International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Inner Ear Anomalies on HRCT and MR Imaging of Temporal Bone in Children with Sensorineural Hearing Loss

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Abstract: ***The ear is an organ of special sense which is crucial for hearing, balance and orientation. It has an extremely complicated anatomy with minute structural components. It is divided into three sections, the outer, middle, and inner ear. The outer ear consists of the auricle, the external auditory canal and terminates at the tympanic membrane. The middle and inner ear are housed in the petrous part of temporal bone. Congenital sensorineural hearing loss arises as a result of abnormalities in the inner ear, the vestibulocochlear nerve, or the processing centers of the brain. Imaging plays an important role in the evaluation of congenital sensorineural hearing loss.***

Keywords: ear, sensorineural hearing loss, temporal bone, inner ear malformations, HRCT, MRI

1. Aims and Objectives

1) To study the normal CT and MR anatomy of temporal bone
2) To identify anomalies of the inner ear on CT and MRI of temporal bone
3) To aid decision making and management strategies by identification and characterization of inner ear malformations

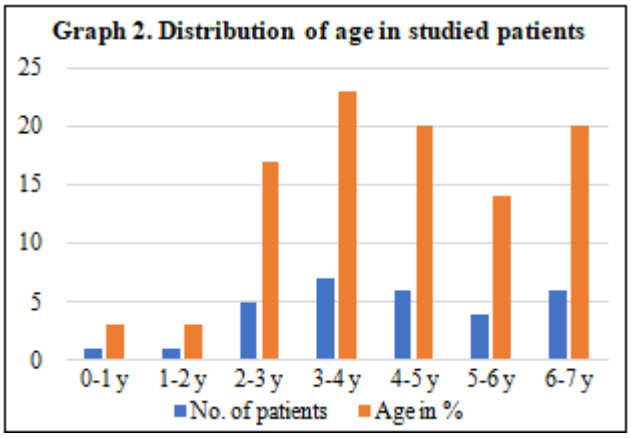
2. Methods and Materials

1) The study was carried out in the Department of Radiodiagnosis and Imaging, Government medical college and New Civil Hospital, Surat.
2) HRCT temporal bone was performed in a CANON Aquilion Lightning Model TSX 035A 16 slice CT machine.
3) MRI temporal bone was performed on MAGNETON Essenza, 1.5 Tesla MRI scanner from SIEMENS.
4) Number of Patients: 30.
5) **Inclusion criteria:**
   a) Children with congenital sensorineural hearing loss referred for study of temporal bone.
   b) Less than 7 years of age (As elasticity of brain to develop hearing and speech only works till 7 years of age)
6) **Exclusion criteria:**
   a) Patients above the age of seven years
   b) Parents/guardians not consenting for the study
   c) Children with conductive and mixed hearing loss
   d) Children who have already undergone surgical management
   e) Children with pacemakers, metallic and cochlear implants.

Maximum number of patients studied were of 4 years of age (23%), followed by 7 years (20%) and 5 years of age (20%). Minimum number were of 1 years (3%) and 2 years of age (3%).

Table 1: Distribution according to the age of the patient

	No. of patients	Percentage
0 - 1 year	1	3%
1 - 2 year	1	3%
2 - 3 year	5	17%
3 - 4 year	7	23%
4 - 5 year	6	20%
5 - 6 year	4	14%
6 - 7 year	6	20%



- Out of 30 patients with sensorineural hearing loss, 5 patients (16%) had inner ear malformations.

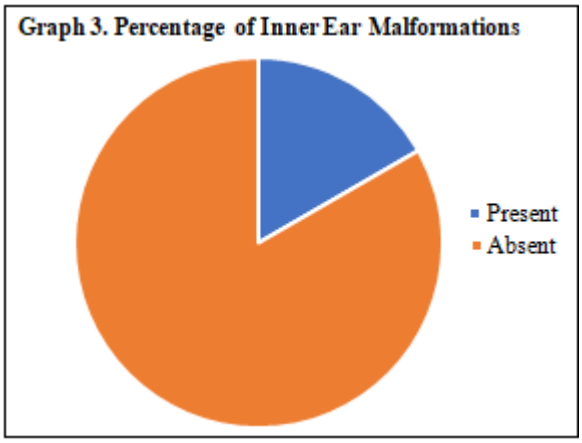
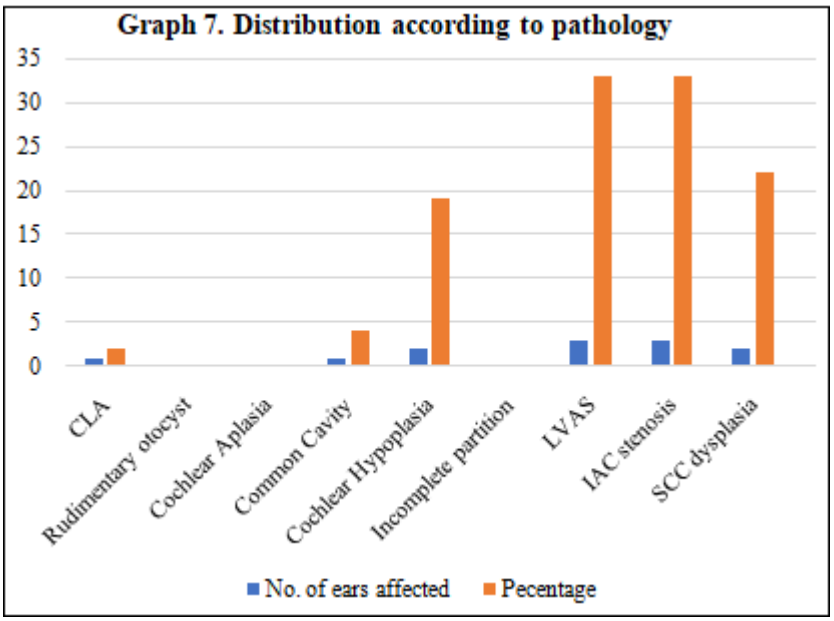


Table 2: Distribution according to the pathology

Pathology	No. of ears affected	Percentage
Complete Labyrinthine Aplasia	1	11%
Rudimentary otocyst	0	0%
Cochlear Aplasia	0	0%
Common Cavity	1	11%
Cochlear Hypoplasia	2	22%
Incomplete Partition	0	0%
LVAS	3	33%
Semicircular canal dysplasia	2	22%
IAC hypoplasia/stenosis	3	33%



3. Summary and Conclusion

- The prevalence of IEMs in this study was 5 (16%) out of the 30 patients studied.
- IEMs were more commonly seen in males and was most commonly seen in the 3–5 - year age group.
- The anomalies identified in this study were complete labyrinthine aplasia, cochlear hypoplasia, common cavity, LVAS, IAC stenosis, semicircular canal dysplasia and VIII nerve hypoplasia/aplasia.
- The commonest IEM noted was LVAS and IAC stenosis.
- The commonest cochleo - vestibular anomaly noted was cochlear hypoplasia.
- The other anomalies noted were common cavity, complete labyrinthine aplasia, semicircular canal dysplasia and VIII nerve hypoplasia/aplasia.
- High - resolution CT helps delineate the intricate osseous anatomy of the temporal bone.
- MR imaging provides crucial information about the fluid - filled spaces of the inner ear and the vestibulocochlear nerve.
- High - resolution CT and MR imaging are complimentary to each other and play an important role in the evaluation of pediatric hearing loss and preoperative assessment.
- Thus, identification of an inner ear malformation helps in clinical decision making, management and prognosis of the patient.

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