

ARMED CONFLICT AND BURN INJURIES: A BRIEF REVIEW*

Atiyeh B.S.,¹ Hayek S.N.,² Gunn S.W.A.²

¹ Division of Plastic and Reconstructive Surgery, American University of Beirut Medical Center, Beirut, Lebanon

² WHO Collaborating Centre for Burns and Fire Disasters, Geneva, Switzerland

SUMMARY. Burns and fire disasters are sad but common and obligatory components of armed conflicts, and with the increasing sophistication of weaponry and of chemical and nuclear devices the problem is not set to disappear; on the contrary. Indeed, with the (fortunate) decrease of major international wars but with the (unfortunate) increase of smaller ethnic and sectarian but equally

As recent events show, no conflict is a fact of the past.¹ In the last century and in particular during the first years of this present century, each armed conflict has proved to be unique, particularly in its medical aspects, with its own features and teaching its own lessons.¹ Classical conflicts between opposing armies in open fields are from the past. The use of armoured vehicles since the First World War has created a subset of casualties with a different epidemiology from infantry soldier casualties.² Evolving tactics of urban warfare and terrorism using more complex, sophisticated and devastating weaponry as well as the emergence of fanaticism have raised the violence of present-day conflicts into an unprecedented sinister level of cruelty and barbarism. As always, and even more so, civilians, in particular children, constitute the majority of victims of present-day conflicts.

Burn injury is a ubiquitous threat in the military environment. Over the last hundred years, the burn threat in combat has ranged from nuclear weapons to small shoulder-launched missiles. Materials such as napalm and white phosphorus plainly present a risk of burn, but the threat extends to encompass personnel in vehicles attacked by anti-armour weapons, large missiles, fuel-air explosives, and detonations/conflagrations on weapons platforms such as ships.³

Sulphur mustard, a vesicant blistering agent producing chemical burns, has been used extensively in the past, and its potential use in present-day conflicts remains a significant threat that would result in a large number of casualties with severely incapacitating partial-thickness burns characterized by considerably slower wound healing.⁴ Large numbers of burn casualties were caused at Pearl Harbor, in Hiroshima and Nagasaki, in Vietnam, during the Arab/Israeli Wars, and in the Falkland Islands conflict. The threat

from burns is unlikely to diminish.³ Data regarding active duty soldiers injured in the Persian Gulf War revealed that burns constituted 6% of the injuries.⁵ Burn injuries constituted 2.5% in Afghanistan, 7.0% in Tadjikistan and 3.9% in Chechnya.⁶

In peacetime, burn injury combined with traumatic, chemical, or radioactive casualties is rarely encountered and often unrecognized; during conflict and disasters, burn injury is unlikely to be the only trauma.⁷ During an armed conflict, a wide range of patterns of wounding arising from combat and non-combat related military and civilian trauma and burns are seen and treated.⁸

The most vulnerable areas to burns are the parts of the body not usually covered: the face and hands.³ Mortality and morbidity of combined injury is higher than that of injuries separately. Severe burns in a battlefield setting have a very low salvage rate. The burden on military medical services in handling burn casualties is daunting as all physiological systems become affected.⁹ Unfortunately the field of combined injury is relatively unfamiliar to burn surgeons.¹⁰

The American Civil War was remarkable because of the contributions that were made to the development of systems for trauma care. The sheer magnitude of casualties required extensive infrastructure to support the surgeons at the battlefield and to care for the wounded.¹¹ Circumstances of any given war and the available medical resources dictate medical care delivered to war casualties. Medical care depends also on the importance that cultures or circumstances place on it. On the one hand, the "precious" casualty of western armies whose medical support is organized in a concept (forward medical and surgical care, ultra-rapid medical evacuation) tailored to each case, and as close as possible to the medical care of a civilian trauma patient whose models remain the North-American ballistic wound managed in trauma centres; on the other hand, civilian victims, in large numbers, in poor and dis-

* Presented at the 13th Meeting of the Mediterranean Council for Burns and Fire Disasters, October 2004, Nicosia, Cyprus.

organized countries, often abandoned to their own fate or sorted by "epidemiological" triage, which guarantees a distribution, as efficient as possible, of limited medical care. In war, advanced medical care and precarious medicine may work side by side according to two logics which do not exclude one another.¹

An optimal medical-evacuation system during local armed conflicts and wars is essential. The evacuation consists of two stages: initially to a first medical aid and resuscitation centre (Phase One), then to specialized medical care services (Phase Two).^{6,8} Experience of a UK reserve field surgical hospital during military operations in Iraq during March and April 2003 demonstrated the importance of the integration of surgical specialities and of consultant led and multidisciplinary teamworking in the treatment of military and civilian casualties from all sources and of all causes.⁸ Close integration of general, orthopaedic, plastic, maxillofacial, ophthalmic and neurological surgeons, and general and ITU anaesthetists allowed the delivery of a range of specialist treatment to a heterogeneous patient population, including children as young as 6 months and a lady in the advanced stages of pregnancy.⁸ The range

of casualties treated by the Defence Medical Services in the recent Gulf conflict has reaffirmed the important role of plastic surgery within the military.⁸

In an effort to determine whether new medical technologies or enhanced training might contribute to a reduction in armed conflict related deaths, causes of death viewed as most likely to be salvageable today include haemorrhage, severe burns, pulmonary oedema, and sepsis. The medical technologies most often mentioned to have a potentially lifesaving effect were ventilators/respirators, computed tomographic scanners, ultrasound, and antibiotics. Areas of training most often mentioned to have a potential impact on the salvageability of the trauma cases reviewed were damage control, ventilator management, liver packing, respiratory distress management, and burn management.¹²

Burn injury, though rarely isolated, will remain a major complicating factor of armed conflict related injuries. A multidisciplinary application of state-of-the-art modalities of burn management, coupled with the necessary humanitarian approach,¹³ will definitely have a positive impact on the morbidity and mortality of victims.

RÉSUMÉ. Les brûlures et les désastres par feu constituent des aspects tristes mais communs et obligatoires des conflits armés, et en considération de la sophistication toujours croissante des armements et des engins chimiques et nucléaires c'est un problème qui n'est pas destiné à disparaître ; au contraire. En effet, avec la diminution (heureuse) des guerres majeures internationales mais l'augmentation (malheureuse) des conflits ethniques et sectaires mineurs mais également perfides, les brûlures resteront sans aucun doute un problème constant.

BIBLIOGRAPHY

1. Houdelette P.: Current aspects of war surgery. From the trauma center to precarious medical care. *Chirurgie*, 122: 187-91, 1997.
2. Dougherty P.J.: Armored vehicle new casualties. *Mil. Med.*, 155: 417-20, 1990.
3. McLean A.D.: Burns and military clothing. *J.R. Army Med. Corps.*, 147: 97-106, 2001.
4. Rice P.: Sulphur mustard injuries of the skin. *Pathophysiology and management. Toxicol. Rev.*: 22: 111-8, 2003.
5. Dillingham T.R., Spellman N.T., Braverman S.E., Zeigler D.N., Belandres P.V., Bryant P.R., Salcedo V.L., Schneider R.L.: Analysis of casualties referred to Army physical medicine services during the Persian Gulf conflict. *Am. J. Phys. Med. Rehabil.*, 72: 214-8, 1993.
6. Sidel'nikov V.O., Paramonov B.A., Tatarin S.N.: Medical care for the burnt in modern local military conflicts. *Voen. Med. Zh.*, 323: 35-9, 2002.
7. Carsin H., Dutertre G., Le Bever H., Ainaud P., Le Reveille R., Rives J.M.: Multiple trauma and burns. *Cah. Anesthesiol.*, 43: 209-14, 1995.
8. Rew D.A., Clasper J., Kerr G.: Surgical workload from an integrated UK field hospital during the 2003 Gulf conflict. *J.R. Army Med. Corps*, 150: 99-106, 2004.
9. Sparkes B.G.: Mechanisms of immune failure in burn injury. *Vaccine*, 11: 504-10, 1993.
10. Kumar P., Jagetia G.C.: A review of triage and management of burn victims following a nuclear disaster. *Burns*, 20: 397-402, 1994.
11. Trunkey D.D.: History and development of trauma care in the United States. *Clin. Orthop.*, 374: 36-46, 2000.
12. Blood C.G., Puyana J.C., Pitlyk P.J., Hoyt D.B., Bjerke H.S., Fridman J., Walker G.J., Zouris J.M., Zhang J.: An assessment of the potential for reducing future combat deaths through medical technologies and training. *J. Trauma*, 53: 1160-5, 2002.
13. Gunn S.W.A.: The right to health of the burnt patient and fire victim. *Annals Burns Fire Disast.*, 17: 117-9, 2004.

This paper was received on 23 October 2004.

Address correspondence to: Bishara S. Atiyeh, MD, FACS, Clinical Professor Division of Plastic and Reconstructive Surgery, American University of Beirut, Beirut, Lebanon. Tel.: (916)-3-340032; fax (961)-1-363291; e-mail: aata@terra.net.lb