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Merits and Demerits of Laparoscopic Lymphatic-Sparing Testicular Vein Ligation: Conclusions From a 10-Year Database Review

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ABSTRACT

INTRODUCTION: This retrospective study was designed to: (1) assess the perioperative and postoperative outcomes of patients following laparoscopic correction of varicocele; (2) compare the outcomes with a group of patients receiving open varicocelectomy; (3) describe predictors of surgical success following the laparoscopic procedure.

METHODS: Data were gathered between January 1998 and December 2008. Male partners of couples seeking care for infertility were evaluated. Those with a documented varicocele and semen analysis suggestive of severe oligospermia constituted the study cohort. A total of 245 patients underwent bilateral laparoscopic testicular vein ligation with a standard approach; 500 patients underwent open varicocelectomy. Patients were evaluated for semen profile and fertility every 3 months for 1 year and at 3 years postsurgery. Perioperative data, complications, semen parameters, fertility rates, and varicocele recurrence rates were compared for each surgical approach.

RESULTS: All patients receiving laparoscopic testicular vein ligation had a bilateral procedure. The mean operative time for patients receiving laparoscopy was 20 minutes (SD, 1.3; range, 15-25 minutes). The mean (SD) analgesic requirement was 1.6 (0.1) grams of paracetamol. The mean duration of the hospital stay was 13 hours (SD, 0.8; range 8-16 hours). When compared with open varicocelectomy, laparoscopy resulted in significantly less analgesic, shorter mean duration of surgery, and shorter mean hospital stay (all with $P < .05$). There were no statistically significant differences in the number of postoperative wound infections or hydroceles. Similarly, there were no significant differences in improvement of semen parameters, number of successful pregnancies, or number of recurrent varicoceles. One year following laparoscopic surgery, there was ≥ 50% improvement in sperm count in 182 males (74.3%), ≥ 30% increase in sperm motility in 219 males (89.4%), and ≥ 15% increase in normal sperm morphology in 190 males (77.6%). A total of 161 female partners (65.7%) reported a positive pregnancy test within 1 year of laparoscopic correction. Three patients had recurrent varicocele with secondary infertility that was corrected via an open approach.

CONCLUSION: Laparoscopic lymphatic-sparing testicular vein ligation is an effective option for management of infertility attributed to varicoceles. The short-term and long-term fertility outcomes are comparable to open approaches.

KEYWORDS: Laparoscopy; Oligospermia; Varicocele.

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original study

Merits and Demerits of Laparoscopic Lymphatic-Sparing Testicular Vein Ligation: Conclusions From a 10-Year Database Review

INTRODUCTION

Male-factor pathology, singularly or in addition to female-factor pathology, is the cause of an inability to achieve a successful first pregnancy in about 50% of couples seeking medical care [1]. Varicocele is among the most common of the surgically correctable causes of primary and secondary male infertility, with a prevalence of 15% in fertile males and 40%-70% in infertile males [2,3].

A wide array of incision approaches has been emphasized for correction of varicocele, including retroperitoneal, inguinal, subinguinal, microsurgical, and nonmicrosurgical procedures [4-7]. Some investigators have proclaimed that laparoscopic correction is a more effective alternative to these techniques, with fewer demerits and durable results [8-10]. However, further investigation is needed. The present retrospective study was designed to: (1) assess the perioperative data, complications, semen parameters, fertility rates, and varicocele recurrence rates of patients following laparoscopic correction of varicocele; (2) compare the outcomes with a group of patients receiving open varicocelectomy; (3) describe predictors of surgical success following the laparoscopic procedure.

METHODS

The study is a retrospective investigation that was conducted between January 1998 and December 2008. The protocol was approved by the Lakeshore Hospital Ethics Committee.

Patients in Database

All male partners of couples presenting with primary or secondary infertility were evaluated. A thorough history was elicited including any past viral illnesses and medical comorbidities. Details of sexual behavior were also recorded, including frequency and periodicity of coitus in relation to the fertile cycle and any difficulty in sexual performance. The female partner's age was noted and infertility workup of the female partner was conducted. This was followed with a comprehensive clinical assessment of the male partner, including assessment of genitalia. Any suspicious or obvious varicocele was confirmed with a scrotal Doppler ultrasound and the grade of varicocele was corroborated. Varicoceles were classified using the Dubin-Amelar grading system. The testicular volume was also measured. All patients had 2 consecutive semen analyses at an interval of 65 days from a standard reference laboratory. Each semen sample was collected after a minimum 3 days of abstinence.

Patients documenting oligospermia (< 20 million sperms/ mL) on both semen analyses were advised hormonal assay. Infertile males with abnormal semen profile and significant varicocele (> grade I) as the only plausible pathology were offered surgical correction.

During the 10-year study period, 245 patients underwent bilateral laparoscopic testicular vein ligation. An additional 500 patients underwent open varicocelectomy.

Surgical Procedures

During the period between evaluation and surgery, all patients were advised to follow conservative measures: (1) wear loose-fitting undergarments, (2) avoid excessively heated surroundings, (3) regularly bathe the genitals with cool water.

Laparoscopic Approach. Patients consenting to the laparoscopic approach were admitted on the morning of the day of surgery. No special preoperative protocols were observed. Patients received intravenous antibiotic prophylaxis at anesthetic induction. They were positioned in 30° Trendelenburg decubitus with shoulder support and padding of pressure points. All procedures were accomplished under general anesthesia. Entrance was by 3 ports (Figure 1): 1 (10 mm) infraumbilical camera port, and 2 (5 mm) working ports pararectally on either iliac fossa. The right port was usually sited at a slightly more cranial level than the left port. Minor adjustments in port positions were made according to the body habitus of the individual. The initial access was always achieved by open Hassan technique. The laparoscopic instruments included a 10 mm 0° telescope, 5 mm curved

Figure 1. Port Positions for Laparoscopic Testicular Vein Ligation.

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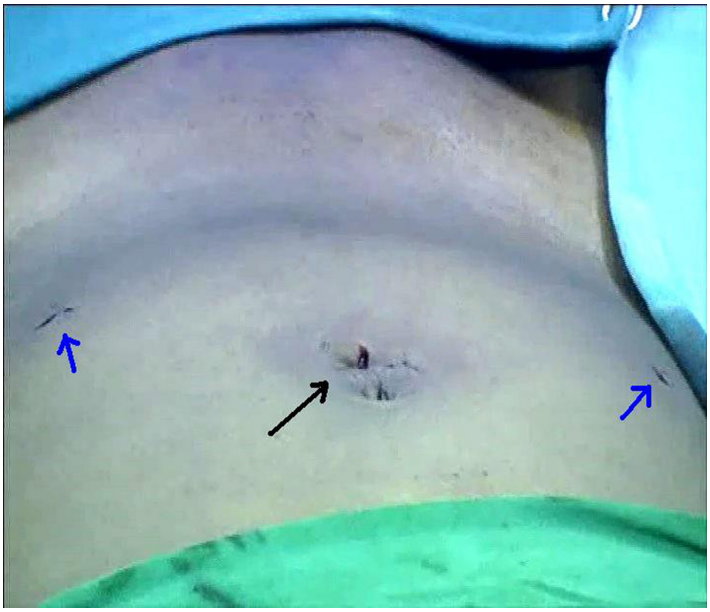

Figure 2. Intraoperative Appearance After Ligation of the Testicular Vein With Lymphatics Spared.
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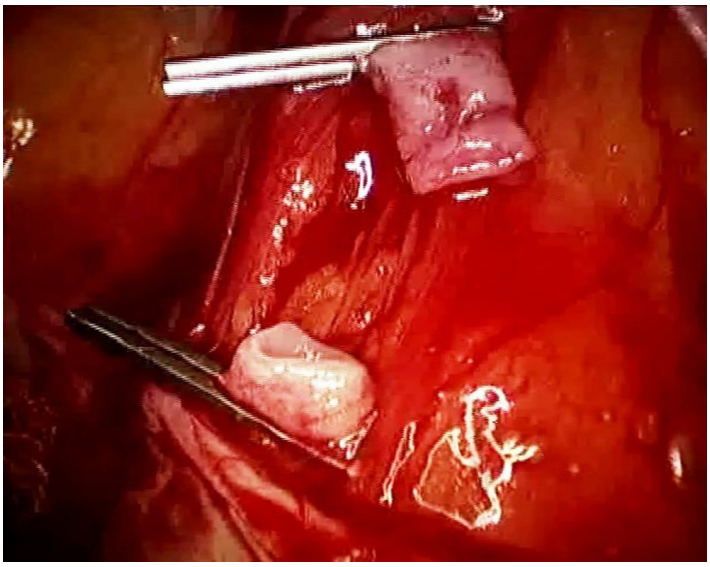

dissector, 5 mm atraumatic grasper, 5 mm scissors, and 5 mm clip applicator. After becoming familiar with pelvic anatomy, the peritoneum overlying the dilated testicular vein was incised. The pathological testicular vein was grasped and meticulously freed from all surrounding tissues, including lymphatics. All dissection was performed athermally with cold scissors. The skeletonized testicular vein was severed between titanium clips (Figure 2). A diligent search was made for additional dilated veins and, if encountered, each was individually dissected, clipped, and severed. In unilateral pathologies, the most prominent vein on the contralateral side was clipped and severed in a similar fashion. The testicular artery was preserved in all cases. After ensuring hemostasis, the ports were closed.

Open varicocelectomy. A subinguinal approach was used with the patient under regional anesthesia. An artery-sparing technique was followed and all testicular veins were ligated with preservation of lymphatics.

Postoperative Follow-up and Evaluations

All patients were allowed orals once they were comfortable, and they were sent home when fully ambulatory. Patients were recalled for evaluation of semen parameters (count, motility, morphology) every 3 months for 1 year. A final evaluation 3 years following surgery was used to enumerate long-term complications (eg, hydrocele, recurrent varicocele).

At each review, patients were evaluated clinically and questioned about their fertility status. A *positive response to surgery* was defined as a 50% or higher increase in semen count on at least 2 postoperative reviews. A *fruitful outcome* was defined as achieving successful fertility within 1 year of surgery. *Treatment failure* was defined as persistent infertility 1 year following surgery, irrespective of improvement in semen parameters. These patients were evaluated to rule out persistent or recurrent varicoceles. Any existing or reappearing varicoceles were corrected through a subinguinal incision.

Data Analysis

The operative time, total analgesic requirement, and duration of hospital stay were tabulated for each surgical approach. Intraoperative and postoperative complications were recorded. Semen characteristics of count, motility, and morphology and evidence of fertility were evaluated at each 3-month interval. Descriptive statistics of mean, median, and standard deviation (SD) were calculated. Laparascopic and open surgery outcomes were compared using the Mann Whitney test. A probability value < .05 was considered statistically significant. Chi-square and odds ratio tests were used to determine significant predictors of success for the laparoscopy procedure.

RESULTS

Demographic Characteristics for Patients Receiving Laparoscopy

During the 10-year study period, 245 patients underwent bilateral laparoscopic testicular vein ligation. The mean age was 31.8 years (SD, 2.1; range, 22-45 years). Six patients underwent laparoscopic varicocele ablation prior to marriage because they had bilateral grade III varicocele with oligospermia. The remaining patients were married.

The mean age of the 245 female partners was 29.6 years (SD, 2.1; range, 21-34 years). A total of 74 females (30.20%) had pathological infertility workup and were under treatment from gynecologists. The female infertility workup was normal in the remaining 171 cases. The mean duration of infertility was 26 months (SD, 1.6 months; range 14-40 months).

Side and grade of varicocele; body mass index. A total of 55 men had unilateral (left side) presentations with grade III varicoceles. Bilateral varicoceles were found in 123 men; 58 were grade III and 65 were grade II. The remaining 67 men reported unilateral grade II and contralateral grade III varicoceles. Among these asymmetrical presentations, the higher grade of varicocele occurred more commonly on the left side (52 individuals). The mean body mass index was 24.2 kg/m^2.

Figure 3. Linear Regression Comparing Sperm Count and Duration of Infertility.
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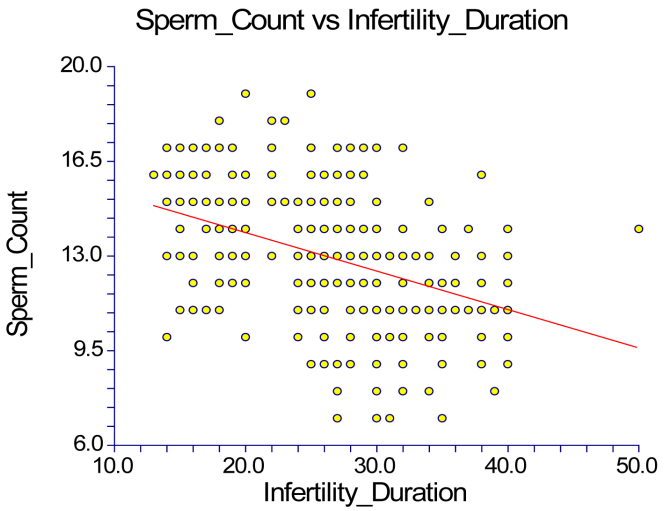

Semen characteristics. The mean sperm concentration was 13 million/mL (SD, 0.8; range 7-17 million/mL). Other semen abnormalities encountered universally were a decrease in motility and an altered morphology pattern. All patients reported a normal range serum follicle-stimulating hormone (FSH). An inverse correlation was observed between the sperm count and duration of infertility (Figure 3).

Laparoscopic Surgical Outcome

Perioperative outcomes. A total of 220 patients had an American Society of Anesthesiologists (ASA) grade I and 25 patients had grade II. All patients underwent triport laparoscopic technique successfully with no conversions to an open approach. The mean operative time for patients receiving laparoscopy was 20 minutes (SD, 1.3; range, 15-25 minutes). The mean (SD) analgesic requirement was 1.6 (0.1) grams of paracetamol. The mean duration of the hospital stay was 13 hours (SD, 0.8; range 8-16 hours).

Complications. No significant intraoperative complications were noted. Postoperatively, 1 patient developed port site infection, which was managed conservatively. A total of 4 patients complained of hydrocele at the 1-year follow-up. These patients underwent eversion of the hydrocele sac.

Semen and fertility outcomes. The time frame for improvement of semen parameters and fertility outcome is depicted in Table 1. One year postoperatively, there was a positive response to surgery (≥ 50% improvement in sperm count) in 182 males (74.29%). A ≥ 30% increase in sperm motility was noted in 219 males (89.39%). A ≥ 15% increase in normal sperm morphology was noted in 190 males (77.55%). A total of 161 female partners (65.71%) reported a positive pregnancy test within 1 year of laparoscopic correction. All 6 men who underwent premarital varicocele correction achieved fertility after marriage.

Correction of the varicocele. All patients had successful correction of the varicocele at the 6-month follow-up evaluation. Of the total 245 patients, 180 patients (73.47%) completed a 3-year follow-up evaluation. Three patients presented with recurrent varicocele and secondary infertility. They underwent open ligation of all collateral veins.

Comparison of Laparoscopic and Open Varicocelectomy Approaches

The outcomes from laparoscopic surgery were compared with those from a group of 500 patients receiving open varicocelectomy. Table 2 contains the results of the comparison. Laparoscopy resulted in significantly less analgesic, shorter mean duration of surgery, and shorter mean hospital stay (all with $P < .05$). There were no statistically significant differences in the number of postoperative wound infections or hydroceles. Similarly, there were no significant differences in improvement of semen parameters, number of successful pregnancies, or number of recurrent varicoceles.

Table 1. Number of Patients Showing Improvement in Semen Parameters and Fertility at 3-Month Follow-up Evaluations (N=245).
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Outcome Measure	Postoperative Evaluation Month				Total
	3rd	6th	9th	12th	
≥ 50% increase in sperm count	51	91	29	11	182
≥ 30% increase in sperm motility	190	26	2	1	219
≥ 15% increase in sperm morphology	73	103	9	5	190
Fertility	36	65	43	17	161

Table 2. Outcome Measures Following Laparoscopic and Open Varicocele Ablation; Probability of Significant Differences.
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Outcome Measure	Surgery Type		Z	P
	Laparoscopy (N = 245)	Open (N = 500)		
Median paracetamol required, g	1.5	4	-22.47	<.05
Median operative duration, min	20	45	-22.29	<.05
Median hospital stay, h	12	28	-22.12	<.05
Wound infection, n	1	8	-1.5	.07
Postoperative hydrocele, n	4	7	-0.02	.49
Recurrent varicocele, n	3	2	-1.37	.09
Improved semen parameters, n (%N)	200 (81.6)	415 (83.0)	-0.47	.32
Successful pregnancy, n (%N)	165 (67.4)	344 (68.8)	-0.42	.34

Predictors of Surgical Success Following Laparoscopy

Table 3 shows the odds ratios and 95% confidence intervals for prediction of good results from laparoscopy. The significant predictors were younger age at presentation (< 30 years), shorter duration of infertility (< 25 months), higher grade of varicocele (bilateral grade III), and less severe oligospermia (> 12 million/ mL). These were the parameters for contemplating favorable results in the laparoscopy cohort.

DISCUSSION

A varicocele warrants medical attention if there are pain or fertility issues [11-13]. Bothersome pain, a high varicocele grade, infertility, and testicular atrophy have been cited as reasons to consider varicocele ablation [14,15]. In the present study, we used surgical correction of varicocele only for infertile males with a high-grade varicocele and abnormal semen profile. A higher propensity of abnormal sperm morphology and motility has been noticed in patients with varicoceles [11], presumably due to oxidative stress and DNA damage to sperm [16]. Additionally, Leydig cell dysfunction has been attributed to varicoceles [17]. A correlation between the size of the varicocele and the severity of semen parameters has also been predicted [18,19]. Consequently, greater benefits occur following correction of large-sized than small-sized varicoceles.

The most appropriate technique for correction of the varicocele is still debated and a many approaches are in vogue, with each bearing inherent benefits and shortcomings [4-6]. Open varicocelectomy has been used at our center for the last 20 years. We have been using varicocelectomy through an incisional approach since 1985. Since 1998, we have been mastering the technique of laparoscopic varicocele ablation. Laparoscopic correction of a varicocele remains the comparatively less-

Table 3. Predictors of Varicocele Treatment Success Following Laparoscopy.
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Outcome Measure	Proportion of Success (%)	Chi-Square	P	Odds Ratio	95% Confidence Interval
Varicocele grade III vs grade II	95.83 vs 50.31	17.560	<.0001	22.71	2.99 - 172.26
Age < 30 years vs ≥ 30 years	83.63 vs 54.07	24.088	<.0001	4.34	2.36 - 7.97
Infertility duration < 25 months vs ≥ 25 months	92.66 vs 47.05	57.216	<.0001	14.20	6.42 - 31.44
Sperm count > 12 million/mL vs ≤ 12 million/mL	88.28 vs 37.0	70.760	<.0001	12.82	6.70 - 24.53

explored approach, with concerns regarding short-term and long-term outcomes [20]. When compared with open surgery, laparoscopy promises enhanced cosmesis and preservation of body image, fewer postoperative analgesic prescriptions, more rapid convalescence, shorter hospital stay, and an earlier return to work. Laparoscopy closely resembles the microsurgical technique in terms of magnification and precision.

The patients in the present study underwent meticulous dissection of the testicular vein. All dissection was carried out athermally. All lymphatics were conserved. Although simultaneous occlusion of the testicular artery has been proposed as a key to successful outcome [21], we have found that ligation of the testicular vein alone is sufficient. Our success rate with this technique is consistent with published standards [5,17,22,23]. Although some authors have hypothesized that there will be recurrences from cremasteric and collateral veins [24,25], this happened uncommonly in our patient group (3 cases; 1.67%). This obviates the need for routine occlusion of collateral veins during testicular vein ligation. This position is further rationalized by the citation of pathological valves in the proximal part of the testicular vein as a major contributor to varicocele occurrence [26]. We doubt the universal presence of any pathological valves in collateral veins that may culminate to varicocele recurrence once the pathological testicular vein is ligated. Also, simultaneous ligation of all veins may jeopardize all venous drainage of the testis and appendages with its consequences.

Varicocele recurrence following laparoscopic varicocelectomy varies between 3.4% and 10% in published literature [27-29]. Although no patients presented with persistent varicocele in the short-term evaluations of the present study, recurrent varicoceles were reported in 1.67% cases at the 3-year follow-up. A thorough search for all pathological veins and ligation of dilated deferential veins, if present, appears to hold the key to a successful outcome.

The reported incidence of hydrocele following the laparoscopic approach varies between 5% and 7% [27,28]. A few patients in our initial laparoscopic series developed hydroceles. Since we adopted the lymphatic-sparing approach, no hydroceles were reported. This affirms the role of meticulous lymphatic preservation during testicular vein isolation.

An improvement of most sperm parameters following varicocelectomy has been reported in published literature [30-32]. We observed appreciable changes in sperm count and sperm motility in our patient cohort that were comparable to other series. However, contrary to the reports by Okeke et al [30], an improvement in sperm morphology was also observed in our study group. In our opinion, improvements in sperm motility and total count following laparoscopic testicular vein ligation are obtained at an earlier time frame than improvement in morphology pattern. Also, numerically fewer patients demonstrated palpable changes in morphology than those showing significant improvements in sperm count and motility.

Few investigators have declared the benefits of laparoscopic varicocelectomy [8-10,33-35]. In our experience, statistically significant gains were obtained in operative time, analgesia, and hospital stay, with success rates comparable to the open approach. The morbidity of laparoscopic correction is also minimal. In our study, no major intraoperative complications were experienced. Although noted in the literature [35], nerve injury is a rarity. Meticulous dissection, strict limitation of thermal energy usage, and clipping of only the pathological testicular vein can ward off this complication.

Various factors have been found for predicting a successful outcome following varicocele ablation [36]. We determined that age of the patient, grade of the varicocele, severity of oligospermia, and infertility duration are independent variables that influence operative outcome. A greater number of patients demonstrated objective improvement of sperm parameters than those achieving fertility. This hints at the involvement of additional undefined factors that may be causing infertility in these care seekers.

Despite all limitations, varicocele repair may be presented as an option to all males who are incapacitated with fertility issues and have high-grade varicocele and an altered semen profile. A significant percentage of patients can benefit from this procedure. Our technique of laparoscopic testicular vein ligation is safe, easy to master, and yields encouraging results.

CONCLUSIONS

Varicocele repair is a well-recognized procedure among the currently practiced panacea for male infertility. The results are appreciable for patients with documented varicocele and severe oligospermia. Laparoscopic testicular vein ligation is equally as efficacious as the open approach with added gains of enhanced cosmesis, earlier return to routine lifestyle activities, and less short-term and long-term morbidity.

Conflict of Interest: none declared.

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