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Preparation for and organization during a major incident

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Abstract

Major incidents during the recent past have reinforced the value that the NHS and other agencies have invested into the comprehensive Emergency, Preparedness, Resilience and Response framework. This 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. Also included is how the response to the incident is handled at a local level and for different levels of response. Examples of how this has played out are described. Specialist training at the higher and advanced level for trainees is established so that victims are triaged at the scene and received by consultants with appropriate training. Hospitals, ambulance services and intensive care units across the country can use networks to ensure not only rapid access to Major Trauma Centres but also to highly sophisticated skills when advanced life support is required. The NHS response to major incidents has been shown to be effective and successful.

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

Introduction

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

Preparation for a major incident takes many forms and processes. In the United Kingdom, 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 relatively predictable eventualities such as weather, disease and transportation, but also to be flexible in the face of unpredictable incidents such as terrorism.

This planning has been in response to several incidents, particularly the Hillsborough crowd control incident of 1989, and the London bombs in 2005.

Events worldwide (Madrid train bombs, Mumbai attacks, tsunamis, earthquakes and floods, etc.) have stimulated other nations to develop and refine existing major incident planning. During the past 12 months major incident planning has been tested several times.

Organizational response, structure and obligation

Recent major incidents-the London Bridge attack, Manchester Arena bomb, London Bridge attack and the Grenfell Tower fire, provide many examples of how the Emergency, Preparedness, Resilience and Response (EPRR) framework has worked. In response to the Westminster incident, the HART (hazardous area response team) was called. During the de-briefing several lessons have been reinforced. After the major incidents in London, victims were rapidly triaged to five or six hospitals with consideration to capacity across the city. A senior clinician said after the London Bridge attack, ‘having staged a mock event in the trust during the previous year when the casualties started to arrive all the training kick-in and the staff did a fantastic job’. In Manchester an estimated 400 extra staff came in to cope with the casualties. Many came in before a major incident was announced because people heard it on the media. A similar response was seen in London when staff from the nearby hospital ran to the scene. It was also noted how the pressure on staff continued weeks and months after the events as many victims remained in hospital. These plans are all contained in the EPRR framework and supporting documents1–4 updated in August 2017. The Civil Contingencies Act (CCA) 20045 makes clear the responsibilities of NHS hospitals. The structure of the response by the local services, NHS England, Public Health England and the Department of Health is shown in Figure 1. All category 1 responders (includes acute trusts) have an EPRR framework. Major incident planning is part of mandatory training for consultants.

Trusts’ Major Incident plans must be tested, with communications exercises 6-monthly, annual desktop exercises and mock events every 3 years. The commissioning board (CB) and commissioning groups are legally required to ensure that trusts can adequately respond and communicate with higher (regional and national) organizations.

A major incident is defined as ‘any event which cannot be managed within the existing capacity of the service’. This requires considerable preparation. Levels of response are shown in Table 2.

Hospital response and co-ordination

The first alert is usually from the ambulance service to the acute trust. As with the pre-hospital response (described elsewhere in this issue), trusts have a hierarchical structure, previously bronze/silver/gold. Now ‘operational’ (bronze) commander, hands-on level, may be the senior emergency department doctor, who will report to the ‘tactical’ commander (silver) in a hospital control room also known as an Incident Coordination Centre (ICC). Tactical reports to ‘strategic’ (gold) command — the most senior level within the trust. Gold command carries many responsibilities, including establishment of business continuity, assessment and requests for additional help from other agencies and external communications with higher levels (e.g. regional or national support). All trusts are required to establish an ICC from which the incident team will work. Some incidents will not require a higher level of 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 1 and 2 responders within the local area.

Any planned event (e.g. sports, demonstrations and marches, concerts, etc.) now must have planning on over twenty areas of risk, including how local healthcare facilities would manage a
For 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 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 fulfill 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 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. In the 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). It shows

| Date and location of headline UK major incidents | Number of Deaths | Number of Injured taken to hospital |
|-----------------------------------------------|------------------|-----------------------------------|
| 1974 Birmingham Pub Bombs                       | 21               | 182                               |
| 1975 Moorgate Tube Crash                        | 43               | 74                                |
| 1989 Hillsborough crowd incident                | 96               | 766                               |
| 2001 Pontefract Train Crash                     | 10               | 60                                |
| 2005 London Bombs                              | 52               | >700                              |
| 2009 H1N1 flu epidemic                         | 392              | 28,456 confirmed cases.           |
| 2017 Westminster Bridge                        | 6                | 49 (15 critical)                  |
| 2017 Manchester Arena bomb                      | 22               | 250                               |
| 2017 London Bridge attack                       | 8                | 48 (21 critical)                  |
| 2017 Grenfell Tower                             | 71               | 70                                |

Table 1

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how outcomes have improved across the country. Individual hospital data for survival is presented as actual against expected. Patients are grouped according to the nature of trauma and the survival band, with additional data for example, in head injury cases, arrival to CT scan time.

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 the ‘incident to MTC’ times. Average transfer times have therefore reduced considerably. In London, the incident to MTC is now 17 minutes. This is well shown in head injuries where incident to CT scan is <60 minutes in 90% of patients. If triage to MTC outside of London is thought possible in <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. Since the recent Ebola crisis several special units have been upgraded or commissioned. This is used for all UK highly infective cases that may require critical care.

Less sick infected patients are 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 provide aid to civil authorities. 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 5 ECMO centres in England with retrieval teams trained to manage this caseload.

Team structure and patient pathways

A typical patient-receiving team is changing as new specialties emerge. When multiple cases arrive simultaneously, leadership and trained personal working with that leadership are vital. Currently in most trusts a consultant in EM and/or

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Table 2

| Alert | Activity | Action | NHS CB Incident levels |
|-------|----------|--------|------------------------|
|       | Dynamic Risk Assessment | Declaration of incident level | 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
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, all EM doctors are trained in airway control, basic ultrasound and trauma care. Pre-hospital emergency medicine (PHEM) is a sub-specialty of anaesthesia, intensive care, emergency medicine 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 clinical skills.

In considering patient pathways and flow there are two clear categories:

The first is the pre-hospital system. This includes triage and delivery of the right patient to the right hospital in the shortest possible time.

The second concerns the management of individual patients. Proper overarching 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 illness severity. Multiple systems for triage exist, although triage based on physiological abnormality is most common. The National Ambulance Resilience Unit uses a Triage Sieve (Figure 2) which can be carried out in the pre-hospital environment in a few seconds. A more detailed triage can be done prior to transfer or on arrival at the 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). Over-triage may contribute to avoidable mortality.

To further assist in decision making, the Injury Severity Score 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:

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**Triage sieve (National ambulance resilience unit)**

1. **Catastrophic haemorrhage**: YES → P1
   - NO → Apply tourniquet/haemostatic dressing

2. **Are they injured**: NO → Survivor reception centre
   - YES → Walking

3. **Walking**: NO → DEAD
   - YES → Airway (open) breathing

4. **Airway (open) breathing**: NO → P3
   - YES → Unconscious

5. **Unconscious**: NO → P1
   - YES → Respiratory rate

6. **Respiratory rate**:
   - 10–29 → 10–29
   - <120/Cr >2 sec → P2
   - >120/Cr >2 sec → P1

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**Figure 2**
• head or 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: $ISS = a^2 + b^2 + c^2$, to give a number.

Commonly a score of $>15$ indicates triage to a MTC and has shown good specificity and sensitivity in relation to under-triage and over triage in adults but less so for paediatrics.\(^{10}\)

Secondary triage or triage sort should include a scoring system such as the Revised Trauma Score. This needs to include documentation which is conveyed to strategic command.\(^{11,12}\)

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

Since a seminal NCEPOD report in 2007 regarding UK trauma management, there has been a shift towards early whole-body CT scanning of even physiologically unstable patients.

Damage control radiology and specifically the use of multi-detector CT (MDCT) has increased. Often directed by anaesthesia rather than going directly to the operating room, MDCT scanning can give precise information on multiple injuries including bleeding and nerve damage in $<$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. Focused assessed sonography in trauma (FAST) scanning may identify bleeding on arrival which may prompt direct access to the operating room.

The long established Advanced Trauma Life Support linear, sequential management system is changing, with more emphasis on multiple concurrent actions, and newer techniques including damage control surgery and resuscitation. During retrieval and initial assessment, administration of blood, blood products, tranexamic acid and antibiotics 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 detailed approach to acute clinical management is covered in more detail in the article *Trauma Resuscitation and the damage control approach* on pages 409–416 of this issue.

Speeding up effective treatment for one patient not only improves their outcome but also makes time and space for treating other patients.

**Critical care expansion**

Critical Care capacity is a crucial resource issue during a major incident.

Critical care networks (CCN) have been functioning in the UK for 18 years. They operate within 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 such as flex bed usage (surge planning), such as knowing how many patients across a network can be ventilated in recovery areas, is an example. Typically, a CCN expectation would be to double critical care capacity during a major incident if required.

**Summary**

Major incident response capability is largely invisible to clinicians and the public during 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 pre-hospital care and multiple other agencies. It is therefore useful for clinicians to have a basic understanding and appreciation of this.

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