Chapter 8

CONCEPT OF A DEDICATED HEAD AND NECK SURGICAL TEAM

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INTRODUCTION

Advances in body armor have contributed to dramatic reduction in wartime mortality but have also led to a higher incidence of operative head and neck trauma.[1] Counterinsurgency operations will likely continue to be major military operations. Improvised explosive devices (IEDs) will remain major threats. These devices cause significant trauma and create major complex injuries to the less protected head and neck. A dedicated head and neck team should be present to maximize care for injured soldiers, as well as the local population. A surgical team capable of performing maxillofacial surgery is a crucial element of managing trauma.[2–4] Although multiple reports highlight the significance of specialists with expertise in maxillofacial trauma, there continues to be lack of adequate delineation of a dedicated head and neck surgical team.[2–6]

HISTORICAL BACKGROUND

The care of traumatic wounds has evolved over hundreds of years, thanks largely to lessons learned from armed conflicts. Dominique-Jean Larrey, a young surgeon in Napoleon's army, observed that most injured soldiers died before receiving medical attention. Considered the father of modern military medicine, Larrey proposed performing battlefield stabilization and installing surgical teams near the front lines.[7] Horse-drawn carriages would transfer the wounded from the battlefield to the closest field hospital. Today, helicopters and ambulances have taken over the job of evacuation.

The US Army's current Role 3 field hospital is the combat support hospital (CSH). The CSH provides hospitalization and outpatient services for all categories of patients in theater. It can provide hospitalization for up to 248 patients. The hospital includes a headquarters and headquarters detachment, and two completely functional hospital companies: one 84-bed and one 164-bed. Collectively, the hospital has four wards providing intensive nursing care for up to 48 patients and 10 wards providing intermediate nursing care for up to 200 patients. In addition, the Army has a hospital augmentation team–head and neck, which may augment a CSH. This team provides special surgical expertise for otolaryngology surgery, neurosurgery, and eye surgery to support the CSH plus specialty consultative services. The augmentation team–head and neck is the only organization in the Army that has an organic computed tomography (CT) scanner.[8]

The US Air Force's deployed hospital was until recently the air transportable hospital (ATH), which could be deployed near an airfield and provided care to evacuated casualties. However, ATHs required a large cubic space and an airframe for transport. To minimize payload size and maximize surgical capability, the current expeditionary medical support, or EMEDS, system was created.[9] These units are modular and can be tailored to meet mission requirements. The EMEDS basic module has four holding beds and supports mobile field surgical units. The basic module can be upgraded with additional beds to the EMEDS + 10 and EMEDS + 25. The EMEDS + 10 provides a 10-bed inpatient capability, and it adds complex medical and surgical inpatient care and enhanced laboratory, radiology, and pharmacy services. The EMEDS + 25 increases the inpatient capability to 25 beds and adds additional operating room, dental, medical, and surgical support. The largest deployed Air Force medical facility is the Air Force theater hospital (AFTH). It provides 58 beds (of which 12 are intensive care unit beds) and four operating tables, and allows expanded surgical capability where subspecialty teams can be plugged in as dictated by mission requirements. Currently, Air Force otolaryngologists deploy to the AFTH.[10]

In the 10 years of conflict in Iraq and Afghanistan, over 7,200 American head and neck trauma patients have been treated at US military medical facilities in the war zones.[10–12] These casualties suffered 37,523 facial and penetrating neck injuries, 25,834 soft tissue injuries, and 11,689 facial fractures.[12] Overall, mortality from head and neck injuries was 3.5%, with a higher rate in Iraq (4.1%) than Afghanistan (2.3%).[12] Head and neck injuries were seen in 16% to 39% of casualties; in prior wars, it was between 14% and 25%.[2,6,13–18] The reason behind the higher incidence of head and neck injuries is the lack of head and neck protection provided by current body armor.[1,5,19] In past conflicts, soldiers would commonly present with severe and often fatal chest and abdomen injuries, but with the introduction of better body armor and its better protection of the torso, the incidence of head and neck trauma has increased.[1]

Additionally, insurgents in Iraq and Afghanistan have embraced the emerging tactic of targeting American and allied soldiers with IEDs. These dangerous weapons deliver high energy, high velocity projectiles, resulting in tremendous tissue destruction. When this degree of disruption affects the head and neck, very complex injury patterns can result. In contrast, small arms weapons were commonly used in past military campaigns.[16,17,20–22] These lower energy weapons (com-

pared to current IEDs) create injury patterns that are less complex, and general surgeons were capable of managing these injuries.

However, the evolution of surgical training has resulted in surgeons becoming increasingly specialized in specific areas, sometimes so exclusively that they are uncomfortable operating outside their primary area of interest. With perpetual discoveries and advances in technology, the field of medicine has become more and more specialized. In the past, general surgeons were trained with technical skills to function as broad-based general surgeons.[23] However, evolving work hour restrictions have resulted in limitations of surgical training,[23] and many surgeons pursue fellowships to achieve appropriate competency and provide excellent care.[24] Furthermore, regionalization is an external force that has delegated certain procedures traditionally performed by the local general surgeon to subspecialists at tertiary hospitals.[19]

Many disciplines have migrated to other surgical specialties; for example, chest injuries to thoracic and cardiothoracic surgeons, vascular injuries to vascular surgeons, and head and neck injuries to otolaryngologists. Neurosurgeons now manage problems affecting the nervous system, orthopedic surgeons manage bony and musculoskeletal problems, general surgeons manage thoracic and abdominal troubles, urologists care for genitourinary issues, ophthalmologists treat ocular injuries, and otolaryngologists manage head and neck pathology. In this new environment where general surgeons are less comfortable with surgical management of head and neck problems, compounded by the considerably complex head and neck injury patterns created by IEDs, otolaryngologists are the best trained surgeons to manage these problems. In light of the increased incidence of head and neck injuries, otolaryngology is a crucial specialty in providing surgical care in wartime. Oral surgeons can complement a head and neck team; they are excellent maxillofacial surgeons comfortable repairing bony injuries, but their expertise in the head and neck is limited compared to otolaryngologists.

Optimal care is achieved with a multispecialty approach. At the onset of Operation Iraqi Freedom (OIF), a multispecialty head and neck team that consisted only of neurosurgeons, ophthalmologists, and oral surgeons had been caring for casualties with head and neck trauma. Since September 2004, this multispecialty head and neck team has included an otolaryngologist (see Chapter 1, History of Deployed Army Otolaryngologists in Operation Iraqi Freedom and Operation Enduring Freedom for a historical overview).

ROLE OF OTOLARYNGOLOGY

The expertise and skills of otolaryngologists in addressing injuries and disorders of the head and neck provide unique capabilities that maximize the care of deployed service members. Head and neck surgeons possess critical skills in acute airway management, and airway control is the priority in any resuscitative effort. Combat medics, anesthesiologists, and trauma and general surgeons are all capable of intubating patients and performing emergent cricothyroidotomy. Translaryngeal intubation is the preferred method to control the airway and can be done in many straightforward cases. Conversely, in a serious case where immediate airway must be established, a cricothyroidotomy is the recommended intervention. However, combat injuries to head and neck can produce scenarios where a difficult airway is present and an airway must be established promptly. For example, penetrating neck and thermal injuries can result in significant edema that makes traditional intubation difficult. Anesthesiologists are quite skilled in intubating difficult airways, but sometimes encounter airways they cannot intubate with their instruments. In these situations, they often ask otolaryngologists for assistance.

Otolaryngologists possess detailed understanding of oropharyngeal, hypopharyngeal, and laryngeal anatomy. Their experience in the evaluation and treatment of patients with head and neck cancer, who often present with airway compromise, helps tremendously in difficult airway management. Cancer patients may have distorted anatomy or restricted mobility due to major surgery or radiation treatments. Otolaryngologists have various instruments that provide better visualization of the airway, such as the Jackson sliding laryngoscope (Figure 8-1). This laryngoscope has better leverage and lighting compared to the anesthesiologist's blades. Its design makes the laryngoscope easier to manipulate past obstructing lesions or edematous soft tissue, and suction can be concurrently used. Once the glottis is identified, a 6.5 endotracheal tube (ETT) can be passed through the scope and into the glottis. The floor of the scope can then be slid out, allowing withdrawal of the Jackson sliding laryngoscope without affecting the ETT's position. Figure 8-2 shows a sliding Jackson laryngoscope with the floor removed. If a larger ETT is needed, it can be safely switched out using a Seldinger technique (changing the ETT over a catheter placed through ETT into airway). Frequently, a difficult airway can be managed with this technique.

Another effective technique involves using a Dedo laryngoscope, which is commonly used to examine

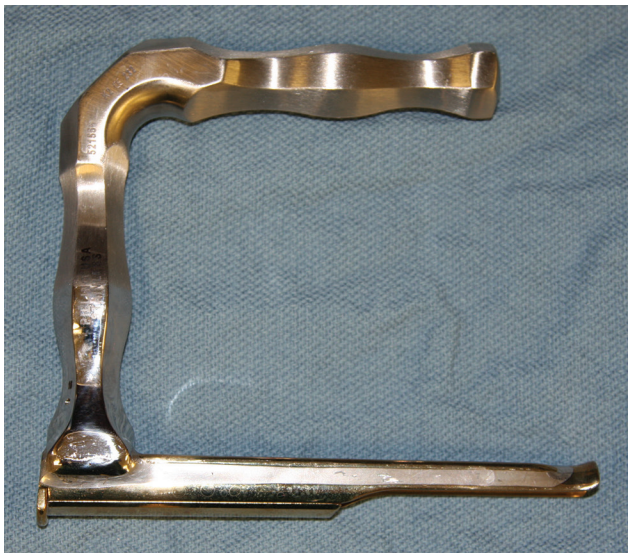

Figure 8-1. Sliding Jackson laryngoscope.

Figure 8-2. Sliding Jackson laryngoscope showing its floor removed, allowing the scope to be withdrawn after a 6.0 endotracheal tube inserted into the glottis through the scope.

upper airway anatomy during cancer evaluations. The Dedo scope also provides excellent leverage and lighting, and has a larger opening compared to the sliding Jackson scope (Figure 8-3). However, it does not have a removable side, making intubation with an ETT difficult. To overcome this difficulty, the practitioner may insert a bougie dilator past the glottis, withdraw the Dedo scope, and then pass an ETT over the bougie.

If a surgical airway is indicated, the options include cricothyroidotomy and tracheotomy. The terms tracheostomy and tracheotomy are often used interchangeably in error, but they have different meanings. According to Chevalier Jackson in 1923, tracheotomy is "the operation of opening the trachea." A tracheostomy is a procedure that exteriorizes the trachea to the cervical skin, resulting in a more permanent tracheal cutaneous fistula. Two prominent otolaryngologists, Montgomery and Dedo, reserve the term tracheostomy for these particular procedures.[25,26] As mentioned previously, if the patient's condition is dire, a cricothyroidotomy is recommended because it is quicker and easier. However, the cricothyroidotomy should be promptly converted to a formal tracheotomy. If the airway is stable but a surgical airway is still needed, a tracheotomy is a better option. Otolaryngologists are capable of performing these procedures in patients with difficult anatomy (eg, progressive neck edema from injury, obese neck). Tracheotomies were the second most common procedure performed in Iraq and Afghanistan.[1,5]

Head and neck surgeons are experts in neck anatomy, trained to perform extensive neck dissections in cancer patients, thyroidectomies and parathyroidectomies, neck mass excisions, and open airway reconstructions. Penetrating neck injuries in wartime can result in extensive damage. A detailed understanding of neck, laryngeal, and pharyngeal anatomy is important to a successful exploration and repair. In both Iraq and Afghanistan, neck exploration for penetrating neck injury was commonly performed.[1,5]

The management of penetrating neck injuries, specifically asymptomatic zone II penetration, remains dynamic and controversial. The central question is whether exploration is mandatory for all zone II injuries, or whether some can be selectively managed with careful observation. Proponents for mandatory exploration cite the unacceptably high rate of missed injuries in those initially asymptomatic.[27–29] Meyer was concerned to find five patients with six major injuries not identified in preoperative testing.[29] On the other hand, mandatory exploration results in an unacceptably high negative exploration rate.[30,31] Many recent studies demonstrate the safety in selective management.[32–35] The introduction of helical CT angiography (CTA) provides a new technology that can help identify and rule out arterial as well as aerodigestive tract injuries. Woo and Bell argued that CTA can safely reduce the number of neck explorations, including negative neck explorations.[36,37]

However, these studies were performed at civilian institutions, and military operations in Afghanistan and Iraq produce more extensive neck injuries. Brennan discovered that apparently insignificant holes

Figure 8-3. Dedo laryngoscope.

caused by high velocity 1- to 3-mm projectiles were potentially lethal, leading to the phrase "small hole equals big pathology."[1] In previous wars, high velocity penetrating neck trauma required mandatory neck exploration, even if the patient was asymptomatic. In OIF and OEF, selective neck exploration is performed for high velocity penetrating neck trauma for asymptomatic patients. Neck exploration is always performed in symptomatic patients and in asymptomatic patients with major pathology demonstrated on CTA or endoscopy. In addition, although the former Air Force theater hospital in Balad (Iraq) and the Craig Joint Theater Hospital in Bagram Air Base (Afghanistan) are well-equipped hospitals, the deployed setting presents a different environment for decision-making. Beds and resources are limited and priority is to treat US and allied troops. The final decision to operate or observe will be made based on each patient's presentation and workup, as noted above.

The most common otolaryngology procedure in both theaters was complex facial laceration repair.[1,5] High velocity projectile injuries to the face from military firearms and IEDs produce significantly more extensive and complex injuries to facial soft and bony tissues. The facial lacerations and fractures seen in a civilian level 1 trauma center pales in comparison to those seen in a military theater hospital. Otolaryngologists should be prepared to encounter more complex and comminuted fracture patterns. In the experience of several deployed practitioners, fractures from high velocity projectiles such as IEDs and military rifles were more challenging to repair than those seen at civilian trauma centers.[1–5]

Otolaryngologists have detailed understanding of facial anatomy and function that allows them to best repair these injuries, which can be quite daunting. Otolaryngologists realize the importance of restoring function but also recognize the significance of facial aesthetics. Furthermore, they are well trained in the use and design of local and regional soft tissue flaps when there is significant soft tissue loss. Finally, high velocity facial trauma poses significant risk to facial nerve and parotid ducts; again, otolaryngologists have the necessary background to repair these injuries.

If lacerations appear clean, primary closure can be performed after copious irrigation and limited debridement. Unfortunately, many facial wounds are caused from IED projectiles. Enemy combatants employ a variety of material, invariably resulting in wounds that are grossly contaminated (with grease, dirt, etc). In Afghanistan, IED wounds were initially treated with aggressive irrigation and careful debridement, then repaired meticulously over hours. Unfortunately, almost all wounds broke down, requiring secondary minor procedures. To reduce this failure rate, otolaryngologists began treating these wounds with irrigation and careful debridement, followed by a brief period of observation before repair was attempted (delayed primary closure). However, some authors advocate extensive irrigation, minimal tissue debridement, and immediate closure of these wounds.[1,5]

High velocity projectiles can cause severely comminute and displaced facial fractures. Repair of facial fractures, with arch bars/intermaxillary fixation and open reduction and fixation of fractures, were the fifth and ninth most common procedures in Iraq, respectively.[1] These repairs were the fourth and fifth most common procedures in Afghanistan.[5] Fractures can be treated with maxillomandibular fixation with or with rigid internal fixation (RIF). The same five

principles for RIF apply in both the civilian and deployed settings: (1) good exposure of fractures; (2) anatomical reduction of bone fragments; (3) functionally stable fixation of bone fragments; (4) preservation of blood supply to bone fragments by employing atraumatic surgical techniques; and (5) early, active, and pain-free mobilization.[38] Initially, many deployed surgeons were hesitant to perform immediate RIF due to a perceived increased risk of wound infection from operating in an austere environment. However, Lopez reported favorable postoperative wound infection and loss of soft tissue coverage rates after definitive repair in theater compared to stateside.[39]

Although the safety of in-theater RIF has been established, other factors should be considered before pursuing surgery. Bed spaces are critical resources. The United States has an outstanding transport capability that is able to transfer soldiers to a Role 4 medical facility outside the combat zone within just a few days (as compared to an average 45-day transport time seen during the Vietnam War).[40] The priorities of maintaining open beds to accommodate newly injured soldiers and quickly transferring service members may be considerations for delaying RIF. Maxillomandibular fixation should be done if possible. However, if the decision has been made to begin surgery under general anesthesia, consideration should be given to RIF.[5] In contrast, local civilian casualties will likely require definitive repair because US hospitals are the most advanced facilities in theater and, hence, the only choice for these patients.

In addition to the unique surgical skills an otolaryngologist brings to the surgical operation, head and neck surgeons also enhance outpatient services. The ability to treat many common ear, nose, and throat disorders improves service members' quality of life and maximizes their effectiveness in the field.[1] Furthermore, transportation to Germany for an otolaryngology consult can be avoided, thus supporting commanders' efforts to improve mission efficiency and reduce costs.

Otolaryngology is a highly specialized surgical specialty, providing distinctive specific services. In order to effectively deliver these services, otolaryngologists must also have the support of a dedicated otolaryngology technician. These technicians are experienced and knowledgeable in the many different instruments used by otolaryngologists. In particular, their familiarity with plating systems and RIF instruments tremendously helps an otolaryngologist achieve good outcomes in surgery. Otolaryngology technicians are also members of the head and teams deployed since 2004 and are integral to the head and neck surgeons' ability to provide the best care to service members and the local population.

SUMMARY

Serious and complex disorders are best managed with a multidisciplinary approach, which has been validated by the creation of various multidisciplinary teams to address cancers, craniofacial disorders such as cleft palates and lips, liver-pancreatic-bile duct disease, etc. With the complex problems associated with combat trauma, and the increased incidence of combat-related head and neck trauma, a head and neck multispecialty team will provide the optimal care for wounded US and coalition service members. Otolaryngologists possess unique skills and knowledge that are crucial to providing this service. A head and neck multispecialty team should also include neurosurgery, ophthalmology, and oral surgery.

Advances in surgery and trauma care are greatly influenced by the lessons learned in armed conflicts. These valuable lessons translate to improving surgical care and better outcomes at home. Mass casualties also occur at home, and, as the terrible Boston marathon bombing in 2013 revealed, the United States remains vulnerable to terrorist attacks. Deployed surgeons have an obligation to pass on the lessons they learned to their respective specialties in order to advance surgical care as well as military medicine. As warfare evolves and weapons get better at taking life, it is reassuring to know that modern medicine also continues to improve at saving it.

REFERENCES

1. Brennan J. Experience of first deployed otolaryngology team in Operation Iraqi Freedom: the changing face of combat injuries. *Otolaryngol Head Neck Surg*. 2006;134:100–105.

2. Salinas NL, Eller RL, Davis MR, Rasmussen TE. Mass casualty response of a modern deployed head and neck surgical team. *J Craniofac Surg*. 2010;21(4):987–990.

3. Will MJ, Goksel T, Stone CG, Doherty MJ. Oral and maxillofacial injuries experienced in support of Operation Iraqi Freedom I and II. *Oral Maxillofac Surg Clin N Am*. 2005;17:331–339.

4. Hayter JP, Ward AJ, Smith EJ. Maxillofacial trauma in severely injured patients. *Br J Oral Maxillofac Surg*. 1991;29:370–373.

5. Brennan J. Head and neck trauma in Iraq and Afghanistan: different war, different surgery, lessons learned. *Laryngoscope*. 2013;123:2411–2417.

6. Dobson JE, Newell MJ, Shepherd JP. Trends in maxillofacial injuries in war-time (1914-1986). *Br J Oral Maxillofac Surg*. 1989;27:441–450.

7. Brewer LA 3rd. Baron Dominique Jean Larrey (1776-1842): father of modern military surgery, innovator, humanist. *J Thorac Cardiovasc Surg*. 1986;92:1096–1098.

8. *Emergency War Surgery*. *Fourth United States Revision*. Fort Sam Houston, TX: Borden Institute; 2013: 24, 25.

9. US Air Force. *Expeditionary Medical Support (EMEDS).* Washington, DC: USAF; 2006. Air Force Tactics, Techniques and Procedures 3-42.71.

10. Owen BD, Kragh JF Jr, Wenke JC, Macaitis J, Wade CE, Holcomb JB. Combat wounds in Operation Iraqi Freedom and Operation Enduring Freedom. *J Trauma*. 2008;64:295–299.

11. Lew TA, Walker JA, Wenke JC, Blackbourne LH, Hale RG. Characterization of craniomaxillofacial battle injuries sustained by United States service members in the current conflicts in Iraq and Afghanistan. *J Oral Maxillofac Surg*. 2010;68:3–7.

12. Feldt BA, Salinas NL, Rasmussen TE, Brennan J. The Joint Facial and Invasive Neck Trauma (J-FAINT) Project, Iraq and Afghanistan 2003-2011. *Otolaryngol Head Neck Surg*. 2013;148(3):403–408.

13. Propper BW, Rasmussen TE, Davidson SB, et al. Surgical response to multiple casualty incidents following single explosive events. *Ann Surg*. 2009;250(2):311–315.

14. Wade AL, Dye JL, Mohrie CR, Galarneau MR. Head, face, and neck injuries during Operation Iraqi Freedom II: Results from the US Navy-Marine Corps combat trauma registry. *J Trauma*. 2007;63(4):836–840.

15. Carey ME. Analysis of wounds incurred by U.S. Army Seventh Corps personnel treated in Corps hospitals during Operation Desert Storm, February 20 to March 10, 1991. *J Trauma*. 1996;40(Suppl):S165–169.

16. Reister FA. *Medical Statistics in World War II*. Washington DC: Department of the Army, Office of the Surgeon General; 1975: 21.

17. Reister FA. *Battle Casualties and Medical Statistics: US Army Experience in the Korean War*. Washington, DC: Department of the Army, Office of the Surgeon General; 1973: Chapter 3.

18. Maughon JS. An inquiry into the nature of wounds resulting in killed in action in Vietnam. *Mil Med*. 1970;135:8–13.

19. Rustemeyer J, Kranz V, Bremrich A. Injuries in combat from 1982-2005 with particular reference to those to the head and neck: a review. *Br J Oral Maxillofac Surg*. 2007;45:556–560.

20. Montgomery SP, Swiecki CW, Shriver CD. The evaluation of casualties from Operation Iraqi Freedom on return to the continental United States from March to June 2003. *J Am Coll Surg*. 2005;201:7–13.

21. Zouris JM, Walker GJ, Dye J, et al. Wounding patterns of US Marines and sailors during Operation Iraqi Freedom, major combat phase. *Mil Med*. 2006;171:246–252.

22. Galarneau MR, Hancock WC, Konoske P, et al. The Navy-Marine Corps Combat Trauma Registry. *Mil Med*. 2006;171:691–697.

23. Santry HP, Chokshi N, Datrice N, et al. General surgery training and the demise of the general surgeon. *Bull Am Coll Surg*. 2008;93(7):32–38.

24. Cooke DT, Jamshidi R, Guitron J, Karamichalis J. The virtual surgeon: using medical simulation to train the modern surgical residents. *Bull Am Coll Surg*. 2009;94(6):38–41.

25. Dedo HH. *Surgery of the Larynx and Trachea*. Philadelphia, PA: BC Decker, Inc; 1990: 82.

26. Montgomery WM. *Surgery of the Larynx, Trachea, Esophagus, and Neck*. Philadelphia, PA: Saunders; 2002: 190–191.

27. Fogelman M, Stewart R. Penetrating wounds of the neck. *Am J Surg*. 1956;91:581–596.

28. Markey JC Jr, Hines JL, Nance FC. Penetrating neck wounds: a review of 218 cases. *Am Surg*. 1975;41:77–83.

29. Meyer JP, Barrett JA, Schuler JJ, et al. Mandatory vs selective exploration for penetrating neck trauma. A prospective assessment. *Arch Surg*. 1987;122:592–597.

30. Obeid FN, Haddad GS, Horst HM, Bivins BA. A critical reappraisal of a mandatory exploration policy for penetrating wounds of the neck. *Surg Gynecol Obstet*. 1985:160:517–522.

31. Merion RM, Harness JK. Ramsburgh SR, Thompson NW. Selective management of penetrating neck trauma: cost implications. *Arch Surg*. 1981:116:691–696.

32. Biffl WL, Moore EE, Rehse DH, Offner PJ, Francoise RJ, Burch JM. Selective management of penetrating neck trauma based on cervical level of injury. *Am J Surg*. 1997;174:678–682.

33. Sriussadaporn S, Pak-Art R, Tharavej C, Sirichindakul B, Chiamananthapong S. Selective management of penetrating neck injuries based on clinical presentations is safe and practical. *Int Surg*. 2001;86:90–93.

34. Nason RW, Assuras GN, Gray PR, Lipschitz J, Burns CM. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. *Can J Surg*. 2001;44:122–126.

35. Klycahkin ML, Rohmiller M, Charash WE, Sloan DA, Kearney PA. Penetrating injuries of the neck: selective management evolving. *Am Surg*. 1997;63(2):189–194.

36. Woo K, Magner DP, Wilson MT, Marqulies DR. CT angiography in penetrating neck trauma reduces the need for operative neck exploration. *Am Surg*. 2005;71:754–758.

37. Bell RB, Osborn T, Dierks EJ, Potter BE, Long WB. Management of penetrating neck injuries: a new paradigm for civilian trauma. *J Oral Maxillofac Surg*. 2007;65:691–705.

38. Prien J, Kellman R. Rigid internal fixation of mandibular fracture: basics of AO technique. *Otolaryngol Clin North Am.* 1987;20:3.

39. Lopez MA, Arnholt JL. Safety in definitive in-theater repair of facial fractures. *Arch Facial Plast Surg*. 2007;9:400–405.

40. Gawande A. Casualties of war—military care for the wounded from Iraq and Afghanistan. *N Engl J Med*. 2004;351:2471–2475.