Neurosurgery in Afghanistan during “Operation Enduring Freedom”: a 24-month experience

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Object. “Operation Enduring Freedom” is the US war effort in Afghanistan in its global war on terror. One US military neurosurgeon is deployed in support of Operation Enduring Freedom to provide care for both battlefield injuries and humanitarian work. Here, the authors analyze a 24-month neurosurgical caseload experience in Afghanistan.

Methods. Operative logs were analyzed between October 2007 and September 2009. Operative cases were divided into minor procedures (for example, placement of an intracranial pressure monitor) and major procedures (for example, craniotomy) for both battle injuries and humanitarian work. Battle injuries were defined as injuries sustained by soldiers while in the line of duty or injuries to Afghan civilians from weapons of war. Humanitarian work consisted of providing medical care to Afghans.

Results. Six neurosurgeons covering a 24-month period performed 115 minor procedures and 210 major surgical procedures cases. Operations for battlefield injuries included 106 craniotomies, 25 spine surgeries, and 18 miscellaneous surgeries. Humanitarian work included 32 craniotomies (23 for trauma, 3 for tumor, 6 for other reasons, such as cyst fenestration), 27 spine surgeries (12 for degenerative conditions, 9 for trauma, 4 for myelomeningocele closure, and 2 for the treatment of infection), and 2 miscellaneous surgeries.

Conclusions. Military neurosurgeons have provided surgical care at rates of 71% (149/210) for battlefield injuries and 29% (61/210) for humanitarian work. Of the operations for battle trauma, 50% (106/210) were cranial and 11% (25/210) spinal surgeries. Fifteen percent (32/210) and 13% (27/210) of operations were for humanitarian cranial and spine procedures, respectively. Overall, military neurosurgeons in Afghanistan are performing life-saving cranial and spine stabilization procedures for battlefield trauma and acting as general neurosurgeons for the Afghan community. (DOI: 10.3171/2010.3.FOCUS09324)

Key Words • Afghanistan • neurosurgery • Operation Enduring Freedom

Operation Enduring Freedom is the US-led war effort in Afghanistan in its global war on terror. The International Security and Assistance Force is NATO’s operation to rebuild Afghanistan and provide security. United States military neurosurgeons are a part of the International Security and Assistance Force, commanded by the acting US general in Afghanistan. The CJTH at Bagram Airfield, Afghanistan, is the military’s primary trauma center for the entire country; its mission is to “preserve the fighting force” by caring for injured coalition soldiers (NATO and Afghani military and security forces [AMSF]), as well as to provide care for war-injured enemy combatants and Afghan civilians.2,7,8,18,21,29,36 A secondary humanitarian mission is to provide care for the local community.3,18,29

In September 2007, a decision was made to provide continuous neurosurgical coverage to Bagram Airfield by sending a single Air Force neurosurgeon for a 4- to 6-month deployment in support of the dual missions/roles. Surgical and personal experiences and lessons learned are dependent on the role being fulfilled. The types of combat-related injuries to coalition forces and the management of those injuries are similar to those previously reported in Afghanistan and Iraq.1–4,11,14,16,19,21,24–26,28–30,32–34,36 However, it is in the context of a secondary
The ability to accommodate humanitarian cases decreased.

Approximately 8 cases per week. Thus, as wartime operations increased, the ability to accommodate humanitarian cases decreased.

Role that neurosurgeons have encountered unique challenges and experiences.

Afghanistan has been at war for the last 30 years, from the occupation by the former Soviet Union in the late 1970s, through fighting between various warlords after the withdrawal of Soviet forces, to the current conflict over the past 8 years. Noncombatant Afghans have been injured as a result of collateral damage from active fighting, millions of past and present land mines, and ongoing placement of IEDs. The Afghan health care system is woefully inadequate and rudimentary at best, and few Afghans can afford medical care. Widespread lack of both running water and waste disposal contribute to the high rate of malaria, intestinal tapeworms, and tuberculosis. Malnourishment abounds, which has direct impact on immediate surgical factors such as prolonged coagulation studies (for example, prothrombin times) and long wound-healing times after surgery.

In this manuscript, we report the types of cases performed by US Air Force neurosurgeons in Afghanistan between October 2007 and September 2009 and detail the lessons learned.

**Methods**

**War Records**

At the onset of the neurosurgical mission in Bagram, neurosurgeons kept track of their personal surgical case war records. Data collected included: diagnosis, mechanism of injury if applicable, operation performed, and complications, as well as the patient’s sex, age, and country of origin. Mechanism of injury was classified as gunshot wound (GSW), IED, rocket-propelled grenade (RPG), land mine, motor vehicle collision (MVC), or fall from height. For mechanism of injury analysis, IEDs, RPGs, and land mines were combined into one category called “explosive devices.” Country-of-origin was classified as NATO (US, Canada, and United Kingdom) or non-NATO (AMSF, enemy combatant, and local Afghan civilians).

Neurosurgical procedures were categorized as major or minor and as battlefield injuries or humanitarian mis-

sions. Minor procedures included placement of an ICP monitor, ventriculostomy, cervical spine clearance by active flexion-extension under fluoroscopy, lumbar drainage or puncture, halo orthosis placement, and placement of Gardner-Wells tongs for cervical traction. Major neurosurgical procedures were defined as taking place in the operating room under general anesthesia (for example, craniotomy, placement of spinal instrumentation).

Battlefield injuries were defined as injuries sustained by soldiers while in the line of duty or civilian casualties. Civilian battlefield injuries were injuries caused by weapons of war (for example, GSW, IEDs). Humanitarian work consisted of routine civilian trauma cases and elective procedures. Routine trauma was defined as injuries sustained by local Afghan civilians while performing normal daily activities (for example, MVC or fall from height). Humanitarian elective cases were non-trauma-related neurosurgical cases (for example, myelomeningocele closure, discectomy).

**Results**

Two-hundred and ten neurosurgical operations were performed in 185 patients at CJTH between October 1, 2007, and September 30, 2009, by 6 neurosurgeons (Fig. 1). Neurosurgeons performed an average of 8.7 operations per month (range 4–14 cases). On average, the number of neurosurgical procedures performed for battlefield injuries and humanitarian work were 6.2 (range 1–11) and 2.5 (range 1–8) per month, respectively (Fig. 1).

One hundred and forty-nine neurosurgical operations for battlefield injuries were performed in 128 patients, including 26 operations in 25 NATO soldiers, 71 operations in 61 AMSF soldiers, 10 operations in 10 enemy combatants, and 42 operations in 32 Afghan civilians who sustained injuries from weapons of war (Table 1). Neurosurgical humanitarian cases accounted for 34 procedures in 31 patients for routine trauma and 27 elective operations in 26 patients (Table 1). Overall, 71% (149) of the 210 surgical procedures performed by military neurosurgeons in Afghanistan were for the treatment of war-related injuries and 29% (61) were considered humanitarian work (Table 1).

**Operations for Wartime Trauma**

Twenty-five NATO soldiers required 26 neurosurgical interventions for trauma, including 20 cranial procedures (13 craniotomies, 6 decompressive hemicraniectomies for uncontrolled ICP, and 1 decompressive hemicraniectomy for hemispheric stroke secondary to penetrating cervical intracranial artery injury). Two soldiers required spine procedures (1 for a penetrating injury and 1 for blunt trauma). Two soldiers underwent nerve graft repairs (1 for segmental median nerve loss and 1 for a transected peroneal nerve). One soldier required closure of a complex scalp wound. One soldier with neurofibromatosis Type 1 underwent elective surgery for removal of subcutaneous scalp neurofibromas. All NATO soldiers undergoing neurosurgical operations for trauma at CJTH were medically evacuated to a US military hospital in Germany (Landstuhl Regional Medical Center) when medically stable.
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Sixty-one Afghan soldiers required 71 neurosurgical operations, including 52 cranial procedures, 16 spine procedures (13 spine stabilizations, 1 dural repair after penetrating injury, and 1 dural repair after penetrating injury), and 3 miscellaneous operations (2 incision and drainage of scalp wounds and 1 incision and drainage of lumbar wound). Ten enemy combatants required 7 cranial surgeries, 1 spinal stabilization, and 2 complex scalp wound closures. Forty-two operations were performed in 32 local Afghan citizens, including 27 cranial surgeries, 6 spine surgeries (4 spine stabilizations and 2 dural repairs after penetrating injury), and 9 miscellaneous surgeries (5 closures of complex scalp lacerations, 3 peripheral nerve repairs, and 1 neck exploration).

**Operations for Humanitarian Work**

Neurosurgical humanitarian work consisted of routine trauma and elective cases. Thirty-one Afghan patients had 34 neurosurgical operations for trauma sustained during normal daily activities. This included 23 craniotomies, 9 spine stabilization surgeries, and 2 complex scalp closures. One patient sustained a non–combat-related indirect GSW to the head while attending a wedding celebration. Twenty-six Afghans underwent 27 elective surgeries, including 3 craniotomies for tumor, 6 miscellaneous cranial procedures (4 ventriculoperitoneal shunt placements, 2 arachnoid cyst fenestration), and 18 spine procedures (12 basic spine surgeries, 4 myelomeningocele closures, and 2 spine operations for tuberculous spondylitis).

**Mechanism of Injury**

For injuries sustained by NATO soldiers, the mechanism of injury was GSW in 38% of cases (9/24), explosive device in 54% (13/24), and accident in 8% (2/24). In AMSF, the mechanism of injury was GSW in 33% (20/61) of cases, explosive device in 56% (34/61), and accident in 11% (7/61). In Afghan civilians, the mechanism of injury was GSW in 23% (15/63), explosive device in 27% (17/63), and accident in 49% (31/63) (Table 2).

**Minor Procedures**

One-hundred and fifteen minor procedures were performed over the time studied. These consisted of 85 procedures for battlefield injuries and 30 procedures for humanitarian cases. Minor procedures for wartime cases included 51 ICP monitor placements, 15 ventriculostomies, 10 lumbar punctures or drain placements, 8 cervical spine clearances by flexion-extension under fluoroscopy, and 1 halo orthosis placement. Minor procedures for humanitarian cases included 15 ICP monitor placements, 6 ventriculostomies, 6 instances of lumbar puncture or placement of lumbar drain, 3 flexion-extension studies of the cervical spine under fluoroscopy, and 1 placement of Gardner-Wells tongs for cervical traction.

**Complications**

No surgery-related complications were noted in NATO forces prior to transfer to Germany. However, these patients were transferred within 1–2 days of surgery and were lost to follow-up to the authors. The authors report only their personal war records, which did not include patient identifiers. Additionally, the US Armed Forces do not track medical outcomes on non-US NATO soldiers. However, the following complications were noted in non-NATO patients: 2 deaths during craniotomy for trauma from pulmonary embolus and uncontrollable bleeding from the sagittal sinus, 1 postoperative death from sepsis after delayed closure of open myelomeningocele, 1 wound revision 5 days after craniotomy for penetrating head injury with debridement of necrotic brain, 2 bone flap expansions after decompressive hemicraniectomy to prevent herniation of brain over bone edges, 1 case of increased paraparesis after thoracic anterior vertebral body reconstruction for tuberculous spondylitis, 4 cases in which incision and drainage of previously closed complex scalp wounds was required, and 2 wound revisions.
TABLE 2: Mechanisms of injury in 210 neurosurgical procedures in an inpatient wartime hospital*

<table>
<thead>
<tr>
<th>Patient Category</th>
<th>No. of Patients</th>
<th>GSW</th>
<th>Explosive Devices†</th>
<th>Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATO</td>
<td>24‡</td>
<td>38</td>
<td>54</td>
<td>8</td>
</tr>
<tr>
<td>AMSF</td>
<td>61</td>
<td>33</td>
<td>56</td>
<td>11</td>
</tr>
<tr>
<td>Afghan civilian</td>
<td>63§</td>
<td>23</td>
<td>27</td>
<td>49</td>
</tr>
</tbody>
</table>

* Surgery performed by 6 neurosurgeons between October 2007 and September 2009 at CJTH. The 210 operations were performed in 185 patients for treatment of war-related injuries and as part of the humanitarian mission.
† Includes IEDs, RPGs, and land mines.
‡ Excludes 1 soldier who underwent an elective procedure.
§ Includes all local Afghan civilians who were treated for either wartime trauma (32 patients) or non-war-related trauma (humanitarian work, 31 patients).

Case Illustrations

Case 1—Decompressive Hemicraniectomy for Penetrating Head Injury

This 23-year-old male Afghan soldier sustained a low-velocity GSW to the right parietal region (Fig. 2). His Glasgow Coma Scale score was 5T, and a head CT scan showed the bullet resting in the right parietal cortex with imploded bone fragments along the bullet path (Fig. 2). The patient underwent a right decompressive hemicraniectomy with wound debridement; the bone flap was stored in a freezer. Three months postoperatively, the patient was conversant and ambulatory on examination. Four months after the decompressive craniectomy, the patient underwent successful autologous cranioplasty with a good cosmetic result.

Case 2—IED Injury to the Eye

This 14-year-old Afghan boy had been struck by a roadside IED and was brought to the CJTH with a large retained metal fragment projecting through the right orbit and into the frontal lobe (Fig. 3). It took over 4 days for him to reach the hospital from his village in western Afghanistan. During this time, the boy was kept moderately sedated with intravenous medication. On arrival, he was awake, alert, and had no focal signs of deficit except for blindness in his left eye. A CT angiogram revealed no evidence of vascular injury. The patient underwent a bifrontal craniotomy to expose the distal end of the fragment (part of a bomb casing), which was then removed in a controlled fashion. The frontal lobe was debrided, a duraplasty was performed, and the frontal fossa floor was repaired with bone and titanium microplates. Ophthalmologists then performed a formal enucleation. Post-

Fig. 2. Illustrative Case 1. A: Axial CT image depicting GSW to the head in which the bullet entered the right parietal bone causing implosion of bone fragments inward along the bullet track. The low-velocity bullet penetrated approximately 3 cm before stopping in the right parietal cerebral cortex. B: Axial CT after placement of left external ventricular drain and right decompressive hemicraniectomy for debridement of GSW. Note: Because of brain swelling, the bone flap was left off and stored at 30°F until cranioplasty with autologous bone flap.

Fig. 3. Illustrative Case 2. A and B: Lateral skull radiograph (A) and photograph (B) depicting metal pipe fragment from an IED that impacted the patient’s left eye. C: A CT coronal reconstruction showing the blunt portion of the metal fragment located within the left orbit. D: Photograph of the metal pipe fragment after removal.
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Case 3—Tuberculous Spondylitis With Anterior VB Reconstruction

This 60-year-old woman with known tuberculosis presented with a 2-year history of worsening lower extremity paraparesis. She had been wheelchair bound for the past year. An examination showed a kyphotic deformity at the thoracolumbar junction and lower extremity strength of 3 out of 5 throughout (Fig. 4). A spine CT revealed severe erosion of T-11 and T-12 with 50% canal compromise (Fig. 4). The patient underwent a left thoracotomy with removal of a caseating granuloma at T11–12. Anterior VB reconstruction was accomplished with double-barreled autologous fibular strut graft and lateral VB rods and screws.22 The patient was able to walk with assistance at the 2-month follow-up examination.

Discussion

Military neurosurgeons in Afghanistan serve a dual role of providing care to soldiers and to the local Afghan community.2,3,8,29 Interestingly, the surgical challenges of today’s conflicts are similar to those of previous wars, with limited hospital beds, supplies, and personnel.38 A war-zone medical facility must quickly transfer wartime injured soldiers out of the country (usually, NATO forces) or to local hospitals (typically, Afghan Army) in order to maintain the ability to treat the newly wounded. Thus, economic use of personnel and hospital resources mandated prompt operative decision-making to balance operatively, the patient made an excellent recovery aside from his unilateral blindness.

Fig. 4. Illustrative Case 3. A: A CT sagittal reconstruction of tuberculous spondylitis eroding the T-11 and T-12 VBs with retropulsion of a caseating granuloma–bone fragment mass into the spinal canal. B and C: Axial CT images of the T-11 (B) and T-12 (C) VBs showing approximately 50% spinal canal narrowing. D: Photograph of left fibula exposure prior to harvesting for “double-barrel” autologous bone grafting for T11–12 anterior VB reconstruction. E and F: Lateral (E) and anterior-posterior (F) radiographs of the final anterior VB reconstruction with double-barrel fibular strut grafts and lateral VB pedicle screw and rod construct.
A difference in the proportion of surgeries for soldiers in comparison with Afghan citizens was observed. The proportion of GSW victims who required neurosurgery for their wounds was between 33 and 39% for soldiers and 47% for Afghan locals. We attribute this difference to the wide use of helmets and body armor by soldiers. The proportion of NATO soldiers requiring neurosurgery is higher than the overall injury rates previously reported in the literature. In that study, the proportions of injuries caused by GSW and explosions were 18 and 78%, respectively. The authors attribute differences in the data they present (38 and 54%, respectively, Table 2) to the different preferences in enemy tactics in Afghanistan (use of direct- and indirect-fire weapons) and Iraq (use of IEDs). Also, our data reflect the caseload at an inpatient wartime hospital rather than overall wartime soldier injury patterns. Interestingly, military neurosurgeons are asked to provide forensic information to aid in the analysis of evolving enemy tactics.

Lessons Learned in the Operative Management of Penetrating Head Injuries From IEDs

The opposing fighters use IEDs to incapacitate or destroy personnel and equipment. These devices are usually constructed from conventional military high-explosive weapons (e.g., artillery shells) attached to a detonating mechanism. Such IED attacks in Afghanistan and Iraq are common, accounting for 48% (2560/5283) and 65% (23,650/36,222) of all US soldier deaths and injuries, respectively. Our experience with penetrating cranial injuries due to IED blast reveal cranial injuries from ball bearings, nails, metal fragments, and rocks (Cases 1 and 2; Figs. 2, 3, and 5).

Several issues were important in the management of these patients. Patient hemodynamic stabilization was a priority in these cases, with treatment of life-threatening bleeding attended to prior to or in conjunction with the craniotomy. Without access to magnetic resonance (MR) imaging equipment, CT angiograms proved valuable for evaluation of intra- and extracranial vascular injury due to a roughly 30% incidence of cerebrovascular injury. Aggressive surgical management was warranted in all cases not believed imminently fatal. Large craniotomies were performed in the event of need to convert to a decompressive hemicraniectomy. There was a low threshold to perform decompressive hemicraniectomies for those cases in which the neurosurgeons believed intracranial hypertension was highly likely, this is because of long transport flights where neurosurgical care and intracranial monitoring were not available (Case 1). Particular attention was paid to making the craniotomy as large as possible to diminish the risk of any postoperative ICP issues and also to prevent herniating brain tissue from becoming lacerated and ischemic at the cut bone edges. Intraparenchymal injuries were debrided without being overly aggressive with deep and small bone or foreign fragments.
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and large hematomas were evacuated. The first surgery often represented “damage control” surgery with an emphasis on quick removal of mass lesions, homeostasis, and quick decision on decompressive hemicraniectomy; deep imploded bone fragments and foreign bodies were not chased.4 Second or third operations were sometimes necessary for further debridement of necrotic brain tissue, and it was found that deep imploded bone fragments and foreign bodies would often deliver themselves to the surface at this time.

Lessons Learned in Bone Flap Management

Bone flap management for soldiers being transported on an 8-hour flight to Germany without subzero freezers, as well as proper handling and storage of autologous bone flaps of Afghan patients without cryogenic freezers presented unique challenges in cases requiring decompressive hemicraniectomy. Three scenarios of managing decompressive bone flaps were encountered, depending upon the patient’s country of origin. For US soldiers, bone flaps were routinely discarded because of fear of infection and our excellent cosmetic results from 3D methylmethacrylate prosthetic implants.21 For all patients from other NATO forces, bone flaps were placed in a subcutaneous abdominal pocket, preferably on the left lower quadrant to avoid contamination by feeding tube placement and to decrease the chance of later confusion with an appendectomy scar. Finally, for injured Afghans, bone flaps were washed with bacitracin irrigation, sterilely wrapped, and stored at 30°F (Case 1, Fig. 2). To date, no postoperative cranioplasty infections have been noted. One 4-year-old patient required cranioplasty revision with mesh and methylmethacrylate at 8 months postoperatively because of autograft resorption.

Lessons Learned in Humanitarian Work

The Afghan health care system has been devastated due to the 3 decades of constant military conflict.5 Many medical professionals fled the country in the 1980s and 1990s resulting in a halt in the training of new health care professionals. In the early 2000s Afghanistan had 11 physicians and 18 nurses per 100,000 population, with 1 medical facility for every 27,000 people.5 Most of the current health care is provided by humanitarian aid, with roughly 25% of the population having no access to medical care.5 Between 250 and 400 patients daily at an Egyptian hospital at Bagram Airfield, with patients needing neurosurgical care referred to the CJTH. Patients were often within driving distance, but some were known to walk for weeks before reaching the Egyptian hospital. The decision to treat neurosurgical disorders was complex and imperfect. Due to lack of ancillary services, the neurosurgeons were unable to treat any disease process that would require prolonged hospitalization, or further high-end therapies (for example, chemotherapy). Treated patients were cared for until well enough to transfer to the Egyptian inpatient service or home.

Neurosurgeons undertaking humanitarian work in Afghanistan report observations similar to those reported by other workers in war-torn countries: horrific wounds from years of war, lack of adequate local health care, malnourishment, long travel times for patients, and lack of postoperative tertiary care (for example, tracheostomy care).9,10,23,32,36 Overall, US military neurosurgeons performed a broad spectrum of general neurosurgical procedures including myelomeningocele closures, microdisectomies, spine stabilization for tuberculous spondylitis, craniotomy for tumor, and general neurosurgical trauma care for Afghans injured during normal daily activities.31 Several lessons were learned in treating malnourished patients, as well as patients with tuberculosis.17 The general nutritional health of the average Afghan civilian is poor because of a combination of inadequate nutritional intake and endemic intestinal parasites (for example, ascarids). The 2 major surgical issues attributed to malnourishment were prolonged coagulation studies and poor wound healing. Preoperative administration of vitamin K would usually correct mildly elevated coagulation studies within 24 hours.12 Attempts to enhance wound healing were made by treating patients with an antihelminthic medication (usually mebendazole) in hopes of increasing nutritional absorption in the short term. In addition, incision staples were left in for at least 14 days because earlier removal often resulted in wound dehiscence. Tuberculosis is also endemic in Afghanistan and untreated patients were required to complete at least 2 weeks of an antituberculosis regimen (typically rifampin and isoniazid) prior to being allowed into the hospital to undergo elective surgery.17

Lesson Learned in Case of Probable Early Fatal Pulmonary Embolus After IED Attack

We would like to draw attention to one particular case of a soldier who died in the operating room of a presumed pulmonary embolus. This 25-year-old Afghan soldier was a passenger in a car attacked by an IED, and sustained a right open tibia–fibula fracture and depressed frontal sinus fracture with embedded bone fragment in the left frontal lobe. A CT angiogram showed no vascular injury. The patient was taken to the operating room for simultaneous below-the-knee amputation and bifrontal craniotomy for skull fracture elevation. Shortly after the leg was removed and the bifrontal craniotomy performed, the patient went into cardiac pulseless electrical activity and his oxygen saturation dropped to 40%. Cardiopulmonary resuscitation was instituted. Intraoperative maneuvers included covering the sagittal sinus with wet packs, placement of bilateral chest tubes, aspiration of the right ventricle with a long central line, replacement of the bone flap, and closure of scalp wound. Epinephrine and blood products were administered. Upon return of his pulse, the patient was transferred to the intensive care unit where an echocardiogram revealed a hypokinetic heart without evidence of air embolus. The cardiac rhythm was again lost and the patient died after bedside exploratory laparotomy and thoracotomy for open cardiac massage. An autopsy was not performed due to local Afghan customs requiring the deceased to be buried within 24 hours. We believe blast injuries prime the vascular system for deep vein thrombosis and venous thromboembolism by damaging vascular endothelium and upregulating pro-

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coagulation factors (such as thromboxane A2).\textsuperscript{7,13} This, combined with extremity bone fractures, rapid infusion of blood products, and possible activated factor VII administration, may increase the chance of early deep vein thrombosis with subsequent fatal pulmonary embolus.\textsuperscript{25} Although in this case fatal air embolus cannot be excluded, we believe primary embolus is more likely due to isolated reports of similar intraoperative deaths in Iraq after attack by IED (personal communications) and the negative echocardiogram. After this case, only life-saving craniotomies were immediately performed on patients sustaining polytrauma from IED attack.

Conclusions

Military neurosurgeons in Afghanistan perform life-saving cranial operations and spine stabilization procedures for wartime injuries and act as general neurosurgeons to the local Afghan community. The lessons learned with regard to combat-related injuries are similar to those learned in Iraq and other conflicts. Military neurosurgeons are also asked to provide forensic information to aid in the continual assessment of evolving enemy tactics. We experienced unique issues when treating the local Afghan population. As the neurosurgical mission continues in Afghanistan, undoubtedly lessons will continue to be learned and measures implemented that will hopefully further endeavors to provide the best care for all patients.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or reflecting the views of the US Air Force, the Department of Defense, or the Department of Veterans Affairs.

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