# Viewpoint

# The French emergency medical services after the Paris and Nice terrorist attacks: what have we learnt?



Pierre Carli, François Pons, Jacques Levraut, Bruno Millet, Jean-Pierre Tourtier, Bertrand Ludes, Antoine Lafont, Bruno Riou

On Nov 13, 2015, Paris was the scene of multiple mass casualty terrorist attacks that were the most violent and devastating events to occur in France since World War 2, resulting in the deaths of 137 people and injuring 413.<sup>1</sup> On July 14, 2016, France was targeted again in the attack on Nice in which a truck was deliberately driven into crowds celebrating Bastille Day, resulting in the deaths of 87 people and injuring 458. Since the attack on Nice, several further terrorist attacks have occurred in Europe (figure),<sup>3</sup> providing the sad proof that the threat has spread to many countries.

The continuing conflicts in Iraq, Libya, and Syria indicate that many countries will face such situations for many years. Preparing and adapting our emergency plans to face this multifaceted threat is crucial. The medical response to terrorist attacks does not just involve saving lives, but it also serves as a message to our people: we shall never surrender to terrorism. In this Viewpoint, we present a synopsis of the measures taken in France to improve our medical capacity to face the unexpected (table).<sup>8</sup>

The history of terrorist attacks in France is long, with notable incidents in the past decades including the 1995 and 1996 Paris Metro bombings. Despite this, the emergency medical services have traditionally been more prepared to respond to natural or technological catastrophic events rather than mass casualties arising from terrorist attacks, particularly those carried out with war weapons.

Often, the main objective of a terrorist attack is to spread fear and disruption among the population, with the willingness to kill and maim a high number of victims. The rise of the suicide bomber has made early detection of such attacks and prevention difficult. Given that the weapons of terror are those of war, after the Paris attack, the French emergency medical services asked the French Military Medical Service to transfer their expertise into the civilian setting. Favouring the concept of prehospital damage control (which is the adaptation of the military "ground zero damage control" to the civilian prehospital phase),<sup>4</sup> mobile intensive care units from the Service d'Aide Médicale d'Urgence (SAMU; the French civil prehospital emergency medical service) as well as first aid fire brigade units were equipped accordingly (eg. with tourniquets and haemostatic dressings), and prehospital administration of tranexamic acid was advised. Since the Paris attacks, the French authorities and emergency medical services have organised, at the national and regional levels, teaching of civilian surgeons, anaesthesiologists, and emergency physicians by their military colleagues about damage control resuscitation and surgery, triage, and <u>care "under fire</u>". An online course is now accessible on demand to medical staff, through the digital platform of the French Military Health Service Academy. Additionally, the French Conference of Deans of Faculties of Medicine has recently proposed the implementation of dedicated teaching for all medical students and some dedicated courses in trauma management during residency, at a basic level for all specialties and at an advanced level for emergency physicians, anaesthesiologists, critical care specialists, and surgeons.<sup>9</sup> Although, some Faculties have already implemented these courses, implementation at the national level is expected during the next university period (2017–18).<sup>9</sup> It should also be pointed out that prehospital damage control might not apply to all types of trauma.<sup>5</sup>

After the Paris events, it was realised that most of France's trauma centres were already trained to treat ballistic trauma, even those related to high-velocity weapons, but that they were not all experienced when facing an overwhelming number of victims. Furthermore, paediatric surgeons recognised that they did not have sufficient experience of this type of trauma, and that most of the established trauma surgeons had little experience of treating paediatric patients. In November, 2015, the terrorist attack against the Stade de France in Saint Denis near Paris partly failed whereas those in the streets of the city of Paris and in the Bataclan theatre killed a high number of victims.1 After these attacks, emergency services realised that many children were present in the Stade de France and recognised that their ability to manage multiple paediatric victims was not optimal. As a result, efforts have been focused on implementing training of how to treat children in mass trauma situations. This need was confirmed in the Nice attack, which took place in front of the Lenval Children's Hospital, and which saw several children presenting with severe blunt trauma transported on stretchers directly to this facility.<sup>3</sup> Even if staff were prepared to mass casualty incident, this scenario overwhelmed the medical resources of the children's hospital, because of the proximity of this receiving centre, leading to which has been previously referred to as the "main gate syndrome".10

The close cooperation between the police and the prehospital emergency medical system, which was initiated before the Paris attacks,<sup>6</sup> has since been further developed, introducing the idea of a secure intervention of medical responders in a dangerous area. The risk of continued shooting or secondary attacks by bombing as well as the necessity to save lives is now integrated and better shared between the two systems.<sup>n</sup> Saving lives does not just mean providing medical care but also extracting

#### Lancet 2017; 390: 2735-38

Published Online July 25, 2017 http://dx.doi.org/10.1016/ S0140-6736(17)31590-8

University Paris-Descartes, Paris France (Prof P Carli MD Prof B Ludes, Prof A Lafont MD); SAMU de Paris, Hôpital Necker-Enfants Malades. Assistance Publique-Hôpitaux de Paris (APHP), Paris, France (Prof P Carli); French Military Health Service Academy, Ecole du Val-de-Grâce, Paris, France (Prof F Pons MD); University Nice-Sophia Antipolis, Nice, France (Prof | Levraut MD); Department of Emergency Medicine, Centre Hospitalier Universitaire de Nice. Nice. France (Prof J Levraut); Sorbonne Universités, University Pierre et Marie et Curie, Paris, France (Prof B Millet MD Prof B Riou MD): Department of Psychiatry (Prof B Millet), Department of Emergency Medicine and Surgery (Prof B Riou MD), APHP, Hôpital Pitié-Salpêtrière, Paris, France: Brigade de Sapeurs-Pompiers de Paris, Paris, France (Prof J-P Tourtier MD); Institute of Legal Medicine, Paris, France (Prof B Ludes MD): and Department of Cardiology, APHP, Hôpital Européen Georges Pompidou, Paris, France (Prof A Lafont)

Correspondence to: Prof Bruno Riou, Service d'Accueil des Urgences, CHU Pitié-Salpêtrière, 75651 Paris cedex 13, France bruno.riou@aphp.fr

For the **online course** see http://www.dev.gedissa.org



**Figure:** Major terrorist attacks in Europe since November, 2015 Numbers include perpetrators. Data from Wikipedia,<sup>2</sup> 2017.

victims safely from the danger area and choosing the best compromise between security of rescuers, immediate care, appropriate orientation, and fast definitive surgery. Close cooperation and preparation between emergency responder teams (ie, the police, fire brigade, SAMU, and hospital teams) might have contributed to the low hospital mortality rate noted during the Paris attack.<sup>1</sup>

After the Paris attack, the incident debriefing process among emergency medical services analysed that our successful management was due partly to the important prehospital and hospital resources available in Paris with a population of 10 million people. Considerable mobilisation of the other regional areas in France took place during the night of Nov 13, 2015.<sup>12</sup> Although not used, this mobilisation would have been essential had the attack taken place in a less populated area. Two factors are important in responding to a mass terrorist attack: first, to activate rapidly distant additional means, either for immediate care or delayed transfers, or because of the scarcity of very specialised resources (eg, burns units and paediatric teams); and second to identify quickly additional preserved resources such as local or regional available hospitals because of the evolving and unpredictable nature of terrorist attacks. A medical strategy is needed, coordinated by experienced healthcare professionals, not only on scene but also at the regional or state level.<sup>7</sup>

Emergency services must also be prepared to face very different scenarios, including attacks with chemical weapons (such as sarin, mustard gas, or chlorine, as recently used in the Middle East), and attacks targeted at iconic victims such as children or emergency care responders. There is no reason to think that terrorism will become less violent. However, the recent attacks suggest that simple means (such as high-velocity weapons and trucks) can result in a very high number of victims.<sup>1,3</sup> Protecting hospitals against an attack is also a new challenge for health-care authorities. Health-care facilities are no longer sanctuaries but soft targets for terrorists.13 Professionals must be responsible for their own security; in view of this, timely updated regulations emphasising protection of hospitals have been introduced in France.14

**Exsanguination** remains a major problem in terrorist attacks using high-velocity war weapons. Equipment of all rescuers with tourniquet and haemostatic dressing might be a simple and efficient solution for some patients and a rapid transfer to hospital for immediate surgery is another important issue requiring a very strong cooperation between actors. We should also be prepared to observe early deaths due to exsanguination despite all our efforts and this must be explained to care-providers and the population. This does not preclude future research efforts in promoting innovations aimed at preventing and treating severe blood loss.

Hospital trauma teams have also tried to improve their ability to triage between absolute and relative emergencies and to better identify their surgical resources within a specified timeframe (ie, immediately, within several hours, within days) rather than focusing on beds available. Besides national or regional teaching of physicians, SAMU, and leading trauma centres organised multidisciplinary simulation exercises especially focused on triage. Improving our knowledge-base also means conducting research and building a comprehensive database of all injured victims in the Paris attack.<sup>15</sup>

Identification of the victims was clearly a deficiency during the Paris and Nice attacks, particularly those left dead on scene.<sup>16</sup> There is immense pressure to provide timely answers to the families looking for their relatives and high quality evidence for judicial authorities.<sup>17</sup> The first responders and forensic teams were confronted with various challenges as a result of the variability of the modus operandi (ie, shootings and suicide bombings), the condition of victims' bodies (from intact to highly disrupted), multiple scenes (indoor and outdoor), and involvement of national and international victims.<sup>18</sup> The

|  | French actions    |
|--|-------------------|
| Insufficient expertise on war weapons  |                   |
| Expertise transfer from the Military Medical service   | Ongoing           |
| Training of EMS personels and physicians   | Done              |
| Basic teaching to all medical students   | To be implemented |
| Advanced teaching for anaesthesiologists, surgeons, and emergency physicians during their fellowships                                  | To be implemented |
| Prehospital damage control⁴  |                   |
| Equipment (tourniquet and dressings) and prehospital administration of tranexamic acid   | Done              |
| Expertise transfer from the military medical service<br>(not to apply to every type of trauma <sup>5</sup> )                           | Ongoing           |
| General public teaching  | Pilot programme   |
| Children as victims of ballistic trauma  |                   |
| Expertise transfer from adult to paediatric physicians for specific training (ballistic trauma, CBRNE)                                 | Ongoing           |
| Expertise transfer from the <mark>paediatric</mark> to the<br>adult physicians (in case of excess capacity of<br>paediatric hospitals) | Ongoing           |
| Cooperation between adult and paediatric centres   | Ongoing           |
| Chemical weapons   |                   |
| Improve our global preparedness  | Ongoing           |
| Upgrade of EMS equipment   | Ongoing           |
| Health-care facilities as target   |                   |
| Include this possibility in the mass casualties plans, both at the prehospital and hospital levels                                     | Ongoing           |
| Secure intervention of medical responders "unde  | r fire"           |
| Cooperation between all emergency responders (police, rescuers, and medical responders) <sup>6</sup>                                   | Done              |
| Triage on scene and at the arrival of the hospital   |                   |
| Expertise transfer from the military medical service to civilian ones  | Ongoing           |
| Simulation exercises to improve the whole process  | Ongoing           |
| Analyse existing <mark>database</mark> (research)  | Ongoing           |
| (Table continues in next column)   |                   |

concerns expressed by the families regarding the identification process, and lessons learned from all actors involved, have led to the elaboration of new Standard Operating Procedures with strict respect of international Interpol Disaster Victim Identification standards.<sup>19</sup> According to these standards, priority is given to the identification process with the collection of primary identifiers (ie, fingerprints, DNA, and dental data) combined with external examination of deceased victims. This procedure accelerates the identification procedure by providing primary identifiers without expecting autopsies to be finalised. All data are compiled in one consolidated list of missing persons and a unique list of victims dead and injured (even those with identity documents) is issued based on daily work of the reconciliation and identification commission. For the victims admitted to hospital, we also obtained reconciliation of the identification number of the prehospital triage tags with the hospital admission number assigned on arrival at the hospital.

During and after the Paris and Nice attacks, many individuals required psychological care, irrespective of

|   | French actions   |
|---|--|
| (Continued from previous column)  |  |
| Terrorist attacks in an area with insufficient med  | ical resources   |
| Early activation of distant resources<br>(ie, regional, national, <sup>2</sup> or international)  | Done (regional and<br>national); to be<br>implemented<br>(international) |
| Identification of the victims   |  |
| New standard operating procedures for victim identification   | Done   |
| Reconciliation of the prehospital and hospital admission identification number  | Done   |
| Care of the <mark>psychological</mark> victims  |  |
| Improve our ability to care for a high number of victims over a longer period to prevent PTSD   | Ongoing  |
| Conduct clinical trials to test therapeutic<br>interventions to alleviate and suppress PTSD<br>symptoms   | Ongoing  |
| International medical network on terrorist attac  | ks   |
| Expert meetings to <mark>share experience</mark> and<br>implementation of new measures: UK, Spain,<br>Belgium, Germany, Denmark <mark>, Israel , USA</mark> , and Japan | Ongoing  |
| Unexpected terrorist innovation   |  |
| To be prepared to be surprised <sup>8</sup>   | Never enough<br>prepared   |
| The plans "used as a tools box" should authorise sufficient local or regional autonomy  | Never enough<br>prepared   |
| E <mark>ncourage innovation</mark>  | Never enough<br>prepared   |
| PTSD=post-traumatic stress disorder. EMS=Emergency A<br>CBRNE=chemical, biological, radiological, nuclear, and ex   | Aedical System.<br>«plosives.  |
| Table <mark>: Identified weaknesses</mark> during the recent Fre<br>in Europe and proposed solutions  | nch terrorist attacks  |

whether they had been wounded physically. These include victims, relatives of the victims, and staff of the different structures (medical or not) involved in the attacks or care of the victims. The role of the emergency medico-psychological units deployed by SAMU, which is usually recognised as important but was clearly not sufficient. Psychological care required a large mobilisation of psychiatrists and psychologists able to cope with acute stress. Practitioners must meet the needs of care of a continuous flow of patients over several weeks or months. The social and political demands for these treatments are very high and the media particularly highlight that point. One third of people involved either as direct victims, their families, or the first responders are likely to develop post-traumatic stress disorder (PTSD). Among those who develop PTSD, one third of them fail to recover after 10 years, causing substantial impairments in everyday functioning and quality of life.20 Mass casualty terrorist attacks present a unique opportunity to conduct clinical research to test therapeutic options to prevent or care for people with PTSD. One such trial is the PARIS-MEM study, which is using reconsolidation blockade to treat trauma-related disorders in victims involved in the

Paris and Nice attacks, their families, and first responders (NCT02789982).

An appropriate medical response does not only save lives but can improve the resilience of the population. It breaks the vicious circle between attacks and repression, provides a positive message of hope and strength, and mobilises the whole country. The medical response is an essential component of the response to terrorist attacks and is in fundamental opposition to terrorism's main objectives of aggression, fear, and panic. The medical community promotes organisation and quality of care for all victims, as close as those provided for a unique victim and including care providers and even terrorists. Because the war against terrorism is an international war, the medical response must be also international and we must share our experience and emergency plans to be able to better serve all of humanity.

## Contributors

All authors contributed equally to this report.

Declaration of interests

We declare no competing interests.

### Acknowledgments

We thank David Baker (Emeritus Consultant Anaesthesiologist, Department of Anaesthesiology and Critical Care, Hôpital Necker-Enfants Malades, Paris, France) for reviewing the report and Laurence Jacquenod (TICEMed, Faculty of Medicine, University Pierre et Marie et Curie, Paris, France) for the figure.

#### References

- Hirsch M, Carli P, Nizard R, et al. The medical response to multisite terrorist attacks in Paris. *Lancet* 2015; 368: 2535–38.
- 2 Wikipedia. https://fr.wikipedia.org (accessed June 24, 2017).
- 3 Carles M, Levraut J, Gonzalez JF, et al. Mass casualty events and health organisation: terrorist attack in Nice. *Lancet* 2016; 388: 2349–50.
- 4 Tourtier JP, Palmier B, Tazarourte K, et al. The concept of damage control: extending the paradigm in the prehospital setting. *Ann Fr Anesth Reanim* 2013; 32: 520–26.
- 5 Braun F, Carli P, Tourtier JP. Jack of all trades, master of none: Damage control is not the universal solution. Ann Fr Med Urgence 2016; 6: 373–74.
- 6 Service Médical du RAID (Recherche, Assistance, Intervention, Dissuasion). Médicalisation de l'extrême-avant au cours d'une intervention des forces de l'ordre pour prise d'otages: principes régissant la prise en charge médicale et retour d'expérience du RAID. Ann Fr Med Urgence 2015; 5: 166–75.

- 7 Philippe JM, Brahic O, Carli P, Tourtier JP, Riou B, Vallet B. French Ministry of Health's response to Paris attacks of 13 November 2015. *Crit Care* 2016; **20:** 85.
- 8 Lagadec P. Preventing chaos in a crisis. Strategies for prevention, control, and damage Limitation. Maidenhead, McGraw-Hill 1993.
- 9 French Republic. Arrêté du 21 avril 2017 relatif aux connaissances, aux compétences et aux maquettes de formation des diplômes d'études spécialisées et fixant la liste de ces diplômes et des options et formations spécialisées transversales du troisième cycle des études de médecine. https://www.legifrance.gouv.fr/eli/ arrete/2017/4/21/MENS1712264A/jo/texte/fr (accessed April 29, 2017).
- 10 Sockeel P, De Saint Roman C, Massoure MP, et al. The Main Gate Syndrome: a new format in mass-casualty victim "surge" management? J Chir (Paris) 2008; 145: 459–65.
- 11 Jacobs LM, McSwain NE, Rotondo MF, et al. Improving survival from active shooter events: the Hartford Consensus. *J Trauma Acute Care Surg* 2013; 74: 1399–400.
- 12 Braun F, Ammirati C, Auchères G, et al. Retour d'expérience des attentats du 13 novembre 2015. Organisation des renforts par les Samu de province. Ann Fr Med Urgence 2016; 6: 62–69.
- 13 The Guardian. MSF hospital in Syria hit by 'double-tap' barrel bombing. Dec 1, 2015. https://www.theguardian.com/world/2015/ dec/01/syria-msf-hospital-homs-barrel-bombing (accessed June 24, 2017).
- 14 French Republic. Décret No 2016-1327 du 6 octobre 2016 relatif à l'organisation de la réponse du système de santé (dispositif «ORSAN») et au réseau national des cellules d'urgence médicopsychologique pour la gestion des situations sanitaires exceptionnelles. https://www.legifrance.gouv.fr/eli/ decret/2016/10/6/AFSP1617819D/jo/texte (accessed April 5, 2017).
- 5 Gregory TM, Bihel T, Guigui P, et al. Terrorist attacks in Paris: surgical trauma experience in a referral center. *Injury* 2016; 47: 2122–26.
- 16 Fenech G, Pietrasanta S, Cresta J, et al. Rapport fait au nom de la Commission d'enquête de l'Assemblée Nationale relative aux moyens mis en œuvre par l'État pour lutter contre le terrorisme depuis le 7 janvier 2015. Registered on July 5, 2016. http://www. assemblee-nationale.fr/14/rap-enq/r3922-t1.asp (accessed Dec 24, 2016).
- 17 Prieto JL, Tortosa C, Bedate A, et al. The 11 March 2004 Madrid terrorist attacks: the importance of the mortuary organisation for identification of victims. A critical review. *Int J Legal Med* 2007; 121: 517–22.
- 18 Ludes B. Attentats du 13 novembre à Paris: premières considérations. Rev Med Leg 2016; 7: 2–4.
- 19 Cerriteli A. Interpol disaster victim identification guide, 2014. https://www.interpol.int/content/download/9158/68001/version/18/ file/INTERPOL%20DVI%20GUIDE.pdf (accessed June 24, 2017)
- 20 Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatr* 1995; 52: 1048–60.