ORIGINAL ARTICLE

Role of HRCT in Temporal Bone Diseases - A Study of 100 Cases

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Abstract

High resolution computed tomogram(HRCT) is a modality of routine computed tomogram. In temporal bone it precisely delineates the bony structures as well as the soft tissue component. Temporal bone is very difficult to access by clinical examination and normal radiograph. HRCT of temporal bone gives a precise window for evaluation of temporal bone involvement in different conditions. The aim of this present study was to evaluate the findings of temporal bone involvement in different traumatic, inflammatory and neoplastic conditions of the surrounding structure. This was a prospective study done in the department of radiodiagnosis, SCBMCH, Cuttack. Patients with clinical signs and symptoms of temporal bone involvement were included in the study. After taking proper history and clinical examination patients were subjected to HRCT of temporal bone. CECT was done whenever necessary. In our study of 100 patients 50 cases were inflammatory, 20 cases were traumatic, 10 cases were neoplastic and 20 cases came out to be normal. HRCT outweighs the conventional modality of investigation and provides high spatial resolution and better soft tissue contrast for the assessment of temporal bone and its adjacent structures proper clinical history and relevant clinical examination are very essential in reaching a definite diagnosis.

Keywords

Mastoiditis, Cholesteatoma, Meningitis, Neoplasm, Trauma

Introduction

Imaging of temporal bone is revolutionized in 1980 by development of high resolution computed tomography. It gives the highest structural definition of any currently available imaging modalities. Bone and air space disorders are best delineated by this method. It is more accurate in delineating soft tissue abnormalities and simultaneously less prone for artifacts. HRCT is a modification of routine CT. It gives minute structural detail of both anatomy and pathology of temporal bone and gives a direct visual window into it. It gives an excellent topographic visualization of temporal bone of adjacent structures. It gives correct information of pathology regarding location, extent and complication of the disease prior to surgery (1).

In a non-traumatic setting of middle ear opacification, imaging mostly reflects chronic inflammatory/ infectious disease. Underlying cholesteatoma is diagnosed in some of the cases. Status of the ossicular erosion and its suspensory apparatus, status of the tympanic and mastoid wall is best delineated by HRCT of temporal bone. When ossicular erosion is visualized the probability of cholesteatoma is 90% (2). MRI is used as a problem solving tool in these cases. Possible extension of infection to the surrounding region

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like posterior fossa, temporal lobe of brain also evaluated by CT and MRI. Specific diagnostic challenges such as whether a cholesteatoma is present in the mastoid or inflammatory middle ear, diagnostic work of patients suffering from long standing facial palsy is made by these modalities (3).

This study was done to evaluate the efficacy of HRCT in the diagnosis temporal bone diseases, to study the extent of middle ear infections and their complications and to evaluate temporal bone neoplasms with their staging.

Materials & Methods

It was a prospective study done in the department of radio diagnosis, SCB Medical college. the institutional ethical committee clearance and patients' consent were obtained to carry out the research.

All patients with clinical signs and symptoms suggesting temporal bone involvement were included in the study. Any patients with history of allergy, post-operative patients and uncooperative patients were excluded from the study.

In the present study of 100 cases (traumatic and non-traumatic) having signs and symptoms of temporal bone involvement, referred to the department of Radio-Diagnosis, S.C.B.M.C.H, Cuttack, were taken for the study. After taking proper clinical history and relevant clinical examination patients were subjected to HRCT of temporal bone and whenever necessary CECT of brain was done. All the data were tabulated according to the preformat and the percentages were calculated. Patients were followed up for six months to check the progress of the treatment.

All the HRCT and CECT were done in our 16 slice GE machine and images were viewed in axial, coronal and sagittal plane for proper localization of pathology. IV contrast(non-ionic) was given wherever necessary.

Intravenous contrast was administered to study the Hypervascular lesions like glomus tumours, Cerebellopontine angle masses and Intracranial or extra cranial extension of middle ear disease

Prior to performing the scan particularly in infants and children less than six years , sedation was usually required. The purpose of sedation was to avoid motion artifact and to ensure a CT scan of diagnostic quality. From six years onwards the need for sedation generally decreased. Sedatives used in our Institution were Tricloryl syrup administered orally. Dosage for infants – ¼ to ½ tsp, Young children- 1 tsp and older children up to 2 tsp (each 5ml – 1tsp contains triclofor sodium BP 500 mg) administered 30 minutes prior the study.

Intravenous Diazepam (Valium) was also used whenever necessary(Dose- 0.2 to 0.4 mg/Kg IV). Patients were kept nil orally four hours prior to the procedure to avoid complications of contrast in infants.

The optimal technique for HRCT described detail by Shaffer and Turski was followed. Films were taken in all patients. HRCT of bone was done to look for any abnormalities followed NCCT/CECT of brain to rule out any evidence like brain abscess, meningitis, primary and secondary neoplastic conditions.

CT images were usually acquired or displayed in axial and coronal. For axial imaging, sections were made in a plane rotated 300 superior the anthropologic base line. Scan produced in this allows separation individual component of the temporal bone so that they are better visualized, with less overlap and fewer partial volume imaging artefacts.

For contrast enhancement, a bolus injection of Iopamidol or Iohexol was given in the dose of 300mg lodine/ml(2m1/kg of body weight). This was given just before the contrast enhanced CT was to be performed.

Result

In our study out of 100 cases we had 50 inflammatory cases, 20 traumatic cases, 10 neoplastic conditions and 20 normal cases.

For convenience we divided the result into three groups. 1. Inflammatory diseases, 2. Traumatic conditions and 3.Neoplastic.

In our study maximum cases are seen in young and middle-aged males, female preponderance is seen in fourth decade. Ear discharge and headache were the most common presenting symptom in our study. Out of 50 cases in our study, we got mastoiditis in 44 cases, cholesteatoma in 5 cases and malignant otitis extema in 1 case. Mastoiditis mostly shows opacification of middle ear and mastoid. Few cases of chronic otomastoiditis show ossicular erosion. Cholesteatoma present with a soft tissue opacification in middle ear with ossicular

erosion. Malignant otitis was presented with soft tissue opacification of external ear with aggressive local bone destruction(***Table-1, Fig-1***). In our series, 2 cases had intracranial complications. Most of our patients were

Table. Radiological Findings In Infection of Temporal Bone Disease

Type of Infection	Opacification of External Ear	Opacification Mid Ear and/or Mastoid	Enhancement	Destruction of Mastoid Segment	Ossicular Erosion	Opacification Mid Ear and/or Mastoid
Mastoiditis	-	+++	+	++	++	++
Cholesteatoma	-	+	-	-	+++	+
Malignant Otitis Extema	++	-	++	-	-	-

Fig-1. Malignant Otitis Externa

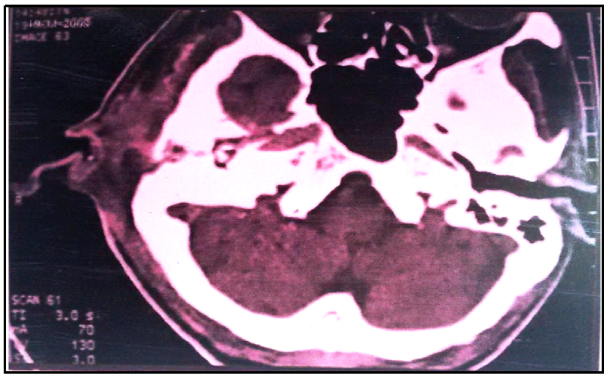

Fig 2. Longitudinal Fracture

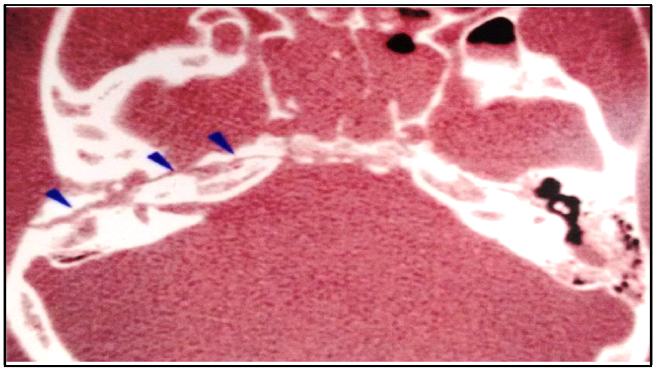

Table 2. Distribution of Trauma (20 Cases)

Type of Injury	No of Patients	Percentage
Longitudinal Fracture	14	70%
Transverse Fracture	6	30%
Complex Fracture	3	15%
Intracranial Haemorrhage	4	20%
Facial Nerve Injury	2	10%

Table 3. Distribution of Neoplasm(10 Cases)

Type of Neoplasm	No of Patients	Percentage
Acoustic Neuroma	4	40%
Metastases	2	20%
Glomus Jugular Tumor	1	10%
Rhabdomyosarcoma	1	10%
Ewing's Sarcoma	1	10%
Epidermoid	1	10%

Table 4. Radiological Findings of Tumor

Tumors	CT Density	Enhancement	Bone Destruction	Iac Widening
Acoustic Neuroma	Hypo/Slightly Hyper	+++	-	+
Metastases	Hypo	++	++	-
Glomus Jugular	Iso To Hyper	+++	+++	-
Rhabdomyosarcoma	Hypo	++	+++	-
Ewings Sarcoma	Hypo	+	+++	-
Epidermoid	Hypo	-	-	-

subjected to medical management and few cases of chronic otomastoiditis and cholesteatoma were subjected to surgical management. After 6 months follow-up 6 cases showed some residual disease.

In traumatic cases we had 14 longitudinal fractures, 6 transverse fractures and three cases had complex fractures **(*Fig 2*).** In these cases two cases had facial nerve injuries and four cases had intracranial hemorrhage**(*Table-2*).**

In the neoplastic group most of the patients were in the third decade. Male female ratio was 2:1. In this group we had 4 cases of acoustic neuroma, 2 cases of metastasis and 1 case

Discussion

HRCT has the advantage of excellent topographic visualization, devoid of artifacts from superimposition of structures. It helps in accurate assessment of pathology prior to surgical exploration regarding location, extent and complication of the disease. It gives a clear anatomical detail prior to surgery which helps the surgeon for proper preoperative planning.

In our study infection was the most common temporal bone lesion. According to one of the study infection was the 3rd most common cause of temporal bone lesion, 1st and 2nd being the tumor and temporal bone trauma respectively (4). 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.

The Male to Female ratio of ear infection in our study was 1.5:1 which differs from the past study where the distribution of diseases was 2.4:1.The difference is probably due to institutional variation and sample size (5). Most of the patients in our study presented with ear discharge and headache. Studies on inflammatory diseases of temporal bone showed ear discharge as the most common complain where as other studies on tumors of mastoid showed headache as the most common manifestation which were correlating with our study (6).

According to our study the infectious diseases are almost equally distributed in the young and middle age group in male patients. Fewer infection are seen in the elder age group. In females however maximum infections are seen in the 4th decade. Out of 50 cases of infection studied 44 cases were mastoiditis, 5 cases were cholesteatoma and 1 was malignant otitis externa. According to one of the study cholesteatoma was the predominant finding followed by mastoiditis (7).

Mastoiditis mostly showed opacifcation of middle ear and mastoid. Few cases had ossicular erosion. Soft tissue opacification in the specific site like Prussak's space or posterior recess with adjacent bony erosion was seen in Cholesteatoma. Soft tissue opacification of external ear with aggressive bone destruction was seen in the case of external otitis extema. These findings were correlated with the findings of previous study (8).

Most patients of our study were subjected to medical management and few cases of Cholesteatoma and Chronic otomastoiditis were subjected to surgical management. In follow-up we found 5 cases of residual disease after medical therapy and 1 after surgical therapy. This differs from the study by Maffe where there were no residual disease after treatment. This is most likely due to resistant organisms and uncooperative patients.

Trauma of temporal bones were divided into longitudinal, transverse and complex fractures. We had 14 longitudinal fractures, 6 transverse fractures and 3complex fractures. one of the author in their study of temporal bone fracture showed that the longitudinal fracture comprised of 70-90% of all temporal bone fractures (9). We had 2 cases of facial nerve injuries. Similarly another author in their study of computed tomographic evaluation of middle ear and mastoid process for hearing loss concluded that 10-20% cases of temporal bone fracture showed involvement of facial nerve which is usually incomplete, horizontal segment was being the most common site of injury (10).

In our study maximum numbers of tumor cases were seen in the 3rd decade of life which almost correlated with the previous study where maximum numbers of cases were seen in the 3rd and 4th decade. Males were most commonly affected by tumors than females which was correlating with the study by GAS Lloyd et al which showed that temporal bone neoplasms were mostly seen in male patients (11).

Out of 10 neoplastic lesions we found 4 cases as acoustic neuromas. Right CP angle predominance was

noted in our study. Acoustic neuroma was the most common internal auditory canal and/or CP angle lesion in a study which correlated with our study. All cases of acoustic neuroma were hypo-dense to iso-dense to the surrounding brain with dense enhancement on contrast administration and widening of internal auditory canal was seen in all cases (12).

Conclusion

HRCT provides higher spatial resolution and better soft tissue contrast. HRCT is helpful in detailed visualization of anatomical structures and their involvement in the disease. It gives proper localization of the lesion with extent of the bone involvement if any. So, diseases can be diagnosed accurately. Intracerebral complications like abscess, empyema, meningitis can be diagnosed.

In cases of trauma it can show the intracranial complications like haemorrhage, involvement of segment of the facial nerve very effectively along with the fracture. Tumor extension both primary and secondary can be assessed very accurately. It gives a complete anatomical roadmap to the surgeon and is the best modality of choice for evaluation of pathologies of temporal bone.

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