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Research Article

CORRELATION BETWEEN PATIENT OUTCOME AND SPECTRUM OF CT LESIONS IN TRAUMATIC BRAIN INJURY IN ROAD TRAFFIC ACCIDENTS

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ABSTRACT
The study was conducted to observe the spectrum of CT head findings in RTA presenting to a tertiary care hospital and also to correlate the clinical observations on admission with the CT findings using revised trauma score (RTS) (Foreman *et al.,* 2007) and modified Marshall CT grading (Marshall *et al.,* 1991) as well as the outcome of the patient. It was concluded that Modified Marshall CT Score has a strong predictive significance, which, in combination with Revised Trauma Score and papillary status can provide sufficient information regarding the patient management and prognosis. Urgent CT Scan of head in traumatic brain injury patients helps to detect operable mass lesions and improves patient outcome through timely decompressive surgery.

Keywords: *Traumatic Brain Injury , Road Accidents*

INTRODUCTION
Alarmingly escalating numbers of road traffic accidents (RTA) are an evidence of the speed with which our society is literally moving but it also is a cause of concern looking at the mortality due to RTA. The growing number of patients with injuries due to road accidents reporting to emergency rooms in any hospital makes it necessary for rapid and accurate evaluation of the extent of damage. This evaluation decides the further course of management and also tilts the mortality graph to either side depending on many factors. The approximate number of deaths has increased from 81 per million populations in 1987 to 101 in 2007 and the numbers are still rising (INCRB Accidental Deaths and Suicides in India, 2007). According to an estimate, upto 70% of these RTA involve cranial trauma (Friedman *et al.,* 1988)[2]. A prompt and systemic evaluation of the patient is incomplete without imaging of the cranio cerebral damage. Non contrast CT head is one of the most commonly performed investigations in a tertiary care hospital as it is quick, accurate, extensive, localizing, measurable and non invasive method of visualizing the damage both in soft tissue and hard parts. There has been almost 94% reduction in craniotomies for management of acute head injuries ever since the advent of CT scan (Ambrose *et al.,* 1976; Foreman *et al.,* 2007; Jannet and Teasedale, 1977). The final neurological status of the patient with RTA is the sum of the acute damage at the time of injury and secondary damage which happens as a sequel to the primary insult. The primary traumatic brain injury (TBI) includes contusions, shearing injuries, lacerations, fractures and haematomas. The secondary injuries which develop as a consequence of the primary insult would be meningitis, hydrocephalous, brain infarcts etc. The timely diagnosis of primary TBI within 48 hours and early recognition of the sequelae can significantly alter the course of treatment and improve outcomes. The role of CT scan in accurate diagnosis of TBI or the complications is undoubtedly relevant and important. The classical clinical features with prognostic significance in TBI include several factors such as age, GCS (Glasgow Coma Scale) (Foreman *et al.,* 2007; Jannet and Teasedale, 1977), papillary reaction, post traumatic lowering of blood pressure and altered brainstem reflexes (Narayan *et al.,* 1981; Srinivasan *et al.,* 1992). Higher mortality rates are seen in either in paediatric age group or in those who are around 60 years or more (Hukkelhoven *et al.,* 2003; Czosnyca *et al.,* 2006). Although males sustain frequent injuries in road traffic accidents but studies have shown that females have higher incidence of complications of brain trauma as compared to men (Farin *et al.,* 2003). Pupilary reaction and brainstem reflexes have a well documented association with the outcome of such patients (Narayan *et al.,* 1981; Jannet *et al.,* 1976). In addition to the above cited clinical observations, CT head as been found to be of

immense value in management of TBI in terms of evaluation of extent of haemorrhage, pressure and size of the haematoma mass, midline shift, herniation, effacement of cisterns and extension of intraventricular haematomas (Wardlaw *et al.,* 2002; Lobato *et al.,* 1986). These injuries which are conventionally classified as acute localized or diffuse injuries can also have an impact on the prognosis. Patients with diffuse injuries are found to have an intermediate prognosis as compared to those with an acute subdural haematoma (SDH) and low GCS (Gennarelli *et al.,* 1982).

Aim of the Study

The study was conducted to observe the spectrum of CT head findings in RTA presenting to a tertiary care hospital and also to correlate the clinical observations on admission with the CT findings using revised trauma score (RTS) (Foreman *et al.,* 2007) and modified Marshall CT grading (Marshall *et al.,* 1991) as well as the outcome of the patient.

MATERIALS AND METHODS

This prospective study was conducted over a period of one year which included 200 patients having open or closed head injury due to RTA presenting in CMC Ludhiana. The study also included those patients involved in RTA who had no external signs of head trauma but had history of loss of consciousness, seizures, vomiting, bleeding or discharges from nose, throat or ear. Since the study was to look at the patterns of findings in road traffic accidents, victims of other trauma like railway accidents, fall from a height or assault were excluded from the study. Patients with associated severe chest or abdomen injury of major vascular trauma were also excluded from this study.

All patients underwent through neurological and other systemic examination on admission. They were also subjected to CT scan imaging of head using GE-FXI single slice spiral CT machine as per the standard CT head protocol. All CT findings were documented and the findings were correlated with clinical neurological assessment using Revised Trauma Score (RTS) and Modified Marshall CT Grade (Marshall *et al.,* 1991) as per the standard protocol. All patients were followed up and the outcome of the patients was noted according to the Glasgow Outcome Scale at discharge or death, 1 month, 3 months and 6 months of follow up period. The data was analyzed and clinical correlations were found using Spearman's Rho as well as Chi square tests.

RESULTS AND DISCUSSION

Observations

Majority (65.5%) of the patients was young and middle aged (21-50 years) suggesting that this age group has higher incidence of RTA associated head injuries. Most of the patients in the present study were males (82.5%). GCS done at the time of admission showed that 50% of the patients had GCS of 13-15 indicating that most of them presented in a stable condition. Similarly most of the patients (86%) had RTS score ranging from 10-12 suggesting a stable condition. There was a poor outcome associated with patients having low GCS score or had fixed and dilated pupils on admission. It was also observed that patients with low GCS also had higher chances of CT abnormalities. We also observed that RTS on admission had definite impact on patient outcome with a moderate positive relation between the two. Higher RTS was observed to be associated with more likelihood of having a better GOS. Higher RTS was also observed to be associated with lower Modified Marshall CT Score i.e. more chances of having a normal CT Scan. Contusions were found to be the most common mass lesions in traumatic brain injury in our study followed by SDH. The commonest site for SDH was found to be along the fronto temporal convexity whereas for EDH and contusions the commonest site was the frontal region. Skull bone fractures in trauma head were mostly confined to temporal bone. On further correlation of clinical and radiological findings we observed that presence of SAH or compressed/absent basal cisterns are associated with a poor outcome. Midline shift is a significant prognostic indicator and helps in deciding the need for emergency decompression surgery. As per the results of the present study the mortality rate increases with increase in the midline shift (44% in patients with midline shift of 6 mm or more. Maximum number of patients (36.5%) was observed to belong to category 2 of Modified Marshall CT

Score followed by 28% who fell in category 1. A high Modified Marshall CT Score was seen to be associated with a poor patient outcome with almost 100% mortality in patients having this score of 6.

Discussion

The spectrum of CT lesions seen in cases of traumatic brain injury in a RTA is variable the most common being contusions or haemorrhages. In the present study we found 47% contusions, 31.5 % SDH, 29% SAH and 17% EDH. These findings are partly comparable with other similar studies done by Mass *et al.,* (2005) and Equabal *et al.,* (2005). Equabal *et al.,* (2005) study also reported the highest incidence of contusions (56%) followed by SDH (16.4%) which is half of what the present study indicated in SDH occurrence. While both the present study as well as that by Equabal *et al.,* noted low occurrence of EDH and SAH, Mass et al found the highest incidence (52%) of SAH. SAH is one of the important predictors in determining the mortality (Boto *et al.,* 2006; Domenicucci *et al.,* 1998) and is seen to rise from as much as 68% to 86% mortality in patients who show evidence of SAH. In the present study 13% of the patients showed absent basal cisterns while another 13% had compressed basal cisterns.

We observed that patients with non effaced cisterns had a good outcome (GOS 3-5). Other similar studies (Boto *et al.,* 2006; Athiappan *et al.,* 1993) are consistent with the present study which also conclude that the state of basal cisterns and presence of lesions in brain parenchyma form the most powerful combination of CT features guiding the mortality or GOS. Another important prognostic CT indicator is the midline shift.

In the present study majority (78.5%) of the patients had a midline shift of 1 mm or less. This negligible or no midline shift in TBI was seen to have a good GOS of 4-5. Mortality rate was 44% with a midline shift of 6mm or more.

The distribution of Modified Marshall Score in the present study is comparable to those conducted by Marshall *et al.,* (1991) and Mass *et al.,* (2005). A strongly inverse (negative) relationship was identified between Modified Marshall Score and GOS at discharge. The mortality rate in all the studies is seen to rise exponentially with the increase in MM Score from 1 to 6. There is considerable evidence to suggest that early recognition and surgical evacuation of traumatic intracranial haematoma prevents death and disability, especially in patients who are able to talk on admission and then deteriorate neurologically.

Conclusion

We conclude that Modified Marshall CT Score has a strong predictive significance, which, in combination with Revised Trauma Score and papillary status can provide sufficient information regarding the patient management and prognosis. Urgent CT Scan of head in traumatic brain injury patients helps to detect operable mass lesions and improves patient outcome through timely decompressive surgery. As a radiologist, timely communication with operating neurosurgeon regarding CT findings with particular emphasis on midline shift and status of basal cisterns is of utmost importance.

Abbreviations used:

CT	computerized tomography	RTA	road traffic accident
EDH	extra dural haemorrhage	SDH	sub dural haemorrhage
SAH	sub arachnoid haemorrahage	GOS	Glasgow outcome scale
MMS	Modified Marshall Score	TBI	traumatic brain injury

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