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Role of High-Resolution Computed Tomography to Evaluate the Abnormalities of Temporal Bone- Systematic Review Study

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KEYWORDS

Hrct

Middle Ear

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ABSTRACT:

Introduction: High resolution CT (HRCT) of the temporal bone delineates the bony and soft tissue anatomy with high accuracy. The excellent resolution of density differences among soft tissues is the main advantage of HRCT over conventional tomography. The temporal bone is a vital and complex anatomical structure which is located on the sides of the skull. A variation on standard CT called HRCT offers a direct visual view into the temporal bone that previously unavailable minute structural features. It plays a central role in housing and protecting essential sensory organs, auditory structures, and neural pathways. We studied those patients who had the following: normal temporal bone, middle ear cholesteatoma, trauma, anomalies, acoustic neuroma.

Objectives: To study the variations fracture of the temporal bone and assess acoustic neuroma, middle ear cholesteatoma, vascular anomalies, sutures and small canal of the temporal bone.

Discussion/Conclusions: In this study we include middle ear cholesteatoma, trauma, anomalies, acoustic neuroma in which we found that HRCT is a useful modality through which pre-operative assessment of temporal bone abnormalities can be done efficiently with a reasonable accuracy and precision for taking surgical decisions. Some of the analyzed structures can cause diagnostic problems when they are confused with fractures. Vascular anomalies have a potential bleeding risk and should be diagnosed prior to surgery. A profound knowledge of normal anatomy and anomalies of the temporal bones improves the quality of radiological findings.

Introduction

High resolution CT (HRCT) of the temporal bone delineates the bony and soft tissue anatomy with high accuracy. The excellent resolution of density differences among soft tissues is the main advantage of HRCT over conventional tomography. As a result, radiologists are more likely to encounter HRCT studies, and their understanding of the anatomy and pathology of the temporal bone on HRCT will be crucial to making a precise diagnosis. (1) A variation on standard CT called HRCT offers a direct visual view into the temporal bone that previously unavailable minute structural features. CT is the technique of choice in patients suspected of having acoustic neuromas or malignant tumours of the temporal bone. (2)

The temporal bone is a vital and complex anatomical structure which is located on the sides of the skull. It plays a central role in housing and protecting essential sensory organs, auditory structures, and neural pathways. (3) The temporal bone is a multifaceted structure with a vital role in hearing, balance, and overall cranial stability. Understanding its anatomy and functions is essential for healthcare professionals, particularly when diagnosing and treating

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conditions related to the ear, hearing, or balance. The tympanic cavity is an air-filled compartment inside the temporal bone that is connected to the mastoid air cells via the tympanic antrum and the nasopharynx through the eustachian tube. Via the eustachian tube, it serves as an extension of the upper respiratory tract and is vulnerable to bacterial and viral invasion. (4)

We studied those patients who had the following: normal temporal bone, middle ear cholesteatoma, trauma, anomalies, acoustic neuroma.

- Middle Ear Cholesteatoma: MEC pathogenesis was found to be connected to cytokines characteristic for Th1, Th17 and M1 cells. Furthermore, we discovered that the inflammation produced DAMPs, or damage-associated molecular patterns, which fuelled inflammation even more. (5)
- Trauma: Temporal bone fracture is classified by their orientation relative to the long axis of the petrous bone. Such fractures are not rare and are often associated with significant morbidity. The majority of observers believe that the longitudinal variety of fracture is the most common. This is followed by transverse, oblique, and mixed. All are best appreciated on axial images. (6)
- Anomalies: Inner ear anomalies are a rare but important cause of sensorineural hearing loss. More frequently, conductive hearing loss and cosmetic deformity are caused by combined external and middle ear abnormalities. Many temporal bone defects involve altered facial nerve canal courses. When surgical therapy is anticipated, the site is crucial. Vascular anomalies and bone dysplasia's occasionally affect the temporal bone. (7)
- Acoustic neuroma: Acoustic neuromas are benign schwannomas that arise from the vestibular portion of the eighth cranial nerve. Small tumours confined to the internal auditory canal may be removed via an extradural sub temporal approach. Tumours that involve the cerebellopontine angle require posterior fossa craniotomy utilizing either the suboccipital or trans labyrinthine technique. The choice of surgical approach depends primarily on the size of the tumour, its location, and the status of hearing in the involved ear. Operative mortality is very low. The two most frequent causes of morbidity are malfunction of the face nerve and hearing loss. (8)

Results/Discussion

The purpose of the current study was to examine any normal variation, congenital abnormalities in the temporal bone's structure, and assess the numerous infectious diseases of the temporal bone as well as the consequences they may have with HRCT. Cholesteatoma is the most common pathological process linked to the dangerous kind of CSOM. We discovered that the HRCT findings of present study indicated presence of congenital variances in 5 (10%), safe CSOM in 15 (30%) and unsafe CSOM with cholesteatoma in remaining 30 (60%) cases. (9)

The previously reported incidence of the different types of fracture may well reflect the selection of patients for radiographic study based on specific clinical signs. Historically, temporal bone fractures are categorized with respect to the long axis of the temporal bone as either longitudinal, transverse, or mixed. Total trauma cases find in 27 patient, Part of temporal bone fracture: Squamous-7, Petrous-6 and pattern of fracture: Mixed/Oblique-4, longitudinal-2, Transverse-1, Astoid-3, Tympanic-3. However, this rigid scheme of classification is somewhat artificial, as many fractures may follow a multi- planar or oblique course. As some of the complications of temporal bone fracture are potentially surgically remediable, the more precise and complete delineation of fracture planes, associated bone fragments, and soft-tissue pathology is of considerable practical clinical importance. In cases of facial nerve paralysis, although the decision to intervene surgically is usually based on clinical criteria, the operative approach depends on the anatomic location of nerve damage. Because determinations of the site of injury using topognostic testing may be misleading, the more refined imaging of temporal bone injury along the course of the facial nerve, possible with high-resolution CT, may allow more informed preoperative planning. In cases of traumatic conductive hearing loss, detailed middle ear imaging may affect not only the timing of surgery but the decision to operate. (10)

The middle and inner ear anomalies we observed in this study may be classified as absence, hypoplasia, and other abnormalities of middle or inner ear structures. Hypoplasia of middle ear structures was the most common anomaly among the middle ear anomalies. All middle and inner ear anomalies may be classified in another way, in terms of their effects on middle and inner ear function; anomalies that would definitely lead to dysfunction, such as interrupted hearing due to absence of stapes or disequilibrium due to the absence of the lateral semicircular canal, anomalies that could possibly be associated with dysfunction, such as a hypoplastic facial nerve disturbing facial expression or a shortened cochlea or a hypoplastic lateral semicircular canal crista, and anomalies that probably would not lead to dysfunction, such as high jugular bulb or an abnormal course of the posterior ampullary nerve. Using this classification, we found that anomalies of the middle ear that would probably not lead to dysfunction were the most common, followed by anomalies that could possibly be associated with dysfunction, while the anomalies that would definitely lead to dysfunction were the least common. In the inner ear, however, we found that anomalies

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that could possibly be associated with dysfunction were the most common, followed by the anomalies that would definitely lead to dysfunction and anomalies that would not lead to dysfunction. These findings may be clinically significant because more than 49.0% of middle ear anomalies and the majority of inner ear anomalies appear to be associated either possibly or definitely with inner ear dysfunction. (11)

During the first phase of CT application in the evaluation of patients suspected of acoustic neuroma only large tumours protruding more than 1 to 1.5 cm outside the IAC could be unequivocally detected. Total 21 cases clinical suspected Acoustic neuroma, these results indicate that thin, overlapping section CT with high iodine content contrast enhancement, performed with a third or fourth generation CT scanner, makes possible the demonstration of acoustic neuromas with an extra canalicular extension of less than 10 mm. (12)

Conclusion

The temporal bone anatomy is complex, with many fissures and canals that can be confused with fracture. Some of the analysed structures can cause diagnostic problems when they are confused with fractures. Vascular anomalies have a potential bleeding risk and should be diagnosed prior to surgery. A profound knowledge of normal anatomy and anomalies of the temporal bones improves the quality of radiological findings. In summary, the present study thus indicated that HRCT is a useful modality through which pre-operative assessment of temporal bone abnormalities can be done efficiently with a reasonable accuracy and precision for taking surgical decisions.

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