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Clipless Needlescopic Bilateral Varix Ligation

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ABSTRACT: We report a novel technique of clipless needlescopic bilateral varix ligation and compare its results with the conventional laparoscopic approach. The positions of ports and surgical procedures were similar to those of the conventional 3-port laparoscopic technique, but all 5- and 10-mm trocars were replaced by 2-mm trocars. The internal spermatic veins proximal to the internal inguinal ring were isolated and coagulated for an adequate segment with a 2-mm bipolar electrocautery apparatus and then transected. The perioperative parameters of 25 patients operated on in this manner were compared with a historical cohort of 25 patients operated on using the conventional laparoscopic approach. Both groups of patients had uneventful surgery with no complications. The mean amount of analgesics used (1.25 vs 3.68 mg of morphine sulfate equivalent, $P = .03$), the maximal and mean postoperative pain scores (3.5 vs 5.6 and 2.5 vs 4.0, respectively, both $P < .05$), the postoperative hospital stay (0.5 vs 1.1 days, $P = .03$), and convalescence to normal activity (0.56 ± 0.3 vs 1.64 ± 0.4 weeks, $P = .01$) were all significantly decreased in the needlescopic group. We conclude that needlescopic bilateral varix ligation not only is feasible and safe but also provides the same therapeutic efficacy of a conventional laparoscopic approach; most importantly, it causes less pain and yields faster convalescence and excellent cosmetic results.

Key words: Needlescope, laparoscope, varicocele, varicocelectomy, bipolar.

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Laparoscopic varix ligation (a varicocelectomy) has been shown to be equally effective as an open varicocelectomy (Donovan and Winfield, 1992; Esposito et al, 2000). Bilateral varicoceles are present in approximately 15%–57% of patients with clinical left varicoceles (Scherr and Goldstein, 1999; Pianalto et al, 2000). Simultaneous laparoscopic bilateral varix ligation is feasible and also provides better recovery than the bilateral open inguinal approach (Amelar and Dubin, 1987; Abdulmaaboud et al, 1998; Scherr and Goldstein, 1999). Conventional laparoscopic varix ligation is usually performed with the use of a 3-port technique, and its port sizes range from 10, 10, and 5 mm to 5, 5, and 5 mm in the literature (Donovan and Winfield, 1992; Matsuda et al, 1995; Pianalto et al, 2000).

Needlescopic instruments are defined as instruments with a diameter of no more than 3 mm so as to further reduce perioperative morbidity and enhance cosmesis (Schauer et al, 1999). Herein, we demonstrate a novel needlescopic technique for a varicocelectomy and examine its preliminary results for bilateral varicoceles.

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Materials and Methods

Scrotal varicoceles were evaluated according to criteria proposed by the World Health Organization (WHO, 1985) with some modifications detailed below. Varicoceles were categorized as grade I when an impulse of dilated veins appeared over scrotal skin with Valsalva maneuver but without venous tortuosity; as grade II when a palpable tortuosity and an impulse was found with Valsalva maneuver, and as grade III when a palpable tortuosity without abdominal straining was noted during examination. Bilateral varicoceles were diagnosed by physical examination and scrotal color Doppler ultrasonography. When the diameters of the varicoceles were more than 3.5 mm and there was reversal of the direction of the venous blood flow with Valsalva maneuver, the diagnosis of varicoceles was confirmed ultrasonographically. Postoperatively, ultrasonographic improvement of color Doppler images was indicated by no more reversal of blood flow during straining or decreased diameters of the veins. Semen analysis was performed in selected patients preoperatively. The criteria of postoperative improvement of semen quality was defined as either a more than 25% increase of the patient's preoperative data or as an improvement to above-normal reference values (count $> 20 \times 10^6$ sperm/mL; sperm motility >40%, and normal sperm morphology >40%). Convalescence was defined as complete patient recovery with return to normal daily activity. The demographic characteristics of the patients, including age, indications for operability, and severity of the varicocele, are listed in the Table.

We explained the procedure in detail and received written consent from each patient for laparoscopic varix ligation before the operation. The perioperative parameters of 25 patients with bilateral varicoceles operated on with our novel technique were

Demographic characteristics of patients before varix ligation

Cohort	Needlescopic	Laparoscopic
No. of patients	25	25
Mean age (y)	22.5 ± 1.7	24.6 ± 1.4
Indications		
Infertility	4	10
Scrotal pain	12	9
Scrotal mass	9	6
WHO grade		
I	1	1
II	5	6
III	19	18

compared with a historical cohort of another 25 patients with bilateral varicoceles operated on with the conventional laparoscopic approach. Although not every patient received morphine for postoperative pain control, the amount of postoperative narcotics used was converted to that (mg) of a morphine sulfate equivalent for the ease of comparison. The pain scores, ranging from 0 (no pain at all) to 10 (worst pain imaginable), were the average of the scores in each patient during the first 16 postoperative hours as recorded by the attending nurses. Data in this study were expressed as the mean ± standard error of the mean. Comparisons between groups were made by means of Wilcoxon's rank sum tests or independent Student's *t* tests, for ordered discrete or continuous variables, and Fisher's exact test for categorical variables. $P < .05$ was considered statistically significant. All analyses were performed with SPSS software (SPSS, Chicago, Ill).

Surgical Technique

Our novel minimally invasive approach of needlescopic bilateral varix ligation was performed by applying only three 2-mm ports after the patient received general endotracheal anesthesia and was put in a supine and modest Trendelenburg position. Locations of the trocars and surgical procedures were similar to those of the conventional transperitoneal laparoscopic technique, but all 5- or 10-mm trocars originally used in the conventional technique were replaced by 2-mm trocars in our novel approach. Two working trocar ports were placed under optical guidance of a 2-mm needlescope at the lateral border of each abdominal rectus muscle at a level lower than the umbilicus after an immediate infraumbilical 2-mm port first created for pneumoperitoneum (up to 12–15 mm Hg of carbon dioxide) and for the needlescope (Figure 1). Several 2-mm laparoscopic instruments (including a minihook, minigrasper/dissector, minisucker, miniscissors, and minibipolar electrocautery apparatus [US Surgical Corporation, Tyco Healthcare, Norwalk, Conn]) were employed for this procedure. After the overlying peritoneum was opened with a T-shaped incision, segments of the internal spermatic veins on each side proximal to the internal inguinal ring were dissected, isolated, and coagulated with a minibipolar electrocautery apparatus for at least a 4-mm segment (Figure 2A), and then each coagulated vein was transected at the midpoint (Figure 2B). The Ivanissevitch procedure was attempted, and caution was exerted to preserve the accompanying lymphatic channels and the testicular artery during dissection by recognizing its pulsating and serpentine nature (Figure 2B). If necessary, xylocaine solution (2%) was irrigated on the vessels through a 2-mm suction-irrigation device to improve vasodilatation, arterial pulsation, and visual clarity during the dissection. The trick to coagulate only the veins is to hold the vein away from the artery (or away from the remaining part of the artery-vein complex if they are not well dissected out yet) with a minigrasper in one hand and then to coagulate that vein with a minibipolar apparatus in the other hand, as in Figure 2A. Thus, whenever coagulation is activated, there is always some space between the artery and the coagulated part. After the bilateral procedures were completed, the intraperitoneal pressure was reduced to 5 mm Hg to check for any subtle

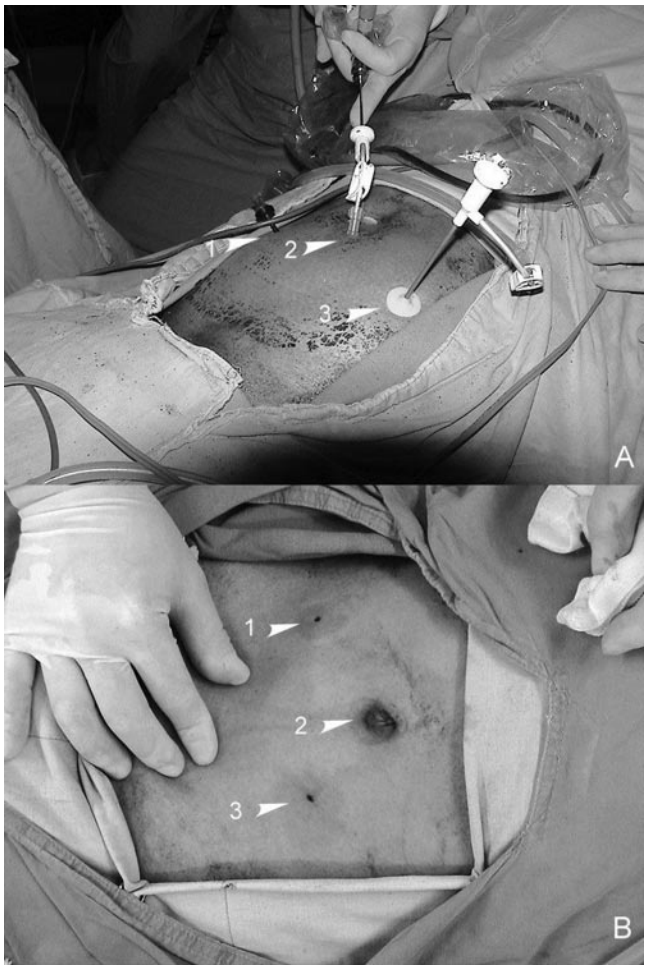

Figure 1. Operative wounds. **(A)** Locations of miniports (arrows) during surgery and **(B)** wounds (arrows) of miniports after trocars were removed.

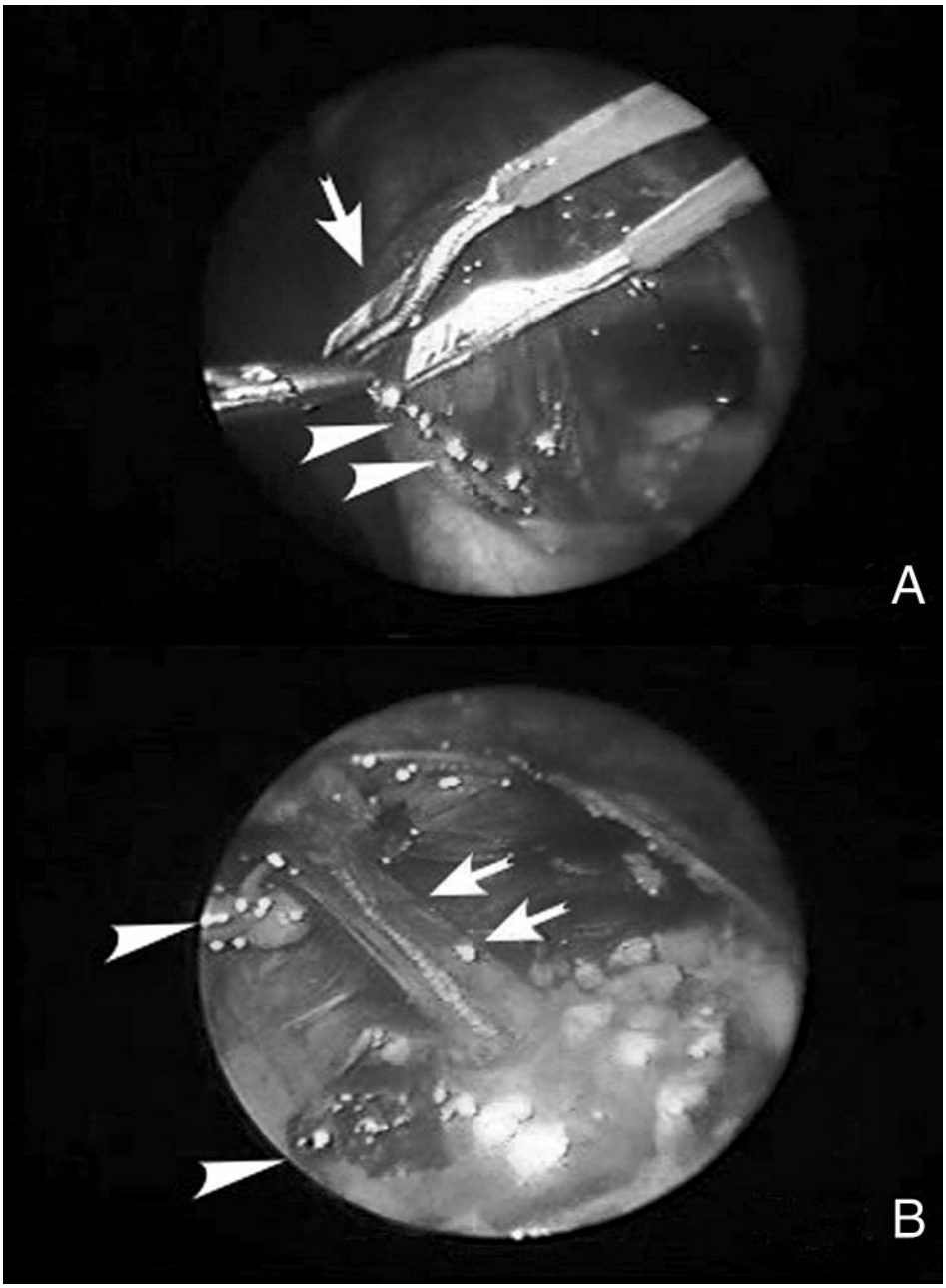

Figure 2. Needlescopic view of internal spermatic vessels. **(A)** Dilated vein (arrows) being coagulated by a bipolar apparatus and **(B)** transected ends of coagulated veins (arrows) and remaining intact testicular artery and lymphatics (arrowheads).

venous oozing, and adequate hemostasis was obtained. Then the trocars were subsequently removed with no suturing of any of the port wounds (Figure 1B).

Results

All patients in both groups had uneventful surgery with no complications. When the perioperative parameters in the patients of the needlescopic group were compared with those in the conventional laparoscopic group, the mean amount of morphine sulfate–equivalent analgesic used (1.25 ± 0.83 mg, range 0–6.67 mg vs 3.68 ± 1.0 mg, range 0–13.3 mg, $P = .03$), the postoperative pain scores (maximum, 3.5 ± 0.4 vs 5.6 ± 0.4; mean, 2.4 ± 0.3 vs 4.0 ± 0.4; both $P < .05$), postoperative hospital stay (0.5 ± 0.3 vs 1.1 ± 0.3 days, $P = .03$), and convalescence to normal activity (0.56 ± 0.3 vs 1. 64 ± 0.4 weeks, $P = .01$) were all significantly and favorably decreased in the needlescopic group.

The operative time (99.7 ± 9.6 minutes, range 54–153 minutes vs 127 ± 6.9 minutes, range 79–180 minutes; *P* = .06), the number of dilated internal spermatic veins ligated during the operation (2.7 ± 0.5 vs 2.5 ± 0.4), the percentages of patients with improved color Doppler images (88% vs 84%), and the percentages with completely resolved symptoms (84% vs 80%) were all similar in both groups. Of 12 patients in the needlescopic group and 14 in the conventional group with pre- and postoperative paired data of semen analysis, 7 (58%) and 8 (57%) patients, respectively, had improved sperm number, motility, or both. After a mean follow-up of 18 months, recurrence (persistence) of varicocele was noted in 2 patients (8%) of both the needlescopic and the conventional groups. There was no case of postoperative hydrocele in either group of patients.

Discussion

Matsuda et al (1995) showed that in those who received laparoscopic varix ligation, the reduction of the port sizes from 10, 10, and 5 mm to 5, 5, and 5 mm significantly decreased the postoperative pain and accelerated the convalescence of patients. Sanchez-de-Badajoz and Jimenez-Garrido (2002) reported a series of laparoscopic unilateral or bilateral varix ligations using three 3-mm reusable small trocars and again demonstrated the benefits of smaller trocars. Our series further downsized the wounds of the trocars to three 2-mm ''mosquito-bite'' dots, which created obvious advantages in cosmetic effects of the wounds in decreasing postoperative pain and in accelerating patients' convalescence compared with the conventional laparoscopic group. This procedure also completely eliminated the possibility of postoperative wound hernia at the trocar sites.

The conventional technique of laparoscopic varix ligation is to ligate the vessels with clips and then transect them in between the clips (Donovan and Winfield, 1992; Matsuda et al, 1995; Pianalto et al, 2000). Sasagawa (2000) reported that they successfully transected the internal spermatic vessels purely using a harmonic scalpel, which comes only in diameters of 5 and 10 mm. Matsuda et al (1995) and Sanchez-de-Badajoz and Jimenez-Garrido (2002) ligated the dilated veins using an intracorporeal knot-tying technique that might require more technical labor, especially with 2-mm instruments. Although Copaescu et al (1996) and Amendolara et al (1999) described the technique of applying bipolar electrocoagulation to ligate dilated veins of the varicoceles, they all used 5-mm bipolar instruments. To our knowledge, this is the first series to describe the successful use of 2-mm bipolar electrocautery to control the internal spermatic vessels in a laparoscopic varicocelectomy. To perform the Ivanissevitch procedure, the veins were dissected and retracted away from the testicular artery during activation of the bipolar diathermy to prevent thermal injury to the artery.

For mild right varicocele, though, no well-controlled studies demonstrated the benefits of concomitant corrections, and the decision of whether to operate is still controversial. Bilateral varicoceles have been reported to be present in approximately 15%–57% of patients with clinical left varicocele (Scherr and Goldstein, 1999; Pianalto et al, 2000). Simultaneous bilateral varix ligation might offer better outcomes than just correcting the left varicocele (Amelar and Dubin, 1987; Scherr and Goldstein, 1999; Pianalto et al, 2000), but this necessitates another 3–4-cm inguinal incision with traditional open surgery, whereas the numbers and sizes of wounds for a laparoscopic varicocelectomy are the same for either unilateral or bilateral varicoceles. Our novel needlescopic technique of varicocelectomy offers an alternative approach with less discomfort than the conventional laparoscopic or traditional open bilateral varix ligation without sacrificing effectiveness.

The recurrence (or persistence) rates of the varicoceles in the 2 groups were relatively high, but this percentage still fell in the range of failure rates (5%–15%) reported by other laparoscopic series (Goldstein, 2002). And the efficacy of this new approach is and should be similar to that of its open counterpart—the traditional open retroperitoneal high-ligation (15%–25% failure; Goldstein, 2002) because they both ligate the veins at the same level. However, the recurrence could be a result of subsequent dilatation of the periarterial plexus of fine veins, which might not look dilated and were possibly recognized as lymphatics at the time of surgery because we intentionally preserved the artery. In our future cases, the fine veins around the artery should be more vigorously dissected to decrease the recurrence (persistence) rate. Other possible causes of recurrence could be the presence of dilated cremasteric veins or parallel inguinal collaterals that exit the testis, bypass the ligated retroperitoneal veins, and rejoin the internal spermatic vein proximal to the site of ligation. These collaterals are not visible from the laparoscopic view.

Conclusion

Needlescopic bilateral varix ligation not only is feasible and safe but also provides the same therapeutic efficacy of a conventional laparoscopic approach, and most importantly, it causes less pain and yields faster convalescence and excellent cosmetic results.

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