

Lymphatic and testicular artery-sparing laparoscopic varicocelectomy in children and adolescents

Abdelaziz Yehya

Al-Azhar University Hospitals, Cairo, Egypt

Correspondence to Abdelaziz Yehya, MD,
Al-Azhar University Hospitals, Cairo, Egypt
Tel: +20 100 526 4000, +20 127 797 7949;
e-mail: drabdelazizyehya@yahoo.com

Received 01 August 2013

Accepted 30 August 2013

Journal of the Arab Society for Medical Research 2014, 9:1–5

Background/aim

The ideal operation for the treatment of adolescent varicocele has been debated for many years. The division of lymphatic vessels during varicocelectomy is complicated by hydrocele formation and decline in testicular function. The aim of this study is to report on our series of children who underwent lymphatic and testicular artery-sparing laparoscopic varicocelectomy (LTASLV).

Patients and methods

Thirty boys with primary left-sided varicocele were subjected to LTASLV. The indications for intervention were scrotal pain and discomfort in 18 cases (60%), hypotrophy in nine cases (30%), and family preference in three cases (10%). An intraparenchymal injection of 2 ml methylene blue was administered after induction of anesthesia. LTASLV was performed for all patients. The main outcome measurements included operative time, hospital stay, development of hydrocele, varicocele recurrence, and testicular atrophy.

Results

The study included 30 patients with primary left-sided varicocele. Their mean age was 12.25 ± 1.6 years (range 9–16 years). Grade 3 varicocele was present in 21 cases (70%) and grade 2 varicocele was present in nine cases (30%). Stained lymphatics could easily be observed alongside the testicular artery and veins in 28 cases, whereas in two cases, a second injection of methylene blue with lowering of CO₂ pressure was required for visualization. All procedures were completed laparoscopically without conversions or complications. The mean operative time was 40 ± 2.6 min (range 30–50 min). All patients achieved full recovery and were discharged within 24 h. The mean follow-up period was 18 ± 4.3 months (range 10–36 months). Residual varicocele was noted in one case (3.3%) with no hydrocele formation or testicular atrophy.

Conclusion

This study shows good results with respect to postoperative hydrocele rates. LTASLV resulted in 0% of hydrocele and decreased the risk of varicocele recurrence. However, larger series are necessary.

Keywords:

lymphatic sparing, methylene blue, testicular artery sparing, varicocelectomy

J Arab Soc Med Res 9:1–5
© 2014 The Arab Society for Medical Research
1687-4293

Introduction

Varicocele is an abnormal tortuosity and dilatation of testicular veins within the spermatic cord that first develops in childhood or early adolescence. The prevalence of varicocele in adolescence boys is estimated to be 11–15%. It has been established that the adolescent varicocele is associated with growth retardation of the ipsilateral testicle and impaired testicular function, which is correlated with the duration of the varicocele [1]. Varicocele is a rare disorder in children, with an average reported incidence of ~5%. Although rare before puberty (1%), the incidence of varicocele in postpubertal children is similar to that in adulthood (15–16%) [2].

Varicocele mainly occurs on the left-hand side in about 80–90% of cases. However, bilateral lesions are reported in up to 20% of cases and right-sided lesions in ~7% [3]. The management of varicocele in adolescents is a controversial topic. Although the indication for intervention can be debated, effective

treatment options are available when an intervention is deemed appropriate. Palomo's technique, first described in 1949, involves en-masse transection of the testicular vessels in the retroperitoneum above the internal ring [4]. There are many surgical approaches to transect the internal spermatic veins such as transinguinal ligation, subinguinal ligation, and laparoscopic suprainguinal ligation. Each technique has its own advantages and disadvantages. Donovan and Winfield first described minimally invasive surgical techniques using laparoscopy for the treatment of a varicocele in adolescents in 1992 [5,6].

The incidence of hydrocele formation after varicocelectomy varies from 3 to 33%. Lymphatic obstruction is more likely than venous obstruction to be the cause. Varicocele recurrence rate after Palomo's procedure has been reported to range from 0 to 16% [7]. Initial reports of lymphatic-sparing laparoscopic Palomo's technique have yielded excellent results, with a decreased incidence of secondary hydrocele down to

2–3%, without lymphatic dyes [8]. Partial or complete division of lymphatic vessels during varicocelectomy not only leads to hydrocele formation but also results in decline in testicular function as indicated by the luteinizing hormone-releasing hormone analogue stimulation test [9]. Microsurgical sparing of the testicular artery and lymphatic vessels has been reported to be an optional method for varicocele repair as it markedly decreases the incidence of postoperative hydrocele formation and minimizes varicocele recurrence [10].

There are different approaches to preserve lymphatic drainage of the testes and scrotum, for example, microscopic varicocelectomy, using laparoscopic varicocelectomy, lymphatic hydrodissection, and a dye-assisted technique using methylene blue (MB) or isosulfan blue, to enable identification and preservation of lymphatic vessels during varicocelectomy [11,12]. Oswald *et al.* [13] described the use of isosulfan blue for visualization and sparing of lymphatics during laparoscopic varicocelectomy and they reported no postoperative hydroceles in their initial series of 56 patients. The aim of this study was to determine the feasibility, safety, and results of MB-assisted lymphatic and testicular artery-sparing laparoscopic varicocelectomy (LTASLV) to decrease postoperative hydrocele formation and varicocele recurrence.

Patients and methods

This study was carried out on 30 patients at the Pediatric Surgery Unit, Al-Azhar University Hospitals, Cairo, Egypt, between July 2009 and July 2012. All children were subjected to a full assessment of history, a thorough clinical examination, and routine laboratory investigations (liver, and renal profile). Varicocele was diagnosed primarily by a physical examination with the patients in an erect position. All findings were confirmed by color Doppler ultrasound (U/S). The varicocele was graded from 1 to 3 according to severity (Dubin and Amelar classification): grade 1, vein dilatation palpable during the Valsalva maneuver in an upright position; grade 2, palpable in an upright position without the Valsalva maneuver; and grade 3, palpable and visible dilated veins through scrotal skin in an upright position without the Valsalva maneuver [14]. A U/S scan of the testicles was performed along with a color Doppler of the enlarged pampiniform veins to confirm the diagnosis, assess the size, structure of the testes, and define the severity of venous reflux. Testicular volume was measured by U/S using the formula: $0.71 \times \text{length} \times \text{width} \times \text{height}$ [15]. Testicular atrophy was defined as the presence of either a floppy testicle or a testicle with a volume noticeably smaller

than contralateral (>20% volume difference). Catch-up growth was defined as resolution of asymmetry of less than 20% on postoperative U/S [16]. Surgery was indicated only for patients with symptoms of chronic pain, discomfort or dragging pain, high-grade varicocele, testicular atrophy, and family preference (Table 1).

Inclusion criteria included all patients with primary varicocele with testicular pain and/or testicular atrophy, whereas exclusion criteria included patients with concomitant hernia, previous groin surgery, and pre-existing hydrocele.

The main outcome measurements included operative time, hospital stay, development of hydrocele, varicocele recurrence, and testicular atrophy. The ethics committee of our hospital approved the study protocol and a written informed parental consent was obtained.

All patients received general anesthesia, placed in a supine position with slight Trendelenburg's. Patients emptied their bladder before surgery. All of the operations were performed using a standard laparoscopic technique, with some modifications in the form of sparing of the testicular artery and lymphatic vessels using an MB injection.

A left intraparenchymal scrotal injection of 2 ml of 1% MB was administered using a 21-G needle (Fig. 1).

Table 1 Indications for surgery

Indications	n (%)
Varicocele (grade 3)	21 (70)
Varicocele (grade 2)	9 (30)
Pain or discomfort	18 (60)
Hypotrophy	9 (30)
Family preference	3 (10)

Figure 1



Intraparenchymal scrotal injection of methylene blue.

The transperitoneal approach was used by a 5-mm subumbilical incision. Pneumoperitoneum followed by placement of two 5-mm ports lateral to the border of the rectus abdominis at the level of the umbilicus on both sides. The spermatic vessels were identified ~5 cm proximal to the internal ring. Stained lymphatic could easily be seen running alongside the testicular artery and vein after a small posterior peritoneotomy over the spermatic vessels (Fig. 2a and b). In cases of no visualization of lymphatics, a second dose of MB was injected with lowering of CO₂ pressure. The testicular artery was identified by installation of a diluted papaverine hydrochloride in the field (2 ml of 30 g papaverine hydrochloride in 10 ml saline). The spermatic veins were identified, dissected, ligated, and divided. Other veins, particularly those accompanying the vas deferens and tributaries of the inferior epigastric artery, were ligated if enlarged and tortuous.

The lymphatic vessels and testicular artery were meticulously identified and preserved on the basis of laparoscopic appearance (Fig. 3a and b). At the end of the operation, CO₂ was expelled and the two working ports were removed under vision. The three small incisions were approximated with silk sutures.

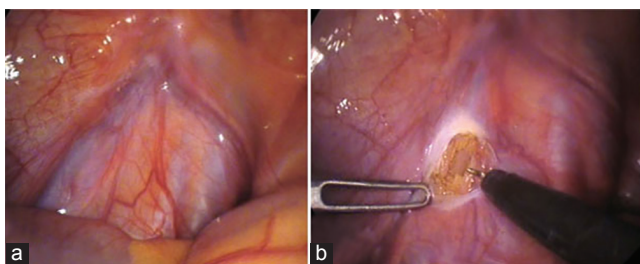
All patients were discharged on the day of the operation or the next day. All patients were followed up for any postoperative complications by clinical symptoms, testicular size, persistence of varicocele, and postoperative hydrocele formation.

The outcome was assessed by both physical examination and Doppler ultrasonography for all patients at ~3, 6, 12, and 24 months.

Results

Thirty patients with primary varicocele were subjected to LTASLV. Their mean age was 12.25 ± 1.6 years (range 9–16 years). Twenty-one cases presented with varicocele grade (70%) and nine cases presented with grade 2 (30%).

Figure 2



(a) Lymphatic vessels' staining with methylene blue and (b) approach for lymphatics and spermatic vessels' identification.

Scrotal pain and discomfort were present in 18 cases (60%), testicular volume asymmetry of greater than 20% was present in nine cases (30%), and family preference in three cases (10%; Table 1). Stained lymphatics could be seen easily alongside the testicular artery and vein in 28 cases, whereas in two cases, a second injection of MB with lowering of CO₂ pressure was required for their visualization. LTASLVs were performed in all cases completely without conversion or complications. The mean operative time was 40 ± 2.6 min (range 30–50 min). All patients achieved full recovery. Twenty-four patients were discharged on the same day, with the remaining six patients discharged after an overnight stay. A residual varicocele was noted in one case (3.3%), which was treated by open subinguinal venous ligation 1 year after laparoscopic surgery, with no hydrocele formation or testicular atrophy (Table 2).

There was no hypersensitivity or allergy to MB. Of 18 patients with scrotal symptoms (pain or discomfort), they completely subsided in 15 cases (83.33%), two cases achieved partial improvement, and in the remaining one, it remained unchanged. Seven (77.7%) of nine adolescents had testicular asymmetry before the operation, with the left testicle smaller than the right; catch-up growth was achieved and the remaining two cases showed no change in testicular size (Table 3).

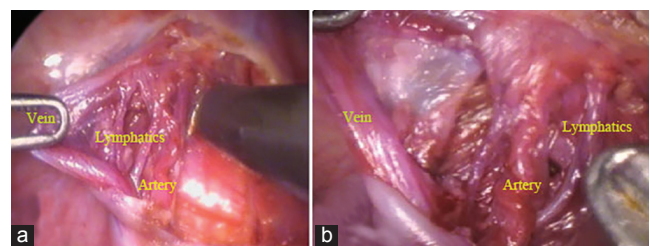
Discussion

The incidence of varicocele in the pediatric population varies with age, from less than 1% in boys aged 2–10 years to 7.8% in those 11–14 years old. In the

Table 2 Patients' characteristics and operative results

Number of cases	30
Age (years)	12.25 ± 1.6 (range 9–16)
Operative time (min)	40 ± 2.6 (range 30–50)
Hospital stay (days)	1
Recurrence	1
Hydrocele	No
Testicular atrophy	No

Figure 3



(a) Grasped vein dissected from the lymphatics and artery and (b) complete sparing of testicular artery and lymphatics.

Table 3 Follow-up results

Characteristics	Number of cases [n (%)]
Varicocele	30 (100)
Disappeared	29 (96.67)
Unchanged	1 (3.3)
Scrotal symptoms	18 (100)
Disappeared	15 (83.37)
Improved	2 (11.11)
Unchanged	1 (5.56)
Testicular size	9 (100)
Catch-up growth	7 (77.7)
No changes	2 (22.3)
Atrophy	0 (0)
Hydrocele	0 (0)

15–19-year-old age group, the prevalence is similar to that in adults (14.1%) [17].

The currently utilized techniques for varicocele repair include the standard inguinal approach, the microscopic subinguinal approach, laparoscopic techniques, high retroperitoneal Palomo's procedure, and radiological interventional sclerotherapy, each with advantages and disadvantages, and there is no agreement on the gold standard in the pediatric age group [18]. Subsequent studies confirmed a high incidence of recurrence up to 16% and secondary hydrocele of 14% despite the use of optical magnification, whereas Palomo's technique improved on the recurrence rate [19].

Schwentner *et al.* [20] compared the occurrence of postoperative hydrocele in 50 adolescents assigned randomly to undergo laparoscopic Palomo varicoectomy with or without isosulfan blue. At 3 months after surgery, the incidence of hydrocele was 0 and 20%, respectively ($P = 0.025$). Laparoscopic varicoectomy may be more time consuming and more expensive, but it offers microsurgical quality of visualization of the testicular veins and collaterals and simpler preservation of the internal testicular artery. In studies comparing laparoscopic lymphatic-sparing procedures, compared with laparoscopic mass ligation, the postoperative hydrocele rate is significantly lower with the laparoscopic lymphatic-sparing procedure (1.9 and 17.9%, respectively) [21]. In our Pediatric Surgery Unit at Al-Azhar University Hospitals, LTASLV is the routine procedure for the treatment of varicocele using an MB injection intraparenchymally. The results are encouraging for postoperative hydrocele. Capolicchio and colleagues switched from isosulfan blue to patent blue because of the lower cost and lower side-effect profile.

The main concern with isosulfan blue is anaphylaxis and milder local allergic reaction up to 3% of cases. Bluish

discoloration of the skin and blue urine was present for some days [22]. Tan *et al.* [23] suggested the use of an MB injection into the space between the tunica vaginalis and the tunica albuginea to highlight the lymphatic vessels during laparoscopic varicoectomy. Mapping of testicular lymphatic drainage with intraparenchymal MB is an easy, safe, rapid, and cost-free technique that almost eliminates postoperative hydrocele formation, irrespective of the surgical approach used. An intraparenchymal injection within the body of the testis is a faster and most specific approach because it is linked to regional lymphatic drainage. It yields the highest rate of successful mapping [24]. Rizkala *et al.* [25] found that performing lymphatic-sparing, non-artery-preserving laparoscopic varicoectomy led to hydrocele (4.5%) and recurrence rates (1.3%), which are similar to those reported for microscopic subinguinal varicoectomy with no testicular hypotrophy/atrophy in those patients with nonpreserving artery.

The testicular artery is frequently accompanied by a smaller vein, which is believed to cause recurrence if not ligated. High rates of persistent or recurrence varicocele (3.6–37.5%) have been considered a drawback of laparoscopic testicular-sparing varicoectomy. There have been several series reporting a low recurrence rate of 0.6–3% with the loupe-assisted microsurgical technique, even though the testicular artery and lymphatic vessels were preserved. The traditional mass high ligation of internal spermatic vein carried a greater risk of persistent postoperative hydrocele (5–25%) compared with a lymphatic vessels-sparing procedure (0–3%).

Zampieri *et al.* [26] found that those with artery sparing had no risk of testicular atrophy and had better postoperative semen parameters than those who had undergone en-masse ligation that included the artery. Atassi *et al.* [27] found that open Palomo's repair with ligation of the testicular artery resulted in equivalent testicular growth as artery-sparing techniques. Our series shows promising results in terms of no hydrocele, recurrence of varicocele (3.3%), and no testicular atrophy. Yaman *et al.* [28] reported catch-up growth in 65.5% of 92 patients at 1 year after lymphatic-sparing microsurgical varicoectomy using a 15% testicular volume difference to define asymmetry. Similarly, Koyle *et al.* [29] reported 82% catch-up growth at the 1-year follow-up after laparoscopic varicoectomy using 20% as the cutoff for asymmetry. Overall, our laparoscopic varicoectomy patients showed rates of catch-up growth of 77.7% using 20% as the cutoff for asymmetry, which is similar to those reported previously in the literature.

The ideal technique for the treatment of varicoceles should be ligation of all spermatic veins with preservation of spermatic arteries and lymphatics [30]. In this study, LTASLV was used in all cases. We used an intraparenchymal injection of MB staining, which is inexpensive, and already established in the clinical routine. With lymphatic staining, we found it very easy to detect and spare them without any hypersensitivity or allergy noted.

Conclusion

The present study showed that the LTASLV can be accomplished easily, is technically feasible, and can effectively ligate all spermatic veins with an intraparenchymal injection of MB dye. With careful laparoscopic dissection and preservation of the testicular artery and lymphatic vessels, varicocele-related complications could be minimized. The initial outcome appears promising, but a larger randomized-controlled study is required to accurately assess the efficacy.

Acknowledgements

Conflicts of interest

None declared.

References

- Kass EJ, Freitas JE, Bour JB. Adolescent varicocele: Objective indications for treatment. *J Urol* 1989; 142:579–582.
- Al-abbadi K, Smadi SA. Genital abnormalities and groin hernias in elementary-school children in Aqaba: an epidemiological study. *East Mediterr Health J* 2000; 6:293–298.
- Saypol DC. Varicocele. *Int J Androl* 1981; 2:61–71.
- Palomo A. Radical cure of varicocele by a new technique: preliminary report. *J Urol* 1949; 61:604–607.
- Ivanisovich O. Left varicocele due to reflux: experience with 4,470 operative cases in forty-two years. *J Int Coll Surg* 1960; 34:742–755.
- Donovan JF, Winfield HN. Laparoscopic varix ligation. *J Urol* 1992; 147:77–81.
- Misseri R, Gershbein AB, Horowitz M, *et al.* The adolescent varicocele: II. The incidence of hydrocele and delayed recurrent varicocele after varicolectomy in a long-term follow-up. *BJU Int* 2001; 87:494–498.
- Glassberg KI, Poon SA, Gjertson CK, *et al.* Laparoscopic lymphatic sparing varicolectomy in adolescents. *J Urol* 2008; 180:326–330.
- Kocvara R, Dolezal J, Hampl R, *et al.* Division of lymphatic vessels at varicolectomy leads to testicular edema and decline in testicular function according to the LH–RH analogue stimulation test. *Eur Urol* 2003; 43:430–435.
- Riccabona M, Oswald J, Koen M, *et al.* Optimizing the operative treatment of boys with varicocele: sequential comparison of 4 techniques. *J Urol* 2003; 169:666–668.
- Atteya A, Amer M, Abdelhady A, *et al.* Lymphatic vessel hydrodissection during varicolectomy. *Urology* 2007; 70:165–167.
- Alessio AD, Piro E, Beretta F, *et al.* Lymphatic preservation using methylene blue dye during varicocele surgery: a single center retrospective study. *J Pediatr Urol* 2008; 4:138–140.
- Oswald J, Korner I, Riccabona M. The use of isosulphan blue to identify lymphatic vessels in high retro-peritoneal ligation of adolescent varicocele avoiding postoperative hydrocele. *BJU Int* 2001; 87:502–504.
- Dubin L, Amelar RD. Varicolectomy as therapy in male infertility. A study of 504 cases. *J Urol* 1975; 113:640.
- Cimador M, Di pace M, Castagnetti M, *et al.* Comprehensive laparoscopic approach to pediatric varicocele based on preoperative color Doppler ultrasound assessment. *Surg Endosc* 2008; 22:701–705.
- Cohen RC. Laparoscopic varicolectomy with preservation of the testicular artery in adolescent. *J Pediatr Surg* 2001; 36:394–396.
- Feber KM, Kass EJ. Surgery for the adolescent varicocele. *Dialogue Pediatr Urol* 2008; 30:10–11.
- Schiff J, Kelly C, Goldstein M, *et al.* Managing varicoceles in children: Results of microsurgical varicolectomy. *BJU Int* 2005; 95:399–402.
- Goldstein M. Adolescent varicocele. *J Urol* 1995; 153:484–485.
- Schwentner C, Radmayr C, Lunacek A, *et al.* Laparoscopic varicocele ligation in children and adolescents using isosulphan blue: A prospective randomized trial. *BJU Int* 2006; 98:861–865.
- Poddoubnyil V, Dronov AF, Kovarskii SL, *et al.* Laparoscopic ligation of testicular veins for varicocele in children. A report of 180 cases. *Surg Endosc* 2000; 14:1107–1109.
- Capolicchio JP, El-sheibiny M, Brzezinski A, *et al.* Dye-assisted lymphatic sparing laparoscopic varicolectomy in children. *J Pediatr Urol* 2013; 9:33–37.
- Tan HL, Tecson B, Ee MZ, Tantoco J. Lymphatic sparing laparoscopic varicolectomy: A new surgical technique. *Pediatr Surg Int* 2004; 20:797–798.
- Salhab M, Alsarakbi W, Mokbel K. Skin and fat necrosis of the breast following methylene blue dye injection for sentinel lymph node biopsy in patient with breast cancer. *Int Semin Surg Oncol* 2005; 2:26.
- Rizkala E, A Fishman, J Gitlin, *et al.* Long-term outcomes of lymphatic sparing laparoscopic varicolectomy. *J Pediatr Urol* 2013; 9:458–463.
- Zampieri N, Zuin V, Corroppo M, *et al.* Varicocele and adolescents: semen quality after 2 different laparoscopic procedures. *J Androl* 2007; 28:727–733.
- Atassi O, Kass EJ, Steinert BW. Testicular growth after successful varicocele correction in adolescents: comparison of artery sparing techniques with the Palomo's procedure. *J Urol* 1995; 153:482–483.
- Yaman O, Soygun T, Zumurbas AE, *et al.* Results of microsurgical subinguinal varicolectomy in children and adolescents. *Urology* 2006; 68:410–412.
- Koyle MA, Oottamasathien S, Barqawi A, *et al.* Laparoscopic Palomo varicocele ligation in children and adolescents: results of 103 cases. *J Urol* 2004; 172:1749–1752.
- Cayan S, Shavakhabov S, Kadioglu A. Treatment of palpable varicocele in infertile men: a meta-analysis to define the best technique. *J Androl* 2008; 30:33–40.