

MASS CASUALTIES*

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A consideration of mass casualties presents many facets and is closely linked up with the following subjects:

1. Traffic control in the hospital grounds.
2. Design of the casualty department or of those areas set aside for dealing with the incident.
3. Personnel required to deal with the patients, the patients' relatives, and admissions to the hospital.
4. Facilities for giving blood, plasma, and blood substitutes to cope with the cases of shock, haemorrhage, burns, acute dehydration, or drowning.

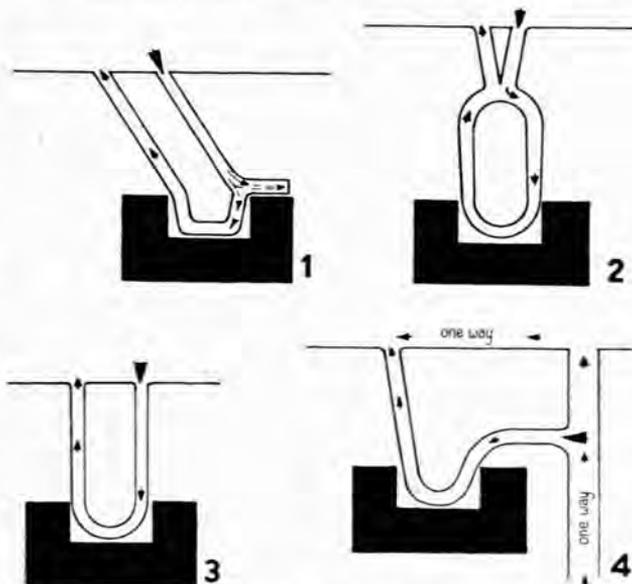
1. Traffic Control in the Hospital Grounds

Ambulances arriving at the hospital should be able to discharge their patients at the casualty entrance and draw away immediately. It should never be necessary for an ambulance to reverse in the hospital grounds, else chaotic conditions can occur if more than one ambulance arrives at the same time (Fig. 1). If the hospital has a large enough space at its disposal, a circular road can be designed within its own grounds. This road takes one-way traffic and the problem is solved (Fig 2). If the grounds are not large enough for a traffic circle, a loop road with separate entrance and exit points and one-way traffic arrangements would serve the same purpose (Fig. 3). If the hospital is situated on a corner site, entrance should be permitted by one road only and exit by the other (Fig. 4). It may be necessary to arrange with the town's traffic control department to have the two roads proclaimed as one-way streets with no-parking zones so that a free flow of traffic is guaranteed. In all designs of this nature, it is necessary that the private cars of doctors and other members of the staff

or of relatives of patients are not allowed to obstruct the traffic circle or loop. Parking facilities for visitors and for the staff should be sited outside the hospital grounds.

2. Design of Space Allotted for Handling Mass Casualties

The basic requirements for this type of casualty work



Figs. 1-4. See text.

* Paper presented at the 43rd South African Medical Congress (M.A.S.A.), Cape Town, 24 - 30 September 1961.

are two large rooms. The larger should be set aside as a waiting room, and the smaller for treatment of patients.

These basic requirements can be modified. If the treatment must be conducted in an existing casualty department, the smaller treatment rooms of this unit will have to be utilized. Any hospital, no matter how small, should have a plan in readiness for dealing with mass casualties, because the number of casualties requiring attention at any one time is unpredictable. It is not enough to handle these occurrences by routine measures; success in these matters is judged by the expedition and smoothness of the procedure and by the lack of upset of the hospital's general running, but primarily, of course, by the high percentage of life saved and morbidity avoided.

'The ingredients for production of a disaster are always with us; a crowded school bus and an unguarded railway crossing, a tornado and a city, a full plane and its critical moments of take-off and landing. These and many other circumstances can provide the potential for creating casualties in more than normal numbers'.¹

In addition to these peculiar accidental circumstances, growing countries and unsettled localities can also offer industrial and racial riots as 'ingredients' for the production of a disaster and mass casualties.

It is to be expected that the largest hospital in the neighbourhood will be called upon to bear the bulk of the burden of any sudden onrush of casualties and, because its resources in personnel and equipment are probably better than those of the smaller hospitals, it is right that this should be so.

While these comments apply particularly to the larger hospitals, no hospital anywhere can consider itself properly equipped in its casualty department unless some arrangement has been made for dealing with mass casualties which need not necessarily be sent to a large hospital. The proximity of the small hospital to the scene of the disaster may cause casualties to be channelled into it and take it unawares, so that all hospitals should have a scheme worked out and in readiness for dealing with rush numbers of patients.

3. Personnel

While the larger hospital can usually call upon its own resident staff to take over the management of mass casualties in its earlier phases, it is felt that, even in a smaller hospital, somewhat different arrangements can be made which will enable it to deal with the situation.

In the *smallest hospital* the staff nurse or sister-on-duty should telephone a previously nominated 'manager of mass casualties', who should be a doctor in the neighbourhood designated to be in charge of the situation, and inform him if news of some serious disaster has been received. A close liaison between the ambulance station and the hospital is, of course, essential. The manager of mass casualties then telephones various doctors in the neighbourhood and assembles them in

the casualty department or in that area set aside for dealing with mass casualties where they go about their duties, which should have been allotted to them well beforehand.

In a *larger hospital* where a casualty officer is always on duty, he should take the place of the nurse or of the sister-in-charge only. He is likely to be a junior, and it is essential that a senior man be appointed as the manager of mass casualties. If the hospital is fortunate enough to have a senior man in the casualty post, he could well be designated as manager of mass casualties himself, and he will then be responsible for assembling the various doctors into the hospital to attend to their duties in this matter.

In the *big hospitals*, where several casualty officers are available, these should previously have been allotted their positions, according to their seniority, on appointment to the department. They are numbered according to their seniority, and each is allotted specific duties very shortly after he has taken up his appointment.

4. Blood and Blood Transfusion

Arrangements should be made in every hospital that a certain amount of *blood* should be available in the refrigerator. In the larger hospital, no difficulty need arise, because there is always a certain number of bottles of blood available for immediate use. Of these, two or three bottles of O-negative blood should always be set aside for use in dire emergency. It is necessary that this blood be renewed from time to time, or else it becomes outdated.

Plasma, especially in its dried form, can be kept for a very long time, and this should be the smaller hospital's main standby. At least 20 or 30 bottles of plasma, as well as a similar number of bottles of plasma diluent, should be kept in the cool chambers of any hospital for emergency use in the case of mass casualties.

Dextran and *plasma substitutes* should be kept available near the casualty department for use where plasma or blood cannot be obtained. It acts as a volume expander in cases of hypovolaemic shock and can be used for treating patients in the absence of better therapy, i.e. blood and plasma. However, it must be used with discretion. Not more than two pints should be given to any patient at one time, because clotting is affected adversely and, in addition, difficulties arise in cross-matching so that in all cases, whether dextran is about to be given or not, a sample of blood for cross-matching should be taken before any intravenous fluid is run in.

EMERGENCY EQUIPMENT

Kitbags

A casualty department should keep about 50 kitbags, made of pillow cases with draw strings, on to each of which are stapled two labels with strings attached to them. These labels are numbered, as are the

bags, and the labels are tied to the wrists of patients admitted in the event of mass casualties.

Stretchers

It is essential for a hospital to have a number of stretchers available near its casualty department. The ordinary stretcher is too large to be kept in Casualty in any numbers, but a collapsible stretcher can be bought which folds up into a size of 7 x 7 inches x 6 ft. 6 inches. About 30 or 40 of these stretchers can quite easily be accommodated on a rack in any casualty department, the rack being fixed to the wall about 7 ft. 6 inches from the floor. These stretchers can be taken down, used, and replaced after the emergency is over.

IPPR Set

It is advisable that hospitals that do not have facilities for mechanical intermittent positive-pressure respiration should keep a simple box containing equipment for manual IPPR. The following equipment can fit into an ordinary metal tool-box, which should be kept and be available at a moment's notice in the casualty department:

- (a) 1 Ruben (Ambu) resuscitation bag.
- (b) 2 masks for this bag (1 large, 1 small).
- (c) 3 metal airways (large, medium, small).
- (d) 5 Portex intratracheal tubes (sizes 2, 4, 6, 8 and 10).
- (e) 1 laryngoscope handle with spare batteries and lamp.
- (f) 2 laryngoscope blades (small and large).
- (g) Gauze bandage for use as a throat pack.

This tool-box should be sealed with a paper seal so that if anybody should use it, the broken seal will indicate that the contents must be re-checked before it is sealed again.

A sterile *tracheotomy set* should be available in a sterile drum and, in addition, a pair of Safar plastic tubes should be kept within easy reach.

Safar² plastic tubes are S-shaped tubes for mouth-to-mouth resuscitation. Under the trade name of 'resuscitubes' (Messrs. Johnson & Johnson, Ltd.) these are available in plastic material for use for mouth-to-mouth resuscitation and can be discarded after use. Two sizes are made (for adults and children), and a pair of these should be kept in every casualty department and hospital ward.

Furnishing of Rooms

All rooms that may be used for treating casualties should have crossed steel wires, strained at right angles at 7 ft. 6 inches from the floor, for hanging bottles of blood, plasma, and saline. This allows simultaneous resuscitation of 6-8 patients on their trolleys in any small room of 15 x 15 ft.

A suction pump, electrically or mechanically operated, or a Sprengel pump on a water tap should be available in every casualty room to clear the airway.

ORGANIZATION OF FACILITIES

Liaison with Ambulance Stations

Arrangements should be made with the central ambulance station in a city or the local ambulance station in a village or small town to notify the hospital casualty department *as soon as* it receives a call for assistance to any incident that suggests that a disaster has occurred. Most ambulances are today fitted with radiophones and keep in constant communication with their ambulance station. The ambulance station should report from time to time to the casualty department, informing them what has happened, so that the necessary dispositions can be made in good time. If radiophones are not available, the ambulance drivers must try to communicate with the hospital in some other way and pass on the information. A fairly exact estimate of the extent of the casualty list can only be made when the first ambulances have reached the spot and authoritative information can then be passed on by the ambulance personnel to the central station. It will usually be found that bystanders take an exaggerated view of the importance of a disaster, being overwhelmed by the horror of the sight of an individual casualty. The professional ambulance personnel are able to take a more detached view of the number of cases that are likely to be involved. If this system of communication has been previously arranged, it will be found in practice that at least 15 minutes notice will be available before the ambulance has time to pick up its two patients and deliver them to the casualty department. The casualty department has at least these 15 minutes in hand before the ambulance arrives at its door, and it is important that this time should be used to the best advantage.

In general, the first ambulances carry the worst patients, and, since each ambulance can take two stretchers, it is obvious that at the beginning of the onrush, very badly injured patients will be arriving in relatively small numbers and the facilities should be adjusted so that this need can be met. Later, the less seriously injured patients begin to arrive in larger numbers by ambulance as well as by private cars. However, if the casualty department is aware of the total number of ambulances that are called to the scene of the disaster, it can also estimate what is the largest number of stretcher patients that can possibly arrive at a single time.

In a situation of emergency such as this, it is clearly to be understood that the functions of the casualty department, as in lesser emergencies, are relatively simple, but require to be carefully integrated into the general work of the hospital, particularly with regard to the disposal of patients. In all these sudden increases in the normal number of casualties, the problem should be considered under the following heading: (A) receiving, (B) sorting, (C) disposal, and (D) information services.

The Fundamental Medical Duties of the Casualty Department

As far as the casualty department is concerned, its fundamental duties in these mass emergency conditions are three in number:

- (a) To clear the airway and maintain respiration.
- (b) To stop haemorrhage.
- (c) To combat shock.

On receipt of the telephone call from the control officer at the ambulance station, indicating that a disaster has occurred and that mass casualties can be expected, the senior casualty officer on duty or, in the smaller hospital, the sister-in-charge of the casualty, carries out the following steps in the given order:

1. Notifies the head of the department or, alternatively, any substitute who has been previously named, e.g. the manager for mass casualties.
2. Telephones the other casualty officers or medical officers on duty, and assembles all who are available into the casualty department.
3. Empties the casualty department of casual patients. This is essential because, unless this is done, those who are being brought in in the new rush will tend to be mixed up with the ordinary casualty patients who are awaiting attention, and this is bound to lead to a certain amount of confusion. It is therefore essential that the ordinary casualties awaiting their turn should be dealt with as quickly as possible and be removed from the department in the least possible time.
4. Collects trolleys from all other departments in the hospital and makes them available in the casualty department. This is done by calling up all available porters and ordering them to bring such trolleys as are available in the hospital into the department.
5. Makes available kit-bags and labels. Labels should be prepared and kept in the department to be tied on to the wrists of patients so as to identify them. All drugs given, as well as a *working diagnosis*, should be entered on this label. *No drugs or blood should be given unless noted on the label.* In the case of mass casualties, the emergency kit-bags can be handed out easily to individual patients to store their goods and their clothes. Should the patients be admitted to the hospital, their belongings will be formally taken over and placed in the official hospital kit-bags in the kit-rooms of the wards that admit them and the kit-bags are returned to the casualty department. (We keep 50 such pillow-cases in a cupboard in our department.)
6. Notifies the blood transfusion department to be prepared to match blood, or, alternatively, in the absence of a blood transfusion officer, makes available whatever supplies of blood, plasma, or blood substitutes he has in stock.
7. Sets up an information office at some point in the hospital remote from the casualty department.

A. Receiving the Patients

By the time the first ambulance has arrived at the hospital, the senior casualty officer or the manager of mass casualties has already made his dispositions, and the organization should be ready to receive the patients. In addition, an information office should be set up where information can be given about those admitted. This information office is a very important factor in the smooth organization, because otherwise it is inevitable that the hospital and casualty space will be crowded by anxious members of the public wanting to know more

about their relatives. The hospital telephone bureau should keep a direct line open to this information office, which is best set up in some room very far away from the casualty department. In this way, telephone calls can be dealt with and the information given in the proper order. If relatives of patients do happen to come to get information about their friends, they are directed to a point remote from Casualty itself which is at this moment at its busiest. Even a small accident can often lead to numerous telephone calls blocking the hospital lines. In a larger accident many people are likely to come to the hospital to see about their relatives and do not telephone, and the information bureau remote from the casualty department helps to prevent confusion. The casualty officers should be instructed to keep the information office supplied with the latest information about each patient.

All is now ready to receive the patients, and the first ambulance should arrive at about this time. The casualty officers, numbered according to their seniority, now proceed to their stations. The *first* Casualty Officer proceeds to the waiting room and awaits the patients. The *second* Casualty Officer goes to the door of the hospital and meets the ambulances at the door. Going into these ambulances, he checks whether the patients are alive and whether the airways of those living are clear. The cases that are brought in dead are sent to the hospital mortuary which should have been set aside for them; those that are alive have their airways checked and are sent to the waiting rooms where they are met by the *senior* Casualty Officer who sorts them under the various heads; the third, fourth and fifth Casualty Officers are in the meantime waiting in the reception rooms and theatres. They do not come forward to meet the patients and they do not go into the waiting rooms at all. The most *junior* Casualty Officer is detailed off to carry on dealing with any ordinary casual patient who may come up for treatment during the busy time, and so anticipate a possible source of confusion. He takes no part in the procedure of dealing with the mass casualties unless he is completely free to do so.

B. Sorting

The first casualty officer sorts the patients under the following headings:

1. *Respiratory obstruction.* Patients who show respiratory obstruction are taken directly from the ambulance to the casualty theatre or, if the condition is missed in the ambulance, from the waiting room to the casualty theatre for immediate attention.

2. *Minor injuries, minor burns, and fractures.* Patients suffering from these injuries are directed to the waiting rooms to await their treatment at leisure, and for these purposes, in this sort of emergency, it must be considered that all fractures are injuries whose definitive treatment may be delayed—though efficient and immediate splinting must be done in all cases of fracture.

In general, a fracture must be treated as a case of urgency rather than emergency, but in some cases of closed fractures of the femur or of the pelvis, since more than 2 pints of blood may extravasate into the

haematoma and the surrounding tissues in a very short time, replacement of this will be required as a matter of urgency before shock can be overcome. Moreover, the pain associated with the unreduced fracture demands immediate relief even when a proper splint has been applied. But the delay of a few hours (at the most) is permissible, if shock, haemorrhage and pain can be controlled and if better facilities for treatment can be made available within these few hours.

'Fractures kill through mismanagement; they should be splinted before the patient is ever moved. Otherwise, shock may develop and what could have been treated successfully, and leisurely, turns into another death.'

It pays to place the patients with fractures, even those with compound fractures, on one side and deal with them later. Not all hospitals have an orthopaedic department and a casualty department physically separated, so that the casualty officer is literally compelled to treat the cases of fracture at leisure and in the correct sequence.

3. *Shocked patients* are placed on trolleys and are never moved from the trolleys until the shock has been successfully treated. The trolleys are wheeled into the resuscitation rooms and placed under the crossed-wires from which bottles of intravenous fluids and blood are suspended. One of the casualty officers goes around and checks the blood pressures at frequent intervals, noting the figure and the time on the patient's identifying label. If pain is severe, morphine or 'omnupon' may be given with suitable precautions (see below) against over-dosage.

Using crossed wires in 3 or 4 small rooms, 18-24 patients can be treated on their trolleys with great ease.

4. *Haemorrhage.* Patients suffering from external haemorrhage are taken directly to the casualty theatres where the casualty officer stationed there controls the haemorrhage. Later on, treatment for shock may have to be instituted, but the control of haemorrhage takes precedence over everything else apart from obstruction of the airway. The treatment for shock in these cases is started in the theatre and may be continued in the resuscitation room. Patients suffering from internal haemorrhage are not sent to the casualty theatres, but are admitted to the wards or directly to the main hospital theatres after the shock has been treated, with the blood transfusion still running into their veins.

5. *Non-ambulatory patients.* These patients, including those with fractures, are placed on wheel-chairs or on trolleys and are seen by the senior casualty officer present who divides them into:

- (a) Those requiring immediate attention, who are sent either to the casualty theatres or to the casualty reception room.
- (b) those who can be sent up to the wards, and
- (c) those who, after treatment, can be discharged.

6. *Blood.* If the blood-transfusion officer is on duty, he should have been alerted in the first instance. If not, blood should be made available as soon as possible. The contents of the refrigerator should have been examined and plasma and plasma substitutes should be taken out.

7. *Morphine.* Morphine can be given to all patients who complain of pain, but its use should not be indiscriminate, particularly in the case of patients in shock. It is best given intravenously, one-quarter grain of morphine being drawn up into a syringe and about half this dose given slowly. As soon as the patient feels that the pain has been relieved no more need be given, and the amount and time should be noted on the patient's label.

Operating theatres. We feel that operating theatres play a very small part in the early management of mass casualties. The first casualties requiring full theatre attention may not be ready for operation until perhaps 4 hours after the accident has occurred, so that it is unnecessary to disorganize the arrangements of any of the theatres by calling on them to begin preparing as soon as a major accident is first reported. However, the sister-in-charge of the main theatre of the hospital should be informed that mass casualties have occurred so that at least one theatre can be put on a 20-minute call to deal with any urgent case of internal haemorrhage.

C. Disposal

If many patients need to be admitted after an accident, it is advisable to clear one ward of all its occupants and to use this empty ward for taking all the patients from the particular accident. In this way they can all be kept under one authority and management is thereby greatly facilitated. Clearing a ward, however, is a serious matter, and should not be undertaken without the full cooperation of the medical superintendent.

D. General Handling

Once the above organization for dealing with mass casualties starts to work, we have found that it can carry on indefinitely, handling many patients very expeditiously. The numbers that can be treated depends ultimately upon the number of beds that can be made available in the hospital.

It will be observed that in this organization for treating mass casualties, the manager of mass casualties is not allotted any specific and definite duties. He is required to supervise the whole procedure and to see that the proper arrangements are set in train; he will be called upon to help to sort the cases. In this way the whole procedure can be greatly accelerated.

'Who qualifies best to sort casualties? A surgeon with experience. The more prominent the surgeon, the more important it is to use his time to guide and direct work with the benefit of all his background training. In this way he can see 50 or 100 patients in the time required to operate on one of them. In a major disaster... the goal must be to save the maximum of lives.'

All through this plan for handling casualties, the principle that is kept in mind is that it is not so much operating on the patient that is of primary importance, as making the decision *when to operate*, and in what order to deal with the individual lesions in patients who have sustained multiple injuries. It is in these decisions that the major responsibilities lie, and the manager of mass casualties, if he is surgically trained, will usually be required to undertake the responsibility of these decisions at this stage of the treatment.

ADMINISTRATIVE DETAILS

It is advisable that separate instruction sheets be made out and posted in prominent places in the department for the instruction of the sister-in-charge as well as for the casualty officers. The following instruction sheets have been used in our department.

Instructions: Casualty Officers

On receiving a telephone call from the ambulance officer indicating that a disaster has occurred, the casualty officer on floor duty shall carry out the following steps in the given order:

1. Telephone the head of the department or his nominated deputy.
2. Assemble other casualty officers on duty, including the orthopaedic casualty officers, in the department.
3. Notify the sister or staff nurse in charge of the department.
4. Empty the casualty department of casual patients.
5. Alert the blood bank, who will summon the blood transfusion technicians.
6. Set up an information bureau.

The following instructions are posted for the benefit of the sister-in-charge.

Instructions to the Sister and Staff Nurse

On receiving information from the casualty officer on duty that a disaster has occurred, please carry out the following steps in the given order:

1. Empty the casualty department of casual patients.
2. Collect trolleys from other departments in the hospital and bring to the casualty department.
3. Break out kit-bags and labels.
4. Break out intravenous sets and bottles of plasma and 5% glucose-saline.
5. Break out IPPR sets and Safar plastic airways.
6. Clear the dressing rooms of patients and of furniture.
7. Collect splints.

8. If on night duty, inform the night superintendent.
9. Warn all nursing staff in the two nearest wards to stand by.

Using this organization, we have found it possible to attend, with expedition and security, to mass casualties on several occasions in which numerous patients have been involved in a disaster. It is felt that, in a smaller hospital, somewhat similar arrangements can be made for dealing with this situation satisfactorily.

As a manoeuvre of this nature is a complicated affair and can only be perfected by practice, we have arranged for the whole procedure to be carried out if 10 or more casualties arrive simultaneously as a result of one accident. In this way, the operation is carried out, each casualty officer learns to know where his position is, and a reasonable state of efficiency can be kept up. The number '10' has been decided arbitrarily, because such accidents can be expected once or twice a year if a lorry-load of passengers or two full motor cars are involved in an accident.

By prudent foresight and a little thought a hospital, no matter how small, can have an organization ready to deal with this emergency at short notice.

SUMMARY

1. A scheme for handling mass casualties is described.
2. Alternative schemes for use in smaller hospitals are considered.
3. The personnel and equipment necessary are detailed.

I wish to thank Dr. J. G. Burger, Medical Superintendent of Groote Schuur Hospital and Prof. J. H. Louw, F.R.C.S., Professor of Surgery, University of Cape Town, for their cooperation and support in building up our organization for dealing with mass casualties, and Mrs. Vivienne T. Sandler for making the diagrams.

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