Presentation, Diagnoses, Mechanisms of Injury, and Treatment of Soldiers Injured in Operation Iraqi Freedom: An Epidemiological Study Conducted at Two Military Pain Management Centers

LTC Steven P. Cohen, MD*‡, MAJ Scott, Griffith, MD†‡, LTC Thomas M. Larkin, MD†‡, MAJ Felipe Villena, DO§, and Ralph Larkin, PhD‖

*Department of Anesthesiology and Critical Care Medicine, Johns Hopkins Medical Institutions, Baltimore; †Department of Anesthesiology, Uniformed Services University of the Health Sciences, Bethesda, Maryland; ‡Department of Anesthesiology, Walter Reed Army Medical Center, Washington, DC; §Pain Management Center, Landstuhl Regional Army Medical Center, Landstuhl, Germany; and ‖John Jay College of Criminal Justice of the City University of New York

In recent military conflicts the major source of soldier attrition has not been battle injuries but more mundane causes similar to those encountered in civilian life. In an effort to determine the pain conditions affecting soldiers during wartime, we conducted an observational study among 162 soldiers medically evacuated from Operation Iraqi Freedom who were referred to 2 large pain treatment centers located outside the theaters of combat. Fifty-three percent of soldiers presented with either radicular ($n = 49$) or axial ($n = 37$) low back pain, with lumbar herniated disk being the most frequently diagnosed condition (24%). The two most implicated etiologies were exacerbation of a previous pain condition treated with surgery (15%) and motor vehicle accidents (12%). Only 17% of patients were injured during battle. Seventy-two percent of soldiers received at least one nerve block/injection, the most common of which was lumbar epidural steroid administration (22%). Nonsteroidal antiinflammatory drugs were prescribed to 56% of patients, opioids to 49%, and some form of alternative therapy to 17%. Among the 49 patients in whom data were available, only 2% returned to combat duty in Iraq. With the exception of battle-related injuries, the pain conditions suffered during modern warfare seem to be similar to those encountered in civilian pain clinics. To improve the return-to-duty rate, better preventive measures and more aggressive treatment conducted in forward-deployed medical units are recommended.

(Anesth Analg 2005;101:1098–103)

Wars have been fought since the beginning of recorded history. Throughout time, the casualties of war have transcended all geographical, ethnic, and cultural boundaries. Although the methods of warfare have changed, the injuries that result have remained constant over time. Some of the most mystifying pain conditions were first described by army surgeons. These include the first distinction between phantom limb pain, phantom sensations, and stump pain by the 16th century French military surgeon Ambrose Pare (1) and the landmark accounts of causalgia by Weir Mitchell during the American Civil War (2).

Surprisingly, the major cause of attrition in recent wars has not been battle-inflicted injuries but more ordinary conditions such as accidents and musculoskeletal complaints (3,4). In civilian life, pain, especially involving the low back, is the primary cause of work-related disability (5). Although the percentage of soldiers rendered nondeployable because of pain has not been studied, it is surmised that this number is substantial. In the military, the mission of the medical corps is a simple one: to preserve the fighting force. Conceivably, the treatment of routine, painful conditions in the field would greatly benefit armies by conserving personnel, reducing logistical expense, and, possibly, saving lives. Considering these factors, this study was performed to determine the presenting complaints, diagnoses, and types of treatment administered in the pain management centers of two tertiary care, military treatment facilities among evacuated soldiers engaged in Operation Iraqi Freedom (OIF).

Accepted for publication April 21, 2005.

Address correspondence and reprint requests to Steven P. Cohen, MD, Johns Hopkins Medical Institutions, 550 North Broadway, Suite 301, Baltimore, MD 21205. Address e-mail to scohen40@jhmi.edu.

DOI: 10.1213/01.ane.0000169332.45209.cf

0003-2999/05

Methods

Permission to conduct this observational study was obtained from the Department of Clinical Investigation at Walter Reed Army Medical Center (WRAMC) who designated it as an exempt protocol. The target population included U.S. active duty and reserve soldiers who were seen in the WRAMC Pain Management Center in Washington, DC or the Landstuhl Regional Army Medical Center Pain Clinic in Germany for injuries sustained or exacerbated in OIF between March 2003 and July 2004. Only those patients who incurred injuries in the theaters of combat (i.e., Iraq, Kuwait, or Qatar) were included in this study. Soldiers deployed in support of OIF who sustained injuries outside these areas were excluded.

Demographic and clinical information on OIF patients was prospectively collected and stored in a special database for later tabulation. Upon review of this information, the decision was made to include two nonmilitary Department of Defense beneficiaries who sustained injuries in support of combat operations conducted with the U.S. Army. In addition to demographic information, other data analyzed included presenting complaint(s), return-to-duty rates (when available), final diagnoses, treatments rendered, and visual analog scale (VAS) pain scores on a 0–10 scale. Presenting complaints were based solely on patients' symptoms. For pain clinic diagnoses, physical examination findings, consultation reports, radiologic studies, and diagnostic tests, such as electromyography/nerve conduction studies, were considered.

Results

The 162 injured soldiers comprised 144 men and 18 women, with an average age of 34.6 yr (median, 33 yr; range, 20–58 yr; SD, 9.2). One-hundred-seven patients were seen at WRAMC, with 55 being evaluated for treatment in Landstuhl, Germany. Of the 162 patients, only 15 were inpatients. Most were seen as consultations for treatment recommendations to be implemented at military treatment facilities located at the patient's home duty station. The mean presenting VAS pain score was 5.9 (range, 2–10; SD 1.9). In the 34% ($n = 55$) of patients who received definitive treatment at WRAMC or Landstuhl (i.e., pain treatment was completed before transfer to a facility closer to the soldier's home duty station), the mean pre- and post-treatment VAS pain scores were 6.2 (range, 3–10; SD, 2.2) and 5.2 (range, 0–10; SD, 3.0), respectively. The mean follow-up in these patients was 14.1 ± 5.0 days. Thirteen of these 55 soldiers reported at least 50% reduction in pain. Among the 49 soldiers for whom definitive disposition data were available, only 1 returned to his unit in the Persian Gulf.

Table 1. Presenting Pain Complaints in Soldiers Injured in Operation Iraqi Freedom

Pain presentation (n =162)	Frequency	%
Lumbar radicular pain	49	30.2
Axial low back pain	37	22.8
Nonradicular leg pain	24	14.8
Nonradicular arm pain	16	9.9
Groin pain	15	9.3
Thoracic pain	10	6.2
Neck pain	10	6.2
Abdominal pain	8	4.9
Cervical radicular pain	6	3.7
Headache	6	3.7
Thoracic radicular pain	2	1.2
Polyarthralgia	1	0.6
Facial pain	1	0.6

The percentage of pain complaints is based on the number of patients (n = 162), not the number of presenting symptoms (n = 185).

The most common pain complaint was low back pain (LBP), which occurred in 53% of subjects. In these 86 patients, 49 presented with radicular symptoms and 37 with axial LBP. A plurality of patients ($n = 21$) with LBP could not identify a precipitating event. Among those who could, the most frequent causes of radicular LBP were heavy lifting and motor vehicle accidents (MVA), implicated in eight patients each. Falls and MVA were the most common identifiable causes of axial LBP and were responsible for nine and six cases, respectively.

The second most common presentation was nonradicular extremity pain, which accounted for 23% of presenting complaints. Twenty-four patients had leg injuries, 16 arm injuries, and in 3 soldiers, both upper and lower extremity injuries were present. The most common cause of extremity pain was missile injury ($n = 7$) in those soldiers presenting with nonradicular arm pain and blast injury ($n = 10$) in patients whose chief complaint was leg pain. In descending order, the next three most frequent pain complaints were groin pain ($n = 15$), thoracic pain ($n = 10$), and axial neck pain ($n = 10$). The most frequent identifiable causes of pain in these patients were previous surgery for groin pain ($n = 6$), previous surgery and blast injury for thoracic pain ($n = 2$), and extended driving in a military vehicle and prolonged carrying of heavy gear ($n = 2$) for neck pain. Overall, 12% of patients presented with multiple pain complaints (mean, 1.1 complaints per soldier; range, 1–3; SD, 0.4). Table 1 lists the frequency of presenting pain complaints broken down by location.

The most common diagnosis was lumbar herniated disk, which accounted for almost one quarter of all pain disorders ($n = 39$). The discrepancy between lumbar radicular pain as a presenting complaint and lumbar herniated disk as a diagnosis was primarily caused by a wide array of other pain conditions mimicking radicular symptoms. These included lumbar spinal stenosis ($n = 4$), sacroiliac joint pain ($n = 2$),

failed back surgery syndrome ($n = 3$), muscle and soft-tissue injuries ($n = 2$), degenerative disk disease ($n = 2$) and psychogenic pain ($n = 2$). In addition, two patients each who presented with axial LBP and nonradicular leg pain were subsequently diagnosed with a herniated disk. In one of the more unusual cases, a patient with bilateral above-the-knee amputations complained of persistent paresthesias and shooting pains in both phantom legs and was found to have a large L4-5 herniated nucleus pulposus.

The second most common diagnosis was postsurgical pain, comprising 14% of all patients. Broken down into subgroups, the most frequently implicated diagnoses were lumbar failed back surgery syndrome ($n = 6$), postherniorrhaphy pain ($n = 6$), failed neck surgery syndrome ($n = 3$), postthoracotomy pain ($n = 2$), and complex regional pain syndrome after open reduction internal fixation with casting ($n = 2$). There was also one case each of postcesarean section delivery abdominal pain and chest pain after breast reduction surgery.

Sixteen percent ($n = 26$) of patients were diagnosed with zygapophyseal joint pain, with most of these being lumbar facet arthropathy ($n = 19$). The next most common diagnoses were muscle pain, neuropathic pain (excluding radiculopathy, complex regional pain syndrome, and postamputation pain) and lumbar discogenic pain. Thirty-one percent of patients were diagnosed with multiple pain conditions, with the mean number of diagnoses being 1.3 (range, 1–3; SD 0.5). Table 2 lists the frequency and percentages of clinical diagnoses.

Almost 30% ($n = 48$) of patients could not identify a cause of injury. Twenty-eight (17%) patients stated they were injured during battle. These included 14 blast injuries (e.g., rocket-propelled grenades, landmines, car bombs, etc.), 12 missile injuries (e.g., gunshot wounds), and 2 soldiers with LBP who sustained injuries fleeing ambushes, one running and the other after a MVA. The most common diagnoses after blast injuries were complex regional pain syndrome II (causalgia) and phantom limb pain, with three cases each. After missile injuries, the most common diagnoses were soft-tissue injury ($n = 4$), complex regional pain syndrome II ($n = 3$), and postsurgical pain syndrome ($n = 3$). The latter diagnoses included one case each of failed back surgery syndrome, postthoracotomy pain, and chronic pain after a skin graft. Another 28 soldiers were injured in motor vehicles: 20 after accidents, and 8 after prolonged driving on unpaved terrain. Previous surgery was implicated by soldiers in 25 cases, either etiologically or via recurrence of an injury previously controlled by surgery. Only two patients received a diagnosis of psychogenic pain, although many patients were referred to the psychiatry service for the management of anxiety, depression, and suspected posttraumatic stress disorder or to better evaluate overlying psychopathology and social stressors. In the one patient whose injury was secondary to alcohol abuse, the final diagnosis was chronic pancreatitis. Table 3 lists the mechanisms of injury based on numbers and percentage.

Table 2. Pain Clinic Diagnoses in Soldiers Wounded in Operation Iraqi Freedom

Pain clinic diagnoses ($n = 162$)	Frequency	%
Lumbar herniated disc	39	24.1
Postsurgical pain syndrome	23	14.2
Lumbar facet arthropathy	19	11.7
Muscle pain	18	11.1
Neuropathy/neuropathic pain (excluding radiculopathy, postamputation pain, and complex regional pain syndromes)	15	9.3
Lumbar degenerative disc disease	11	6.8
Soft tissue injury (nonmuscular)	10	6.2
Cervical herniated disc	7	4.3
Complex regional pain syndrome type II	7	4.3
Lumbar spinal stenosis	7	4.3
Fracture injury	6	3.7
Sacroiliac joint pain	6	3.7
Phantom limb pain	5	3.1
Cervical degenerative disc disease	4	2.5
Cervical facet arthropathy	4	2.5
Psychogenic pain	4	2.5
Complex regional pain syndrome type I	3	1.9
Postamputation stump pain	3	1.9
Spermatocele/hydrocele	3	1.9
Thoracic facet arthropathy	3	1.9
Grade 3 spondylolisthesis	2	1.2
Lumbar spondylolysis	2	1.2
Plantar fasciitis	2	1.2
Postdural puncture headache	2	1.2
Thoracic herniated disc	2	1.2
Others	10	6.2

The percentage of pain diagnoses is based on the number of patients ($n = 162$), not the overall number of diagnoses ($n = 217$). "Others" includes brachial plexopathy, cervical stenosis, coccygodynia, diffuse idiopathic skeletal hyperostosis, recurrence of Gulf War syndrome, nephrolithiasis, pancreatitis, postherpetic neuralgia, spinal cord contusion, and shin splints.

The most common treatment for soldiers injured in OIF was nonsteroidal antiinflammatory drugs, which were prescribed to 56% ($n = 91$) of patients. Opioids were prescribed to 49% of patients ($n = 79$), with the most soldiers receiving short-acting opioids ($n = 69$). Soldiers who received opioids reported higher presenting VAS pain scores than those who did not (mean, 6.2 ± 2.0 versus mean 5.6 ± 1.7; $P = 0.05$).

Seventy-two percent ($n = 116$) of patients received at least one type of injection, with epidural steroid injections accounting for most of these ($n = 65$). Epidural steroid injections were performed in 46 of the 48 patients with a herniated disk. Sixty-six (41%) patients received some type of neuropathic pain medication, which included antiseizure drugs ($n = 50$), tricyclic

Table 3. Causes of Injury in Pain Clinic Patients Injured in Operation Iraqi Freedom

Mechanisms of injury (n= 162)	Frequency	%
Unknown	28	17.2
Surgery	25	15.4
Motor vehicle accident	20	12.3
Heavy lifting	17	10.4
Fall	15	9.2
Blast injury	14	8.6
Missile injury	12	7.4
Running/physical training	12	7.4
Extended driving in military vehicle	8	4.9
Wearing heavy gear	8	4.9
Psychiatric illness	2	1.2
Alcohol use	1	0.6

antidepressants (n = 28), oral steroids (n = 6), or intranasal salmon calcitonin (n = 2). Seventeen percent (n = 28) of soldiers were treated with some form of alternative therapy, almost half of which included therapeutic massage (n = 13). The most common diagnoses in these 28 patients were postsurgical pain (n = 8), lumbar herniated disk (n = 7), and lumbar facet arthropathy (n = 5). Table 4 lists the numbers and percentages of the different treatments administered.

Discussion

Battle-inflicted injuries have never been the major cause of army attrition in contemporary warfare. This is not surprising, considering that the ratio of support to combat personnel now approaches seven to one in modern armies. In World War I, nonbattle-related injuries (NBI) were the fourth leading cause of hospital admissions after respiratory illness, infectious disease, and digestive ailments. In World War II and the Korean conflict, they ranked third, and by the Vietnam War, NBI had become the leading type of casualty (3).

In the first Persian Gulf War, unintentional trauma accounted for 81% of deaths and 25% of hospital admissions4. Consistent with our findings, MVA accounted for most nonbattle-related deaths (34%) in Operations Desert Shield and Desert Storm. When MVA were combined with aircraft crashes, the percentage of soldiers who died in transportation accidents was 60%. Among the 21,655 soldiers admitted to army hospitals in Southwest Asia during the Persian Gulf War, acute NBI comprised 25% of all hospitalizations, with musculoskeletal conditions ranking second at 13%. The most common NBI in hospitalized soldiers were fractures, muscle sprains, miscellaneous injuries, and dislocations. Battle-related admissions accounted for <5% of all hospital stays (4).

The impact of NBI on troop strength becomes even more skewed during noncombat missions. In 414 recorded hospitalizations among British troops during Operation Joint Endeavor (Bosnia), only 2% of injuries were incurred in battle (6). The remaining admissions were attributed to disease (52%) and routine injuries (46%). Musculoskeletal disorders were by far the most common "disease" category, accounting for more than half (54%) of all hospital stays. In the injury category, the most frequently affected sites were the lower limbs, upper limbs, head and neck, and spinal injuries, respectively (6).

There are several important findings in this study. Perhaps the foremost is that aside from the slightly more frequent incidence of unavoidable war-related conditions, such as complex regional pain syndromes (6%) and postamputation pain (3%), the presenting complaints and final diagnoses found in our subjects

Table 4. Treatment Modalities in Pain Clinic Patients Injured in Operation Iraqi Freedom

Treatment modalities (n= 162)	Frequency	%
Nonsteroidal antiinflammatory drug	91	56.2
Short-acting opioid	69	42.6
Referral to physical therapy	55	34.0
Antiseizure medication	50	30.9
Lumbar epidural steroid injection	36	22.2
Antidepressant medication	28	17.3
Muscle relaxant	28	17.3
Long-acting opioid	21	13.0
Lumbar transforaminal epidural steroid injection	21	13.0
Lumbar facet joint or facet joint nerve (medial branch) block/ radiofrequency denervation	19	11.7
Tramadol	14	8.6
Benzodiazepine	13	8.0
Massage therapy	13	8.0
Other nerve block	11	6.8
Sympathetic nerve block	9	5.6
Transcutaneous electrical nerve	9	5.6
Trigger point injection	9	5.6
Chiropractic manipulation	8	4.9
Pulsed radiofrequency	8	4.9
Therapeutic ultrasound	7	4.3
Cervical epidural steroid injection	6	3.7
Oral steroid course	6	3.7
Surgical referral	6	3.7
Cervical medial branch block	5	3.1
Sacroiliac joint injection	5	3.1
Topical medication	4	2.5
Thoracic medial branch block	3	1.9
Acupuncture	2	1.2
Epidural blood patch	2	1.2
Glucosamine/chondroitin sulfate	2	1.2
Intranasal salmon calcitonin	2	1.2
Intravenous phentolamine test	2	1.2
Refused injection	2	1.2
Thoracic epidural steroid injection	2	1.2
Others	7	4.3

The percentage of treatment modalities is based on the number of patients (n = 162), not the overall number of treatments (n = 575). "Others" includes antihistamine, antioxidant, biofeedback, botulinum toxin injection, *N*-methyl-D-aspartate receptor antagonist, discography, and spinal cord stimulation.

mirror those seen in civilian pain management centers. In descending order, the most frequently conferred diagnoses in our patients were lumbar herniated disk, postsurgical pain syndrome, lumbar facet arthropathy, and muscle pain. The incidence of postamputation pain seen in our pain management centers is surprisingly infrequent and likely reflects several factors. These include the ease of diagnosis and clinical acumen of our surgical and rehabilitation services, which have become very adept at treating stump and phantom pain since "9/11," and the fact that aggressive and early treatment of postamputation pain, including the placement of long-standing peripheral nerve and epidural catheters, is becoming the standard of care in forward-deployed medical units. In fact, soldiers with all types of injuries are now being transported from the combat theater back to the continental U.S. with sterile catheters infusing local anesthetic. It should also be emphasized that we could only include in this study patients who were specifically referred to our pain treatment centers.

The referring physicians' (i.e., primary care provider or surgeon) tentative diagnosis was indicated in <25% of patients ($n = 36$) but accurate 75% of the time ($n = 27$). Along these lines, the treatments soldiers received were similar to that rendered in anesthesiology-based civilian pain treatment centers. Seventy-two percent received some type of injection, whereas pharmacotherapy was initiated on all but 19 patients (88%).

Another key finding is that only 24% of soldiers experienced a ≥50% pain reduction after treatment, with only 2% of soldiers returning to combat duty in Iraq. There is no frame of reference by which to measure treatment success in a pain center catering to soldiers wounded in combat. However, based on other outcome studies conducted in similar cohorts at the same institutions (7,8), these numbers are surprisingly small. In a retrospective study analyzing data from ground operations in Okinawa, Korea, Vietnam, and the Falkland Islands, Blood et al. (9) found that soldiers wounded in action took between 4.3 and 5.1 convalescent days on average before returning to duty. In a follow-up study, the authors found that among combat troops, between 26% and 38% of disease and NBI were severe enough to preclude returns to their unit. For support troops, <17% required a medical transfer (10).

Not withstanding the human costs of deployed soldiers being medically boarded out of the military or transferred to noncombat roles, the economic impact of our small return-to-duty rate is staggering. For example, the financial cost of medically boarding just one Special Operations or other highly trained soldier and retraining a replacement can exceed U.S. $1,000,000. The disposition of the 113 soldiers in whom follow-up data were not available, and whether the 48 soldiers who remained stateside did so for medical or logistical reasons (i.e., their unit rotated back to the U.S. by the time they were deemed fit for duty, or a replacement had already been designated) are important pieces of information we were unable to obtain.

To gain a better understanding of our poor treatment outcomes, it is first required to put OIF in perspective. In contrast to previous wars, OIF is not a classical conflict with a clear-cut battlefront, behind which noninfantry troops perform support operations under relatively safe conditions. In the present conflict, support troops manning supply lines seem to be the most vulnerable to attack. The differences between the training and conditioning of combat versus support troops, along with a larger reserve-to-active duty ratio in this conflict than any other war the U.S. has been involved in, may be partially responsible for our findings. Unlike the military's active component, reserve troops generally train only one weekend per month and have a disproportionate percentage of soldiers older than 40 years of age. At WRAMC and Landstuhl, health care providers are discouraged from asking whether an injured soldier is a reserve or active duty component.

An even more important factor contributing to our small return to duty rate may be the site where pain therapy was administered. From July 2003 to June 2004, a board certified pain physician was assigned to one of three combat support hospitals in Iraq. For several months during this period, basic pain therapies, such as epidural steroid injections, facet blocks, and symptom-directed pharmacotherapy, were aggressively used at this facility. Among the 38 patients treated there, approximately 80% remained "in country." What makes these data even more striking is that the diagnostic mix was nearly identical to that seen at Landstuhl and WRAMC (personal communication from LTC Allan Hayes, 21st Combat Support Hospital, Balad, Iraq).

One of the reasons for the improved outcome data from patients treated in Iraq may be the strong bonds soldiers develop with their units. Medically evacuating a soldier out of danger may represent a severing of these ties, such that the incentive to return to duty and assist comrades pales in comparison to the prospect of being safe at home with family. This is perhaps the most compelling argument one could make regarding the necessity of deploying far-forward pain management capabilities. Other possible reasons for our poor treatment outcomes include the impact nonphysiologic factors such as fear and anxiety have on the pain experience, treatment delays stemming from the time it takes to transport injured patients to a tertiary care military treatment facility, more extensive pathology than that encountered in noncombat environments, overlying psychopathology secondary to being

Table 5. Possible Steps to Improve Treatment and Return-to-Duty Outcomes in Soldiers Injured During Wartime

Improve diagnostic capabilities in combat support hospitals.
Initiate pain treatment in forward-deployed areas.
Better predeployment preparation to include psychological screening, physical and mental training, and adequate support services to family members.
Provide prompt and aggressive treatment of factors known to exacerbate pain such as fear, anxiety, and depression.
Better use of preventive medicine services.
Consider use of modalities that provide immediate rather than delayed pain relief such as nerve blocks and aggressive use of opioids.

in a war zone, including but not limited to subconscious feelings of guilt in soldiers with no overt war injuries, and secondary gain issues relating to fear of death or injury, and money (11–13; Table 5).

There are several shortcomings inherent to this type of study. First, the soldiers included in this study were only those specifically referred to our pain center from primary care doctors and surgeons, and we were obliged by the Command to see all of these within 48 hours. During the study period, 4477 U.S army soldiers were wounded in action in OIF, and 13,263 required medical evacuation to U.S. army medical facilities (14,15). It is possible that if our referral base had included more of these patients, the breakdown of data would have been different. Second, although our outcomes were clearly inferior to those obtained at the pain clinic in the hospital in Iraq, the smaller sample size, different treatment context, and absence of hard data from the combat support hospital mitigate the conclusions that can be drawn from comparison. It is also impossible to determine what percentage of patients did not return to duty because their tour of duty finished or their unit rotated back stateside during treatment. Third, even in the 55 patients who received definitive treatment, the length of therapy and follow-up period were considerably less than that afforded under less impelling conditions. Finally, the overlying psychosocial issues injured soldiers must cope with are arguably more complex and less well studied than those encountered in civilian life. Without extensive evaluation, it is impossible to predict how these factors impact treatment outcomes.

In conclusion, this is the first paper to present data on the presenting symptoms, diagnoses, and treatment of medically evacuated soldiers seen in pain management centers during wartime. Whereas new, our finding that LBP is the primary pain complaint is not surprising. What is surprising is the poor outcomes and small return-to-duty rates of these soldiers. These results indicate that better preventive measures and a more aggressive treatment approach are required to preserve strength and maintain efficiency in the military, which is the ultimate objective of modern medical corps.

References

1. Pare A, Johnson T. The apologie and treatise of Ambroise Pare containing the voyages made into divers places with many of his writings upon surgery. London: Cotes and Young, 1634.
2. Mitchell SW. On the diseases of nerves, resulting from injuries. In: Flint A, ed. Contributions relating to the causation and prevention of disease, and to camp diseases. New York: US Sanitary Commission Memoirs, 1867.
3. Hoeffler DF, Melton LJ. Changes in the distribution of Navy and Marine Corps casualties from World War I through the Vietnam conflict. Mil Med 1981;146:776–9.
4. Writer JV, DeFraites RF, Keep LW. Non-battle injury casualties during the Persian Gulf War and other deployments. Am J Prev Med 2000;18:64–70.
5. Sinaki M, Mokri B. Low back pain and disorders of the lumbar spine. In: Braddom RL, ed. Physical medicine and rehabilitation. 2nd ed. Philadelphia: WB Saunders, 2000:853–93.
6. Croft AM, Hoad NA, Dale RF. Hospitalization of British troops during Operation Joint Endeavor (Bosnia). Mil Med 1999;164: 460–5.
7. Cohen SP, Larkin T, Abdi S, et al. Risk factors for failure and complications of intradiscal electrothermal therapy: a pilot study. Spine 2003;28:1142–7.
8. Cohen SP, Abdi S. The treatment of sacroiliac joint pain with lateral branch blocks: a preliminary report. Reg Anesth Pain Med 2003;28:113–9.
9. Blood CG, Gauker ED, Jolly R, Pugh WM. Comparisons of casualty presentation and admission rates during various combat operations. Mil Med 1994;159:457–61.
10. Blood CG, Jolly R. Comparisons of disease and nonbattle injury incidence across various military operations. Mil Med 1995;160: 258–63.
11. Elkayam O, Ben Itzhak S, Avrahami E, et al. Multidisciplinary approach to chronic back pain: prognostic elements of the outcome. Clin Exp Rheumatol 1996;14:281–8.
12. McWilliams LA, Goodwin RD, Cox BJ. Depression and anxiety associated with three pain conditions: results from a nationally representative sample. Pain 2004;111:77–83.
13. Milojevic K, Cantineau JP, Simon L, et al. Acute severe pain in emergencies: the key for efficient analgesia. Ann Fr Anesth Reanim 2001;20: 745–51.
14. Office of the Surgeon General, US Army Medical Department. Army medical evacuation statistics for Operations Iraqi Freedom and Enduring Freedom. Available at http://www.armymedicine.army.mil/news/medevacstats/medevacstats.htm. Accessed March 13, 2005.
15. Defense Manpower Data Center, Statistical Information Analysis Division. War on terrorism: Operation Iraqi Freedom. Available at http://web1.whs.osd.mil/mmid/casualty/OIF-total-by-month.pdf. Accessed March 13, 2005.