ORIGINAL ARTICLE

Pattern of Computerize Tomography Findings in Hearing Loss: A Two Year Retrospective review

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ABSTRACT

Background: Ear diseases and their associated problems are common presentations in clinics worldwide, but are seen more in developing countries. They are causes of morbidity and frequent hospital visits, thereby consuming many man-hours. There is limited literature regarding the burden of ear diseases among Africans, and Nigerians in particular. The advent of computed tomography (CT) and magnetic resonance imaging (MRI) have immensely changed the management pathway of hearing impairments, particularly in the developing world. CT has been shown to be useful for demonstrating the detailed anatomy and pathology of the temporal bone and its surrounding tissues. **Objective:** This study aims to determine the clinical presentations and CT pattern of hearing impairments among patients that were referred for CT in the Radiology Department of an ENT hospital in Kaduna, Nigeria. **Method:** The study is a twenty-four months' hospital-based retrospective study at the Radiology Department of the National Ear Care Centre, Kaduna which is a mono-specialty referral centre for ear, nose and throat pathologies. CT of the petro-mastoid region was done for 117 patients as a result of hearing impairment. A retrospective analysis of request cards, duplicate copy of radiology reports, soft copy of their CT images and patients' folders were considered. All patients with history of hearing loss from other causes were included. Results: A total of 117 patients were recruited for this study, with a female preponderance. The most frequently affected age group were those within the 3rd decade of life. Ear discharge was the most frequent presenting complaint and mastoid opacification constituted the highest frequency of occurrence on CT followed by mastoid wall scleroses, but 5.9% of the CT images were normal. **Conclusion:** CT findings, along with the clinical examination is a powerful diagnostic tool in the diagnosis of hearing loss and also provides sufficient information to the ENT surgeon regarding the extent of disease process, complications, and anatomical variants which may influence management.

Key words: clinical, computed tomography pattern, hearing loss

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Introduction

Hearing impairment or loss is a common cause of frequent hospital visitation all over the world,[1] and is a major public health problem in developing countries.[2]

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It is a common chronic disorder affecting all age groups,[2] but it is more prevalent in adults than children.[3] According to the World Health Organization (WHO), 466 million people worldwide It is a common chronic disorder affecting all age groups,[2] but it is more prevalent in adults than children.[3] According to the World Health Organization (WHO), 466 million people worldwide have one form of hearing disability or the other, and 92.7% of these are adults.[4] Of this adult estimate, 242 (60%) million are males while 190 (40%) million are females,[5] with approximately one-third of the affected persons over 65 years of age.[6] The prevalence of hearing loss varies from place to place,[7]with an estimated two-thirds living in developing countries.[2]In Nigeria, it is estimated that one in seven children have hearing loss and this is quite worrisome,[1] but Ilechukwu et al is of the opinion that this data is not adequate to describe the burden of ear disease among Nigerians.[8] This is because the incidence in their study was low, constituting only 0.8%.

Causes of hearing loss include aging (presbycusis), head trauma, infections (bacterial or viral), heredity, autoimmune inner ear disease, malformation of the inner ear, Ménière's disease among many others.[9] In the developing world, chronic otitis media is the most frequent cause of hearing impairment.[10] Hearing loss can be classified according to the severity or degree of the disease namely, mild, moderate, moderate severe and severe.[9, 11-13]. Common signs of hearing loss are when someone frequently ask others to repeat themselves or needs to be looking at someone to hear what they're saying by reading their lips.[14]

CT and MRI are essential imaging modalities for the assessment of hearing loss pathologies, since their use has significantly changed the pattern of management of individual cases.[6] However, all that is needed is a thorough knowledge of the anatomy of the temporal bone and its surrounding tissues, coupled with interpretation capabilities of the two imaging modalities.[15] CT excels in the evaluation of ear disease process and the adjacent bone, and its advent has positively altered the contribution of radiological imaging in the diagnosis and management of ear disease.[6, 16, 17] There is paucity of literature on the imaging of otologic diseases in Africa, especially Nigeria. Hence, this study is aimed at highlighting common findings on CT in otologic diseases and its role in patients' management in a fragile health system like ours.

Method

The study is a twenty-four months' hospital-based retrospective study between January 2018 and December 2019 at the Radiology Department of the National Ear Care Centre, Kaduna which is a mono-specialty referral centre for ear, nose and throat pathologies. A 32 multi-slice protocol with 5 mm cuts from the base of skull to the midbrain was used and images were acquired in the axial plane with multiplanar reformatted sagittal and coronal images. Out of 589 patients seen within the 24-month period for hearing-loss related problems, only 117 had CT of the petro-mastoid region done, constituting 20%.

A retrospective analysis of their request forms, folders, duplicate copies of radiology reports, and soft copies of CT images of the patients were reviewed independently by two consultant radiologists of not less than twenty and ten-years working experience respectively, and a consultant oto-rhino-laryngologist. A proforma was developed and used to document the obtained information about the patients. All data was entered, tabulated and analyzed using the Statistical Package for Social Sciences (SPSS 23, Armonk, NY: IBM Corp). Frequency distributions (proportions), graphs, charts and tables were drawn to present the data appropriately.

Results

The total number of hospital attendance for hearing-loss related diseases within the 24 months' period was 567. However, only 117 patients had CT done, constituting 20.6% of the total number of patients seen within the period under consideration. There were 48 males (41%) and 69 females (59%), with a male to female ratio of 1: 1.4.

Ear discharge was the most frequent presenting complaint among patients who presented to the CT suite, constituting more than a third (38%) of the patients, while tinnitus and swollen ear constituted 10.5% and 2.3% respectively. Others such as inability to talk, narrowed external auditory meatus (EAM), sinusitis, irrational behaviour and cerebrospinal fluid (CSF) leakage put together constituted 8%. Of the CT findings, 14 (5.9%) were normal. Those with hyperdense mastoids constituted the highest frequency of occurrence (24.8%), followed by mastoid wall scleroses in 13%. Deficient mastoid bone was seen in 2.1% of the patients, while others like foreign bodies, hypo-pneumatized mastoids and lytic mastoids made up 5.9% of the findings.

Table 1 Distribution by age and sex

Age range (years)	No. male	No. female	Total	Percentage
0-10	3	6	9	7.7
11-20	7	13	20	17.1
21-30	11	14	25	21.4
31-40	11	6	17	14.5
41-50	1	13	14	12.0
51-60	6	7	13	11.1
61-70	2	6	8	6.8
70	7	4	11	9.4
Total	48	69	117	100

Table 2 shows distribution of patients by clinical features

Clinical information	Number of cases	Percentage
Ear discharge	98	38
Tinnitus	27	10.5
Otalgia	19	7.4
Hearing loss	18	7.0
Auricular polyp	17	6.6
Vertigo	16	6.2
Facial nerve palsy	13	5.0
Bleeding ear	8	3.1
Headache	8	3.1
Post tympanomastoidectomy	7	2.7
Swollen periauricular area	6	2.3
Others	21	8.1
Total	258	100

Table 3 Distribution by CT findings

Radiologic findings	Number	Percentage (%)
Opaque mastoids	59	24.8
Sclerosed mastoids	31	13.0
Sinus diseases	23	9.7
Under-developed mastoids	20	8.4
Middle ear fluid	19	8.0
Ext/Middle ear soft tissue mass	14	5.9
Mass in external auditory canal/meatus	12	5.0
Displaced/ ill-defined ossicles	11	4.6
Lytic mastoid walls	9	3.9
Ext ear soft tissue mass	7	2.9
Expanded/eroded external /mid ear canal	7	2.9
Deficient mastoid bone	5	2.1
Others	7	2.9
Normal findings	14	5.9
Total	**138**	**100**

Fig. 1 showing a hyperdense left mastoid air cell.

Fig 2 shows a close view of sclerosed mastoid cell.

Discussion

Hearing loss has increased the burden of disability on society worldwide, which include schools and the workplace.[18] This burden varies from place to place[7] but more in the developing world[2]. It is the most frequent reason for prescribing antibiotics and performing surgeries in both children and adults in Otorhinolaryngologic Clinics[19]. Conventional radiology was once its mainstay of clinical imaging, but has now been replaced by modern imaging modalities such as CT and MRI.[20,21] CT has demonstrated the detailed anatomy and pathology of the temporal bone and the surrounding soft tissues, hence has now become an important imaging modality in the diagnosis and management of patients with temporal bone disease and hearing disorders.[8,22]

In this study, the rate of scanning using CT among patients presenting with otologic symptoms was 20.6. This incidence is the same with the one by Ibekwe et al in the Niger Delta region of Nigeria.[23] The male female ratio of 1:1.4 agrees with the result of Ogah et al who had a male to female ratio of 1: 1.04[1] but the study by Jose at al found a slight male preponderance of 53.6%, (M: F= 1.2: 1).[24] This was as a result of the fact that more males present to the hospital than the females in India. Also, the WHO estimates of 2015 show a male preponderance of about 1.5: 1.[5]

The commonest symptom was otorrhea (23%), followed by tinnitus (10.5%). This finding agrees with that of Nwabuisi et al in Ilorin,[25] Ilechukwu et al in Enugu[8] and Huyett et al in Pittsburgh who reported that otorrhoea is the most frequent presenting disease in hearing loss, with children and the elderly more affected.[26] Poor socioeconomic circumstances are said to be the main cause of the chronic suppurative otitis disease in this group because they are more susceptible to most infectious diseases, and do not present to the hospital early enough.[6,8,23] It is also proposed that the high reluctance among the older people to seek orthodox medical treatment is because they have ardent belief in home remedies, traditional medicine, and spiritual cures rather than going to busy hospitals for long waiting periods.[6,25,27] Tinnitus was seen in 10.5% of our patients, and is the second in frequency. However, it is known that tinnitus is a common symptom affecting about 30% of the population worldwide[28] Dizziness and vertigo are common clinical complaints in hearing-loss.[29] In our study, this constituted only about 6.2%. Other presenting symptoms seen in our study such as inability to talk, narrowed external auditory meatus (EAM), sinusitis, irrational behavior and cerebrospinal fluid (CSF) leakage put together constituted 8% of the patients.

Up to about 6% of the CT was normal while opacification of the mastoid air cells was seen in 24.8% and ranked the most common finding. This pattern is similar to those of Trojanowska et al and Musa et al.[19,30] These findings are secondary to mastoiditis which is a common presentation in majority of our ENT clinics.[25,26] Scleroses of mastoid cortex was seen in 13% and ranked second most common finding, this is also thought to be due to mastoiditis. It has been reported that most mastoid scleroses are due to mastoiditis.[19] The bone defect seen in 2.1% of cases was due to previous surgery, while About 6% of findings consist of foreign bodies, hypo-pneumatized mastoids and lytic lesions.

CT and MRI are modern imaging modalities that complement one another in the evaluation of hearing-loss.[19] Each modality has its strength and weakness.[31] This has positively influenced the treatment options of hearing disorders of varying etiologies and degree.[32,33] It is said that MR imaging demonstrates associated soft tissue complications better than CT,[34] but the later offers better spatial resolution of bones compared to the former.[31, 35] However, there is increased concern over the effect of ionizing radiation received during CT studies.[36] These concerns are linked to various types of cancers and cataracts.[33] This radiation exposure makes CT less acceptable by referring physicians compared to MRI, particularly in very young children.[33,37,38]

Early interventions to prevent, identify and address hearing loss are cost-effective and can bring great benefits to the affected individuals.[24] These interventional steps help to rehabilitate hearing loss, since it is critical to speech and language acquisition in children.[39] Although the pathology itself can be well estimated on otoscopic examination, further information concerning the extent of the disease, exact location, structures involved and possible bone erosion, will be addressed in detail only by the use of CT and/or MRI.[19] These radiological instruments aid

in determining contraindications and predicting intraoperative difficulties. CT and MRI findings for these patients should be evaluated by an experienced radiologist before the operation.40CT is important in the evaluation of hearing loss and is the imaging modality of choice, particularly for bony outlines.41It is a better imaging modality for identifying bony abnormalities such as trauma, otosclerosis, inner ear bony dysplasia, and erosive or destructive temporal bone lesions.[42] Lastly, it is also much more available, affordable and cheaper in our environment.[25]

Conclusion

A combination of clinical and radiological findings becomes a powerful diagnostic tool in the diagnosis of ear disease. It also provides sufficient information to the ENT surgeon regarding the extent of disease process, the complications, and anatomical variants which may be encountered during management. There is therefore a need for continuous medical education for the imaging practitioners on ear care. Our government should see ear disease and its complications such as hearing loss, tinnitus vertigo as a peculiar challenge and should seek to reduce its impact on individuals through early detection and timely, appropriate intervention.

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