LEAD ARTICLE

Role of Computed Tomography in Unsafe Chronic Suppurative Otitis Media

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Abstract

Thirty Patients of Unsafe chronic suppurative otitis media were subjected to pre-operative CT scanning followed by surgical exploration of the middle ear and mastoid. and their scans were compared with the peroperative data. High resolution CT scanning has been advocated for evaluation of unsafe chronic suppurative otitis media as it is capable of delineating detail required to detect Labyrinthine fistulae, Facial canal erosion, Sinus and Dural plate erosion and Ossicular integrity. Our results showed CT scan to be highly sensitive for soft tissue density mass in the middle ear and mastoid. Dural plate exposure, Sinus plate erosion, Facial canal and Stapes integrity, moderately sensitive for Malleus and Incus integrity and least sensitive for Lateral canal fistulae. Both Axial and Coronal scans were done as many important structures are best seen in only one of these planes. The principal merit of CT scan of the Temporal bone lies in its inherent ability to depict pathology which is not clinically evident.

High resolution thin section computed tomography has widely replaced conventional techniques for temporal bone imaging. The most significant use of computed tomography lies in evaluation of cases of chronic suppurative otitis media. (O'Reilly et al, 1991). High resolution CT of temporal bone has been implicated as a mode of diagnosing cholesteatoma (Mafee et al, 1988, Jackler et al, 1984), demonstrating ossicular chain (Schwartz, 1983), analysing labyrinthine fistulae (Bates et al, 1988) and detecting bony defects in facial canal (Johnson et al, 1983)

To formulate the above objective, 30 cases of unsafe chronic suppurative otitis media were subjected to computed tomography scanning of temporal bone prior to mastoid exploration. The pre-operative CT films were analysed by experienced Radiologist and answers pertaining to following questions were sought without the benefit of peroperative findings :

1. Presence of soft tissue mass in middle ear and mastoid.
2. Presence of bone erosion.
3. Integrity of sinus and dural plate.
4. Ossicular status.
5. Facial canal erosion.
6. Lateral canal fistulae.

The answers to above questions given by radiologist were then compared with peroperative findings and an attempt was made to evaluate the role computed tomography in unsafe CSOM :

Methodology

Computed tomography was performed on General electric (GE) scanner using high resolution thin section (1-2 mm) sections. Traditionally both coronal and axial sections were performed. Axial scans were taken at a plane 30 degrees above zero degree base line (orbito-meatal line). Coronal scans, on other hand, were done with the patient either prone with maximally extended or

Fig: 1 Normal CT Temporal Bone (Axialcut) Showing Horizontal Portion of the Facial Nerve, Vestibule, Cochlea, Malleus, Incus, Incudo-Malleal joint and Internal Auditory Canal

supine and section being at an angle of 105 degree (Fig : 1, 2)

Fig : 2 Normal CT Temporal Bone (Coronal Cut) Showing vertical Portion of the Facial nerve, Mastoid Air cells and Dural Plate

Discussion

● Soft Tissue Mass

In present series, soft tissue masses were detected in each and every case in the

middle ear and mastoid. However, the division between cholesteatoma and other soft tissue masses could not be made out preoperatively on CT. Peroperatively cholesteatoma was observed in 17 (56.66%) cases, granulations alone without cholesteatoma in 11 (36.66%) cases and polyp and purulent material along with granulations in 1 (3.34%) case each respectively. Jackler et al (1984) found cholesteatoma to be present in 30% of cases where soft tissue mass along with bone erosion was present. Mafee et al (1988) stated that hallmarks of cholesteatoma on CT scan are a soft tissue mass in the attic and antrum along with smooth bony expansion, scalloping of the mastoid, erosion of lateral attic wall, erosion of anterior tympanic spine and erosion of ossicles.

● Integrity of Dural and Sinus Plate

As regarding integrity of sinus and dural plate on CT temporal bone, it was observed that in 9 (30%) cases dura was exposed whereas erosion of sinus plate was seen in 6 (20%) cases. However peroperatively, erosion of dural plate was seen in 7(23.34%) cases and that of sinus plate in 2(6.66%) cases. Thus, out of 9 cases showing dural plate erosion on CT, only in 6(66.66%) cases it was confirmed peroperatively whereas in 3(33.34%) cases, CT gave an erroneous impression of dural plate erosion (Fig3)) Similarly. out of 6 cases demonstrating sinus plate pathology on CT, only in 2(33.34%) it was confirmed and rest of 4(66.66%) cases gave a false impression on CT O'Reilly et al (1991) stated that it is not possible to reliably show an erosion in the tegmen on axial cuts alone but even using coronal cuts, the effect of partial volume averaging gives a false impression of a defect. (fig.4)

Fig : 3 Normal CT Temporal Bone (Coronal Cut) Showing Erosion of the Dural Plate by the Disease process which was also confirmed peroperatively

Fig : 4 Normal CT Temporal Bone (Axial Cut) Showing Erosion of the Sinus Plate by Cholesteatoma. However on mastoid Exploraion it Found to be Intact.

• Lateral Canal Fistulae

As stated by Sheehy et al (1977), Lateral canal fistulae occur in about 10% of cases of chronic suppurative otitis media. In present series, lateral canal was observed to be intact in 25(83.33%) cases, erosion present in 1(3.33%) and not properly seen in 4 (13.34%) cases on CT. Peroperatively, lateral canal was intact in 27(90%) cases and eroded in 3(10%) cases. However, 1 case in which CT showed lateral canal fistulae peroperatively it was intact. Erosion seen in 3(10%) cases peroperatively was not delineated by CT scan in any of the cases. Also 4(13.34%) cases in which lateral canal was not properly visualised on CT, was found intact on exploration. It is important to realise that axial scans can give a false imprint of lateral canal fistulae (Mafee et al, 1988). On CT lateral canal can be seen in full length on axial scan in cross section coronally. On coronal scan, it often appears dehiscant on the medial wall of the antrum due to the volume averaging of the thin wall, In the presence of an soft tissue

density mass, this may give the erroneous impression lateral canal fistulization. Thus for a proper information on the status of lateral canal, Axial scans (preferably tilted 30 degree to orbito-meatal line) should be done. Jackler et al (1984) in their study observed a high incidence of false positives which was caused by sole reliance on coronal scans. (fig 5)

Fig : 5 CT Temporal Bone (Axial Cut) Showing a lateral Canal Fistula. Peroperatively the lateral canal was Found to be intact.

Table No 1

Correlation between computed tomography and surgical findings :

Feature	Peroperatively present	On CT
Middle ear & Mastoid mass	30	30
Dural plate erosion	07	09
Sinus plate erosion	02	06
Ossicular necrosis	21	00
Lateral canal fistulae	03	01
Facial canal erosion	05	00

• Facial canal

In present study, facial canal was observed to be intact in 26 (86.66%) cases and not clearly seen in 4 (13.34%) cases on CT. However, peroperatively facial canal was intact in 25(83.34%) cases and erosion present in 5 (16.66%) cases. Nevertheless out of the 4 cases in which facial canal was not visualized on CT, it was found eroded in 3 (75%) cases and intact in 1 (25%) case on mastoid exploration. Facial nerve was found exposed in 2 cases peroperatively in which CT showed an intact facial canal. Mafee et al (1988) and Jackler et al (1984) stated that a soft tissue overlying the canal caused loss contrast gradient, obscuring a small dehiscence. Jackler et al (1984) commented that the best technique for detecting erosion of bony canal is to view it with multiple crosssectional slices. For this reason, coronal scan is preferred for the horizontal portion of facial nerve while axial scan is the view of the choice for the vertical portion. Mafee et al (1988) found agreement about facial nerve canal integrity in 41 (85%) cases between radiographs and surgery. When the middle ear is disease free, thin lateral bony wall of fallopian canal is easy to visualize on CT scans against its black radioluscent background. But when pathologic soft tissue abuts the tympanic portion of the canal, it may be difficult to determine whether cholesteatoma has eroded the canal or merely lies adjacent to a congenital defect.

• Ossicular Status

It is relatively easy to visualize the bodies of malleus and incus on CT but this has little clinical value unless integrity of the whole ossicular chain is ascertained. The long process of Incus and Stapes suprastructure are most at risk in unsafe chronic suppurative otitis media but are also difficult to illustrate on CT. In present series, Malleus and Incus were seen to be intact in 18 (60%) cases and absent in 12 (40%) cases on CT whereas Stapes was intact in 1 (3.33%) case and absent in 29 (96.67%) cases. No definite comment could be made on the status of the ossicular chain necrosis on CT. Peroperatively Malleus was intact in 11 (61.11%) cases, out of the 18 cases in which Malleus appeared intact on CT scan. In rest of the 7 (38.89%) cases, CT gave a false impression of Malleus being intact. Peroperatively Malleus was necrosed in all of the above 7 cases. Out of the 12 cases in which malleus was absent on CT scan, in 9 (75%) cases it was absent peroperatively and necrosed in 3 (25%) cases. Thus, malleus was necrosed in 10 (33.34%), intact 11 (36.66%) and absent in 9 (30%) cases peroperatively. Out of the 18 cases in which CT showed incus to be intact, only in 6 (33.33%) cases it was confirmed peroperatively. In 12 (66.67%) cases CT gave a faulty impression of incus being intact. Incus was found to be intact in 6 (20%), necrosed in 8 (26.66%) and absent in 16 (53.34%) cases On mastoid exploration.

Stapes was seen intact in 12 (40%) cases peroperatively. However, 11 (91.66%) of 12 cases of intact stapes were missed on CT scan. In out of 14 (48.27) of 29 cases in which stapes appeared absent on CT scan, it was found necrosed peroperatively in 3 (21.42%) cases and intact in 11 (78.58%) cases. Stapes was absent in 15 (50%) cases peroperatively. Jackler et al (1984) stated that stapes was not consistently seen on CT. Phelps and Wright (1990) doubted that CT could reliably demonstrate the ossicular chain because of the combination of partial; volume averaging and tissue silhouetting.

Conclusion

The results of the present study showed CT temporal bone to be highly sensitive for dural plate exposure, sinus plate erosion, facial canal erosion and stapes integrity, moderately sensitive for malleus and incus sensitivity and least sensitive for lateral canal fistulae, when analysed statistically. However certain

drawbacks of CT such as partial volume averaging do lead to false interpretation of the disease process. CT scan has a role in the evaluation of cases of unsafe chronic suppurative otitis media but must be interpreted with caution in view of its certain limitations.

1. Both axial and coronal scans should be done as important structures are best seen only on one of these planes.
2. CT occasionally gives an erroneous impression of lateral canal fistula, tegmen erosion and facial canal erosion due to partial volume averaging of the thin bone covering of these structures with adjacent soft tissues.
3. Abnormal soft tissue associated with bone erosion on CT is highly correlated with cholesteatoma.
4. In present study, the findings of CT scan corroborated well with the peroperative findings

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