ORIGINAL ARTICLE

The use of Brain Computed Tomography Scan in the Assessment of Coup and Counter Coup injuries of the head

LAL SHAHBAZ[1], ARIF UZ ZAMAN[2], REETA RANI[3], *SAQIB BASR[4], AHMED ALI[4]*

ABSTRACT

Aim: To evaluate and assess the coup and countercoup injuries of the brain and its prognosis, using the plain computed tomography scan.
Method: The type of study is a comparative cross sectional study, and the sample size taken is of 170 patients, it was done in Civil Hospital Karachi, for duration of 7 months from August 2012 to February 2013. The patients were divided into two groups Coup injuries (n=133), counter coup injuries (n=37). The patient population was selected, taking care of a similarity with their age, Glasgow coma scale (GCS) score and outcome. The process of figuring out the site of primary injury was done by using the helical CT scan modality.
Results: The death rate of patients was compared with regards to their Glasgow coma scale score, patient's age and the computed tomography scan pattern. Significance of the study was calculated using Chi-Square test. A significant difference in mortality was found between patients with coup ($p \leq 0.005$) and patients with countercoup ($p \leq 0.001$) head injuries.
Conclusion: Our study shows that counter coup brain injury has poor outcomes and requires prompt management.
Keywords: Coup, countercoup, brain injury, Glasgow Coma Scale (GCS), Deceleration injury, helical CT scan.

INTRODUCTION

In the accidents and emergency department of a hospital, head injury is always given prompt attention and comprises about 3.4% of all emergency presentations[1]. Head injury refers to any kind of trauma to the head, either caused by an accident or by assault; it is either penetrating or a blunt type of injury. A blunt injury is one in which the skin of the skull is not broke open, and in penetrating head injury, the skin of the bony skull is compromised. Head injury is a major concern in the emergency department as it has high mortality and morbidity all over the globe, in the developed world patients under 45 years of age are at an increased risk of mortality[2,3]. The classification of head injury is based upon the use of the Glasgow Coma Scale (GCS) score and is classified as minor, moderate and severe head injury[4]. The patients having minor head injury usually have a good recovery post concussive symptoms last for a few weeks[5]. Patients having a low Glasgow coma scale score in the range of 3 or 4, and those who are elderly (age 65 years or more) have a proper prognosis[6]. The coup and countercoup injuries comprise a set of focal brain injuries. In the coup type of injury the skull is moved inwards and gives a direct blow to the brain parenchyma. As the skull is moved and injures the brain on the site of impact, it might set the brain into a sudden state of motion, causing an impact on the other side of the skull as well, thus resulting in a countercoup injury[7]. A recent study proves that prognosis and outcome after head trauma has been a burgeoning field of study, it reports a 9% decline per decade in mortality of head trauma patients from the year 1970 to the year 1990, but shows little or no progress after that year[8]. The outcome and prognosis of coup and countercoup injuries as studied by the computer tomography (CT SCAN) has not been studied, and the outcome in both coup and countercoup injury is expected to have a significant difference. The ischemic changes and pattern of injury to the brain parenchyma are important factors to take under consideration. The outcome of patients with head injury can safely be predicted based on the patients Glasgow Coma Scale scoring and the patients age. Majority of modern day trauma centers are evolving to handle head injuries and it is widely believed to be a future epidemic[9]. Our study aims to advance the science behind treatment of head injury by studying the pattern of coup and countercoup injuries and possibly helping the physicians to determine the prognosis and the relevant management of the injury.

[1]*Resident Emergency Medicine, Ziauddin Medical University, Karachi*
[2,3]*Consultant Radiologist, JPMC, Karachi*
[4]*House Officer, DUHS, Karachi*
Correspondence to Dr. Dr Saqib Basr Email: saqibbasar1@gmail.com, Cell: 0345282946, 0322235667

MATERIAL AND METHODS

The type of study is a comparative cross sectional study, the sample size taken is of 145 patients having primary head trauma, presenting to the accident and emergency department of Civil Hospital Karachi, which houses a helical CT scanner. The CT scanner took axial cuts with sections being 5mm apart, though the vertex all the way up to the posterior fossa of the skull. A proforma including the patients details and demographics including age, gender, how the injury occurred and all the components of the Glasgow Coma Scale was filled. The exclusion criteria for the study included all those patients who have had head injuries before, and those who were multiple trauma patients. The inclusion criteria included all the patients who had coup and countercoup injuries with or without a subgaleal hematoma formation. The injuries included fracture of skull, underlying hematoma or contusion of the brain. Out of the total patient population the injuries were classified into two categories namely the coup (n=133) and countercoup (n=37) head injury. Patient mortality rate, in association with the Glasgow coma scale score and patients age was how the outcome of the study was measured. GCS and age data was studied based upon the P value. A p value of less than 0.05 was considered to be significant. Chi square test was used to study mortality rates. A Glasgow coma scale score of 13-15 was considered mild, 9-12 was considered moderate and 3-8 was considered to be severe.

RESULTS

The mean age of patients was 21 years with age range from 6 months to 65 years of age, males being 105(62%) and females being 65(38%) as shown in the figure below. Patients with coup injuries were predominantly young adult males. And there was no significant difference in the average ages of coup and countercoup injury patients. There was no difference in the Glasgow coma scale scores among the two groups and the mean GCS score was found to be 9. Out of the total patients studied, 78.23% had coup and 21.77% had countercoup head injuries.

Among the coup injuries Depressed skull fracture with contusion was the highest in number 46(34%) followed by linear fracture with an extradural hematoma 23(17%). According to the table given below a total of 97(72.6%) of patients having coup type of brain injury had an improvement and a significantly lower mortality rate (p≤0.005), on the other hand countercoup type of head injury had a significant increase in the mortality rate (p≤0.001).If the Glasgow coma scale score is taken under consideration, there was no significant difference in the mortality rate of patients belonging to the severe group, on the other hand a significant difference was found in the mild and moderate group of patients.

Table 1: The pattern of Head Injuries

Type of lesion	n	%age
I. Coup ((n=133)		
Fracture with SDH	12	9
Depressed fracture with	46	34
contusion		
Linear fracture with EDH	23	17
EDH with contusion	13	10.2
EDH with SDH + contusion	06	4.2
Acute SDH	17	12.8
Acute SDH +Contusion	08	5.9
Contusion		
Subarachnoid hemorrhage	08	5.9
+contusion		
Total	133	78
II. Countercoup injuries (n=37)		
Acute SDH	11	30.4
Contusions	16	42.4
Acute SDH with contusion	10	27.2

Fig. Male versus female ratio for cause of head injuries.

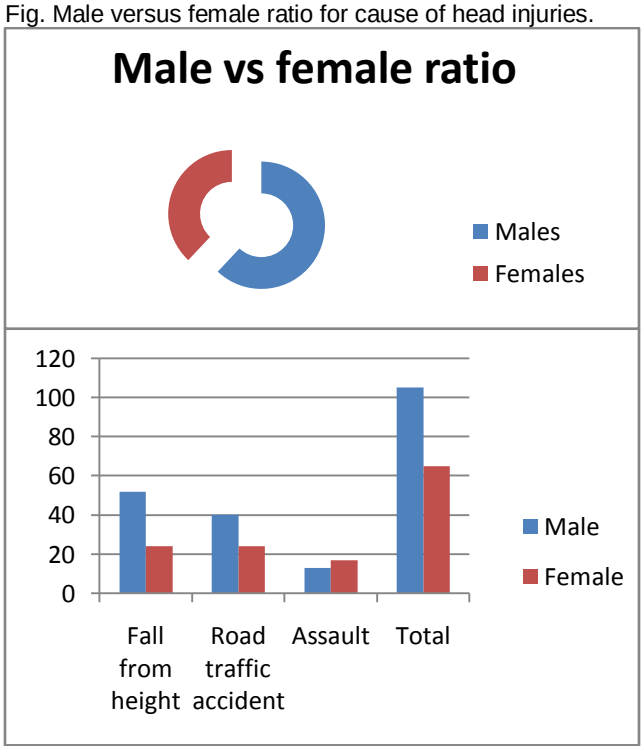

Table 2: Outcome of Injuries

Outcome	Coup	Countercoup injuries
Improved	97(72.6%)	21(57.5%)
Same	17(12.8%)	06(15.5%)
Dead	19(14.5%)	010(27.2%)

P value ≤0.001

Table 3: Mortality of patients in relation to the Glasgow Coma Scale

Mortality	Coup	Countercoup injuries	P value
3-8	20/50(40%)	8/21(38%)	NS
9-12	5/34(14.7%)	3/8(37.5%)	≤0.04
13-15	1/33(3%)	1/4 (24%)	≤0.02

NS* Non significant

Table-4: Mortality of patients as compared to age group

Mortality	Coup	Countercoup injuries	P value
Upto 40	12/78 (14.38%)	3/7(42.8%)	≤ 0.001
41-60	4/28(14.2%)	8/21(38%)	≤0.001
above 60	6/11 (54.45%)	3/5(60%)	NS

NS* Non significant

DISCUSSION

Acute head injury has always been associated with a high mortality rate, accurate and prompt diagnosis of brain lesions is of prime importance, and an early diagnosis and management is found to lower the complications associated with acute head injury significantly. After the invention of the CT scanner the outcome of the patients has increased significantly due to the prompt diagnosis[3]. At the present moment, the use of CT scan is the primary modality for evaluation of patients with head injury, as it helps to reveal associated fractures along with intra axial and extra axial lesions of the brain[10]. On a clinical basis the use of the Glasgow coma scale score has been a standard for prognosis. Our study contradicts this result as patients with low GCS scores may show significant improvement, and patients with high GCS scores may deteriorate with due time which reflects that there are other factors which influence the patient outcome. A recent study have related patient outcome with CT findings, and various factors including a raised intracranial pressure have been an indicator of poor prognosis[11]. However there is very little data that studies coup versus countercoup type of brain injury, and our study relates the Glasgow coma scale score and age with the associated type of brain injury. Our study evaluated patients based on their pattern of brain injury with a correlation with GCS score and age, and patients with a GCS score of less than 8 and belonging to the elderly age group showed poor prognosis which is also consistent with another study which studied patients with non penetrating head injury and GCS score of 15, and shows increasing age group of injured patient to be associated with a more severe pattern of brain injury as revealed by the CT scan[12]. In another study including 1429 patients, it is suggested that age greater than 60 years as one of the reasons for obtaining a CT scan in patients with acute head injury[13]. In our study older age has been shown to have a poor prognosis in patients with head injury and countercoup type of head injury in all age groups shows poor outcome. In another study the mortality for patients having countercoup type of head injury was found to be 9.6% among the 650 patients included in the study, the mortality rate was higher among patients older than 40 years of age 67% as compared to those below 40 years of age 41%[14]. Our study shows similar findings. Studies have shown gender disparity in the outcome after head injury, women have lesser mortality rate as compared to men of similar age after a traumatic head injury[15]. In our study females have less number of head injuries and associated complications due to cultural restraints and also because they are less exposed to accident prone areas and jobs[16]. Patients with a history of fall are more likely to have CT findings[17] which is also consistent with our study. Mortality rates are higher among patients with GCS scores of less than 8 and age more than 60 years, also the mortality rates varied among the coup and countercoup type of head injuries, which is also consistent with a recent study which shows high mortality rate in patients with a subdural hematoma[20]. In a recent study[18] highest mortality rate was found among patients having bilateral contusions (58%), where as in our study patients with subdural hematoma as well as bilateral contusions showed a high mortality rate (35%), in contrast patients with a subdural hematoma and with contusions had a better outcome as compared to a subdural hematoma alone[19]. Countercoup injuries shows poor outcome due to the farther reach of the shock waves causing more damage to the brain parenchyma.

CONCLUSION

Our study shows that there is a definite role of computed tomography scan in evaluating the coup and countercoup head injuries, and it also has a role in predicting the outcome when the Glasgow coma scale score and age if given due consideration. Countercoup head injury in an elderly patient having a low Glasgow Coma scale (<8) shows a poor prognosis.

REFERENCES

1. Stacey R, Leach J. Head Injury. In: Williams NS, Bulstrode CJK, Connrl PRO. Bailay and Love's short practice of surgery, 25th ed. London: Hodder Arnold 2008; 299-308.
2. Jawaid M, Wardug GM, Ashraf J. Pattern of head injuries at civil hospital Karachi. Pak J Surg. 2006; 22:91-5.
3. Khan MJ, Shaukat A, Khalid M, Aziz MA. Surgical management and outcome analysis of extradural

hematoma at Combined Military Hospital Rawalpindi. Pak AFMJ 2009; 1-4.
4. Naveed D, Bhatti SN, Akbar M, Aurangzeb A. Etiology, presentation and outcome of head injury patients admitted in Ayub Teaching Hospital, Abbottabad. KUST Med J 2010; 2: 45-8.
5. Smits M, Hunink MGM, Van Rijssel DA, Dekker HM, Vos PE, Kool DR, et al. Outcome after Complicated Minor Head Injury. Am J Neuroradiol 2008; 29: 506-13.
6. Brazinova A, Mauritz W, Leitgeb J, Wilbacher I, Majdan M, Janciak I, et al. Outcomes of Patients with Severe Traumatic Brain Injury Who Have Glasgow Coma Scale Scores of 3 or 4 and are over 65 years old. J Neurotrauma 2010; 27: 1549-55.
7. Gengenbach MS, Hyde T. Conservative Management of Sports Injuries. Sudbury, Massachusetts: Jones & Bartlett Publishers. 2007; 316.
8. Stein SC, Georgoff P, Meghan S, Mizra K, Sonnad SS. 150 Years of Treating Severe Traumatic Brain Injury: A Systematic Review of Progress in Mortality. J Neurotrauma 2010; 27: 1343-53.
9. Nathwani DK. Early assessment and management of trauma In: Williams NS, Bulstrode CJK, Connrl PRO. Bailay and Love's Short Practice of Surgery, 25th ed.London: Hodder Arnold 2008; 284-98.
10. Singh, Suryapratap An unusual case of a compound depressed skull fracture. Journal of Surgery Pakistan (International), 2009; 14, 184-186.
11. Marshall LF, Marshall SB, Klauber MR, et al. A new classification of head injury based on computerized tomography. J Neurosurg 1991; 75: 14-20.
12. Jeret JS, Mandell M, Anziska B, et al. Clinical predictors of abnormality disclosed by computed tomography after mild head trauma. Neurosurgery 1993; 32:9-15.
13. Haydel MJ, Preston CA, Mills TJ, et al. Indications for computed tomography in patients with minor head injury. N Engl J Med 2000; 343:100.
14. Jayakumar PN, Kolluri Sastry VR, Basavakumar DG, et al. Prognosis in countercoup intracranial haematomas a clinical and radiological study of 63 patients. Acta Neurochir (Wien) 1991; 108:30-3.
15. Haider AH, Crompton JG, Chang DC, et al. Evidence of hormonal basis for improved survival among females with trauma-associated shock: An analysis of the National Trauma Data Bank. J Trauma 2010; 69:537.
16. Berry C, Ley EJ, Tillou A, et al. The effect of gender on patients with moderate to severe head injuries. J Trauma 2009; 67:950.
17. Smits M, Dippel DW, Steyerberg EW, et al. Predicting intracranial traumatic findings on computed tomography in patients with minor head injury: The CHIP prediction rule. Ann Intern Med 2007; 146:397.
18. Lobato RD, Cordobes F, Rivas JJ, et al. Outcome from severe head injury related to the type of intracranial lesion. A computerized tomographic study. J Neurosurg 1983; 59:762-74.
19. Kotwica Z, Braezinskin J. Acute subdural haematomas in adults and analysis of outcome in comatose patients. Acta Neurochir (Wien) 1993; 121:95-9.