

Management of testicular rupture after blunt trauma in children

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Abstract

Purpose Testicular rupture is a very rare entity in children and adolescents. The aim of this study was to evaluate the outcomes of surgical repair after testicular rupture in children.

Methods Between January 2000 and January 2010 seven patients were operated on because of testicular rupture. Mean age at the time of the accident was 15 years. In all patients, an emergency scrotal ultrasonography showed a rupture of the testicular capsule with a surrounding hematocele. Surgical exploration was performed to evacuate the hematocele and repair the ruptured testis.

Results Mean follow-up was 4.9 years. Average hospital stay was 2 days. Mean time between surgery and the initial trauma was 35 h. There were no major complications. Control ultrasound imaging showed that the tunica was repaired and Doppler signal confirmed vascularity in all patients. There were no significant differences in size between the right and left testes. There were no recorded cases of testicular atrophy. Semen analysis showed normospermia 6 months after surgery and anti-sperm antibodies count was within normal limits in all patients.

Conclusion Prompt surgical intervention is crucial. Ruptured testis can be salvaged, with a high success rate, if surgical repair is performed within 72 h of testicular injury.

Keywords Testicular rupture · Blunt trauma · Testis · Hematocele · Surgery · Children

Introduction

Scrotal trauma accounts for less than 1% of all trauma-related injuries, because of the anatomic location and mobility of the scrotum. The peak occurrence of scrotal trauma is in the age range of 15–40 years [1]. Blunt trauma is the most commonly occurring form and usually results from sport injury, motor vehicle collision or assault [2]. The right testis is injured more often than the left one, because of its greater propensity to be trapped against the pubis or inner thigh [1]. Testicular rupture (also called fractured testis) is a rip or tear in the tunica albuginea resulting in extrusion of the testicular contents. It is a rare complication of testicular trauma. It may cause pain, scrotal swelling, nausea and sometimes vomiting. Early surgical exploration and repair of the ruptured capsule is recommended for the best results [3, 4]. There are serious repercussions if a testicular rupture is missed. Although not life threatening, loss of a testicle could contribute to a hypogonadal state, impair future fertility, and affect social confidence.

Considering the fact that this injury is very rare in children and a literature data are mostly limited to a few case reports, the purpose of this study was to evaluate the outcomes of surgical repair after testicular rupture in children.

Patients and methods

The case records of seven children treated for testicular rupture in the department of pediatric surgery, University Hospital Split, from January 2000 through January 2010 were retrospectively reviewed. During this 10-year-study period, there were 139 patients identified for different

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non-sexual male genital injuries and of these 7 involved testicular ruptures (5%). The medical records included initial medical history, physical examination, emergency ultrasound, operative findings, and the results of follow-up. Mean age at the time of the accident was 15 years (range 11–17 years). On physical examination, all patients presented with large swelling, tenderness and hemathoma of the hemiscrotum. Injured testis could not be palpated due to tenderness. The contralateral testis was normal. An ultrasound scan of the scrotum was performed immediately in all patients and showed a rupture of the testicular capsule with a surrounding hematocele (Fig. 1).

Surgical exploration was then performed in emergent basis after analgesia administration and anesthesia preparation. An exploration of the injured hemiscrotum was performed through a horizontal incision to evacuate the hematocele and repair the ruptured testis. The extruded seminiferous tubules were returned into the testicular capsule in five patients. In two cases some seminiferous tubules were irreparable and were excised. Viability was verified, because the extruded tissue bled when incised. Testicular capsule was sutured with 4-0 polyglactin 910 sutures (Vicryl, Ethicon Endo-Surgery, Cincinnati, USA). Tunica dartos and skin were closed in separate layers with no drain tube. Oral antibiotic therapy in the form of amoxicillin and clavulanic acid, twice daily by mouth was prescribed. The patients were followed-up at 14 days, 3, 6 and 12 months postoperatively, and then examined once a year. Semen analysis was performed 14 days, 6 months, and 1 year after surgery, except in two children (11- and

14-year old). Sperm antibodies count was performed once and 6 months after trauma.

Results

In this study, seven children were treated because of testicular rupture. Mean follow-up was 4.9 years (range 1–9 years). Average hospital stay was 2 days (range 1–3 days). The mean time between the pediatric surgeon consultation and the initial trauma was 35 h (range 6–72 h). In five patients (71.4%) right testis was injured, and two patients (28.6%) had injury of the left testis. The leading cause of injuries was a kick to the scrotum during a sport (five patients); one patient sustained a kick to the scrotum during the fight, and in one patient injury arose in motor vehicle collision. The patient and injury characteristics are outlined in Table 1. A rupture was observed in the middle part of the testis in five cases, and in the upper pole of the testis in two cases. The mean size of the rupture was 2.85 cm in diameter (range 2–4 cm). At first visit, all patients were pain-free and reported no residual symptoms. There were no major complications; only one wound infection was recorded. Control ultrasound imaging showed that the tunica was repaired and Doppler signal confirmed vascularity in all patients (Fig. 2). Follow-up showed a good outcome in all the patients, with no significant difference in size between the right and left testes. There were no recorded cases of testicular atrophy. Semen analysis showed normospermia 6 months after surgery (Table 2) and anti-sperm antibodies count was within normal limits in all patients. Mean anti-sperm antibodies count was 17 U/ml (range 5–41 U/ml; normal values: 0–60 U/ml).

Discussion

Based on the mechanism of injury, there are three categories of testicular injuries. These categories include blunt trauma, penetrating trauma, and degloving trauma. Blunt injuries are encountered more often than penetrating injuries and are usually unilateral, whereas penetrating injuries involve both testes in a three of the cases [5]. The testicles are usually protected by the mobility and elasticity of the scrotal tissues from most injuries. Testicular trauma most commonly occurs in young men aged 15–40 years [1]. The mechanism of rupture is a direct blow to the testicle, bringing about forceful compression, trapped between the pubic bone and the crushing object, and hence tearing the usually strong tunica albuginea covering the mobile intrascrotal testicle [6]. Sports injuries are one of the most common causes of significant testicular injury, and all male

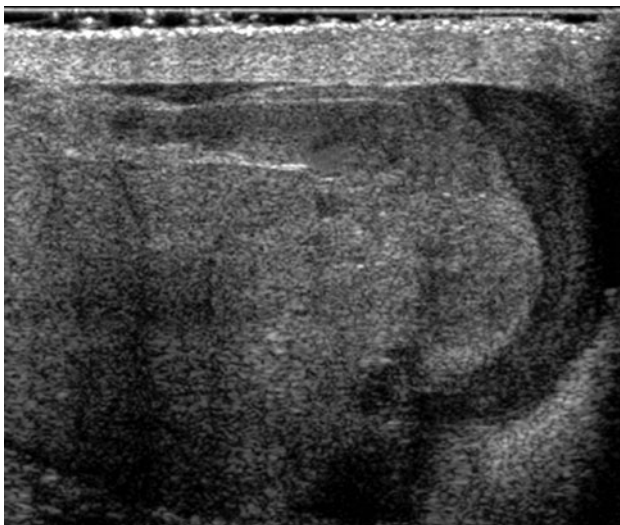
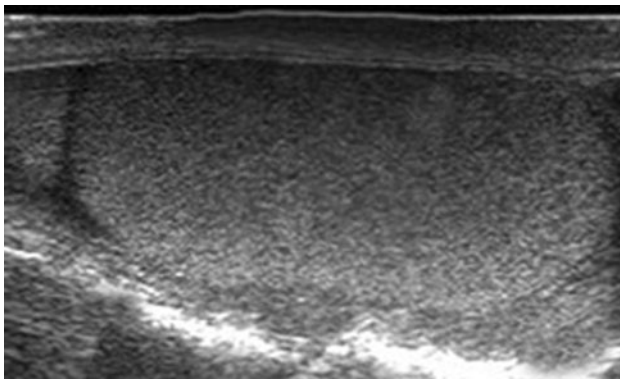


Fig. 1 Ruptured testis with hematocele. Ultrasound image of the right testis demonstrate an oblong testis with a heterogeneous echotexture and very irregular outline, with an area of discontinuity in the tunica albuginea, a defect in the middle part of the testis. The echogenic fluid surrounding the testis is consistent with a hematocele

Table 1 Patient and injury characteristics

Patient	Age (years)	Side	Size of the rupture (cm)	Accident mechanism	Related injuries	Time from trauma to surgery (h)	Complications	Follow-up (years)
1	16	Right	4	Kick-sport	–	24	–	9
2	17	Right	2	Motor vehicle collision	Forearm fracture	6	–	7
3	14	Right	3.5	Kick-sport	Penile laceration	48	–	5
4	15	Right	2	Kick-sport	–	24	Wound infection	5
5	16	Left	3	Kick-fight	Thigh wound	24	–	4
6	11	Left	3	Kick-sport	–	72	–	3
7	16	Right	2.5	Kick-sport	–	48	–	1
Average	15		2.85			35		4.9


Fig. 2 Control ultrasound 3 months after surgery. Completely healed testis with normal testicular architecture

athletes should be encouraged to wear adequate protective equipment. It is essential that primary care physicians educate young male athletes about the possibility of testicular injury and its sequelae. A survey of male athletes aged 12–25 years showed that 47% did not wear a protective cup [7, 8]. In addition, most did not recognize the urgency of medical evaluation of a painful, swollen testicle [8]. Common physical examination findings in testicular rupture include severe edema and ecchymosis of the scrotum and exquisite tenderness of the testicle. Abnormal lie of the testis or the absence of cremasteric reflex should raise suspicion for coincident testicular torsion [7, 9, 10]. Because the scrotum is an elastic and distensible space, significant swelling or bleeding can occur, dramatically distorting the normal anatomy. Severe pain is also a consistent finding, and all seven patients in this study required intravenous painkillers for pain control. Most cases of blunt trauma to the testicles are minor and usually require only conservative therapy. Operative indications for blunt trauma include suspicion of rupture, expanding hematomas, dislocation refractory to manual reduction, avulsion, and scrotal degloving [5]. Approximately 50 kg of force is required to rupture the testicle [5]. Success in the treatment of testicular rupture in the literature ranges from 82 to 86%

[1, 4, 6]. An ultrasound accompanied by a thorough physical examination provides a readily available noninvasive and highly accurate investigation [1, 2]. The accuracy of ultrasound for the diagnosis of testis rupture is controversial. Corrales et al. [11] obtained a poor sensitivity of 28% and a specificity of 78% and Ugarte et al. [12] reported 4 testis ruptures in 10 patients misdiagnosed by ultrasound. More recent works reported better accuracy for the diagnosis of testis rupture with a sensitivity and specificity of >95% for diagnosing testicular rupture [1]. The accuracy of ultrasound is often difficult to evaluate in the literature, because patients were managed differently based on clinical and ultrasound findings. In our institution all patients with blunt scrotal trauma benefit from ultrasound evaluations of the scrotum. In case of abnormal ultrasound or clinical findings, patients are managed surgically. In this work we reported and analyzed the results of seven scrotal ultrasound followed by surgical exploration. No testis rupture was misdiagnosed by ultrasound. These results are similar to previously reported [1, 2].

Early surgical exploration is advocated in confirmed cases of testicular rupture after blunt trauma, because conservative management carries a high risk of complications, including infection, leading to orchidectomy or testicular atrophy [1, 3]. Surgical delay may decrease the salvage rate from 80–90% to 45–55% and may necessitate orchidectomy [1, 7]. Mean time between trauma and surgery in our study was 35 h, and all testes were salvaged. Surgery includes evacuation of the hematocele, debridement and primary closure of the tunica albuginea [1, 3, 7–10]. In situations where viable extruded seminiferous tubules achieve closure of the testicular capsule, the free edges of the tunica vaginalis can be wrapped around the extruded tubules and secured in place with polyglactin sutures [3, 7, 10]. Unlike a testicular torsion where the arterial blood supply is completely compromised requiring immediate exploration, a testicular rupture is a relative ischemic state. Potential complications of delayed diagnosis include testicular ischemic necrosis, abscess, and loss

Table 2 Seman analysis

Patient	Time after surgery	Motility (%)	Morphology		Volume (ml)	pH	Liquefraction	Concentration of spermatozoa ($\times 10^6$ ml)	Conclusion
			Normal (%)	Abnormal (%)					
001	14 days	57	46	54	0.6	7.5	After 20 min	14.50	Hypooligoasthenozoospermia
	6 months	94	82	18	1.8	7.7	After 20 min	35.00	Normospermia
	1 year	89	82	18	2.1	7.5	After 20 min	37.70	Normospermia
002	14 days	75	74	26	3.5	7.8	After 20 min	31.25	Normospermia
	6 months	91	85	15	4.1	7.6	After 20 min	42.90	Normospermia
	1 year	93	82	18	3.8	7.4	After 20 min	44.50	Normospermia
004	14 days	–	–	–	–	–	–	–	–
	6 months	78	80	20	1.8	8.0	After 20 min	28.00	Normospermia
	1 year	86	80	20	2.5	7.6	After 20 min	31.25	Normospermia
005	14 days	55	51	49	2.0	7.5	After 20 min	9.90	Oligoasthenozoospermia
	6 months	84	80	20	2.8	7.5	After 20 min	25.75	Normospermia
	1 year	83	80	20	2.9	7.5	After 20 min	34.50	Normospermia
007	14 days	61	52	48	1.6	8.3	After 20 min	11.70	Oligoasthenozoospermia
	6 months	81	80	20	3.2	8.5	After 20 min	29.75	Normospermia
	1 year	91	80	20	2.9	8.0	After 20 min	39.00	Normospermia

Semen analysis was not performed in patients 003 and 006, because they were 11 and 14-year old

of spermatogenesis [9, 10]. A small study compared semen analysis parameters between patients who underwent primary testicular reconstruction and orchiectomy for testicular ruptures. They concluded that testicular salvage group had no significant seminal or endocrine abnormalities, whereas the orchiectomy group demonstrated a significant decrease in sperm density [13]. A few studies have documented the impact of unilateral testicular trauma on fertility parameters. Approximately 40% of men with a history of testicular torsion or testicular trauma have an abnormal semen analysis [14, 15]. Moderate trauma can result in the production of anti-sperm antibodies thus resulting in infertility. This is not an absolute scenario. All men who have testicular trauma are not subfertile or necessarily form anti-sperm antibodies [15–17]. The semen analysis may be normal, but the sperm do not perform properly. This supports an aggressive attempt at testicular reconstruction over orchiectomy even in the setting of a severe testicular rupture with a normal contralateral testis. In our study, semen analysis performed 6 and 12 months after the injury showed normospermia in all patients. It is very important to begin broad-spectrum antibiotics preoperatively and continue postoperatively because gangrenous infection is the most feared complication of scrotal trauma. Testicular atrophy is a rare late sequela of rupture, but does not require additional treatment. It is postulated that trauma-related atrophy is due to ischemia and resorption of nonviable testicular tissue, which result from increased pressure within the tunica secondary to hematoma formation

[1, 4]. We did not record any case of testicular atrophy in this study. Conservative approach is recommended only in a case of delayed presentation of testicular rupture after blunt scrotal trauma [18, 19]. The usual conservative treatment consists of scrotal support, nonsteroidal anti-inflammatory medications, ice packs, bed rest for 24–48 h and serial ultrasound. Cubillos et al. reported a group of seven pre-adolescent boys with testicular rupture treated by conservative approach. All patients in that group resulted in resolution of the fracture and maintenance of testicular architectural integrity [18].

Anti-sperm antibodies are antibodies directed against the sperm. Under normal conditions, the immune system develops antibodies to help protect our immune system against illnesses. Normally, the testes contain a natural barrier, known as the blood-testes barrier. This barrier acts as a protective layer that prevents immune cells from being able to access sperm within the male reproductive tract. This barrier can be broken, through testicular injury, thereby allowing the immune cells to come into contact with the sperm and recognize them as foreign bodies, which they are. Once the barrier is broken, immune cells are able to detect the presence of sperm due to their unique antigen surface. This triggers a response by the immune system to treat sperm as an “invader” and attack it. Antibodies then attach themselves to different parts of the sperm and interfere with male fertility in a number of ways [16]. In this study the anti-sperm antibodies count was within normal limits in all patients.

Conclusion

Scrotal trauma calls for careful physical and imaging evaluations to determine the appropriate management of injuries. Ultrasound is the modality of choice for imaging of scrotal trauma, because it allows reliable identification of various testicular and extratesticular injuries. Testicular rupture, the most severe testicular injury, requires immediate surgical intervention. Ruptured testis can be salvaged, with a high success rate, if surgical repair is performed within 72 h of testicular injury.

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