

ROLE OF CT IN LOCALISING THE INJURY TO THE PARTICULAR INTRACRANIAL COMPARTMENT IN PATIENTS WITH CRANIOCEREBRAL TRAUMA

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ABSTRACT

BACKGROUND

To evaluate and assess the role of CT in localising the injury to the particular intracranial compartment in patients with craniocerebral trauma. To evaluate the value of early CT imaging, which helps in patient prognosis. To correlate CT findings with Glasgow coma scale and clinical findings there by guide the neurosurgeon for the surgical planning.

MATERIALS AND METHODS

The study was conducted at Department of Radiology, Government General Hospital, Kakinada, from September 2012 to September 2014 over a period of two years. The study includes evaluation of 300 cases of craniocerebral trauma. All age groups were included.

RESULTS

A higher incidence noted in males and age group of 20-29 years and moderate Glasgow coma scale in majority of cases. Most common presenting symptom being loss of consciousness followed by vomiting. The commonest finding on CT being subdural haematoma followed by intraparenchymal haematoma. Skull fractures noted in 74% of cases. All the patients with moderate Glasgow coma scale showed intracranial bleeds. Out of 300 patients, normal CT findings in 159 patients that is 53% and abnormal CT findings in 141 patients that is 47%.

CONCLUSION

Incidence of road traffic accidents was more in male population with peak age incidence in between 20-30 years. Subdural haematoma was most common form of intracerebral bleed. Glasgow coma scale combined with relevant presenting complaints can be used as an indication for CT scan in order to avoid unnecessary CT scans.

KEYWORDS

Computed Tomography, Glasgow Coma Scale, Subdural Haematoma, Skull Fracture.

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BACKGROUND

Trauma is a major health problem and is a leading cause of death. Brain injury is the major contributor to death in multitrauma patients.¹ Motor vehicle accidents are the leading cause of head injuries followed by fall, assault, firearm wounds and others.²

Computed Tomography (CT) is one of the most comprehensive diagnostic modality of accurate localisation of the site of injury in craniocerebral trauma. The ability of CT to rapidly demonstrate a surgically correctable lesion,

fracture and subarachnoid haemorrhage makes it modality of choice in evaluation of acute head injury.³

CT can accommodate lifesaving equipment, traction and patient monitoring devices. It is rapid, widely available, inexpensive and is easy to obtain.⁴

Correlation between CT findings with Glasgow coma scale and clinical outcome may give useful information.⁵

CT would minimise hospitalisation and more invasive and hazardous procedures by delineating normal brain.⁶

CT has an accuracy approaching 100% in diagnosis of intra and extra cerebral collections of blood.⁷

Early detection of intraventricular haemorrhage is possible and prompt drainage can improve survival.⁸

Chronic SDH were more common in elderly patients with minor craniocerebral trauma due to absence of tamponade effect of contusion and oedema, which occurs in major trauma and by presence of cerebral atrophy.⁹

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MATERIALS AND METHODS

The protocol was approved by Ethics Committee and written informed consent was obtained from each patient. This study was conducted at Department of Radiology, Government General Hospital, Kakinada, from September 2012 to September 2014 over a period of two years. 300 patients of all age groups were included in the study.

All cases with history of road traffic accident and suspected of craniocerebral trauma referred to Department of Radiodiagnosis for CT scan within 24 hours of injury were included in the study.

Relevant history of the patients was taken, which includes age, sex, type of injury, principal presenting complaints such as headache, vomiting, loss of consciousness.

Relevant clinical findings were noted such as external injuries overhead, pupillary size and reaction, etc.

Glasgow Coma Scale (GCS) Recorded as Follows

Grades scores

- Normal : 15
- Mild head injury : 13-14
- Moderate head injury : 9-12
- Severe head injury : <8

Noncontrast CT brain was performed with SIEMENS dual slice spiral CT unit on all the patents.

CT findings were correlated with history, clinical findings and Glasgow coma scale.

Inclusion Criteria

All cases with history of road traffic accident and suspected of craniocerebral trauma referred for CT scan within 24 hours of injury.

Exclusion Criteria

Cases referred for CT scan after more than 24 hours of injury, history of assault, fall, firearm injury, etc. Patients in whom Glasgow coma scale could not be evaluated such as tracheal intubation, severe eye swelling, drug overdose or intoxication, metabolic disturbances, spinal cord injury, etc. children under 5 years of age.

CT Performed Using Siemens Somatom Dual Slice CT

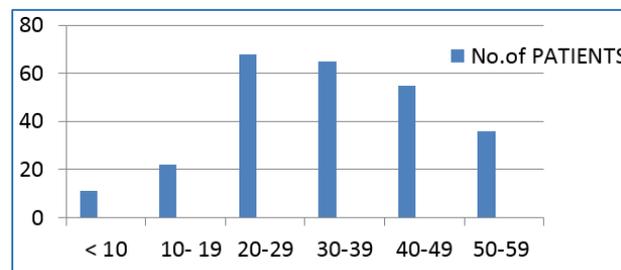
The computed tomography findings in patients with craniocerebral trauma were noted in wide range of window level and window widths to note bleed, fractures and other relevant findings.

RESULTS

During the study, 300 patients with history of road traffic accidents were studied. Out of 300 patients, 220 were male patients (73.33%) and 80 were female patients (26.67%).

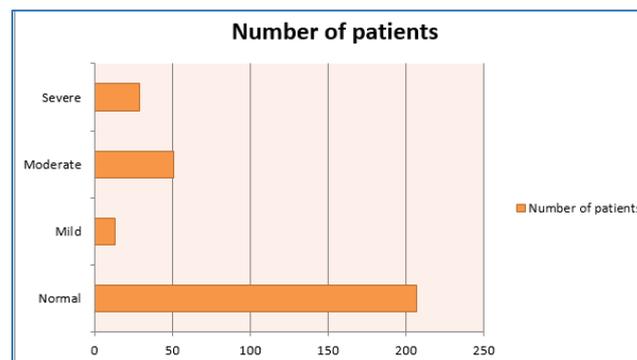
Age distribution of patients with road traffic accidents showed highest in age group between 20-29 years (68 patients 22.66%) followed by 30-40 years (65 patients 21.67%).

AGE DISTRIBUTION AMONG THE POPULATION



Out of 300 Patients

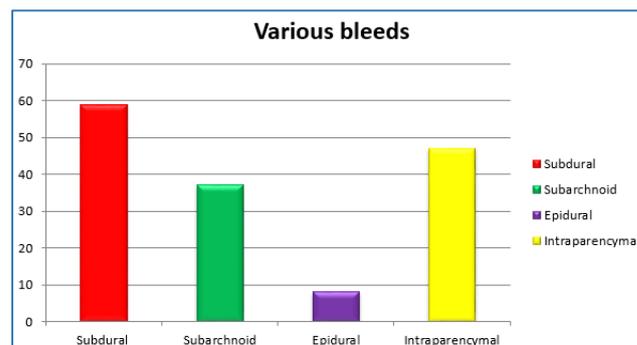
207 patients showed normal Glasgow Coma Scale (GCS) at the time of examination. 93 patients showed abnormal GCS at the time of examination. Out of 207 patients with normal GCS- 130 patients had no obvious clinical findings. 77 patients had one or more clinical findings. Severity of head injury by traumatic coma data bank, which is based on GCS score was mild in 13 patients, moderate in 51 patients and severe in 29 patients.



History of loss of consciousness was most common presenting symptoms in head injury patients (147 patients - 87.5%) followed by history of vomiting in 101 patients - 60.12% and abnormal pupillary reaction in 29 patients - 17.26%.

CT FINDINGS

Out of 96 patients who showed various types of intracranial bleeds subdural haematoma was commonest seen in 59 patients (61.4%). Subarachnoid haemorrhage was seen in 37 patients (38.5%), epidural bleed in 8 patients (8.3%) and intraparenchymal haematoma was seen in 47 patients (48.9%).



Skull fractures seen in 105 patients (74.4%), midline shift was seen in 16 patients (11.3%) and pneumocephalus seen in 16 patients (11.3%).

Correlation between Glasgow Coma scale, Clinical and CT Findings.

Out of 207 patients with normal Glasgow coma scale, 11 patients had intracranial bleeds.

Out of 51 patients who had moderate GCS scale, all had intracranial bleeds.

Out of 29 patients who had severe GCS scale, 28 had intracranial bleeds.

The one patient who did not have intracranial injuries with severe GCS had facial bones fractures and blunt intraabdominal injury. 16 cases who had midline shift were classified under severe head injury (13 patients) and moderate head injury (3 patients) by GCS scale.

Sensitivity, specificity, positive predictive value and negative predictive values of Glasgow coma scale to predict intracranial bleed was calculated with following data.

Patients who had normal GCS and showed intracranial bleed (true negative)- 196 patients.

Patients who had abnormal GCS and showed intracranial bleed on CT (true positive)- 85 patients.

Patients who had normal GCS and showed intracranial bleed on CT (false negative)- 11 patients.

Patients who had abnormal GCS and no intracranial bleed (false positive)- 8 patients.

When Glasgow coma scale alone is taken as test to identify intracranial bleed, it showed sensitivity 88.5%, specificity 96.1%, positive predictive value 91.4% and negative predictive value 94.7%.

Sensitivity, specificity, positive predictive value and negative predictive values of Glasgow coma scale combined with clinical findings to predict intracranial bleed was calculated with following data.

Patients who has normal GCS and clinical findings and no intracranial bleed (true negative)- 130 patients.

Patients who had abnormal GCS and/or clinical findings and showed intracranial bleed on CT (true positive)- 93 patients.

Patients who has normal GCS and clinical findings and showed intracranial bleed on CT (false negative)- 2 patients.

Patients who has abnormal GCS and/or clinical findings and no intracranial bleed (false positive)- 75 patients.

When Glasgow coma scale combined with relevant presenting complaints is taken as test to predict intracranial bleed showed sensitivity 97.8%, specificity 63.4%, positive predictive value 55.3% and negative predictive value 99.2%.

Two out of 132 patients with normal GCS and clinical findings had minor intracranial bleed on CT.

Out of the 159 patients who had normal CT findings, 94 (31.3% of total study population) had normal GCS and clinical findings.

DISCUSSION

CT is one of the most comprehensive diagnostic modality for accurate localisation of the site of injury in craniocerebral

trauma. CT helps in early and timely diagnosis of the lesion precisely. CT not only has substantial impact over instituting appropriate treatment and timely surgical intervention.

Various clinical parameters used for planning management and predicting the prognosis of a patient with craniocerebral trauma are based on neurological dysfunction, which is due to structural damage to the brain. This structural damage can be efficiently detected by CT scan. It is worthwhile to utilise this modality as the primary modality of choice in acute craniocerebral trauma.

In our study by incidence, male population was predominantly involved (83%) in road traffic accidents. Age wise most involved age group is between 20 to 30 years (36.33%) followed by age group between 30 to 40 years (21.67%).

An enumerative population study by National Head and Spinal Cord Injury Study (NHSCIS) showed the incidence rate for head injury range with highest incidence being 15-24 years and the male incidence being more than twice that for females.¹⁰ Another study by Kraus JF, Black MA et al, showed that males having a 2.2 times higher rate than females in head injury and rates were highest for males aged 15-24 years.¹¹

Our study also showed similar findings. Universally, male patients and working young population are more prone to craniocerebral trauma.

Subdural haematoma is the most common form of intracranial bleed (64.46%) followed by intraparenchymal haematoma (48.95%) among 96 patients who showed intracranial bleeds on CT in our study.

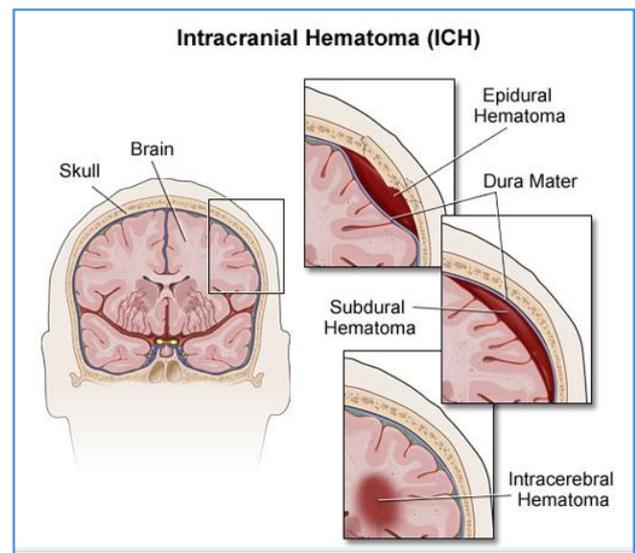




Figure 1. Subdural Haematoma Density Seen in Right Frontotemporal Region Causing Midline Shift Towards Left. Fracture of Overlying Frontal Bone Along with Small Pneumocephalus Noted



Figure 4. Large Intraparenchymal Haematoma is Seen in Left Temporal Lobe with Surrounding Oedema and Subdural Haematoma is Seen in Left Frontotemporal Region. There is Also Midline Shift Towards Right



Figure 2. Subdural and Subarachnoid Bleed Densities Along Right Frontotemporal Region. Subarachnoid Haemorrhage is Seen Extending into Right Sylvian Fissure. Subdural Haematoma also Seen Along Right Tentorium Cerebelli

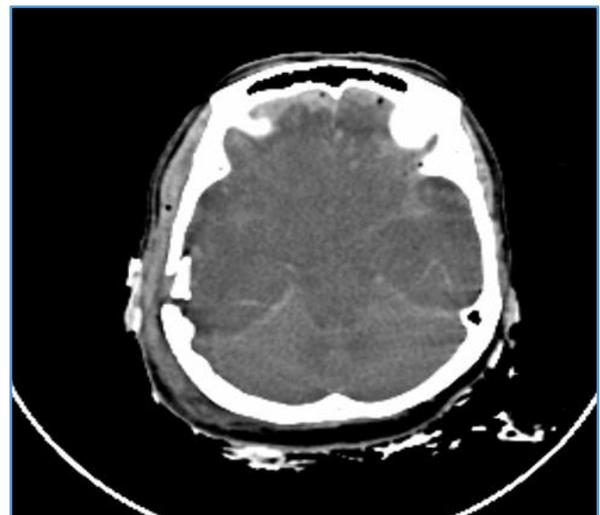


Figure 5. Diffuse Cerebral Oedema Seen Obliterating Bilateral Cortical Sulci and Basal Cisterns with Diffuse Subarachnoid Bleed. Displaced Fracture of Right Temporal Bone Seen. Subdural Bleed is Seen in Bilateral Frontal Lobes

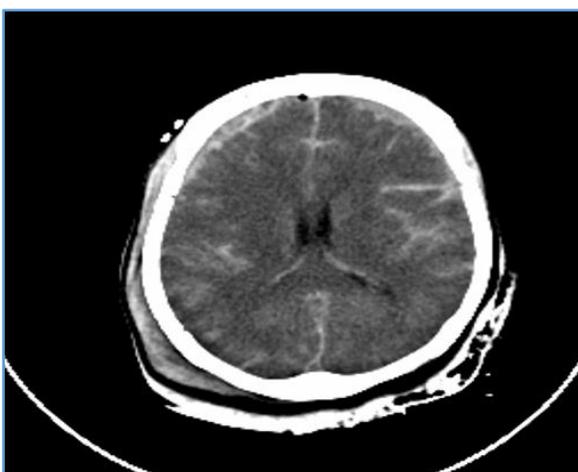


Figure 3. Subdural Haematomas Seen in Bilateral Frontal Region with Small Pneumocephalus and Subarachnoid Haemorrhage is Noted Diffusely Involving Interhemispheric Fissures and Bilateral Cortical Sulci.

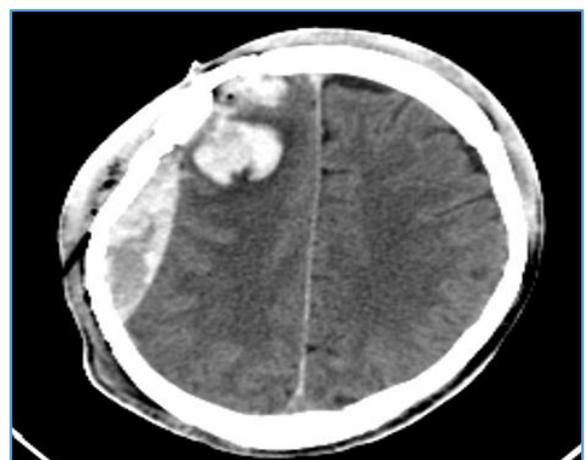


Figure 6. Epidural Haematoma is Seen in Right Frontoparietal Convexity. There are Intraparenchymal Haematoma with Minimal Surrounding Oedema in Right Frontal Lobe with Fracture of Frontal Bone



Figure 7. Epidural Haematoma is Seen in Left High Parietal Region

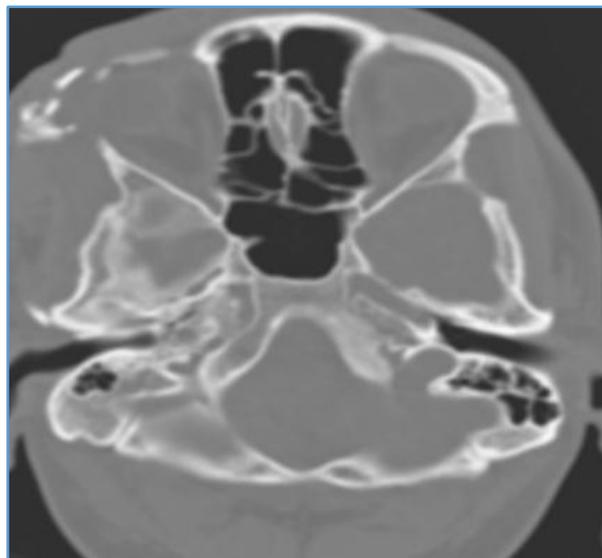


Figure 10. Patient with Comminuted and Displaced Fracture of Lateral Wall of Right Orbit and Supraorbital Margin of Frontal Bone



Figure 8. Multiple Haemorrhagic Contusions in Right Frontal Lobe with Significant Surrounding Oedema and Causing Mass Effect and Midline Shift Towards Left



Figure 11. Patient with Isolated Intraventricular Haemorrhage in Right Lateral Ventricle



Figure 9. Above Patient in Higher Section Shows Mass Effect Causing Compression of Ipsilateral Lateral Ventricle and Dilatation of Contralateral Ventricle with Intraventricular Haemorrhage Within

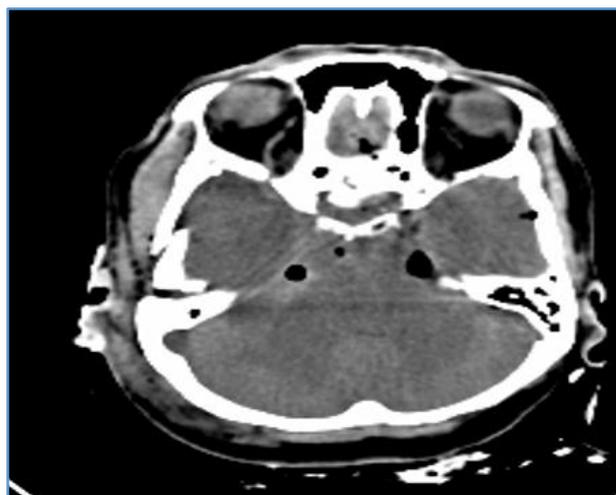


Figure 12. Patient with Pneumocephalus and Displaced Fracture of Right Temporal Bone

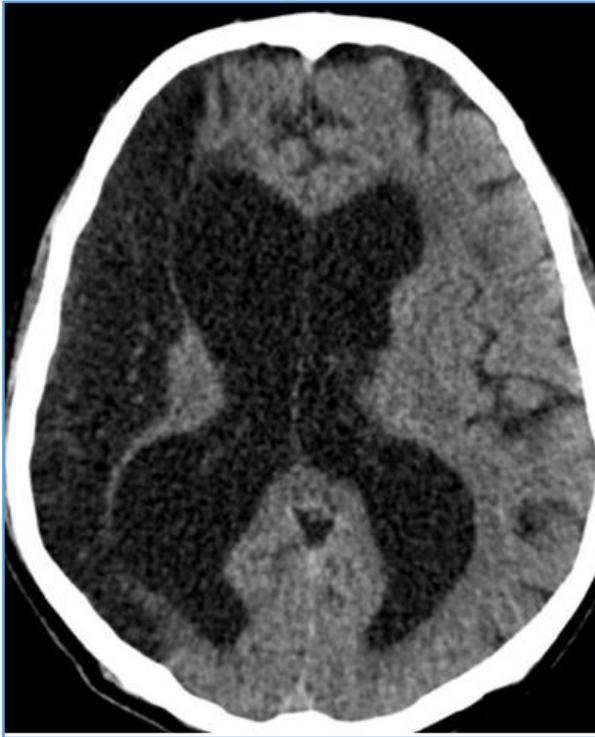


Figure 13. Encephalomalacia

CONCLUSION

Incidence of road traffic accidents was more in male population.

Peak age group involved in road traffic accident was between 20 to 30 years followed by 30 to 40 years in our study.

Variety of abnormalities were detected in CT scan. Subdural haemorrhage was most common form of intracranial bleed. Most of the cases with midline shift had moderate or severe head injury by GCS. None of the cases with normal or mild GCS had midline shift. Glasgow coma scale with relevant presenting complaints is sensitive method of predicting intracranial injuries. GCS combined with relevant presenting complaints rarely misclassifies patient with intracranial bleed as normal.

Glasgow coma score combined with relevant presenting complaints can be used as an indication for CT scan in order to avoid unnecessary CT scans.

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