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RESEARCH ARTICLE

EXPERIENCE OF PEDIATRIC HEAD INJURY IN RURAL HOSPITAL

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ABSTRACT

Introduction: The total patients of head injury 3059 patients out of which 127 patients of pediatric head injury. Pediatric trauma refers to a traumatic injury that happens to an infant, child or adolescent.

Aim: To analyze & share the experience of pediatric head injury in rural hospital in last 5 years.

Materials and Methods: In this hospital based prospective, observational study was carried out in 124 patients of the age group 0-15 years admitted to the neurosurgery department in pediatric wards of a tertiary care hospital, with a history of trauma during the period from last five years from 01/01/2012 to 22/11/2016, were included. Information was recorded in which included age, sex, details of head injury, clinical, Computerized Tomography scan and outcome of head injuries among pediatric patients.

Results: The prevalence of head injury in children up to 15 years of age in the hospital was 4.05%. Maximum head injuries were found in 1-5 year's age group (54.5%). Road traffic accident was the most common cause of injury observed in 70 % patients.

Conclusion: was the most common type of injury found in 66.67 % patients. Conclusion: Patients with motor vehicle-related head trauma need special consideration regardless of injury severity. To bring the mortality rate down, children, especially with rural background should be made aware about the importance of strict compliance to traffic rules and regulations. One of the best ways to do it is to include road safety issues in school curriculum.

INTRODUCTION

Head injuries are a major cause of pediatric hospital emergency room visits and frequently require extensive treatment. [1] Every year head injury results in many hospital admissions and this problem is commonly reported from India, [2, 3] In India, injuries are the 7th leading cause of mortality contributing to 11% of total deaths, 78% due to motor vehicle related head injuries alone. [2] Almost half of the deaths in 10-25 years age group are due to injuries and head trauma is the most common injury leading to death. [4] However, with one of the highest motorization growth rate in the world accompanied by rapid expansion in road network and urbanization over the years, our country is faced with serious impacts on road safety levels. The total number of road accidents in urban areas were lower (2, 31,894) as compared to number of accidents in rural areas (2,69,529). The percentage share of accidents in rural areas and urban areas were 53.8 and 46.2 respectively in total number of accident in the country. [5]

Nowadays, head injuries are becoming more frequent in children. We are witnessing fights among children that sometimes result in death. In older children, there is an increasing prevalence of bicycle accidents, sports injuries, car accidents with the child as a passenger in a motor-car, and suicide accidents. [6] Children present a unique challenge in trauma care because they are so different from adults - anatomically, developmentally, physiologically and emotionally. Yet only about 10% of injured children are treated at pediatric trauma centers. The highest mortality rates occur in children who are treated in rural areas without access trauma centers.[7] Survivors are susceptible to irreversible neurological damage that represents an important socioeconomic problem. [8] After injuries occur, many challenges exist for appropriate and effective pre-hospital and trauma care including an inadequate transport system, and logistical and infrastructure deficiencies. Many studies from India have described the epidemiology of PHI and discussed related issues, including the need for public awareness

campaigns and enforcement of legislation to reduce the number of injuries. [8, 9 & 7] Most of these studies have been conducted in large urban trauma centers. There is a lack of reliable data regarding PHI in rural area. The aim of our study is analyze and share the experience of pediatrics head injury in rural hospital in last 5 years.

MATERIALS AND METHODOLOGY

Study design

Acharya Vinobha Bhave Rural Hospital (AVBRH) Sawangi (M) Wardha, Yavatmal road, national high way No-361 is comprise a 1280 beds tertiary care teaching hospital organization serving the rural population of Wardha and surrounding districts.

Patients

This retrospective study comprised infants, children and adolescents, 0–15 years consecutively diagnosed with traumatic head injury, International Classification of Diseases 10 (ICD-10) S00.0 – S09.9 (WHO 2010), at AVBRH, Sawangi (M) Wardha during the year from 01/01/2012 to 22/11/2016, of the 124 patients, 124 were treated at the Neurosurgery unit of AVBRH and subsequently get managed with coordination of pediatrician and after recovery get discharged with regular follow up 03 to 06 months.

Data analysis

Patients of medical records included entering the following variables into an electronic data base: age, sex, place of residence, Pediatric Glasgow Coma Scale (PGCS) score, mechanism of injury, severity of head injury [defined as mild (GCS- 13-15) 87 patients, moderate (GCS- 9-12) 31 patients and severe (GCS-3-8)] 6 patients, associated injuries, length of hospital stay (days), computed tomography (CT) results, type of management, surgical intervention (if any), discharge disposition (died vs. discharged alive), and Glasgow Outcome Scale (GOS) score. All patients were evaluated and resuscitated following established hospital guidelines for management of TBI. In circumstances where CT scan was indicated but unavailable, (e.g. equipment maintenance, operator unavailability, etc) skull X-ray was performed. When indicated, cervical spine X-rays were performed. Included were patients who treated after being admitted to hospital and those who referred to other center or those get discharged after recovered from AVBR H and get regular followed up in Neurosurgery OPD.

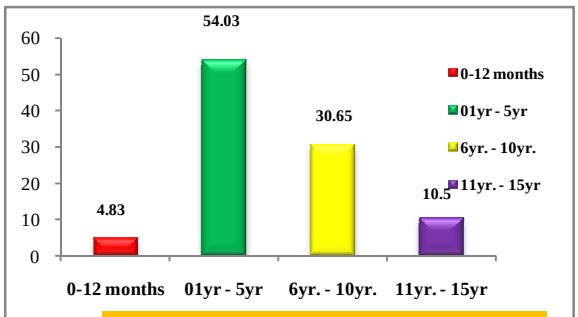
We performed a descriptive analysis of the collected variables to understand the age-group, cause of injury, and imaging findings among patients. We also described the outcome with respect to the Glasgow coma scale on admission. Further, we performed a multivariate logistic regression analysis, to identify significant independent predictors of mortality. Four plausible explanatory variables were included in the model of sex, mode of incidents, duration of hospital stay in days, and neurological severity as measured by the standard GCS categories. These variables were selected as these were likely to be most plausible reasons for mortality, and these were consistently collected data were analyzed using Microsoft Access software and results were tabulated and compared. Statistical tools – averages and percentages. This was the only model which was evaluated, with an aim to analyze and share the experience in rural area in the period of last five years.

RESULTS

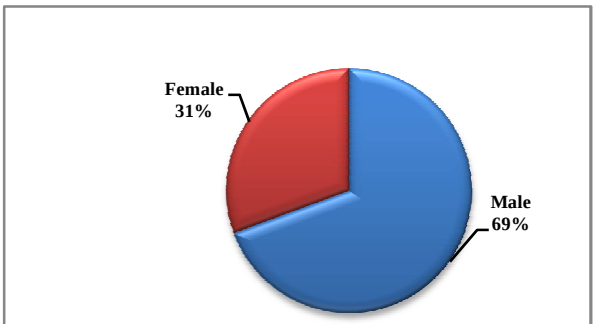
During the study period, 124 children were admitted with Head Injury in our hospital were included in the study. There were only 6 (4.83 %) infants, 67 (54.03 %) were belonging to age group of 1-5 Yrs, 38 (30.65 %) were of 06 -10 Yrs, and 13 (10.5%) were of 11-15 Yrs. Majority 86 (69.35 %) were boys (male) and 38 (30.65 %) were girls (female).

Graph 1 & Graph 2

Numbers of patients with Pediatric head injury by gender and age group admitted AVBRH, Maharashtra, India.



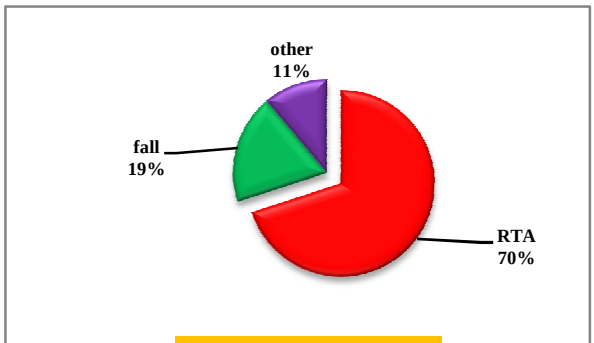
Graph 1 : Age wise distribution in percentages



Graph 2.Gender

The major cause of head trauma was Road Traffic Accident 70 % and fall from height (19 %) which included. Other causes (11%) which included as-assaults, head shake, sports etc.

***Graph 3*:** Numbers of patients with pediatrics head injury by mode of incidents admitted in Acharya Vinoba Bhave Rural Hospital, Maharashtra, India.



Graph 3 : Mode of Incident

10 % (12children) presented with seizures. Most common was Loss of consciousness with 60 % (74 children) whereas

Vomiting was present with 35 % (43 children) and 15 % (19 children) was presented with ENT bleed.

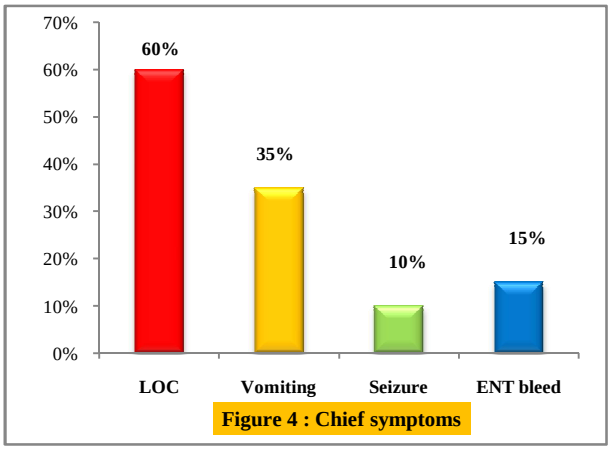
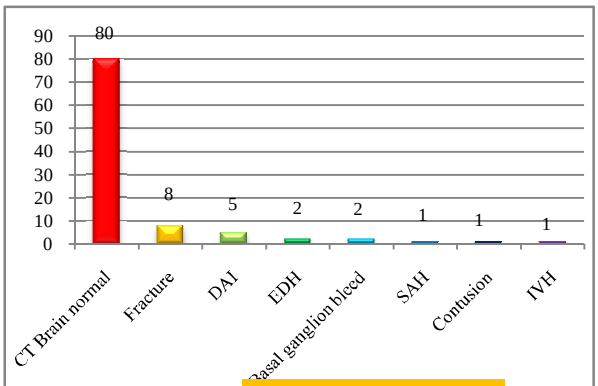


Figure 4 : Chief symptoms

Graph 4: Numbers of patients with traumatic brain injury by chief symptoms admitted to AVBRH, Maharashtra, India.

Graph 5: There is 80 (66.67%) children where normal scan of brain (conclusion) and Other CT findings are; 8 (6.45 %) fractures, 5 (4.03 %) Diffuse Axonal Injury (DAI), 2 (1.61 %) Basal Ganglion Bleed & Extradural Hematoma each respectively, and 1 (0.80 %) of each Intra-ventricular hemorrhage (IVH), Subarachnoid hemorrhage (SAH), Cerebral Contusion each respectively.

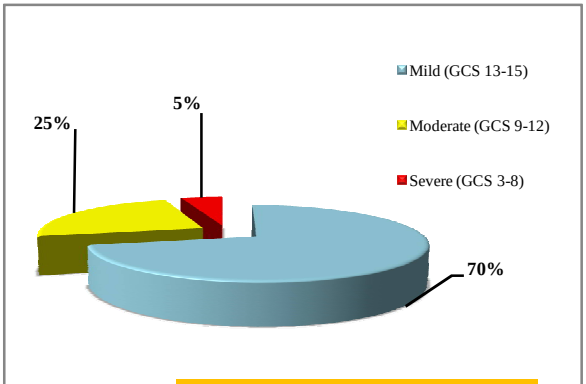


Graph 5: CT Scan findings

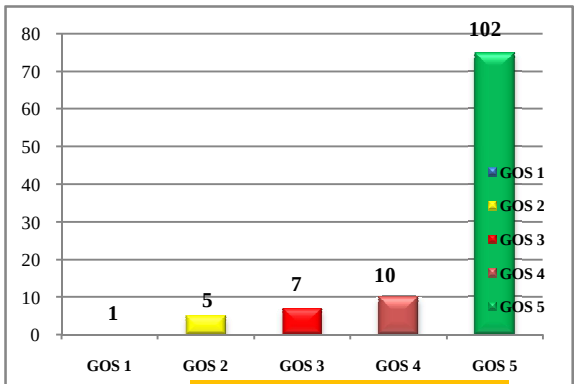
Graph 6 : Mean Glasgow Coma Scale was 12+/-3, 87 (70 %) had mild head injury with GCS - 13/15, 31 (25%) had moderate head injury with GCS - 9/12 and 6 (5%) children's with GCS- 3/8 had severe head injury. None of the children were found to have associated cervical spine injury in our study 1.61 % (02 children) required surgery for traumatic brain injury in our study.

Graph 7: Pediatric head injury Glasgow outcome score are following 1 - Expired, 2 – Vegetative, 3 - Severe disability, 4 - Moderate disability and 5 - Good outcome. In our study Good recovery (independent for day-to-day activities) was seen in 102 (82.5 %), moderate disability was seen in 10 (8.06 %) children and severe disability (dependent for day-to-day activities) was seen in 7 (5.64 %) of the children, Vegetative was seen in 5 (4.03 %) and there were only 1 child expired in our study. [Graph 7]

***Graph 6 & 7*:** Numbers of patients with pediatric head injury by Glasgow coma scale and Glasgow outcome scale admitted to AVBRH Sawangi (M) Wardha, Maharashtra, India



Graph 6: GCS (Glasgow Coma scale)



Graph 7: Glasgow outcome score

DISCUSSION

This study found that in rural hospital of central India, showed RTA as major cause of pediatric head injuries, whereas other studies from India showed fall as the most common cause. [1-6] These injuries resulted in a spectrum of imaging features and expected pathology. Low Glasgow coma score at admission was significantly associated with mortality as an outcome. This report is not exactly similar to many other reports from rural or urban India, and other parts of the world, as there is a disproportionate burden of motor vehicle-related injury morbidity and mortality. [4, 6 and 7] The most common cause of head injuries in children is fall, and, in more severe injuries, traffic accident trauma. In traumatic brain injuries in infants and small children, the most common symptoms are paleness, somnolence and vomiting, the so called “pediatric contusion syndrome”. It can be seen that certain types of injury are related to the child’s age and development. As the child learns to walk, falls from greater heights occur. As the child grows, due to the lack of research abilities, accidents of the care pedestrian type are becoming more common.

Children have greater disposition to head trauma and Greater head mass relative to body weight and its ratio making them top- heavy. Neck musculature has not been developed to handle relatively heavier structure; increased head weight results in increased momentum during falls or injuries. Children brain area has more fluid: hence more susceptible to wave- like forces, has less myelination, and thinner cranial bones that are more easily shattered. [8]

The present study highlights the various experiences of pediatric head injury and its outcome in children in rural

hospital. Almost half head injuries (54.03%) were sustained in 1-5 years age group followed by (30.65%) in 6-10 years, (10.5 %) in 11-15 years and in (4.83 %) infants. Suresh HS *et al* [10] reported slightly higher proportion of children (18.8%) in 0-5 year's age group, (41.1%) in 6-10 years age group and (45.8%) were aged 11-15 years. In his study maximum numbers of children were in 11-15 years age, probably due to high levels of motorization and urbanization in Bangalore predisposing children to head injuries. In our study found, the major cause of head trauma was Road Traffic Accident 70 % and falling from height 19 % which included. Other causes 11% which included as- assaults, head shake, sports etc.

Agarwal's *et al* concluded that fall (65.11%) was the most common mode of injury followed by road traffic accidents (25.6%). [11] The proportion of road traffic accidents is in the range 27 - 75% - Gururaj *et al*, [2] Jennett *et al*, [12] Atabaki *et al*. [13] Vinayak R *et al* [14], road traffic accidents (52.1%) were the leading cause of pediatrics head trauma followed by falls (40.6%) of total admissions. There is few comparative statistical study reported as Amin *et al* (2003) Kashmir, [15] 26 % of RTA and 68 % of fall, Swarnkar M *et al* (2006,Wardha) [16] 22.78 % incidence, 28.99 % of RTA, 42.5 % of fall, Mukesh Sharma *et al* (Indore 2009) [17] 19.23 % incidence, 24.27 % of RTA, 39.44 % of fall, Oboirien *et al* (Nigeria, 2010) [18] 14.2 % of incidence, 24.27 % of RTA, 39.44 % of fall, Sharma *et al* (Rewa 2014) [19] 20.16 % of incidence, 32.15 % of RTA, 30.78 % of fall. Sharma *et al*. [19] studied road safety in 23 metropolitan cities of India and found that RTA accounted for 15% of total accidents. Other studies from Delhi, [20] South India [21] and Nepal [22] also noticed an increasing trend of RTA among children. In present study, considering the male female proportion in fall related injuries, males accounted for (69.35 %) and females accounted for (30.65 %) of total fall injuries. Therefore, males were more prone for falls than females. WHO reports which state that males are twice more likely to sustain road traffic injuries. [23] The study by A. Khambalia *et al* (2006), [24] showed that young age (0–6 years), male sex and low socioeconomic status were consistent risk factors for fall injuries, males being affected twice than females. Vinayak R *et al* (2014) [14], males accounted for (61.5%) and females accounted for (38.5%) of total fall injuries. Also more number of falls occurred in 0-5 years age group (38.5%) as compared to 11-15 years age (23.1%). This finding was within ranges reported by Noel Tulipan *et al*. [25] These injuries are all preventable if health protection guidelines are adopted.

In our study radiological findings (CT Brain), (66.67%) Normal Scan (Conclusion) and Other CT findings are; (6.45 %) fractures (2 parietal, 2 occipital and 1 temporal bone), (4.03%) Diffuse Axonal Injury (DAI), (1.61%) Basal Ganglion Bleed & Extradural Hematoma; each respectively, and 1 (0.80 %) Intra-ventricular hemorrhage (IVH), Subarachnoid hemorrhage (SAH), Cerebral Contusion; each respectively. Subarachnoid hemorrhage was least likely probably since children lack sufficient subarachnoid space. Considering infants and young children, young children suffer greater damage from diffuse cerebral edema than their older counterparts and show significant impairment in cognitive and performance skills due to injury to developing brain. [11] In the present study, in 0-5 years age group, one child out of (1.64 %) with diffuse cerebral edema had poor outcome (death). Sharma *et al* [19] reported that 216 patients had isolated head injury. Skull fracture was noted in 73 (26.83%). Cerebral edema (45.22%) was the most common presentation in head injury patients seen in pediatric age group, and the outcome is good in these patients. Parietal bone was the most common bones to get fractured (38.23%) in traumatic head injury. These findings are supported by studies from India. [24] Kraus *et al* [26] reported concussion (70%) to be the most common injury in children. Concussions were responsible for 37.9% of head and neck injuries according to Mac Gregor *et al*. [27] Suresh *et al* [10] from Bangalore said that, diffuse head injury (29.4%) was most common followed by extradural hematoma (27.9%), skull fracture (16.4%), contusion (16.17%) and subdural hematoma (10%). The most common type of injury in that order was skull fracture (48%), intraparenchymal hemorrhage (31%), subdural hematoma (24%), subarachnoid hemorrhage (21%) and diffuse cerebral edema (17%) -William H. *et al*. [28] Vinayak R *et al* (2014) [14], diffuse cerebral edema found in 41.6%, concussion in 30.2%, skull fracture in 22.9%, extradural hematoma in 11.4%, hemorrhagic contusion in 10.4%, subdural hematoma in 9.4% and subarachnoid hemorrhage in 4.2% patients. According to Malik NK *et al*, [29] Posterior fossa Extradural Hematoma was an uncommon entity, accounting for only 4% to 12.9% of all EDHs. It has a characteristic clinical presentation, which if detected can be life-saving.

According to the on admission GCS patients were divided into mild, moderate and severe injury. Gururaj *et al* (2000), [2] found (70%) mild, (14%) moderate and (16%) severe head injuries in children. Suresh *et al* (2003), [10] found (44.8%) mild, (28%) moderate and (27%) severe head injuries. Hence most of childhood head injuries are mild. Jennett *et al* [12] reported 80% cases of mild head injury alone in UK. Vinayak R *et al* (2014), [14] found (80.2%) mild, (13.5%) moderate and (6.25%) severe head injuries. A similar finding was noted in the present study found (70%) mild, (25%) moderate and (5%) severe head injuries. None of the children were found to have associated cervical spine injury in our study 1.61 % (02 children) required surgery for traumatic brain injury in our study. Glasgow coma score was a good indicator of the clinical outcome of patients- Kraus *et al*, [26] Suresh *et al*. [10] Patients of mild head injuries [GCS 13-15] had good outcome. Suresh *et al* [10] observed 1.3% patients with mild head injury (GCS 13-15) had poor outcome whereas 45.6% patients with severe head injury had poor outcome. In our study, Good recovery (independent for day-to-day activities) 82.5 %, moderate disability found (8.06 %), severe disability (dependent for day-to-day activities) (5.64 %) and Vegetative (4.03 %).

The in hospital mortality as reported by Kraus *et al* [26] was 3/100 and as reported by Gururaj [2] was 9%. In the present study, overall mortality was 1/124 cases of pediatrics head injury was 0.80 %. This retro prospective chart review, is one of the firsts from rural area in central India, and included all consecutive cases which presented to a teaching hospital. This study also has certain limitations. First, being a retrospective study only those variables could be studied, which are collected for standard clinical care. We could not collect information about important indicators such as velocity of impact, type of road where accident occurred, and post-discharge outcome of patients. Second, it is plausible that only a certain proportion of all traumatic brain injuries will reach the hospital, and few of those with severe injuries may have died in the pre-hospital setting, and many with mild injuries may not have sought clinical care. Further, as this was the only neurosurgery equipped hospital in the district at the time of the

study, referral bias is also possible. Last, while the results may be typical of rural India, but being a single center study the findings may not be generalized able to other area. It is important to understand the dynamics of vehicular as well other head injuries in rural India. Most vehicle ownership is in the urban areas, and those vehicles which are owned by rural population are typically low-speed (such as tractors and two-wheelers). However, a vast number of highways pass through rural and remote areas with extensive use of heavy motor vehicles travelling at high speed. Residential areas and highways are not segregated, and safety laws are not universally applied. Many interventions (e.g., road lighting, traffic signals, guard railing, seatbelts, helmets, airbags, and antilock brakes) have also demonstrated success in more industrialized setting and are likely to be valuable in resource-constrained setting such as India. This decrease was largely attributed to an increase in seat belt and child safety seat use, standardized implementation of air bags, infrastructure investments and improved safety engineering.[14] In India, vehicles, especially those designed locally; do not conform to international safety standards in materials or design (e.g., roll-over prevention or passenger ejection). [6] There is a need to improve pre-hospital care to reduce morbidity and mortality. [14] Apart from safety laws, prompt transport to a hospital after an accident is another important measure to reduce mortality. [14-15]

The majority of patients in India are brought to the emergency department by relatives or bystanders in private vehicles, and pre-hospital emergency medical services remain under-organized. Field triage often relies on bystanders who transport injured victims to the nearest clinic, which is often unable to provide appropriate treatment. [15] Major urban areas also have a loosely networked trauma system, untrained emergency medical services personnel and unequipped ambulances. [16]

The delay in reporting to hospital after golden hour period could be probably due to increase in rural patients reporting to the hospital so travel time is more, lack of awareness regarding free transportation facilities by the government, hesitancy to report to the nearest health center, PHC, Community Health Centers, and even district hospitals.

Our observations of family and bystander transport support the notion that pre-hospital care in rural India requires much improvement. In the present study the mortality in patient with shorter stay was higher probably due to rapid patient death from more severe injuries. PHI rates would be crucial to develop public health intervention programs in India. Additionally, during each year of the study, PHI admissions experienced a bimodal peak, during the years of 2012 to 2016. These years coincide with the planting and harvesting season of the province. However, there is further need to confirm this pattern as it would be useful to plan preventive strategies.

CONCLUSION

The study highlights the PHI in rural areas is mostly among the young male children population and is increasing every year with majority coming from nearby villages which is very alarming and highlights the need for taking urgent steps for establishing good pre-hospital care and provision of trauma services at site in India. Mortality is 0.80 % with the majority of deaths occurring among children in the most productive age groups. Recovery with minimal disability was observed in approximately 82.5 % of cases in this sample. Availability of good neurosurgical care is essential for these children. A computerized trauma registry is urgent required to bring out the risk factors, circumstances, chain of events leading to the accidents and will be extremely helpful in policy making and health management at the national level in India. It is concluded that several factors should be highlighted as significant for PHI in children in rural areas. PHI outcome depends on the regional economic status, whereby regions with higher incomes can enable better care. Strict compliance to the recommendations and guidelines for PHI care are associated with better outcomes and are more often found in high income regions. Therefore it must be noticed below mentions points to reduce the pediatric head injury; Raise awareness about road safety issues, Road Traffic Safety Education and Training program in rural areas, Emergency Medical Services for Road Accidents, Research for Road Safety, Enforcement of Safety Laws and significant improvement in rural infrastructure is required for reducing accidents in rural areas.

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