

Burn Care During Operation Desert Storm

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In anticipation of a mass burn casualty situation during Desert Storm, the US Army Institute of Surgical Research mobilized resources worldwide to ensure that care could be provided as early and as close to the scene as possible.

The response of the US Army Institute of Surgical Research (Fort Sam Houston, Texas) to the initiation of Operation Desert Shield on Aug 7, 1990 was guided by more than four decades of clinical experience in burn care, knowledge of the incidence of burn injury in prior wars, and experience in responding to peacetime military and civilian mass burn casualty situations necessitating intercontinental transfer of the patients generated by such disasters. On Sept 4, 1990, the Institute submitted a plan that defined the burn care teams necessary for the theater of operations and described a system of burn patient management that would provide timely resuscitation, effective triage, safe aeromedical transfer, and expansion of tertiary burn care facilities to ensure optimum definitive care to minimize mortality and maximize functional recovery.

To accomplish its assigned mission of providing all-inclusive care to the burned soldier, the Army burn center proffers its personnel continuous peacetime training in the care, triage and transfer of burn patients. A cadre of specialists trains personnel assigned to the Institute in all phases of burn patient management. Since major burns are best treated in facilities that specialize in the management of burn injury, soldiers and civilians with extensive thermal injury requiring intensive care are transported by the Institute's burn teams to the Army burn center form all over the world, utilizing multi-modal transportation, ie, ground ambulances for short distances, helicopters

for patients within a 200-mile radius and specially equipped fixed-wing aircraft for patients coming from more distant locations.¹⁻³ The comprehensive management of these patients, who have sustained extensive burns and associated inhalation and other injuries, affords a unique peacetime opportunity to learn the subtle intricacies of burn therapy and intensive care. Such patient experience is instrumental in imparting the skills required for the delivery of emergency care to burned soldiers in time of war.

The planning for the care of burns incurred during Operation Desert Storm was based on data generated from past armed conflicts and on the Institute's experience in the management of patients with burns in peacetime mass casualty disasters. The actual incidence of burn injury in combat casualties has ranged from 5% during the Vietnam conflict to 20% during the Falkland Islands operation, and it might rise to 70% with the use of thermonuclear weapons. These incidence figures define the extremes of burn casualty density, but the approximate 10% incidence of burns in the Israeli conflicts of 1965 and 1973 provides a more realistic estimate for use in planning for burn care in support of desert warfare. Though the incidence of burn injury has been relatively high in warfare involving armored fighting vehicles, the distribution of burn size has resembled that in patients with burns incurred during peacetime, with 70% to 80% of the injuries involving less than 20% of the total body surface area. Such a distribution indicates that the majority of thermal casualties can be cared for in a gen-

eral hospital setting, and that only a relatively small fraction will require burn center care.

On the basis of a United States and Canadian burn center survey and a consensus meeting of the Disaster Planning Committee of the International Society of Burn Injury, a field care burn team has been defined as consisting of a general or plastic surgeon, a registered nurse, two licensed practical nurses (clinical specialists) and a respiratory therapist. When provided with appropriate supplies and equipment, such a team can effect resuscitation during the initial 24 to 48 hours following injury, provide initial wound care and conduct triage for up to 50 burn patients having a typical distribution of burn size and co-morbid conditions. This team composition and its effectiveness were validated and confirmed by the experience gained when teams were dispatched in 1989 to assist in the care of more than 700 patients burned in the Ufa disaster in the USSR.⁴ This mission emphasized the importance of responsive logistical support, as was provided by the 7th Medical Command under the command of Maj Gen Richard T. Travis. It was also found that it was necessary to augment the basic team by the addition of an anesthesiologist, a microbiology section, and physical and occupational therapy personnel to provide adequate total care and fully address initial rehabilitation needs.

To receive and treat burn casualties sustained during Operation Desert Storm, the US Army Institute of Surgical Research implemented a three-dimensional strategy that consisted of

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expansion of tertiary care US burn facilities, organization of triage capability in Europe and establishment of burn units in the theater of operations. The availability of tertiary burn beds in the United States was ascertained in collaboration with Dr. Anthony A. Meyer, Chairman of the American Burn Association Regionalization Committee. Working closely with Dr. Meyer, Army burn center personnel identified sufficient burn center beds to accommodate the number of major burns expected on the basis of casualty estimates, and maintained an updated list of such beds available within an approximate 50-mile radius of each designated Army casualty receiving center. Concurrently, the peacetime operational capacity of the Army burn center was initially increased from 40 to 80 beds, with plans for further expansion if required. Such commitment considerably taxed the finite manpower resources of the Institute. A decision, nevertheless, was made to deploy burn teams to Saudi Arabia and to dispatch one senior physician to Landstuhl Army Regional Medical Center in Germany. It was understood that teams sent to Saudi Arabia would be attached to fully staffed TO&E units operating in well equipped, fixed hospitals within the theater of operations. In light of that information and because of the need to expand the capacity of the tertiary care facility at the Army burn center simultaneously, it was necessary to reduce the team membership by one licensed practical nurse so that each team consisted of a general surgeon, a registered nurse, a licensed practical nurse and a respiratory therapist. Attachment of such teams to fully staffed, appropriately equipped hospitals was expected to enable the team members to establish a specialized burn care capability, conduct the necessary on-the-job training of additional personnel detailed by the receiving unit to assist in burn care, and accompany patients with major burn injury during aeromedical transfer to a burn holding unit established at the Landstuhl Army Regional Med-

ical Center.

One senior surgeon was deployed to the Landstuhl Army Regional Medical Center to set up a staging facility from which he would coordinate and direct the flow of burn casualties to various burn centers in the United States. To provide burn care in the theater of operations, two burn teams were initially deployed to Saudi Arabia on Jan 16, 1991, the day Operation Desert Shield phased into Operation Desert Storm. For full geographic coverage, it was necessary to dispatch a third team shortly thereafter.

The three burn teams, in their advisory and treatment roles, established treatment facilities at strategic locations (Dhahran, Hafar-al-Batin and Riyadh) where burned soldiers could be resuscitated and stabilized prior to transfer to the staging facility in Germany. Dhahran is a coastal city on the Persian Gulf bordering Kuwait, Hafar-al-Batin borders Iraq and is home to the armed forces of the Gulf Cooperation Council, and Riyadh, the capital city, is the seat of the Saudi Kingdom. Fortunately, the existing fixed facilities included burn units that were available for occupancy at the King Fahad Military Medical Complex in Dhahran, the King Khalid Military Medical City in Hafar-al-Batin and the King Fahad National Guard Hospital in Riyadh. The burn units at all three hospitals were owned and operated by the Saudi Arabian government but were not fully staffed until the teams arrived.

Each burn team met the challenge of preparing the existing facilities to receive and treat burned patients by training the United States Army staff at those hospitals. Groups of physicians, nurses, respiratory therapists, physical and occupational therapists, and laboratory and x-ray technicians with interest in the care of critically ill patients were identified among the United States National Guard and Reserve personnel deployed to those facilities. To enhance readiness for burn care, multidisciplinary educational programs were set up that combined di-

dactic teaching, seminars, workshops, group discussions and hands-on training in the proper use of ventilators and monitoring and infusion devices. Physicians were taught the assessment and management of thermal injury and nursing personnel were instructed in burn wound management and other patient care-related topics. Continuing education focused on evaluation of severity of injury, recognition and timely treatment of life- and limb-threatening complications, and the essentials of fluid therapy, triage and stabilization of thermally injured soldiers. By mid-February, trained teams of dedicated medical and paramedical personnel were available at each of the three hospitals.

In addition to the in-theater burn teams, an experienced surgeon was dispatched at the request of Maj Gen Michael J. Scotti, Jr., Commander, 7th Medical Command, to direct the operations of a burn holding facility at Landstuhl Army Regional Medical Center, conduct any necessary triage and facilitate the transfer of patients with major burn injury to tertiary burn centers. The aeromedical transfer of such patients was coordinated between the United States Air Force Military Airlift Command and the Army burn center. Burn flight teams were to be dispatched as needed from the Army burn center to return with these patients, maintaining continuity of care during aeromedical transfer; this system was used quite successfully in transporting patients from the Far East to the Army burn center during the Vietnam conflict.

All teams remained in the theater until the war ended. In Saudi Arabia, 64 burn patients (31 combat injuries and 33 noncombat burns) were treated (Table I). Theater policy dictated evacuation of injured soldiers unable to return to duty within 14 days of injury during the air strikes, and within seven days during the ground war. This necessitated prompt evacuation of all seriously burned United States soldiers from Saudi Arabia. To ensure safe transfer and continuity of care,

Table 1. Burn Patients Treated by Institute Teams in Saudi Arabia.

Component	Number of Patients
United States Active Duty	35
Arab Alliance Active Duty	13
Enemy Prisoners of War	8
Arab Civilians	8
Total	64

members of the burn teams accompanied patients during aeromedical transfer on four occasions, once within the Saudi Kingdom and three times to Germany. After evacuation of United States soldiers from the burn units in Saudi Arabia, the Institute's teams continued to provide burn care for Arab soldiers and civilians and Iraqi prisoners of war. Among these were patients with full-thickness skin injuries needing excision and grafting, which was performed with difficulty due to a shortage of equipment and supplies. The physician at the staging facility supervised management and transfer of 27 critically ill burned soldiers. Thirty-six critically ill burned soldiers were admitted to the Army burn center for definitive care, nine reaching the center by routes

other than the Landstuhl facility.

Because of its abbreviated nature, the 100-hour ground war did not afford the military medical community a good test of the effectiveness of training, equipment and personnel performance under prolonged conflict or mass casualty conditions. Our minimal losses (148 killed in action and 458 wounded in action) made our medical assets, logistical support and aeromedical transport capability not only abundant but, perhaps, superfluous for the management of burns and other casualties. This windfall, however, did not test the sufficiency of support had the projected number of casualties, 30,000 to 40,000 injured including 15,000 killed in action, been realized.⁵ Our overwhelming military success in the Persian Gulf

war should not make us complacent about our medical readiness for war. To insure such readiness, we must continue peacetime medical training and research, for it is possible that this anomalous war may have failed to uncover deficiencies in our medical training and support assets.

REFERENCES

1. Pruitt BA Jr: Improvements in burn care (editorial). *JAMA* **244**:2090, 1980.
2. Moylan JA Jr, Pruitt BA Jr: Aero-medical transfer. *JAMA* **224**:1271-1273, 1973.
3. Treat RC, Sirinek KR, Levine BA, et al: Air evacuation of thermally injured patients: principles of treatment and results. *J Trauma* **20**: 275-279, 1980.
4. Becker WK, Waymack JP, McManus AT, et al: Bashkirian train-gas pipeline disaster: the American military response. *Burns Incl Therm Inj* **16**: 325-328, 1990.
5. Gunby P: Another war ... and more lessons for medicine to ponder in aftermath. *JAMA* **266**:619-621, 1991. ●