

# Terrorist attacks: learning from the past and planning for the future

**T**errorist bomb attacks on the UK mainland are not a new phenomenon. However, since the IRA ceasefire, such incidents have been relatively few. Unlike IRA bombings, which generally targeted commercial property or military personnel and were often preceded by warning phone calls, the attacks in London and Madrid deliberately targeted civilians with no warning. The detonation of devices at multiple sites and in densely packed, enclosed areas was intended to maximize the number of fatalities and inflict severe injuries on survivors. Indiscriminate outrages such as those perpetrated in London on 7 July are unlikely to be 'one offs' and may be repeated in the near future.

## Patterns of blast injury

When an explosive device detonates, a small volume of explosive is rapidly transformed into a large volume of gas. A high-pressure blast wave expands outward at the speed of sound and, in interacting with the body, causes characteristic injury patterns. These injuries were classified during World War 2 according to the physical effects of the energy on the body (Zuckerman, 1940).

Primary injuries result from the interaction of the blast shock wave with the body and are localized at areas of air-tissue interface, such as the ear, lung and the gut. Secondary injuries result from the collision of energized fragments with the body. Tertiary injuries result from whole body or body part displacement by the blast energy and include traumatic amputations. To this list can be added burns from the hot gases of detonation and inhalational injuries from smoke and aerosolized debris. Frequently patients are injured by a combination of these mechanisms and present a huge challenge to both the immediate care practitioners and the hospital teams.

Tympanic perforation is common in the survivors of close proximity blast as the eardrum is very susceptible to quite mod-

est increases in pressure. Isolated eardrum damage in patients without obvious signs of other injuries is not thought to be a marker of further morbidity (Leibovici et al, 1999). Traumatic amputation of a limb, however, is a marker of severe multisystem injury and carries a high mortality (Hull, 1992).

## Blasts in enclosed spaces

Explosive blasts in confined spaces exacerbate such effects by reflecting the blast wave off multiple surfaces. The intensity and duration of the blast pressure are increased and the amount of energy transferred to the bodies of people in close proximity to the explosion is maximized. This creates an increased risk of primary blast injury such as tympanic perforation and blast lung (Cooper, 1996), and displacement of the body wall which causes a shearing effect on larger organs, especially abdominal viscera (Cooper and Taylor, 1989). The severity of injuries and the resultant mortality are significantly greater in confined spaces when compared to open air explosions (Cooper et al, 1983; Leibovici et al, 1996).

The London bombs injured approximately 700 people. Fifty-six people were killed – an 8.0% fatality rate (Ryan and Montgomery, 2005). This is a proportion identical to the Madrid train bombings in when 191 (8.0%) of the 2253 injured persons died (Gutierrez de Ceballos et al, 2005). The majority of deaths in both attacks occurred at the scene of the blasts.

The majority of the 700 casualties had relatively minor injuries and were discharged from hospital after assessment and treatment. Most of these patients were injured by non-penetrating fragments, which can be managed non-operatively (Bowyer, 1997). However, in an uncontrolled incident, the vast numbers of 'walking wounded' can result in a so-called 'reverse triage effect' where patients with minor injuries present to hospitals before the serious casualties

because they are able to travel on their own. Care must be taken both at the pre-hospital and hospital level to triage patients properly and ensure that the system is not swamped by this influx to the detriment of the severely wounded who may arrive at a later stage.

## Planning for terrorist attacks

The July 7 attacks had been anticipated by the UK authorities – several statements from leading figures in the police and intelligence services had indicated that eventually the terrorists would get through the surveillance net and succeed in attacking a major city. All the emergency services in London had planned and practiced for such eventualities. Nevertheless, the unpredictability both in location, timing and number of simultaneous attacks shown by bombings in both London and Madrid illustrate that any doctor may be called upon to manage patients injured by explosive blast – previously regarded as the preserve of the military doctor or emergency specialist (Chaloner, 2005).

What we must now recognize is that the threat facing us has changed not just in scale but in nature. Although ready access to information on bomb construction via the internet facilitates the use of explosive devices by any number of aggrieved individuals and organizations, in the past these have been restricted to disturbed people working alone, such as David Copeland, the Soho bomber. What we now face are highly motivated and organized indigenous terror groups working within the UK with support from international collaborators. These groups are ruthless, implacable and intent on killing and maiming as many UK civilians as possible by any possible means.

Their use of suicide bombers and the lack of warning means that taking the usual precautions against 'unattended packages' is not guaranteed to be effective in averting an attack. Of additional concern is the possibility that biological or

chemical agents might be used by terrorists as sarin gas was used to attack the Tokyo subway system in October 1995, or that radioactive material could be released at the time of a conventional blast – a so-called ‘dirty bomb’.

## Training for doctors

In the light of this new situation, and the changing nature of the threat itself, there is a pressing need for wider training in immediate care and awareness of on-scene management within the UK medical community. Training and planning within the London emergency services certainly paid off on 7 July and the medical response to the attack was very effective (Ryan and Montgomery, 2005).

In order to assist meaningfully at the scenes of explosions, doctors must understand the working practices of the emergency services and how an emergency scene is organized and controlled. Such training should be generally available as many ‘passer-by’ doctors engaged in casualty care at each of the scenes on 7 July. Particularly in our major cities, specialist

pre-hospital doctors must be trained in new skills, such as extrication, triage and transport, and hospital doctors should learn to recognize and meet the needs of multiply injured blast victims.

## Conclusions

Before the July 7 incidents, there were some commentators in the media (and probably in the medical community) who believed that the scale of the terrorist threat was exaggerated – there can be few who believe that now. We must acknowledge that future attacks on UK civilians are likely, may be larger in scale than those we have seen to date and may use ‘unconventional’ weaponry such as chemical, biological or radioactive material. Having acknowledged this we need to take the necessary steps to train and prepare for these threats – if we fail to plan, we plan to fail. **BJHM**

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## KEY POINTS

- Blast injury in enclosed space is more lethal than in the open air.
- Characteristic anatomical and physiological patterns of blast injury are seen in bomb attacks.
- Hundreds of people sustain minor injuries in most attacks.
- Future attempts to target UK civilians in major population centres are highly likely.
- Chemical, biological or radioactive agents may be used in the future.
- Training and planning for such events are both possible and necessary within the UK medical community.

## Bomb and Blast 2005

The fourth in a series of training courses for doctors about bomb attacks will be held in London on 17/18 November

Further information is available from:

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<http://www.ucl.ac.uk/anaesthesia/meetings/index.html>

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