Role of Ultrasonography for Testicular Injuries in Penetrating Scrotal Trauma

Gauthami R. Churukanti, Andrew Kim, David D. Rich, Kyle G. Schuyler, Garjae D. Lavien, Deborah M. Stein, and M. Minhaj Siddiqui

OBJECTIVE To review our 12-year experience with penetrating scrotal trauma in civilians and to evaluate the diagnostic utility of scrotal ultrasound prior to operative intervention.

MATERIALS AND METHODS We retrospectively studied all patients who had sustained penetrating scrotal trauma between 2002 and 2014. Charts were reviewed for demographic data, mechanism of injury, scrotal ultrasound findings, patient treatment, and outcomes. The sensitivity, specificity, negative predictive value, and positive predictive value of scrotal ultrasound in relation to scrotal exploration findings were calculated.

RESULTS We reviewed the charts of 91 patients who had sustained penetrating scrotal injuries between 2002 and 2012. A total of 28 charts were excluded due to death from other injuries or incomplete information. Of the remaining 63 patients, 25 (40%) underwent immediate surgical intervention whereas 38 (60%) underwent scrotal ultrasound. Sixteen patients had a positive ultrasound, of which 12 (80%) were found to have testicular injuries upon scrotal exploration. Of the 22 patients with a negative ultrasound, 14 were managed expectantly and 8 underwent exploration, all of which (100%) were negative for testicular injury. Of the 14 patients who were managed with observation, none had developed complications of an inaccurate or delayed diagnosis. Scrotal ultrasound sensitivity and specificity in this series were 100% and 84.6%, respectively.

CONCLUSION In the setting of penetrating trauma. a well-performed scrotal ultrasound is highly sensitive and specific for scrotal content injuries, making nonoperative management an appropriate treatment option in otherwise stable patients. UROLOGY 95: 208–212, 2016. © 2016 Elsevier Inc.

Genitourinary (GU) trauma accounts for 10% of all civilian injuries.[1] Up to 60% of these injuries involve the external genitalia, which may hold significant consequences for young male patients. Although blunt trauma accounts for over half of all testicular injuries, penetrating scrotal trauma is a frequent cause for testicular loss that in turn may lead to infertility, endocrine dysfunction, and psychological damage.

As reflected in the current American Urological Association and European Association of Urology guidelines,[2,3] early scrotal exploration and salvage remains the standard of care for testicular injuries. In particular for penetrating scrotal trauma, the guidelines note that penetrating injuries to the scrotum should undergo surgical exploration as about half of the patients may have testicular rupture. Nonetheless, the prompt diagnosis of injury to scrotal content injuries continues to present a challenge. At the University of Maryland Shock Trauma Center, we have frequently relied on scrotal ultrasonography (SUS) to determine the necessity for operative intervention. Although SUS has been shown to be extremely sensitive and specific for blunt scrotal injuries,[4] only a few studies have analyzed its role in the setting of penetrating wounds and ballistic injuries.[5,6] Utilizing nonoperative management with the aid of SUS is not currently the standard of care for penetrating scrotal trauma. However, we believe that SUS could be a safe and effective diagnostic tool to help determine when observation could be appropriate for select patients with penetrating scrotal trauma. In this study we report our 12-year experience with penetrating scrotal trauma to describe the incidence and management of scrotal injuries as well as the utility of SUS for operative decision-making. We hypothesize that SUS is a highly sensitive diagnostic modality for the identification of testicular injuries.

MATERIALS AND METHODS

After receiving institutional review board approval from the University of Maryland Shock Trauma Center, we retrospectively reviewed our trauma registry for records of all patients who had sustained penetrating scrotal injuries from 2002 to 2014. These injuries were identified by discharge diagnoses according to

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

From the Division of Urology, Department of Surgery, University of Maryland Medical Center, Baltimore, MD; the R Adams Cowley Shock Trauma Center, Baltimore, MD; and the Greenebaum Cancer Center, University of Maryland Medical Center, Baltimore, MD

Address correspondence to: M. Minhaj Siddiqui, M.D., Division of Urology, Department of Surgery, University of Maryland Medical Center, 29 S Greene St Suite 500, Baltimore, MD 21201. E-mail: msiddiqui@smail.umaryland.edu

Submitted: February 9, 2016, accepted (with revisions): April 22, 2016

http://dx.doi.org/10.1016/j.urology.2016.04.025
0090-4295

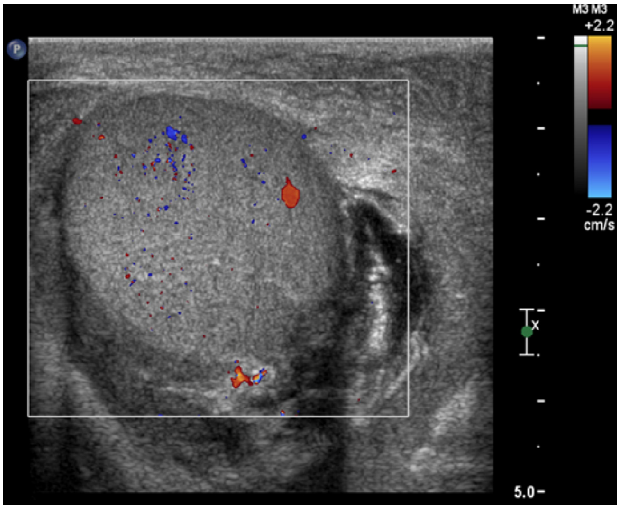

Figure 1. SUS was performed in this patient who sustained a single gunshot wound to the scrotum. Prior to this study, he had undergone a computed tomography that demonstrated findings that were equivocal for left testicular injury. SUS showed appropriate blood flow in the left testis as well as normal contour and echogenicity. Subsequent scrotal exploration was unremarkable for any injuries. SUS, scrotal ultrasonography. (Color version available online.)

ICD-9CM (International Classification of Diseases—Ninth Revision—Clinical Modification) codes. Exclusion criteria included patients who had expired on arrival. Demographic data, mechanism of injury, site and extent of injury, and associated GU injuries were investigated. Operative management, intraoperative findings, nonoperative treatments, and complications were also examined. If the patient had expired from other injuries or were lacking the full amount of information listed above, these charts were excluded from the analysis. The primary outcome measure of this study was the sensitivity and specificity of SUS findings for penetrating scrotal content injuries compared with assessment during scrotal exploration. SUS was performed using a 14 mHz probe upon the patient's arrival in our trauma resuscitation unit. Color Doppler sonograms were examined to detect testicular ischemia. Grayscale sonograms were also obtained to look for hematomas and edema. Each SUS was performed by a certified ultrasound technician and was reviewed by the on-call radiologist shortly thereafter. Findings concerning injury included failure to visualize both testicles, diminished perfusion of either testicle, heterogeneous echogenicity within the testicle (Fig. 1), or a discontinuous or irregular tunica (Supplementary Fig. S1). Secondary outcome measures included testicular salvage rate and the percent of injuries managed with nonoperative treatment vs surgical intervention.

All patients were initially evaluated and treated per the standard trauma protocol prior to a urologic evaluation. Physical examination included a digital rectal examination as well as evaluation for blood at the urethral meatus and concomitant penile or urethral injury. Patients with penetrating injuries to the scrotum underwent either surgical exploration or a SUS workup prior to determining management. Reasons to forgo SUS included obvious injury that definitively required scrotal exploration, or concomitant injury that required operative intervention. Follow-up data were limited due to the transient nature of this patient population. A total of 63 patients were identified and evaluated. Chi-square statistics was used for comparison analysis.

RESULTS

After reviewing 91 patients, 28 were excluded for reasons described above. A total of 63 patients presented to the trauma resuscitation unit and were evaluated by the standard trauma protocol (Table 1). The average age was 27 years. Forty-four injuries (70%) were the result of assault by handgun, 7 (11%) were self-inflicted or due to a suicide attempt, 2 (3%) were due to animal bites, and 10 (16%) were from accidents caused by handguns, heavy machinery, powered hand tools, and cutting and/or piercing instruments. Concomitant GU injuries included injuries to the urethra (8%) and penis (10%). None of the gunshot wounds came from high-velocity weapons.

Thirty-eight patients (60%) underwent SUS (Table 2). Sixteen (42%) showed findings concerning testicular injury. Fifteen of these patients subsequently underwent scrotal exploration, of which 12 (80%) showed injury to scrotal contents. One patient was managed with observation after demonstrating ischemia to the upper pole of the right testis on SUS. A repeat SUS 48 hours later showed resolution of these findings. Two patients suffered postoperative complications from scrotal exploration. One developed a scrotal hematoma and 1 had a scrotal abscess that required incision and drainage in the operating room.

Of the 22 patients with normal SUS, 14 (64%) were managed with conservative treatment whereas the remaining 8 patients underwent exploration despite a normal SUS. Conservative treatment in all cases involved bedside irrigation and packing of the wounds with wet-to-dry dressing. The average hospital length of stay for the patient undergoing conservative management was 3.7 days, during which time they were observed without additional GU

Table 1. Patient characteristics

N	63
Average age	27.1 years ± 8.5 years
Race	No. (%)
Black	49 (78)
White	12 (19)
Hispanic	2 (3)
MOI	No. (%)
Assault by handgun	44 (70)
Suicide and self-inflicted injury	7 (11)
Accident caused by hunting rifle or handgun	3 (5)
Accident caused by cutting and piercing instrument	3 (5)
Accident caused by powered hand tool	2 (3)
Animal bite	2 (3)
Accident caused by agricultural machine	1 (2)
Accident caused by fireworks	1 (2)
Associated GU injuries	No. (%)
Penis	6 (9)
Urethra	5 (8)

GU, genitourinary; MOI, mechanism of injury.