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MICROSURGICAL INGUINAL VARICOCELECTOMY WITH DELIVERY OF THE TESTIS: AN ARTERY AND LYMPHATIC SPARING TECHNIQUE

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ABSTRACT

Conventional techniques of varicocele repair are associated with substantial risks of hydrocele formation, ligation of the testicular artery, and varicocele recurrence. We describe a microsurgical technique of varicocelectomy that significantly lowers the incidence of these complications. The testicle is delivered through a 2 to 3 cm. inguinal incision, and all external spermatic and gubernacular veins are ligated. The testis is returned to the scrotum and the spermatic cord is dissected under the operating microscope. The testicular artery and lymphatics are identified and preserved. All internal spermatic veins are doubly ligated with small hemoclips or 4-zero silk and divided. The vas deferens and its vessels are preserved.

Initially, we performed 33 conventional inguinal varicocelectomies in 24 men without delivery of the testis or use of a microscope. Postoperatively, 3 unilateral hydroceles (9%) and 3 unilateral recurrences (9%) were detected. For the next 12 cases 2.5× loupes were used resulting in no hydroceles but another recurrence (8%). We then performed 640 varicocelectomies in 429 men using the microsurgical technique with delivery of the testis. Among 382 men available for followup examination from 6 months to 7 years postoperatively no hydroceles and no cases of testicular atrophy were found. A total of 4 unilateral recurrent varicoceles (0.6%) was identified. The differences between the techniques in the incidence of hydrocele formation and varicocele recurrence are highly significant ($p < 0.001$). No wound infections occurred in any men. Four scrotal hematomas (0.6%), 1 of which required surgical drainage, occurred in the group with microsurgical ligation and delivery of the testis compared to none with the conventional technique. Preoperative and postoperative semen analyses (mean 3.57 analyses per patient) were obtained on 271 men. The changes in sperm count $\times 10^6$ cc (36.9 to 46.8, $p < 0.001$), per cent motility (39.6 to 45.7%, $p < 0.001$) and per cent normal forms (48.4 to 52.10%, $p < 0.001$) were highly significant. The pregnancy rate was 152 of 357 couples (43%) followed for a minimum of 6 months postoperatively.

Delivery of the testis through a small inguinal incision provides direct visual access to all possible avenues of testicular venous drainage. The operating microscope allows identification of the testicular artery, lymphatics and small venous channels. This minimally invasive, outpatient technique results in a significant decrease in the incidence of hydrocele formation, testicular artery injury and varicocele recurrence.

KEY WORDS: testis, varicocele, microsurgery

Varicocele is found in approximately 15% of the general population but in at least 35% of infertile men.[1] Traditional approaches to the surgical repair of varicocele include retroperitoneal[2] and inguinal[3,4] operations. Hydrocele is the most common complication of these operations. Szabo and Kessler reviewed the incidence of hydrocele formation after varicocelectomy and found rates varying from 3 to 39%, and in their own series an incidence of 7.2%.[5] Analysis of the protein concentration of the hydrocele fluid indicated that lymphatic obstruction is the cause of hydrocele formation after varicocelectomy.[5]

Testicular atrophy or azoospermia is the most devastating complication of varicocelectomy but this is rarely reported and the incidence, therefore, is unknown. Animal[6] and human[7] studies suggest that ligation of the testicular artery is associated with a substantial risk of testicular injury.

The incidence of persistent or recurrent varicocele following surgical repair in adults varies from 5 to 45%[8-11] and appears to be even more common after repair of the pediatric varicocele.[12-14] Venography of recurrent varicocele has revealed that most recurrences are the result of mid retroperitoneal or low inguinal parallel collaterals[13,15,16] but 7% of all recurrences appear to be due to scrotal collaterals.[17]

Attempts at decreasing the complication and recurrence rates following varicocelectomy led to microsurgical approaches.[18-20] These methods have the advantages of identification and preservation of the testicular artery and lymphatics, and decrease the incidence of hydrocele formation and testicular artery injury. These approaches do not address retroperitoneal, parallel inguinal or scrotal collaterals, which are the most common causes of recurrent varicocele. Intraoperative venography performed at the time of conventional varicocelectomy[13,21] or balloon occlusion[15,22,23] often visualizes these collaterals but substantially increases the operating time and still results in a significant incidence of varicocele recurrence.[17,24-26] We describe the evolution of a microsurgical approach with delivery of the testis, which decreases the complication and recurrence rates after varicocelectomy.

MATERIALS AND METHODS

Patients. A total of 429 men and boys 12 to 54 years old with varicoceles underwent 640 varicocelectomies (211 bilateral). Of

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the men 368 presented with infertility at least 1 year in duration. In the remainder the indication for surgery was pain or testicular atrophy. Examination for varicocele was performed in a warm room with the patient in the upright position with the aid of a Valsalva maneuver and was confirmed by 2 independent physicians. Men and boys with suspected subclinical varicoceles were excluded. Men who presented with infertility had at least 2 semen analyses obtained preoperatively after 3 days of abstinence and at least 1 month apart. The men were examined at 1, 3 and 6 months, and 1 year postoperatively. Semen analyses were obtained at 3 and 6 months, and 1 year postoperatively. Scrotal transillumination was performed at each postoperative visit for the detection of hydrocele. Initially, 33 varicocelectomies were performed with a standard inguinal approach without magnification. Inability to visualize and preserve reliably the testicular artery and lymphatics led to the use of 2.5× magnification loupes for the next 12 operations. Although this method improved our ability to identify the testicular artery to at least two-thirds of the cases, recurrent varicoceles led to dissatisfaction with this operation and to the development of the procedure described. Because of the danger of testicular artery injury with blind cord block,[27] general or regional anesthesia was used in all patients.

Surgical technique. The location of the external inguinal ring is marked on the skin. An incision is made beginning at the external inguinal ring and extended 2.0 to 3 cm. laterally in the skin crease (fig. 1). The incision is deepened through Camper's fascia. With small Richardson retractors the superficial epigastric artery and vein, and surrounding fat are retracted. Scarpa's fascia is retracted revealing the external oblique aponeurosis, which is opened the length of the incision in the direction of its fibers through the external inguinal ring. A 3-zero polyglactin suture placed at the apex of the incision in the external oblique aponeurosis facilitates later closure. In men with prior inguinal surgery or a high external ring the external oblique aponeurosis is not opened and the spermatic cord is grasped just below the external ring. The spermatic cord is then encircled with a Babcock clamp and delivered through the wound. The ileoinguinal and genital branches of the genitofemoral nerves are excluded from the spermatic cord, which is surrounded with a large Penrose drain. The spermatic cord is then bluntly dissected with a finger down to the scrotum and the testis is delivered through the wound.

All external spermatic veins are identified and doubly ligated with hemoclips or 4-zero silk and divided (fig. 1). The gubernaculum is inspected for the presence of veins exiting from the tunica vaginalis. These are either cauterized, doubly ligated or clipped and divided. The testis is then returned to the scrotum and a tongue blade covered with a Penrose drain is placed beneath the cord structures. The operating microscope is then brought into the field. Under 8× magnification the external and internal spermatic fascias are opened. A 1% papaverine solution is sprinkled on the spermatic cord, which is inspected for the presence of pulsations revealing the location of the testicular artery. If the testicular artery is identified it is dissected free of all surrounding tissue, tiny veins and lymphatics, using a fine tipped nonlocking microsurgical needle holder and smooth small forceps. The artery is encircled with a 1-zero silk suture for positive identification (fig. 2, *A*). If pulsations of the suspected artery are not obvious, a partial occlusion test may be performed by elevating the artery with the tips of the needle holder until it is completely occluded and then slowly lowering it until a pulsating column of blood appears just over the needle holder. If the artery is not immediately identified the spermatic cord is carefully dissected beginning with the largest vein. The veins are stripped clean of adherent lymphatics and the underside of the largest veins are inspected for an adherent artery. In approximately 50% of the cases the testicular artery is adherent to the underside of a large vein. All veins within the spermatic cord, with the exception of the vasal veins, are doubly ligated with either hemoclips or by passing 2, 4-zero silk sutures, 1 black and 1 white, beneath the vein (fig. 2, *B*). These sutures are then tied and the vein is divided. If the vas deferens is accompanied by dilated veins greater than 3 mm. in diameter, they are dissected free of the vasal artery and ligated. The vas deferens is always accompanied by 2 sets of vessels. As long as at least 1 set of vasal veins remains intact venous congestion will not occur.

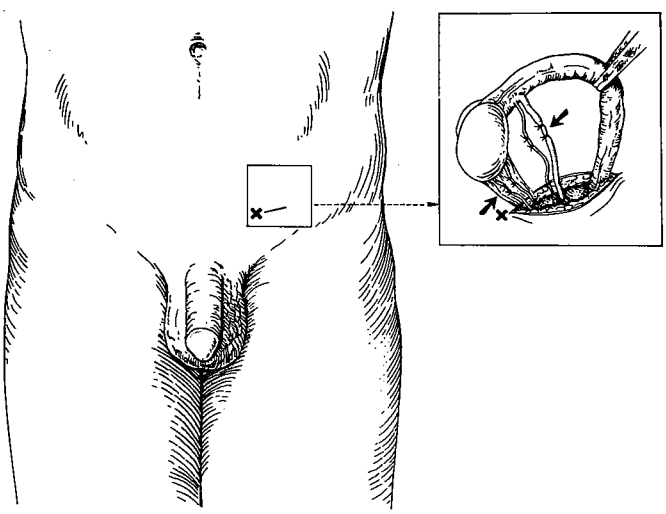

FIG. 1. X marks site of external inguinal ring. Incision is 2.5 to 3 cm. long. Inset: after delivery of testis, external spermatic and gubernacular veins are doubly ligated with 4-zero silk and divided.

At the completion of the dissection the spermatic cord is run over the index finger and inspected to make sure all veins have been identified and ligated. Small veins adherent to the testicular artery are dissected free and ligated if greater than 1 mm. or cauterized using a bipolar unit with a jeweler's forcep tip. At the completion of the dissection only the testicular artery, lymphatics (fig. 3), and vas deferens and its vessels remain. The testis is then delivered again, inspected for bleeders and returned to the scrotum. The external oblique aponeurosis is reapproximated with continuous suture of the previously placed 3-zero polyglactin. Scarpa's fascia and Camper's fascia are reapproximated with a single continuous 3-zero plain catgut suture and the skin is approximated with sterile strips. A scrotal support is stuffed with fluff type dressings. The patient is discharged on the same day as the operation with a prescription for acetaminophen with codeine. Light work may be resumed within 2 or 3 days. Statistical analysis of semen data was performed using the paired Wilcoxon signed rank test.[28] Differences in the incidence of complications were compared with a Z test.[29]

RESULTS

Among 33 varicocelectomies performed without benefit of the microscope and without delivery of the testis 3 recurrent varicoceles (9%) and 3 hydroceles (9%) were detected 6 months or more postoperatively. Neither atrophy nor azoospermia was detected on followup examination in any of these men. No hematomas or wound infections occurred. In the next 12 men 2.5× loupe magnification was used without delivery of the testis. The testicular artery and lymphatics could be identified in two-thirds of these patients. No hydroceles and 1 recurrent varicocele (8%) were identified. A total of 429 men underwent 640 microsurgical varicocelectomies with delivery of the testis as described. Of these men 382 were examined at least 6 months postoperatively. No hydroceles and 4 recurrences were detected (0.6%).

A total of 4 hematomas occurred (0.6%): 1 required surgical drainage and 3 resolved spontaneously. No incidence of atrophy

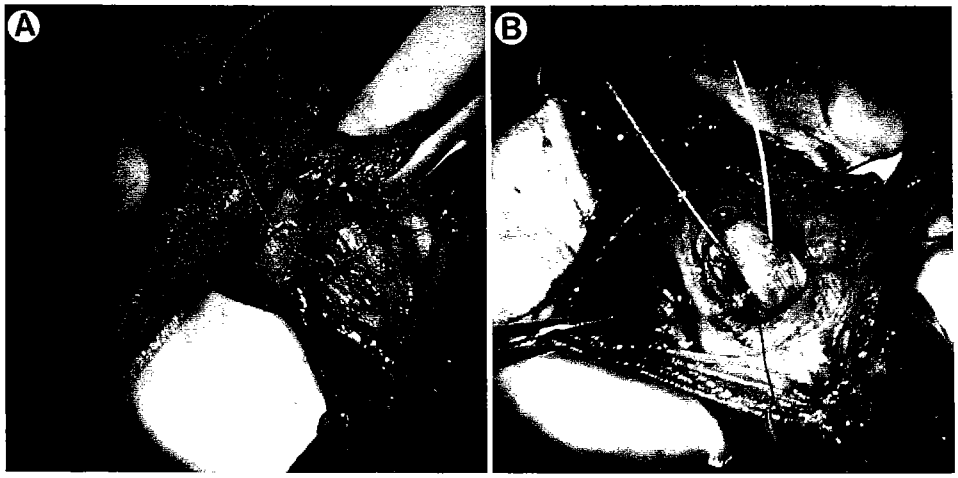

FIG. 2. *A*, testicular artery is identified and tagged with 1-zero silk suture. *B*, internal spermatic veins are cleaned and double 4-zero silk sutures, 1 black and 1 white, are passed beneath them before ligation and division.

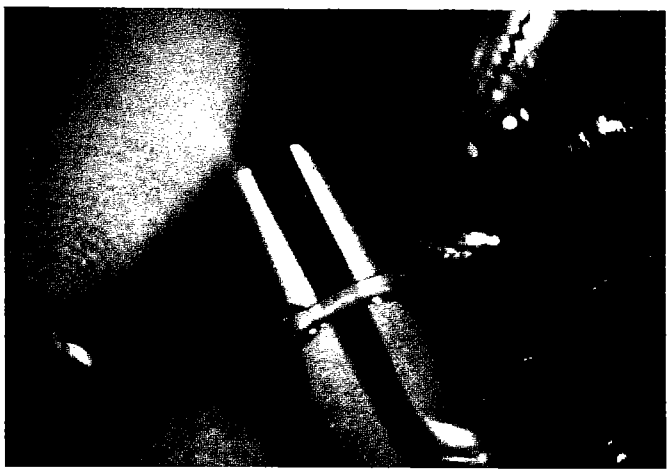

FIG. 3. Lymphatics are clearly identified and preserved

Mean preoperative and postoperative semen analysis results in 271 men

	Preop.	Postop.	Mean Difference ± SE	P Value
Sperm concentration × 10^6/cc	36.97	46.85	10.63 ± 2.33	<0.001
% Motility	39.62	45.66	5.88 ± 1.20	<0.001
% Normal forms	48.42	52.10	3.17 ± 1.29	<0.001
% Tapered forms	8.84	4.11	4.75 ± 0.69	<0.001

or azoospermia was identified. There were no wound infections. Although no systemic antibiotics were used, 1% neomycin irrigation was used from the moment the incision was made and every few minutes until completion of the operation. The average operating time for the first 20 cases performed microsurgically was 78 minutes. Subsequently, the operating time has decreased to between 25 and 40 minutes per side. Preoperative and postoperative semen analyses were obtained on 271 men followed at least 3 months postoperatively. A mean of 3.57 analyses was obtained per patient. Improvements in sperm count, motility, normal forms and decreased percentage of tapered forms are statistically significant (see table). The pregnancy rate among couples who were followed for a minimum of 6 months postoperatively was 43% (152 of 357).

DISCUSSION

Our microsurgical technique clearly decreases the incidence of hydrocele and recurrent varicocele. Hydroceles can sometimes grow to a large size and require a secondary operation. Although the effect of hydrocele on fertility is unknown, it is possible that a large hydrocele may alter the temperature regulating mechanism of the testis and have an adverse influence on fertility. Microsurgical technique allows for clear identification and preservation of lymphatics, and avoidance of this complication.

Testicular atrophy and azoospermia following varicocelectomy are risks associated with ligation of the testicular artery.[6,30] Preservation of the testicular artery is particularly critical when operating upon a solitary testis, or in children[7] and adolescents on whom the operation is being performed prophylactically.

Several studies have clearly shown that recurrent varicoceles are usually due to venous collaterals that bypass the inguinal portion of the spermatic cord[13,15,16] and that 7% of the recurrences are apparently due to scrotal collaterals.[17] Delivery of the testis, and ligation of all external spermatic and gubernacular veins eliminate these collaterals. In addition, during microsurgical dissection of the spermatic cord small veins immediately adjacent to the testicular artery are often identified. If missed, these may slowly enlarge and cause recurrence. Preservation of the vasal veins assures adequate venous return. Even percutaneous balloon occlusion of the internal spermatic veins results in a substantially higher recurrence rate than we have reported with our current technique.[17,24-26] Furthermore, balloon occlusion is a more lengthy procedure, involves exposure to radiation and may result in complications from perforation of the veins, migration of the coil or balloon, or failure to catheterize the spermatic veins.[31] The 2 to 3.0 cm. incision we currently use for microsurgical varicocelectomy is no larger than the combined incisions used for laparoscopic varicocelectomy without the risk of intraperitoneal morbidity.

Substantial evidence is accumulating that varicocele causes duration-dependent testicular injury.[32-38] Varicocelectomy can prevent further worsening of semen quality. Our microsurgical technique is a safe, minimally invasive, outpatient approach to varicocelectomy that lessens the incidence of hydrocele formation and varicocele recurrence, and assures preservation of the testicular artery.

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