

Case Report

Role of Plastic Surgery in the Treatment of War Injuries

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ABSTRACT

War is a man made calamity and innocent human beings are its unfortunate victims. While nations engage in war, neighboring countries can be of great help in providing proper and prompt medical treatment. During the 2003 Iraqi liberation war, 11 patients were treated at the Al-Babtain Center for the following injuries: bullet injuries - two, rocket propelled grenade injury - one, war related burns and blast - six and kerosene burns at home - two. Only four patients were adults, while the rest were all under the age of 18 years. Twenty-seven surgical procedures were undertaken in these patients, which

included skin grafting, bone grafting, local flaps and free flap reconstruction. The authors recount their experience in the management of these patients and stress on the difficulties faced due to the delayed resuscitation in burn patients, inadequate medical facilities in the war zone and late transfer to centers with better medical facilities. Though plastic surgery played a major role a multidisciplinary team comprising of multiple specialties is needed in managing these patients. The treatment of these cases also highlights how neighboring countries can efficiently provide medical relief to unfortunate victims of war.

KEYWORDS: burns, micro-vascular surgery, war injuries

INTRODUCTION

Since the beginning of civilization, human beings have engaged in conflict for preservation of self and personal possessions or in the interest of fame, power and politics. While in the early ages, wars were mostly fought during fixed hours by armies with limited arms in the battlefield, the invention of gunpowder and high velocity delivery systems brought unlimited casualties with gunshot, burns and blast injuries. Besides 'carpet-bombing', global positioning satellites have enabled laser-guided missiles and bombs to destroy entire localities, in the bargain causing enormous damage, death, destruction and untold misery to innocent civilians uninvolved in the conflict. In addition, mechanical errors and human errors have also increased the incidence of 'collateral damage'. With each conflict the need for military medical care increased and new developments took place rapidly especially in the field of neurosurgery, orthopedic, general, cardiothoracic, maxillofacial and plastic surgery. Following World War I and II, physical medicine and rehabilitation became adjuncts in the treatment of military orthopedic casualties; artificial limb services were set up and workshops and factories for vocational rehabilitation were created^[1]. While military medicine and rehabilitation improved at an amazing pace,

treatment of civilian casualties took a backseat, possibly due to the large and widespread civilian population, unpredictable attacks by misguided missiles and bombs, inadequate governmental policies, financial constraints and lack of visionaries. The authors present 11 victims of war treated at the Al-Babtain Center to highlight their difficulties in finding prompt treatment and the ensuing complications while discussing the management.

During the four-week period of the 2003 Iraqi war, 11 casualties were treated at the Al-Babtain Center in Kuwait (Table 1). All relevant data was entered into a personal computer using standard data entry software. Five consultants, four senior registrars and six registrars were divided into teams for triage, surgery and ward management. While all regular nonemergency work was suspended, four surgical theaters were made available to manage the war casualties. Four patients were adults while the rest were below the age of 18 years (range 4 - 45 years). Eight patients were male. Four patients suffered burn injuries out of which, two were from kerosene burns at home. The remaining two suffered flame burns due to air raid bombing. While three of the burn patients had inhalation injury, most of the burns were deep dermal to full thickness burns (range 35-75% TBSA).

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Table 1: Clinical data of 11 patients

Patient	Age	Sex	Diagnosis	Treatment	Complication
1	45	M	50% TBSA burn, inhalation injury	Skin grafting, gastrostomy	Septicemia, MOF, death
2	14	M	Blast injury, amputation- right upper limb, below knee amputation- left lower limb exposed right ankle joint shrapnel wounds	Skin grafting, free latissimus dorsi myocutaneous flap	
3	6	M	Blast injury- face, ruptured left globe, extensor tendon injury	Skin grafting, forehead flap, left globe removal, tendon repair	
4	40	M	Bullet injury partial loss of zygoma, maxilla ,nasal bones fracture humerus, radius and ulna with tissue loss.	Skin grafting, tissue expander, forehead flap, local flap	
5	12	M	35% TBSA burn, infected wounds, amputation both upper limbs	Skin grafting	
6	21	M	Grenade injury, amputation- right limb, tissue loss, pneumothorax and fracture- ribs, fracture- right tibia fibula, fracture- right femur	Skin grafting, local faciocutaneous flap	
7	16	F	52% TBSA burn and blast injury, inhalation injury	Skin grafting	Septicemia respiratory failure, sacral pressure sore
8	4	F	Blast injury, fracture phalanx, wound abdomen, forearm	Skin grafting, wound closure	
9	11	M	Blast injury, skin loss- face, sternum, right foot, Left globe injury, fracture- right tibia Fibula, fracture- left tibia	Skin grafting, local flap reverse sural flap, wound closure	
10	15	M	Bullet injury, wound- left leg, fracture- left tibia	Skin grafting, free latissimus dorsi flap	
11	30	F	75% burns		Septicemia MOF, DIC, death

TBSA= total body surface area, MOF = multi-organ failure, DIC = disseminated intravascular coagulation

Three patients had maxillofacial injuries with additional trauma to the globe. Besides soft tissue loss, facial fractures were noticed in two of these patients. Six patients had upper extremity injury: fractures - two, amputation - three, tendon injury - two and soft tissue loss - two. Lower extremity trauma occurred in five patients: compound fracture - five, soft tissue defects - four and below knee amputation - one. Other associated injuries included penetrating chest trauma - one, abdominal injury - one and urethral injury - one. Twenty seven surgical procedures were carried out in these patients. Soft tissue loss was treated by local and regional flaps, which included advancement flap - two, rotation flap - two, forehead flap - two; distally based faciocutaneous flap in the lower limb - one and reverse sural faciocutaneous flap - one. Free microvascular flaps were done in two patients with soft tissue loss and exposure of vital structures. Burns patients underwent escharectomy and skin grafting, which included homografts and autografts.

Out of 11 patients, two patients with burns expired. The first patient was a forty-five-year-old male with 50% TBSA burn and inhalation injury. He was admitted on the 25th post burn day to our center with respiratory failure, pneumonia, atrial

fibrillation and septicemia. Though he was managed aggressively and underwent three surgical procedures of skin grafting and gastrostomy, he died following septicemia and multi-organ failure. The second patient was a thirty-year-old female with 75% TBSA burn. She was admitted to our center with respiratory, cardiac and renal failure, along with disseminated intravascular coagulation and septicemia. She died on the same day of admission. Out of 11 patients treated, three representative case reports are presented here.

CASE REPORTS

Patient 1:

UJ, a forty-four-year-old male Iraqi was admitted to our hospital, three days following gunshot injury, which involved the face and left forearm. The facial wound, which had soft tissue loss coupled with maxillary, zygomatic and orbital fractures, was debrided in Iraq (Fig. 1a). External fixators had been applied to the left forearm to stabilize the fractures of the radius and ulna. In the first stage, it was decided to debride and close the facial wound. Following this procedure, nasal reconstruction was carried out with an expanded



Fig. 1a: Photograph showing facial wound following gunshot injury

forehead flap (Fig 1b). The flap was divided and excess tissue was used to enhance the soft tissue defect of the cheek. Additional bone grafting was done to correct the facial fractures (Fig. 1c). The ophthalmologist exenterated the eye and an ocular prosthesis was put in place. The raw area over the forearm was skin grafted and the external fixator was removed when radiological healing of the radius and ulna was observed. Although the movement at the radio-ulnar joint was restricted, both elbow movements and hand function were adequately preserved. Though the patient returned to Iraq following this treatment, he will need further reconstructive and touch - up procedures.

Patient 2:

AM, a fourteen-year-old male Iraqi boy was involved in a blast injury in Iraq on 6th April 2003. He was treated and operated in a field hospital in Iraq and later at the Al-Razi Hospital in Kuwait for the following problems - traumatic amputation of the right upper limb at the level of the wrist joint, below knee amputation of the left lower limb, multiple shrapnel wounds and scrotal laceration. In addition, the patient had a large wound on the right ankle with an exposed ankle joint, stabilized by external fixators, which needed soft tissues cover (Fig. 2a). He was transferred to the Al-Babtain Hospital where, he underwent a free microvascular



Fig.1b: Photograph showing repaired facial wound and expander inserted in the forehead region.



Fig. 1c: Photograph showing nasal reconstruction using the expanded forehead flap.

latissimus dorsi flap with peripheral skin grafting to cover the exposed right ankle joint. The thoracodorsal artery was anastomosed end to side with the anterior tibial artery and thoracodorsal vein anastomosed end to end with the vena comitantes. Postoperatively the flap and peripheral graft survived in-toto (Fig 2b). The external fixator was later removed and the ankle was supported by a plaster of Paris cast. Finally, prior to his discharge, artificial limb specialists in Kuwait took measurements to provide him with a prosthetic right hand.

Patient 3:

AI, a twelve-year-old Iraqi boy was admitted to our center on 16th April 2003, with a history of being involved in a missile explosion in Iraq, which caused traumatic amputation of both upper limbs and 35% burns affecting the anterior and posterior trunk, flank and shoulders. He was admitted in a critical condition with anemia, shock, sepsis and severely infected third degree burn wounds (Fig 3a). Following resuscitation and antibiotic therapy (piperacillin and amikacin), he was operated on the same day under general anesthesia by escharectomy and homograft skin cover. Methicillin resistant



Fig. 2a: Photograph showing wound on the right ankle with exposed ankle joint, stabilized by external fixators



Fig. 2b: Photograph showing a healed free latissimus dorsi microvascular transfer to cover the exposed ankle joint with peripheral skin grafting.

staphylococcus aureus and acinobacter were isolated from the blood culture and following treatment with vancomycin and imipenem, his general condition improved remarkably. On 27th April 2003, he underwent a second operation where 80% homograft skin was removed and replaced by auto graft skin meshed in a ratio of 1.5:1, that was harvested from the back and posterior thighs. A week later, he underwent a third operation where the homograft skin of the lower abdomen was removed and replaced by autograft skin from both thighs and right leg, meshed in the ratio of 1.5:1. Post operatively all the skin grafted sites and donor areas healed (Fig. 3b) and he was subjected to intensive physiotherapy of both the amputated stumps and lower limbs. Cream applications and pressure garments to improve the scars were provided for the trunks and arrangements for artificial limb prosthesis were made.

DISCUSSION

Burns form a major cause of injury in war casualties since all forms of explosives can result in fire. Burn civilians in the war zone may not get prompt attention and treatment as happened in all our burn patients. When resuscitation is delayed, hypovolemic shock and subsequent complications may result. Most of the burn patients transferred to our center, were hypovolemic, anemic, septic and with infected wounds. We have successfully used the Parkland formula for burn resuscitation in our

center for the last twelve years. Colloids are added on after the first twenty-four hours or occasionally after the first eight hours depending on the clinical condition and laboratory parameters. However, in war zones, civilians should be resuscitated with available fluids based on different standard formulae. Sepsis is an important factor that burn patients suffer from, as the burn eschar forms a fertile ground for microorganisms to thrive on. This needs strict clinical observation and microbiological surveillance, wound swab and cultures. Early excision of burn eschar and treatment with specific antibiotics is now well known to help decrease sepsis in burn patients. Again, prompt transfer facilities from the war zone for civilians may not be available. Since the Vietnam War, a refined system for the triage, management and evacuation of wounded military personnel was developed so that a wounded soldier could actually be at a well-equipped base hospital within minutes after injury with more than 90% chance of survival^[2]. All national army medical services have evolved organizations to reduce the time lag between injury and surgery for their wounded and helicopters are almost universally used for the evacuation of seriously ill casualties when this is practicable^[3]. However, in civilian patients this mechanism of prompt transfer appears to be lacking and may not be feasible due to the large civilian population. Patient 11 was transferred in septicemia and multi-organ failure. While she was on mechanical



Fig. 3a: Photograph showing the patient on admission with third degree infected burns on the anterior trunk.



Fig. 3b: Photograph showing healed burns wound over the anterior trunk following skin grafting.

ventilation, pressure supports and in renal failure, she expired on the same day of admission. Patient 1 also was transferred in a similar situation and succumbed later from septicemia and multi-organ failure. Early excision of the burn eschar with skin grafting, isolation of the infecting organism and treatment with specific antibiotics were instrumental in the survival of patient 5 who additionally suffered blast injury with amputation of both upper limbs and developed septicemia. Again, nutritional status of all these patients was appalling on admission and all of them needed hyperalimentation to build them up.

Bullets, grenades, bombs and missiles are integral part of any war and cause serious injuries to civilians. Children are mostly wounded by shelling, bombing or by left over explosive devices^[4]. Four children had partial or complete amputation of their upper or lower limbs. External fixators now allow for rapid immobilization of fracture sites and secure transfer to hospitals for appropriate treatment. Microvascular tissue transfer provides immediate coverage and early rehabilitation when compared to pedicled flap cover. Patient 2 and 10, suffered blast injury and underwent successful free microvascular flap cover. This allowed early healing, physiotherapy, rapid mobilization and reduced hospitalization. The management of thoracic trauma by ballistic agents can be very challenging as seen in patient 6 who suffered blast injury with amputation of the right upper limb at the shoulder joint along with penetrating chest trauma and pneumothorax. He needed skin grafting to cover the raw area and local flaps to cover the exposed shoulder joint. The chest trauma was managed conservatively with insertion of intercostal drain by the chest surgeon and the patient recovered completely. Sir Harold Gilles refined his techniques and laid down some of the basic principles of maxillofacial trauma and plastic surgery in World War I. Explosives can cause severe

injury to the eyes and in one study, 38.9% of casualties with gunshot injuries of the eyes underwent enucleation or evisceration^[5]. Three of our patients had globe injury, which resulted in removal of the globe in two of them. Replacement of soft tissue loss and accurate reconstruction of bony defects form the basis of maxillofacial trauma management.

“Forward psychiatry” which relied on three principles: proximity to battle, immediacy, and expectation of recovery, was devised in World War I for the treatment of shell shock and today is the standard intervention for combat stress reaction^[6]. Such forward psychiatry may not be possible with civilian casualties due to the vast civilian population. Our patients manifested with acute stress reaction, aggressiveness, depression and increase in reactive anxiety levels, which needed counseling and psychiatric treatment at various stages during the management. The possibility of chronic disorders such as post-traumatic stress disorder (PTSD) may occur in these patients and they need to be appropriately followed up on their return to the home country. Relatives of the patients who accompanied them during their treatment in Kuwait also needed support from social workers and clinical psychologists. Rehabilitation services have developed partly in association with war and the experience of rehabilitating war casualties supplied valuable principles and practices to rehabilitation medicine, enriching the specialty and contributing to the health care systems of the involved countries^[1]. Rehabilitation plays a vital role in multi-trauma patients and helps them gain functional independence, self-confidence and feeling of psychological well-being. Inadequate physiotherapy may lead to stiff joints, chest infections and even bedsores as happened in patient 7 who needed surgical debridement and flap reconstruction. An appropriately staffed hospital, efficient surgical techniques and the presence of highly skilled specialists from different

specialties working as a multidisciplinary team, depending on the patient's need, is essential for the successful treatment of civilian casualties. While the goal of the hospital emergency plan is to provide severely injured patients with a level of care that approximates the care given to similar patients under normal conditions, discrete-event computer simulation and war game tabletop exercises for key personnel are two new modalities that are supplementing the traditional mock disaster drill as effective planning and training tools^{7]}. Though we did not face a patient with a nuclear biological or chemical injury, it is important that civilian medical responders be adequately trained to face such contingencies in the future.

CONCLUSION

Prompt first aid, which includes securing the airway and breathing, insertion of intravascular line and fluid resuscitation, controlling hemorrhagic shock, immobilization of fracture sites and immediate evacuation through joint operations planning between essential service teams to centers with better treatment facilities where a multidisciplinary team treats these patients, are important factors in civilian casualty management. Though Kuwait is in

close proximity to Iraq and air, land and sea routes were used to transfer patients, being a war zone, transfer was delayed. The management of these patients highlights the fact that during war times, neighboring states can be of great help in providing medical facilities so that innocent lives may be saved.

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