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Preparation for and organization during a major incident

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Abstract

Major incidents during the past 30 years have caused the NHS and other agencies to respond in a coordinated fashion and create the comprehensive Emergency Preparedness, Resilience and Response framework 2013. This along with supporting documents gives a detailed structure of the role of the NHS in any type of major incident from man-made disaster to pandemic flu. This has required preparation of communication, transport, security, military and healthcare systems. Included is also how the response is handled at a more local level and for different levels of response. The Royal Colleges have responded by including specialist training at the higher and advanced level for trainees so that victims are triaged at the scene and received by consultants with appropriate training in such work. Hospitals, ambulance services and intensive care units across the country are able to use networks to ensure not only logical and rapid access to major trauma centres but also to network highly sophisticated skills when advanced life support is required. The NHS is better able to cope with major incidents than ever before.

Keywords Emergency medicine; incidents; intensive care unit; mass casualty

Introduction

Major incidents, whether man-made or natural, happen as shown in Table 1.

Preparation for a major disaster takes many forms and processes. In the UK organizations such as the police, ambulance service and National Health Service (NHS) have worked with NHS England in major incident planning to cover not only predictable eventualities such as weather, disease, transportation and terrorism but also to be flexible in the face of unpredictable incidents.

This planning has been in response to a number of key incidents, including the Hillsborough football crowd control incident in 1989 (Figure 1). At this incident the number of cases would have overwhelmed any single hospital and triage at the scene was crucial in sending victims to different hospitals. Figure 2 shows how a bomb destroyed a London bus. This incident alone would be manageable by a nearby hospital, but less than an hour before this three other bombs had detonated in London.

Similar events elsewhere (Madrid train bombs, Tsunamis, earthquakes and floods etc.) have stimulated other nations to respond proportionate to the incident, levels of response 1–4, are shown in Table 2.

The Royal Colleges have responded by including specialist training at the higher and advanced level for trainees so that victims are triaged at the scene and received by consultants with appropriate training in such work. Hospitals, ambulance services and intensive care units across the country are able to use networks to ensure not only logical and rapid access to major trauma centres but also to network highly sophisticated skills when advanced life support is required. The NHS is better able to cope with major incidents than ever before.

Table 1

| Date and location of headline UK major incidents | Number of deaths | Number of injured |
|-----------------------------------------------|------------------|-------------------|
| 1974 Birmingham pub bombs^5                   | 21               | 182               |
| 1975 Moorgate underground crash                | 43               | 74                |
| 1989 Hillsborough football crash               | 96               | 766               |
| 2001 Pontefract train crash                    | 10               | 60                |
| 2005 London bombs^7                           | 52               | >700              |
| 2009 H1N1 flu epidemic                        | 392              | 28,456 confirmed cases. >100 ICU per week during peak. |

Table 1
communications with higher levels (e.g. regional or national support). All trusts are required to provide an ICC from which the incident team will work.\(^4\) Some incidents will not require any higher level support, however the commissioning board must be informed and if a wider response is required command will devolve to a strategic coordinating group (SCG) under the chairmanship of a police commander. The SCG coordinates all category one and two responders within the local area.

Any planned event (e.g. sports, demonstrations and marches, concerts etc.) now must have planning on over 20 areas of risk, including how local healthcare facilities would manage a major incident. If an incident occurs, the event organizer hands over control to the police.

This broad, long-term view acknowledges that we face various incidents which require thorough preparation not only for equipment but also better training of healthcare workers to provide new skills and roles to improve the outcomes for people caught in major incidents.

**Medical staff and major trauma centres**

Historically, in the UK, the first medical person receiving trauma or disaster victims would have been a junior doctor without specialist qualifications. Time would be wasted calling more senior doctors. All trauma victims should now be seen by a consultant trained in trauma within 5 minutes of arrival in the ED. In a major incident, medical staff have designated sign-in locations and roles. Hospitals must run regular tests of consultant availability and they must be adequately trained and resourced to fulfil their role.

Trauma management is included in the syllabus of all surgical specialty training throughout the 7-year period. The surgical curriculum for trainees is available via the Royal College of Surgeons of England website\(^6\) or through the Intercollegiate Surgical Curriculum Programme directly (www.iscp.ac.uk).

Different countries have different problems but evidence from the USA and Australia showed that specialist trauma centres save lives.\(^7\) Recently, UK trauma networks have been established along with 26 major trauma centres (MTC). The Trauma Audit and Research Network (TARN) keeps important data on hospital outcomes across the UK and is a good source of published data on outcomes in trauma (www.tarn.co.uk). Its data on trauma cases, at first highlighting the deficiencies of trauma care in the NHS, now shows improving outcomes across the country. Between 2011 and 2013 an estimated 19% improvement in survival for serious trauma along with a 50% increase in the number of cases seen by a consultant on arrival, has been shown. Included in the data is the time: ‘incident to MTC’.

In the UK the concept of the ‘golden hour’ for resuscitation has been less of a focus than the time to definitive treatment. Immediate care, especially regarding the airway is sometimes required, but staying and providing treatment on scene is not the primary goal — the emphasis is on reducing ‘incident to MTC’ times. Average transfer times have therefore reduced considerable in London and are now 17 minutes. This is well shown in head injuries where incident to CT scan is less than 60 minutes in 90% of patients.\(^8\) If triage to MTC outside of London is thought possible in less than 45 minutes then patients bypass non-trauma hospitals.

Non-trauma incident planning has been prepared successfully for flu epidemics, and the model can be applied to Ebola and other infections. This has involved everything from preparing vaccinations to provision of ventilators and extra ICU capacity. Infected patients are sometimes best kept away from hospitals where cross-infection and infection of staff becomes a major issue. This may require activation of plans for military intervention to protect emergency departments and pharmacies. This was seen recently during the Ebola epidemic in West Africa, and the Middle East respiratory syndrome (MERS) outbreak. In one area over 80% of MERS cases were coming from within the hospitals. By triaging patients in temporary buildings in the car parks and preventing them from reaching the hospitals unprotected, cross-infection dropped to zero in 1 month.

Advanced planning may extend to highly specialized technologies. For example, extracorporeal membrane oxygenation (ECMO) may reduce mortality in severe cases of H1N1 flu. ECMO was a very limited resource in the UK during the flu epidemic of 2009. Since then central funding has established five ECMO centres in England, with retrieval teams trained to manage this caseload (Figure 4).
Team structure and patient pathways

A typical patient receiving team is changing as new specialities emerge. When multiple cases arrive simultaneously, leadership and trained personal working with that leadership are vital. Currently in most trusts a consultant in emergency medicine (EM) and/or orthopaedics and trauma will be the team leader. They will be assisted by an anaesthetist, primary and secondary circulating nurse and a radiology technician. In England now all EM doctors are trained in airway control, basic ultrasound and trauma care. Pre-hospital emergency medicine (PHEM) is a subspeciality of anaesthesiology, intensive care, EM and acute internal medicine, with the first doctors completing this training in 2015. This training will give the skills required to not only be the trauma team leader (TTL) but also to provide the clinical skills required when patients arrive.

In considering patient pathways and flow there are two clear categories, as follows.
The first is the pre-hospital system, including triage and delivering the right patient to the right hospital in the shortest possible time.

The second concerns the management of individual patients, ensuring that each step is done correctly so that the next step follows appropriately. Proper training as described above should deliver this with improved results.

**Triage, investigations and interventions**

When managing incidents with multiple victims, triage is essential. The aim of triage is to sort patients into groups by acuity. Multiple systems of triage exist, although triage on the basis of physiological abnormality is most common.

An initial, rapid triage (triage sieve, Figure 5) can be carried out in the pre-hospital environment in a few seconds, and is described in the pre-hospital care article in this issue. More detailed triage (triage sort) may be carried out to further refine priority for transfer to hospital or on arrival to hospital.

Triage can be difficult, with a tendency to over-triage, whereby patients are labelled as P1 (very sick) when they are P2 or P3 (less sick). This may simply block hospital space for true P1 patients, but also inappropriately diverts attention away from true P1 patients. In some incidents, over-triage may have contributed to avoidable mortality.

To further assist in decision making, the Injury Severity Score (ISS) can be used. It is quite detailed and utilizes an ‘abbreviated injury score’ to get the ISS number. The body is divided into six anatomical parts:

- head and neck-including cervical spine
- face, including the facial skeleton, nose, mouth, eyes and ears
- chest, thoracic spine and diaphragm
- abdomen or pelvic contents — abdominal organs and lumbar spine
- extremities or pelvic girdle — pelvic skeleton
- external.

The three most injured body parts are scored 0 to 6 (minor to incompatible with life). Scores are squared and summated: \( \text{ISS} = a^2 + b^2 + c^2 \), to give a number.

Commonly a score of more than 15 indicates triage to an MTC and has shown good specificity and sensitivity in relation to under-triage and over-triage in adults but less so for paediatrics.

Other scoring systems in use include the Triage Revised Trauma Score. This is shown in use in Figure 6.

Once in hospital, stabilization and assessment continues, focussing on ‘immediate treatment’, ‘further investigations’ or ‘appropriate monitoring and treatment area’.

Since a seminal National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report in 2007 regarding UK trauma management, there has been a shift towards early whole body CT scanning of even relatively unstable patients.

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**Table 2**

| Alert | Activity | Action |
|-------|----------|--------|
| 1     |          | A health related incident that can be responded to and managed by local health provider organisations that requires co-ordination by the local CCG. |
| 2     |          | A health related incident that requires the response of a number of health provider organisations across an NHSCB area team boundary and will require an NHSCB Area Team to co-ordinate the NHS local support. |
| 3     |          | A health related incident, that requires the response of a number of health provider organisations across and NHSCB area teams across an NHS CB region and requires NHS CB Regional co-ordination to meet the demands of the incident. |
| 4     |          | A health related incident that requires NHSCB National co-ordination to support the NHS and NHS CB response. |

CB, Commissioning Board; CCG, Clinical Commissioning Group; NHSCB, National Health Service Commissioning Board.
Damage control radiology and specifically the use of multi-detector CT (MDCT) has increased. Often directed by anaesthesia rather than going to the operating room, MDCT scanning can give precise information on multiple injuries including bleeding and nerve damage in under 90 seconds (head to knees). Furthermore the use of angiographic endovascular haemorrhage control is now possible and easier to do in radiology than an operating room. Focussed assessment with sonography for trauma (FAST) scanning may identify bleeding on arrival which directs the patient straight to the operating room.

Likewise, the long-established advanced trauma life support linear management system is changing, with more emphasis on multiple concurrent actions, and newer techniques (often derived from military experience) including damage control surgery and damage control resuscitation. Rather than waiting for results and tests, damage control runs in parallel, this is ‘damage control resuscitation’. During retrieval and initial assessment administration of blood, blood products and tranexamic acid amongst other things can be used empirically in certain scenarios. Blood bank resources need to be considered and diverted appropriately. Much has been learnt from the military medical emergency response teams in this regard. The overall approach to acute clinical management is covered in more detail in *Trauma resuscitation and the damage control approach* on pages 430–436 of this issue.

Speeding up effective treatment for one patient not only improves their outcome but also makes way for other patients.12

**Critical care expansion**

Critical care capacity is a crucial bottleneck and resource issue during a major incident. Critical care networks (CCN) have been functioning for 15 years. They operate in the NHS EPRR framework under ‘operational delivery networks’, providing specialist input along with neonatal ICU, trauma and burns. One key CCN function is to enable units to work together in the face of a major incident that would overwhelm local ICU resources. Incidents such as H1N1 flu were planned for and managed with some disruption to elective work but no compromise of care. Systems to flex bed usage locally (sometimes called surge planning) such as ventilation of patients in recovery are also useful planning activities. Typically, a CCN expectation would be to double critical care capacity during a major incident if required.
Summary

Major incident responses are largely invisible to clinicians in their daily activities, but must always be instantly available to support high-quality efficient individual patient care, even with multiple simultaneous casualties.

Hospital planning for major incidents is complex and wide ranging, having to integrate with pre-hospital care and multiple other agencies, and it is useful for clinicians to have a basic understanding and appreciation of this.

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