 הל.intellij in
Emergency Medicine

RETINAL DETACHMENT DUE TO FACIAL GUNSHOT WOUND: THE UTILITY OF ULTRASONOGRAPHY IN A MEDICALLY AUSTERE ENVIRONMENT

Denise A. Whitfield, MD and Steven J. Portouw, MD
Department of Emergency Medicine, Naval Medical Center San Diego, San Diego, California
Reprint Address: Denise A. Whitfield, MD, Department of Emergency Medicine, Naval Medical Center San Diego, 34800 Bob Wilson Dr., San Diego, CA 92134

Abstract—Background: Retinal detachment is one complication of ocular trauma. Retinal detachments resulting from gunshot wounds are typically associated with significant facial trauma, orbital trauma, or globe penetration. Ultrasonography has been shown to be of diagnostic utility in the evaluation of retinal detachments. Objectives: In this case, an atypical mechanism for retinal detachment is described. The aim is to describe the successful use of ultrasound as an aid for accurate diagnosis and disposition of a retinal detachment in practice environments with limited medical resources. Case Report: We present a case of a low-velocity gunshot wound resulting in retinal detachment from pressure wave forces. A 21-year-old patient sustained a facial gunshot wound injury from a ricocheting AK-47 round, resulting in a closed globe retinal detachment. Portable ultrasonography was utilized as an accurate diagnostic modality in the management and disposition of this patient, allowing prompt confirmation of the diagnosis in a medically austere environment. Conclusion: Ultrasonography can be a valuable diagnostic tool in the evaluation of ocular trauma in medically austere environments. Published by Elsevier Inc.

Keywords—retinal detachment; gunshot wound; orbital trauma; ultrasonography; ocular injury

INTRODUCTION

Trauma accounts for 10% of retinal detachments in the general population (1,2). Although symptoms can be of immediate or insidious onset, recognition of the diagnosis is paramount for the emergency physician (3). A traumatic retinal detachment is considered an ocular emergency that requires emergent specialty consultation for definitive management. In settings where ophthalmologic consultation is not readily available, the challenge to the emergency physician is even more apparent, as decisions regarding disposition are frequently made with limited diagnostic information. A shock trauma platoon (STP) is a small mobile emergency medical unit with limited laboratory, radiographic, and ancillary testing capability. This case was encountered at an STP in Fallujah, Iraq during Operation Iraqi Freedom.

CASE REPORT

A 21-year-old male Iraqi police officer presented to the STP 5 days after sustaining a gunshot wound, due to accidental fire, from an AK-47 rifle. By history, the bullet initially projected through the abdomen of a bystander, ricocheted off the ground, and then entered the face of the victim, just inferior to the right medial canthus. On the day of injury, the patient presented to a local physician. A lower lid laceration was repaired and the patient received a dose of dexamethasone, ciprofloxacin eye

The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, or the United States Government.

Received: 21 March 2010; Final submission received: 24 April 2011; Accepted: 5 June 2011
drops, and cephalaxin oral antibiotic therapy. He presented to the STP with a chief complaint of partial vision loss in the right eye that was persistent and unchanged since the time of injury.

On physical examination, a repaired skin laceration inferior to the medial canthus was noted. Visual acuity was intact to finger counting only in the right eye. Significant lateral vision loss was present in the right eye. His globe was intact with no external ocular injuries identified on visual inspection. Pupillary examination demonstrated equally reactive pupils with a sluggish afferent pupillary response on the right. Extraocular movements were intact in all planes. Fundoscopic examination was not recorded as it was limited due to the inability to dilate the pupil with available resources. The remainder of the physical examination was unremarkable.

Given limited radiographic capabilities, a plain film skull series was obtained, which revealed a projectile round lodged in the right ethmoid sinus (Figures 1, 2). A portable ultrasound was available and ocular ultrasound demonstrated a large inferoposterior retinal detachment (Figure 3), confirming the diagnosis. The patient was evacuated to the nearest Combat Support Hospital, where ophthalmologic consultation was available. Due to delay in presentation and the extent of the detachment, no additional therapeutic options were available to repair vision loss.

DISCUSSION

Traumatic retinal detachments occur by a variety of mechanisms. In open globe injuries, the retina may be avulsed directly by a penetrating force. In addition, detachments frequently occur after a delayed fibrovascular healing response to the open globe. In these cases, the resultant fibrovascular membrane contracts, resulting in traction, and a subsequent detachment as the retinal pulls away from the choroid. Retinal detachments in closed globe injury may occur after a direct contusion. The contacting force transmits through the globe, resulting in immediate impact dehiscence of the retina. Detachments can also occur indirectly when blunt force transmits as a shearing force absorbed by the globe. This leads to separation of vitreous gel, predisposing to an ensuing retinal detachment (1).

The majority of traumatic retinal detachments are characterized by an “insidious progression of the
detachment and the variable latent interval between the injury and presentation" (3). It is estimated that one-third of retinal detachments are not diagnosed until at least 6 weeks after trauma (4). Immediate rhegmatogenous retinal detachments are rare, but most occur by an impact dehiscence mechanism, and are associated with focal scleral impact (1,3).

In this case, the projectile may have lost significant momentum as it ricocheted, entering the ethmoid sinus at a significantly reduced velocity, thereby preventing more significant maxillofacial injury. As no globe injury was noted, and the projectile’s path did not result in direct scleral impact, the impacting force absorbed by the globe may have been due to the transfer of pressure wave forces through the orbit, as the projectile settled in the neighboring sinus. Case reports have reported retinal detachments likely secondary to similar mechanisms due to blast injury as well as penetrating injury (5–8). However, to our knowledge, there have been no reports of facial gunshot wounds that have led to retinal detachment by this proposed mechanism.

Ocular injuries are common in warfare environments. In recent conflicts, U.S. casualty reports estimate that 13% of all injuries have involved ocular trauma (9). Timely diagnosis and definitive treatment of a suspected retinal detachment can be a logistical challenge in a medically austere environment. Definitive diagnosis of a retinal detachment or tear requires a dilated indirect ophthalmoscopic evaluation by an ophthalmologist (10). The current standard practice for suspected retinal detachments detected in the Emergency Department (ED) is referral to an ophthalmologist within 24 h for a complete ocular evaluation and definitive management (10). When prompt specialty consultation is not easily accessible, ultrasonography may be a valuable adjunct for the evaluation and accurate diagnosis of retinal detachments, especially when physical examination is limited.

Bedside ultrasonography has been shown to accurately diagnose multiple ocular pathologies, including retinal detachments. A high-resolution 7.5–10-MHz linear array ultrasound transducer is used to perform an ocular examination. To perform the examination, a large amount of standard water-soluble ultrasound transmission gel is applied to the patient’s closed eyelid. With the patient looking straight ahead, the transducer is aimed over the eyelid, and the globe scanned in both sagittal and transverse planes. The transducer does not have to touch the eyelid (Figures 4, 5). The ultrasound image’s depth can be adjusted such that the image of the eye fills the screen. The normal eye appears as a circular hypoechoic structure (Figure 6). The normal retina cannot be differentiated from other choroidal layers. In the case of a retinal detachment, a hyperechoic membrane is seen within the globe. As ultrasound is in real-time, a detached retina...
may be seen to undulate (11). Diagnosis of retinal detachments has been demonstrated using such a technique in the setting of one large ED with full specialty backup (12). A recent prospective, observational study demonstrated retinal detachment diagnosis with 100% sensitivity by emergency physicians (13). Although these studies were performed at single institutions on relatively small populations, the results suggest that ultrasonography can be used to diagnose retinal detachments with great utility. From a diagnostic perspective, this is promising for practitioners that work in austere environments, as physical examination is often limited and a sufficient fundoscopic examination may be difficult at best, as was the case with this patient. In environments with limited medical capabilities or where specialty backup is not readily available, arranging definitive care for one’s patient can, in itself, be a challenge. Effective use of ultrasound technology may allow an emergency physician to stratify patients by ruling a potential ocular emergency in or out, which subsequently determines the need for emergent vs. urgent evaluation. In wartime environments, the decision to mobilize a medical evacuation team urgently is one that can result in additional casualties, depending on flight and overall safety conditions. Although this is particularly true in a military setting, it may have relevance during humanitarian missions or any situation where the safety factors involved with medical evacuation logistics are relevant. In this case, the suspected diagnosis of a traumatic retinal detachment was confirmed by ultrasonography, and immediate medical evacuation was arranged, as it was required for appropriate care of the patient. Despite prompt diagnosis and specialty referral, vision could not be salvaged in the affected eye due to the extent of the detachment in this particular case.

CONCLUSION

Traumatic retinal detachments can occur by a variety of mechanisms. We present a case of an immediate rhegmatogenous detachment secondary to impact dehiscence, likely due to the transmission of pressure wave forces from a projectile lodged in the ethmoid sinus, through the orbit. Bedside ultrasonography assisted in the prompt diagnosis and disposition of the patient. In this case, ultrasonography was used as a modality for the evaluation, accurate diagnosis, and disposition of a retinal detachment in a medically austere environment.

REFERENCES