

Testis-sparing surgery: Experience in 13 patients with oncological and functional outcomes

Murat Keske, MD¹; Abdullah Erdem Canda, MD²; Ali Fuat Atmaca, MD³; Ozer Ural Cakici, MD⁴; Muhammed Ersagun Arslan, MD⁵; Davut Kamaci, MD⁵; Mevlana Derya Balbay, MD²

¹University of Health Sciences, Kayseri Training and Research Hospital, Department of Urology, Kayseri, Turkey; ²Koc University, School of Medicine, Department of Urology, Istanbul, Turkey; ³Yildirim Beyazit University, School of Medicine, Department of Urology, Ankara, Turkey; ⁴Yenimahalle Training and Research Hospital, Department of Urology, Ankara, Turkey; ⁵Ankara Ataturk Training and Research Hospital, Department of Urology, Ankara, Turkey

Cite as: *Can Urol Assoc J* 2019;13(3):E83-8. <http://dx.doi.org/10.5489/cuaj.5379>

Published online August 30, 2018

Abstract

Introduction: We present oncological and functional outcomes of patients who underwent testis-sparing surgery (TSS).

Methods: Overall, 13 patients were included. Mean patient age was 29.9 ± 12.5 years. In five patients, TSS was performed for sequential bilateral testicular tumours. One patient underwent concurrent left radical orchiectomy and right TSS. In eight patients with normal contralateral testis, seven underwent left and one underwent right TSS.

Results: Mean pathological tumour size was 14.6 ± 12.5 mm. Intraoperative frozen section evaluation of the mass was performed in eight patients that revealed benign lesions. No intraoperative tumour bed biopsies were taken in this patient group. Regarding the remaining five patients, intraoperative tumour bed biopsies were taken and testicular intraepithelial neoplasia (TIN) was reported in two (40%) patients; no local testicular radiotherapy was given postoperatively. Tumour pathology was malignant in all but one lesion, including Leydig cell tumour (n=1), seminoma (n=2), embryonal carcinoma (n=1), and adenomatoid tumour (n=1). During 47.2 ± 22.5 months of followup, local recurrence was detected in one patient who underwent radical orchiectomy. No additional local recurrence or systemic metastasis was identified in other patients with malignant lesions. For patients with malignant tumours, of the three patients with a normal preoperative testosterone levels, testosterone level was normal in one patient (with no erectile dysfunction [ED]) and was decreased in two patients (with ED) following TSS. No ED was reported in the nine patients with benign lesions.

Conclusions: In carefully selected cases, TSS appears to be a safe, feasible procedure with adequate cancer control that could preserve sexual function.

Introduction

Testicular neoplasms are the most common solid organ tumours in males aged between 15 and 35 years. Radical

inguinal orchiectomy has been considered as the standard treatment since it was first described.^{1,2} Testis-sparing surgery (TSS) is reported to be feasible and applicable in bilateral tumours and patients with single testis when the tumour volume is less than 30% of the total testicular volume and the preoperative testosterone levels are within normal limits.² Organ-sparing surgery carries psychological and endocrine advantages that would avoid erectile dysfunction (ED) and fertility issues.

In contemporary practice, small and incidental testicular tumours are more widely observed because of the frequent use of radiological imaging modalities. Mainly, use of the ultrasound in the primary evaluation of the scrotal symptoms has led to high incidence in the detection of small, mostly benign, testicular masses.³ In this study, we aimed to evaluate the oncological and functional outcomes of the patients in whom we performed TSS.

Methods

Overall, 13 patients were included who underwent TSS between January of 2008 and December of 2017.

Inclusion criteria and indications for TSS followed recommendations of the European Association of Urology (EAU) guidelines and German Cancer Study Group. These criteria included patients with malignant tumours in solitary testis or bilateral testicular tumours with small lesions without radiological rete testis invasion,⁴ tumour volume <30% of overall testicular volume,² tumour location suitable for surgical excision respecting oncological principles,⁵ tumours that are not palpable and are identified with ultrasound,⁶ testicular mass lesions <1.5 cm in size and with normal serum tumour markers that have a >60% probability of being benign,^{7,8} and in children with small-sized lesions with a high probability of being benign.^{9,10}

TSS was performed using a classical high inguinal incision, which involves the early clamping of the spermatic cord. Cold ischemia was induced using sterile ice-slush for 15 minutes.

Tunica vaginalis was incised, the testicular mass was excised, and frozen sections of the mass and the tumour bed were obtained in selected cases. Intraoperative ultrasound was used to locate the mass if required. Tunica vaginalis was closed with absorbable sutures in continuous fashion if the outcome of the frozen section evaluation was compatible with benign tumour. In patients with solitary testis or metachronal ipsilateral tumours, tunica vaginalis was closed if the tumour bed frozen section biopsies were benign or the frozen section of the mass was reported as malignant.

Patient charts were reviewed in terms of history, preoperative and postoperative ultrasound reports, postoperative computerized tomography (CT) scan of the abdomen and the thorax, and preoperative/postoperative blood tests and testosterone levels.

Results

Overall, 13 patients were included. Mean patient age was 29.9 ± 12.5 (2–47) years. In five patients, TSS was performed for sequential bilateral testicular tumours. One patient underwent concurrent left radical orchiectomy and right TSS. In the other eight patients, contralateral testis was normal and of those, seven underwent concurrent left and one underwent concurrent right partial orchiectomy.

Palpable testicular mass with scrotal pain was the initial symptom in two patients, while seven patients were admitted with a painless testicular mass. Recurrent testicular mass was noticed during the followup of three patients by scrotal ultrasound, and in one patient by the elevated serum tumour marker levels. Demographic and clinic data of the study cohort is presented in Table 1.

Mean tumour size was 14.6 ± 12.5 mm. Intraoperative frozen section evaluation of the mass was performed in patients with benign lesions ($n=8$), including adenomatoid tumour ($n=1$), epidermoid cyst ($n=3$), ischemic infarct ($n=1$), sperm granuloma ($n=1$), tunica albuginea cyst ($n=1$), and hyaline changes without tumour ($n=1$). No intraoperative tumour bed biopsies were taken in this patient group.

In the remaining five patients, malignant lesions included Leydig cell tumour ($n=1$), seminoma ($n=2$), embryonal carcinoma ($n=1$) and adenomatoid tumour ($n=1$). Intraoperative tumour bed biopsies were taken and testicular intraepithelial neoplasia (TIN) was reported in two patients in the tumour bed biopsies. No local testicular radiotherapy (RT) was given postoperatively in these two patients because both patients refused RT. These patients had history of contralateral radical inguinal orchiectomy, and the mean time to the recurrence in the solitary testis was 42.5 ± 21.7 (24–74) months.

No intraoperative, perioperative (0–30 days), or postoperative (31–90 days) complication was identified in any patient.

Mean followup time was 47.2 ± 22.5 (24–80) months. No re-do TSS was performed in any patient. Local recurrence

was detected in one patient. This patient initially underwent right radical inguinal orchiectomy that revealed classical seminoma and received postoperative RT. During follow-up (six years later), a left testicular lesion was identified and TSS was performed that revealed a 12 mm seminoma. Postoperative chemotherapy was given. During followup, a 6.5x8.5 mm left testicular lower pole lesion was detected and left inguinal orchiectomy was performed. Pathology revealed intra-tubular germ cell neoplasia. Tumour markers were normal at 80-month followup and no additional therapy was given. Patient received testosterone replacement. During followup, local recurrence or systemic metastasis was not observed in other patients with malignant lesions.

For patients with malignant tumours, of the three patients with a normal preoperative testosterone levels, serum testosterone level was normal in one patient with no ED and was decreased in two patients with ED after the TSS procedure. No ED was reported in nine patients with benign lesions.

Discussion

Despite the historical acceptance of radical inguinal orchiectomy in the standard treatment of the testicular tumours, TSS has been used more widely in the contemporary management of the small testicular masses.

The volume, dimensions, and location of the mass are regarded as the most important factors in deciding whether to use an organ-sparing approach in testicular tumours. Giannarini et al reported that two-thirds of the testicular masses under 2 cm are benign, and they suggested that TSS could be considered in these patients.⁶ Another study reported a higher incidence of malignancy in testicular masses that are larger than 1.5 cm in size, and proposed classifying the testicular tumours smaller than 1.5 cm as “small,” while classifying testicular tumours smaller than 1 cm as “very small.”⁷ Several previous papers reported even higher incidence of benign pathology (up to 60%) of tumours in testicular masses smaller than 1.5 cm.^{7,8}

In our study, the mean tumour size was 14.6 mm. Malignant lesions were observed in four of 13 patients (30.7%), while benign lesions were observed in nine of 13 patients (69.3%).

Benign testicular masses are also common in the prepubertal period. TSS is reported to be feasible and applicable if the alpha-fetoprotein (AFP) levels are normal.¹¹ In our series, testicular mass was noticed by the scrotal ultrasound scan in one patient who was two years old and laboratory tests revealed normal serum tumour markers. Pathological evaluation of the partial orchiectomy material showed hyalinized changes without any neoplastic growth.

Intratesticular germ cell neoplasia (ITGCN) is the precursor lesion of the germ cell tumours that can be seen in 80% of the normal-appearing testicular tissue surrounding the

Table 1. Clinical, pathological, oncological, and functional outcomes of patients

Patient	Previous operation	Side	Preop AFP	Preop B-hCG	Histological tumour type	Tumour size (mm)	CIS	Treatment	Postop AFP	Postop B-hCG	Local recurrence	Vascularization at Doppler US	Preop T	Postop T	ED
1	Left radical orchiectomy	R	3.1	0.1	Leydig cell tumour	34	No	TSS	-	-	No	-	4.52	3.83	-
2	Left radical orchiectomy	R	1.4	0.1	Embryonal carcinoma	12	No	TSS	1.3	0.72	No	-	2.47	1.86	+
3	Right radical orchiectomy	L	1.7	0.1	Seminoma+ITGCN	12	Yes	TSS+RT+chemo	2.2	0.47	Yes	Normal	1.6	1.12	+
4	Right radical orchiectomy	B	5.6	1.84	Seminoma	40	Yes	TSS	5.6	0.76	No	Normal	3.34	1.62	+
5	Right radical orchiectomy	L	2.4	0.1	Adenomatoid tumour	8	No	TSS	1.9	0.1	No	Normal	-	-	-
6	-	L	1.7	0.1	Epidermoid cyst	20	No	TSS	-	-	No	Normal	-	-	-
7	-	L	1.6	0.1	Epidermoid cyst	10	No	TSS	-	-	No	Normal	-	-	-
8	-	L	3.0	0.1	Ischemic infarct	5	No	TSS	3.19	0.1	No	Normal	-	-	-
9	-	L	1.6	0.1	Sperm granuloma	5	No	TSS	-	-	No	Normal	-	-	-
10	-	L	23.0	2	Hyaline changes without tumour	15	No	TSS	-	-	No	Normal	-	-	-
11	-	L	2.0	0.1	Tunica albugenia cyst	5	No	TSS	-	-	No	Normal	-	-	-
12	-	R	2.2	0.1	Adenomatoid tumour	20	No	TSS	-	-	No	Normal	4.95	3.9	-
13	-	L	1.8	0.1	Epidermoid cyst	10	No	TSS	1.77	0.1	No	Normal	4.12	3.82	-

AFP, alpha-feto protein; B-hCG, human chorionic gonadotropin; CIS, carcinoma in situ; ED, erectile dysfunction; ITGCN, intratesticular germ cell neoplasia; RT, radiation therapy; T, testosterone; TSS testis-sparing surgery; US, ultrasound.

germ cell tumours.¹² Thus, low-dose postoperative RT is suggested when the final pathological result is malignant. We previously reported 20% of ITGCN existence in the normal appearing peritumoural testicular parenchyma in a large multicentre study.¹³

Benign lesions have no risk of the recurrence.¹³⁻¹⁵ TSS is a safe option in these tumours. It has also been shown that organ-sparing surgery is a reasonable and reliable alternative for testicular tumours with benign tendency.¹⁶

Preservation of the testicular function holds importance in terms of preventing postoperative ED. ED is seen in 31.5% of patients after radical orchiectomy.¹⁷ Postoperative hormonal therapy is feasible, however, several possible side effects — cardiological, endocrine, immunological, and dermatological — should be considered.¹⁸ Furthermore, exogenous androgens may fail because of the dysfunctional hypothalamic-hypophysis axis. In our study, ED was not observed in any of the patients with benign testicular mass and intact contralateral testicle. Performing partial orchiectomy in benign-appearing testicular masses may prevent postoperative ED, as well as avoid hormone replacement.

Fertility is another issue to assess in the young population affected by testicular tumours. Some evidence is available in the literature on the disruptive effects of unilateral orchiectomy on the overall spermatogenesis.¹⁹ Liu et al reported no significant changes between preoperative and postoperative sperm concentrations and motilities in 11 patients with TSS history due to benign testicular tumours.¹⁶ The risk of recurrence in the contralateral testis in patients with who had malignant testicular tumours was reported to be between 1.8% and 2.8%.²⁰ The most common bilateral testicular tumour is seminoma that can present with metachronous metastasis in four years.²¹ Heidenreich et al reported the followup of 73 patients who were treated with TSS for metachronous testicular tumours. They further used radiotherapy in 46 patients because of the existence of ITGCN in peritumoural tissue. As a result, they reported a recurrence-free seven-year followup in 72 of 73 (98%) patients.¹²

A list of select published series on TSS is presented in Table 2. Among those series, Bojanic et al reported that TSS was carried out in 24 patients and local recurrence was detected in seven cases. Five out of the seven patients were diagnosed with TIN and radical orchiectomy was performed. A re-do TSS procedures was carried out in the remaining two patients. Chemotherapy protocol was initiated in one patient because of systemic disease. Overall survival rate was reported as

Table 2. Use of testis-sparing surgery for the management of testicular tumours

Study	Age (mean)	Years	No. of pts	Synchronous	Metachronous	Tumour size, mm (mean)	Tumour markers	No. of benign tumours	No. of malignant tumours	TIN
Gentile et al ¹⁵	44.3±18.7	2009–2012	15	Normal	contralateral testis	0.95±0.44	Normal	Dermoid cyst Leydig cell tumour (5); epidermoid cyst (1); inflammation (2); hematoma (1); abscess(1); Sertoli cell tumour (1); adenomatoid tumour (1);	Low-grade fibromyxoid liposarcoma (1); seminoma (1)	2
Shilo et al ¹³	NR	1994–2009	16	2	14 normal contralateral testis	NR	NR	Leydig cell tumour (4); epidermoid cyst (2); adenomatoid tumour (1); cyst (1); Sertoli cell tumour (1); multilocular cyst (1); focal fibrosis (1)	Seminoma (3); embryonal carcinoma (1); teratoma (1)	NR
Bojanic et al ²²	29.58 ±8.15	1996–2013	24	9	12 3 solitary testis tm	NR	NR	—	Seminoma (16); non-seminoma (7); Leydigeoma (1)	9
Liu et al ¹⁶	26	2000–2012	11	2	1 solitary testis tm, 8 normal contralateral testis	NR	Normal	Epidermoid cysts (6); Sertoli cell tumour (3)	Mixed sex cord/gonadal stromal tumour (2)	NR
Galosi et al ⁸	38 (18–68)	NR	28	Normal	contralateral testis	9.3 (2.5–15)	↑ B-hCG (n=1)	Sertoli cell tumour (2); Leydig cell tumour (5); hemorrhagic infiltration (8); fibrosis (3); angiofibroma (1); epidermoid cyst (1); normal parenchyma (1); adenomatoid tumour (1)	Seminoma (3); seminoma and intratubular neoplasia (3)	3
Bojanic et al ²³	35.3±7.3	2010–2015	28	Normal	contralateral testis	11.4±3.7	Normal	Leydig cell tumour (5); Sertoli cell tumour (3); dermoid cyst (1); fibroses (2); adenomatoid tumour (3); segmental infarction (3); hemangioma (1)	Seminoma (6); NSGCT (4)	NR
Our study	29.9±12.5 (2–47)	2008–2017	13	1	4	14.6±120.5 mm (range 5–40)	↑AFP (n=1)	Leydig cell tumour (1); adenomatoid tumour (2); epidermoid cyst (3); ischemic infarct (1); sperm granuloma (1); hyaline changes (1); tunica albuginea cyst (1)	Embryonal carcinoma (1); seminoma (1); seminoma+ ITGCN(1)	2

AFP: alpha-feto protein; B-hCG: human chorionic gonadotropin; CIS: carcinoma in situ; ED: erectile dysfunction; ITGCN: intratesticular germ cell neoplasia; L: left; NR: not reported; NSGCT: non-seminoma germ cell tumour; R: right; RT: radiation therapy; US: ultrasound; T: testosterone; TIN: testicular intraepithelial neoplasia; TSS: testis-sparing surgery.

Table 2 (cont'd). Use of testis-sparing surgery for the management of testicular tumours

Study	Complementary orchiectomy (n)	Adjuvant chemo (n)	Adjuvant RT (n)	Local recurrence	Treatment of recurrence	Sperm count	Testosterone level	Postop testosterone supplement	Postop sexual function	Followup (mos)
Gentile et al ¹⁵	2	No	No	No	No	Normal	Normal	No	Normal	19.2±11.5
Shilo et al ¹³	5	1	No	No	No	NA	NA	NA	NA	48 (range 30–68)
Bojanic et al ²²	0	10	No	7	Radical orchiectomy (5) Re-do TSS (2)	Azospemia after surgery (2)	NR	NR	NA	51 (range 7–178)
Liu et al ¹⁶	2	No	No	No	No	Normal	Normal	No	Normal	31.7±15.8
Galosi et al ⁸	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bojanic et al ²³	1	No	No	1	Radical orchiectomy (1)	NA	NA	NA	NR	40.9±20.5
Our study	No	1	1	1	Radical orchiectomy (1)	NA	Normal (10) Low (3)	2	Normal (10) ED (2) Preop ED (1)	47.2±22.5

ED: erectile dysfunction; RT: radiation therapy; TSS: testis-sparing surgery.

100%.²² Therefore, TSS was shown to be feasible without compromising survival rates and with potential benefits.

In our study group, we also observed local recurrence in one patient that led to radical orchiectomy. By this approach, TSS was performed without compromising the oncological outcomes, particularly cancer-free survival. Due to these results, we think that TSS can be performed in patients with germ cell tumours (GCT) and who can be closely followed up.

Bojanic et al evaluated 28 patients with both benign and malignant testicular lesions. During 40.9 weeks of followup, of the 10 GCT patients, only one patient had local recurrence and this patient underwent radical orchiectomy. Contralateral tumour or distant metastasis were not observed in any patient in their cohort. Overall survival was reported to be 100%.²³ Benign testicular tumours were observed in 18 patients, which is also compatible with our results.

Galosi et al observed malignant lesions in six of 28 patients whose tumour sizes were 15 mm or smaller.⁸ They also developed an algorithm proposing that the frozen sections can be avoided in lesions smaller than 8 mm in diameter. In our study, we did not observe any malignant lesions in tumours smaller than 12 mm, which is compatible with Galosi et al's results.

TSS can provide long-time survival, even a cure. TSS is a sensible option considering the preservation of the fertility, avoidance of hormonal replacement, improved cosmetics, and psychological advantages. However, this surgical approach should be performed in experienced centres.²⁴

Patients who are considered for TSS should be informed about the possible benefits and the risks of the approach. Furthermore, patients should be aware of the possibility of receiving adjuvant treatments, if needed. TSS may be more suitable than the radical approach in selected patients with small, benign testicular tumours.

Competing interests: The authors report no competing personal or financial interest related to this work.

This paper has been peer-reviewed.

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Correspondence: Dr. Murat Keske, University of Health Sciences, Kayseri Training and Research Hospital, Department of Urology, Kayseri, Turkey; muratkeske@yahoo.co.uk