

ORGANISATION OF A TRAUMA CENTRE

S K Lim, V Anantharaman

SYNOPSIS

A Trauma Centre should not be looked at in isolation. It should be viewed and evaluated in all its aspects, viz. the pre-hospital phase of trauma, the emergency department care given, the in-hospital treatment and the recovery and rehabilitative phases. A Committee dedicated to management of a Trauma Centre in all these respects would go a long way in ensuring excellence in the management of trauma victims.

SING MED J. 1988; 29: 367-370

INTRODUCTION

In the history of our state there have been a few attempts to formalise the management of trauma victims. Trauma victims in the 1960s were transported to the Emergency Unit of the then Outram Road General Hospital by an ambulance service run by the Fire Brigade. This went on until 1976 when the public ambulance services for both trauma and non-trauma patients were taken over by the Singapore Fire Brigade, nowadays referred to as the Singapore Fire Service. In the early 1980s an attempt was made to set up a Trauma Ward in Block 5 of the New Singapore General Hospital. This did not work out for a variety of reasons. Trauma care then reverted to treatment of injuries by surgical departments depending on the relevant major injury sustained by a particular patient. Therefore, head injuries were attended to either by the General Surgical Units or by the Neurosurgical Department of the Tan Tock Seng Hospital. Abdominal injuries remained the province of the General Surgery Units. Intrathoracic injuries became the domain of the Department of Cardiothoracic Surgery and limb injuries were attended to by the Orthopaedic Departments. Formal co-ordination and centralised control of all these services have been largely absent. Accident and Emergency Departments remained as middlemen transporting casualties from the Fire Service Ambulances to the surgical speciality laying claim to the casualty, in as short a time as possible and until recently with the barest of major resuscitative efforts. Now and then, talk had surfaced of setting up a Trauma Centre at the Singapore General Hospital. These references to a Trauma Centre were, however, mainly based on the revival of a Trauma Ward. We, the authors, both working in an Accident and Emergency Department, have discussed amongst ourselves the idea of a Trauma Centre. The ideas and views on the organisation of a Trauma Centre we have expressed in this article are personal and do not reflect any official views of any organisation in this country.

DEFINITION

A Trauma Centre is an organisation that specialises in the management of injured patients. A hospital should be regard-

ed as a Trauma Centre if the following services of the hospital are welded together for the management of trauma patients:-

- (1) A Pre-Hospital Care Service for the management of the injured patient.
- (2) An Emergency Reception, Triage and Resuscitation Service for the injured patient.
- (3) An Emergency Operative and Post-Operative Service for the trauma patient.
- (4) A Rehabilitation After-Care Service for the trauma patient.

Need for Dedicated Trauma Care

There is a scarcity of statistics from all over the world on the size of the trauma problem as it relates to the needs of a community for a Trauma Centre. R J Wilder¹⁰ states that at least 3 cases of multiple trauma per day are necessary to ensure maintenance of surgical skills of a Hospital Trauma Team and for the cost-effectiveness of that Team.

In a retrospective study of trauma deaths in this country¹¹, 431 such deaths were identified in 1985 of which 27 (or 6.3%) were regarded as preventable. We do not, however, know the number of major multiple trauma victims who reached hospital and lived.

For the three months from May to July 1987, a total of 2,043 trauma emergencies were admitted by the Accident & Emergency Department into the Singapore General Hospital. Though the proportion of multiply injured patients in this group is not known, the figures available point to a daily average of 22 to 23 major trauma admissions into this Hospital.

In the year 1986, the Singapore Fire Service Ambulances attended to 21,513 patients with trauma. This amounts to a daily average of 59 trauma patients per day by a fleet of 15 ambulances.

We thus have, in our country, a sizeable group of trauma victims who utilize presently available trauma services. Whether all these services, need, can or should be co-ordinated has to be seriously considered.

The purpose of this paper is not to compare the emergency trauma systems of Singapore with that of other countries. Rather, since most doctors here should be fairly familiar with local trauma care systems, this paper is an effort to discuss an optimal trauma care system. It remains for the individual to view this in the light of his/her own impressions and experiences of our system of trauma care.

Objectives

A Trauma Centre should have as its objectives the provision of immediate and total care to trauma victims, especially those with severe and multiple injuries; the minimisation of morbidity and mortality of trauma victims; and the development of excellence in the management of trauma patients.

Trauma Committee

In order to achieve these objectives, there must be close and

Accident & Emergency Department
Singapore General Hospital
Outram Road
Singapore 0316

S K Lim, MBBS, AM, FRCS (Edin); M CH (Orth), Consultant
V Anantharaman, MBBS, MRCP (UK), registrar

Correspondence to: Dr Lim

efficient co-ordination of the Pre-Hospital Team, the Emergency Department Trauma Team and the In-Patient Trauma Team. This co-ordination is best done by a Trauma-Centre Committee¹. The Chairman of this Committee should be a trauma-trained physician or someone interested and dedicated to the management of trauma victims. The Committee should also include the chiefs of the care teams of the other supporting disciplines as members.

The Trauma Committee must co-ordinate the care teams involved in the management of trauma patients. It should standardise and control the total protocol of management of all aspects of the injured patient. In addition to developing, implementing and evaluating training syllabi and policies for trauma management, it should ensure quality control and design auditing programmes for the trauma service. Finally, a Trauma Committee must evaluate and recommend equipment to be used for trauma management so that "state-of-the-art" equipment will be available for use.

Pre-Hospital Trauma Team (PHTT)

The people making up this team need not be hospital staff. Rescue elements who specialise in rescue and first aid, such as Paramedics, Fire service personnel, Emergency Medical Technicians and Ambulance Officers can constitute such a team. Some Centres have "Flying Squads"³ which are either part of the Accident & Emergency Department or part of the Fire and Ambulance Service. Each such flying squad has at least one doctor. The Trauma Centre Committee will eventually need to decide on the composition of the Pre-Hospital Trauma Team and make a careful appraisal of the various items of equipment required by the team^{2,3}.

It is without doubt that the clinical management of a trauma patient begins at the accident site.⁹ The survival and the morbidity of such a patient depends on the timely treatment given by the PHTT. To ensure that PHTTs are able to provide a high standard of treatment and resuscitation at the accident site, a proper training syllabus and audit programs need to be designed by the Trauma Committee.

A PHTT will have the following roles⁴:-

- (1) Prevention of Additional Injury — this will be accomplished through careful patient handling during extrication, loading and unloading onto stretchers and ambulances. Splintage of the injured parts must be effective and comfortable for the patients.
- (2) Rapid Transport — while in cardiac emergencies, stabilisation can usually be carried out in the field followed by smooth and un-hurried transportation, in cases of serious trauma, a compromise has to be made between stabilisation and immediate evacuation. This is because patients with serious trauma often have injuries that require operative intervention. It may not be possible to perform some operative procedures such as thoracotomy in the field. It would, however, definitely be possible to perform procedures such as intravenous infusions and endotracheal intubation at the accident site to the benefit of the patient.
- (3) Initiation of Treatment — On completion of the initial stage of triage to separate the living from the dead, the three main priorities of pre-hospital treatment should be to secure the airway, ensure adequate airway ventilation and restore circulating blood volume. Good work done by the PHTT in these areas reduces morbidity and mortality because patients arrive at the Trauma Centre in a better condition and are then more responsive to Emergency Room Resuscitation. The treatment started at the accident site must be continued during evacuation and transportation to the Trauma Centre. Geographical distance and congested urban traffic contribute to delays in patient transportation. A Trauma Committee must not only involve itself in looking into ways and means to reduce the delay, it must also be able to influence the standard of patient care during transportation. If a delay is unavoidable, then the care during transporta-

tion must be excellent to maintain life and limb until the patient reaches the Trauma Centre.

- (4) A Good Communication System — this will be necessary if all of the above are to be effected. Communication between the PHTT and the Trauma Centre should fulfill⁵:-
 - (a) a notification function which alerts the emergency department and allows the emergency physician to make ready his resuscitation room and make available personnel, including consultants, for reception of the casualty.
 - (b) relaying of information to other hospitals such that the Trauma Centre may act as a relay to other specialist hospitals if the trauma victim's injuries demand an expertise not available in the Trauma Centre.
 - (c) field management guidance provided by the emergency physician to field personnel.

Emergency Department Trauma Team (EDTT)

With early notification from the PHTT, the reception of the patient can be prepared. Triage will be done at the doorstep to determine the severity of the injury and to which area of the Emergency Department the patient be best sent to. The Triage Officer must be experienced and knowledgeable⁶. Trauma Scoring Systems must be established by the Trauma Committee so that all Trauma Teams use a common language. Presently, various types of Injury Severity Scores are used by different Centres. A Trauma Centre must establish one that best suits the needs of this Community.

The EDTT should have the following personnel⁷:-

- (a) Captain of the Trauma Team — the most experienced trauma physician should be the decision maker.
- (b) Anaesthetist — to manage airway and ventilation.
- (c) A doctor to insert intravenous lines (if the PHTT have not done so)
- (d) A doctor to perform physical examination of patient.
- (e) A Runner to take specimens to the laboratory and return with results.
- (f) A nurse to collect inventory and store valuables.
- (g) A Clerk to record vital signs and begin the resuscitation chart.
- (h) A nurse to help with intravenous solutions and other medications.
- (i) Orderlies to move patients.

Each member of the EDTT must perform their expected role in the team.

The principles of management by the EDTT should be:-

- (a) Thorough Examination — for the presence of one injury is no guarantee that a second or third injury does not exist.
- (b) Prioritised Examination — so that immediate and potential threats to life may be identified and treated.
- (c) Treatment before Diagnosis — the urgency of the situation in cases of trauma often demands a treatment based on the initial brief assessment without substantiation by laboratory data. Such treatment involves aggressive management based on sound clinical judgement.
- (d) Assume the most Serious Injury — because "it is better to look and see rather than wait and see".
- (e) Frequent Reassessment — which needs to be done to detect significant changes in the patient's vital signs and overall condition and to make appropriate adjustments in therapy.
- (f) Monitoring — since vital functions need to be assessed, monitoring is important. This involves not only simple indices such as pulse rate, temperature and respiratory rate, but also central venous pressure monitoring, intra-arterial blood pressure monitoring, intake/output, laboratory monitoring for blood gases, electrolytes, haematological indices and x-rays.

The effective performance of the EDTT demands an immediate, co-ordinated and knowledgeable response from the Blood Bank, Laboratory, X-ray Department and Cardiology and Anaesthesia Departments^{6,1}. To aid this immediate response,

there needs to be present, preferably within or close to the trauma resuscitation room, built-in x-ray machines, readily available blood from the Blood Bank, anaesthetic machines and piped medical gases, 12-lead ECG with defibrillation and on-line transmission facilities to the Coronary Care Unit and facilities for carrying out and rapid analysis of emergency laboratory tests.

Early notification of the In-Patient Trauma Team by the EDTT is essential for optimal trauma care. The Emergency Department management of trauma victims, though crucially important, is just the beginning of their care. Regardless of the effectiveness of this management, without the commitment of the hospital administration, nursing, the surgical departments and the speciality consultants, the ultimate outcome for trauma victims will not be optimal.

In-Patient Trauma Team (IPTT)

The captain of the In-Patient Trauma Team should be a Trauma Surgeon who will rely on the initial diagnostic work-up by the Emergency Physician to help decide the course of action. A mutual respect and spirit of co-operation must exist for such a relationship to be successful⁴. Other members of the IPTT will include the chiefs of the various areas where the patient would be treated.

On taking over a trauma patient from the Emergency Department, the IPTT would have had the patient moved to either the X-ray Department, Operating Theatres, Surgical High Dependency Area or Surgical Intensive Care Area. The Trauma Committee will have to co-ordinate the provision of services in these areas for trauma patients. The desired objectives should be expediency, availability and skill in the management of trauma patients in these areas.

In the X-ray Department, urgent invasive x-ray procedures may need to be carried out for *definitive* evaluation of the bodily injuries prior to appropriate surgical treatment. The X-ray Department should be located close to the Emergency Department and the Operating Theatres. It should be manned 24 hours a day with highly trained radiographers and radiologists. The latest state-of-the-art equipment such as Magnetic Resonance Imaging should be available to complement the types of x-ray investigations required.

Emergency Operating Theatres must be geared to receiving trauma victims at any time of the day or night. One operating theatre must always be kept free for this purpose. There should not be any question of waiting for the emergency theatre to be free for the patient. In selecting an operating room for trauma work, adequate space is perhaps the largest single factor because care of the trauma victim often necessitates attendance by more than one group of operating teams of various disciplines⁸. These operating teams may have to work simultaneously and the space will therefore also be needed for their equipment and for the large number of personnel required to support these operating teams. To be able to fulfil these functions, the operating theatre must be well stocked with sets of instruments, sterile supplies, intravenous infusions and resuscitative drugs. It must also be located close to the A&E Department, X-ray Department and the Intensive Care Unit. To make all these work, people are needed. Operating theatre staff must be highly trained in the management of trauma because a patient with multi-system trauma is likely to have multiple operations in one anaesthesia. The ability to assist in all types of operations makes it different from elective procedures which tend to be grouped into disciplines. One very important group of doctors, the anaesthetists need to pay some attention to this area. They may have to tackle problems such as hypoglycemia, hypoxia, massive blood replacement and prolonged surgical procedures. The pace of work is often hectic and monitoring needs to be refined to anticipate cardiac arrests.

In spite of all the protocols that the Trauma Committee may have for giving priority for emergency operations for a patient with multi-system trauma, the captain of the IPTT will have to make the final decision, depending on the clinical

status of the patient. He will have to co-ordinate the choices of types of operation procedures amongst the various surgical disciplines involved in the patient's management such that the common objective to save life and limb can be achieved in the best possible way.

Any good Trauma Centre should have a high dependency/intensive care area responsive and dedicated to trauma victims. These units situated close to A&E Departments and Emergency Operating Theatres will take over trauma victims from both A&E Departments and Emergency Operating Theatres at any time of the day and night. The team leader of the Trauma Intensive Care Team should be an Intensive Care Specialist. He should be able to mobilise the necessary surgical and medical specialists when required in the Intensive Care Unit. The nursing staff of this Unit should be trained in Trauma Intensive Care. The Unit should be well stocked with resuscitative and intensive care equipment and drugs.

A Trauma Ward solely for the management of trauma patients is ideal. By concentrating trauma patients in a Trauma Ward(s), management of these patients can be more efficiently co-ordinated. The IPTT will then easily locate their patients in a large hospital complex, instead of having to go to several wards as would occur if patients are located in wards of different surgical disciplines. A Surgical High Dependency/Trauma Intensive Care Unit may be part of a Trauma Ward.

Recovery and Rehabilitation

Recovery and rehabilitation of trauma victims from their injuries and surgical operations is an often forgotten area. Most trauma victims are young and in the prime of their lives. Snatching them from the jaws of death is not enough for a Trauma Centre. Rehabilitation of the patient has to be considered early and should begin in the early post-operative period.

Therefore, staff from the Rehabilitation Department, should form an essential component of the group managing the patient post-operatively. An early visit by a Rehabilitation physician and physiotherapist not only to plan the physical, social and mental rehabilitation of the patient, but also to commence early the rehabilitative treatment is necessary as this sets the patient in the positive mental frame that is needed for optimal recovery.

The Rehabilitation team managing the post-operative trauma victim is in an excellent position to evaluate the patient's mental state and psychological response to the trauma recently experienced. Where a change is perceived in a patient's thinking, feelings, or behaviour or where a patient begins to have unusual or unexplained somatic complaints, a screening mental status examination should be performed. Functions to be tested should include orientation to time, place and person, attentiveness, short-term memory, remote memory and abstracting ability. The services of a Psychiatrist should then be enlisted to help tackle this all-important aspect of post-trauma patient care.

The physical and social rehabilitative management of the patient should be planned together with the other members of the In-patient care team. In this area, the Trauma Centre Committee must initiate and encourage biomedical research to look for better prosthesis, patient aids, implants and fixative devices to shorten the recovery and rehabilitative phase.

The social rehabilitation of the patient requires the active participation of the Medical Social Worker. Every post-operative patient of major trauma needs to be assessed by a social worker so that the patient's family, social and work situations may be properly assessed and so that members of the family, social and work circles may not only participate in the patient's rehabilitation, but be adequately prepared for the patient's discharge from hospital.

The patient's discharge from the Hospital should be a joint decision made by all components of the In-patient care

team so that a definite individualised plan for further recovery and post-discharge rehabilitation can be formalized for the patient's benefit.

Trauma care is expensive. The Trauma Committee should advise the authorities on the need to enact laws on road and industrial safety.

CONCLUSION

A Trauma Centre, thus, cannot exist in isolation. Any Trauma Centre worthy of its name should concern itself with the A to the Z of the management of the trauma victim. It should be organised on this premise.

REFERENCES

1. Eckert, Charles: Emergency Room Care, 1987; 1-44.
2. Basket, PIF., and Zorab J. S. M.: "Essentials of Emergency Management", Rescue Emergency Care, 1977; 1-59.
3. Snook Roger: "The Accident Flying Squad — Resuscitation and Release", Rescue Emergency Care, 1977; 218-233.
4. Jorden, Robert C.: "Multiple trauma", Emergency Medicine — concepts and clinical practice, 1983; 1: 111-27.
5. Dinerman N., Pons P., and Rosen P.: "Medical Control in pre-hospital care II. Current topics in Emergency Medicine", Med Coll. Pa. 1981; 2(7).
6. Pilcher, David B.: "Trauma Team Examination", Critical Decisions in Trauma, 1984; 26-29.
7. Eiseman B.: "Mass Casualties", Critical Decisions in Trauma, 1984; 16-9.
8. Styler William F.: "Operating Room Organisation for the Trauma Patient", Critical Decisions in Trauma, 1984; 70-3.
9. Hirsh Erwin F.: "Pre-hospital Management of the Seriously injured", Critical Decisions in Trauma, 1984; 2-7.
10. Wilder, Robert J.: "Initial Management of the Critically Injured Patient", Progress in Critical Care Medicine, 1984; 1:1-14.
11. Leong A. P. K. Wong S. K., Tay B. K., Chao T. C.: "Preventable Trauma Death in Singapore", Singapore Medical Journal, 1987; 28: 244-8.