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Lessons Learned from War: A Comprehensive Review of the Published Experiences of the Iranian Neurosurgeons During the Iraq-Iran Conflict and Review of the Related Literature


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Key words

- CNS infection
- Iraq-Iran conflict
- Penetrating head wound
- Peripheral nerve injury
- Posttraumatic epilepsy
- Spinal injury
- Traumatic aneurysm
- War

Abbreviations and Acronyms

- CNS:** Central nervous system
CSF: Cerebrospinal fluid
CT: Computed tomography
GCS: Glasgow Coma Scale
OEF-A: Operation Enduring Freedom–Afghanistan
OIF: Operation Iraqi Freedom
PHW: Penetrating head wound
PTE: Posttraumatic epilepsy
SCI: Spinal cord injury
TA: Traumatic aneurysm

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■ **BACKGROUND:** This study sought to review the articles published by Iranian neurosurgeons regarding their experiences during the Iraq-Iran conflict and compare them with reports from other conflicts.

■ **METHODS:** We searched databases (MEDLINE and 2 Iranian databases, namely IranMedex and Scientific Information Database, up to December 2011) and references for relevant studies. The search terms included Iran, Iraq, conflict, battle, war, traumatic aneurysm (TA), posttraumatic epilepsy (PTE), brain infection, penetrating head wound (PHW), cerebrospinal fluid (CSF) leakage, spine injury, and peripheral nerve injury.

■ **RESULTS:** Twenty-eight articles were found that presented PHW, development of TA, infections, PTE, and peripheral nerve injuries. There were 2 different protocols for management of PHWs: radical surgery and minimal debridement protocol. The overall central nervous system infection rate was 10%. The cumulated incidence of TA was 6%.

■ **CONCLUSIONS:** Conservative minimal debridement of the wounds is indicated in patients with small entrance wounds, or those with Glasgow Coma Scale score ≥ 8 and no progressive neurological deficit. To diagnose TA before rupture, angiography is indicated in patients who have shells or bone fragments pass through the crowded vasculature, or have large/delayed hematoma, or if the surgeon has high index of suspicion based on neuroimaging and early debridement surgery. Surgery in a well-equipped nearby hospital after quick and safe evacuation of the victims by trained salvaging ancillary groups and the administration of broad-spectrum antibiotics and proper antiepileptics decrease the morbidity and mortality of casualties after PHW in war situations. The biases of the case selection, data collection, and confounders, and decreasing biases by conducting blinded controlled clinical trials, are discussed.

INTRODUCTION

Appropriate neurosurgical management of victims in war situations is controversial. War injuries have been recognized as one of the main causes of different types of severe physical, psychological, and social injuries in all nations. The Iraq-Iran conflict started in September 1980 and ended in July 1988. About 200,000 deaths and more than 400,000 injured people have been the humanitarian damage to the Iranian community (80). This situation was a great unfortunate opportunity for Iranian neurosurgeons to reevaluate what they had learned about managing the problems of war victims from the previous wars regarding management strategies in acute-stage, early, and late complications of injuries and their outcomes. In this review, we have appraised these neurosurgical articles, highlighted important aspects of the experiences of authors in these regards, and made a critical overview comparing the achieved outputs with similar reports from similar events during the last century.

METHODS

To find the articles related to the Iraq-Iran conflict, we searched MEDLINE and 2 Iranian databases: IranMedex (indexing articles published in Farsi medical journals containing English abstracts) at <http://www.iranmedex.com> and the Scientific Information Database at <http://www.sid.ir>. They were searched using the keywords Iran, Iraq, conflict, battle, war, traumatic aneurysm (TA), posttraumatic epilepsy (PTE), brain infection, penetrating head wound (PHW), cerebrospinal fluid (CSF) leakage, spine injury, and peripheral nerve injury. All articles were reviewed by the authors; those related to our topic were selected and full texts were studied, followed by a hand search in the related references and personal contact with authors. Meanwhile, the world literature was searched using the same key words and the full texts of the reports from similar battles that happened during the last century were studied.

RESULTS

According to our search in the available literature, 500 articles have been published internationally by Iranian researchers regarding the medical and surgical problems encountered during the Iraq-Iran war,

among which 30 refer to the issues related to neurosurgical practice. Twenty-eight of 30 articles have been written by Iranian neurosurgeons. Aarabi et al. (1-8, 10, 11) and Amirjamshidi et al. (16-18, 74) published 10 (35%) and 5 (17.5%) of these articles, respectively. Among the published articles, 8 (28.5%) reported the aneurysmal complications of war-induced injuries (2, 7, 15, 16, 18, 23, 74), 5 (17.5%) reported the infectious complications (1, 3, 9, 10, 37), 1 article (3.5%) discussed the management of PHW after low-velocity penetrating war injuries (17), and 2 articles (7%) concerned epileptic complications (11, 36). The remaining articles were about brainstem injuries (5), comparative study of surgical and conservative management after missile-induced spinal cord injury (SCI) (8), craniocerebral missile injuries (13), gunshot injuries to the brachial plexus (84), cranioplasty (22), quality of life in blind survivors of war and SCI veterans (61, 80), cauda equina lesions (65), and surgical mortality and outcomes in missile head injuries in war situations (4, 6). Following are the policies undertaken by neurosurgeons during the Iraq-Iran war.

Transportation and Management Protocol in the Frontiers

During the Iraq-Iran war, transporting the victims from the static lines of campaign and wide regions of conflict (1, 6, 8) could be achieved mostly via surface to several 4-bed ambulant stations 1 mile away from the front line (1, 3, 6, 8); helicopters were rarely used and no mobile medical care unit was used (6). Thereafter, patients were transferred to a second location about 5 miles away, where 2 general surgeons were available for life-saving surgical procedures (insertion of endotracheal tube, chest tube, and primary handling of the bleeding wounds) (3, 4), and administration of antibiotics (8), antiepileptics, and dexamethasone (2-4, 8, 17). Victims were then transported to base hospitals almost always by ground, about 200 miles from the front line, where computed tomography (CT) scans were done after primary survey and stabilization of hemodynamic and respiratory conditions. Then, appropriate surgical/neurosurgical procedures were performed (8, 17). Aircraft transported patients to major city hospitals after proper possible surgical care; in case of overflow of the injured patients, resulting in limitations on

proper surgical interventions; and in cases of severe spine injuries demanding complex surgical interventions and instrumentations (4, 8, 9). The mean time to transport an injured patient to arrival at a main city hospital was about 40 to 49 hours (3, 8, 11).

Following Steps in Management Protocol

Wound Care. There were 2 main approaches undertaken for treatment of in-driven foreign bodies after missile head wounds: conservative minimal debridement management and radical surgery (1, 4, 17, 18). In radical management, all pulped brain and hematoma were removed and every effort was made to withdraw bone fragments; however, in cases with metal fragments crossing the midline or situated deep enough to make them surgically inaccessible, they were either not removed or left for a second intervention (1, 4, 17). A conservative approach was performed in some centers (17). Accordingly, patients with the following criteria were not debrided radically: small entrance wound <2 to 3 cm, Glasgow Coma Scale (GCS) score ≥ 8 , and no rapid deterioration in the level of consciousness. In such patients, the wound was simply debrided and sutured and the patient was transferred to the secondary medical care center (17). Moreover, the presence of a clump of debris, contused brain, or in-driven bone and metal fragments in the absence of a progressively enlarging mass or hematoma might not warrant immediate vigorous surgical interventions (17). A second surgery was undertaken inevitably in the following cases (1, 9, 10, 17):

- Impending herniation or evidence of brainstem compression
- Confusing or illegible operative notes of front line surgeon
- CSF leakage from the wound and/or skull base
- Presence of a high amount of foreign material, especially clothes, bone, shell, or bullet fragments
- The undesirable condition of scalp wound (wound being under tension)
- Late infectious complications such as abscess or meningitis confirmed to be induced by retained foreign materials.

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