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RESEARCH ARTICLE

A RETROSPECTIVE ANALYSIS OF PEDIATRIC CRANIOCEREBRAL TRAUMA DUE TO FALL FROM HEIGHT, TREATED IN A TERTIARY CARE CENTRE

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ABSTRACT

Aim: This is a retrospectrive study done to study the incidence and results of all pediatric patients who reported to our hospital as case of fall from height.

Materials and Methods: The records of all fall related patients in the age group below 15 years of age between June 2013 and June 2017 were analysed. Mortality in patients with associated extracranial injuries were not taken for the study (mortality was taken into account for purely craniocerebral neurosurgical patients).

Results: Two thousand two hundred and sixty eight children were found to have fell from height. Two hundred and thirty four patients were found to have sustained skull fracture. 99 patients had sustained fracture of skull base. A quarter of patients needed admission. The mortality associated has been found to be one percent. Three percent patients had isolated cerebral contusion, another 3 percent had subdural hematoma, 3 percent had subarachnoid hemorrhage and one percent had EDH (extradural hematoma) and another 3 percent had combined insults to brain. About 9 percent had fractures of skull bone out of which a quarter fractures were depressed. 5 percent children required surgery. In patients of pure craniocerebral trauma half a percent died.

Conclusion: We conclude that falls form an important mode for mortality and morbidity in the society paticularly the children. Brain injuryform an important cause of these mortality and morbidity. We need to improve on this count by planning measures to avoid such mishaps in future.

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INTRODUCTION

Falls from height are a leading cause of morbidity and mortality in children. Taking all trauma in pediatric population into account, falls account for the most common reason for an emergency department visit. The injury patterns following a fall differ between children and adults. Overall, falls accounted for about 6 percent of childhood deaths, so this category of illness has to be taken seriously.

MATERIALS AND METHODS

The records of all fall victims treated at the Department of Neurosurgery at Govt SMHS Hospital over a four-year period (June 2013-June 2017) were retrospectively reviewed. Records of all paediatric patients were analysed. All the patients who were under 15 years of age and suffered a fall as the primary mechanism of blunt injury were included.

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However, patients who suffered a fall, for example, after rolling down the stairs or being ejected as a result of a motor vehicle accident were excluded. The height of fall was determined by history from witnesses. GCS score, neuroimaging results, type of injury, hospital length of stay, medical costs, and outcome were all reviewed. Patients were categorized into two age groups namely 0-4 years and 5-15 years. Two more categories of patients were devised regarding height of fall, one category below 15 feet and another above 15 feet.

RESULTS

Two thousand two hundred and sixty eight children were found to have fell. Out of those 1360 were boys and 908 were females (male : female=1.5:1). Sixty percent (1360 patients) had had a fall from more than 15 feet and 40 percent had had a fall from less than 15 feet. There was no correlation between height of fall and GCS. The most common site of an accident was a fall from a window (36 percent), balcony (27%), furniture (9%), tripping (7%), walkers (5%), and play

equipment (3%). Rest of the modes are unknown or history was poor. 72 percent patients sustained fall at home while 9 percent had a fall at school. CT scan head has been done in 63 percent of paediatric patients who had fell. Some (12 percent) have undergone x-ray skull. 09 percent have been discharged without any observation or CT scan or x-ray. Two hundred and twenty five patients were found to have sustained skull fracture. 99 patients had sustained fracture of skull base. Five percent patients had isolated cerebral contusion and 3 percent had subdural hematoma, 3 percent had subarachnoid hemorrhage and one percent had EDH (extradural hematoma) and another 3 percent had combined insults to brain. 10 percent had fractures of skull bone out of which a quarter fractures were depressed. 5 percent children required surgery. In the children group aged between 0-4 years more percentage sustained head injuries (or were hospitalized) than in other groups. In patients of pure craniocerebral trauma half a percent (a total of 12 patients) died. Out of the 12 patients who died 4 patients had fallen from height greater than 15 feet.

Table 1. The number and percentage of patients with fall in various categories of diagnosis

Diagnosis	Number	Percent (approximately)
Fracture skull	225	10
Fracture base of skull	99	4
Contusion brain	113	5
Subarachnoid hemmorhage	66	3
Extradural hematoma	22	1
Combined	66	3
Others ---not serious	1677	

Table 2. Gender distribution

Gender	Number	Percentage
Male	1360	60
Female	908	40

Table 3. Percentage of patients in two categories of height of fall

Height	Number	Percent(approximately)
More than 15 feet	1359	60
Less than 15 feet	909	40

Table 4. Modes of fall

Mode	Percent
Window	36
Balcony	27
Furniture	9
Tripping	7
Walkers	5
Play equipment	3
Others…unknown	13
TOIAL	100

Table 5. Percentage of fall patients in various age categories

Age	Number	Percentage (approximately)
0-4 years	1368	60
5-15years	900	40

DISCUSSION

Falls are a common source of traumatic injuries in children, and the authors of several studies have shown that fall injury patterns differ between adults and children. For doing the CT Scan or not the resident on duty is guided more or less by the clinical condition of the patient. CT should be liberally used to investigate paediatric fall patients. In our case the CT scan head has been done in a good proportion (63percent) of cases. It has been usually found that the choice of attending resident on duty has played a role in deciding whether to go for CT or x-ray (the choice being guided by the medical status of the patient). In our study percentage of patients who went for CT Scan is more because one indication of CT Scan in our area is that sometimes the patient belongs to a far flung area where CT Scan is not available. So the resident on duty, in such cases, in order not to put patients to risk does ask for the CT Scan head of the patient. Height seems to have an important role in management. The increasing reliance on trauma triage protocols to manage fall victims has resulted in specific height-related criteria intended to predict injuries (Ochsner *et al*., 1995). Therefore, most trauma centers activate trauma response systems based on height-related criteria only when victims have fallen 15 to 20 feet or more (Barlow *et al*., 1983; Williams, 1991). Some of the authors conclude that fatal injuries caused by low-level falls indicate an incorrect history until proven otherwise (Chadwick *et al*., 1991). In another study the authors found no incidence of death in children who fell from heights of three stories or fewer (Barlow *et al*., 1983). Child abuse must clearly be excluded in pediatric deaths that occur after low-level falls; however, in our study none of the four deaths from a height of fewer than 15 feet had stigmata of abuse. The rate of injury among younger children (0–4 years of age) was greater than that among older children (5–15 years of age), and younger children were more likely to sustain serious injuries, as demonstrated by their increased risk of hospitalization or death. This is likely to be attributable, in part, to their large proportion of head injuries, compared with older children (Vaughn *et al*., 2011).

In our study the percentage of patients who fell from windows has been around 36 percent which is slightly higher than some studies done so far. In one study the percentage of fall from window was around 20 percent (Anthony Kim *et al*., 2008). The reason for this probably the in most of our rural areas there are no safety measures in place to prevent falls from windows. In our study we found that younger children have the highest risk of falling and boys fall more often than girls. Most of the previous studies drew similar conclusions, that is, preschool-aged children have the highest risk of falling, boys fall more frequently than girls, window falls have high morbidity rates, and falls demonstrate seasonal trends, with peaks during warmer months (Vaughn *et al*., 2011). A national epidemiological study was done in USA on pediatric falls from buildings and structures, which was published in 2005. It was based on a data sample from 27 states of USA (Pressley and Barlow, 2005). Its observations were more or less same. Regarding mortality we found a mortalty rate of half a percent in paediatric patients who had head injury. In a study on adult falls, an 8% mortality rate was demonstrated in patients who fell fewer than 20 feet (Helling *et al*., 1991). In one study a 7% mortality rate was found in children who fell 4 feet or fewer (Chadwick *et al*., 1991). In another study the mortality in children who had a fall was found to be 1.7 percent (Anthony Kim *et al*., 2000). In the context of mortality it is pertinent to mention that mortality in our study is low for which we do not know the cause. Probably the cause is that since our centre is catering to the whole valley, patients from far flung areas may not be able to reach to the hospital in time and they die in the periphery before reaching the tertiary hospital. In this study we found a high incidence of intracranial injury in patients falling

from high heights. In one study they found that high incidence of intracranial bleeding in patients falling from low heights (Anthony Kim *et al*., 2000). Though we do not know the reason for the difference, the probable reason for the difference could be that in our series we did a CT Scan in higher percentage of cases and we could discover some additional findings. Though our categorization of height of fall has given us a direction regarding future studies our assessment was based on rough assumption because we did not exactly measure the height. Likewise some new variables can be studied in future. This can be done on the basis of landing surface, window status before the fall, furniture near the window, and risky behavior of the child. It has been concluded previously that parents and other child caregivers should be counseled not to depend on screens to prevent children from falling out of windows. To prevent these falls, window guards or window locks that prevent the window from opening more than 4 inches should be used (American Academy of Pediatrics, 2001). A meta-analysis of home-safety interventions against falls lacked evidence to show that window fall prevention initiatives have been successful in promoting the use of window guards and locks (Kendrick *et al*., 2008). Safety measures against falls is a must because considering all pediatric trauma, falls account for the most common reason for an emergency department visit (Vaughn A. Harris *et al*., 2011). Overall, falls accounted for 5.9% of childhood deaths (Hall *et al*., 1989). Falls are the the fourth leading cause of trauma-related death, ranking behind motor vehicle accidents, fires, and drowning (Garretson and Galleger, 1985; Kraus *et al*., 1984; Mathers and Weiss, 1998; Shafi and Gilbert, 1998).

In our part of the world, in urban areas, we have a system of keeping iron grills in the window which is permanently fixed. This seems to be the ideal as it gives cent percent safety but further studied are needed regarding it. Like wise one more drawback in our study is that our study does not take into consideration the number of pre-hospital deaths due to falls which we do not have any information of. The limitation with this study is that it was based on hospitalization data, which did not include various yearly trends or other details regarding the circumstances of the injury events, which are important for planning the prevention strategies of future.

Conclusion

It is recommended that pediatric trauma triage criteria should take into account the likelihood of occult head injuries. Also the physicians should liberally obtain a head CT scan in pediatric fall victims. It is very clear that these injuries are an important pediatric public health problem, and increased prevention efforts are needed, including development and evaluation of innovative prevention programs.

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