Hook Wire Localization for Testis Sparing Surgery

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OBJECTIVE
To describe a novel technique for localizing small testicular mass during testicular-sparing surgery (TSS).

METHODS AND RESULTS
A 20-year-old man presented with bilateral testicular masses. Both alpha-fetoprotein (AFP) and beta-human chorionic gonadotropin (BHCG) levels were raised. Clinical and imaging studies revealed a 2.7 cm and 0.7 cm mass in the right and left testis, respectively. No metastatic disease was detected on staging scans. Right inguinal total orchiectomy was performed. For the left testis, the inguinal approach was used to deliver the testis to the surgical wound. Vascular clamping and cooling of the testis were performed. A hook wire (Ghiatas Beaded Breast Localization Wire, 20G) was then inserted through the small testicular tumor with the aid of on-table ultrasound imaging. Testicular-sparing surgery (TSS) was easily performed with the aid of the hook wire. Postoperative recovery was uneventful. The histology report revealed a mixed germ cell tumor with clear margin. Tumor markers returned to normal after surgery. Serum testosterone level was also within normal range. Follow-up ultrasound scan showed a viable left testis with normal vascularity.

CONCLUSION
Hook wire localization of a small testicular mass under ultrasound guidance is an easy-to-perform technique that facilitates TSS in selected patients. This technique allows TSS to be performed in a more controlled and confident manner.

INGUINAL ORCHIECTOMY FORMS THE CORNERSTONE IN MANAGING TESTICULAR CANCERS. HOWEVER, THE NEGATIVE IMPACT ON THE REPRODUCTIVE AND ENDOCRINE FUNCTIONS, AS WELL AS BODY SELF-IMAGE, IS IMMENSE. THIS IS ESPECIALLY TRUE FOR PATIENTS PRESENTING WITH BILATERAL TESTICULAR CANCERS. THEREFORE, IN SUCH CIRCUMSTANCES, TESTICULAR-SPARING SURGERY (TSS) HAS BEEN ADVOCATED WITH THE AIM OF PRESERVING AS MUCH TESTICULAR FUNCTION AS POSSIBLE. CURRENTLY, THE MAIN INDICATIONS FOR TSS ARE: SYNCHRONOUS BILATERAL TESTICULAR TUMORS, METAChRONOUS CONTRALATERAL TUMOR, AND A TUMOR IN A SOLITARY TESTIS WITH NORMAL PREOPERATIVE TESTOSTERONE LEVEL.1

The TSS technique was first described in the English-language scientific literature by Stoll et al.2 Recent reports on TSS had demonstrated favorable outcomes in selected patients. Although the general surgical principle of TSS is well described in the literature,3 controversial aspects, such as cold vs warm ischemia, are still a matter of debate. However, the overall impact of such issues on the outcome of TSS seems to be low.

One constant concern for surgeons performing TSS is the exact localization of the tumor during operation. This concern is made more acute in patients with an intra-testicular mass. Accurate localization of the tumor intraoperatively would avoid unnecessary excision of normal testicular tissues while preserving an adequate surgical margin. The complexity of TSS could be simplified by pinning down the target lesion. In this article, we describe a method using ultrasound-guided hook wire localization to facilitate TSS.

MATERIAL AND METHODS
A 20-year-old man presented with a 2-week history of painless right testicular swelling. He concomitantly complained of painful right breast swelling. Clinical examination confirmed a gross uniformly enlarged right testis and a tender right gynecomastia while blood and urine analysis were unremarkable. His testicular tumor markers were elevated (alpha-fetoprotein [AFP] 255 IU/mL, beta-human chorionic gonadotropin [BHCG] 884 mIU/mL).

Ultrasound scan of the scrotum revealed 2 ill-defined heterogeneous right testicular lesions measuring 2.0 cm × 2.7 cm and 1.3 cm in diameter, respectively. A single well-defined lesion was seen within the left testis measuring 0.7 cm in diameter (Fig. 1). This small lesion was clinically felt as a tiny induration at the surface of the left testis. Both testes had features of microcystis. The clinical diagnosis was that of...
bilateral testicular malignancy. The breast ultrasound scan showed a right retroareolar mass.

The preoperative staging computed tomography scan showed bilateral intramammary lesions with no evidence of metastasis. The subsequent right breast fine-needle aspiration biopsy revealed benign epithelial proliferative disease. The patient underwent sperm banking and then proceeded with right inguinal orchiectomy and left partial orchiectomy.

SURGICAL AND ULTRASOUND TECHNIQUES

Inguinal approach was used for the left partial orchiectomy. Once the left testis was delivered through the inguinal wound, the target tumor was localized with ultrasound (SonoSite, Bothell, WA) using the 3-6 MHz Linear HFL38x transducer. Under ultrasound guidance, a 20G × 9 cm introducer needle loaded with hook wire (Ghiatas Beaded Breast Localization Wire) was inserted into the tumor. The tip of the needle was positioned just beyond the tumor margin. The needle was then withdrawn and the hook wire deployed [Fig. 2]. The depth of the tip of the hook wire from the skin was documented.

Clamping of the cord at the level of the internal inguinal ring was carried out after hook wire localization. The testis was then cooled by covering it with ice slush for about 10 minutes. After that, the testicular lesion was excised with adequate margin (about 3-4 mm) with the guide of the hook wire (Fig. 3). Hemostasis was secured before the closure of the defect in the testis. The clamp on the cord was subsequently released before the testis was returned to the scrotum. The pathologist was notified to examine the tissues adjacent to the tumor specifically for the presence of carcinoma in situ (CIS).

RESULTS

Postoperatively, the patient made good recovery and, during his subsequent follow-up visit, showed satisfactory healing of surgical scars. The tender right breast swelling had also subsided. The histology report showed bilateral mixed germ cell tumor with 90% embryonal carcinoma and the rest consisting of teratoma and endodermal sinus tumor elements. The margins of left testicular tumor, resected with the aid of a hook wire, were also clear for cancer without any evidence of CIS.

On follow-up visit, 3 months after surgery, the tumor markers had dropped to normal levels (AFP 2 IU/mL, BHCG <2 mIU/mL). The total testosterone level was within normal limits (13.5 nmol/L) with normal luteinizing hormone and follicle-stimulating hormone levels. No preoperative testosterone level was available for comparison as the test was not performed preoperatively because the patient was clinically eugonadal. The scrotal ultrasound plus Doppler (3 months postsurgery) demonstrated a left testis with normal vascularity, testicular microlithiasis and small testicular cysts. The patient was counseled to consider postoperative adjuvant therapy in the form of chemotherapy and local radiotherapy on the remaining testis. However, the patient opted for observation and surveillance.

COMMENT

In a patient with clear indication for TSS, the main technical challenge is the precise localization of the small lesion in the testis. With accurate localization, complete
excision with adequate margin can be achieved. There are very few articles on TSS that describe in details the technique for tumor localization. Hopps et al. in their article on the microdissection for incidental nonpalpable testicular tumors, described the use of real time ultrasound localization of testicular mass and simultaneous insertion of a 30-gauge needle adjacent to the mass to aid localization. Subsequently, Hallak et al. published a series of 5 patients with azoospermia and nonpalpable testicular mass in which a stereotaxic hook-shaped needle was inserted adjacent to the mass under ultrasound guidance to facilitate microsurgical resection of the testicular mass. In all these cases, the needles were inserted adjacent to the testicular mass. Although this step helps tumor localization, there will always be concern that the needle might slip off or move in position while the surgeon is dissecting toward the tumor.

In our current description of hook wire localization of a small testicular mass, the hook wire is inserted directly through the lesion under real time ultrasound guidance. Upon passing through the lesion, the hook is deployed to pin down the lesion in a “harpoon-like” manner. With this maneuver, the lesion is fixed in position with certainty, thus, avoiding any concern about the hook wire moving out of position during dissection. Once the hooks are deployed and the hook wire is confirmed to be in position through the lesion, the surgeon can then incise the tunica albuginea and hold on to the hook wire to use it as a guide to dissect toward and around the lesion. This simple and easy-to-perform technique allows a greater degree of confidence for complete resection of the lesion with adequate margin. Moreover, tumor seeding is not an issue as the distal margin of the dissection goes slightly beyond the tip of the hook wire. For nonpalpable testicular lesions, this method of tumor localization will be of great value. The technique could be used for both palpable and nonpalpable small tumors as it helps to stabilize the tumor for precise excision. Potentially, this method could also be used for multiple small testicular lesions in the ipsilateral testis, although this remains to be proven in future clinical cases.

Most clinical reports on TSS used cold ischemia during dissection. This allows the dissection to be carried out in a more controlled manner in a bloodless field. Recently, however, some experts have advocated “zero” ischemia (ie, without clamping the testicular vessels with the aim of preserving testicular functions). Although the benefit of cold vs zero ischemia is debatable, the use of hook wire localization will cut down on the operative time as it allows easy localization of the target lesion. In a typical setting, localization with a hook wire will be carried out before clamping the testicular vessels. After the testis is cooled, TSS can be carried out in an expeditious manner with the aid of the hook wire.

After the resection of the testicular lesion, some surgeons have advocated multiple biopsies of the surrounding testicular parenchyma in order to rule out intratubular germ cell neoplasia. The use of fresh frozen section (FFS) in this respect is controversial as there are variations in the capability of different laboratories in reporting FFS for testicular lesions. Thus, FFS is advocated for centers with a high volume of workload for such cases. In centers where FFS are not available, the biopsy specimens could be examined in formally prepared tissue blocks. This would be helpful in deciding on subsequent adjuvant therapy. Adjuvant radiotherapy to the testis is advised in the presence of CIS. However, even in the absence of CIS, the need for adjuvant radiotherapy to the testis is discussed with the patient as there is a very high incidence of CIS in such cases (ie, about 80%) which may be missed on examining the adjacent tissues around the tumor.

Executed in the proper manner, TSS carries very low complication rates (overall less than 6%). Testicular atrophy was reported in the range of 3%-5%. Meticulous hemostasis is critical in the successful performance of TSS. Patients are to be monitored for the development of hematoma in the postoperative period. With the aid of hook wire localization, a focused dissection could be carried out with precision. This avoids blind dissection, which carries the risk of exposing a wide testicular tissue surface and subsequent bleeding. Favorable long-term outcomes of TSS have recently been reported. For the patient in this case report, the short-term clinical outcome was good with no complication. In addition, the viability of the testis was confirmed by ultrasonography and the postoperative testosterone level was in the normal range. Further follow-up is required to observe the long-term result for this patient.

To ensure the success of hook wire-guided localization for TSS, close working relationship with the radiologist is essential. Radiologists who are familiar with ultrasound-guided insertion of the hook wire should have no problem in carrying out the procedure as it is commonly done for hook wire localization for excision of small or impalpable breast lesions. Our current case provides a practical method to localize testicular lesions for TSS. It is, of course, limited by the fact that it is a single case experience. Application of this method in future cases of TSS will provide more information on the usefulness of this technique. It is hoped that hook wire localization for TSS will achieve similar clinical usefulness as is the case for hook wire localization in breast surgeries.

CONCLUSION

Hook wire localization of testicular lesion for TSS is an easy-to-perform technique. It enables the precise localization of the small or impalpable testicular lesion to be carried out with a greater degree of certainty and facilitates the complete resection of the target lesion.

References


EDITORIAL COMMENT

The authors describe an interesting technique for testicular preservation surgery using a hook wire localization method in conjunction with intraoperative Doppler imaging to remove a testicular mass. A similar technique using placement of a comparable needle adjacent to the tumor was reported by Hallak et al (referenced above) but the current report involves needle deployment directly into the testicular lesion. Both reports advocate cold ischemia resection, but the current article does not use concurrent frozen section assessment of tumor margins.

The concept of testicular sparing surgery certainly follows a logical progression for neoplasm management that we have successfully observed in a variety of other diseases including renal and breast neoplasms. However, testicular sparing poses some unique issues relative to other organ sparing experience. The physiologic and psychologic impact of complete testicular removal must be balanced against the potential risk of cancer recurrence because of incomplete tumor resection. The physiologic implication of orchietomy can be mitigated by the relative ease of testosterone supplementation and preoperative sperm cryopreservation for retention of fertility potential. Clearly, the psychologic impact of orchietomy can be substantial, even in context of testicular prosthesis placement. Ultimately, organ-sparing procedures for neoplasia, regardless of the organ involved, should meet 2 criteria. First, they must provide cancer control that is comparable to traditional extirpative procedures. In this case, the authors do not describe the tumor margin requirements for their technique, utilization of resection base biopsies, nor are we provided long-term follow-up regarding tumor-free survival. It is particularly concerning that the patient selected for report had embryonal carcinoma with elevated preoperative tumor markers, a situation that many would consider a contraindication for testis-sparring consideration because of the high risk of local recurrence and distant metastasis. A recent series suggested that testis-sparring surgery should be used when it is almost certain preoperatively that a lesion is benign, size less than 2 cm, and negative preoperative tumor markers.1 The particular method of localization used by the current report involves direct needle entry into and through the tumor. This would seem to elevate the risk of tumor bed seeding; although, ultimately, it will depend upon the depth of the tumor margin, which is not described in the report. Although the authors comment on the controversy regarding accuracy of frozen section pathology assessments of testicular resection, it would seem critical that an experienced genitourinary pathologist be used to examine tumor margins real time to avoid the need for subsequent resection upon return of permanent pathology results.

A second requirement of a successful organ-sparring procedure is retention of significant physiologic function postoperatively. The authors recommend routine consideration for adjuvant gonadal radiation to eradicate occult carcinoma in situ. Although this will provide excellent control of occult carcinoma in situ, radiation doses used will usually result in persistent azoospermia. Leydig cell function remains relatively radiation resistant and most patients will retain adequate serum testosterone levels.2

Ultimately, the success of this technique must be judged with long-term follow-up in carefully described prospective series. Adherence to meticulous surgical technique and appropriate patient selection will be vital to the success of organ-sparring techniques.

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REPLY

We appreciate the editorial comment on our article. The comment highlighted the 2 most important aspects in organ sparing surgery, cancer control and preservation of function of the native organ. With regard to these aspects, testicular-sparing surgery (TSS) draws comparison with nephron-sparing surgery for renal tumors. Both surgeries aim for complete tumor resection while preserving the functions of the remaining organs, but while nephron-sparing surgery has evolved over many years and is now considered a standard procedure for small renal tumors, TSS is an evolving surgical technique that is not yet widely practiced.

In the case described in our article, a margin of 3-4 mm around the tumor was achieved with ease with the aid of a hook
wire for tumor localization. This was possible as the target tumor was relatively small (0.7 cm). The testis is a small organ compared to the kidney, and too wide an excision would render the remaining testis too small to be functionally useful. However, the exact minimal margin for TSS is still undefined. It will be interesting to see if future studies can address this issue. There is also an issue with regard to margin in nephron-sparing surgery, except that here a wide margin is not considered as essential.

We agree with the utilization of experienced genitourinary pathologists to examine the tumor margins in real time if the service is available. The use of “zero ischemia” (without clamping the testicular vessels) has to be considered in this setting as frozen section examination will take some time. On the other hand, the use of hook wire localization stabilizes the target tumor, thus enabling a greater degree of confidence in its resection with adequate margin for cancer control. Furthermore, the tip of the hook wire which “harpooned” the tumor is included in the resection margin. Therefore, the concern of tumor seeding is minimal.

The list of indications for TSS is evolving. Although there may be reservation in considering TSS for high-risk testis cancer, this in itself is not an absolute contraindication for TSS. The final histology diagnosis, which provides information on risk estimation, is usually available after the permanent pathology result is ready. In selected patients, TSS offers the patients greater psychological and physiological advantages compared to total orchiectomy. A detailed discussion with the patient is essential in the decision-making process.

For the patient described in our article, follow-up 1 year after surgery showed no sign of tumor recurrence according to imaging study and tumor markers. The remaining testis was viable by ultrasound and normal on clinical palpation. The testosterone level was at a normal level (17.6 nmol/L).

The current literature comes from a few centers with a high volume of TSS. With the future accumulation of clinical data, there will come a time when TSS will receive similar acceptance as nephron-sparing surgery.

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