Efficacy of ultrasound-guided testicle-sparing surgery for small testicular masses

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Received: 14 January 2015 / Accepted: 28 February 2015 / Published online: 23 June 2015
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Abstract

Purpose The aim of the present study was to evaluate evolution of conservative echo-guided surgery for testicular tumours ≤ 1.5 cm and to assess the safety of this surgical procedure.

Methods 49 consecutive patients diagnosed with ultrasonography testicular lesions (mono or bilateral) ≤ 1.5 cm and treated with conservative echo-guided testicular surgery were examined. The parameters considered in this retrospective analysis included case history, physical examination, scrotal and abdominal ultrasonography, computed tomography scan, size of the nodule (maximum diameter), tumour markers, chest radiography, frozen section examination, histologic size of the tumour, overall survival (OS) and findings on follow-up.

Results Mean age of patients was 33 years (range 18–62). Patients who presented with a palpable testicular nodule were 32.7 %, gynecomastia 10.2 %, precocious pseudopuberty 4 %, and scrotal pain 12.2 %. Permanent section examination confirmed the FSE data in all cases of certainty malignant lesion and definitive histological types were: 22 seminoma, 13 non-seminomatous or mixed germ cell tumours, 4 Leydig tumours, 2 hamartoma, 1 epidermoid cyst, 2 sertoli cell tumours, and 5 fibrous pseudotumour. No complications intra- and postoperative were observed. Overall survival was 100 % and scrotal US showed evidence of local tumour recurrence in 6 patients (12.2 %) after a mean follow-up of 34.7 months.

Conclusion The OS, the low rate of local recurrence, and absence of complications, tend to demonstrate the safety of the procedure. The benefits to testicular-sparing surgery include improving the patient's overall quality of life, fertility, endocrine function and negative cosmetic effects of radical orchiectomy.

Keywords Testicular tumour · Ultrasound · Testicle-sparing surgery · Small testicular mass · Non-palpable

Riassunto

Scopo del lavoro Lo scopo del presente studio è stato quello di valutare il ruolo della terapia chirurgia ecoguidata conservativa nel trattamento dei tumori testicolari ≤ 1.5 cm e valutarne la sicurezza ed efficacia.

Metodi Furono esaminati 49 pazienti con diagnosi ecografica di lesione testicolare (mono o bilaterale) ≤ 1.5 cm e sottoposti a chirurgia testicolare conservativa ecoguidata. I parametri presi in considerazione in questo studio retrospettivo furono la storia clinica del paziente, l'esame obiettivo, l'ecografia scrotale ed addominale, la TAC, le dimensioni della lesione, i marcatori tumorali, la radiografia del torace, l'esame istologico estemporaneo e definitivo della lesione, il tasso di sopravvivenza globale e i risultati del follow-up.

Risultati L'età media dei pazienti è stata di 33 anni (range 18–62). Il 32.7 % dei pazienti presentavano un nodulo testicolare apprezzabile palpatariamente, il 10.2 % ginecomastia, il 4 % pseudopubertà precoce, mentre il 12.2 % dolore scrotale. In tutti i casi l'esame istologico definitivo delle lesioni tumorali aveva confermato i risultati riscontrati all'esame istologico estemporaneo. Gli istotipi definitivi furono: 22 tumori seminomatosi, 13 non seminomatosi o a cellule germinali miste, 4 tumori a cellule Leydig, 2 amartomi, 1 cisti epidermoide, 2 tumori a cellule

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del Sertoli e 5 psudotumori con componente fibrosa. Non sono state riscontrate in tutti i casi complicanze intra e post-operatorie. Il tasso di sopravvivenza è stato del 100 %, in 6 pazienti (12.2 %) è stata riscontrata una recidiva locale al controllo ecografico scrotale dopo un follow-up medio di circa 34.7 mesi.

Conclusioni Il tasso di sopravvivenza elevato, il basso tasso di recidiva locale della malattia e la completa assenza di complicazioni, dimostrano la sicurezza della procedura praticata. I vantaggi della chirurgia testicolare conservativa comprendono il miglioramento della qualità complessiva di vita del paziente in termini di fertilità, miglioramento della funzionalità endocrina e di estetica legati all'orchietomia demolitiva.

Introduction

The consideration of the best way to manage small (≤ 1.5 cm in diameter), non-palpable testicular masses remains controversial and has evolved over last 20 years. While radical orchiectomy is the reference standard for the treatment of testicular masses, testicle-sparing surgery has been advocated for a selection of patients. Examples include a patient with a synchronous bilateral testicular tumour, one with a metachronous contralateral tumour, and one with a tumour in a solitary testis and a normal pre-operative testosterone level [1]. The patients frequently present as asymptomatic with no palpable mass on physical examination. During recent years, a number of advances in ultrasound (US) technology have enhanced US image quality, resulting in the increased detection of small testicular lesions. Although orchiectomy resolves the problem simply and definitively, it has potentially harmful consequences, mainly for fertility and endocrine function. Therefore, partial orchiectomy has been proposed as the first-line therapy for small testicular lesions in infertile men [2]. Some authors [3] also report an 80 % incidence of benign definitive histology in small tumours. The aim of the present study is to evaluate the evolution of conservative echo-guided surgery (CES) for testicular tumours ≤ 1.5 cm and to assess the safety of this surgical procedure (Figs. 1, 2, 3).

Materials and methods

A monocentric, retrospective clinical study was performed from January 2001 to October 2010. During this period, 49 consecutive patients diagnosed with (monolateral or bilateral) testicular lesions ≤ 1.5 cm using ultrasonography and treated with conservative echo-guided surgery (CES) for

Fig. 1 Hypoechoic lesion in the left testis

Fig. 2 Non-palpable, small lesion is identified and removed

Fig. 3 Hyperechoic area (white arrows) at follow-up, 6 months after tumour excision

testicular tumours were examined. The selection criteria for CES were the size of the mass (≤ 1.5 cm) and a safe distance between the mass and rete testis. The parameters considered in this retrospective analysis included case history, physical examination, scrotal and abdominal ultrasonography, computed tomography (CT) (of the

abdomen and lungs), the size (maximum diameter) of the nodule, tumour markers, chest radiography, frozen section examination, the histological size of the tumour, overall survival (OS) and findings on follow-up. Every patient was evaluated preoperatively with a clinical examination and a scrotal US with an 8–13 MHz probe. The parameters determined at grayscale were size, echogenicity and vascularisation with a colour Doppler signal. Tumour marker determination, including that of alpha-fetoprotein (AFP), beta-human chorionic gonadotropin (β hCG) and lactate dehydrogenase (LDH), was undertaken in all cases. The patients were informed in detail about the procedure and its risks, and they provided written informed consent. All patients underwent antibiotic prophylaxis with cephalosporin. The procedure was performed under spinal anaesthesia. In all cases, the operation was performed through the inguinal approach. The testis and surrounding tunica vaginalis were extracted from the scrotum. For the earlier cases, a soft clamp was used on the spermatic cord during mass enucleation. Then, the tunica vaginalis was opened at the closest point to the mass. Intraoperatively, location of the tumour was performed by US, or, if palpable, by palpation.

In those cases where the mass was not palpable, a 30-gauge needle was placed directly through the lesion under US guidance to minimize trauma to the remaining testicle. When a nodular area was found to be different from the surrounding tissue and to correspond in dimensions, site and aspect to the one indicated by US, it was excised and sent for frozen section examination (FSE). In those cases where the analysis revealed a benign lesion, the vascular clamp on the spermatic cord was removed. The parenchyma was inspected for haemostasis, the tunica albuginea was closed with a continuous suture of polydioxanone 3–4/0 and the testicle replaced in the scrotum. If the FSE revealed a malignant tumour, a radical or partial orchiectomy was performed. The final pathological diagnosis was established by the pathologist's examination of the permanent sections. All patients underwent postoperative follow-up for 5 years.

For the first 3 years, follow-up consisted of a clinical examination, tumour marker determination, abdominal and scrotal US every 3 or 6 months, and, in cases of malignant tumours, a chest X-ray and abdominal CT once or twice a year. After 2 years, urological follow-up was performed every 6 months for 2 years, and, thereafter, a chest X-ray was only performed annually if clinically indicated.

We assessed the hormonal and fertility profile of younger patients with serum testosterone determinations and a spermogram preoperatively and postoperatively. The cryopreservation of 27 patients' semen was performed. Descriptive statistics were used to analyze and present the data.

Results

Seven patients with bilateral synchronous tumours and 42 with monolateral testicular lesions underwent CES. The lesion was on the left testis in 21 patients and on the right testis in 28 patients. The mean age of the patients was 33 years (for a range of 18–62 years). Preoperative tumour markers were normal in all patients, including the patient with a seminoma. Before surgery, no patient showed further pathology on abdominal US or CT scan. The microsurgical technique allowed us to identify and successfully excise the hypoechoic areas that US showed in all patients. The mean size of the nodule on US was 11.6 mm (for a range of 6–15 mm) and the mean size on histological examination was 12.3 mm (for a range of 5–15 mm). Of the patients, 32.7 % (16/49) presented with a palpable testicular nodule, 10.2 % (5/49) with gynaecomastia, 4 % (2/49) with precocious pseudopuberty and 12.2 % (6/49) with scrotal pain. The intraoperative FSE evidenced a benign lesion in 12 patients, was strongly suggestive of testicular neoplasia in 24 patients and indicated an uncertain lesion that required a deepening histological examination in 13 patients. Permanent section examination confirmed the FSE data in all cases where there was certainty of a malignant mass. The definitive histological types were: 22 seminomas (44.9 %), 13 non-seminomatous or mixed germ cell tumours (26.5 %), 4 Leydig cell tumours (8.2 %), 2 hamartomas (4.1 %), 1 epidermoid cyst (2 %), 2 Sertoli cell tumours (4.1 %) and 5 fibrous pseudotumours (10.2 %) (Table 1). The mean ischemia time was about 22.3 min (for a range of 20.5–30.4 min). No significant intraoperative bleeding was observed. Neither perioperative infections nor haematomas occurred. All patients recovered uneventfully from the surgical procedure and were discharged from the hospital on postoperative day two. The mean follow-up was 59 months (for a range of 41–74 months). The overall survival rate was 100 %, and scrotal US showed evidence of local tumour recurrence in six patients (12.2 %) after a mean follow-up of 34.7 months. Subsequently, radical orchiectomy was performed on these six patients. No metastases were observed. None of the patients with preserved testicles required androgen therapy, and the mean postoperative total testosterone was 4.0 ng/ml. Overall, 18 patients were subjected to three cures of chemotherapy (BEP), and, among these, only one was fertile after these treatments.

Discussion

The extensive use of high-frequency testicular US has led to the incidental detection of an increasing number of small, asymptomatic, non-palpable masses [4–6]. Until a

Table 1 Clinical and pathological characteristics of the patients

Variable	Number (%)
Number of patients	49
Age, years (median, range)	33 (18–62)
Clinical presentation (<i>n</i>)	
Asymptomatic	20 (40.9)
Nodule palpable	16 (32.7)
Gynecomastia	5 (10.2)
Precocious pseudopuberty	2 (4)
Scrotal pain	6 (12.2)
Preoperative ultrasound size, mm (median, range)	11.6 (6–15)
Pathologic size, mm (median, range)	12.3 (5–15)
Warm ischemia time, min (median, range)	22.3 (20.5–30.4)
Histologic type at final pathologic examination (<i>n</i>)	
Seminoma	22 (44.9)
Non-seminoma	13 (26.5)
Leydig cell tumour	4 (8.2)
Hamartoma	2 (4.1)
Epidermoid cyst	1 (2)
Sertoli cell tumour	2 (4.1)
Fibrous pseudotumour	5 (10.2)
Follow-up, months (median, range)	59 (41–74)

short time ago, all intratesticular masses were virtually treated with radical orchiectomy; however, testicle-sparing surgery is now advocated for, especially for bilateral and/or multiple lesions or in monorchid patients [7]. Although US can identify these lesions, it is not always possible to use imaging to determine whether they are reactive or neoplastic and benign or malignant [8, 9]. The benefits of testicle-sparing surgery include the improvement of the patient's overall quality of life, fertility and endocrine function, and the avoidance of the negative cosmetic effects of radical orchiectomy [10]. Hopps et al. [11], who performed intraoperative US-guided localization and the subsequent surgical excision of small testicular tumours, proposed surgical exploration for non-palpable, hypoechoic testicular masses. He reported on four patients treated using this approach, concluding that this type of surgery provided the opportunity to remove benign masses as well as malignant lesions, with appropriate margins, in selected cases. Other investigators have also proposed US-guided needle localization with the subsequent performance of testicle-sparing surgery [12]. For most (40.1 %) of the patients in our study, the diagnosis was incidental and the testicular mass was completely asymptomatic. The masses in 28.6 % of the patients were revealed to be benign. This was discordant with some studies, which showed that non-palpable benign masses constituted approximately 80 % [3, 13, 14]. The accuracy of FSE on testicular biopsy in differentiating between benign and malignant lesions has been

proved; thus, its results can guide surgical management [15]. Moreover, it is often difficult to identify the suspicious areas on macroscopic intraoperative examination, and it is not always rapidly available, is time-consuming, requires long-standing experience and cannot be applied to multiple lesions [16].

In our study, FSE showed efficacy in the detection of germ cell tumours as its positive predictive value was 100 % and its negative predictive value was 80 %. The sensibility and specificity of FSE were 84.3 and 100 %, respectively. A 94.2 % positive predictive value and 92.6 % negative predictive value has been reported in the literature [17]. It seems that problems with accuracy only arise when a differential diagnosis between seminomatous and non-seminomatous malignancy is necessary. The German Testicular Cancer Study Group showed that 98.6 % of patients treated using this approach survived without evidence of disease at a median follow-up of 91 months [18]. Hallak et al. [2] published on a series of patients with azoospermia and non-palpable testicular lesions. In each case, a stereotaxic hook-shaped needle was inserted adjacent to the testicular lesion under US guidance to facilitate its surgical resection. Our technique involves the needle localization of a small testicular mass: The needle is inserted directly through the lesion under real-time US guidance. Our approach to testicular nodules uses a longitudinal incision in the tunica albuginea. This has the advantage of providing better exposition of the parenchyma, allowing closer examination and, consequently, the identification of suspicious lesions. For the patients in this study, the short-term clinical outcome was good; there were no complications. In the literature, CES reported very low complication rates (lower than 6 % overall). Testicular atrophy occurred in the range of 3 to 5 % [3]. Using this approach to treat unilateral testicular masses, Shukla et al. [19] seem to have recorded a lower incidence of testicular atrophy and tumour recurrence. The concept of testicle-sparing surgery certainly follows the logical progression for neoplasm management that we have successfully observed in a variety of other tumours, including renal and breast cancers. The psychological impact of complete testicular removal must be balanced against the potential risk of cancer recurrence due to incomplete tumour resection [20]. Furthermore, recent data show an increase in diagnostic accuracy with the use of contrast-enhanced US to diagnose small, non-palpable testicular lesions. These studies found that contrast-enhanced US revealed specific properties of testicular tumours. This helps not only in differential diagnosis to rule out non-neoplastic lesions (ischemia, abscesses, cysts) but also in differential diagnosis between malignant tumours and benign lesions [21, 22].

CES should be considered for a testicular cancer patient who presents with a benign pathology, a bilateral tumour or

a single testicle. CES appears to be safe and effective in experienced ultrasonography centres. The 100 % overall survival rate, the low local recurrence rate (12.8 %) and the absence of complications tend to demonstrate the safety of the procedure.

Conclusion

The results of this study confirm the favourable data in the literature, indicating that ultrasonography constitutes an excellent diagnostic method with 100 % sensitivity in the diagnosis of testicular masses with diameters of between 0.5 and 1.5 cm. Long-term follow-up and multicentre studies as well as our study suggest that testicle-sparing surgery does not compromise oncological efficacy in the treatment of these tumours.

Conflict of interest Lucio Dell’Atti declares no conflict of interest.

Informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). All patients provided written informed consent for enrolment in the study and the inclusion in this article of information that could potentially lead to their identification.

Human and animal studies The study was conducted in accordance with all institutional and national guidelines for the care and use of laboratory animals.

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