Rational Approach to Diagnosis and Management of Blunt Scrotal Trauma

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OBJECTIVES To provide a rational approach to the diagnosis and management of blunt scrotal trauma to aid clinicians in the selection of patients for surgical exploration.

METHODS We performed a retrospective evaluation of the medical records of 44 patients from two metropolitan tertiary referral hospitals. A total of 29 patients were recruited from July 1, 1993 to June 30, 2003 at one institution and an additional 15 patients from February 1, 1991 to January 31, 1999 at the second. Scrotal ultrasound scans were retrieved and reviewed by a uroradiologist unaware of the treatment regimen and outcome.

RESULTS The presence of both testicular swelling and tenderness suggested more significant testicular injury; however, testicular rupture was present in the absence of tenderness. Three patients with operatively confirmed testicular rupture had only swelling on clinical examination. Five patients with intratesticular hematoma were successfully treated conservatively with interval ultrasound scans recommended to assess for resolution. All patients with operatively confirmed testicular rupture had a combination of the following ultrasound features: the presence of hematocele, disruption of the tunica albuginea, and/or extrusion of the seminiferous tubules.

CONCLUSIONS Patients presenting after blunt scrotal trauma with clinical hematocele should progress directly to exploration. The remainder should undergo scrotal ultrasonography. Those with large hematoceles or suspected rupture on ultrasonography should also proceed to exploration. Those without hematocele, a clearly distinct tunica albuginea, and a lack of fracture planes within the testes are a subgroup that can be successfully treated conservatively. UROLOGY 70: 230–234, 2007. © 2007 Elsevier Inc.

Testicular rupture is a surgical emergency. Early repair maximizes testicular salvage. The acutely traumatized scrotum is often painful and markedly swollen, making clinical examination difficult. Ultrasonography provides a simple and rapid method to evaluate the scrotal contents and aids in distinguishing among pathologic entities.[1–4] We aimed to provide a rational method to aid clinicians in selecting patients for exploration in our 10-year review of blunt scrotal trauma.

MATERIAL AND METHODS

A total of 44 patients from two metropolitan tertiary referral hospitals were evaluated—29 patients from July 1, 1993 to June 30, 2003 at one institution and 15 patients from February 1, 1991 to January 31, 1999 at the second. The patient age range was 14 to 60 years (median 26).

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The medical records were retrospectively reviewed. Clinical hematocele was defined as a tense tender scrotal mass that did not transmit light, with the underlying testis impalpable or indistinct.[5–7] Ultrasonography was mainly performed using the ATL 3000 or ATL HDI 5000 unit and 5 to 12-MHz linear array transducers on an emergent basis by a sonographer, radiologist, or radiologist-in-training. The aim was to assess for testicular integrity, particularly of the tunica albuginea. Multiple views were obtained to assess for alterations of the normal homogenous echotexture of the seminiferous tubules or disruption of the normal thin echo-rich line of the tunica albuginea. The contralateral testis was imaged for comparison. The ultrasound films were reviewed by a uroradiologist unaware of the treatment regimen and outcome.

Scrotal wall hematoma was defined as a focal area of increased echogenicity or thickening within the scrotal wall.[8,9] Intratesticular hematoma (Fig. 1) was defined as a focal area of altered echogenicity within the testes with no internal flow on color Doppler and preservation of the ovoid shape in multiple planes.[8,9] An extratesticular collection within the tunica vaginalis with low-level echoes denoted a hematocele[10] (Fig. 1). An attempt was made to quantify hematoceles into small and large, with the latter more than three times the volume of the testes. This was arbitrary and suffered from interobserver variability; however, it has been used previously in management algorithms in published reports.[1]

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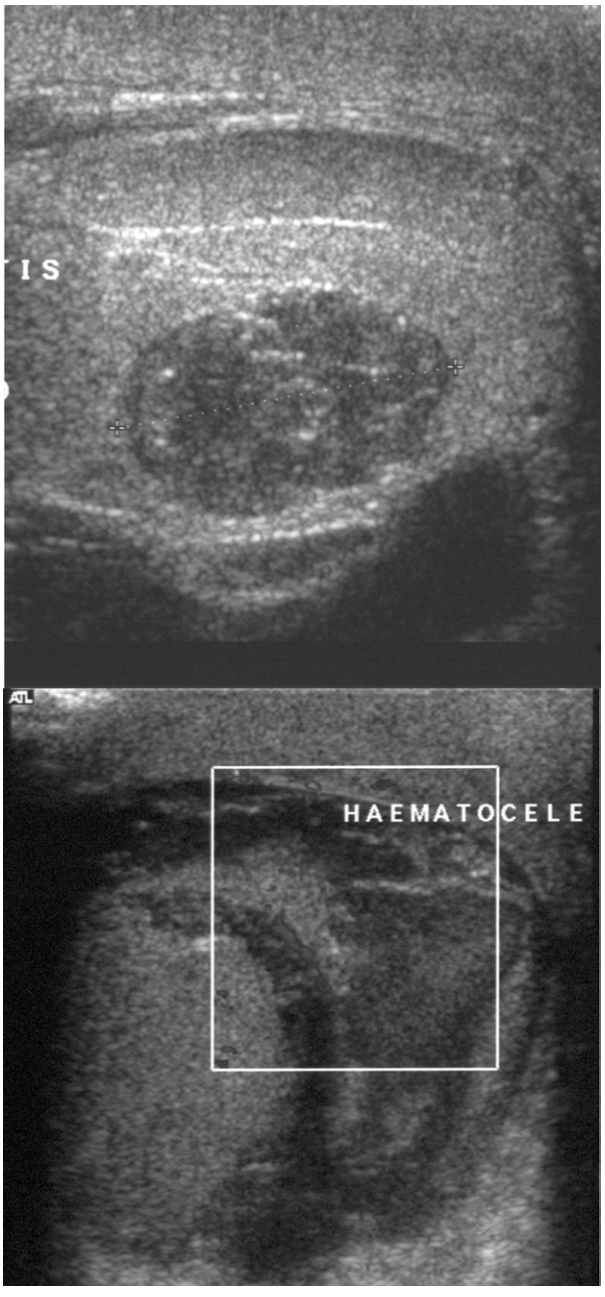

Figure 1. Ultrasound scans showing **(Top)** intratesticular hematoma and **(Bottom)** hematocele in 2 different patients.

Testicular rupture was defined as interruption of the tunica albuginea or extrusion of seminiferous tubules[9] (Fig. 2). The testicular shape is often abnormal with mixed echogenicity, also, a fracture plane may be present.[4,8–11] The echotexture is heterogeneous,[4] with areas of hemorrhage and ischemia. Usually an associated hematocele is present.[9,11,12]

Successful conservative management was defined as no exploration, clinical recovery, and lack of repeat presentation with testicular symptoms. The follow-up examination was at 3 months, and the medical records were reviewed during the 10-year duration of the study and at an additional 3 years after closure.

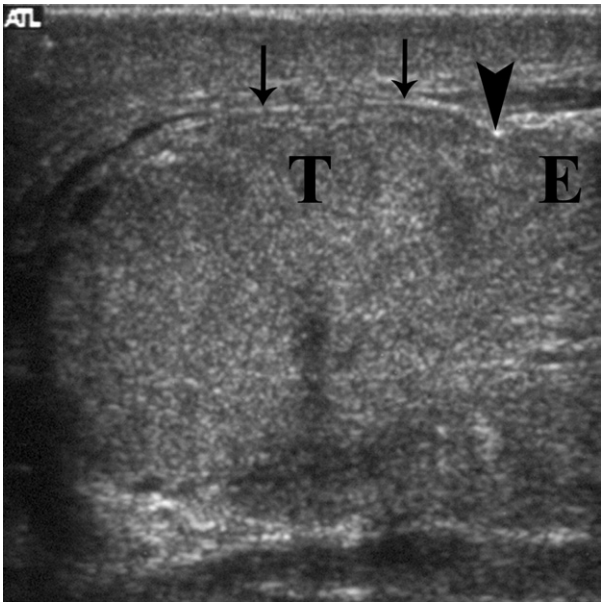

Figure 2. Ultrasound scan showing ruptured testis, with interruption of normal echo-rich line of tunica albuginea (arrows) at arrowhead. Extruded seminiferous tubules (E) have herniated through tunica defect. Testis (T) was markedly heterogeneous and was confirmed intraoperatively and successfully repaired.

RESULTS

The mechanism of injury was a direct blow in 25 patients (57%), motorbike or motor vehicle accident in 13 patients (29%), and a variety of mechanism in 6 patients (14%), most commonly a straddle injury. No bilateral injuries were present.

The physical examination findings were categorized as swollen, tender, or swollen and tender. Table 1 lists the examination findings with the operative diagnosis.

Of the 44 patients, 17 did not undergo ultrasonography. Of the 17 patients, 3 proceeded directly to surgery because of the presence of a clinical hematocele and 1 because of the mechanism of injury (direct testicular crush). Two patients who also proceeded to exploration had a large scrotal wall hematoma—in one, 500 mL of blood was drained from the wall. Of the 44 patients, 27 underwent ultrasonography. The operative correlates are listed in Table 2.

All scrotal wall hematomas were successfully managed conservatively. Of the six intratesticular hematomas, five were successfully managed conservatively. The sixth was in a patient with a technically difficult study with the tunica albuginea difficult to visualize; he underwent exploration, at which it was intact.

Of 10 patients with ultrasound findings of a hematocele, 3 underwent operative intervention. All 3 patients had operatively confirmed hematoceles and 2 had rupture. Of the 7 who did not undergo intervention, 2 had small hematoceles for which conservative management was deemed appropriate, 2 presented longer than 72 hours after injury, 1 was self-discharged, and 2 were diagnosed with intratestic-

Table 1. Physical examination findings and operative diagnosis for all patients

Physical Examination Finding	Operative Diagnosis					Total
	Scrotal Wall Hematoma	Hematocele	Intratesticular Hematoma	Testicular Rupture	No Surgery	
Swollen	2	—	—	3	13	18
Tender	—	—	—	—	1	1
Swollen and tender	—	3	—	7	15	25
Total	2	3	—	10	29	44

Table 2. Ultrasound and operative diagnoses

Ultrasound Finding	Operative Diagnosis					Total
	Scrotal Wall Hematoma	Hematocele	Intratesticular Hematoma	Testicular Rupture	No Surgery	
Scrotal wall hematoma	—	—	—	—	5	5
Hematocele	—	1	—	2	7	10
Intratesticular hematoma	—	1	—	—	5	6
Testicular rupture	—	—	—	4	2	6
Total	—	2	—	6	19	27

ular hematoma only. On review by the uroradiologist, they were noted to have hematoceles.

Six testicular ruptures were revealed by ultrasonography; four were confirmed operatively and repaired. One patient self discharged and one had sustained injury 5 days previously and was treated conservatively.

Only 4 (9%) of the 44 patients attended the 3-month review. One patient with intratesticular hematoma had a palpable testicular mass, with excisional biopsy confirming an organizing hematoma. The patient with an operatively confirmed hematocele had an atrophic testis. Of the two operative testicular repairs, one was a normal-size testis and the other was atrophic. None of the remaining patients presented again with testicular symptoms.

COMMENT

A missed testicular rupture not only has cosmetic and psychological consequences, but also an increased risk of secondary infection and atrophy.[7] If presentation occurs within 72 hours of injury, the rate of testicular salvage can be as great as 90%.[1,3,5,8,11] After 72 hours, this decreases to 30%.[3,13,14] This significantly lower salvage rate was the rationale behind our conservative approach if patients presented more than 72 hours after their injury.

Patients with clinical hematoceles have sustained significant injury and should undergo exploration—rupture was present in 2 of 3 patients and in 20% of those reviewed by Altarac.[5] However, Fournier *et al.*[1] conservatively managed small clinical hematoceles and operated on large hematoceles. Although a paucity of published data is available regarding the management according to hematocele size, the method used by Fournier *et al.*[1] is consistent with our ultrasound approach—operative for large and conservative for small hematoceles, as determined by ultrasound examination.

The value of ultrasonography for examining clinical hematoceles is questionable. Gross[14] emphasized that early exploration allowed for confirmation of the diagnosis, hastened resolution, and maximized salvage.[1,6,15] Cass and Luxenberg,[7] Cass,[15] Ugarte *et al.*,[16] and Cass and Luxenberg[17] suggested that early exploration reduced morbidity and the length of stay and hastened the return to normal activity. Thus, with clinical hematocele, for which patients will probably proceed to exploration, ultrasonography is of little benefit.

Ultrasonography has its greatest value in the absence of clinical hematocele, because ultrasonography reported rupture in 6 patients without clinical hematocele. This is a subgroup that might not proceed to exploration on clinical grounds alone. Of the 10 patients with operatively confirmed testicular rupture, 3 presented with swelling only. Both MacDermott *et al.*[18] and Micallef *et al.*[11] also reported patients with nontender testicular swelling and confirmed rupture. Thus, the lack of tenderness does not exclude a significant testicular injury, and ultrasonography is recommended in all cases of blunt trauma without the presence of a clinical hematocele.

In contrast to the results in the study by McAninch and Santucci,[19] who advocate exploration for intratesticular hematoma, 5 patients were successfully treated conservatively. Our experience has been that even in the presence of intratesticular hematoma, if the tunica albuginea is intact and no fracture planes are present within the testes, the patient can be treated conservatively—a practice similar to that of Kratzik *et al.*[9] Nonetheless, an ultrasound examination at the 6-week interval is recommended to ensure that the hematoma has resolved and does not represent occult tumor.[9]

Overall, the ultrasound accuracy for testicular rupture is a specificity of 75%, sensitivity of 64%, positive predictive value of 78%, and negative predictive value of

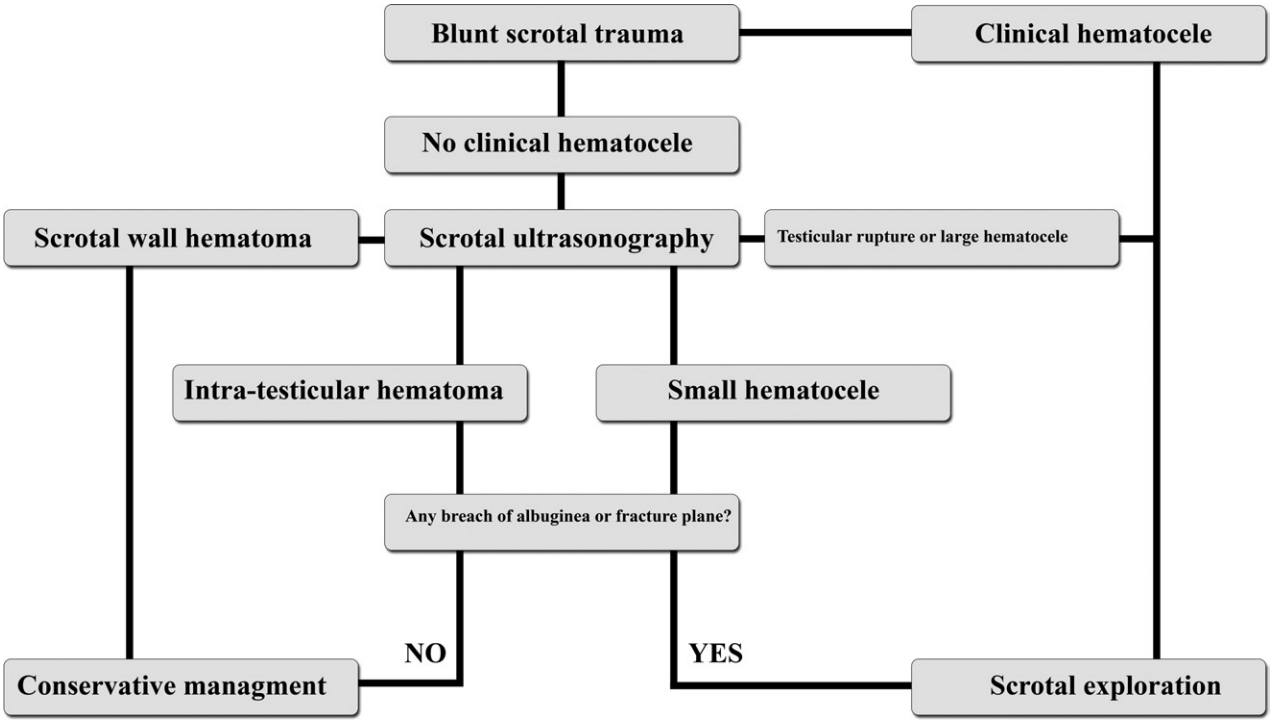

Figure 3. Rational management algorithm for blunt scrotal trauma.

60%.[6,20] However, it is well recognized that hematocele heralds more significant injury and that albuginea integrity is difficult to confirm when a hematocele is present.[1,3,5,17] In our series, 2 patients with ultrasound-determined hematocele without rupture had both hematocele and rupture present intraoperatively. Thus, we accept the reduced accuracy for rupture in the presence of a hematocele because these patients should progress to exploration unless the hematocele is small and the tunica albuginea is well visualized (Fig. 3). All ultrasonographically determined ruptures in the patients who underwent exploration were confirmed.

Cass[16] and Cass and Luxenberg[17] reported an incidence of rupture in those who underwent surgery after blunt trauma of 48%. In our series, 66% patients who underwent exploration had ruptures and, all bar one, was successfully repaired for a 90% salvage rate. Cass[16] in 1983 noted a 48% failure rate with conservative management, with 11 of 23 patients requiring delayed surgery. In contrast to these findings, no delayed explorations were required in our study during the hospital admission. These findings could, in part, be attributable to the use of ultrasonography in patient selection.

It is difficult to define the accuracy of ultrasonography in our series—patients with clinical hematocele proceeded direct to exploration, patients presenting after 72 hours or with small ultrasound-detected hematoceles were treated conservatively, and some early in the series did not undergo ultrasonography. Moreover, we had no long-term data available because only 9% of patients attended 3-month review examination.

However, it is noteworthy that all patients with operatively confirmed rupture had a combination of the following ultrasound features: presence of hematocele, disruption of tunica albuginea, or extrusion of seminiferous tubules. This suggests the ultrasound diagnosis of rupture is probably accurate. The presence of hematocele is a good predictor of testicular rupture, although with low sensitivity, and the lack of hematocele with a normal tunica albuginea is an excellent negative predictor.

CONCLUSIONS

We suggest a rational method for the management of blunt scrotal trauma. If clinical hematocele is present, the patient should undergo scrotal exploration without ultrasonography. The remainder should undergo scrotal ultrasonography. Those with large hematoceles, fracture planes within the parenchyma, disruption of the tunica albuginea, or extrusion of seminiferous tubules should undergo surgical exploration as soon as is practicable,[1,3,5,9] ideally within 72 hours to maximize salvage. On the ultrasound examination, if no hematocele is present, the tunica albuginea is clearly intact, and no fracture plane is present within the testes, the patient can be safely treated conservatively.

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References

1. Fournier GR, Laing FC, and McAninch JW: Scrotal ultrasonography and the management of testicular trauma. Urol Clin North Am **16:** 377–385, 1989.

2. Martinez-Piñeiro L, Cerezo E, Cozar JM, *et al:* Value of testicular ultrasound in the evaluation of blunt scrotal trauma without hematocele. Br J Urol **69:** 286–290, 1992.
3. Munter DW, and Faleski EJ: Blunt scrotal trauma: emergency department evaluation and management. Am J Emerg Med **7:** 227–234, 1989.
4. Morey AF, Metro MJ, Carney KJ, *et al:* Consensus on genitourinary trauma: external genetalia. Br J Urol **94:** 507–515, 2004.
5. Altarac S: Management of 53 cases of testicular trauma. Eur Urol **25:** 119–123, 1994.
6. Corrales JG, Corbel L, Cipolla B, *et al:* Accuracy of ultrasound diagnosis after blunt testicular trauma. J Urol **150:** 1834–1836, 1993.
7. Cass AS, and Luxenberg M: Value of early operation in blunt testicular contusion with hematocele. J Urol **139:** 746–747, 1988.
8. Ragheb D, and Higgins JL: Ultrasonography of the scrotum—technique, anatomy and pathologic entities. J Ultras Med **21:** 171–185, 2002.
9. Kratzik CH, Hainz A, Kuber W, *et al:* Has ultrasound influenced the therapy concept of blunt scrotal trauma? J Urol **142:** 1243–1246, 1989.
10. Berman JM, Beidle TR, Kunberger LE, *et al:* Sonographic evaluation of acute intra-scrotal pathology. AJR Am J Roentgenol **166:** 857–861, 1996.
11. Micallef M, Ahmad I, Ramesh N, *et al:* Ultrasound features of blunt testicular injury. Injury **32:** 23–26, 2001.
12. Friedman SG, Rose JG, and Winston MA: Ultrasound and nuclear medicine evaluation in acute testicular trauma. J Urol **125:** 748–749, 1981.
13. Patil MG, and Onuora VC: The value of ultrasound in the evaluation of patients with blunt scrotal trauma. Injury **25:** 177–178, 1997.
14. Gross M: Rupture of the testicle: the importance of early surgical treatment. J Urol **101:** 196–197, 1969.
15. Ugarte R, Spaedy M, and Cass AS: Accuracy of ultrasound in diagnosis of rupture after blunt testicular trauma. Urology **36:** 253–254, 1990.
16. Cass AS: Testicular trauma. J Urol **129:** 299–300, 1983.
17. Cass AS, and Luxenberg M: Testicular injuries. Urology **37:** 528–530, 1991.
18. MacDermott JP, Gray BK, and Hamilton-Stewart PA: Traumatic rupture of the testis. Br J Urol **62:** 179–181, 1988.
19. McAninch JW, and Santucci RA: Genitourinary trauma, in Walsh PC, Retik AB, Vaughn ED, *et al* (Eds): *Campbell's Urology*, 8th ed. Philadelphia, WB Saunders, 2002, pp 3735–3738.
20. Sagalowsky AI, and Peters PC: Genitourinary trauma, in Walsh PC, Retik AB, Vaughn ED, *et al* (Eds): *Campbell's Urology*, 7th ed. Philadelphia, WB Saunders, 1998, pp 3116–3117.