

Scrotal trauma: interest of preoperative ultrasound in the prediction of the rupture of the tunica albuginea

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ABSTRACT

Aim Scrotal bruises are quite frequent injuries affecting young subjects, with psychological repercussions on body image and fertility. The interest of ultrasound in the context of the emergency remains controversial. The aim of our study was to investigate clinical, ultrasonographic and operative features of scrotal contusions, and to evaluate the contribution of ultrasound in the description of traumatic lesions.

Methods In this retrospective and descriptive study 71 scrotal contusions operated from December 2015 to April 2020 were collected. We retrospectively analysed 26 patients (aged between 14 and 79 years) of 71 who sustained a scrotal ultrasound, where the latter was positive. The primary endpoint was albuginea rupture, whose concordance between ultrasound and surgery was assessed using the Kappa method. Positive and negative predictive values, sensitivity and specificity for the presence of albuginea rupture were evaluated for a set of ultrasound data: scrotal haematoma, haematocoele, regularity of testicular contours, testicular fracture (specificity (93%), testicular haematoma, and Doppler signal intensity.

Results Surgical treatment was necessary in 26 (37%) patients; only six orchietomy were performed. Surgical exploration should be performed if haematocoele is found in the genital examination without any ultrasound complement.

Conclusion The ultrasonography is useful, detailed and accurate when the haematocoele is not clinically evident.

Key words: genital, injuries, testicular, ultrasound

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INTRODUCTION

Testicular injury as a result of scrotal trauma is a relatively uncommon occurrence. Mechanisms of trauma are categorized as blunt, penetrating and degloving with more than half of all cases resulting from blunt trauma. Penetrating trauma to the scrotum occurs less frequently and can result from a GSW (gunshot wound ultrasound), stabbing, an animal attack or a self-inflicted injury (1-2).

Testicular rating injuries can often be challenging as physical examination of the scrotum is often hampered by patient discomfort, or haematoma or haematocele, which may like testicular rupture (3). Testicular rupture is a surgical emergency and early diagnosis of this disease is very important (4).

Ultrasound (US) and physical examination are the best diagnostic options. In front of blunt trauma US may preclude unnecessary surgery in the absence of findings consistent with testicular rupture (1-5).

Ultrasound is readily available, inexpensive, non-invasive, and it is not associated with exposure to ionizing radiation. The clinical usefulness of the US examination depends on the skill of the technician performing the examination and the physician interpreting the images. The US of testicular rupture includes a finding of discontinuity of the tunica albuginea with loss of testicular contour and heterogeneity of the testicular parenchyma. Disruption of the tunica albuginea alone has 50% sensitivity and 76% specificity on ultrasound examination for testicular rupture in the setting of blunt trauma (6). Rupture of the tunica albuginea may be associated with injury to the underlying tunica vaginalis and the testicular parenchyma, which may be appreciated on ultrasound as heterogeneous echogenicity with areas of avascularity in the injured testis (7). Scrotal ultrasound has demonstrated clinical usefulness in the setting of blunt scrotal trauma (7).

The aim of this study was to evaluate the contribution of ultrasound in the detection of traumatic lesions according to clinical, ultrasonographic and operative data of scrotal contusions.

PATIENTS AND METHODS

Patients and study design

In this retrospective study records of all patients who underwent scrotal ultrasound prior to subsequent scrotal exploration between December 2015

and April 2020 were reviewed. Demographic data, average consultation time, trauma side and injury mechanism were included in the analysis. Patients who sustained a scrotal ultrasound in whom US was not performed prior to exploration were excluded from the study (concomitant injury requiring urgent exploration). In accordance with the European Association of Urology (EAU) guidelines all patients with testicular trauma underwent scrotal ultrasound before any surgical exploration (8-9). All 71 patients with suspected testicular trauma underwent ultrasound, of which 26 (36.6%) underwent surgical treatment (Figure 1).

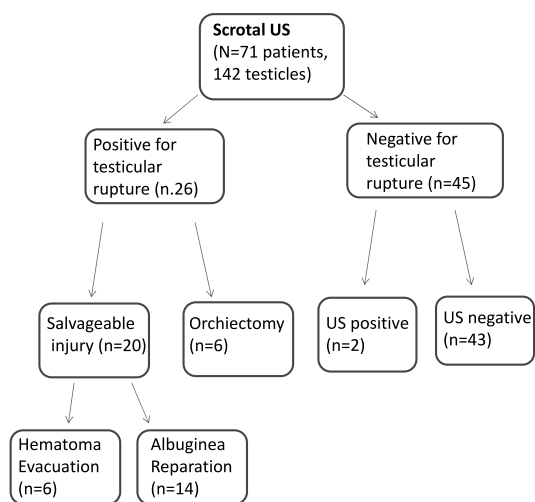


Fig. 1 Flowchart study design
US, ultrasound;

The study was approved by the Ethic Committee of the Pugliese-Ciaccio Hospital, Catanzaro.

Methods

Scrotal US was performed with the 12 MHz high frequency (PROSOUND SSD-3500 SX, ALOKA, Bucheon- South Korea) linear array transducer upon patient presentation prior to proceeding to the operating room. US findings, such as heterogeneous echogenicity in the testicular parenchyma and a concomitant loss of tunica albuginea contour, were considered a positive test. The US was initially performed by a certified US technician or the radiologist on call and read by a radiologist at the time of the patient presentation. All ultrasounds were centrally reviewed by a single urologist in blinded fashion for the purpose of this study.

Following US, each patient was taken to the operating room for scrotal exploration within 24 hours to the trauma. Operative findings were compared with preoperative US images and records.

Statistical analysis

The sensitivity and specificity of US were determined in comparison to operative findings in patients with suspected testicular trauma. The area under the curve (AUC) was calculated from the receiver operating characteristic (ROC) curve.

RESULTS

A total of 71 patients with suspected testicular trauma underwent ultrasound.

A total of 26 patients had positive and 45 had negative US finding. Trauma side was on the right testicle in 28 (40%), left side was affected in 37 (52.2%) and bilateral trauma occurred in six (7.8%) patients.

The study cohort consisted of 26 patients who sustained trauma of the scrotum and underwent scrotal US prior to operative exploration. Median patient age was 27.5 (14-79) years. Of the 26 patients, 22 (85%) were Italian, 3 (12%) were African and 1 (3%) was of Thai origin.

From the anamnestic history of the patients, 31 (44%) reported an accident or an assault, 14 (20%) testicular trauma after a sporting activity, 8 (12%) after sexual activity and 17 (24%) occurred as a result of other causes (animals bite, heavy machinery, cutting/piercing instruments). Physical examination in 46 (65%) showed a haematocele, a scrotal haematoma in 17 (24%), testicles appeared normal in 3 (4%), a doubtful physical examination classified as "other" in 5 (7%) patients. The average hospital stay was 1.5 (1-6) days (Table 1).

Table 1. Clinical characteristics of 26 patients who sustained trauma of the scrotum and underwent scrotal ultrasound prior to operative exploration

Variable	
Average age (years)	27.5
Average hospital stay (range) (days)	1.5 (1-6)
Trauma side (No; %)	
Right	10 (40)
Left	13 (52.2)
Bilateral	3 (7.8)
Mode of injury (No; %)	
Accident	11 (44)
Sports	5 (20)
Sexual activity	3 (12)
Other*	7 (24)

*animals bite, heavy machinery, cutting/piercing instruments

Operative evaluation revealed 20 (out of 26; 77%) salvageable injuries: 14 (70%) of these 20 patients underwent surgical repair of the tunica albuginea, and 6 (30%) underwent a simple evacuation of the haematoma. Only 6 (out of 26; 23%) orchietomies were performed.

In 26 screened patients, in which the US findings were suggestive of a rupture of the tunica albuginea, in the intraoperative surgical act 20 (77%) actually presented a rupture of the scrotal albuginea. Of the 20 salvageable testicular injuries, all 20 had positive US findings, but 14 (70%) were really positive for rupture of the tunica albuginea, while 6 (30%) cases were simply haematoma.

The sensitivity of preoperative scrotal US for diagnosing testicular rupture after scrotal trauma was 66.5% and specificity was 93%. There were two false-positive US results. Positive predictive value was 77% and negative predictive value was 43%. The ROC AUC was 0.75, indicating that preoperative scrotal ultrasound in the setting of penetrating scrotal trauma by GSW can be considered a good score (Figure 2).

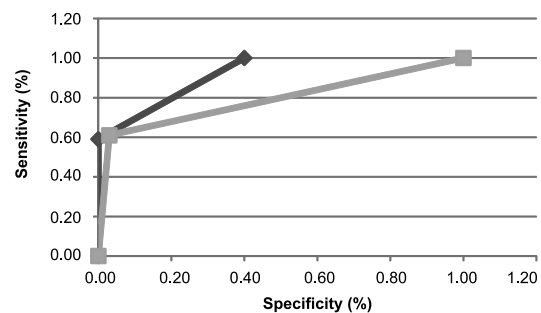


Figure 2. Receiver operating characteristic (ROC) curve of preoperative ultrasound

*ROC using operative (1, positive for rupture; 0, negative) = 1 as positive level (AUC 0.74977, effect likelihood ratio test p<0.0001)

The presence of a haematocele or haematoma decreased the sensitivity and specificity of scrotal US to detect albuginea rupture to 40% and 74 %, respectively (Table 2).

Table 2. Ultrasound data

Variable	Sensitivity (%)	Specificity (%)	PPV	NPV
Haematocele	95	74	0.64	0.8
Scrotal haematoma	40	48	0.51	0.36
Testicular fracture	66.5	93	0.77	0.43
Testicular haematoma	48	82	0.8	0.53
Irregularity of outlines	77	71	0.79	0.71
Doppler alterations	40	79	0.72	0.48

PPV, positive predictive value; NPV, negative predictive value;

DISCUSSION

The EAU guidelines for urotrauma, which was written in 2014 and most recently updated in 2020, do not specify the optimal radiographic evaluation for high energy penetrating scrotal trauma (10). In the literature pertaining to testicular injuries sustained from blunt trauma scrotal ultrasound is recommended to rule out testicular rupture, and this is supported in the guidelines

(10). Although there are limited data specifically on scrotal ultrasound in the setting of penetrating scrotal trauma, that recommendation is often extended to this setting.

Of all urological injuries, 33-66% involve the external genitalia (11). Genital trauma is commonly caused by blunt injuries (80%). In males, blunt genital trauma frequently occurs unilaterally with approximately 1% presenting as bilateral scrotal or testicular injuries (12). Any kind of contact sport, without the use of protective aids, may be associated with genital trauma. Off-road cycling, motor biking (especially on motorbikes with a dominant petrol tank), rugby, football and hockey are all activities associated with blunt testicular trauma (13,14). Penetrating injuries are most commonly caused by firearms (75.8%) (15).

Traumatic dislocation of the testicle rarely occurs and is most common in victims of motor vehicle accidents (MVAs). Bilateral dislocation of the testes has been reported in up to 25% of cases (16). Testicular rupture is found in approximately 50% of cases of direct blunt scrotal trauma (17,18). It may occur under intense compression of the testis against the inferior pubic ramus or symphysis, resulting in a rupture of the tunica albuginea. A force of approximately 50 kg is necessary to cause testicular rupture (7). Testicular rupture is associated with immediate pain, nausea, vomiting, and sometimes fainting. The hemiscrotum is tender, swollen, and ecchymotic. The testis itself may be difficult to palpate (18).

Ultrasound should be performed to determine intra- and/or extra-testicular haematoma, testicular contusion or rupture (18,19). However, the literature is contradictory as to the usefulness of US compared to clinical examination alone (7,19). Lee and Bak have reported convincing findings with a specificity of up to 98.6% (20).

Heterogeneous echo pattern of the testicular parenchyma with the loss of contour definition is a highly sensitive and specific radiographic finding for testicular rupture (7). Others reported poor specificity (78%) and sensitivity (28%) for the differentiation between testicular rupture and haematocele, while accuracy is as low as 56% (7). Colour Doppler-duplex US may provide useful information when used to evaluate testicular perfusion (7). If scrotal US

is inconclusive, testicular CT or MRI may be helpful; however, these techniques did not specifically increase the detection rates of testicular rupture (21-22).

To our knowledge our study is among few in the literature to have evaluated ultrasound sensitivity and specificity. Our study found 66.5% sensitivity and 93% specificity. Given the limited sensitivity we would recommend that a negative scrotal ultrasound should not preclude surgical exploration in patients who have sustained a scrotal gunshot wound ultrasound.

Testicular salvage is the objective of scrotal exploration following penetrating trauma with the aim of avoiding a missed testicular rupture diagnosis and the potential sequelae of an undiagnosed testicular rupture like ischemia, chronic pain and delayed orchiectomy (23). In our study 20 of 26 cases have reported the rescue of testicle.

Our study, a retrospective series of a cohort of patients who underwent scrotal ultrasound prior to operative exploration, has some limitations that must be acknowledged: this is a single-centre retrospective study and a low number of patients were recruited, which might result in a bias.

Scrotal ultrasound may be considered a potentially useful adjunct in the diagnosis of testicular injury. The sensitivity and specificity of the examination remain highly questionable to date. Negative scrotal ultrasound is not sensitive enough to rule out the need for surgical exploration. Therefore, negative scrotal US should not be considered sufficient to debar prompt operative assessment (24).

In conclusion, it is essential to surgically explore equivocal patients whenever imaging studies cannot exclude testicular rupture. This involves exploration with evacuation of blood clots and haematoma, excision of any necrotic testicular tubules and closure of the tunica albuginea, usually with running absorbable sutures.

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TRANSPARENCY DECLARATION

Competing interests: None to declare.

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