

Original Research Article

Role of HRCT in temporal bone trauma vis-à-vis site of facial nerve injury: a pilot study

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ABSTRACT

Background: Facial nerve paralysis in head injuries has a lesion in the bony fallopian canal. The line of fracture and site of lesion was studied using high resolution computed tomography.

Methods: A prospective study of 37 subjects of facial nerve paralysis following head injury was undertaken. The patients were selected from the neurosurgical trauma centre of a tertiary care facility, of Dayanand Medical College, Ludhiana, during a period of one and a half years. HRCT was performed taking 2 mm axial and coronal cuts of temporal bone for all patients to analyse the type and site of fracture of the bony facial canal.

Results: Total 19 (51.3%) patients had longitudinal fractures while transverse fracture was seen in 7 (18.9%) patients and 11 (29.7%) patients showed comminuted fracture on HRCT. Perigeniculate region was involved in 4 (44.4%) patients. Tympanic segment was affected in 3 (33.3%) patients and the mastoid segment in 4 (44.4%). The tympanic and the mastoid segments were involved simultaneously in two patients. These findings correlated with those observed on HRCT. 500 patients of head injury were screened and 48 (9.6%) patients were found to have facial nerve paralysis. 44 (91.67%) of these were males and 4 (8.33%) females. Majority of the patients (62.5%) were between the age group of 21-40 years.

Conclusions: In the present study of facial paralysis post head injury, longitudinal facial fractures were commonest followed by mixed and transverse on HRCT. The pregeniculate and the mastoid segments showed an equal incidence followed by the tympanic segment.

Keywords: High resolution CT scan, Facial nerve injury, Fracture

INTRODUCTION

Fronto-occipital or temporal trauma disrupts the bony integrity of the temporal bone. The brunt of the trauma being transmitted to the bony canal of Fallopius that conveys the nerve of facial expression. Clinically, there is loss of frowning, sniffing, grinning, grimacing, smiling, pouting, intolerance to loud sounds, dry eye and loss of taste on the affected side.

Imaging computed tomography or magnetic resonance traces the petrosquamous and petro mastoid fracture line, if it exists or the intraneural hematoma.

Necessity of surgical intervention is guided by radiology in addition to progressive or retrogressive clinical status.

The classic characterization of transverse versus longitudinal fracture 20% vs. 80%, respectively has now been modified to an otic capsule violating versus sparing

designation, to explain the likelihood of sequel like facial paralysis, cerebrospinal fluid leak, profound hearing loss, as well as intracranial complications including epidural hematoma and subarachnoid hemorrhage.¹

HRCT is able to demonstrate fracture lines, ossicular chain disruptions, facial nerve injuries, and hemotympanums in most of the patients. Associated severe head injuries (brain contusion etc.) can be noted in the routine head CT.²

Aim

Aim of the study was to determine on high resolution computed tomographic scanning the type of temporal bone trauma wrt the site of injury in the fallopian canal and the middle ear status.

METHODS

A prospective study of 37 subjects of facial nerve paralysis following head injury was undertaken. The patients were selected from the Neuro-surgical trauma

centre of a tertiary care facility; Dayanand Medical College, Ludhiana during a period of one and a half years. i.e. June 2008 to December 2009)

High resolution CT scan (HRCT) was performed to evaluate 1) type of fracture 2) site of fracture line 3) status of the middle ear.

Both axial and coronal cuts were taken with slice width of 2 mm. This investigation was performed for all the patients.

The patients underwent facial nerve excitability tests (Table 1) followed by surgical intervention (Table 2) and results tabulated.

Table 1: Results of facial nerve excitability test (n=48).

NET difference	No. of patients	Percentage
<3.5 mA	34	70.8
>3.5mA	13	27.1
No response	1	2.1

Table 2: Detailed data of patients who underwent surgical management (n=9).

S. no.	Name	Age/sex	Onset	NET diff.	Site of injury	Nature of injury	Recovery at 3 months	
							Clinical	NET diff.
1	RP	25/M	I	4.5	G	BI	III	>3.5
2	KS	36/M	I	3.9	T	BI	III	3.5
3	JS	65/M	I	NR	G	CT	*	*
4	MS	35/M	I	4.2	T, M	BI, BI	III	3.5
5.	SR	24/M	I	5.8	T, M	BI, IH	IV	>3.5
6.	SS	23/M	D	3.6	M	PT	III	<3.5
S. no.	Name	Age/sex	Onset	NET diff.	Site of injury	Nature of injury	Recovery at 3 months	
							Clinical	NET diff.
7.	AC	38/M	I	4	G	BI	III	3.5
8.	TR	40/M	I	4.3	M	IH	III	3.5
9.	GS	53/M	D	3.7	G	IH	III	<3.5

*Lost on follow-up, G = Geniculate, M = Mastoid, T= Tympanic, BI = Bony Impingement, IH = Intraneural haemorrhage, PT = Partial Transection, CT = Complete Transection, NR = No Response

Inclusion criteria

Inclusion criteria were head injury patients with facial palsy and Glasgow coma score more than 4.

Exclusion criteria

Exclusion criteria were penetrating injuries, non-shiftable patients and with preexisting ear ailments

Statistical analysis

All statistical analysis was performed using Microsoft Excel and statistical package of social sciences (SPSS) version 17 for Microsoft windows (SPSS Inc. Released 2008. SPSS statistic for windows, version 17.0, Chicago).

RESULTS

Total 37 patients had evidence of temporal bone fracture while no fracture was visualised in 11 patients. 19 (51.3%) patients had longitudinal fractures. Transverse fracture line was seen in 7 (18.9%) patients while 11 (29.7%) patients showed comminuted fracture on HRCT.

Here, 19 (51.3%) patients had longitudinal fractures. Transverse fracture line was seen in 7 (18.9%) patients while 11 (29.7%) patients showed comminuted fracture on HRCT (Table 3).

Site of injury

Perigeniculate region was involved in 4 (44.4%) patients. Tympanic segment was affected in 3 (33.3%) patients

and the mastoid segment in 4 (44.4%). The tympanic and the mastoid segments were involved simultaneously in two patients. These findings correlated with those observed on HRCT.

Table 3: Type of fracture on HRCT (n=37).

Type of fracture	No. of patients	Percentage
Longitudinal	19	51.3
Transverse	7	18.9
Comminuted	11	29.7

Onset of facial paralysis

Based on history, 13 (27.1%) had immediate onset and 21 (43.7%) patients had delayed onset facial paralysis. The onset of paralysis could not be assessed in 14 (29.1%) patients as they were unconscious at the time of admission (Table 4).

Table 4: Onset of facial nerve paralysis (n=37).

Onset of paralysis (based of history)	No. of patients	Percentage
Immediate	13	27.1
Delayed	21	43.7
Not assessed	14	29.1

In the present study group right sided paralysis was noted in 25 patients and left sided in 23 patients.

The site of fallopian canal was localized in the patients who underwent surgical intervention. Mastoid segment was found to be involved in 4 (44.4%) patients. Involvement of the perigeniculate region was found in 2 (22.2%) patients and tympanic segment in 3 (33.3%) of patients.

DISCUSSION

Computed tomography (CT) scanning is performed routinely in head injury patients and is a part of the initial workup of poly trauma patients. It is primarily carried out to exclude any life threatening intracranial haemorrhage which requires immediate management. Dahiya, 1999, reported that about one third of temporal bone fractures were not evident in the initial computed tomographic scans used in acute trauma settings.¹ However, high resolution computed tomography (HRCT) provides high sensitivity in detecting subclinical temporal fractures.

HRCT is able to demonstrate fracture lines, ossicular chain disruptions, facial nerve injuries and hemotympanum in most of the cases, and also aids in clinical decision making.^{2,3} It is necessary to classify temporal bone fractures on the basis of location of the fracture line.⁴ In CT head, occasionally the fracture line is not directly visualised. In such scenarios, findings like air in intracranial cavity, temporomandibular joint (TMJ)

fossa, infratemporal fossa, and soft tissue overlying the temporal bone, opacification of the mastoid air cells, middle ear and external auditory canal should point toward a fractured temporal bone.⁵⁻⁷

Non-contrast HRCT of temporal bone (HRCT-TB) with cuts not more than 1.5 mm, is the diagnostic imaging standard for temporal fractures.⁷⁻¹⁰ HRCT-TB provides excellent delineation of fracture anatomy, and also allows evaluation of facial nerve canal, ossicular chain, otic capsule, carotid canal and floor of the middle cranial fossa. Moreover bony dehiscence which mainly occurs in the region of stapes and oval window with perilymphatic fistula can be diagnosed with HRCT.¹¹ With the advent of contemporary scanners, it is possible to rapidly image critically ill patients with minimal manipulation of the patient.^{9,12,13} On correlating physical findings with HRCT, radiographically evident TBF were missed in about 14% to 35% of head trauma patients on clinical examination.^{12,14,15}

Once the patient is stabilised and can be subjected to longer examination time, magnetic resonance imaging (MRI) is the ideal choice to evaluate intracranial contents and to evaluate nerve palsies which are not explained by HRCT.^{9,16-18} MRI is also vital for preoperative evaluation in cases of temporal bone fractures requiring surgical interventions, especially middle cranial fossa approaches which require temporal lobe retraction.¹⁹ Jones et al. demonstrated that MRI revealed higher incidence of temporal lobe injuries associated with temporal fractures. In this study around 46% of patients had ipsilateral temporal lobe contusion; none of which were clinically evident.²⁰ MRI is superior to HRCT in differentiating between herniated intracranial contents into the mastoid and fluid filled mastoid.²¹ The other imaging modalities include traditional four-vessel arteriography and CT metrizamide cisternography.

In the present study a high-resolution CT scan was performed for all patients to basically evaluate the type of fracture. The site of fracture was evaluated in patients who were explored and correlated with the surgical findings. Commonest type of fracture seen was longitudinal which was found in 19 (51.3%) patients. Our findings are consistent with those reported by Schubiger et al who found relatively higher incidence i.e., 70% of longitudinal fractures in their patients.²² Transverse fractures were found in 18.9% of cases. Reported incidence of transverse fractures varies between 10-20% Hough et al, 1980.²³ we were also able to classify a high percentage (29.7%) of fractures as mixed or comminuted. These findings are consistent with those reported by Aguilar et al 1987.²⁴

The surgical findings revealed the nature and site of injury. The most common type of injury to the facial nerve was found to be bony impingement by a fractured bony spicule, which was present in 6 (54.5%) of cases. Intra-neural haematoma was seen in 3 (27.5%) of cases.

Complete facial nerve transection was seen in 1 (9.1%) case and partial transection in another 1 (9.1%) of case.

These findings are quite consistent with the Lambert and Brackmann 1984 series, who reported bony impingement to be the commonest type of injury to the facial nerve in temporal bone fractures.²⁵ Neural oedema was seen at the site of fracture in almost all the patients. Coker et al 1987 also reported neural oedema at the lesion site in 93% of the cases.²⁶

The site of injury was found to be in the perigeniculate region in 44.4% of the cases. In 33.3% of the patients the tympanic segment was affected while the mastoid segment was involved in another 44.4% of the patients. These findings are contrary to those of Lambert and Brackmann 1984 who considered the geniculate ganglion to be the most common site of facial nerve injury.²⁵ The site of injury to the fallopian canal as revealed by HRCT was correlated with the surgical findings. It was thus found that on HRCT, the mastoid segment was affected in 44.4% patients, the tympanic segment in 33.3% while perigeniculate region was involved in only 22.2% patients.

CONCLUSION

We recorded an incidence of 9.6% of facial paralysis in our patients of head injury with longitudinal fracture being predominant followed by mixed and transverse on HRCT. The pregeniculate and the mastoid segments showed and equal incidence followed by the tympanic.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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