LETTERS TO THE EDITOR

Early decompressive craniectomy and limited tract debridement: a proven strategy?


Wolfe in her editorial states “military doctrine over the past decade has shown that emergency craniectomy significantly improves outcome in these patients.” As an aging veteran (and with the assistance of Jim Goodrich, a consumer of military neurosurgical history), I’m unsure that this contention is justified, and concerned that a remarkable body of historical literature has been forgotten by our generation of military surgeons.

“Each war brings great respect and recognition to individual neurosurgeons who have done an exemplary job in impossible situations. Each war involves neurosurgeons who are inexperienced for the tasks at hand. Each war involves relearning principals [sic] that were useful in the past but which have been forgotten.” (Slater J: Neurosurgery at war. Presidential Address, Western Neurosurgical Society Annual Meeting, Lake Tahoe, CA, September, 2005.)

Long-Term Neurological Outcomes From Combat-Related Penetrating Brain Injury

Larkin and coauthors present data on an 80-patient cohort of US service members out of a 908-patient population treated in Kandahar, Afghanistan, between January 2010 and March 2013. Their cohort mortality was 21%. Although comparison of data between conflicts is understandably challenging based on differing data collection and methodology, the reader should be aware of available historical data. Cushing’s mortality for his last 45-patient cohort in World War I (WWI) was 28%. Estimated mortality for craniocervical wounds in World War II (WWII) was 25% of patients reaching an evacuation hospital and 13% of those receiving surgery. In Korea, in a cohort of 1105 casualties with penetrating head injuries reaching an Army neurosurgical installation between September 1950 and August 1952, fewer than 8% of patients died. In Hammon’s analysis of 2187 consecutive penetrating injuries to the brain in Vietnam over a 26-month period, an in-hospital mortality rate of 9.7% was reported for US casualties who received surgical intervention. Assuming a post-hospitalization mortality rate on par with the 6%–8% reported by Carey et al. in a follow-up study of 103 soldiers followed up at 1 year, survivability in Vietnam appears to have been similar, if not better than that reported in the Iraq and Afghanistan conflicts.

In conversation with colleagues, I’ve heard comparisons of data between conflicts dismissed based on immoral time bias, different mechanism of injury, and/or more rapid casualty evacuation during the Iraq and Afghanistan conflicts. I see little validation for such concerns. The proportion of blast and gunshot wounds between Vietnam and the current conflicts are similar. Blast injuries comprised 80% of injuries in Larkin et al.’s study, essentially identical to the 80% (1170 fragmentation vs 247 gunshot wounds) among US personnel reported in Hammon’s series.

As to the contention that patients with more severe injuries are surviving to receive care, resulting in higher overall mortality? The recognition that forward neurosurgical care results in improved outcomes is hardly new. Surgeons learned and relearned this principle in each war of the 20th century. Matson raised similar concerns regarding casualty care during WWII: “When a neurosurgical team functioned close to the scene of combat and received casualties very early (2–6 hours post injury) head wounds were operated on that would not have survived to reach a hospital further in the rear (6–24 hours after injury). The operative mortality in the former group was naturally higher.” Based on the best information available, the contention that the change in the treatment paradigm from limited craniectomy, aggressive tract debridement, and watertight dural closure to one of decompressive craniectomy with limited debridement has resulted in improved outcomes is not supported.

Complications Related to Surgical Approach

The strategy of aggressive debridement, limited craniectomy, and watertight dural closure developed during WWI/WWII/Korea and perfected in Vietnam was hard
earned through the treatment of thousands of casualties. Beginning with Brandvold et al. in the 1980s, a new strategy of minimal debridement was advanced that has influenced management in the Iraq and Afghanistan conflicts. Carey in 2003 cautioned against limited debridement strategies based on literature review, highlighting a profound increase in the need for further debridement, CSF leakage, and fatal meningitis in minimalist strategies compared to Vietnam data. Again referencing Hammon’s series, the incidence of CSF fistula (0.63%) and meningitis (0.63%) were quite low. The only long-term outcome study performed to date on patients from the Iraq and Afghanistan conflicts that included these variables (Weisbrod et al.) reported a 10.2% rate of CSF leakage and a 29.9% rate of meningitis/ventriculitis. Whereas the surgical strategy used in the Iraq and Afghanistan conflicts has achieved excellent outcomes for many US service members as demonstrated by Larkin, it is sobering to consider the potential impact of higher rates of CSF leakage and meningitis on non-US casualties, who comprised the largest fraction of Larkin’s study population (828 of 908 casualties) and on whom long-term follow-up could not be obtained. At the very least, strong consideration should be given to a strategy of aggressive tract debridement and watertight dural closure for non-US casualties who will probably remain in austere medical conditions by US standards.

Operational Considerations on the Treatment of Penetrating Brain Injuries

This is not to say that decompressive craniectomy has not played an important role in the Iraq and Afghanistan conflicts. It has played an essential role1 based on the small medical footprint and limited in-theater holding system used during this conflict. In comparison to the 7.2 days patients with penetrating head injuries spent at evacuation hospitals in Vietnam, critically injured US casualties were typically evacuated from theater less than 24 hours after initial resuscitative surgery. Critical Care Air Transport Teams (CCATT) provided outstanding in-flight critical care to US casualties, albeit usually without direct neurosurgical oversight. Decompressive craniectomy allowed for safe transportation of casualties during this critical time period. The favored technique included “large craniectomies to prevent brain strangulation over bone edges, minimal brain debridement, adequate brainstem decompression, and dural onlay substitutes for dural closure.” Preliminary data suggest that this technique has achieved good long-term outcomes for US soldiers fighting an insurgency with clear air superiority over the enemy, low casualty burden, with immediate critical care air transport out of the theater within 24 hours of injury. How the same strategy would perform in a conventional war absent air superiority and rapid casualty evacuation to the rear is an open question. In many circumstances, a single definitive operation capable of providing the highest likelihood of survival for an individual casualty is preferable. This is particularly true for a casualty who is unlikely to be rapidly evacuated from the battlefield. I would argue there are few data to suggest that the strategy used (by this author as well) during the heaviest casualty periods of the Iraq and Afghanistan wars is preferable to methods developed during 20th-century conflicts in the absence of a plan for rapid evacuation from theater.

I applaud the continued efforts of my colleagues in uniform to continue to pursue outcome data on our experience in Iraq and Afghanistan. They face considerable challenges in assembling these data. I offer the above comments as a reminder of the words of George Santany that those who cannot remember the past are condemned to repeat it.

Jonathan E. Martin, MD
University of Connecticut School of Medicine, Connecticut Children’s Medical Center, Hartford, CT

References

Disclosures
The author reports no conflict of interest.

Correspondence
Jonathan E. Martin: jmartin03@ccmckids.org.

INCLUDE WHEN CITING