

Severe trauma presenting to the resuscitation room of a Hong Kong emergency department

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Background: Little is known about the epidemiology or mortality associated with trauma in Hong Kong or of its demands on the service of emergency departments. This study describes both the quantity and quality of trauma presenting to an emergency department in Hong Kong. **Methods:** In a retrospective study conducted from January to June 1997 there were 100,000 new patient attendances at the emergency department of the Prince of Wales Hospital of which 227 trauma patients (0.002%) were triaged to the Resuscitation Room. Patient records were scrutinised for types and mechanisms of injury, times of injury and arrival at the emergency department, role of alcohol, and scored using an injury severity score. Important outcomes were mortality and duration of hospital stay. **Results:** Data was available on 221 (97%) subjects (male to female ratio 3.7:1) of which there were 203 adults and 18 children. Blunt injury accounted for 199/215 (92.6%) cases and penetrating for 16/215 (7.4%) cases. Motor vehicle crashes accounted for 113/205 (55%) cases, falls for 47/205 (23%) cases and assault for 18/205 (9%) cases. 51/224 (23%) cases presented between the hours of midnight and 8 am. The median injury severity score (ISS) was 9 (mean 11; range 1-59). 32/227 (14%) patients died, the majority resulting from road traffic accidents or falls. **Conclusion:** Patterns of 'severe' trauma in Hong Kong primarily affect male adults, include a preponderance of motor vehicle crashes and falls, and significant mortality. (*Hong Kong j.emerg.med.* 2000;7:129-135)

Keywords: Emergency department, trauma, wounds and injuries

Introduction

Trauma is the third leading cause of death for all ages in the developed world, and is the fifth categorised under 'Injury and Poisoning' in Hong Kong.¹ According to recent local statistics, it is the single commonest cause of death for both sexes under the age of 35 years in the Special Administrative Region, and for men under the age of 45 years.²

The annual incidence of trauma in Hong Kong

increased progressively in the 1970s, reached a peak in mid-80s, and thereafter fell despite an annual population growth of around 7 per 1000 population.³ By 1991, there were 254,711 cases of trauma, which comprised about a quarter of all attendances at emergency departments, whilst in 1994, 1,718 people died as a result of trauma and over 70,000 people required hospitalisation.

Despite these statistics, and because trauma is classified alongside poisoning, relatively little is known about the epidemiology of trauma in Hong Kong nor of the demands on the service of emergency departments. Therefore, the aim of this study was to describe qualitatively and quantitatively the 'burden' of trauma presenting to the resuscitation room of a typical emergency department in Hong Kong.

Methods

A retrospective observational study was conducted from January to June 1997 and included all trauma

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cases presenting to the resuscitation room at the Prince of Wales Hospital. This is a major teaching hospital in Hong Kong with a bed complement of 1400, which at the time served a population of over 1 million in the Eastern New Territories including Shatin, Tai Po, Fanling and Sai Kung. Data collected is summarised in Table A.1 of the Appendix.

As we were primarily interested in blunt and penetrating injury, cases due to thermal injury, electrocution and drowning were excluded. Anatomical injuries were categorised according to Abbreviated Injury Scale (AIS) 1990 revision.⁴ The Injury Severity Score (ISS) scoring system was employed to assess the severity of the trauma injury.⁵ The Abbreviated Injury Scale describes specific injuries in an individual patient. They are assigned a single code number according to the severity on a scale from 1 to 6 (See Table A.2 in the Appendix). Injuries are grouped by body region and, within each region, given an injury description as listed in the AIS dictionary. The AIS is then used to derive the Injury Severity Score.

The Injury Severity Score was initially based on an analysis of road-traffic accident victims in Baltimore by Baker and her colleagues, and then used for the purpose of injury severity scoring.⁵ The body is divided into six regions (See Table A.3 in the Appendix), and an AIS code is assigned to each region. The ISS is calculated by summing the squares of the highest AIS codes in each of the three most severely injured body regions. The maximum score

for any one region is 25, and the highest possible ISS is 75. Any patient with an injury severe enough to attract an AIS code of 6 in any one region is automatically assigned a score of 75 and classified as unsurvivable. The main outcome measures evaluated were mortality and the number days of hospitalisation.

Results

In the six month period there were 100,000 new patient attendances at the emergency department, of which 227 (0.002%) were triaged to the resuscitation room. Accurate data was available on 215 (95%) cases in which the age ranged from 1 to 97 years old and the male to female ratio was 3.7:1 (see Figure 1). The largest proportion of cases including both sexes was in the age group of 20-29 years, and 44% of patients were in the age range of 20-39 years. In this range, 61% were due to road traffic accidents. Males outnumber females in the first seven decades of life after which the proportion reverses. Among the 15 female cases with an age greater than 70 years, 7 (47%) resulted from road traffic accidents and 6 (40%) fell from heights of less than 2 m.

Type of injury

There were 199 (92.6%) cases of blunt and 16 (7.4%) cases of penetrating injury. All cases of penetrating injury were caused by sharp instruments (knives and choppers) and none by firearms.

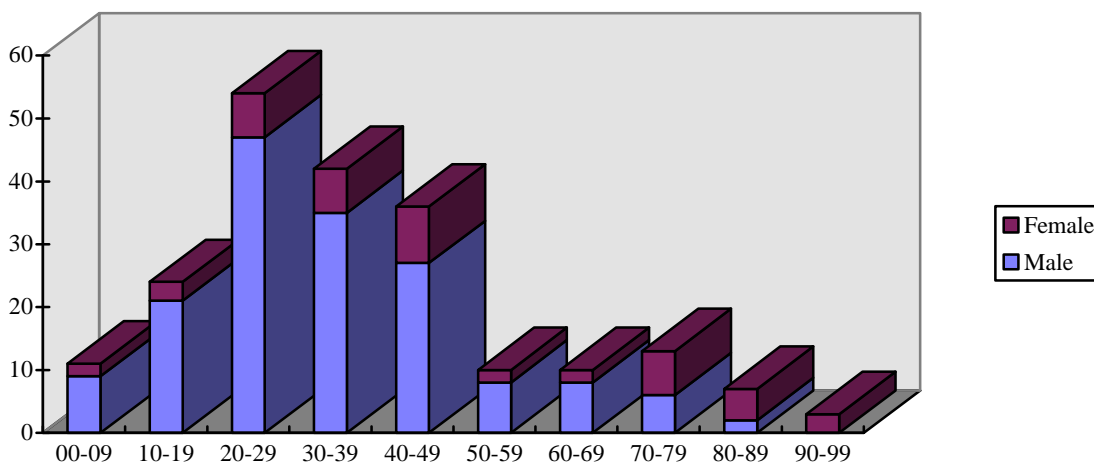


Figure 1. Age and sex distribution.

Mechanism of injury

The distribution of mechanism of injury is shown in Figure 2. Of the 205 records with accurate mechanisms of injury, 113 (55%) resulted from road traffic accidents. In this group, 56 (50%) patients were in the vehicle, 37 (33%) were pedestrians and 19 (17%) were cyclists or travelling on a motorbike.

Time of injury and arrival at the emergency department

Accurate information on the exact time of injury was not available but in 95 of 227 (42%) cases there was a record of the approximate time of injury. Fifty-one cases (53.7%) occurred between 8 am and 4 pm, 30 cases (31.6%) between 4 pm and midnight and 14 cases (14.7%) occurred between midnight and 8 am. Arrival times at the emergency department was available in 224 cases of which 93 (41.5%) occurred between 8 am and 4 pm, 80 (35.7%) between 4 pm and midnight and 51 (22.8%) between midnight and 8 am (see Figure 3). Of the 51 cases with an ISS ≥ 16 , 22 (43%) arrived between 8 am and 4 pm, 19 (37%) between 4 pm and midnight and 10 (20%) between midnight and 8 am.

Role of alcohol

Only 14 of 225 (6%) patients had taken alcohol on the day of injury. Five of these suffered major trauma with ISS of 16 to 25. Two died, both of whom were drivers of a vehicle. The three other alcohol related deaths involved falls from >2 m (n=2) and from <2 m (n=1).

Injury severity score

The proportions with different injuries are shown in Figure 4, in which the mean ISS was 10.72 (range from 1 to 59). Ninety-nine cases (48.5%) were classified as minor injuries (ISS 1-8), none of whom died. Fifty-four cases (26.5%) were moderate injuries (ISS 9-15) with 2 deaths, whilst 51 cases (25%) had major trauma (ISS 16-75) with 21 deaths. The injury distribution is shown in Table 1. Injuries in the extremities accounted for most of the injuries followed by those in the head and neck region. There were no unsurvivable (AIS 6, ISS 75) cases in this study.

Outcomes

32 patients (14.2%) died as a result of their injuries, the majority in the third and fifth decades of life,

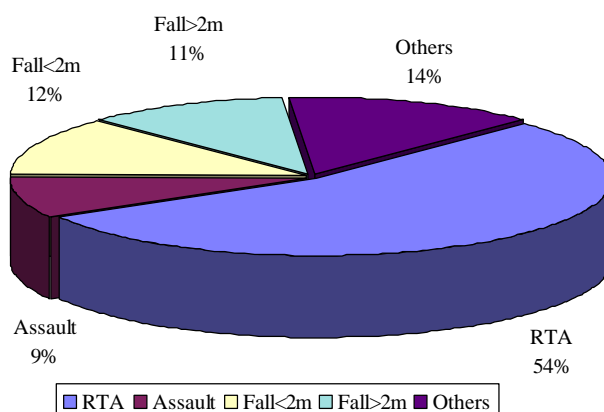


Figure 2. Mechanis of injury.

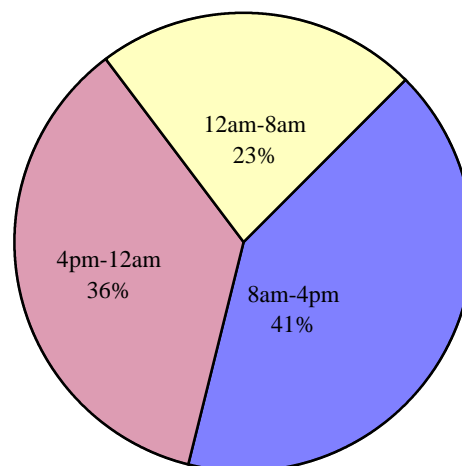


Figure 3. Arrival times at the emergency department.

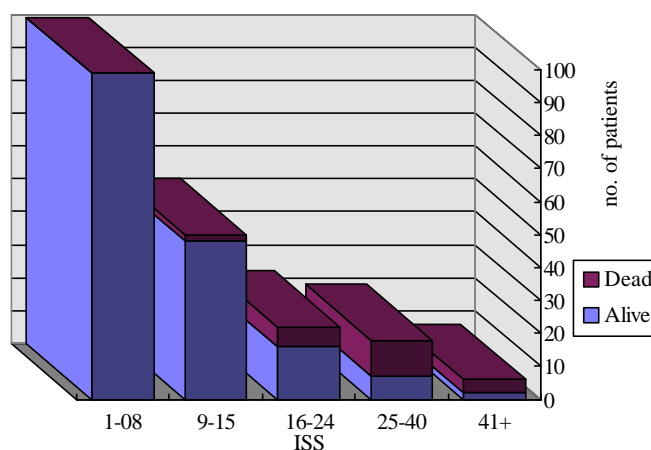


Figure 4. Injury severity scores and mortality.

Table 1. Distribution of Maximum Abbreviated Injury Score (MAIS) amongst the six main body regions (N=204).

	MAIS						Total
	1	2	3	4	5	6	
Head & neck	41	26	27	11	14	0	119
Face	22	8	3	0	0	0	33
Chest	10	9	14	7	4	0	44
Abdomen	12	6	7	0	1	0	26
Extremities	33	43	46	3	0	0	125
External	18	0	0	0	0	0	18

resulting from road traffic accidents or falls from >2 m (see Tables 2 and 3). Twenty-three (72%) were male whereas 9 (28%) were female. Post-mortem reports were only available for 23 patients in which 21 of them had an ISS more than 16. Two cases had an ISS of 9 to 14. Ten of these deaths occurred either before or on arrival at the emergency department. A further 10 died within 24 hours of admission whereas another 12 died greater than 1 day after admission. Some deaths were related to alcohol ingestion. There were no deaths resulting from penetrating injury in this population.

Triage

207 cases were available for analysis. 114 cases were triaged as emergency (E) whereas 93 cases as resuscitation (R). Most of the minor ISS were triaged as emergency whereas most of the major ISS were triaged as resuscitation. (Table 4)

ISS and duration of hospital stay

The duration of hospital stay was not affected by the severity of injury as classified using ISS. (Figure 5)

Table 2. Distribution of age in those who died.

Age	00-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	Unknown
No. of patients	1	0	10	3	7	2	2	3	3	1

Table 3. Mechanism of injury in those who died.

Mechanism of injury	No. of patients
RTA	13
Fall <2 m	1
Fall >2 m	9
Others	5
Unknown	4

Table 4. Triage distribution and injury severity score.

ISS	E	R
1-8	62	27
9-15	30	22
16-24	7	14
25-40	3	15
41+	1	5
Unknown	11	10

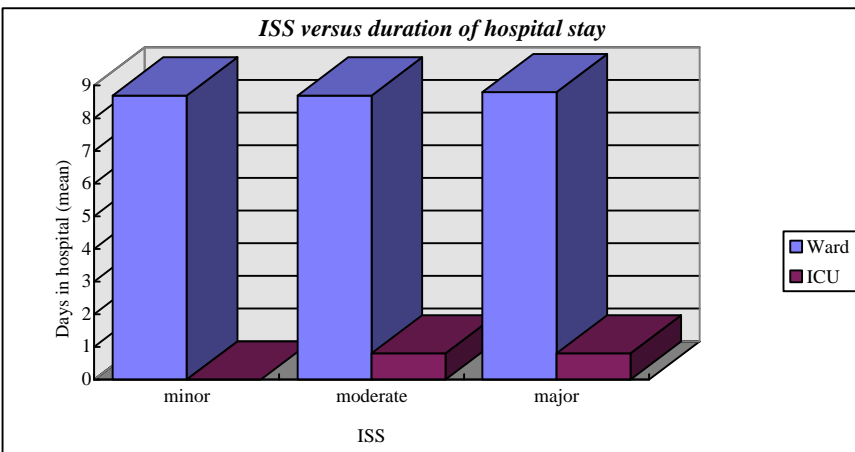


Figure 5. Mean duration of ward and intensive care stay by injury group.

Discussion

This study describes patterns of blunt and penetrating trauma in patients admitted to the resuscitation room of an emergency department in Hong Kong. 'Injury and poisoning' are the fifth commonest cause of death in Hong Kong and the commonest in children, and so play a significant part in premature death. However, little research has been done on this important problem in Hong Kong.

Road traffic accidents account for the majority of major trauma, and in 1991, there were 315 fatalities, 3,960 seriously traumatized survivors and 16,361 minor cases. Over the last 30 years, the trend of fatalities has remained consistently low with less than 500 cases each year. Annual road traffic accidents has remained constant despite a rapid rise in the total number of locally registered vehicles. This success may be attributable to the effectiveness of local legislation and administration in road safety.

Age and sex

Approximately 40% cases occurred in the third and fourth decades of life and the majority were male. The situation here is similar to those in US and UK. The reasons for this are probably because there are more male drivers in Hong Kong and men are also involved in more dangerous occupations. However, it is interesting to know that the male dominated pattern reverses when approaching older age group. One of the reasons may be that the lifespan of men are in general shorter than that of women. We also discovered that the mechanisms of injury in the older aged (>70) female patients were mainly road traffic accidents and falling from height. Home and road safety education has to be emphasized to reduce the incidence of injury in this group of patients.

Type and mechanism of injury

The type of injury in Hong resembles the general situation globally, with the vast majority resulting from blunt causes. There were no cases of gunshot, but an important small number of sharp-object, assault-related incidents.

Road traffic accidents, both globally and locally, are responsible for a nearly half of the trauma cases.

Although there appears to be little increase in deaths and serious injuries resulting from RTAs, despite the increase in number of vehicles registered in Hong Kong, nevertheless it is important to maintain legislation and policing of the region. It is likely that the low vehicle-related trauma death rate is a result of the implementation and policing of road safety and low speed restrictions.

Falling from height (including < and >2 m) was responsible for one-third of the cases whereas assault was responsible for one-tenth. Other mechanisms include hanging, head injury due to cerebrovascular accidents or convulsions and self-inflicted injuries.

Time of injury

Most of the cases in our study were admitted during daytime when we have most of the staff available in the emergency department. However, a significant proportion (23%) of cases arrived between the hours of midnight and 8 am. The credibility of our specialty is under scrutiny worldwide and the priority of emergency specialists is the identification and appropriate management of critical ill patients by trained staff. Inexperienced emergency staff are often rostered to cover these periods, with experienced emergency staff providing an on call service. It may be that between the hours of midnight and 8 am, other specialties can provide on-site trained personnel to manage difficult cases. Whilst this may be seen as an appropriate use of resources, it undermines the credibility of our service. The fact remains that if we do not provide experienced staff to respond immediately to critical cases, then it is other specialties that receive the credit for managing these cases.

The proportion of primary care cases that are being directed to emergency departments in increasing numbers in Hong Kong drains time and resources, detracts from training, blurs the focus of emergency staff and decreases the quality of our emergency and critical care service.

Role of alcohol

In the United Kingdom up to 15% of all patients attending the emergency department and 10% of road traffic accident victims occurred as a direct

consequence of alcohol abuse. In Hong Kong, only 6.5% of trauma patients were alcohol-related, a finding easily explained by cultural difference in alcohol consumption. However, it is important to notice that 5 out of 14 alcohol related cases suffered from major injuries with ISS of 16 to 25 and therefore alcohol remained one of the major etiologic factors involved in major trauma in Hong Kong.

Injury severity score (ISS) and outcome

Nearly half of the trauma cases admitted were classified as minor (ISS 1-8). The highest ISS was 59 and no unsurvivable (AIS=6) cases were identified. The ISS here is relatively low when compared to the US and UK, possibly because of lower speed restrictions, and less violence.

Head and neck, and the extremities were the most affected regions in our patients. Of the injuries to the head and neck region, there were a total of 25 cases with a AIS of 4 or 5 which accounted for most of the injuries with an AIS of 4 or more. The prevalence of injuries to the head & neck region and their more severe nature in trauma patients increases the importance of the early recognition of damage to these structures.

For the 32 patients (death rate of 14.9%) who died from their injuries, 21 had an ISS of more than 16 (range 16-25). Road traffic accidents and falls were together responsible for 23 of the cases.

Apparently, there is no definite direct relationship between the ISS and the duration of hospital stay. That could be true or the results may have been biased due to a number of reasons. For example, a majority of trauma cases were having orthopaedic problems and we discovered that the duration of stay of those cases did not correlate very well with the severity of the anatomical injuries. Also, in reviewing the records, we found out that some of the cases with long term disability would not be kept in the Prince of Wales hospital but were transferred to other convalescent hospitals instead, and therefore underestimating their duration of stay in hospital. Therefore, since the duration of hospital stay can somewhat be viewed as reflecting morbidity in general, the ISS may be more useful

to determine the mortality rather than morbidity of trauma patients.

Most of the minor ISS were triaged as emergency whereas most of the major ISS were triaged as resuscitation cases. The patients who had been triaged as resuscitation cases could receive earlier attention. From here we could say that the way we triaged trauma cases was appropriate.

Limitations

There were a number of limitations in our study. First, we have all the inherent problems of a retrospective study, which in future should be minimised by using a prospective method to collect our data. Second, we were limited by the availability of complete records. Third, we have our study population in a 6-month period instead of scattered over the year without bias from seasonal changes.

In conclusion this study describes aspects of the epidemiology of trauma in Hong Kong with particular reference to cases admitted to an emergency department resuscitation room.

Acknowledgement

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Appendix

Table A.1. Data gathered for each patient.

Age	Past medical history:	Time of injury
Gender	Medication	Type of injury:
Ethnicity	Operation	Blunt
	Alcohol intake	Penetrating
Outcome:	URTI*	Mechanism of injury:
Live or death	TB**	Road traffic accident
Discharge date	DM***	Assault
Date of death	IHD****	Fall<2 m
Number of days in ITU	Chest disease	Fall>2 m
Number of days on ward	Renal disease	Sport
Total in-patient days	Liver disease	Occupation
	Chronic drinker	Other
	Active smoking	
	GI disease	Physiological scoring
	Neurological disease	Anatomical scoring

*URTI: upper respiratory tract infection; **TB: tuberculosis; ***DM: diabetes mellitus; ****IHD: ischaemic heart disease.

Table A.2. Abbreviated injury scale.

AIS code	Description
1	Minor
2	Moderate
3	Serious (non-life threatening)
4	Severe (life threatening - survival probable)
5	Critical (survival uncertain)
6	Unsurvivable (with current treatment)

Table A.3. Body regions used in ISS.

1. Head and neck
2. Face
3. Chest
4. Abdominal / Pelvic contents
5. Extremities / Pelvis girdle
6. External, i.e. Skin

Summary

- nearly half of the patients were aged from 20-39 years
- 93% injuries resulted from a blunt mechanism
- motor vehicle crashes and falls accounted for 89% cases
- most trauma patients requiring resuscitation arrive between 8 am-4 pm
- 6.5% cases had consumed alcohol; 5/14 were severely injured
- ISS ranged from 1 to 59
- injuries to the extremities and head and neck were both the most frequent and severe
- Mortality was 14.9%