BURNS MASS DISASTERS IN SINGAPORE - A THREE DECADE REVIEW WITH IMPLICATIONS FOR FUTURE PLANNING

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ABSTRACT

Objective – The main objective of this paper is to review three decades (1962–1991) of data relating to burns mass disasters in Singapore.

Design – Records of the Burns Centre, Singapore General Hospital were reviewed retrospectively. Only patients admitted were analysed in three separate groups in relation to the cause of the burns mass casualties and place of occurrence.

Setting – Patient selection was based on O'ya's criteria of burns mass disaster and were grouped into separate decades: Group A (1962-71), Group B (1972-81) and Group C (1982-91).

Intervention – Data collected will provide useful information on high risk sources, patterns and trends of burns mass disasters in Singapore.

Main Outcome Measure – The data will provide the facts and will have implications for future planning and organisation of burn treatment facilities.

Results – There were 17 burns mass casualties and 257 patients admitted. The largest single admission was 76 in 1978. Group A had four, Group B had two and Group C had eleven disasters. Explosions (66%) and fires (30%) were the main causes of burns. The predominant place of occurrence in Group A patients was outdoor injuries (78%), Group B was work environment (100%) and Group C was evenly spread out: work environment (55%), indoors (36%) and outdoor (9%).

Shipyards and fires were the largest sources of burns mass disasters. Other potential sources identified include hazardous materials, petrochemical industries, aviation industries, mass rapid transit train system, high rise fires, shopping complexes and imported disasters.

Conclusion – The recommendation is to plan and reorganise burn treatment facilities. This is to cope with existing pattern, frequency and projected patterns of burn mass disasters which have occurred in other highly urbanised and populated countries.

Keywords: mass burn casualties, disaster planning, burn epidemiology

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INTRODUCTION

Burn injuries generally reflect the socioeconomic activity of a country. The pattern of burn injuries over the last three decades in Singapore has changed. Fortunately, Singapore had established a specialised burn treatment facility in the early sixties and we currently have a cumulative experience of three decades of specialised burn care in Singapore.

Mass disaster arising from burn injuries has increased and are occurring at regular intervals. The pattern and frequency of burn mass casualties worldwide however is not well known. There appears to be a general lack of information and a need for more awareness for disaster medicine[1] in general. Specifically burn mass casualties have been monitored by burn specialists worldwide[2-5]. However worldwide trends have not been documented. The tendency has been to focus attention on particular incidents. Hopefully lessons are learnt and remedial steps are taken to avoid recurrence. With the change in global and political orientation abroad implications for hospitals to plan ahead to respond to disaster have become evident[6,7]. Similarly, in Singapore there is a need to review and plan accordingly to cater to the changing local pattern of anticipated mass burn injuries.

This paper studies the trend and development of mass burns casualties in Singapore over the past three decades, identifies potential sources of mass burn casualties and suggests modification to the existing system and planning for a large number of casualties.

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MATERIAL AND METHOD

All available data relating to mass burn disasters handled by the Burn Centre, Singapore General Hospital since 1962 were retrieved. The data included only patients who survived long enough to be admitted into the Burns Centre. Patients who had associated injuries without surface or inhalational burns who were admitted to other wards of the hospital were excluded.

In this review O'ya's criteria[3] for definition of mass burns were used. This was burn injuries involving three persons transported in an ambulance in the same accident. The nature of the disaster, number of casualties admitted to the burns centre and date of occurrence were studied. The casualties were divided into three groups, each for a period of one decade: Group A (1962-71), Group B (1972-81) and Group C (1982-91). They were reviewed in relation to the cause and place of occurrence of the mass disaster.

Specific burn disasters were recorded, individually studied and separately documented. This paper draws on the cumulative data that have been made available through the years.

RESULTS

A total of 257 mass burn casualties patients were admitted into the Burns Centre over the three decade period (1962-91). The results were divided into three groups.

Group A (1962-71)

Cause of mass casualties

There were 96 patients in the first decade. Fire was responsible for 29 (30.0%) and explosions 67 (70.0%).

Place of occurrence
Nine mass casualties patients sustained their injuries indoors, 12 in a work-related environment and 75 were injured outdoor.

Table I tabulates the year, the incident and number of casualties.

Table I – Year, Incident and Number of Casualties between 1962-71

Year	Incident	Casualties
1966	American plane crash at Kallang Airport	20
1969	Sembawang Shipyard explosion	12
1970	Chinese New Year fire cracker incident	9
1971	Balloon explosion at National Day Parade rehearsal	55

Group B (1972–81)
Cause of casualties
There were 86 casualties in the second decade. Seventy-six of the casualties were caused by an explosion and 10 were from other cause (chemical).

Place of occurrence
All of these casualties were from work related environment. Table II tabulates the two major incidents within the decade 1972-81.

Table II – Year, Incident and Number of Casualties between 1972-81

Year	Incident	Casualties
1974	Acid spillage on ship	10
1978	"Spyros" tanker explosion	76

Group C (1982–91)
Cause of casualties
There were 75 casualties in the third decade. Fire caused 48 casualties and explosions 27.

Place of occurrence
Work place related injuries were responsible for 41 casualties, whilst indoor fires 27 and outdoor fires 7.

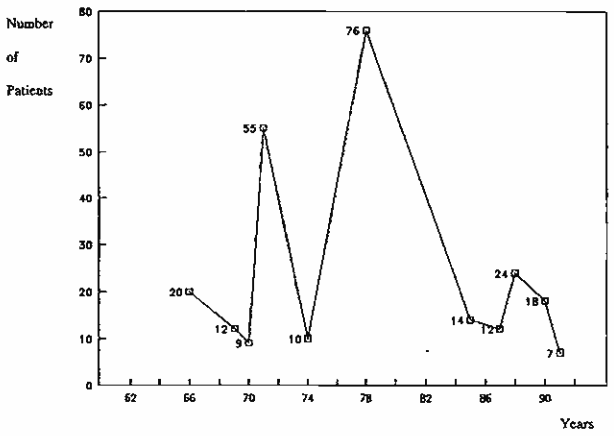
Table III tabulates the mass burns incidents between 1982-91.

Table III – Year, Incident and Number of Casualties between 1982-91

Year	Incident	Casualties
1985	Pulau Bukom fire	14
1987	Ammonia container explosion on board S. S. Jin Jong 103	12
1988	Bukit Batok flat fire	5
1988	Gambling den fire	12
1988	Fire walking ceremony	7
1990	Miri Bank explosion (Sarawak, East Malaysia)	10
1990	Shipyard container explosion	3
1990	Gas explosion in a flat (suicidal)	2
1990	Bedroom fire	3
1991	Johore Road fire	5
1991	Fire on barge off Pulau Bukom	2

The overall occurrence of burn mass casualties in the past three decades may be seen in Fig 1.

Fig 1 – Trends and Frequency of Burn Mass Casualties between 1962–91



Current potential sources of mass burns disaster in Singapore
As the pattern of burn injuries has changed through the three decades it is essential therefore to identify the potential sources of mass burns disasters.

The data show shipyard explosions and fires to be the largest sources of mass burn disasters. Other potential sources include hazardous materials either manufactured or transported in and around Singapore; petrochemical industries, aviation and air travel industries; large shopping complexes and high rise buildings with high population densities and a mass rapid transit train system. A new category is imported disasters where patients are transferred to our burns centre from countries around Singapore. Table IV lists the potential sources of mass burn disaster in Singapore.

Table IV – Potential Sources of Mass Burn Disasters in Singapore

1) Hazardous materials
2) High rise fires
3) Petrochemical industries
4) Aviation industries
5) Shipping industries
6) Mass rapid transit
7) Imported disasters

DISCUSSION

Mass casualties arising from burn injuries are a reality in Singapore. From 1962 to 1991 there were 17 burn mass casualties of which the largest was the 'Spyros' oil tanker disaster in 1978. Details of this incident have been reported elsewhere[8,9].

Cause of mass burn disasters
The results of the first decade of specialised burn care in Singapore (Group A) indicate that fire accounted for 30% of casualties whilst the remainder were caused by explosions. In the second decade (Group B) an explosion was the main cause accounting for 88% of casualties. The remaining 12% were from other causes (acid spillage). In the third decade (Group C) fire emerged the main cause accounting for 64% of casualties. Explosion were responsible for the remaining 36%. Explosions (66%) and fire (30%) were the main causes of burns mass casualties in the past three decades. This was also the experience in Japan[3] as reported

by O'ya. Comparing our Group B patients (1972-81) to O'ya's series (1970-79), our mass burns casualties during that decade were mainly from explosions. O'ya's series showed the following pattern: explosion 31.0%, fire 23.6% and others 23.6%.

Place of occurrence of mass burn disaster

In Group A patients, mass burn casualties occurred mainly outdoor (78.0%) whilst work environment injuries accounted for 12.5% and the remaining 9.5% occurred indoors. Group B patients were different in that all injuries were sustained in the work environment. Group C patients had a more even spread: work environment accounted for 55.0%, indoor 36.0% and outdoor 9.0%. The outdoor injury in this group was caused by a religious fire walking ceremony. Over the last three decades, the sources of burns mass casualties changed from outdoor to work environment. In the last decade, the different causes were more evenly represented.

In contrast, places of occurrence of mass burns in Japan in the years 1970-79 were predominantly indoor. Fire and explosions at home has been the predominant cause and location of mass burn casualties in Japan. It is interesting that Japanese factory related mass burns was surprisingly low at 27.2%. This is perhaps related to the high standards of industrial safety. The recent pattern of mass burn casualties in Japan seems to have centred on civil disasters involving a gas explosion in a subway construction site (Osaka 1973) and an underground shopping centre (Shizuoka 1980). Both these disasters involved large number of victims. The Osaka incident[3] had 389 victims and Shizuoka[3] 237 victims; the latter incident being managed by 7 hospitals spread over a 30 km radius.

These mass burns patterns reflect the urbanisation, population density, successful industrial safety measures and organisation and planning of burn treatment facilities to cater to mass burn casualties.

In 1990 Mackie and Koning[4] reviewed 11 fire disasters with multiple burn casualties which had occurred since 1970. Their survey showed that incidents occurring outdoors resulted in larger numbers of hospital admissions and had more severe injuries than incidents occurring indoors. Outdoor disasters have also been found to have resulted in admission of a significant number of patients with burns covering more than 70% of body surface area. The recommendation is for expert triage to minimise the requirements for specialised burn beds. Effective early management extends the time available for the disposal of casualties and delays may be avoided by prior planning. This is especially the case if international transfer of patients is envisaged. This is particularly relevant when transport across national boundaries has become so common.

The Miri Bank explosion[10] is a case in point whereby the victims of the mass burns disaster were transported long distance, approximately 13,000 km, to a burn treatment centre. On the other hand the Trans-Siberian railway explosion[11] in the USSR was managed by medical support teams being transported to render professional assistance to the victims.

The Future

While the pattern of burns mass casualties in Singapore has changed over the last three decades, fire and explosion remain the two largest causes of injuries. We are fortunate that there are no natural disasters leading to burn mass casualties. However, there are many man-made situations that may pose potential sources of mass burns disasters. These have been identified and hopefully appropriate preventive measures will be taken to avoid their occurrence.

Nevertheless it remains prudent firstly to plan and to reorganise burn treatment facilities to cope with a potential larger number of injuries. Secondly, the planning should take into consideration some of the potential sources of dangers identified. Lastly, trainedburn personnel and resources in Singapore are limited as is the situation in many countries. It is perhaps appropriate to include all hospitals in the planning process because large disasters involving many burn victims may be considered a national disaster. The current plan in our fifty-four bed burn centre will be inadequate to cope with a larger mass burn disaster.

CONCLUSION

The data and pattern of burns mass disaster occurring in Singapore in the last three decades have been presented and reviewed. There was a total of 257 mass burn casualties seen over the last three decades. Fire and explosion were the main causes. The place of occurrence has fluctuated from outdoor to work environment and in the last decade a more even spread to include indoor causes. Potential sources of mass burn disasters in Singapore have been identified and the experiences and lessons learned from others compared with ours. Finally it is appropriate to plan and integrate future plans into existing mechanisms of handling mass burn casualties in Singapore.

REFERENCES

1. Nalliah S. Disaster medicine: a need for awareness. MMA Newsletter June 1990; 22 (2) : 1&4.
2. Jackson DM. Causes and classification of accident burns and assessment of the patient. In: Accident & Emergency burns: Lessons from the Bradford disaster. Royal Society of Medicine, Round table series 1986; 3. 2-8.
3. O'ya H. Mass burn injuries in Japan. Incidence, treatment and prevention of mass burns in Japan. The Bulletin of Burn Injuries 1990, 7: 27-8.
4. Mackie DP, Koning HM. Fate of mass burn casualties: Implications for disaster planning. Burns 1990; 16: 203-6.
5. Arturson G. Analysis of severe fire disasters. 8th International Congress on Burn Injuries 1990. New Delhi, India: International Society for Burn Injuries, 1990: 171 (Abstract)
6. Editorial. Asian hospital: Hospitals must plan ahead to respond to disaster. Asian Hospital 1989; 11: 4-5.
7. Faktor JH, Danon YL. Mass casualty planning in a general hospital. Asian Hospital 1989, 11: 9-12.
8. Lee ST. Two decades of specialised burns care in Singapore. Ann Acad Med Singapore 1982; 11: 358-65
9. Chao TC. Forensic investigation of deaths due to fire in mass disaster. Ann Acad Med Singapore 1992; 21: 649-55.
10. Wu W, Ngim RCK. Anatomy of a burns disaster: The Miri Bank Explosion. Ann Acad Med Singapore 1992; 21: 640-8.
11. Davies J. A report on Russian train gas pipeline disaster of June 1989 with 700 burn casualties. Paper presented at 8th International Congress on Burn Injuries. New Delhi, India: International Society for Burn Injuries, 1990: 175 (Abstract)