DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF RED TAG PATIENTS AND THEIR ONE-WEEK MORTALITY RATE FROM THE EMERGENCY DEPARTMENT OF THE HOSPITAL UNIVERSITI SAINS MALAYSIA

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Abstract. Early identification and rapid treatment of red tag patients may decrease morbidity and mortality. We examined the clinical characteristics, etiologies and one week mortality rate of red tag (life threatening and potentially life threatening illness) patients at the Hospital Universiti Sains Malaysai (HUSM). A cross-sectional study was conducted at the Emergency Department of the HUSM from 1 August 2006 to 31 January 2007; 440 eligible patients were analyzed. The group had a mean age of 47.2 ± 22 years, with 67.3% of the patients being male. Twenty-three percent were trauma cases with motor vehicle accident being the major mechanism of injury. Fifty-four percent of the cases had cardiac related illnesses. The mean duration of stay in the Emergency Department (ED) was 3.9 ± 1.5 hours. The survival rate at one week was 76.6%. The non-trauma group comprised 74.0% of death cases. Acute coronary syndrome and road traffic accidents comprised 22.0% of total death cases at one week. Red tag patients constitute a large proportion of ED cases and may remain in the ED for significant periods of time.

INTRODUCTION

The Emergency Department (ED) provides initial treatment to patients with a broad spectrum of illnesses and injuries, of which some may be critical and require immediate assessment and managerment. Acute, critical illnesses have a predicted mortality in excess of 30% (Shoemaker, 1992). Critically ill patients make up a substantial part of some ED patient populations. They may constitute up to 8% of all patients and over 25% of patients who are admitted (Fromm *et al*, 1993). In our ED, these patients are categorized as red tag patients. Early identification and rapid treatment of red tag patients may decrease morbidity and mortality (Gropper, 2004).

To date, there have been no proper studies of the demographic characteristics and disease/clinical profiles of red tag patients and their morbidity and mortality rate in Malaysia or Southeast Asia. There are no studies of the efficiency of critically ill patient management in the ED of the Hospital Universiti Sains Malaysai (HUSM). Study of such characteristics need to be considered for decisions to be made regarding improving emergency health services. The purpose

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of this study was to examine the demographic and clinical characteristics and one-week mortality rate of red tag patients in the ED of the HUSM.

MATERIALS AND METHODS

This cross-sectional study was conducted at the ED of the HUSM. The HUSM is a 750-bed teaching hospital and tertiary referral center for the east coast of Peninsular Malaysia. The northeast coast covers 2 states, Kelantan and Terengganu, with a total population of 3.1 million and a total area of 27,877 km^2. The HUSM is located in Kelantan. The entire Kelantan population is covered by both the HUSM and Hospital Kota Bharu under the Ministry of Health, Malaysia. The HUSM had an annual patient census of 55,000 persons from 1 August 2006 to 31 January 2007. Ethical approval for this study was obtained from the Research and Ethics Committee, School of Medical Sciences, Universiti Sains Malaysia [reference: USMKK/PPSP/JK EP (manusia) USM]. The target population was red tag patients, both trauma and non-trauma cases.

All patients triaged as red in the ED of the HUSM during the study period were included in the sample population. In the ED of the HUSM, a 3-tier triage system is used. Patients are triaged to different zones based on their presenting illness: Green Zone – non-urgent case; Yellow Zone – semi-urgent case, and Red Zone – life-threatening/potentially life threatening conditions.

Cases with impaired conscious monitored in the red zone and transit patients were excluded from the study. We found no similar studies in the literature. To calculate standard deviation and mean, attendance data in the ED of the HUSM from 1 January 2005 to 30 June 2005 were reviewed. The sample size was then calculated using a single proportion formula with significance set at $p<0.05$. This study used a convenience sample design with a prospective identification of red tag patients followed by a retrospective review of the medical records a week after hospitalization to determine the length of stay and outcome (alive or dead).

Various demographic and clinical data regarding studied patients were recorded using a data collection sheet specifically designed for the purpose. Factors taken into consideration for analysis were: age, sex, race, category of illnesses, mechanism of injury in trauma cases, length of stay in the ED, acute care management and outcome. It was sometimes difficult to specify the exact diagnosis due to the variety of diseases in the ED. Therefore, we categorized the diseases according to the respective teams who managed the cases. A Revised Trauma Score (RTS) was used to categorize the severity of trauma cases, while non-trauma cases were categorized using a Shock Index (SI) scoring system. A RTS of less than 4 was considered severe and a shock index score of more than 1 was considered a significant risk for mortality.

Qualitative and quantitative variables were analysed using the Statistical Package for Social Sciences (SPSS) 12.0 software for Windows. Sociodemographic data was analyzed using descriptive statistics. Data were presented as frequencies and proportions. The data obtained were subjected to chi-square test at a 5% ($p<0.05$) confidence interval.

RESULTS

Four hundred forty patients were analyzed. The mean age of the studied patients was 47.2 (± 22) years old (median: 52 years; mode: 65 years; range: 1 to 89 years). One hundred sixty-five patients (37.5%) were more than 60 years old, 198 (45%) were 21-60 years old and the others (17.5%) were less

than 20 years old. About two thirds (67.3%) of the studied patients were male. Malays made up the majority of the studied patients (94.1%). Half the patients (50.3%) came to the ED on their own or were brought in by family members or the public, whereas the rest came from various sources of referral such as being referred from health clinics (16.4%) or district hospitals (22.1%). A small proportion (0.7%) was referred by private hospitals around Kota Bharu town.

We subdivided the data into trauma and non-trauma groups: 23% were trauma cases and 77.0% were non-trauma cases (Fig 1). The mean age of non-trauma cases was 52.0 (±19.5) and the median age of trauma patients was 27.0 (±21) years; males were predominant in both groups (64% and 78.2%, respectively). Two hundred fifty-six (75.5%) non-trauma patients had a Shock Index less than 1. The mean RTS in the trauma patients was 6.5 (±2) (mode: 8; median: 6). Ninety-four (93.0%) trauma patients had a Revised Trauma Score (RTS) of greater than 3.

Of 339 critically ill non-trauma cases, 258 (76.1%) had medical illnesses. We divided the medical cases into cardiac and non-cardiac cases. Thirty-two percent of the red tag patients had cardiac related illnesses. One hundred forty out of 258 medical cases (54.3%) had cardiac related illnesses and the remaining 118 cases had mixed medical illnesses (respiratory diseases, renal diseases, sepsis, or cerebrovascular accidents).

One hundred four medical cases (40.0%) suffered from acute coronary syndrome (ACS): ST elevation myocardial infarction in 6.6%, non-ST elevation myocardial infarction in 1.6% and unstable angina in 32.1%. The mean age of the patients with ACS was 58.0 (±12) years; they were predominantly male (78.0%). Thirty-six medical cases (14.0%) were considered as non-acute coronary syndrome cases. The cases included stable angina, congestive cardiac failure, valvular heart disease, and cardiac arrhythmias.

One hundred eighty-two patients (47.4%) suffered from trauma related illnesses. Most (93.0%) had a RTS greater than 3. Motor vehicle accident was the major mechanism of injury in trauma cases (80.0%). The insults caused were varied, including head injury, cervical and bony fractures, chest and abdominal trauma and polytrauma (Fig 2). Neurosurgical cases contributed to 81.0% of trauma cases, mainly head injuries; 56.3% were male patients. Motor vehicle accident was the main contributor (84.0%) of the neurosurgical cases.

Fifty-one patients (11.6%) required intubation and mechanical ventilation; 30 (58.8%) were neurosurgical cases, 13% (4/30 intubated neurosurgical patients) succumbed to their illnesses in the ED despite vigorous resuscitation. Seven neurotrauma cases (23.0%) were taken urgently to the operating theater for immediate surgical intervention while the others were admitted to the high dependency neurosurgical ward. Other procedures done in the ED include central venous catheter insertion (7.7%), chest tube insertion (1.1%) and bladder catheterization (29.3%).

The mean duration of stay in the ED prior to ward admission was 3.9 (±1.5) hours (median: 3.5 hours). Seventy-five percent of red tag cases stayed from 2 to 6 hours in the ED. The percentage of those who stayed more than 6 hours in the ED was 12.5%. Trauma cases were in the ED longer than non-trauma cases [4.5 (±2) hours versus 3.8 (±2) hours, respectively]. Medical and neurosurgical cases spent more time in the ED than the others non-trauma cases. Pediatric and Obstetric and Gynecology (O & G) cases stayed in the ED for a shorter period of time.

Most patients (76.6%) were discharged within a week. Twenty-seven patients (6.1%)

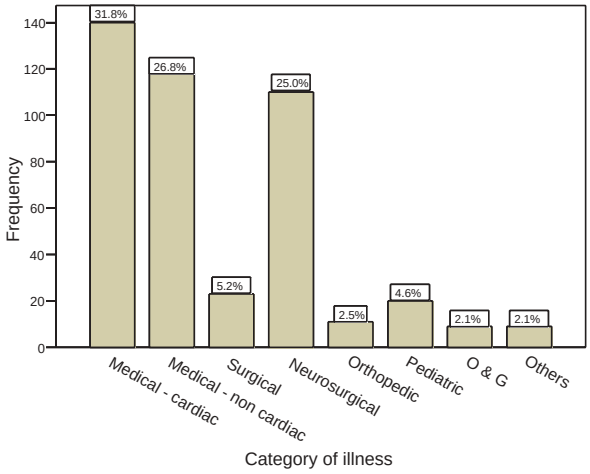

Fig 1–Frequency of categorical illness in the studied red tag patients.

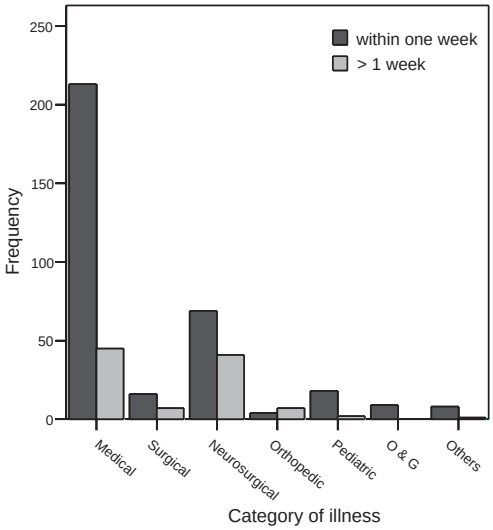

Fig 3–Distribution of length of stay by various categories of illness.

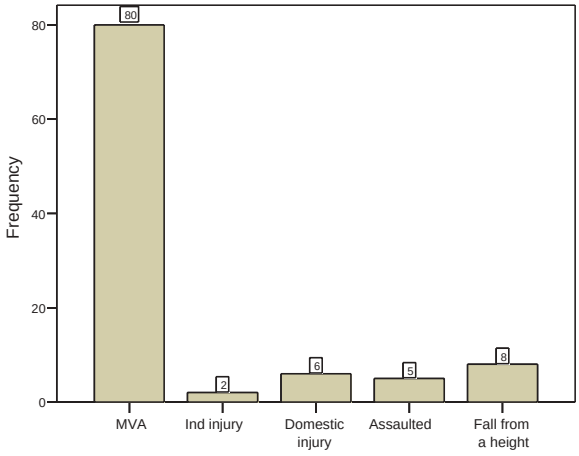

Fig 2–Mechanism of injury.

succumbed to their illnesses within a week of hospitalization. Forty-one percent of patients who died were 20-60 years old and 51.0% were more than 60 years old. Seventy percent of patients who died were males. Non-trauma and trauma cases consisted of 74.0% (4.5% of the total cases) and 26.0% (1.6% of the total cases) of those who died, respectively. Forty-four precent and 22.2% of total deaths within one week were contributed by ACS and road traffic accidents, respectively. Twenty-six percent of deaths occurred in the ED (Table 1). A high rate of mortality was observed among critically ill patients with underlying medical (63.0%) and neurosurgical illnesses (30.0%). Twenty-five percent (11 of 51 intubated patients) died within a week ($p<0.05$; OR 9.1; 95% CI 4.0-21.0). The majority of critically ill non-trauma patients who died within a week of hospitalization (85%, 17 of 20 patients) had a SI value of >1 ($p<0.05$; OR 21.3; 95% CI 6.1-74.9). Subanalysis of the patients who died due to head injuries had poor revised trauma score (RTS) values (≤ 3 upon presentation the ED).

DISCUSSION

Red tag or critically ill patients make up a substantial part of some ED patient populations. To the best of our knowledge, this is the first review of red tag patients in the ED.

Table 1
Distribution of one-week mortality in studied red tag patients.

	Trauma *n* (%)	Non-trauma *n* (%)	Total *n* (%)
Death in ED	3 (11.1)	4 (14.8)	7 (25.9)
Death in ward	4 (14.8)	16 (59.3)	20 (74.1)

We reviewed 440 treated cases and their one week mortality outcome. The number of studied patients represents approximately 2.0% of the total ED census during the study period. The above findings are comparable with other studies (Fromm, 1993; Nelson, 1998).

In this study, the mean of age of patients was 47.2 (±22) years old and the majority were adults of >50 years old. Men >65 years old formed the majority of patients. The obvious reason why many of the red tag patients were elderly is this population is more likely to have underlying chronic diseases. The presence of comorbid disease states among the elderly, such as diabetes mellitus, coronary artery disease, renal disease and pulmonary disease, makes it more difficult for them to recover from acute illnesses or injuries (Morris *et al*, 1990). Ageing can be defined as a biological, sociological, economic and chronological phenomenon (Arokiasamy, 1997). Schwab and Kauder (1992) divided the elderly population into two groups: the "young old" (65 to 80 years old) and the "old old" (80 years of age and older). However, in this paper, the chronological definition used the United Nation's and Ministry of Health's recommendations: "the elderly or ageing population" was defined as people ≥60 years old (Arokiasamy, 1997). Interestingly, when we separated the data into trauma and non-trauma cases, we noted two different types of age distribution. In the non-trauma group, the distribution of age was normal, whereas in the trauma group, it was skewed to the left. The observed mean age for non-trauma and trauma patients were 52 and 32 years old, respectively. In other words, serious trauma more commonly occur in the younger age group. In contrast, critically ill non-trauma patients are more likely to be adults at later ages. Factors that may explain the above phenomena includes urbanization, industrialization, multiple stress factors, advancement of engineering technology and non-compliance with healthy lifestyles.

In this study, 67.3% of patients were male. Further group analysis also revealed that more than two thirds of trauma and non-trauma cases involved male patients. The above findings are most likely influenced by the fact the incidence of ischemic heart disease (IHD) is lower in females and because males generally hold job positions with higher risks for accidents. Both the elderly and male patients are at greater risk for developing hypertension, diabetes, atherosclerosis and coronary artery disease (Rashidi *et al*, 2007). Male drivers are also more prone to accidents than female drivers because men are more likely to speed, are aggressive, dangerous and easily distracted during driving. According to a study by Schiller *et al* (1995) male trauma victims were predominantly in the younger age group. However, males and females were equally represented in the geriatric trauma population.

In northeastern Peninsular Malaysia, a vast majority of the population are Malays

(93.0%). (Rashidi *et al*, 2007). Therefore, it was not a surprise when the distribution of races in this study was predominantly Malay (95.0%). Hence, the racial distribution in this study reflected the true Malaysian population.

Within the study period, the HUSM received critical cases as walk-in patients and from various sources of referral. Although the Hospital Kota Bharu and the HUSM are both tertiary referral centers for the east coast, the ED of the HUSM receives the substantial number of critical cases.

Cardiac cases comprised to 32.0% of red tag cases. This figure is comparable (33.0%) to a previous study done by Nelson *et al* (1998). Acute coronary syndrome comprised 40.0% of cases.

Trauma comprised 23.0% of the total number of cases. This result is higher than a previous study done by Nelson *et al* (1998) from the Department of Emergency Medicine, Long Medical Center, Baton Rouge, LA, USA (23.0% *vs* 16.0%). However, in the Nelson study, head trauma cases were not included due to the unavailability of neurosurgeons at the center (Nelson *et al*, 1998). Taking this factor into consideration, our critical case figures are similar to this center. We postulate these findings are associated with rapid urbanization and industrialization in Malaysia and reflect the nature of diseases that will be encountered by the ED in the future.

The mean duration of stay in the ED prior to admission was 2 to 6 hours; the majority of patients stayed no longer than 3 hours. This result is comparable with previous studies ranging from 2.4 to 4.7 hours (Graft *et al*, 1993; Varon *et al*, 1994; Nelson *et al*, 1998). Longer stays in the ED were most likely caused by in-patient bed availability. According to previous studies, there are four main reasons for extended stay by critical care patients: time to examination, work-up time, time to bed availability and overcrowding with non-emergent patients (Fromm *et al*, 1993; Graft *et al*, 1993). In our institution, lack of intensive care and high dependency bed space were the main causes for delayed admissions. Shortage of doctors in Malaysian EDs is considered a normal phenomenon. Many urban EDs have 10-12 doctors and 1 or 2 Emergency Physicians (EP). It is worse in district EDs whereby EPs are not available and only 4-6 doctors run the whole hospital and take turns at managing patients in the ED each day. As a result, critical care patients presenting to the ED may experience long delays. Although this situation may not be optimal, it is a reality in many hospitals in Malaysia. A few measures to improve this problem have been adopted including increasing the number of medical students, training more local EPs compulsory service in district hospitals, compulsory posting in the ED for houseman and others.

In this study, we reviewed the one-week outcomes of red tag patients. We believe that patient one week survival is significantly influenced by appropriate management in the ED. We assumed the diagnosis could be made within a week and if it was beyond a week, the complications of the illness or disease might have masked the actual diagnosis. Ninety-four percent of red tag patients survived a week after admission. We speculate this is because of the ability of our emergency physicians, residents and paramedics to recognize potentially critically ill patients and manage them appropriately.

In this study, 51.0% of patients who died within a week were >60 years old. According to a WHO report (2003), 42.0% of adult deaths in developing countries occur after 60 years of age, compared to 78.0% in developed countries. They also find that globally 60-year-olds had a 55.0% chance of dying

before their 80th birthday and regional variations in risk of death at older ages were smaller, ranging from around 40.0% in developed countries of Western Europe to 60.0% in most developing regions and 70.0% in Africa. We postulate that the prognosis of critically ill patients is relatively poor among elderly patients.

A high rate of mortality was observed among critically ill patients with underlying medical (63.0%) and neurosurgical (30.0%) illnesses. The fact the HUSM is a tertiary referral center for the east coast of Peninsular Malaysia, especially in cardiology and neurosciences, affects the distribution of cases. Forty-four percent of deaths within a week were due to coronary artery disease and another 20.0% were due to trauma cases. These results are not surprising. According to the WHO (2004) ischemic heart disease is the leading cause of death worldwide (12.2% of total deaths). Cerebrovascular disease and trauma contribute to 9.7% and 1.3% of total deaths, respectively (WHO, 2004). Malaysian statistic regarding to top ten causes of death in 2002, cardiovascular disease was the leading cause (11%) and in the year 2005 cardiovascular disease was the second leading cause of death (14.3%) behind septicemia (Ministry of Health, 2006). The mortality rate due to ACS in this study was high and worrisome. Although our institution has a cath lab, the rates of urgent revascularization were low for both CABG and PTCA despite the fact that recent data indicates that in patients with unstable coronary artery disease, the prognosis can be greatly improved by early revascularization (FRISC II investigators, 1999).

According to Malaysian statistics regarding the top ten causes of death in all ages for 2002, trauma ranked 8th on the list (3%). However, in the year 2005, the incidence of trauma related death increased and became the third leading cause of hospitalization and the fifth leading cause of death (5.7%) in MOH hospitals in Malaysia (Ministry of Health, 2006). The above trend is expected since; approximately 5 million people worldwide die from injuries yearly (Ali *et al*, 1993). Road traffic-related injuries, self-inflicted injuries, interpersonal violence, burns and drowning were among the 15 leading causes of death among people age 5 to 44 years old (ACEP, 2000). In addition to the millions who die each year, millions more are temporarily or permanently disabled. This toll is expected to increase in coming years (ACEP, 2000).

We noted a majority of critically ill non-trauma patients who died within a week of hospitalization had SI values of more than 1 ($p<0.05$). SI has been evaluated as a predictor in many medical illnesses as well as traumatic injury cases. It has been shown to be a better indicator in identifying patients with acute illnesses as well as in those with early acute blood loss than either the heart rate or systolic blood pressure used in isolation (Rady, 1994). Kucher *et al* (2002) classified patients into two categories: a positive shock index defined as 1 (hemodynamically unstable patients) and a negative shock index of <1 (hemodynamically stable patients). We postulate the outcome of patients with a persistently high SI despite intensive resuscitation have a poorer prognosis than patients who respond to acute treatment.

We noted there was a significant difference between the means of the RTS value and the mortality within the period of one week after receiving treatment in the ED ($p<0.05$). Subanalysis of the mortality of head injured patients revealed that their RTS value was less than 4 upon the ED presentation. Though the sample size was very small for inferential statistical analysis and the RTS was heavily weighted towards the Glasgow Coma Scale

in this study, we still can conclude the RTS demonstrates accuracy in predicting death (Champion *et al*, 1989).

Twenty-five percent of intubated patients succumbed to death within a week. A previous pilot study at the Department of Emergency Medicine, Beth Israel Deaconess Medical Center, revealed the 30-day mortality after an ED intubation in their study population was 27.0% (Sanchez *et al*, 2008). We could not conclude whether the above was due to the severity of the illness or a complication of the intubation itself. Future studies should attempt to identify predictors of mortality among ED intubations.

In summary, red tag or critically ill patients constitute an important proportion of ED practice and may remain in the ED for significant periods of time. Although we are satisfied with the ED performance in managing red tag patients in view of the number of survivors within a week, but this result may not reflect the general outcome of red tag patients. Given the realities of ED practice, emergency medicine practitioners should receive training in the continuous management of critically ill patients.

By knowing the demograhic characteristics, clinical profiles and mortality rates of red tag patients, we can be more prepared in terms of number of staff required, equipment, drugs, and training of personnel in managing red zone cases. Optimal care can be given efficiently to reduce mortality and morbidity. It can help us improve the quality of services provided to our patients, thus improving the overall quality of life in our community. Data from this study can be used as a landmark or general guideline to understand the magnitude of red tag cases in the ED and hopefully will contribute to the improvement of emergency care. Further study of life threatening or potentially life threatening diseases should be on-going to better understand the diseases for facility preparedness.

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