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Research Article

Role of sequel CT scan head after twenty four hours of traumatic head injury

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ABSTRACT

Background: The CT scan has become popular in cases of head injury. Since its inception it has become single best reliable tool for head injury diagnosis.
Methods: In this study 65 cases (M: 48; 68.0% and F: 17; 29.23%) with traumatic head injury admitted and initially managed conservatively at Hamidia hospital, Bhopal starting from Nov 2008 to Oct 2009.
Results: The most common cause of injury was road traffic accidents (40 cases 61.5%). Altered sensorium was the most common symptom in 55 cases (84.61.0%), followed by vomiting in 49 cases (75.38%). Contusions were the most common radiological findings in 80.0% (52 cases) followed by extradural haematoma in 18.46% and pneumocephalus in 16.92%. Out of these the most common location for contusion was frontal (14 cases), followed by parietal (12 cases) and then bilateral contusions in 10 cases. Repeat scan showed increase in volume of contusion in 29 cases (44.61%), no change in 26 cases (40.0%) and decrease in 10 cases. The increase was mainly due to edema in 18 cases (27.69%) and due to actual increase in contusion in only 11 cases. Only 4 cases needed operative intervention.
Conclusions: It is concluded that repeat CT scan in mild to moderate head injury should be done when: there is clinical deterioration, age >65 years, multiple traumatic lesions on first CT scan head, first CT scan done early.

Keywords: CT scan, Contusions, Glasgow coma score (GCS), Traumatic head injury

INTRODUCTION

Computed tomography represents a major breakthrough in the investigation of cases of head injuries. In management of craniocerebral trauma patients it has become the single, sufficient, and necessary radiographic test. Although it is used widely in trauma the indications for repeat scan are not well defined. In patients managed conservatively the role of repeat scan has been a subject of debate.[1] The extent of information the second or repeat scan provides than the initial scan or control scan varies from study to study. Different studies have reported conflicting conclusions on the advantage and disadvantage of doing routine CT scan. Since majority of the relevant pathological changes develop within the first twenty four hours a pathological categorization using the initial scan has also been proposed for prognostic purpose.

METHODS

This is a prospective study that included cases with traumatic head injury admitted and initially managed conservatively at Hamidia hospital, Bhopal from Nov. 2008 to Oct. 2009. Repeat CT scan head was performed on a routine basis at 24 hours of admission unless the

patient deteriorated in which case it was done earlier. The sex ratio, age, mode of injury, presenting symptoms will be studied. All the pre and post repeat scan radiological findings will be recoded with respect to appearance of new lesions, initial volume, and change in lesion or edema. The initial Glasgow Coma Score (GCS) at admission and the GCS at time of repeat scan will be noted. The change in operative management and the advantage of repeat scan in terms of prognosis of head injury patients when used routinely will be assessed. As per our methodology all those cases with significant mass lesion that required surgery, or cases that had Intracranial Pressure Monitoring (ICP) insertion and those cases which were admitted more than 12 hours of injury were excluded from this study. Repeat scan was done as a routine basis after 24 hours of admission irrespective of the GCS score.

RESULTS

The total number of cases included in this study was 65 with males (48 cases, 70.76%) more common than females (17 cases, 29.23%). The majority of patients were between age group's 21-30 years and 31-40 years. Constituting 35.38% and 24.61% respectively (Table1). The age ranged from 10 years to 70 years.

Table 1: Age groups.

Age groups	N=65	%
10-20	05	7.69
21-30	23	35.38
31-40	16	24.21
41-50	09	13.84
51-60	08	12.30
61-70	04	6.15
Range from 10 year to 70 year		

Road traffic accidents account for 61.5% (40 cases) of head injury cases in our study. Not wearing the helmet and poor traffic law and order are the possible reason. Assault was the next common cause 23% (15 cases) (Table 2).

Table 2: Sex wise distribution of patients.

Male		Age distribution	Female	
No.	%		No.	%
04	80	10-20	01	20
18	78.26	21-30	05	21.3
12	75	31-40	04	25
06	66.66	41-50	03	33.33
05	62.5	51-60	03	37.5
03	75	61-70	01	25
48	70.76	**Total**	17	29.23

Altered sensorium 84.61% (55 cases), vomiting 75.38% (49 cases) and headache 67.69% (44 cases) were the most common modes of presentation in head injury patients. Early seizures defined as within one week of injury was present in 09 cases (13.84%) (Table- 3).

Table 3: Mode of injury.

Mode of injury	Number	Percentage
R.T.A	40	61.5
Assault	15	23
Fall from height	10	15.63

Contusions, including bilaterally and counter coup types, were the most common radiologic findings in 80% (52 cases) followed by extradural hematoma in 18.46 % (12 cases) and pneumocephalus in 16.92%. Out of these the most common location for contusion was frontal (14 cases 26.92%), followed by parietal (12 cases 23.07%) and then bilateral contusions (10 cases) (Table 4). Repeat scan showed increase in volume of contusion in 29 cases (44.61%), no change in 26 cases (40%) and decrease in 10 cases (15.83%). The increase was mainly due to edema in 18 cases (27.69%) and due to actual increase in contusion in only 11 cases (Table 5). There was no increase in size of the extradural hematoma on the repeat scans.

Table 4: Symptoms present.

Symptoms	No. of cases	%
Altered sensorium	55	84.61
Vomiting	49	75.38
Headache	44	67.67
E.N.T. bleed	22	22.84
Black eye	28	43.07
Seizure	09	12.84
Associated injury	26	40

Table 5: Initial CT scan finding.

Finding	No.	%
Contusion	52	80
EDH	12	18.46
Pneumocephalus	11	16.92
SAH	07	10.76
Subdural haematoma	04	6.15
Fracture depressed/elevated	10	15.38
Intra cerebral haematoma	03	4.61

The admission GCS was 13-15 in 28 cases (43.07%), 8-12 in 33 cases (50.76%) and only 4 cases with 6.0% had score less than 7. Thus the majority of cases were in the moderate group. Repeat score during the scan at 48 hours showed change from 28 (43.07%) to 35 (53.84%) cases for score of mild head injury and decrease from 33 (50.76%) to 29 (44.61%) for moderate head injury. This

showed clinical improvement to score of 13-15 in 10% of cases within 24 hours of admission (Table 6).

Table 6: Admission and repeat scan findings.

Findings	No. N=65	Initial volume (mean)	Repeat volume (mean)	Surgical intervention
Contusion	52			
Frontal	14	12	14	3 cases
Parietal	12	9	10	
Temporal	08	9	12	1 case
Occipital	02	4	4	
Mixed: Fronto-temporal	06	5	5	
Bilateral contusions	10	9	11	
EDH	12	5	6	
Pneumocephalus	11	12	10	

Change in the management plan by operative intervention was needed in 4 cases (6.15%). Of these 4 cases two had a GCS of 15, one had score of 10 and one had score of 12 on initial admission. Three out of these four had associated drop in GCS and the other had increase in contusion volume requiring intervention. Considering the location of the lesions 3 of them were in the frontal lobe and one in temporal lobe. All of them improved after surgery. Table 9 shows that most of the patient comes early to hospital and their CT scan done early. Most of the head injury patient underwent CT scan head within 3-6 hours of head injury. Patients who had repeat CT scan head after 12 hours of head injury were excluded.

Maximum changes occur in repeat CT scan of those patients who had CT scan early after head injury.

Table 7: Repeat scan findings.

Result	No.	%
No change	26	40%
Increase of haematoma/contusion	29	44.61%
Decrease	10	15.38%
Increase edema/mass effect	18	27.69%
Appearance of new lesions	11	16.92%

Table 8: The overall GCS change with regards to repeat scan and outcome.

GCS	Admission GCS	Repeat GCS@ 48 hours	GCS improvement	Surgery
13-15	28 (43.07%)	35 (53.84%)	10%	04 cases
8-12	33 (50.76.2%)	29 (44.61%)		
3-7	04 (06.15%)	1 (01.53%)		

Table 9: Time between injury and CT scan and changes in repeat CT scan.

Time between injury and CT scan	No. of patients	No. and % of patients in which changes occurs in repeat CT scan	
		No.	%
0-3 hours	08	06	75
3-6 hours	27	19	70.37
6-9 hours	2	10	50
9-12 hours	10	04	40

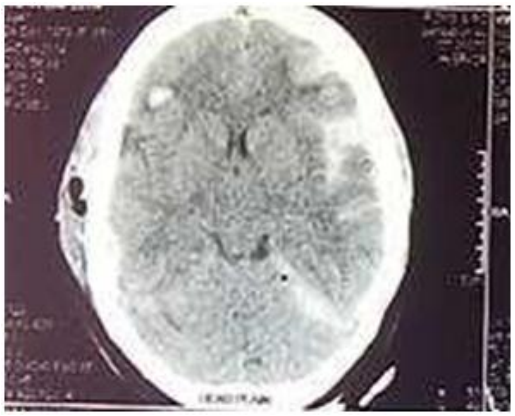

Figure 1: First CT scan.

Figure 2: CT scan after 24 hours of same patient.

DISCUSSION

Since its advent CT scan has become the principle diagnostic tool in the evaluation of head injury. During the acute period, it permits the rapid, safe detection and precise localization of intracranial hematomas, brain contusion, edema and foreign bodies and serial CT scan aid in the diagnosis of subsequent complications. The exact time and the result of repeat scans yet to be determined.

Many of them have been studied on severe or blunt head injury. The old study to record repeat scan was in the study by French and Dublin in 1977 in which out of their series of 1000 head injury, cases 103 had repeat scans 31% of them undergoing surgical intervention.[2] One of the earliest study dedicated to repeat scan by Roberson et al. in 1979 concluded that repeat scan could be done on first post craniotomy day, on third day if no improvement up to 2-3 weeks and 3 months. They saying that repeat scan were of value in identifying post-traumatic hydrocephalus, delayed intracerebral hematomas, and intraventricular hemorrhage.[3]

In study of Velmahos in Boston they reviewed 179 patients of minimal head injury and repeat CT scan were done in all patient, of them 37 (21%) showed signs of injury evolution on repeat CT scan and 7 (4%) require intervention. All 7 (4%) had clinical deterioration preceding CT scan. With this study they concluded repeat CT scan is unnecessary in patients with minimal head injury. Clinical examination identifies accurately the few who will show significant evaluation and require intervention.[4]

In study by S. B. Dharap in 2004 in Mumbai India, 175 patients of head injury were reviewed and repeat CT scan was done and there was no standard protocol for ordering the repeat CT scans. CT scan was repeated in 53 (30%) patients. The clinical indication for the repeat CT scan in their study grouped into three (1) clinical deterioration (2) failure of improvement (3) as a follow-up scan. Nine underwent surgical intervention based on the repeat CT scan finding; in others the repeat CT scan finding did not alter the management. They were concluded that in patients of head injury who are improving follow up repeat CT scan is unnecessary and unlikely to yield any further information necessitating change in treatment.[5] In study by Y. B. Roka in 2008 in Nepal, 71 cases of head injury were reviewed and underwent repeat CT scan head after 48 hours after admission. Repeat scan showed increase in volume of contusion in 31 cases, no change in 28 cases and decrease in 12 cases. Only five cases needed surgery. They were concluded that routine use of repeat scan in mild to moderate head injury has no role unless there is clinical deterioration.[1]

Since that study the literature is also full of papers that support or disagree with serial CT scan in head injury patients.[9-12] Those of them which support have called it standard practice to repeat scans at 1, 3, 7 days and 1 month or on days 3 and 7.[1] Other studies have concluded that repeat scan should be done at 12 hours if the first scan was done within 3 hours of injury the reason being that a significant proportion of cases, especially if unconscious may be harboring intracranial lesions.[6] Good outcome was found in cases who did not have new lesions on repeat scan.[7]

Various indications for repeat CT scan have been proposed.

Frankhauser et al. in 1983 proposed the following:[8]

1. After 2-3 days if the first CT scan shows a fracture with an overlying collection of blood too small for surgical intervention.
2. In all cases of secondary deterioration.
3. Where there is a secondary elevation of intracranial pressure.
4. Where there is no clinical improvement.
5. In cases where there is persistent elevation of ICP after evacuation of intracranial hemorrhage.
6. After 12 to 24 hours for all paralyzed and ventilated patients.

Bucci et al. in 1986 suggested that poly trauma patients must be rescanned after correction of hypovolemia even if the initial CT scan was normal.[9]

In addition a repeat scan within 24 hours was also suggested to detect a delayed contra lateral hematoma after surgical decompression.

Lately the indication for repeat CT have been simplified, Gentleman et al. in 1989 mentioned thay repeat CT is indicated when:[10]

1. Mean ICP becomes elevated above 30 mmHg.
2. There is clinical deterioration.
3. There is failure to improve.

A similar protocol was advocated by Handley in 1991.

In this study we took 24 hours for repeat scan as the maximal changes occur within the same period and any advantage thereby provided by repeat scan would be most beneficial.[3] The changes in repeat scan in this study was present in 44.61%, which was mainly due to edema (27.69%). Study by Roka et al. showed 43.6% new lesion development.

Contusions were the most common findings and the frontal lobe as the most common site. This would reflect direct injury. Repeat scan findings that needed surgery was found in only 6.15% of cases in this study and the majority of them were located in the frontal lobe. This is in accordance with the study by Patel et al. which showed

that in conservatively managed patient's frontal intraparenchymal hematoma were more prone to failure.[11]

Of the total cases of 29 in this study, which showed increased hematoma only 4 underwent surgery. A similar study by Sifri et al. on patients with minimal head injury with a bleed showed that out of 161 cases in their study only 4.0% needed intervention and none of those with repeat scan needed intervention. The Glasgow outcome scale in this study was favorable in 98.0% of cases. With this they concluded that repeat scan would have no benefit and thereby suggested multicenter trial to further validate it.[12] Another study by Brown et al., who did a prospective study of 100 patients who underwent repeat scan showed that of the 68.0% who underwent repeat scan 90.0% was done on routine basis and only 10.0% due to a change in ICP, GCS, both pupil changes or new onset of headache. Of this 10.0% (9 cases) only 3 underwent intervention in the form of surgery in two and barbiturate coma in one case.[13] In study by Roka of 71 patients 31 patients showed increased hematoma and only 5 underwent surgery.[1] We should do repeat CT scan head after 24 hours of head injury prophylactically to decide their plan of management.

We conclude that repeat CT scan head should be done when:

1. There is clinical deterioration.
2. Age more than 60 years.
3. Multiple traumatic lesions found on first head CT.
4. Interval shorter than 90 minutes from arrival to first head CT.

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