



FEATURE

ESSAY

How to stop the dying, as well as the killing, in a terrorist attack

There's a therapeutic vacuum in the "hot zone" of a terror attack. **Claire Park and colleagues** describe efforts in the UK and beyond to deliver expert medical care to casualties trapped at the centre of an attack

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Mobile attackers with bladed weapons, firearms, or explosive devices are currently a significant global threat to the public and emergency responders. The risk of chemicals, vehicles, and fire used as weapons adds further complexity to such attacks.

Recent attacks have killed many innocent people: more than 9800 terror attacks occurred worldwide in 2018, resulting in 22 980 deaths.¹ Some of these people might have survived had the medical response gained to access to them earlier. Emergency services face the problem of how to provide medical care to casualties in an area deemed under direct threat, known as the "hot zone." Although many of the armed police responding in the hot zone are also trained to provide some lifesaving medical care, they are the same armed officers who are trained to first locate and stop the attackers—delaying their focus on medical interventions until the threat is controlled. The resulting therapeutic vacuum of medical intervention can last for minutes to hours after people are injured.

We believe that the UK should adopt standard military practice in these attacks and enable armed police to give "care under fire," alongside management of the immediate threat. Appropriately trained medical officers should also be integrated with the police in the hot zone: this happens in France, as seen in the Paris terror attacks in 2015. These steps would tackle many of the areas that currently encourage this potentially lethal therapeutic vacuum in the UK.

The story so far

The "hot zone" in a terror attack is one that poses a credible and continuing threat to life, including attackers with weapons. The "warm" zone is an area where the attackers are not believed to be present but an identified threat remains, and the "cold" zone is an area far enough from the threat to be considered safe.

Analysis and suppression of the threat and the declaration of these zones are led by the police. By working closely with police commanders, other agencies adapt their response, aiming for rapid treatment and extrication of patients. The hot and warm zones are often dynamic, rapidly changing in size or location as the incident evolves, as exemplified by recent attacks with mobile and multiple attackers. Unknown numbers and locations of attackers—and continual, potentially confusing, intelligence updates—also complicate the situation.

The term "therapeutic vacuum" was coined in the 1960s to describe the lack of prehospital advanced medical care for people in road crashes. The specialty of prehospital emergency medical medicine has evolved such that helicopter emergency medical services and ground based prehospital critical care teams are now standard in many countries. They deliver not only technical medical interventions but also decision making and medical leadership.

In the UK, however, these teams are currently not trained to work in high threat environments. Instead, the police are the only emergency service deployed in the hot zone, and, even then, initially only armed police. As mentioned, these armed

officers are the same officers whose mission is to locate and confront the threat. So, while they are trying to stop the killing, no one is trying to save the lives of those casualties trapped in the hot zone.

The therapeutic vacuum was raised last year in HM Chief Coroner's report⁵ on action to prevent future deaths after the inquests arising from the fatalities in 2017's terror attack at London Bridge and Borough Market.

The chief coroner suggested improved training of police medics to be analogous to battlefield first aid.^{2,3} UK soldiers provide medical care while dealing with the immediate threat—a concept that is standard UK military practice and is known as “care under fire.” He also urged action to tackle the problem posed by hot and warm zones: chiefly, that they could be designated for long periods of time, during which whole areas would be considered out of bounds for ambulance staff.

A national review of joint operating procedures⁶ between ambulance, fire, and police services since the London Bridge attack has dealt with some of these challenges in principle, but plans are yet to be tested.

Why timing is crucial

Evidence is limited on the potentially preventable causes of death from terror attacks. The literature, predominantly military in origin, indicates that haemorrhage is the leading cause of prehospital death in 91% of military cases in Iraq and Afghanistan, and airway compromise is associated with 8%.⁷

Emerging civilian data⁸ show the causes of death in US active shooter events, which point to lung injury (without any major vascular compromise) as the most likely cause of potentially preventable death. More data are required to cover all mechanisms of attack, but skills to adequately manage pneumothorax and ventilatory failure may be required earlier than in the cold zone, where it is currently provided in the UK.

The timing of interventions is critical if they are to save lives. Minimal data are available on the exact timings of deterioration and intervention. Although dating back to the mid-1960s, the most detailed database available is that of the Wound Data and Munitions Effectiveness Team. These are meticulously collected data from 7801 US casualties from Vietnam documenting all causes, injuries, timings, and interventions.⁹ These data showed that 42% of deaths occurred in the first 30 minutes (26% within five minutes and 16% within five to 30 minutes).^{9,10} To deal with any of these deaths that are preventable the interventions need to be performed by people who can rapidly access the casualties.

Catastrophic external haemorrhage can be controlled with tourniquets, junctional wounds with haemostatic dressings, and pressure bandages, and airways can be opened by simple manoeuvres. All of these interventions can be provided by appropriately trained bystanders or first responders, such as police officers who may be present. For example, a passing ENT surgeon at the Westminster Bridge attack in 2017¹¹ opened a patient's airway, allowing him to start breathing again after the initial effects of hyperacute head injury.

Stopping the dying as well as the killing: the medical response

The UK has made improvements in in the joint emergency services' response to a marauding terrorist attack (MTA),⁶ including new operating principles that allow unarmed police responders into the hot zone and non-specialist ambulance

responders into the warm zone, depending on the nature of the threat and method of attack.

Simple care procedures⁴ that can be carried out by carried out by police officers and would form part of the “care under fire” concept^{2,3} include tourniquets and rapid patient positioning for postural airway management. All armed police in the UK are trained to apply tourniquets, blast bandages, and chest seals, to open airways, insert airway adjuncts, and to provide bag valve mask ventilation and administer oxygen.

Some of the teams use these skills daily. However, in current training on MTAs, medical interventions are taught to be delivered only by armed police after the threat is neutralised. If this takes hours and the hot zone remains “hot,” no one is available to provide medical care to these casualties except for uninjured bystanders, because the armed police are not using their medical skills at this stage. Meanwhile, patients with penetrating torso injuries, for example, have a high chance of internal non-compressible haemorrhage requiring rapid identification and extrication to hospital.

In an evolving terror attack it may be impossible to rapidly locate and neutralise or contain the mobile threat, and so police may not be able to immediately evacuate casualties. Even where evacuation becomes possible, however, some patients remain clinically trapped at the scene because of the painful nature of their injuries. For example, those with blunt injuries from an associated mobile vehicle attack may not be easily moved from the hot zone without potent analgesia.

Current triage systems allocate patients into broad groups commonly described as priorities 1, 2, and 3. But reports from marauding terrorist attacks¹² have revealed difficulties in recalling and applying these triage systems. The complex problem of defining the triage priorities in the priority 1 group itself remains a significant challenge and is likely to require senior experienced clinicians.

The current ambulance service response is limited in dealing with the therapeutic vacuum because it can access only the warm zone and provides a very limited range of standard paramedic interventions. The “fog of war” that inevitably leads to confusion at the outset of such incidents, along with continually changing intelligence updates, results in delays in being able to define a warm zone.

International models

Emergency services worldwide have tackled these problems in various ways. In France the emergency response was tested in the Paris attacks of 2015, when Islamic State militants attacked eight places in the city, killing 130 people. In the French system, hot zone medical care integrates doctors into the specialist police intervention teams such as RAID (Recherche, Assistance, Intervention, Dissuasion). This tackles the problem of the therapeutic vacuum with rapid treatment, triage, and extrication of casualties. After walking casualties are evacuated rapidly, lifesaving interventions are provided. Non-ambulant casualties are triaged by the forward medical commander and then carried by the police intervention unit to a casualty “nest,” from which they can then be triaged for evacuation by a warm zone corridor (or “noria”) out to the cold zone.¹³

The coordination between the RAID forward medical commander and police commanders who train and work closely together, along with the movable warm zone corridor, is key to their success. In the incident at the Bataclan concert hall in Paris, two RAID doctors entered with police cover and triaged all casualties (about 100) from the orchestra pit while the

intervention plan was coordinated.¹⁴ All live casualties were evacuated within 30 minutes of RAID entering the theatre and 30 minutes before the terrorists were killed. Had evacuation been delayed until after police intervention, as happens in the UK, it would have been three hours before any medical care was delivered. Only 1.4% of casualties evacuated from the Bataclan later succumbed to their injuries, compared with around 10% in historical military data.¹⁰

In the United States, integrated public safety rescue task forces,¹⁵ which include paramedics and firefighters, can rapidly deploy into warm zones behind the initial law enforcement response. Other warm zone integrated rescue response models include the “protected island” or “protected corridor,” allowing medical personnel to access and stabilise wounded people quickly. Sometimes, however, a rescue task force may not be available or appropriate. In these instances a “police rescue” by initial police responders has occurred, for example, at the San Bernardino active shooter event in California in 2015.¹⁶ Police provided immediate tactical emergency casualty care³ and evacuated casualties either to a casualty collection station on the edge of the cold zone or directly to hospital, avoiding delays in treatment and evacuation.

In Australia, the Lindt Café siege in Sydney in 2014 precipitated improvements to the management of casualties in the hot zone and better integration between the police and healthcare services. A national, multi-agency drive to increase awareness and capability to respond effectively beyond the cold zone led to the development of the Australian Tactical Medical Association and increased medical skills for some police medics, and senior paramedics are now embedded with the Police Tactical Group in Sydney.

What needs to happen now

Internationally, there are examples of senior medical professionals embedded or working closely with police to ensure appropriate advice and decision making, communication with medical resources in warm and cold zones, and coordination of more rapid treatment and extrication of casualties from hot zones.

The tragic recent terrorist events in the UK have been of a significant scale but have not tested the country’s resources to the extent of much larger events abroad. These relevant lessons from domestic and international events must be learnt and adopted into UK practice. The dying process does not wait for a warm or cold zone to be in place or for the threat to be completely suppressed. Trained and untrained bystanders may provide immediate and simple lifesaving interventions. Empowering bystanders is a repeated lesson from these international events.

People who die in these situations predominantly do so in the hot zone. The strategy to improve outcomes is to identify potentially reversible pathology and ensure that medical providers at the appropriate level, whether police medics, paramedics, or doctors, can access the patients to provide the required intervention.

Alternatively, the casualties need to be evacuated in a timely manner. A forward senior medical officer integrated with the

police response is key to this dynamic decision making and can increase the fluidity of the tactical medical response. To achieve this in the UK, the current system needs further development.

Biography

The authors have based this essay on their personal experiences and professional expertise in the preparation and response to terrorism incidents internationally. Claire Park works for London’s Air Ambulance and the Specialist Firearms Command of the Metropolitan Police Service to improve the training and response to routine and terrorism incidents. She has also been pivotal in bringing together experts from around the world to seek better solutions to these challenging issues.

We thank Michael Wade and Andrew Barrett, officers from the Metropolitan Police Service.

Competing interests: Gareth Grier and Claire Park run interdisciplinary educational events for police and paramedics through Queen Mary University London (QMUL). Gareth Grier is a senior lecturer in prehospital care at QMUL. Gareth Davies sits on the clinical governance panel for the Metropolitan Police and was the medical director of London’s Air Ambulance for the past 20 years.

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