

Severely injured patients presenting to the Singapore General Hospital: a one year study

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Study objectives: To determine the quantity and resource utilisation in management of the severely injured patients presenting at the Singapore General Hospital (SGH). **Method:** All patients who were initially triaged to the hospital Emergency Department's (ED) resuscitation room and all trauma related mortality in the year 1998 were studied. All records were traced and the cases were followed up. Important outcomes studied were mortality and length of hospital stay. **Results:** Three hundred and forty-seven (0.2%) severely injured patients who were initially treated at the ED's resuscitation room were studied. The median age of the patients was 32 years old. Male patients formed 82.1% of the total. The three main causes of trauma in such patients were fall from height, motor vehicle related accidents and penetrating injuries caused by sharp instruments and firearms. Of all the patients, 62.8% were admitted to the ED between 1601 hours to 0759 hours and 30.5% of all severely injured patients were treated at the ED on weekends. One hundred and twenty three (35.4%) patients had emergency surgery within 24 hours of admission to the ED and 42.4% of the patients had an ISS score of 16 or more; 22.8% of patients had ISS score of 25 or more. The mortality of patients with ISS score of 25 or more was 39.2%. **Conclusion:** One percent of all new ED patients with trauma were classified as 'severely' injured and these occurred mostly outside "normal working hours". There was significant mortality in patients with ISS score of 25 or more. (*Hong Kong j.emerg.med.* 2003;10:19-23)

Keywords: Emergency department, major trauma

Introduction

Trauma is the 5th leading cause of death in Singapore¹ and is the third leading cause of death and of disability in the first four decades of life in the developed world.²

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Trauma has been termed as a silent epidemic and trauma related dollar cost in United States of America (USA) exceeded US\$400 billion annually.³

Clear and factual information is needed about trauma workload in terms of numbers, type and severity of injury in any large hospital. The treatment of the seriously injured patient requires rapid assessment of the injuries and the institution of life-preserving therapy. An organised approach and commitment to trauma care has been credited with decreasing trauma-related mortality and morbidity.³ Little is known about the epidemiology, mortality or morbidity associated with trauma in Singapore. There is also a lack of data on the trauma load in each of the public hospitals and quality of care in the hospitals managing such patients.

Methods

The Singapore General Hospital (SGH) is a major tertiary teaching hospital in Singapore. It has 24 clinical departments and a bed complement of 1680. All major specialties are on-site within the hospital. The Emergency Department (ED) at SGH provides a 24-hour comprehensive service. There were 124,311 new attendances at the ED from 1 January 1998 to 31 December 1998. There were 347 (0.28%) patients who had severe trauma who were admitted to the ED resuscitation bay in 1998.

All patients who had electrocution, hanging and drowning were excluded. Anatomical injuries were categorised according to Abbreviated Injury Scale (using AIS 1990 revision, 1998 update).⁴ The AIS describes specific injuries in the individual. They are assigned a single code number according to the severity on a scale from 1 to 6. Injuries are grouped by body region and within each region, given a description as listed in the AIS 90 dictionary. The AIS is then used to derive the Injury Severity Score (ISS). The ISS scoring system was employed to assess the severity of the trauma injury.

The ISS was originally based on a large scale analysis of road-traffic accident victims in Baltimore in the United States of America by Baker and her colleagues.⁵ This was later used for scoring the severity of injuries. The body is divided into 6 regions and an AIS score is

assigned to each body region. The ISS score is then calculated by summing up 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 score is 75. Any patient with an injury severe enough to attract an AIS code of 6 in any body region is automatically assigned a score of 75 and this is classified as unsurvivable. The main outcome measure evaluated were mortality, length of hospital and length of intensive care (ICU) stay.

Results

There were 124,311 new attendances at the ED at SGH in 1998. Of the 124,311 patients, 34,695 (27.9%) were classified as trauma patients. Three hundred and forty seven (1%) patients were initially triaged as severe trauma and were treated in the resuscitation room at the ED.

Age and sex distribution

The median age of the patients was 32 years old (age range was 1-96. The mean age was 37. There were only 62 (17.9%) female patients and 285 (82.1%) male patients giving the male: female ratio of 4.6:1. The age group distribution of the patients is as shown in Figure 1. The largest number of cases including both sexes was in the age group 15 to 54 years.

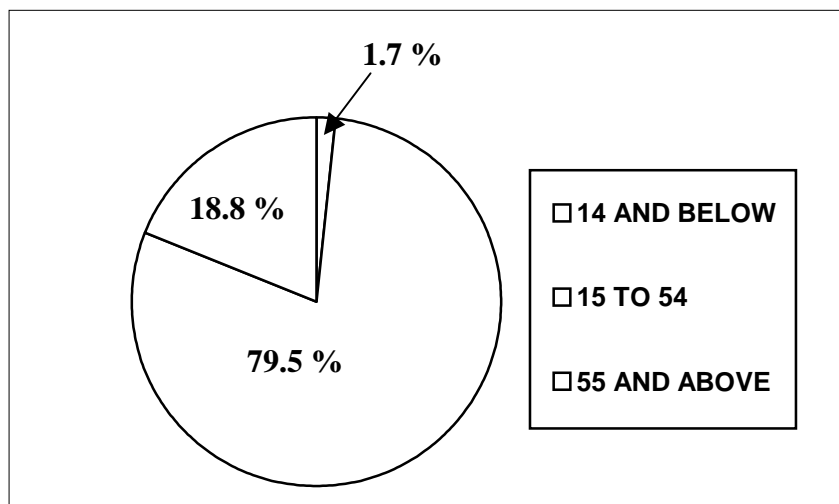


Figure 1. Age group distribution of the patients.

Type of injury

The majority of cases involved blunt injuries and only two cases of injury by firearms. The three main causes of trauma were injuries related to motor vehicle accidents, fall from height and injuries involving low velocity sharp instruments. The main cause of injury is as shown in Table 1.

Day of arrival and times of arrival at the ED

One hundred and six patients (30.5%) of the 347 patients arrived at the ED on weekend days or on public holidays. Arrival times at the ED were available

for all the cases. One hundred and twenty nine (37.2%) patients arrived at the ED between 0800 hours and 1600 hours, 121 (34.9%) between 1601 hours to 2359 hours and 97 (28.1%) patients arrive at between 0000 hours to 0759 hours.

Total time spent at ED

We were not able to evaluate 11 (3.2%) patients as accurate information was not available. Table 2 summaries the distribution of the time spent in the ED. One hundred and twenty five (36%) patients stayed more than 2 hours in the ED and 102 (29.4%) patients stayed less than 60 minutes in the ED.

Utilisation of admitting services

All patients were initially admitted to the SGH ED. They were initially resuscitated and managed according to established protocols. The utilisation of admitting services in the hospital is as shown in Table 3. The trauma service was a separate unit within the department of general surgery. There was a high proportion of burns patients treated at SGH as it had the only burns centre in Singapore and all such patients were transferred here for management.

Table 1. Main cause of injury in the severely injured patients in 1998.

Cause of injury	Number	%
Motor vehicle	98	28.2
Pedestrian	27	7.8
Gunshot	2	0.5
Stabbing	63	18.2
Fall from height	96	27.7
Others	61	17.6
Total	347	100

Table 2. Duration of patient spent at ED.

Duration	ISS <=15	ISS 16-24	ISS >=25	Total
Up to 60 min	58	16	28	102 (29.4%)
61 min-120 min	65	19	25	109 (31.4%)
121 min-240 min	47	25	20	92 (26.5%)
>240 min	22	6	5	33 (9.5%)
Not valued	8	2	1	11 (3.2%)
Total	200 (57.6%)	68 (19.6%)	79 (22.8%)	347 (100%)

Table 3. Utilisation of admitting services.

Admitting service	Number	%
Emergency department	347	100
Trauma service	125	36.0
Neurosurgery	54	15.6
Orthopaedics	34	9.8
General surgery	83	23.9
Burns	19	5.5
Thoracic surgery	3	0.8
Other surgical services	4	1.2
Others	25	7.2
Total	347	100

Injury severity score, duration of hospital stay and outcome

Of the 347 patients, 39 (11.2%) patients were transferred from other hospitals. Seven (2%) patients died at the ED and 30 (8.6%) patients died in the ward. The post mortem results of all patients who died in hospital were reviewed and the AIS score is as shown in Table 4. All trauma-related deaths were reviewed at a multidisciplinary trauma meeting and discussed in detail. There were no preventable deaths in this study.

Time interval from ED admission to first operation

Of the 347 patients, 167 (48.1%) had surgery performed. Ninety-two (55.1%) patients had their first operation within 6 hours of admission and 123 (35.4%) patients had their first operation within 24 hours of admission to the ED. Table 5 summaries the distribution of the ISS scoring and time interval from ED admission to first operation.

Discussion

Clear and factual information about trauma workload is important when steps are to be taken for

the improvement in the organisation of Trauma Service in any country. Much work had been done in America (USA) and some work had been done in United Kingdom (UK).⁶ This is because a Trauma Centre setup is very expensive to build and maintain.

This study describes the general pattern of severely injured patients treated in Singapore General Hospital in 1998. The median age of the patient was 32 years old affecting predominantly male adults and this is in line with the experience in USA and UK.⁶ It is interesting to note that there were a significant number of injuries involving low velocity sharp instruments (18.2%). The number of injuries caused by firearms remained low. Ninety percent of Singaporeans live in high rise flats and hence it is not surprising that falling from height was a major cause of injury in patients with severe trauma.

About two thirds of all such patients arrived at the ED outside the "normal working hours" with 30.5% of the patients arriving on weekends and 62.8% of the patients arriving between 1601 hours and 0759 hours. All such patients were admitted to the ED in the first instance. The bulk of the patients were admitted to the Trauma Service Unit (36%). As SGH has the only Burn Centre in Singapore, all patients

Table 4. Injury severity scoring, hospital stay and mortality.

ISS scoring	ISS <=15	ISS 16-24	ISS >=25
Number of patients	200 (57.6 %)	68 (19.6 %)	79 (22.8 %)
Median age (min, max)	29 (4, 96)	33 (5, 88)	40 (1, 87)
Median hospital stay (min, max)	4 days (0, 116)	12 days (1, 176)	12 days (1, 257)
Median ICU stay (min, max)	1 day (0, 47)	2 days (0, 15)	4 days (0, 40)
Mortality	3#	3@	31*
ED death	0	0	7

cause of death: ischaemic heart disease, multi-organ failure and perforated duodenal ulcer

@ cause of death: ischaemic heart disease, head injury and lacerated common carotid artery and internal jugular vein

* include 7 patients who died in ED

Table 5. Time interval from ED admission to first operation.

Time interval	ISS <=15	ISS 16-24	ISS >=25	Total
0-6 hours	45	18	29	92 (55.1%)
>6-24 hours	23	2	6	31 (18.6%)
>24 hours	22	14	8	44 (26.3%)
Total	90 (53.9%)	34 (20.4%)	43 (25.7%)	167 (100%)

with burn injury will be admitted to this hospital hence accounting for the relatively high number of patients with burn injury (5.5%).

Of the 347 patients studied, 200 (57.6%) patients had a ISS score of 15 or less. One hundred and forty-seven (42.4%) patients had an ISS score of 16 or more and 79 (22.8%) patients had an ISS score of 25 or more. There was significant mortality (39.2%) amongst patients with ISS score of 25 or more; seven of these patients died at the ED. A measure of the efficient use of time is the total time patient spent at the ED. Only 29.4% of the patients were processed within 60 minutes in the ED and there were significant delays as multiple investigations were planned and carried out on the patients. One hundred and sixty-seven (48.1%) patients had surgery and of this 92 (55.1%) patients had surgery within 6 hours of admission to ED. The rest were treated conservatively. There was no direct relationship between the ISS and duration of hospital stay or ICU stay. However, it was noted that the higher the injury load, the longer the hospital and ICU stay.

Conclusion

The results confirm the observations of others that trauma is primarily a disease of the young adult males and about two thirds of all such patients arrived outside the "normal working hours". This has significant effects on manpower deployment to cope with such patients.

The primary enemy of the resuscitating physician is the lapse of critical time. The injured patient may harbour continuing haemorrhage or other sources of shock that will result in death quickly if not identified and managed effectively. The essence of good and skilled resuscitators make good use of every second of time starting from the time of notification; in addition to decisive, timesaving leadership.⁶

The Trauma Registry is an essential component of a trauma system. It provides for the collection, storage and reporting of an efficient and effective performance and quality improvement programs for the care of the injured.

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