Original Article

Elderly pedestrian neurotrauma: A descriptive study from a premier neurotrauma center in India

Ashok Munivenkatappa, Nupur Pruthi, Mariamma Philip[1], Bhagavatula I Devi, Sampath Somanna

Departments of Neurosurgery, [1]Bio-stastitics, National Institute of Mental Health and Neurosciences, Bangalore, Karnataka, India

ABSTRACT

Context: Experience with elderly pedestrian neurotrauma at a major neurotrauma tertiary center. **Aims:** To highlight the specific injuries and outcome of the elderly pedestrian neurotrauma patients within the city of Bangalore and its surrounding districts. **Settings and Design:** A retrospective study consisting of demographic data, clinical findings, radiological details, and outcomes. **Materials and Methods:** A study was conducted at the casualty services, in which 143 consecutive elderly pedestrian (age >60 years) head injury victims were studied from June to September 2009. The records from the hospital mortuary were analyzed from 2007 to 2009. An analysis of 77 elderly patients who died as a pedestrian in accidents during this period was performed. **Statistical Analysis Used:** SPSS 15. **Results:** The elderly pedestrians constituted 27% (143/529) of all pedestrian traumas. Two wheelers were the most common accident vehicle (56.6%, 81/143). Most of the injuries (38.5%, 55/143) occurred during peak traffic hours, that is, 4 pm to 9 pm. Majority sustained moderate to severe head injury (61%, 87/143). More than three-fourths of patients required a computed tomography (CT) scan (77%, 110/143), in which there was a higher frequency of contusion (31.5%, 45/143), and subdural hemorrhage (23.1%, 33/143). Most of the injured (43.3%, 13/30) underwent surgery for intracranial hematoma. The mortality rate was 22.8% (8/35). Nearly one-fourth of conducted postmortems among pedestrians belonged to the elderly age group (77/326, 23.6%). **Conclusions:** Elderly pedestrian neurotrauma patients sustain a more severe injury as evident by poorer Glasgow Coma Score (GCS) scores and CT scan findings, and hence have a higher mortality rate.

Key words: Bangalore, elderly pedestrian, neurotrauma

Introduction

Road traffic accidents account for more than 10 million injuries and nearly one million deaths worldwide annually.[1] India is a developing country with a rapidly growing industrialization, economy, and research. As the basic health infrastructure has improved over past years, the life expectancy is slowly increasing.[2] Hence, more and more geriatric patients are being treated. In India road traffic accidents accounts for 45-60% of traumatic brain injury, in which pedestrians contribute 30-40%.[3,2] Pedestrians form a large share of all the elderly trauma victims.[4] The increasing older population in India presents a challenge to the health care system and yet there is paucity of literature on lethal injuries and deaths in elderly pedestrian trauma. The purpose of the study was to highlight the magnitude, specific problems, and outcome of the elderly pedestrian neurotrauma patients within the city of Bangalore, South India, and its surrounding districts.

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Materials and Methods

Study type

Retrospective study

During the period of June to September 2009, the emergency services at a tertiary neuro-science institute, Bangalore attended to 2555 head injury victims. Out of these, 529 (20.7%) patients were pedestrians [Figure 1]. The elderly pedestrians (age >60 years) constituted 27% (143/529) of all pedestrian head injuries. Emergency case records and case files of these 143 patients were studied. A proforma was made which consisted of age, gender, time and place of injury, time taken to reach

Address for correspondence:
Dr. Nupur Pruthi, Department of Neurosurgery, National Institute of Mental Health and Neuro Sciences, Hosur Road, Bangalore, Karnataka, India. E-mail: pruthi_nupur@yahoo.co.in

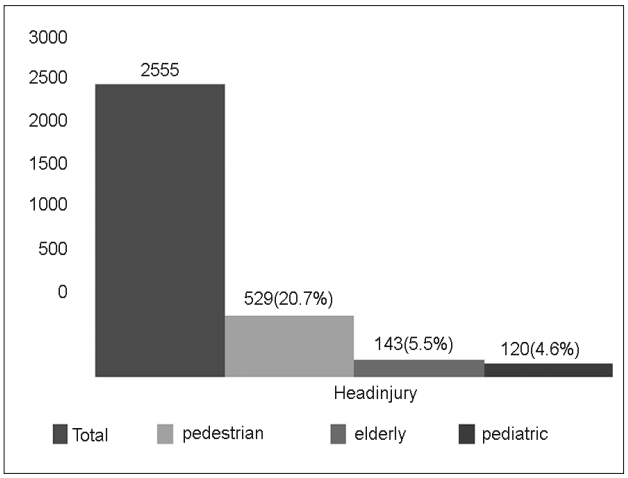

Figure 1: Percentage of reported neurotrauma patients during the period of June to September 2009

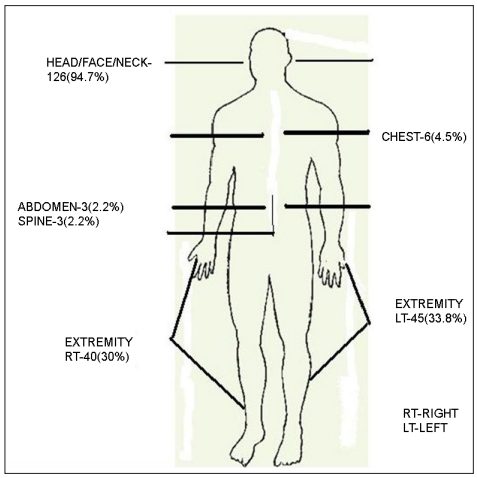

Figure 2: Associated injuries of elderly pedestrians

hospital, primary aid, and associated injuries. Glasgow's coma score (GCS), computed tomography (CT) scan requirement and findings, treatment given, and the condition at discharge.

In the second part, records from hospital mortuary were retrospectively analyzed from January 1, 2007 to December 31, 2009. An analysis of 77 elderly patients who died as pedestrians in accidents during this period was performed.

Statistics

The statistics of the data were achieved by SPSS 15.0 version. SPSS, inc., Chicago, IL, USA; Feature 1200- SPSS Statistics Base 15.0: Local license for version 15.0– Network Expiration: None.

Results

The city of Bangalore accounted for 44.1% (63/143) of the study group. Majority of the accidents (38.5%, 55/143) occurred during peak traffic hours, that is, 4 pm to 9 pm. Most of the patients (92.3%, 132/143) had received primary care before reaching the hospital emergency. Two wheeler was found to be the most commonly involved vehicle (81/143, 56.6%), followed by four wheeler (21/143, 14.7%).

Nearly 60% (60.9%, 87/143) had sustained moderate-to-severe head injury (GCS at admission after resuscitation-3 to 13). On examination, 11.9% (17/143) had abnormal pupillary reaction. Majority (93%, 133/143) of them had sustained associated injuries [Figure 2].

More than three-fourths of the elderly neurotrauma pedestrian patients required a CT scan (110/143, 76.9%); among them 64.5% (71/110) were abnormal. The most common CT scan findings were: Contusion (40.9%, 45/110), subdural hemorrhage (30%, 33/110), skull fracture (24.5%, 27/110), edema (16.3%, 18/110), sub arachnoid hemorrhage (12.7%, 14/110), extra dural hemorrhage (9%, 10/110), and diffuse axonal injury (6.3%, 7/110). During study period, 30 pedestrian patients underwent surgery for evacuation of intracranial hematoma, of which 43.3% (13/30) belonged to the elderly age group. Out of 35 pedestrian patients who expired during the course of the study, 22.8% (8/35) were in the elderly age group.

As compared with pediatric (<18 years) and middle age group (19-40 years) the elderly age group has higher percentage of moderate to severe GCS score, abnormal pupil and CT findings, associated injuries, and death rate. For details refer Table 1a. The comparison between elderly with pediatric and middle age pedestrian mortuary data from same institute is depicted in Table 1b.

The mortuary attached to the hospital conducts postmortems on all patients who succumb to death after sustaining neurotrauma. Pedestrians accounted for nearly one-fourth of all postmortems (326/1243, 26.2%) conducted during the study period. Nearly one-fourth of these belonged to the elderly age group (77/326, 23.6%) [Figure 3]. The most common cause of death in this age group was head injury (66/151, 85.7%). Polytrauma in addition to head injury was the cause of death in the remaining patients (11/151, 14.3%).

Discussion

In summary, the present study from a leading neurotrauma centre in Bangalore, South India, revealed that the elderly pedestrians constituted nearly one-third of all pedestrian neurotrauma. Two wheelers were the most common

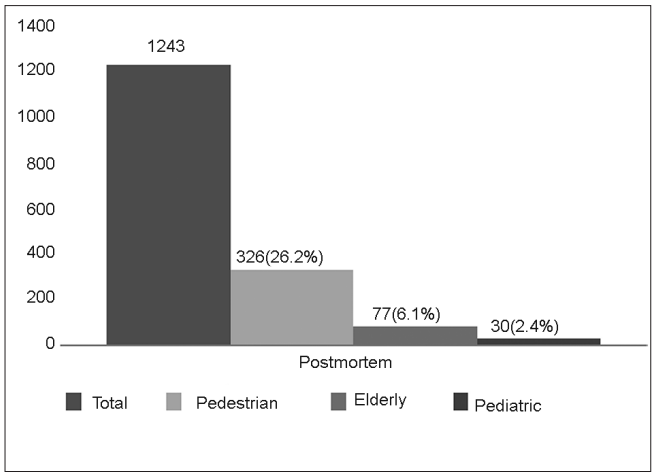

Figure 3: Percentage of postmortem data during the period of 2007, 2008, and 2009

Table 1a: Comparison of elderly pedestrian injuries with matched other age groups

Variables	<18 years *n*=120	19-40 years *n*=184	≥60 years *n*=143
Age (M±SD) years	9.7±4.7	30.7±6.5	66.2±6.4
GCS (Mod-severe) (*n*) (%)	63 23.2	110 (40.6)	87 (60.9)
Pupil abnormality (*n*) (%)	5 (4.2)	17 (9.2)	17 (11.9)
Associate injuries (*n*) present (%)	105 (87.5)	164 (89.1)	133 (93)
CT abnormal (*n*) (%)	39 (32.5)	70 (38)	71 (64.5)
Death (*n*) (%)	3 (2.5)	10 (5.4)	8 (5.5)

M-Mean, SD-Standard deviation, GCS-Glasgow coma scale, CT-Computed tomography

Table 1b: Comparison of elderly pedestrian mortuary data with matched other age groups

Variables	<18 years *n*=30	19-40 years *n*=106	≥60 years *n*=77
Age (M±SD) years	10.5±4.9	31.5±6.0	65.7±6.8
Male (*n*) (%)	17 (56.7)	89 (84)	55 (71.4)
Associate injuries (*n*) (%)	100 (100)	102 (96.2)	70 (90.9)
Contusion (*n*) (%)	5 (16.6)	14 (13.2)	24 (31.2)

M-Mean, SD-Standard deviation

accident vehicle. Most of the injuries occurred during peak traffic hours, that is, 4 pm to 9 pm. More than half of these patients sustained moderate to severe head injury. Nearly three-fourths of the patients required a CT scan. The mortality rate was 5.6% (8/143). The elderly pedestrians contributed to nearly one-fourth of all the postmortems conducted on pedestrians succumbing to neurotrauma.

Data from Indian studies has revealed that pedestrians contribute 30-40% of traumatic brain injuries secondary to road traffic accidents. About 10,125 pedestrian deaths were reported in 2007.[2,5]

In developing and underdeveloped countries, walking is one of the common modes of transport and pedestrian accidents have been increasing in number in these countries.[4] Elderly pedestrians are more prone to trauma, predominant cause being falls, followed by crash by motor vehicle, and hit by automobiles[4,6,7] The contributory factors for elderly pedestrian accidents are the cognitive decline or dementia,[8] alcohol consumption,[9] and the timing given to cross road being not sufficient for elderly pedestrians.[10] Yeung *et al.* (China, 2008)[4] reported that elderly pedestrians constituted 77.2% of all elderly trauma victims.

Busy urban areas pose the highest threat for pedestrian accidents especially in the elderly.[11] In the present study, accidents involving elderly pedestrians were more common during peak traffic hours, that is, 4 pm to 9 pm. Similar results were reported by Small *et al.*[12] in a study from Sydney, Australia. They observed two peak injury periods: One between 17.00 and 18.00 hours and the other between 20.00 and 22.00 hours.

GCS is one of the standard criteria to assess the severity of head injury. Odebode *et al.* (Nigeria, 2008)[13] reported that 41.0% of all elderly head injury victims had sustained severe head injury. Yeung *et al.* (China, 2008)[4] reported that 53.5% of elderly patients had major trauma (Injury severity scale, ISS > 15). The present study, which focuses on elderly pedestrian neurotrauma, also revealed similar results with 60.9% of the victims sustaining moderate/severe head injury.

Gan *et al*.[14] (Singapore, 2004) conducted a study comparing the outcome of elderly (>64 years) and young (20-40 years) patients who had sustained moderate to severe traumatic brain injury. The results revealed that CT scans of elderly patients had a higher incidence of mass lesions. The present study mainly focusing on elderly pedestrian neurotrauma showed a 64.5% incidence of abnormal CT findings, with higher incidence of contusion (40.9%, 45/110), and subdural hemorrhage (30%, 33/110).

Elderly patients are more prone to multi-system trauma.[13] Our data suggest 93% (133/143) elderly pedestrians had multi system trauma. Yeung *et al*. (China, 2008)[4] in their study revealed that 38.4% of all elderly trauma victims required some kind of a surgical intervention. In the present study, which was conducted in a neurotrauma center revealed that 9.0% (13/143) of patients required surgery for evacuation of intracranial hematoma.

It is known that elderly trauma patients are supposed to have a poorer outcome as compared with their younger counterparts. The mortality rates for trauma in the geriatric population varies widely in literature from 6%

Table 2: Mortality data comparison of other countries with present study data

Variables	Study place	Study and duration	Age (years)	RTA cause (%)	Mortality (%)	Multi system trauma (%)	Head injury (%)
Yeung *et al*.[4]	Hong Kong	Retrospective and 2 years	≥55	33.6	24.8	-	80.3
Odebode *et al*.[13]	Indigenous Africa	Retrospective and 10 years	≥60	*	48.7	51.3	41.0
Adam *et al*.[15]	United Arab Emirates	Prospective and 3 years	≥60	32	6	-	-
Akkose Aydin *et al*.[16]	Bursa	Retrospective and 6.7 years	≥65	-	10.2	54.4	36.4
Present study	Bangalore, India	Retrospective and 4 months	≥60	100	5.5	93	100

RTA-Road traffic accident

(Adam *et al*., UAE,[15] elderly trauma patients), 10.2% (Aydin *et al*., Turkey,[16] elderly injury patients included head trauma, extremity trauma, and thoracic trauma), 24.4% (Yeung *et al*., China,[4] elderly trauma patients), and 48.7% (Odebode *et al*., Nigeria,[13] elderly pedestrian patients with severe head injury). In the present study, which was conducted on elderly pedestrian neurotrauma patients, mortality rate was 5.5% (8/143). The mortality rate from previous studies is based on elderly trauma victims due to various modes like falls, alcohol consumption, pedestrians, two/three/four wheeler driving or pillions. Therefore the mortality rate of the present study, which specifically focuses on elderly pedestrian neurotrauma, cannot be compared with the above studies.

There are no studies specifically focusing on elderly pedestrian neurotrauma mortality data. However, few attempts have been made from various studies pertaining to pedestrian mortality data consisting of all age groups and different mode of causes [Table 2].

Pedestrians constitute a major proportion of the postmortems conducted at centers attached to trauma hospitals. Moharamzad *et al*.[17] (Iran, 2008) reported that 39.8% of all autopsies conducted on traffic accident victims were performed on pedestrians. In the present study, over a 3 year period pedestrians constituted 26.22% (326/1243) of all the autopsies. The elderly pedestrians contributed to 23.6% (77/326) of the autopsies conducted on pedestrians. In future, these figures may further increase if the law making authorities continue to neglect the problem of pedestrian trauma.

Unique features of present study

To the best of our knowledge, this is the first study which highlights the specific features of neurotrauma in the elderly pedestrians. The data are especially valuable for developing countries like India as both the pedestrian accidents and the geriatric population are increasing alarmingly. Unfortunately, pedestrian safety measures continue to be neglected and are given a very low priority by the concerned authorities.

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