

Corneal Foreign Body Management at a Role 1 Flight Line Aid Station

Risks, Benefits, and Implications for Special Operations Medicine

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ABSTRACT

Eye injuries are common in forward areas of operations. Definitive diagnosis and care may be limited not by provider skill but rather by available equipment. The ability to treat simple trauma such as corneal foreign bodies at the Role 1 level has advantages including rapid return to duty, decreased cost of treatment, and, most important, decreased risk of delayed care. We propose the device such as a hand-held portable slit lamp should be made available for appropriate Special Operations Medical Forces (SOFMED) or aviation providers.

KEYWORDS: *ocular, trauma, slit lamp, Role 1, aviation, special operations medicine*

Introduction

Combat aviation is often a critical component of the fifth “SOF truth”: SOF often need non-SOF support. Illnesses and injuries that compromise mission success warrant prioritized attention to minimize downtime. For example, an embedded corneal foreign body in a pilot is likely a grounding event because it is visually debilitating. It may require transfer to the nearest higher level facility with ophthalmology care and equipment capacity which lengthens the down period. This report will discuss the management of a corneal foreign body (FB) using a handheld portable slit lamp at a Role 1 flight line aid station in theater. We will also examine the likely “pros and cons” of providing such equipment to skilled aviation and SOF medics in forward and austere environments.

Case Presentation

A 25-year-old U.S. military aviator presented to the flight line aid station with complaints of left eye pain and irritation and inability to sleep following a mission. He reported no known injury and no blast or environmental

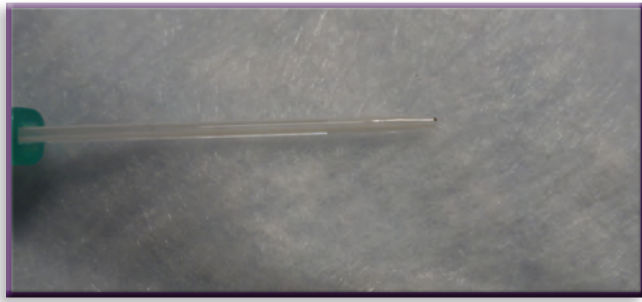
exposures, and he was wearing protective eyewear associated with his usual flight equipment. His past medical history was negative for systemic or ophthalmic disease. Visual acuity was 20/15 OU, pupils were round and reactive OU with no afferent pupillary defect, and tonometry was not available. The ocular adnexa were normal bilaterally with no evidence of injury, laceration, or foreign bodies. With use of a handheld slit lamp (Figure 1), the left cornea was examined. A sub-1mm-diameter embedded foreign body was identified at the 12 o'clock position in the mid-periphery 3mm from the limbus (Figure 2). It was at approximately 25% depth within the cornea stroma. (Depth perception is facilitated because the user views the target with both eyes through the slit lamp beam via the loupe lens.) We irrigated the cornea using sterile saline and an 18-gauge angiocatheter but were unable to dislodge the foreign body. Visualizing the eye using the slit lamp, we were able to safely lift the foreign body free of the corneal stroma. The eye was Seidel negative and vision was 20/15 both before and after the procedure. (The Seidel test uses fluorescein dye placed on a suspected injured eye to visualize a possible stream of anterior chamber aqueous humor, which

Figure 1 *The Eilodon Hand Held Slit Lamp Model 510LS (Loupe System).*



Eilodon Inc.; www.Slitlamp.com

Figure 2 Sub-1mm corneal FB removed from aviator at a Role 1 flight line aid station using a hand-held portable slit lamp. The FB is visible at the tip of the catheter.



would indicate an open globe.) Erythromycin ophthalmic ointment was placed into the eye, and the patient was seen the following morning, when fluorescein staining did not reveal an epithelial defect. The aviator was cleared for flight.

Technical Specifications

Eidolon's Hand Held Slit Lamp Model 510LS (Loupe System) provided an excellent view of the cornea and anterior chamber. It is available with quick-change, color-coded loupes (lenses) that snap in and out of a specially designed housing. This enables increases in magnification from $\times 5$ to $\times 15$. The Model 510LS comes standard with 20D ($\times 5$) and 40D ($\times 10$) loupes. A 60D ($\times 15$) loupe is available as an option. The device provides several hours of use with two "AA" batteries. It weighs approximately 8oz and has a suggested retail price of \$495. This compares well with older designs (such as the Haag-Streit BA-904 "hand-held" portable slit lamp) that, although portable, are too large and heavy for use in austere settings. For example, the SL-15 Kowa portable device has an advantage over traditional table-mounted systems, but at 28oz with an additional 44oz charging stand, the net 4.5 lb device is again not practical for SOFMED applications. Figures 3 and 4 demonstrate the ease of use by our medic for anterior segment evaluation. Figure 4 clearly shows the slit lamp illumination of the cornea.

Our experience as eye surgeons (R.W.E. and C.J.C.) in austere deployed environments demonstrates the utility of these devices. We encourage the availability of a hand-held portable slit lamp for SOFMED teams. The rationale for this recommendation follows.

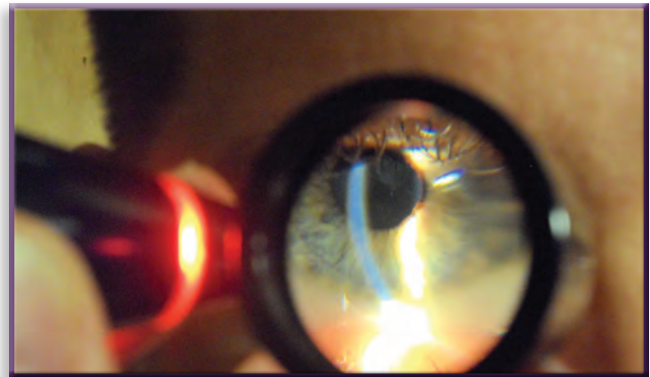
Implications for Aviation Medicine and SOFMED

"The National Guard has extensive capabilities that are impossible to attain in active duty units, largely because its citizen Soldiers bring their civilian expertise

Figure 3 Medic using the hand-help slit lamp to examine the anterior segment.



Figure 4 Close-up view of corner through the hand-held slit lamp.



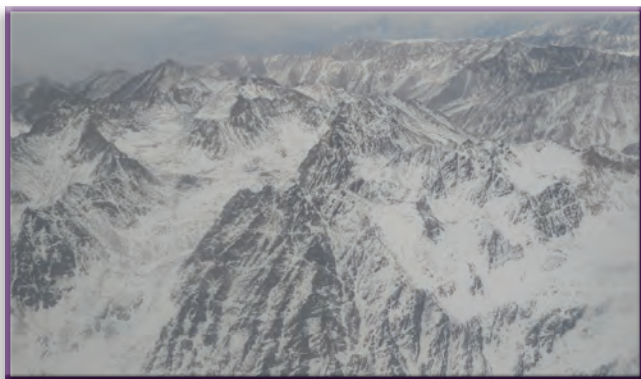
in addition to their military occupational specialties."¹ The experiences of BG Enzenauer as a Special Forces battalion flight surgeon deployed to Afghanistan proved that emergency eye care and surgery as provided for Allied, Coalition, and host nationals built significant rapport and trust. This is in keeping with the Special Forces "winning the hearts and minds" philosophy, and this quote is also fitting for combat aviation (the 1-135th ARB is a Missouri Army National Guard AH-64 unit). It is our opinion that pushing the highest skill level forward by both "man and machine" is just as critical for combat aviation mission success. Given the extent, nature, and incidence of ocular trauma in recent conflicts, it is that apparent that military medical providers must continue to transition from the boundaries of what is possible to better mirror the standard of civilian care.^{2,3} We (R.W.E. and C.J.C.) are willing to teach any SOFMED and aviation providers who are willing to learn and demonstrate proficiency. We are developing advanced nonlive tissue derived skills simulators for corneal injury, open globe, and orbital compartment syndrome and expect to have prototypes available at the 2014 Special Operations Medical Association Scientific Assembly and Exhibition (SOMSA).

Ocular trauma is, of course, difficult to assess, and the best plan is often to transport the Servicemember rearward when possible. The detection of globe laceration is certainly facilitated by slit lamp examination compared with a nonmagnified image. When the clinical scenario suggests risk of open globe (blast injury, improvised explosive device, shrapnel, lack of eye protection), a brief but accurate examination is also key to proper management. A Fox or rigid shield should be placed and the casualty evacuated for definitive diagnosis and treatment as a vision-threatening injury. Terrorist-orchestrated blast injuries often have glass fragments presenting as an intraocular foreign body (IOFB).⁴ Compared with civilian IOFB cases, military personnel are at greater risk for IEDs as the cause. This is associated with a delay of accurate diagnosis due to lack of specialty care and equipment.⁵ We believe our medics can succeed in diagnosing eye trauma when given the proper instrumentation.

In forward positions, if you did not bring it, you do not have it (Figure 5). Every ounce of weight carried into austere environments is critical for SOFMED personnel. However, the common incidence of eye injury and disease argues for the supply of equipment that can match the skill set of our medics. While not reasonable for every medic's bag, we argue that the 18D, Seal Team Corpsman, civil affairs medical officer, and flight medic should have the option to include a portable slit lamp such as the device described here. The training needed to master such a device is 10 to 15 minutes, and we (R.W.E. and C.J.C.) have successfully transferred skills to physicians and medics at Special Operations Medical Association (SOMA) 2013 on the Eilonon portable slit lamp.

To that end, two of us (R.W.E. and C.J.C.) offered ophthalmology skills transfer lecture and laboratory exercises at the annual meeting of SOMA 2012. We intend to provide this training biannually at a minimum at

Figure 5 Afghanistan: a typical austere environment for aviation and SOFMED.



SOMA. Ideally, this would expand to the curriculum at JSOMTC and SOCMSSC. Advanced skills are readily mastered when there is a low instructor-to-student ratio and the emphasis is on hands-on performance of the technique on a live patient. The 18Ds and other SOFMED personnel therefore are able to demonstrate competency in slit lamp examinations before deployment.

Simple eye trauma such as embedded FBs involving less than 50% stromal thickness can safely be removed with use of the slit lamp. Our experience in Task Force Reaper resulted in an aviator returning to duty with no delay before next scheduled mission. We also assessed and treated other conditions including conjunctivitis and possible iritis and flight physicals. The ability to diagnose accurately in the field prevents both the expense and, more important, the risk of referral and transport to the next higher role facility. Timely definitive care also lowers costs by preventing more expensive specialist care needed as a problem worsens in theater. Given the expense invested in training our SOF and aviation communities, a strong argument can be made for a \$495 purchase that will surely yield return on investment after the first successful use in Role 1 aid stations.

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Disclosures

The authors have nothing to disclose.

References

1. Enzenauer RW, Vavra DE, Butler F. Combat ophthalmology. When there isn't an assigned ophthalmologist. *Bimocul Vis Strabismus Q.* 2007;22:153-168.
2. Heier JS, Enzenauer RW, Wintermeyer SF, et al. Ocular injuries and diseases at a combat support hospital in support of Operations Desert Shield and Desert Storm. *Arch Ophthalmol.* 1993;111:795-798.
3. Calvano CJ, Enzenauer RW. Field diagnosis and treatment of ophthalmic trauma. *J Spec Oper Med.* 2012;12:58-64.
4. Thach AB, Ward TP, Dick JS 2nd, et al. Intraocular foreign body injuries during Operation Iraqi Freedom. *Ophthalmology.* 2005;112:1829-1833.

5. Thach AB, Ward TP, Hollifield RD, et al. Eye injuries in a terrorist bombing: Dhahran, Saudi Arabia, June 25, 1996. *Ophthalmology*. 2000;107:844-847.

MAJ Calvano is currently the United States Army Reserve Consultant to the Surgeon General for Ophthalmology. His training includes a dual PhD in pharmacology/toxicology and an MD, both from Albany Medical College in New York, where he also completed an internship in general surgery. His ophthalmology residency was at the University of Texas Medical Branch and MD Anderson Cancer Center in Houston, TX. This was followed by subspecialty training in oculoplastic, orbital, and ocular trauma surgery at Wayne State University in Detroit. He holds a voluntary appointment as assistant professor of medical education: ophthalmology at the University of Central Florida and is a Fellow of the American College of Surgeons and the American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS). Dr. Calvano has enjoyed traveling the world as a team member of USA Powerlifting and has participated in surgical missions from Haiti to Ukraine. Dr. Calvano deployed as a reservist last fall as a flight surgeon to Afghanistan with the 1-135th Attack Reconnaissance Battalion (supporting the Missouri Army National Guard), and he looks forward to continued support of Special Operations Medical Forces through teaching, research, and future deployments. E-mail: christopher.j.calvano.mil@mail.mil, chris_calvano@yahoo.com.

BG Enzenauer is an M-day Guardsman, serving as the assistant adjutant general for space and missile defense, Colorado Army National Guard, since 2010. He provides leadership, current operations oversight, and emerging mission capabilities and technologies advocacy in the critical mission area of space with a specific focus on mid-course missile defense, Army space support teams, and space support elements. In the civilian sector, Dr. Enzenauer is professor of ophthalmology and pediatrics and the chief of ophthalmology at the Children's Hospital of Colorado in Aurora, on the campus that was formerly Fitzsimons Army Medical Center (1920-1996). Dr. Enzenauer is board certified in ophthalmology, preventive medicine (aerospace medicine), and pediatrics. He was commissioned a Distinguished Cadet from the United States Military Academy in 1975. In 1979, he received his medical degree from the University of Missouri-Columbia School of Medicine. He completed internship and residency in pediatrics from 1979 to 1982 at Tripler Army Medical Center, Hawaii. He served as a pediatrician at Scholfield Barracks from 1982 to 1984, including a rotation to the PI for Balakatan Tangent Flash and to Honduras with the 47th Field Hospital at Joint Task Force Bravo, Palmerola, Honduras. From 1984 to 1986, he served as the chief flight surgeon for the 101st Aviation Brigade, 101st Airborne Division (Air Assault) with a second tour at JTF-B in Honduras. From 1986 to 1989, Dr. Enzenauer completed a second residency in ophthalmology at Fitzsimons Army Medical Center in Colorado, followed by a pediatric ophthalmology fellowship at Toronto's Hospital for Sick Children. Dr. Enzenauer left active duty in 1994 and joined the

Army National Guard in 1995. From 1998 to 2010, Dr. Enzenauer served as a senior flight surgeon and the battalion surgeon for 5/19th SFG(A), Colorado Army National Guard. He deployed on many JCETs to PACOM from 1998 to 2011. He deployed to Afghanistan from 2002 to 2003 during OEF2 and to Iraq from 2003 to 2004 during OIF2. Dr. Enzenauer has more than 37 years of uniformed service on active duty and in the Army National Guard.

LTC Schreffler received his commission through ROTC in 1991 on graduating from Benedictine College in Atchison, KS. Initially branched into the Chemical Corps, he attended the Chemical Officer Basic Course at Ft. McClellan, AL, and served as the Battalion Chemical Officer for the 2-135th AVN BN, COARNG. He received a branch transfer to Aviation after completing flight training at Ft. Rucker, AL, in 1995. In 1996 he joined the MOARNG as a member of the 1-135th Attack Reconnaissance Battalion. During his career, LTC Schreffler has held a variety of positions to include most recently the 1-135th ARB commander. In June 2008, LTC Schreffler deployed to Kosovo as part of KFOR 10 and served in NATO HQ-KFOR as the J3 air-chief of helicopter operations. Qualified in the UH-1 Iroquois, the AH-1 Cobra, and the AH-64 Apache helicopters, LTC Schreffler also holds a bachelor of arts degree in biology from Benedictine College and a master of science degree in aviation safety from the University of Central Missouri. He is employed by College of the Ozarks in Pt. Lookout, MO, as an assistant professor of patriotic education.

MAJ Howerton, from Clinton, MO, is a 2001 graduate from the University of Missouri-Columbia with a bachelor of science in political science. In 2006, he left the active component to accept a position within the Missouri National Guard in the 1-135th Attack Reconnaissance Battalion (ARB). He received a branch transfer to aviation and attended Flight School XXI in 2007-2008. MAJ Howerton has held a variety of positions to include rifle platoon leader, support platoon leader, battalion S-1, and rear detachment commander in the 82nd Airborne Division. He also deployed twice as a rifle platoon leader, once to Operation Enduring Freedom III from December 2002 to July 2003 and once to Operation Iraqi Freedom II from January 2004 to April 2004. Following his transfer to the Missouri National Guard, MAJ Howerton has held the positions of battalion S-1, assistant S-3, company commander, and battalion executive officer in the 1-135th ARB. In March 2013, MAJ Howerton mobilized with 1-135th ARB to complete the AH-64D Unit Fielding and Training Program and deploy in support of Operation Enduring Freedom XIV from July 2013 to January 2014. MAJ Howerton is qualified in the AH-64A Apache, AH-64D Longbow, and UH-60 Blackhawk helicopters.

CPT Wenkel graduated from the Interservice Physician Assistant Program (IPAP) in 2008 and has 6 years of experience in emergency and family medicine and 2 years of experience as an aeromedical physician assistant. He currently holds an active guard reserve (AGR) position for the Missouri Army National Guard as the officer-in-charge (OIC) of the Medical Detachment Clinic in Jefferson City, MO.

SSG Miller has been a member of the Missouri Army National Guard for 22 years and a combat medic since 2005. She most recently became a registered nurse in 2007, obtained her BSN in 2012, and plans to start her MSN program in May 2014. SSG Miller was the NCOIC of the flight line aid station for the 1-135th ARB in Afghanistan.

SGT Henke is a combat medic for the United States Army National Guard. As a civilian she works as a catastrophe claims adjuster and specializes in residential structural damage.

SPC Rohrbough has been enlisted in the Missouri Army National Guard for 5 years and has been a medic for 4 years, with one deployment to Afghanistan. Currently, she is a part of the 1-135th Attack Reconnaissance Battalion, where she performs medical readiness tasks to ensure the 1-135th soldiers are fit for duty. SPC Rohrbough is a registered dental hygienist at a private practice, where she provides oral hygiene care and education to people of all ages.

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