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POSTSURGICAL OUTCOMES ASSESSMENT FOLLOWING VARICOCELE LIGATION: LAPAROSCOPIC VERSUS SUBINGUINAL APPROACH

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ABSTRACT

Objectives. To prospectively compare and objectively assess the postsurgical outcome parameters of both laparoscopic and open subinguinal techniques for varicocele ligation in infertile men.

Methods. A total of 41 evaluable patients with a history of infertility, abnormal semen analysis, and clinically diagnosed varicoceles underwent surgical ligation either by the insufflative intraperitoneal laparoscopic (n = 15), gasless laparoscopic (n = 7), or the open subinguinal (n = 19) approach. Most procedures (39 of 41) were performed in the outpatient setting, and patients were followed postoperatively for a minimum of 6 months. Postsurgical outcome was assessed by physical examination and review of a patient questionnaire quantifying the graded pain severity, analgesic requirements, and number of days to return to work.

Results. The average operative time was 82.3 ± 26.5 minutes for insufflative intraperitoneal laparoscopic varicocelectomy, 170 ± 55 minutes for gasless laparoscopic varicocelectomy, and 35.6 ± 13.5 minutes for the open subinguinal approach. The analgesic requirement was 13.7 ± 9.9 tablets for the insufflative laparoscopic group, 22.5 ± 11 tablets for the gasless laparoscopic group, and 10.9 ± 10.3 tablets for the open subinguinal group. The average number of days to return to work was 4.9 ± 2.7 for the insufflative group, 6.6 ± 2.6 for the gasless group, and 5.1 ± 3.7 for the open subinguinal group.

Conclusions. These results show no superiority of laparoscopic techniques over the standard open subinguinal technique with respect to hospital stay, analgesic requirements, or return to work. Laparoscopic techniques require excessive operative time, may have attendant complications, and require general anesthesia, limitations that preclude their routine application in varicocele ligation. However, the laparoscopic approach may have a role in the setting of other concurrently performed laparoscopic procedures.

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Varicocele occurs in approximately 15% of adult men.[1] It contributes frequently to male factor infertility with a prevalence of up to 41%.[2–4] Surgical management has been the primary form of treatment of varicocele with several techniques used to ablate the dilated pampiniform plexus. These techniques include the traditional open surgical approach (retroperitoneal, inguinal, and subinguinal) and minimally invasive procedures, such as transvenous percutaneous embolization and laparoscopic varicocele ligation.[5–9] Although rare, adverse effects have been documented following the conventional open surgical approach, such as spermatic arterial injury,[10] lymphatic disruption with subsequent hydrocele formation,[11] as well as prolonged postoperative pain. The recently advocated subinguinal surgical approach[7] is a simple technique that minimizes many of these untoward effects.

As laparoscopic varicocelectomy has gained increased popularity, recent reports have suggested that laparoscopic varicocele ligation has potential advantages of reduced morbidity, reduced analgesia requirements, and a more rapid rate of return to work compared with the standard open surgical approach.[9,12,13] To test this assumption, we prospectively assessed the objective and subjective

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surgical outcome of both laparoscopic and incisional subinguinal varicocele ligation performed at our institution.

MATERIAL AND METHODS

Of 46 patients with infertility, abnormal semen analysis, and clinically diagnosed varicocele, 41 evaluable patients underwent either laparoscopic (n = 22) or incisional subinguinal (n = 19) varicocele repair. The operative approach was selected by the patient. Standard insufflative intraperitoneal laparoscopy was performed in 15 men, whereas gasless laparoscopy was used in 7 patients. All procedures were performed by a single surgeon in an outpatient setting with 2 patients requiring overnight observation following laparoscopic ligation.

Laparoscopic Insufflative Intraperitoneal Varicocele Ligation

With the patient placed in the supine position and after induction with general endotracheal anesthesia, a nasogastric tube, and Foley catheter, the Hasson technique[14] was used to place the primary trocar. A 2 to 3-cm transverse infraumbilical incision is deepened down to the peritoneum, which is grasped and incised sharply under direct vision. A Hasson style cannula (Origin Medsystems, Menlo Park, Calif) is inserted into the peritoneal cavity. This cannula is equipped with a balloon at the tip and a sliding foam gromet over the shaft. The balloon is inflated with 20 mL of air. While maintaining outward retraction against the peritoneum, the foam gromet is pushed inward to seal in the incision and then locked to prevent leakage of CO_2 out of the peritoneal cavity. After establishing an adequate pneumoperitoneum, the laparoscope is inserted through the trocar to evaluate the abdominal contents. Subsequently, two separate 10-mm working ports are placed in the lower abdominal quadrants under direct laparoscopic vision. The posterior pelvic anatomy is carefully identified, including the internal inguinal vein, vas deferens, and gonadal vessels. Retraction of the testis facilitates the identification of the ring and spermatic cord. The posterior peritoneum overlying the spermatic vessels is tilted up by using laparoscopic forceps and incised with scissors or electrocautery. The T-shaped peritoneotomy is made to expose the spermatic vessels. Care is taken to spare the spermatic arteries by visual identification and with the aid of laparoscopic Doppler probe auscultation. One to three spermatic veins are usually found and are doubly clipped without division with subsequent reconfirmation of the integrity of the spermatic arteries. After ensuring hemostasis, the peritoneotomy is left without closure, and the same procedure is repeated on the contralateral side in cases of bilateral varicocele. On the left side dissection of sigmoid colon adhesions may be needed to expose the spermatic cord. On completion of varicocele ligation, hemostasis of the abdominal wall is accomplished before trocar removal and closure of the trocar site.

Gasless Laparoscopic Varicocele Ligation

Extraperitoneal gasless laparoscopic varicocele ligation was performed in a group of 7 men with unilateral varicoceles after appropriate informed consent and Institutional Review Board approval. Patients undergoing unilateral varicocele ligation are placed in a partial flank position. Following induction with general anesthesia, the midaxillary line is demarcated, and a 1.5 to 2.0-cm mini-incision is made two finger breaths above the iliac crest within Petit's (lumbar) triangle, which is bounded by the latissimus dorsi, external oblique muscle, and iliac crest. This incision is deepened bluntly through the transversus abdominus muscle, and the retroperitoneal space is accessed and bluntly dissected with the index finger. Video laparoscopic confirmation of the extraperitoneal space is carried out via a 10-mm trocar sleeve and followed by the insertion of the preperitoneal distention balloon (PDB, Origin Medsystems). This device consists of a transparent silicone balloon mounted on a 10-mm extended length blunt laparoscopic trocar. With a capacity exceeding 1 L, it can provide uniform displacement of the peritoneum and has previously found application in extraperitoneal urologic laparoscopic surgery.[15] The lubricated trocar is inserted in the retroperitoneal space and directed caudally. The balloon is gradually inflated with 700 to 1000 mL of air, with the laparoscope introduced through the trocar, allowing prompt visualization of the retroperitoneal space through the transparent balloon. The peritoneum is seen lying medially, the spermatic vessels inferiorly and interiorly, whereas the psoas muscle and its overlying genitofemoral nerve lie posteriorly. Scrotal retraction of the testis confirms the location of the arterial-venous spermatic packet. The balloon is left inflated in place for 5 minutes to ensure adequate distention and hemostasis, and then it is deflated and removed. The Laparofan (Origin Medsystems), is inserted through the incision, opened, and retracted anteriorly against the inner surface of the abdominal wall. The device consists of a fan-shaped retractor with 10-cm-long blades. On insertion through the incision the fan blades are in the closed position and, once safely situated underneath the abdominal wall, are spread open, providing a triangular base of retraction. Vertical lifting of the abdominal wall is accomplished following attachment of the Laparofan to the Laparolift system and the activation of an electromechanical mechanism until the desired visualization and working space is achieved. The Laparolift contains an intrinsic force-limiting device built into the arm that automatically stops lifting at a predetermined level. Subsequently, the laparoscope is reinserted through the fan retractor incision via a valveless 10-mm trocar sleeve introduced behind the open fan blades. Subsequently, two additional 10-mm valveless trocar sleeves are inserted in the left lower quadrant under laparoscopic guidance. These sites may accommodate either laparoscopic instruments or standard open surgical instruments. Both sharp and blunt dissection are used to isolate the internal spermatic vessels, and auscultation with the laparoscopic Doppler probe clearly distinguishes between the gonadal artery and vein. The gonadal vessels are isolated, doubly clipped by the endoscopic multiple clip applier, and the preserved artery is reidentified by Doppler auscultation. On completion of the procedure, inspection of the above-mentioned retroperitoneal structures, including the genitofemoral nerve, peritoneum, and spermatic artery, is performed. Closure of the trocar site is performed under laparoscopic guidance.

Open Subinguinal Varicocele Ligation

Anesthesia consists of local 1% xylocaine, 0.5% bupivacaine, and monitored anesthesia care (midazolam/fentanyl). In the supine position a 3 to 4-cm incision is made above the pubic symphysis overlying the external inguinal ring. The spermatic cord is identified, further anesthetized, bluntly dissected free, and elevated with the index finger. When necessary, external venous collaterals are ligated. Under loupe magnification (× 3.5), the external spermatic fascia is teased from the spermatic cord, and the internal spermatic fascia is spread, exposing the dilated internal spermatic veins, which are doubly ligated with 2-0 silk suture. Care is taken to preserve the lymphatic vessels and arteries. A Doppler probe may be used before and after ligation to ascertain the integrity of the spermatic artery. After ligating all dilated veins, the testis is retracted, returning the spermatic cord into anatomic position. In 3 patients the gubernaculum (and its vessels) was ligated

TABLE I. *Intraoperative parameters of laparoscopic versus open subinguinal varicocele ligation*

Approach	No. of Patients	OR Time (Minutes, Average ± SD)*	Anesthesia	No. of Ligated Veins (Range)	
				Left	Right
Laparoscopic	22 (16 unilateral, 6 bilateral)				
Insufflative	15 (9 unilateral, 6 bilateral)	82.3 ± 26.5	General	1–3	1–2
Gasless	7	170 ± 55	General	2–3	2–2
Subinguinal	19 (15 unilateral, 4 bilateral)	35.6 ± 13.5	Local	2–7	2–5

KEY: OR = operative time; SD = standard deviation.
** The operative time was significantly less for the subinguinal approach ($P < 0.001$) than for either laparoscopic approach.*

following delivery of testis into the wound. On completion of the procedure, the wound is closed in standard fashion.

Postoperatively all patients received acetaminophen/codeine (Tylenol 3) tablets as an analgesic.

OUTCOME ASSESSMENT

Patients were followed for a minimum of 6 months postoperatively. Objective outcome was assessed by both preoperative and postoperative scrotal examination, evaluation of varicocele by palpation and Doppler auscultation, and repeat semen analysis. A patient questionnaire was developed to assess this objective outcome. This questionnaire determines the graded pain severity, analgesic requirements (total number of pills taken), and the number of days required to return to work. Pain severity was determined on the 1st, 3rd, 7th, and 14th day after surgery according to the following pain scale: 0 = pain free; 1 = pain only on touching lower abdomen (site of surgery); 2 = pain with excessive movement; 3 = pain with moderate movement; 4 = pain with any movement at all; and 5 = pain requiring bed rest.

Postoperative evaluation of varicocele size and relative change from preoperative size was based on the following assessment criteria: 5 = large; 4 = moderate; 3 = small; 2 = palpable impulse only; 1 = audible impulse only; and 0 = nonpalpable/nonaudible.

The patients were also characterized according to body habitus (thin, medium, obese) and the nature of their occupation (sedentary, standing, heavy work).

Analgesic requirements were determined by the mean number of pain pills recorded by the patient in the postoperative period. Convalescence time postoperatively was recorded by the patient as the mean number of days required to return to work. Because all laparoscopic procedures were performed on Mondays and all subinguinal varicocelectomies were performed on Fridays, the convalescence period for the subinguinal group may have an obligate increase of 2 days.

Intraoperative and postoperative parameters were analyzed by using Wilcoxon's rank sum test.

RESULTS

Varicocele ligation was attempted in 46 men. From a total of 41 evaluable patients, 22 underwent successful laparoscopic varicocele ligation (15 patients by standard intraperitoneal insufflative laparoscopy and 7 by gasless laparoscopy). The remaining 19 patients underwent varicocelectomy by open subinguinal technique. Intraoperative parameters are tabulated and compared in Table I. The average operative time was 82.3 ± 26.5 minutes for insufflative intraperitoneal laparoscopy, 170 ± 55 minutes for gasless laparoscopy, and 36.6 ± 13.5 minutes for the subinguinal approach. The operative time for the subinguinal approach was significantly less than either laparoscopic approach ($P < 0.001$) The number of veins ligated in all laparoscopic cases ranged from one to three whereas in the subinguinal case the range extended from two to seven. Internal spermatic arteries were spared in all patients as confirmed by postoperative Doppler auscultation of the scrotum. Two patients undergoing insufflative intraperitoneal laparoscopy required overnight monitoring for nausea and suture compression of inferior epigastric vein bleeding. All other patients were discharged on the day of surgery. The procedure was successfully accomplished in 15 of the 17 patients who underwent laparoscopic insufflative intraperitoneal technique. In 2 patients conversion to an open subinguinal approach was required because of subcutaneous emphysema or extensive adhesions of the bowel and omentum to the anterior abdominal wall. In the gasless extraperitoneal group, 1 patient developed transient postoperative left scrotal hyperesthesia and urinary retention. Another patient of the same group suffered a small intraoperative perforation of the peritoneum and was converted to an open subinguinal approach. This gasless technique was not feasible in 2 patients approached intraperitoneally for bilateral varicoceles due to inadequate exposure and lack of a satisfactory working space. All 5 patients whose procedures could not be completed laparoscopically were excluded from the study. This left 15 evaluable men in the insufflative laparoscopic category and 7 evaluable patients in the gasless laparoscopic category. Alternatively, for the subinguinal group only 2 minor complications occurred (subcutaneous hematoma and minor wound infection). Both resolved promptly with conservative management.

During postoperative office follow-up no scrotal hematoma, hydrocele formation, or altered testis volume were noted. The spermatic arteries were audible on Doppler auscultation in all patients, and

TABLE II. *Comparison of preoperative and postoperative varicocele size in men undergoing varicocele ligation by laparoscopic and open subinguinal approaches**

Procedure	Right (Average Size)			Left (Average Size)		
	Preoperative	Postoperative	Change	Preoperative	Postoperative	Change
Insufflative laparoscopy	3.5 ± 0.8	1 ± 1.1	2.5 ± 0.5	3.43 ± 0.6	0.7 ± 1.3	2.7 ± 1
Gasless laparoscopy				3.75 ± 1	1.25 ± 1.9	2.75 ± 0.5
Subinguinal	3.0	1.0	2.0	4.1 ± 0.8	1.6 ± 1.5	2.45 ± 1.3

** See text for grading of varicocele size.*

TABLE III. *Physical and occupational characteristics of men undergoing laparoscopic and subinguinal varicocelectomy*

Approach	Body Habitus (n)	Occupation (n)
Laparoscopic	Thin (3)	Sedentary (11)
	Medium (18)	Standing (9)
	Obese (1)	Heavy (2)
Insufflative	Thin (2)	Sedentary (9)
	Medium (12)	Standing (5)
	Obese (1)	Heavy (1)
Gasless	Thin (1)	Sedentary (2)
	Medium (6)	Standing (3)
		Heavy (2)
Subinguinal	Thin (4)	Sedentary (6)
	Medium (13)	Standing (9)
	Obese (2)	Heavy (4)

there was no evidence of early recurrence of varicocele in any patient.

Tables I to III summarize the objective findings and characteristics. Of the 41 patients, 38 responded prospectively to the subjective outcome questionnaire tabulating the number of days to return to work, analgesic requirements, and graded pain severity. Table II shows the relative decrease in mean varicocele size between preoperative and postoperative measures. All groups showed comparable varicocele size preoperatively. No statistically significant difference was noted between the three approaches in the relative decrease in postoperative varicocele size. Patients appeared equally distributed in terms of their body habitus and level of occupational activity (Table III). Table IV summarizes the information taken from the outcomes questionnaire. Postoperative subjective outcome (Table IV) as measured by convalescence period (number of days), analgesic requirements (number of analgesic tablets), and graded pain scale during the early postoperative period showed comparable tolerance to both laparoscopic and open subinguinal approaches with the exception of a greater number of analgesic tablets required following gasless laparoscopy ($P < 0.02$).

COMMENT

Varicocele has been shown to be the most common etiologic cause of male infertility.[16] Historically, an open surgical approach, either inguinal or retroperitoneal, has been used for varicocele ligation. Recently, laparoscopic varicocelectomy has been proposed as an alternative procedure with reported advantages of simplicity, minimal invasiveness, better convalescence, and less analgesic requirement postoperatively.[9] However, previous reports lacked parallel comparison with an open surgical group and referenced their impressions to the inguinal approach for varicocelectomy. Recently, Enquist *et al.*[17] retrospectively reviewed concurrent groups of men undergoing laparoscopic and open subinguinal varicocele ligation. This group found no benefit to the laparoscopic approach over the currently recommended subinguinal approach for open varicocele ligation. Therefore, we prospectively examined postsurgical outcome parameters of varicocelectomy performed in concurrent groups treated laparoscopically and by open subinguinal approach.

Our results also showed no significant advantage of open laparoscopic varicocelectomy compared with the subinguinal approach. The average number of analgesic tablets and the average graded pain score for the laparoscopic group were not significantly different from that of the subinguinal group. Similarly, the average number of days of convalescence and return to full activity did not differ significantly between the two groups. Interestingly, the average total number of analgesic tablets was significantly higher in the gasless laparoscopic group, and the insufflative laparoscopic group showed a slightly higher need for analgesic medication than the subinguinal group. Of note, each approach effectively results in a comparable reduction of varicocele size postoperatively. The relative rate of varicocele recurrence in each category remains to be determined.

An obvious advantage of the subinguinal approach is the absence of general anesthesia, nasogastric tube suction, and Foley catheterization, which are required for laparoscopy. Alternatively, local anesthesia and intravenous sedation suffices

TABLE IV. ***Postoperative subjective outcome in 38 respondents undergoing laparoscopic or open subinguinal varicocelectomy, as measured by convalescence period, analgesic requirements, and graded pain score***

Procedure	No.	Convalescence (days) (Mean ± SD)	No. of Pain Tablets (Mean ± SD)	Pain Scale (Mean ± SD)			
				Day 1	Day 3	Day 7	Day 14
Insufflative laparoscopy	13	4.9 ± 2.7	13.7 ± 9.9	3.8 ± 0.8	2.7 ± 0.7	1.5 ± 0.7	0.28 ± 0.6
Gasless laparoscopy	7	6.6 ± 2.6	22.5 ± 11	4.6 ± 0.9	2.8 ± 0.4	1.8 ± 0.4	0.6 ± 0.9
Subinguinal approach	18	5.1 ± 3.7	10.9 ± 10.3	3.7 ± 0.8	2.5 ± 0.7	1.58 ± 0.8	0.4 ± 0.8

KEY: *SD = standard deviation.*

for the subinguinal approach. Additional advantages may be realized when considering the cost of instrumentation, anesthesia, and operating room usage for the subinguinal approach. The average operative time was significantly lower for the subinguinal approach compared with either laparoscopic approach, reaching statistically significant proportions ($P < 0.001$).

Further tangible benefit to the subinguinal approach rests on its simplicity and low risk. Although laparoscopy is a minimally invasive procedure, it still carries potential for vascular and viscus injury.[18] Although no serious complications occurred in our series, even a rare major complication would not justify routine laparoscopic approach for varicocele ligation. Occasionally, laparoscopic varicocelectomy may not reach successful completion because of technical factors. In our experience insufflative intraperitoneal laparoscopic varicocelectomy could not be completed in 2 patients (excluded from study) because of subcutaneous emphysema and obscuring intraperitoneal adhesions.

We successfully performed gasless retroperitoneal laparoscopic ligation in 7 evaluable patients for unilateral varicocele. Adequate visualization of the spermatic vessels, freedom from obscuring intraperitoneal contents, and the ability to use standard surgical instruments through valveless trocar sleeves were advantageous in this approach. In 1 patient the procedure was converted to the open subinguinal approach (and excluded from study) because of a small peritoneal perforation. The gasless laparoscopic procedure was technically unfeasible in 2 patients (excluded from study) approached intraperitoneally for bilateral varicocele ligation; however, the exhaustive operating time and the prolonged recovery compared with other approaches makes the gasless technique currently undesirable for varicocele ligation.

The open surgical subinguinal approach to varicocele ligation, compared with laparoscopy is simple, low risk, and cost-effective. Moreover, it lends itself to the urologist's familiarity with inguinal anatomy, controls all routes of possible venous collateral (ie, external spermatic veins), and does not require extensive laparoscopic training. Based on our findings, laparoscopic varicocelectomy provides no advantage when considering analgesic requirements and postoperative convalescence. We believe that the laparoscopic approach to varicocele ligation is rarely justified, possibly in the limited context of a concurrent laparoscopic procedure, such as laparoscopic herniorrhaphy. In the routine setting, however, varicocele ligation is best approached by the open subinguinal technique.

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