The new face of war: Craniofacial injuries from Operation Inherent Resolve

Daniel C. Neubauer, MD, Macario Camacho, MD, Eamon B. O'Reilly, MD, Matthew Brice, DO, Jennifer M. Gurney, MD, *and* **Matthew J. Martin, MD**, *Los Angeles, California*

BACKGROUND: During the last 20 years of conflict in the Middle East, improvements in body armor and the use of improvised explosive devices have resulted in an increased incidence of complex craniofacial trauma (CFT). Currently, CFT comprises up to 40% of all casualties. We present new data from the recent conflict in Iraq and Syria during Operation Inherent Resolve.

METHODS: Data were collected for patients treated at role 1, role 2, and role 3 facilities in Iraq and Syria over a 1-year period. During this time, a specialized head & neck surgical augmentation team was deployed and colocated with the central role 3 facility. Data included for this cross-sectional study are as follows: injury type and mechanism, triage category, initial managing facility and subsequent levels of care, and procedures performed.

RESULTS: Ninety-six patients sustained CFT over the study period. The most common injuries were soft tissue (57%), followed by cranial (44%) and orbital/facial (31%). Associated truncal and/or extremity injuries were seen in 46 patients (48%). There were marked differences in incidence and pattern of injuries between mechanisms (all $p < 0.05$). While improvised explosive devices had the highest rate of cranial and truncal injuries, gunshot wounds and blunt mechanisms had higher incidences of orbital/facial and neck injuries. Overall, 45% required operative interventions including complex facial reconstruction, craniotomy, and open globe repair. Mortality was 6% with 83% due to associated severe brain injury. Most patients were local nationals (70%) who required discharge or transfer to the local health care system.

CONCLUSION: Complex craniofacial trauma is increasingly seen by deployed surgeons, regardless of subspecialty training or location. Deployment of a centrally located head and neck team greatly enhances the capabilities for forward deployed management of CFT, with excellent outcomes for both US and local national patients. (*J Trauma Acute Care Surg.* 2022;93: S49–S55.)

LEVEL OF EVIDENCE: Therapeutic/care management; Level V.

KEY WORDS: Craniofacial; war; Syria; Iraq.

Craniofacial trauma has always been a significant portion of the casualties treated by military surgeons in modern warfare. Head and neck injuries accounted for roughly 21% of all injured service members during World War II and the Korean War.[1] During the recent conflicts in Afghanistan and Iraq, the incidence of craniofacial injuries has increased to 22% to 39% of casualties, depending on the campaign and years examined.[2–8] As the conflicts have drawn down over the last decade and been replaced by consolidation or contingency operations, the number of casualties has decreased, subsequently resulting in fewer published studies or series.[9,10] There is currently a dearth of information concerning the incidence of head and neck injuries during the ongoing stabilization efforts in Iraq and Syria. In addition to the risks of major morbidity and mortality, these injuries can have significant functional and aesthetic complications.

There is currently no clinical practice guideline for craniofacial trauma and most deploying general surgeons do not have specific in-depth training in head and neck injuries and reconstruction. The most recent publication on facial trauma is by Breeze et al. looking at facial fractures in Afghanistan from 2016 to 2019.[10] His small case series looked at 55 patients. In this cohort, there was a total of 125 fractures—the most common was mandibular, followed by maxillary/zygomatic, and finally orbital wall fractures.[10] His case series was unique in that it exposed a notable increase in local national casualties compared with coalition forces. This work also showed a relatively high infection rate at 26% along with a high complication rate of 46%.[10]

In response to the volume and complexity of combat-associated craniofacial trauma, the US military created a head and neck augmentation team with the mission to deploy as an added component of a combat support hospital and supply theater-wide coverage for patients requiring craniofacial surgical interventions. The

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From the Department of Surgery (D.C.N.), Naval Medical Center San Diego, and Trauma Service, Scripps Mercy Hospital, San Diego, California; Department of Surgery (M.C.), Tripler Army Medical Center, Honolulu, Hawaii; Department of Surgery (E.B.O.), Naval Medical Center San Diego, San Diego, California; Department of Surgery (M.B.), Madigan Army Medical Center, Joint Base Lewis-McChord, Washington; Joint Trauma System (J.M.G.), San Antonio, Texas; and Department of Surgery (M.J.M.), University of Southern California, Los Angeles, California.

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Address for reprints: Matthew Martin, MD, FACS, Division of Trauma and Acute Care Surgery, Department of Surgery, Los Angeles County + USC Medical Center, Rm C5L100, 2051 Marengo St, Inpatient Tower (IPT), Los Angeles, CA 90033; email: matthew.martin@med.usc.edu.

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head and neck augmentation team (CSH H&N team) included a neurosurgeon, an otolaryngologist, an ophthalmologist, and their own team of subspecialty-trained nurses, surgical technicians, and anesthesia providers. However, there has been no published analyses of the case mix, volumes, complexity, and outcomes associated with these augmentation teams during contingency operations. We sought to describe and analyze the experience of this specialty augmentation team during a 1-year period, as well as the theater-wide incidence and management of craniofacial trauma that serves as the referral base for the augmentation teams.

METHODS

Permission was obtained from United States Central Command Office of Command Surgeon and the United States Army Institute of Surgical Research for publication clearance. A review of records for patients undergoing clinical and/or radiologic assessment at roles 1, 2, and 3 facilities was performed to identify neurosurgical, ophthalmological, and head and neck traumatic injuries in theater. The Strengthening the Reporting of Observational Studies in Epidemiology checklist was followed in the reporting of these data (Supplemental Digital Content, http://links.lww.com/TA/C583).[11]

Data were collected and evaluated for patients seen and treated at role 1 and role 2 facilities, as well as by the CSH H&N team (Fig. 1) at the role 3 facility in Baghdad, Iraq over a 1-year period from January 1, 2017, through December 31, 2017. Mechanisms of injury, injury patterns and treatment were assessed to determine the relative workload of each component of the role 1 and role 2 facilities and CSH H&N team, as well as to provide a possible foundation for a separate preventive measures' analysis. Patient chart review of chief complaints, physical examination findings, imaging findings, and clinical or surgical interventions were collected for patients presenting for medical treatment in theater for evaluation and/or management of trauma-related complaints.

The deployed US military and NATO allied military medical teams providing the medical evaluation and management during this period were operating under a general set of medical rules of engagement that provided all medical care for both battle and nonbattle injuries in US and allied service members or contractors. This included the full spectrum of injury mechanisms from combat-associated blast or gunshot injuries to mechanisms unrelated to direct combat including vehicular crashes, heavy equipment injuries, falls, etc. These teams also provided care for host-nation military and civilian patients injured during or as a result of combat operations, or any life, limb, or eyesight threatening injuries that required immediate evaluation and treatment. Less urgent injuries in this patient population were generally not managed at US military treatment facilities.

Specific data collected included type of injury, mechanism of injury, triage category, type of facility that treated the patient initially and subsequent treatment facilities, and procedures performed. Simple descriptive and summary statistics were performed. Patients with missing data were excluded from subgroup analyses.

RESULTS

A total of 96 patients sustained craniofacial, ophthalmological and neck traumatic injuries from January 1, 2017, to December 31, 2017. Ninety-two were male (96%), the mean age was 29.3 ± 9.5 years, and 70% were local nationals. The mechanisms of injury were as follows: improvised explosive devices in 46 patients, motor vehicle crashes in 19 patients, gunshot wounds in 16 patients, blunt trauma in seven patients, and other mechanisms of injury in seven patients. Associated truncal and/or extremity injuries were seen in 46 patients (48%). Injuries included 55 soft tissue, 42 cranial, 19 orbital traumas with 10 open globes, 16 facial fractures (two maxillary, seven mandibular, seven nasal), nine penetrating neck traumas, three burns, three external ear traumas, and two cervical spine injuries. Twenty-nine patients had trauma to multiple craniofacial, ophthalmological and neck subsites. A summary of injury location and mechanism of injury is presented in Table 1.

Figure 1. Task force MED OR team (top). Head and neck augmentation team (bottom).

Of the 96 patients, 45% (n = 43) required surgical intervention. This included 20 washout/soft tissue repairs, nine ophthalmologic (four open globe repairs, three lateral canthotomies) procedures, and nine exploratory laparotomies. In addition, three thoracotomies were performed, three cricothyrotomies with one of these being converted to trach upon arrival at the role 3. Three vascular repairs/ligations were performed in addition to one extra-corporal membrane oxygenation (ECMO) cannulation. There were two formal neck explorations, two escharotomies for significant truncal burns, two craniotomies, one external ventricular

TABLE 1. Injury Location Based on Mechanism

Mechanism of Injury	n	Age, y	Cranial Trauma	Orbital Trauma	Facial Fractures	Soft Tissue Injuries	Neck Trauma	Injury Below the Clavicles
Overall	96	29.3 ± 9.5	42 (44%)	19 (20%)	11 (11%)	55 (57%)	9 (9%)	42 (44%)
IED	46	25.7 ± 10.2	18 (39%)	11 (24%)	4 (9%)	29 (63%)	5 (11%)	25 (54%)
MVC	19	30.4 ± 7.0	10 (58%)	2 (11%)	4 (21%)	13 (68%)	0 (0%)	10 (58%)
GSW	16	31.5 ± 13.1	8 (47%)	2 (11%)	2 (11%)	6 (35%)	3 (18%)	7 (41%)
Other	14	31.4 ± 9.2	6 (43%)	4 (29%)	1 (7%)	7 (50%)	1 (7%)	4 (29%)

drain (EVD) placement, and one esophageal injury repair. There were five orthopedic procedures performed as well. Table 2 includes a breakdown of surgical interventions by mechanism and whether they were isolated head and neck surgery versus multiple body regions requiring intervention.

IMPROVISED EXPLOSIVE DEVICES

The mean age for the 46 patients was 25.7 ± 10.2 years, and all were male. Over half of the patients—25 patients (54%)—had trauma below the clavicles as well. Multiple subsites above the clavicles were traumatized in 35% of the patients. Cranial trauma was present in 18 patients (39%) and cervical spine trauma in one of those patients. Orbital trauma was present in 11 patients, and 10 of them had at least one open globe (two patients had bilateral open globes). Facial fractures were present in four patients, one maxillary, three mandibular and three nasal fractures. Soft tissue damage was present in 29 patients (63%). Penetrating neck trauma was present in five patients (11%) and external ear trauma in two patients (4.4%).

Overall, 26 patients (56%) required surgical intervention. This included seven exploratory laparotomies, three thoracotomies, eight soft tissue repair/washouts, seven ophthalmological procedures, two neck explorations, one craniotomy, three vascular interventions, one esophageal repair, four orthopedic surgeries, one EVD placement, and one ECMO cannulation.

MOTOR VEHICLE COLLISIONS

The high clearance, v-shaped hull, and up-armor of modern military vehicles make them prone to rollovers, which occur quite frequently during military operations which are recorded as MVCs in this data set. The inside of modern military vehicles contain numerous pieces of heavy equipment that can injure service members when dislodged during a rollover. Also, during combat operations service members are usually unrestrained in order to effectively engage the enemy, this results in significant injuries as well when a rollover occurs. Interestingly, MVCs were the most common etiology of trauma to US service members.

The mean age for the 19 patients was 30.4 ± 7.0 years, and 16 patients (84%) were male. Over half of the patients (10 patients 58%) had trauma below the clavicles as well. Multiple subsites above the clavicles were traumatized in 37% of the patients. Cranial trauma was present in 10 patients (58%), and none had spinal trauma. Orbital trauma was present in two patients, and none of them had open globes. Facial fractures were present in three patients—two mandibular and one nasal fracture. Soft tissue damage was present in 13 patients (68%). None of the patients had any neck or ear trauma. Only one patient (5%) required surgical intervention in this group, and it was a washout and laceration repair for a facial laceration.

GUNSHOT WOUNDS

The mean age for the 17 patients was 31.5 ± 13.1 years, and 16 patients (94%) were male. Less than half of the patients—seven patients (41%)—had trauma below the clavicles. Multiple subsites above the clavicles were traumatized in three patients (18%). Cranial trauma was present in eight patients (47%) with spine trauma in one of those patients. Orbital trauma was present in two patients, and none of them had open globes. There were two mandibular fractures in this cohort. Soft tissue damage was present in six patients (35%). Penetrating neck trauma was present in three patients (18%). There was no external ear trauma.

Thirteen patients (76%) required surgical intervention in the gunshot wound (GSW) group. This included two exploratory laparotomies, 10 soft tissue washouts/repairs, one craniotomy, and one orthopedic surgery.

OTHER CAUSES

The mean age for the 14 patients was 31.4 ± 9.2 years, and 13 patients (93%) were male. Only four patients (29%) had trauma below the clavicles. Multiple subsites above the clavicles were traumatized in three patients (21%). Cranial trauma was present in six patients (43%) and spine trauma in none of those patients. Orbital trauma was present in four patients and none of them had open globes. One patient had a nasal fracture. Soft tissue damage was present in seven patients (50%). Penetrating neck trauma was present in one patient (7%).

Three patients (21%) required surgical intervention in this group. This included two burn patients who underwent escharotomies and cricothyrotomies and one patient who was injured in a noncombat tire explosion resulting in a cricothyrotomy and bilateral canthotomies.

TABLE 2. Operative Intervention by Mechanism of Injury

Mechanism of Injury	n	Isolated Head and Neck Surgery	Multibody Region Surgery
Overall	43	10 (23%)	33 (77%)
IED	26	6 (23%)	20 (77%)
MVC	1	1 (100%)	0 (0%)
GSW	13	2 (15%)	11 (85%)
Other	3	1 (33%)	2 (66%)

LOCATION OF INJURY

Cranial

The mean age for the 42 patients was 30.2 ± 11.2 years old, and 39 patients (93%) were male. Five patients died. Mechanism of injury includes improvised explosive devices (IED) (n = 18), MVC (n = 10), GSW (n = 8), and other trauma (n = 6). Twelve patients (29%) had trauma below the clavicles. Multiple subsites above the clavicles were traumatized in 16 patients (38%). Orbital trauma was present in 10 patients (24%) and six had open globes. Three patients had facial fractures: two maxillary, one mandibular, and two nasal fractures. Soft tissue damage was present in 13 patients (31%). Penetrating neck trauma was present in two patients (5%). Ten patients (23%) required surgical intervention including four exploratory laparotomies, two thoracotomies, four soft tissue washouts, one esophageal repair, one neck exploration, one EVD placement, one ECMO cannulation, and three ophthalmologic procedures.

Orbital Trauma

The mean age for the 19 patients was 30.6 ± 9.1 years, and 18 patients (95%) were male. Mechanism of injury includes IED (n = 11), MVC (n = 2), GSW (n = 2), and other trauma (n = 4). Eleven patients (58%) had trauma below the clavicles and the same number had trauma to multiple subsites above the clavicles. Ten patients (53%) had open globes. Two patients had a facial fracture—one with maxillary fractures and one with nasal fractures. Soft tissue damage was present in eight patients (42%). Penetrating neck trauma was present in one patient (5%). Six patients (31%) underwent surgical intervention for either canthotomies or globe repair.

Deaths

Six patients died. Of the six deaths, five sustained cranial injuries by the following mechanisms: IED (n = 1), GSW (n = 3), and mortar (n = 1). Upon presentation, one patient had a penetrating cranial injury, with brain matter extruding from the wound and was GCS 3 with fixed and dilated pupils. One patient had a gunshot wound to the forehead with no exit injury; he was unresponsive and was breathing spontaneously, he had fixed and dilated pupils with no response to pain. Two other patients presented with GSWs to the head, one patient was unresponsive with brain matter exposed and the other one died before arriving to the CSH. One patient presented with a lethal mortar injury and sustained severe cranial injuries, as well as face and neck injuries. The one patient who did not have cranial injuries was injured by an IED and sustained injuries to the entire front part of his body, with a positive FAST examination.

DISCUSSION

Craniofacial injuries continue to increase in incidence and complexity in modern conflicts. This is due to multiple factors, but the three main ones are improvements in modern body armor, increasing blast and fragmentation mechanisms, and a lack of effective head and neck protection.[12] Modern body armor allows service members to survive previously fatal thoracoabdominal injuries, and thus they may present with more severe and complex injuries to lesser protected areas such as the head and neck and extremities. The increased use of IEDs and explosives also has resulted in more diffuse fragmentation injuries requiring multi-compartment or anatomic area procedures (Fig. 2). Finally, there is limited head and neck protection with most service members only being issued a helmet and eye protection, and that eye protection can be easily defeated with high velocity shrapnel or projectiles.

During the conflicts in Iraq and Afghanistan, numerous studies concerning head and neck injuries were published. The two most important of these were the Joint Facial and Invasive Neck Trauma (J-FAINT) Projects by Feldt et al. and Lanigan et al. These studies reviewed the Joint Theater Trauma Registry from 2003 to 2011 and 2011 to 2016 for all facial injuries excluding cervical spine, calvarium, and intracranial injuries. During Feldt et al.'s[13] J-FAINT from 2003 to 2011, there were 37,523 facial and neck injuries among 7,177 casualties resulting in an average of 5.2 injuries per casualty. A majority of the injuries were soft tissue injuries: the most common to the face/check (48%), the neck/larynx/trachea (17%), and mouth/lip (12%).[13] There were a total of 11,689 facial fractures with the most common being the maxilla (25%), then the mandible (21%), and finally the orbit (19%).[13] The data from Lanigan et al.'s[9] study from 2011 to 2016 show an overall decrease in the number of injuries to 5,312 head and neck injuries among 922 service members. While the injury patterns are similar to 2003 to 2011 J-FAINT data, there was a noticeable increase in orbital fractures from 19% to 26.3% of all fractures and a decrease in mandible fractures from 21% to 12% in the 2011 to 2016 J-FAINT population.[9] The more recent J-FAINT data also show the high proportion of open fractures in modern conflicts with upward of 75% of all fractures being open.[9] The decrease in casualties during 2011 to 2016 correlates with the decrease in operations in both Iraq and Afghanistan, as well as changes in tactics and strategy. It is also important to acknowledge that many reports include injuries sustained by US service members or coalition partners, and not local national military or civilian personnel. Thus, the actual numbers and incidence of complex craniofacial trauma is grossly underestimated and, again, highlights the need for familiarity of this topic among all deploying surgeons.

Besides the J-FAINT studies, there are numerous published case series from surgical logs or shorter periods from the varying trauma registries.[1–5,14–18] While each of these series has biases in the data set used or during which phase of the war they reviewed, the publications demonstrate a common injury

Figure 2. Example of diffuse fragmentation injuries.

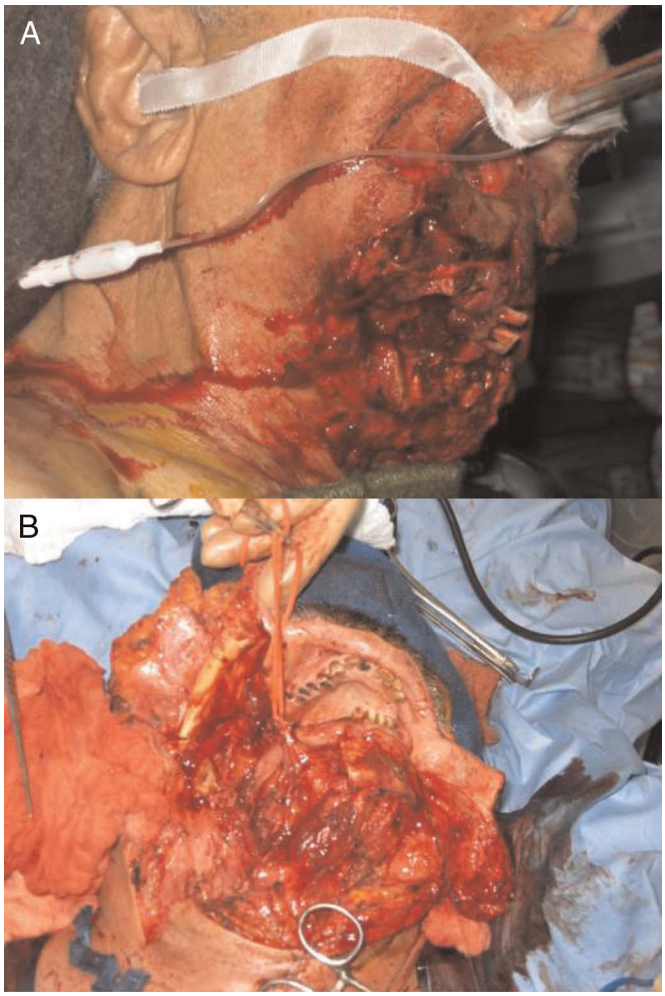

Figure 3. High velocity gunshot wound (*A*) compared with improvised explosive device blast injury (*B*).

pattern that deploying surgeons should be prepared to address. Because of the nature of improvised explosive devices, craniofacial trauma will occur in roughly 25% to 30% of all casualties.[2–8] A majority of these will be soft tissue injuries because of the mechanism of IED blasts.[1,9,13,15,19] Approximately 30% to 40% of craniofacial casualties will also have an associated facial fracture with midface (maxilla, zygomatic) being the most common followed by mandibular and orbital fractures.[1,9,13,14,20] These fractures are more likely to be open—upward of 75%—and patients are likely to have multiple facial fractures.[1,14–16] Craniofacial trauma patients have a much higher incidence of multiple trauma, particularly after blast injury mechanisms. The common scenario of multiple amputations, truncal and spine injuries, and face/brain injuries encapsulates "complex dismounted blast injury". A thorough and comprehensive initial trauma evaluation and expeditious management strategy must be adopted to address these highly complex and difficult casualties.

Our data were similar to these previous studies in that the most common injury was soft tissue. Approximately 57% of the patients had soft tissue injuries (Fig. 3). This was followed by cranial injuries at 44%, globe injury in 20%, facial fractures in 11% of patients, and neck injuries in 9% of patients. Interestingly, 48% of patients had associated truncal or extremity injuries highlighting the need for a holistic and multidisciplinary approach to these patients, with close collaboration between teams, including general/trauma surgery, orthopedics, and the head and neck specialty team members. When the injuries are evaluated by mechanism, an interesting pattern occurs. Motor vehicle crashes had the highest incidence of soft tissue injuries, then cranial, and then facial fractures. IEDs had a pattern of soft tissue followed by cranial followed by orbital injuries. In comparison, gunshot wounds had a high rate of cranial injuries, but with less extensive soft tissue injuries and the highest incidence of associated neck injuries. The anatomic injury patterns and required procedures highlight that even among those patients with isolated trauma to the head and neck area, multispecialty care and coordination between the members of the H&N team, including neurosurgery, ophthalmology, otolaryngology, and oral-maxillofacial surgery, is frequently required.

When looking at surgical interventions required, there was a wide breadth of critical interventions (Fig. 4). The most commonly performed procedure was washout and soft tissue repair. This is expected as the most common injuries were soft tissue in nature. These procedures encompassed everything from simple washouts and laceration repairs to complex flap coverage for large soft tissue defects. The next most commonly performed procedure were ophthalmologic in nature as well as exploratory laparotomies. The two main ophthalmologic procedures were open globe repairs and lateral canthotomies. Although open globes and ocular compartment syndromes are extremely uncommon in civilian trauma, these are much more common in the forward military setting. Clearly, these are highly subspecialized procedures but it shows the transformational nature of having a dedicated head and neck team with expertise to perform these. Those seven procedures saved the vision of those patients, and would not have been possible without the presence of the H&N augmentation teams.

The associated need for exploratory laparotomy in this cohort ran the gamut of findings from nontherapeutic to requiring liver laceration repair, nephrectomy, and small or large bowel resections. The three thoracotomies were performed with one of these being resuscitative. The patient that underwent the resuscitative thoracotomy unfortunately died. In addition, three cricothyrotomies were performed at role 1 facilities or in the field. Interestingly, only two these were successful. The one failure received noninvasive ventilatory support and was found to not require any surgical airway when he arrived at the role 3. One of the two successful cricothyrotomies was converted to a tracheostomy upon arrival to the role 3, and this was accomplished by the head and neck team. There were a handful of vascular injuries to named vessels in the extremities. One of these was repaired and two were ligated. In addition, one patient required ECMO cannulation.

There were two formal neck explorations for penetrating trauma. One of these explorations resulted in the discovery of an esophageal injury that was repaired at the time finding. The other was negative for any vascular or aerodigestive injuries. Two neurosurgical procedures performed including one decompressive craniotomy with debridement and duraplasty. Another patient had an EVD placed for intracranial pressure monitoring.

Figure 4. (clockwise from top left) Craniotomy and duraplasty, soft tissue wound with carotid artery and mandible injuries from gunshot wound to the neck, complex soft tissue closure after high-velocity gunshot wound to the mandible, and mandibulo-maxillary fixation for facial fracture.

Interestingly, two patients with very large burns (100% and 25% total body surface area, respectively) required escharotomies prior to transportation to the local national health care system. None of the patients operated on in our case series required reoperation in theater for their injuries by the H&N team, although several underwent initial limited surgical intervention at the role 2 level and then more definitive reconstructive surgery by the H&N team at the role 3 facility.

The decrease in case volume and case complexity across the military health care system has been well documented.[21] This combined with lack of regular head and neck operations in the average general surgeon's practice leads to a critical lack of recent experience with the head and neck anatomy and procedures. There is also an increased incidence of complex injuries to areas, such as the eye and brain in the combat setting, that require emergent Ophthalmologic or neurosurgical procedures that are outside the scope of practice and experience of general or trauma surgeons. The presence of a centrally located multispecialty head and neck augmentation team allows for this critical need to be filled rapidly and reliably in a deployed setting.

CONCLUSION

Our small case series demonstrated that improved body armor is driving an increase in the incidence of craniofacial injuries and modern conflict. These craniofacial injuries were associated with complex multisystem injuries. Deploying surgeons need to be ready to operate in the head neck region. They also need to be creative and how they address these injuries. A majority of casualties are host nationals and deployed surgeons may be the only form of definitive care. It may be the general surgeons that are addressing their complex head neck injuries and performing the definitive reconstruction prior to the patient's discharge in to the local health care system. This small case series also demonstrated that every theater should have a dedicated neck team. These injuries are incredibly complex, and the experience and technical skills of a dedicated head and neck surgical team were invaluable.

To address these challenges, future deploying surgeons will require additional training. The question is where to obtain this training in an early overburden health care system and with numerous predeployment requirements. General surgeons should dedicate time to cross-training with their otolaryngology, head and neck, and plastic surgery colleagues in order to become comfortable with the head neck region. They should also be familiar with simple rotational and pedicled flaps in the region. While general surgeons are already expected to have a wide and varied set of skills, it is quite evident that head neck injury is will become a larger and larger portion of their deployed surgical population.

AUTHORSHIP

D.C.N. participated in the literature search, data analysis and interpretation, writing. M.C. participated in the data collection, critical revision. E. B.O.R. participated in the data interpretation, critical revision. M.B. participated in the data analysis and interpretation. J.M.G. participated in the data collection, critical revision. M.J.M. participated in the data collection, analysis, and interpretation, writing, critical revision.

DISCLOSURE

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REFERENCES

1. Chan RK, Siller-Jackson A, Verrett AJ, Wu J, Hale RG. Ten years of war: a characterization of craniomaxillofacial injuries incurred during operations Enduring Freedom and Iraqi Freedom. *J Trauma Acute Care Surg*. 2012; 73(6 Suppl 5):S453–S458.
2. Keller MW, Han PP, Galarneau MR, Gaball CW. Characteristics of maxillofacial injuries and safety of in-theater facial fracture repair in severe combat trauma. *Mil Med*. 2015;180(3):315–320.
3. Wade AL, Dye JL, Mohrle 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.
4. Breeze J, Bowley DM, Combes JG, Baden J, Rickard RF, DuBose J, et al. Facial injury management undertaken at US and UK medical treatment facilities during the Iraq and Afghanistan conflicts: a retrospective cohort study. *BMJ Open*. 2019;9(11):e033557.
5. Breeze J, Gibbons AJ, Shieff C, Banfield G, Bryant DG, Midwinter MJ. Combat-related craniofacial and cervical injuries: a 5-year review from the British military. *J Trauma*. 2011;71(1):108–113.
6. Belmont PJ Jr., McCriskin BJ, Sieg RN, Burks R, Schoenfeld AJ. Combat wounds in Iraq and Afghanistan from 2005 to 2009. *J Trauma Acute Care Surg*. 2012;73(1):3–12.
7. Owens 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(2):295–299.
8. Hoencamp R, Vermetten E, Tan EC, Putter H, Leenen LP, Hamming JF. Systematic review of the prevalence and characteristics of battle casualties from NATO coalition forces in Iraq and Afghanistan. *Injury*. 2014;45(7):1028–1034.
9. Lanigan A, Lindsey B, Maturo S, Brennan J, Laury A. The joint facial and invasive neck trauma (J-FAINT) project, Iraq and Afghanistan: 2011-2016. *Otolaryngol Head Neck Surg*. 2017;157(4):602–607.
10. Breeze J, Gensheimer W, DuBose JJ. Combat facial fractures sustained during operation resolute support and Operation Freedom's Sentinel in Afghanistan. *Mil Med*. 2020;185(9–10):414–416.
11. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the reporting of observational studies in epidemiology (STROBE): explanation and elaboration. *PLoS Med*. 2007; 4(10):e297.
12. Tong D, Beirne R. Combat body armor and injuries to the head, face, and neck region: a systematic review. *Mil Med*. 2013;178(4):421–426.
13. 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.
14. 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 of Iraq and Afghanistan. *J Oral Maxillofac Surg*. 2010;68(1):3–7.
15. Kittle CP, Verrett AJ, Wu J, Mellus DE, Hale RG, Chan RK. Characterization of midface fractures incurred in recent wars. *J Craniofac Surg*. 2012;23(6): 1587–1591.
16. Zachar MR, Labella C, Kittle CP, Baer PB, Hale RG, Chan RK. Characterization of mandibular fractures incurred from battle injuries in Iraq and Afghanistan from 2001–2010. *J Oral Maxillofac Surg*. 2013;71(4):734–742.
17. Madson AQ, Tucker D, Aden J, Hale RG, Chan RK. Non-battle craniomaxillofacial injuries from U.S. Military operations. *J Craniomaxillofac Surg*. 2013;41(8): 816–820.
18. Wordsworth M, Thomas R, Breeze J, Evriviades D, Baden J, Hettiaratchy S. The surgical management of facial trauma in British soldiers during combat operations in Afghanistan. *Injury*. 2017;48(1):70–74.
19. Brennan J. Head and neck trauma in Iraq and Afghanistan: different war, different surgery, lessons learned. *Laryngoscope*. 2013;123(10):2411–2417.
20. Keller MW, Han PP, Galarneau MR, Brigger MT. Airway management in severe combat maxillofacial trauma. *Otolaryngol Head Neck Surg*. 2015; 153(4):532–537.
21. Dalton MK, Remick KN, Mathias M, Trinh QD, Cooper Z, Elster EA, Weissman JS. Analysis of surgical volume in military medical treatment facilities and clinical combat readiness of US military surgeons. *JAMA Surg*. 2022;157(1):43–50.