that 15-25% of all cases of chronic suppurative otitis media are associated with cholesteatoma.

In our study maximum cases are seen in the 2 nd decade . the cases in this were in the age group of 11-20. It is in accordance with Gupta et al (1998)

The male to female sex distribution in the present study is 1.8 : 1 which correlates with the study of Paparella and Kim (1997)

Distribution Of Age Group Of Patients With Cholesteatoma

Age in Years	No. of Patients	Percentage
0-10	0	0
11-20	4	30.7
21-30	5	38.5
31-40	3	23.0
41-50	1	7.6

Cholesteatoma in children and adolescent is said to be more aggressive. This is validated by the high incidence of complication in the first two decades of life and further substantiated by the fact that very extensive disease at the time surgery is more frequent in children than in adults and also by higher rates of recidivism in children.

1. Limitations of the use of HRCT in evaluation of chronic middle ear disease: CT scans of chronically draining ears demonstrated abnormal soft tissue densities in the middle ear or mastoid. However, if this soft tissue mass was not associated with bone erosion, it was not possible to discern whether or not cholesteatoma was present.

Infrequently the soft tissue masses were proved to be granulation tissue or mucosal hypertrophy. Of greater predictive value in the diagnosis of cholesteatoma was the presence of abnormal soft tissue densities with bony erosion.

2. Tympanic membrane thickening and perforations were difficult to assess on HRCT and better seen on otoscopy.

TEMPORAL BONE TRAUMA

Injuries to the temporal bone occur in 30 to 70% of cases involving blunt head trauma. Bleeding from ears, Hearing loss, dizziness ,dysequilibrum are the most common complaints .

Hearing loss is usually immediately apparent to conscious patients and is the most common chief complaint following temporal bone trauma, occurring in as many as 40% of patients with head injury.

Designating fractures as otic capsule–sparing or otic capsule–violating seems to be the most clinically relavant classification system

	No.of patients (27)	Percentage
Otic capsule violating	5	18.5
Otic capsule sparing	22	81.5

Table Facial canal involvement

	No. of Patients (20)	Percentage %
Facial canal involvemnt	5	25
Facial canal sparing	15	75

Brodie et al) described classification of temporal bone fractures on the basis of whether the otic capsule is involved or spared

In our study 18.5 % patients showed otic capsule invovement and 81.5% showed otic capsule sparing.

In our study facial canal involvement is seen in 25%% patients.

Table Showing location of Facial canal involvement

location of facial nerve injury	No. of Patients (5)	Percentage (%)
proximal to geniculate ganglion	2	40
distal to geniculate ganglion	3	60

NEOPLASM:

They constitute (n=6) 12% of our study which is not correlated with the study of GAS Lloyd et al (1980)8 which claimed neoplasms to be the most frequent lesions. Age group of these patients in our series varied from 5years to 45 years with female preponderance.

1. **Acoustic neuroma:** Out of 6 neoplastic lesions (12%) that were scanned 3 were diagnosed as acoustic neuromas. Right CP angle predominance was noted in our study. All cases were hypodense to isodence to the surrounding brain with dense enhancement on contrast administration and depicted internal auditory canal erosion. Taylor S(1982)33, in his study had reported bony erosion on CT in upto 87% of the cases. This difference can be because we encountered all large size acoustic neuromas. Acoustic neuroma was the most common internal auditory canal and/or CP angle lesion in a study by P Wolf (1987)53 and GAS Lloyd (1980).
2. **Metastatsis:** in our study 2 cases showed metastasis. According to Hugh D Curtin (1995) metastases to petrous apex is common from carcinoma breast, kidney and lung and variety of other rare tumours have been reported to involve the apex. The appearance is variable depending on the site of the primary lesion. Some metastases are very cellular,infiltrating tumours and some may be less invasive and remodel the bone. Thus, metastasis must be considered whenever and intra petrous apex lesion is discovered and evidence of a distant primary tumour or other metastatic foci should be sought.
3. **Ewing's sarcoma:** In 1921 James Ewing described a lethal primary bone lesion that affects children and young adults and most frequently originates in the long bone (47%) pelvis (19%) or ribs (12%) . The skull is rarely involved, probably in less than 4% cases with the frontal and parietal bones being the most commonly affected.
4. These tumors rarely arise in soft tissue. Classically Ewing's presents as a diaphyseal permeative lesion with a characteristic onion peel periosteal reaction resulting from new bone formation in parallel layers with mottling, cortical erosion and bone expansion. However these pathogenic features are often absent.

CT of Ewing's sarcoma has often shown a diffusely enhancing hyperdense extra axial mass and extensive bone destruction involving both inner and outer table. Bone involvement by the lesion and bone healing by chemotherapy are better demonstrated on CT scans. MR imaging although providing better delineation of the soft tissue component has a limited role in the treatment of these patients. Bone scans indicate increased uptake in the region of the tumours, suggesting an ossification process. Isotope scans are useful for identification of extracranial bone involvement.

Primary Ewing's sarcoma involving the cranial bones are rare and only 13 cases involving the temporal bone have been reported in literature to the best of our knowledge The significance of this case lies in the fact that there are few reported cases of Ewing's of squamous part of temporal bone.

The histiogenesis of Ewing's tumour has been controversial, and it seems possible that lesions diagnosed as Ewing's sarcoma may actually be a heterogenous group of analplastic neoplasms. More recently, many studies have confirmed the appearance of structures (such as scanty neurosecretory granules) that suggest that Ewing's sarcoma is a form of primitive peripheral neuroectodermal tumour.

The prognosis of extra cranial Ewing's sarcoma is reported to be poor, because of metastasis to long and other bones. In contrast infrequent metastasis appears to present biological characteristics of primary cranial Ewing's sarcoma

Treatment includes radiation therapy along with chemotherapy with a 5 year survival of 8 to 24%.

RHABDOMYO SARCOMA:

Rhabdomyosarcoma (RMS) is a malignant tumour of mesenc hymal origin thought to arise from cells committed to a skeletal muscle lineage. The disease has a peak age presentation at 2 to 5 years and again at 15 to 19 years, and there is a slight male predominance.

Three main histopathologic types of rhabdomyosarcoma have been described

(1) embryonal, which accounts for 75% of tumours and is most common in younger children;
(2) alveolar (20%), which has the worst prognosis and is seen in older children; and
(3) pleomorphic, which accounts for 5% of the cases.

The embryonal and alveolar subtypes of RMS have been found to have genetic alterations that may play a role in the pathogenesis of these tumours. Head and neck disease is further divided into, three categories based on the site of occurrence; (1) Orbital, which carries the best prognosis; (2) paramseningeal, which has the poorest prognosis; and (3) other sites

Imaging shows a soft tissue mass, often with bony destruction. Bony destruction is typically lytic and destructive, but bony remodeling can also be seen. The tumour is usually heterogeneous, maybe hemorrhagic or necrotic, and has relatively well circumscribed borders. The tumours enhance following the administration of contrast for CT. Treatment involves surgery, radiation therapy and chemotherapy.

CONCLUSION

HRCT outweighs the conventional modalities of investigations and provides higher spatial resolution and better soft tissue contrast.

For the assessment of middle-ear infections, a close clinical correlation is essential to evaluate the nature of middle-ear soft tissue masses as cholesteatoma is mimicked by many other middle-ear pathologies. In these cases, HRCT-

1) Is far advantageous in assessing the complications of infection.
2) Lays down an anatomical roadmap for the surgeon preoperatively
3) Predicts certain normal variants of surgical significance preoperatively.
4) Identifies the hidden areas of the middle-ear, namely the posterior recesses.

A previously operated ear has an altered anatomy. The disease of such a ear has a different morphological pattern of involvement.

CT scan plays an important role-

1. To comment regarding the extent of surgery, and the general overall condition of the postoperative temporal bone including the internal auditory canal.
2. The residual/recurrent disease can be assessed.
3. Status of the inner ear can be established.

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