

# Features of head injury at Prince of Wales Hospital, Hong Kong, from 1989 to 1993

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The features of head injury at Prince of Wales Hospital, Hong Kong, were determined by reviewing the medical records of head-injured patients admitted to its neurosurgical service during the period commencing January 1989 to December 1993. During this time, there was a decline in the total number of head injury admissions. This reduction was secondary to a decrease in admissions for minor head injuries. The number of severe head injuries remained constant during these years. Falls represented the leading cause of head injury and accounted for more than 50% of all head injury admissions. Fall from a height was mainly a paediatric problem and falling at ground level was most common in the elderly. In teenagers and young adults, the most common causes of head injury were bicycle- and traffic-related accidents. Traffic-related accidents accounted for more than 50% of all head injury fatalities. There was a direct relationship between age and the mortality rate.

*HKMJ 1996;2: 141-145*

*Key words: Head injuries; Mortality*

## Introduction

Head injuries represent a major health problem in modern societies. In most countries, they are a leading cause of death, morbidity, and disability.<sup>1-3</sup> The features of head injury in each society are unique to the different culture, geographic location, government policy, social structure, city design, population, and religion of that society. Hong Kong is a major international metropolitan city and has a population of six million residing in an area of 1076 km<sup>2</sup>; 98% of the population are ethnic Chinese. Hong Kong is unique in its mix of Eastern and Western cultures. Hong Kong is an over-populated metropolitan city, with many high-rise buildings. The most common modes of transportation are by private motor vehicle and public transport. Because of its small area, Hong Kong does not have a well-developed highway system, and traffic congestion is common.

The Prince of Wales Hospital (PWH) is the teaching hospital of the Chinese University of Hong Kong. It is one of the major medical centres in Hong Kong and has 1400 beds. The neurosurgical service of the PWH has a catchment population of 1.5 million—one quarter of the Hong Kong population. During the five years from January 1989 to December 1993, there were more than 9000 head injury admissions to the neurosurgery service. This number of head-injured patients has given us the opportunity to study the features of head injury. Since the PWH has a catchment area of one quarter of Hong Kong's population, the results of this study should also reflect many of the general features of head injury in Hong Kong.

## Materials and methods

During the study period, from January 1989 to December 1993, 9415 head-injured patients were admitted to the neurosurgery service at the PWH. Head injuries were defined as either contusion, laceration, skull fracture, or brain injury, with or without loss of consciousness, following impact to the head. All head-injured patients were initially seen in the accident and emergency (A&E) department. Neurosurgery consultation was requested for patients with a history of head injury. There was a low threshold for admission to the neurosurgery ward for observation for cases of minor head injury. Those patients discharged from the A&E

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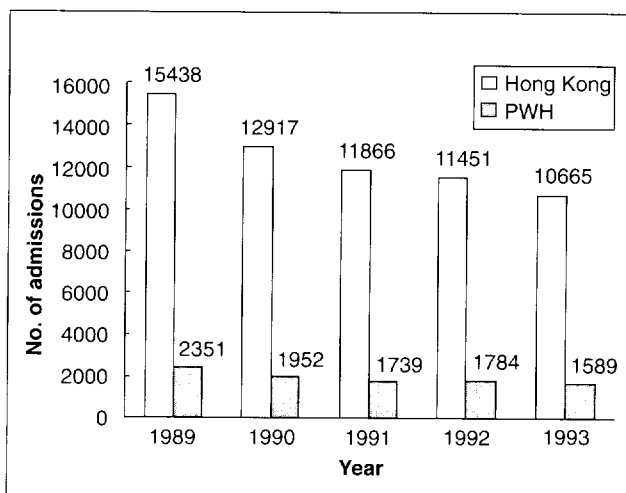
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department with a diagnosis of head injury, but without overnight observation in the neurosurgical ward, were excluded from the study. Patients who had sustained obvious head injuries, but were pronounced dead on arrival, were also excluded. All patients with head injury and any injury to other organs were initially admitted to the neurosurgical service. Some patients in this study were transferred from other hospitals that did not have a neurosurgery service. A few patients in this study were Vietnamese boat people who live in two camps, which are within the PWH catchment area.

Data of each head-injured patient admitted to the neurosurgery service at the PWH were retrospectively studied. This included demographic profiles, severity of head injuries, and outcomes. Of the 9415 patients, 7137 had complete records. The mechanism and pathology of injury were also reviewed. The severity of head injury was measured by the Glasgow Coma Scale (GCS).<sup>†</sup> The GCS score was determined by the neurosurgery on-call medical officer during the consultation in the A&E department. Patients with GCS scores of 13 to 15 were classified as having minor head injury, scores of 9 to 12 were classified as moderate, and 8 and below were classified as severe. This information was stored in a computer using commercial database software ( Microsoft Access, Microsoft Corp., California, US ).

Data for the total number of head injury admissions and the associated number of fatalities in Hong Kong from January 1989 to December 1993 were obtained from the Hong Kong Hospital Authority.

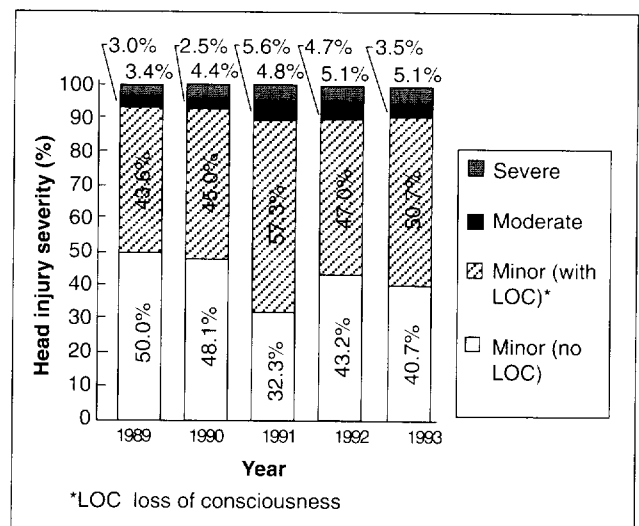
**Fig 1. Total number of head injury admissions in Hong Kong and to the Prince of Wales Hospital (PWH) during 1989-1993**



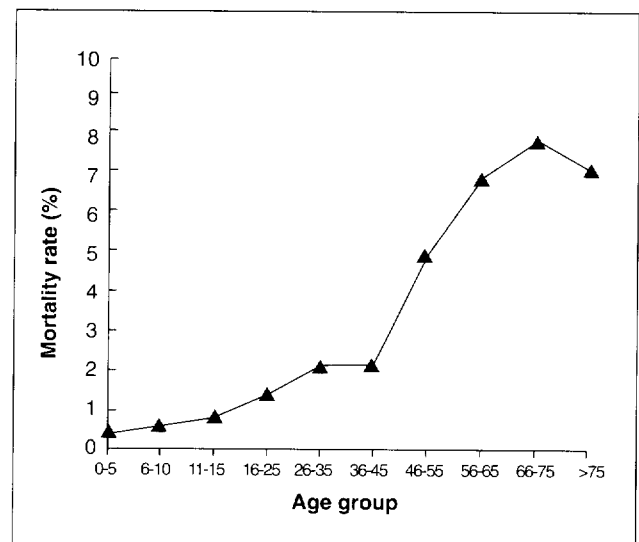
**Results**

During the study period, there was a gradual decline in the incidence of head injury admissions. This trend followed a general decline in head injury admissions in Hong Kong (Fig 1). In our hospital, the drop in the total number of head injury admissions was the result of a decrease in minor head injury admissions, which comprise more than 90% of all head injury admissions. The number of severe head injury admissions basically remained the same during this time and hence, the proportion of severe head injuries actually increased (Fig 2). As expected, there was a general increase in mortality with advancing age (Fig 3).

**Fig 2. Severity distribution of head injuries incurred during 1989-1993 (n = 9415)**

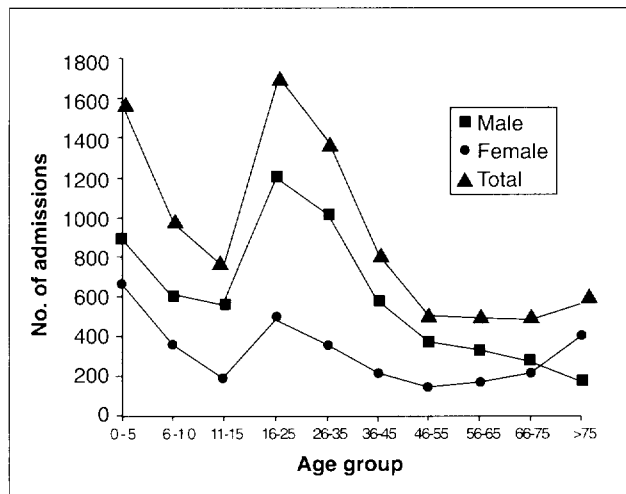


**Fig 3. Mortality rate for head-injured patients according to different age groups**



The incidence of head injury was highest among young adults, aged between 16 and 25 years. The second peak incidence was in children younger than two years. Our results also revealed a male predominance for head injury in all age groups, except for those older than 75 years (Fig 4).

**Fig 4. Age- and sex-specific number of head-injured patients admitted to the Prince of Wales Hospital during 1989-1993 (n = 9415)**



The most common causes of head injury were a fall at ground level (27.8%) and a fall from a height (25.6%). Together, these accounted for more than half of the head injury admissions. Traffic-related accidents totalled 17.5%, of which only 5% were motorcycle accidents. Cycling is mainly a recreational activity in Hong Kong, and bicycle-related head injury comprised only 7.6% of all head injury admissions. While assault was quite common, responsible for 9.2% of all head injury admissions, penetrating head injury caused by a missile was rare (0.03%).

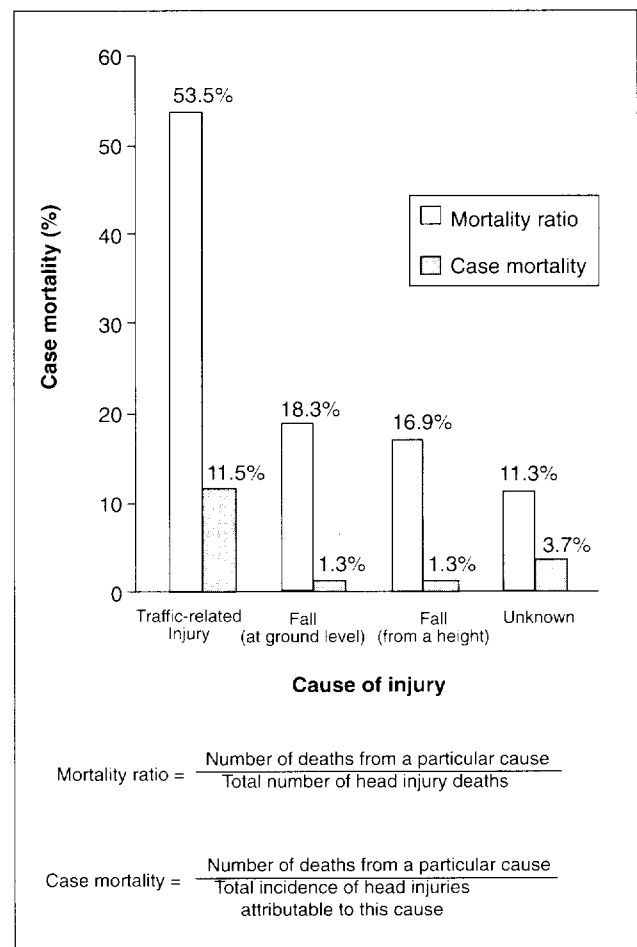
Head injury caused by a fall at ground level was most common in the elderly. These injuries were more frequent in women older than 75 years. Fall from a height mainly occurred in toddlers and children and was the most common cause of head injury in children younger than 10 years old. For traffic-related accidents, the peak incidence age was between ages 21 to 30 years. For drivers involved in motor vehicle accidents, the peak incidence age was between ages 21 to 25 years. Women drivers were seldom involved in this type of injury. The number of head injuries from bicycle-related accidents was higher in males for all age groups. Occurrence peaked at ages 11 to 15 years for males

and 16 to 20 years for females. Head injuries caused by assault were predominantly a male problem. The peak incidence age was from 16 to 20 years, followed by a lower peak at 31 to 35 years.

Those involved in traffic-related accidents had the highest percentage of abnormal skull X-ray and computed tomography (CT) findings, such as skull fractures and traumatic sub-arachnoid haemorrhage (55.3%). Skull X-rays were carried out in all these patients, and CT in half of them. This was followed by those who fell from a height (21.5%). Even though a fall at ground level was the most common cause of head injury admission, only 10% of these patients had abnormal CT findings.

The total number of mortalities was 294. Traffic-related accidents produced the most serious injuries, and were the cause of more than 50% of the head injury fatalities (Fig 5). A fall at ground level and fall from a height were the cause of 18.3% and 16.9% of all head injury fatalities, respectively. The case mortality rate for victims from traffic-related

**Fig 5. Per cent case mortality and mortality ratio according to the cause of the head injury**



accidents was 11.5%, compared with 1.3% for both fall at ground level and fall from a height.

Linear skull fracture was the most common pathological finding on X-ray and CT scan following head injury. Subdural hematoma and brain contusion were the most common intracranial lesions diagnosed by CT scan. These were followed by epidural hematoma and intracerebral hematoma. Of the epidural hematomas, 67.5% were associated with radiographic skull fracture while 37.8% of subdural hematomas were associated with radiographic skull fracture. Linear skull fracture was the predominant lesion caused by head injury in children younger than two years old. Subdural hematoma and brain contusion were rare in children younger than five years old. Their occurrence slowly increased with age and were the most common lesion in patients older than 75 years. Epidural hematoma was more common in young adults.

## Discussion

As with all retrospective studies, this study has the disadvantage of incomplete data that may affect the reliability. For this reason, those data related to mechanisms of injury and pathologies are based on 7137 of the total 9415 head injury admissions. However, we believe that the data obtained from this number of patients should reflect the general picture of head injury in Hong Kong.

Trauma in Hong Kong is the leading cause of death in children and young adults, especially in the male population.<sup>5</sup> Similar to head injury reports from the West, our results also demonstrate that head injury is highest among young adults, followed by a second peak incidence in children younger than five years old.<sup>1,3,6,7</sup> Our study, however, reveals certain features of head injury that are unique to Hong Kong. Unlike most Western countries where traffic-related accidents are the leading cause of head injury, falls—either at ground level or from a height, are the main cause of head injury in Hong Kong.<sup>1,2,8,9</sup>

Falls at ground level were the only type of injury with a female dominance in patients older than 75 years. This is probably due to the higher proportion of women in this age group.<sup>5</sup> Only 10% of all patients who suffered head injury as a result of ground level falls had abnormal CT findings. However, they accounted for 18.3% of all deaths due to head injury. This is probably age-related, as most of these patients were elderly women. The fact that a fall at ground level is such a common problem in the elderly reflects a serious social problem in Hong Kong. Nowadays,

because of the change in family structure, many elderly people are left alone and there are not enough facilities and resources to provide adequate support.

Traffic-related accidents are the single largest cause of head injury in the United States.<sup>1,9</sup> In Hong Kong, traffic-related accidents are the third most common cause of head injury. This is probably because public transport is the main means of transport, and there is only a limited highway system where it is possible to drive at high speeds. Government legislation for the mandatory use of a seat-belt for drivers and a helmet for motorcyclists should also be credited. Motorcycle accidents are uncommon in Hong Kong, unlike another Asian city, Taipei, where motorcycle accidents account for 53.6% of all head injuries.<sup>10</sup> This can simply be explained by the fact that there are fewer motorcycles in Hong Kong.

Head injury caused by falling objects is another feature unique to Hong Kong, for this cause has not been reported in other head injury studies. Injury from falling objects accounted for 1.6% of all head injury admissions. Falling objects can cause serious injury and 16.7% of the patients in this study had abnormal CT findings. This type of injury is usually caused by inconsiderate individuals throwing objects out of the windows of high-rise apartments.

Bicycle-related injury was especially common because our catchment area includes places set aside for recreational cycling. Some of these injuries can be attributed to the poor condition of the bicycle path, and the number of novice cyclists, as most of the injured were teenagers.

Vietnamese refugees also accounted for a small proportion of head injury admissions. This group of patients have special head injury features related to their closed-camp living conditions.<sup>11</sup>

Although traffic-related accidents are not the leading cause of head injury in Hong Kong, they produce the most serious injury and account for more than 50% of all deaths. Most of these fatalities are pedestrians hit by a car or truck. Hong Kong is a densely-populated city and consequently, pedestrians and vehicles are competing for limited space. The lack of road-sense on the part of both pedestrians and drivers is also a contributing factor.

Studies of head injury provide data with which to assess the usefulness of strategies designed to prevent head injury, and to determine where scarce health care resources should be allocated. The results of our study

suggest that improved government facilities for the elderly, better public health education with regard to head injury prevention and road safety for pedestrians, cyclists, and motor vehicle drivers, coupled with improved road conditions would help to reduce the incidence of head injury in Hong Kong.

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