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Training for major incidents

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Abstract
Major incidents are serious events with broad-reaching consequences that require extraordinary solutions to be implemented. They call for a team-based approach and efficient communication at all levels in addition to effective command, control and oversight. While consolidation of care into major trauma centres has led to improved outcomes for patients, it also means that clinicians may miss out on real-life experience of major incident or severe trauma casualties. It is therefore important to factor training, exercises and planning into individual and organizational preparedness. While several recent major incidents have occurred and provided further experience and lessons, such as the Grenfell Fire, Manchester Arena bombings and London Bridge stabbings, the global COVID-19 pandemic has required clinicians and organizations around the world to re-examine major incidents and the extent of their impacts. This has reinforced the importance of all members of the clinical team possessing an appropriate level of awareness and understanding of major incidents.

Keywords COVID-19; logistics; MAJAX; major incidents; surgery; training

Introduction
A major incident is an event, or series of events, with serious consequences that require extraordinary measures to be implemented by responding organizations. They can have broad consequences involving those responding at the scene, but also surgeons and other healthcare professionals who care for the casualties in hospital.

It may become a ‘major’ incident due to the location, type, severity or number of casualties. Incidents involving a large number of casualties may be described as ‘mass casualty’ events, but major incidents may also involve a small number of casualties who are victims of an unusual event or have specific high-acuity or niche requirements, such as an explosion at a chemical factory. This latter group could require additional precautions in their management, such as decontamination, specific antidotes or specialist personal protective equipment for clinicians.

Table 1

| CBRNE3T All-hazards approach          |
|--------------------------------------|
| Chemical                             |
| Biological                           |
| Radiological                         |
| Nuclear                              |
| Explosive                            |
| Endemic                              |
| Environmental                        |
| Trauma                               |

The various hazards which may present during the pre-hospital phase of major incidents can be considered with the mnemonic CBRNE3T. Initially used by the UK military, it is equally applicable to civilian incidents (Table 1). It is important to grasp the nature and cause of an incident as this could influence management options and subsequently, hospital response.

Recent examples of major incidents in the UK include the Grenfell fire, Manchester Arena bombings and London Bridge stabbings. Logistically, these incidents required extra resources outside of a single hospital’s capability to deal with multiple casualties, and clinically they all required surgical input. However, they were discrete individual episodes that were dealt with and their effects mitigated within a couple of weeks. The COVID-19 pandemic represents the single biggest sustained major incident since the foundation of the NHS in 1947. While there has been a specific, single clinical entity to treat, the effects have been prolonged and wide ranging. This has impacted not only the immediate day-to-day functioning of the service, but the broader health ecosystem and provision of other services over a protracted period. In the hospital setting, a major incident may result in a change to the everyday running of the facility such as
repurposing of wards and equipment, redeployment of staff, diversion of resources and cancelling of non-essential activity. This article explores individual and systemic preparation for comparatively simple major incidents, with considerations given to working in more protracted scenarios.

Clinical versus logistical issues

There are several courses and programmes which focus on the logistical element of a major incident. MIMMS (Major Incident Medical Management and Support) and JESIP (Joint Emergency Services Interoperability Principles) are largely utilized for the pre-hospital phase of an incident, whereas HMIMMS (Hospital MIMMS) is geared towards in-hospital issues including the potential impact on ‘normal daily running’. These courses do not have a large clinical content (except for an introduction to triage principles) as the idea is to provide instruction on the principles of command and control rather than specific clinical guidance. This emphasis allows for the implementation of a similar logistical management system across different incident types. For example, when dealing with a major incident involving a chemical weapon such as a nerve agent (e.g. Salisbury in 2018), the clinical guidelines and patient presentations will be very different compared to dealing with an incident such as a plane crash onto a motorway (e.g. Kegworth Air Disaster in 1989). However, in both incidents establishing a well-understood command structure, safe cordons or exclusion zones, effective communications between services and hospitals and assessing casualties are equally important incident management principles. While surgeons may not be involved in the first example, it is highly likely they will be involved in the second, so an understanding of the general principles is useful.

Clinically, decision-making and surgical practice may differ greatly in major incidents in comparison to ‘normal’ hospital conditions. While there is greater awareness and availability of approaches such as damage control surgery in major trauma centres, it is not yet a ubiquitous practice in all hospitals in the UK (or worldwide). The centralization of major trauma care by the creation of major trauma centres (MTCs) and networks has raised standards of care, but by concentrating this expertise in fewer centres the exposure of non-MTC based clinicians to this paradigm of care has decreased. While terrorist-related major incidents are more likely to occur in large, urban areas with direct access to an MTC due to their population size and potential targets, surgeons who work outside of MTCs may still be involved in major incidents (e.g. transport-related incidents in more rural areas). Indeed, previous terror attacks have specifically targeted hospitals to increase deaths and decrease the healthcare system’s ability to respond, so it is inconceivable that an MTC could be the epicentre of an attack. If that were the case, non-MTC hospitals need to have the ability to cope not only with a sudden influx of patients from the incident, but also support the ‘normal’ workload of the MTC during the recovery phase of the disturbance. The Royal College of Surgeons of England stated in 2014 that it aspired to develop training for general and vascular surgeons to become competent in damage control and definitive trauma surgery. There are several courses that will teach these practical principles (e.g. the Definitive Surgical Trauma Skills or Advanced Emergency Trauma Skills courses). These courses comprise a mixture of lectures to underpin the principles of damage control, and cadaveric-based practical sessions for hands-on instruction of surgical technique. This dissemination of knowledge and skills may add operational resilience in the event of a major incident overwhelming a trauma network, or an MTC becoming incapacitated.

By definition, a major incident will require more resources than are available to treat all patients under normal conditions, so previous exposure to damage control surgery techniques will be of benefit. It is unlikely that definitive operations would (or even should) be performed at the first sitting for both clinical and logistical reasons. If a complex operation that requires several hours of surgical time is undertaken on one patient, this may prove deleterious (possibly even futile) if the patient is physiologically compromised. From a systemic perspective, it would also inequitably divert scarce resources away from other patients. An example of this would be an attempted free flap to acutely cover a soft tissue defect in a patient with a severely damaged limb. This is a long operative procedure that may fail if the patient is physiologically compromised at the best of times, and means that other patients cannot access theatre or a surgeon for a prolonged period. Wound irrigation, decontamination, packing and temporary closure may be a better option both individually and systemically, in both clinical and ethical terms in these patients.

Individual preparedness

While major incidents are rare and most clinicians will go through their career without being involved in one, a knowledge of what to do in the event one occurs is essential. Plans will vary depending on location and local resources, and the acute role or involvement of surgeons may be different in different hospitals. As surgical trainees rotate through different hospitals this should be borne in mind, and they should endeavour to find out at least their initial role in a major incident in their current hospital (ideally included in their induction programme). Understanding an individual’s role in a major incident begins with reading over the local major incident plan and understanding three things — where to go when called, whom to notify and what is expected on arrival. Hospital staff are often unfamiliar with their local policy and what their role could be. A lack of knowledge of an assigned role may be at least partially mitigated with laminated crib cards to hand out on arrival, with a description of a role and responsibilities for the allocated individual.

Workers’ personal resilience, circumstances and wellbeing should be considered as a further element of individual preparedness and the NHS is increasingly recognizing the importance of this. The psychological burden of major incidents and disasters can be significant with those involved professionally suffering from acute stress reactions, burnout and post-traumatic stress disorder. Simple measures such as educating workers about signs and symptoms of these conditions and basic coping strategies and online resources such as those available at the website www.marchonstress.com may be useful.

Barriers that may impact a hospital worker’s ability to respond to a protracted major incident can include issues with
the care of children and other potentially vulnerable dependents, alongside difficulties with transport and accommodation. Conducting exercises, whether table top or practical, can help to tease out these factors and other situational requirements for individuals.

Local/systemic planning

At an individual facility level, it should be considered what staff would be required in response to a major incident. How would they be contacted and how long would it take them to arrive? Which routine operations could be suspended to retain capacity in theatres and intensive care? Planning and training with table-top exercises and simulations can further enhance preparedness at all levels. These exercises may be conducted within individual departments or organizations, or at a higher level involving multiple responding services with high fidelity simulation of a theoretical incident — for example, exercises mimicking a terror attack on a large shopping centre have been conducted in the UK. Concerningly, a 2016 survey reported in the World Journal of Emergency Surgery with respondents from 46 hospitals in 31 countries reported that only 76% of hospitals had a written major incident plan. Of these, less than 50% of hospitals had any regular exercise of the plan at all, and only 28% ran drills on a yearly or more frequent basis. While 84% of respondents expressed an interest in some form of major incident training, only 28% had taken any educational courses in this area. When this is compared against the frequency of staff rotation, it is clear to see why there may be confusion in the initial stages of the response — many people are enacting a plan they may never have read, with minimal information and no previous practice. The lack of testing a plan in vivo also means that certain considerations may have been overlooked; is the hospital list of contact details up to date? If 50 staff arrive at the same time, where will they park? Can a large number of patients be registered on hospital systems quickly? Is there a unified plan for the whole hospital, or have some departments made changes independently that may stymie efforts elsewhere? All these scenarios may occur with a perfectly functioning and executed plan, leading to unanticipated problems. When testing the plan, other potential problems should be considered and mitigated for when performance is reviewed in the ‘debrief’ (e.g. IT failure, loss of telephone network, etc.).

HMIMMS suggests the formation of a hospital coordination team, comprising a medical coordinator, senior emergency physician, senior nurse and senior manager. The individual filling these roles may vary depending on availability and may be reallocated throughout the incident. Depending on the nature of the incident, surgeons may be deployed in a number of areas or roles, e.g. triage, acute resuscitation, acute theatres, ward care or identification of patients for discharge to create bed capacity. Consideration should also be given to the allocation of incident management roles versus medical roles depending on the patient profile (Table 2).

Exercising a major incident plan can begin as simply as a thought experiment. When in theatre next, consider what would happen if a major incident was declared at that moment. Which lists could stop and how quickly? What surgeons and theatre staff would be required, for which speciality and how many theatres? Where would they come from? How would they be contacted? What are the logistical challenges at that point? Hopefully, when checking the results of this experiment against the published hospital major incident plan there will be a good degree of concordance! If not, then the plan may need adjusting to reflect organizational changes since it was written (e.g. new buildings/service reconfiguration), or assumptions that may not be accurate (e.g. how many general/vascular/orthopaedic theatres are needed for the first wave).

The next stage of testing would be to expand that scenario out into a table-top exercise. Consider inviting external departments (e.g. anaesthetics, ICU, general medicine) to critique the plan and suggest how their departments plans align. Consider adding in ‘wildcard’ events related to the scenario (e.g. the ED becomes contaminated by a chemical incident or there is a loss of power or communications) and see how the plan can be adapted. Every suggestion so far only costs non-clinical time and local resources rather than specific course expenditure, and has tangible local benefit. It allows rehearsal within teams that will work together during incidents, providing higher fidelity and organizational memory. Specific local challenges such as repurposing real estate can be explored, for example, consideration of locations for staff/volunteer reporting areas, discharge areas, body holding facilities and information points for press and relatives. These can be tested and subsequently incorporated into a revised live plan. Criteria should also be established for when to return to ‘normal’, and how a facility should transition from resuscitation and

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**Medical roles that may be involved in various stages of the MIMMS CSCATT schemata**

| Management | Command | Effective management of the response and clear point of contact. This should be provided by the hospital coordination team |
| --- | --- | --- |
| Safety | Safety 1-2-3 | |
| Communication | Communications plans should be tested before an event and contingencies in place |
| Major incident standby and activation notifications should be in place |
| Assessment | This will be a dynamic process with the scale of response based on casualty load |
| Medical | Triage | Prioritization of casualties for treatment |
| Treatment | Will depend on the availability and skill set of staff, available time and resources, nature and severity of casualties |
| Transport | Casualties may arrive from an incident by any means, and there may be onward pressures in moving them around or between hospitals |

Table 2
damage control to delivering definitive care and resumption of elective services.

This locally based training has several attractive advantages but has to be balanced against the benefits of external courses. These advantages include the opportunity to share the insights of others who may have specific experience, and exploration of the systems in place in their areas. While local consensus in planning is good, the risk of groupthink is real and so an external perspective (specifically in the planning stage rather than the middle of a crisis) may help mitigate some of this. A sensible compromise may be to invite external faculty to run an exercise and provide some valuable external validation/feedback to inform local decision making. Further table-top exercises or scenario-based training beyond this level could involve other organizations or responders, though this requires a lot more time, effort, funding and buy-in from several organizations (e.g. ambulance trusts or fire and rescue services) and may be prohibitive in terms of cost or time-consumption. It is a wise investment but may be incredibly difficult to organize.

Should a major incident be declared before this sort of training can be undertaken, there are resources which may help acutely. The NHS has drawn up major incident and mass casualty clinical guidelines to assist in preparedness which can be accessed via the Emergency Preparedness, Resilience and Response area of the NHS England website. These clinical guides are not a substitute for adequate training and prior preparation but can serve as a useful aide-memoire when dealing with less frequently encountered presentations (e.g. CBRN casualties). This document also covers principles of triage and communication (such as the METHANE format for reporting incidents) which may not be familiar to staff who have not attended formal training.

**Recurring problems in major incidents**

Communication is frequently cited as a common problem in major incident management. This can range from failure of equipment to operate (as highlighted in the coronial report into the King’s Cross Fire and the Grenfell Fire Inquest) to failure to communicate between agencies and develop a shared mental model and plan (e.g. Manchester Arena bombings).

An additional, less considered, factor is the potential for information overload from unvalidated sources. It is a natural reaction to attempt to gain information in times of uncertainty, and given the pervasiveness of social media and rapid news reporting, reports of evolving incidents may reach hospitals via these methods before an official response has been declared, adding to uncertainty and confusion. During recent events, there has been an increasing focus on the general public’s role. Campaigns such as ‘Run-Hide-Tell’, and applications and public education initiatives such as ‘CitizenAid’ and ‘WhatThreeWords’ aim to increase the utility of non-medically trained individuals to make life-saving interventions and improve situational awareness. While ideally all information would be collected and contemporaneously channelled to relevant incident commanders, this is not yet the case.

Miscommunication, rumours and misunderstandings can also change perceptions and subsequent plans, so simple instructions and questions (ideally written down and delivered by runners as needed) should be encouraged rather than overly complex solutions or relying on memory. The use of other means of communications such as WhatsApp groups also occurs. While this is useful in that it provides a written record of times, decisions and can achieve widespread dissemination, there are concerns about data security as it is not fully GDPR compliant and it is again susceptible to network failure.

Record keeping in major incidents is also problematic. While keeping a dedicated incident log is recommended (ideally by a scribe), this may not be practical in the initial phases. Major incidents will almost universally involve police and coronial investigations, so it is imperative that decision making is recorded. One potential solution would be to use voice recording apps that are built into most smartphones, as the metadata will include a date and time of recording which can be interrogated later. During the previously mentioned table-top exercises, a useful adjunct would be for a third party who was not involved in the exercise to attempt to reconstruct the event purely from the logs, notes and recordings generated by participants. What was recorded as being done and the rationale may differ greatly from what actually occurred!

**Lessons learned from the COVID-19 pandemic**

The COVID-19 pandemic has forced us to consider major incidents in a new light. The demand for resources (including PPE) was outstripped, and this has highlighted the need for testing resupply chains in a major incident plan. There has been minimal opportunity for recovery for the economy and infrastructure, and personally for both the general population and clinical staff working during the pandemic. Personnel can ‘dig in’ for a short period of working extensive hours under high pressure in physically and emotionally challenging circumstances, but over a longer term, this leads to fatigue and burnout. Depression, anxiety and post-traumatic stress disorder have been noted in COVID-19 as with previous epidemics.

Prior to the pandemic, few medical staff had any experience of dealing with the arduous conditions of long shifts in PPE, the strict infection control measures required and subsequent degradation in performance. Sustaining this response for a protracted period relied on managing a workforce not only to mitigate for fatigue, but to also build in contingencies for when the staff themselves became ill. In the face of this challenge, the expectations of the general public, and indeed of the responders, had to be managed as to what really could be achieved.

The pandemic has also highlighted the impact that a major incident can have on apparently unrelated services. Operating theatre suites were repurposed into treatment areas for ventilated patients and commonly accepted working practices were overhauled such as donning and doffing in anaesthetics rooms and conducting anaesthesia in the same clinical space as the subsequent surgery, though this is commonplace outside of the UK. During the first wave of the COVID-19 pandemic, the protracted reduction in services deemed ‘non-essential’ became both morally intolerable to the nation, and likely had consequences on many areas affecting the long-term health of several thousand non-COVID patients. Delays and disruption to diagnostic services, for example, are estimated to result in thousands more deaths to cancer and it is expected that services like cardiology/
cardiothoracic surgery may experience a surge in requirement following a reduction in acute presentations during the first wave.15 This is likely to have a much more tangible impact than the service reduction caused by a short-lived incident.

Conclusions

Major incident preparation can take many forms, from a simple review of established plans all the way to multi-agency, high fidelity scenarios. While there is necessarily a stronger emphasis on logistical training, there are specific courses that may equip surgeons and surgical teams with necessary clinical skills that may be useful in such incidents. Surgeons have a significant role to play in both clinical and non-clinical roles in acute incidents, and as has been demonstrated from the COVID-19 pandemic, the impact on surgical services will extend beyond the initial phase. When considered together, these factors lead to the conclusion that in order to advocate for surgical patients, surgeons must involve themselves in aspects of major incident and recovery planning.

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Practice points

- Major incidents are rare occurrences, but are likely to require clinical and non-clinical input from surgeons
- Major incident training courses largely focus on logistical aspects, though specific clinical courses will provide benefit when treating patients in major incidents
- While the initial clinical influx of patients from major incidents is usually short lived, there may be a prolonged effect on service provision thereafter
- In-house table-top exercises are cheap to run, provide buy-in from hospital staff and may be of more benefit than generic external courses, however external validation of plans is essential
- The COVID-19 pandemic has illustrated the effects of prolonged major incidents on clinical staff and service provision, so any future major incident plans should take these findings into account