ORIGINAL

Indigo Carmine Dye-Assisted Lymphatic-Sparing Laparoscopic Palomo Varicocelectomy In Children

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Abstract : The ideal method for varicocelectomy in children remains controversial. We present our experience with dye-assisted lymphatic-sparing laparoscopic varicocelectomy (LSLV) in children, which overcomes the limitations of previously described techniques. Materials and methods : Five consecutive LSLVs were performed over a period of three years on children with a mean age of twelve years. The varicocele grade was three in one case and grade 2 in four cases, respectively. A left subdartos injection of 2 ml of Indigo carmine dye was done using a 25-gauge needle at ten minutes before an operation. A scrotal injection of lymphatic dye was utilized to spare at least one lymphatic and the remaining spermatic vessels were divided. Results : Lymphatic-sparing was accomplished in all cases. No peri-operative complication was noted. We spared one lymphatic channel in one patient (20%) and two channels in four patients (80%). There were no cases of hydrocele or residual varicocele. Conclusion : Dye-assisted LSLV is easily accomplished with an excellent surgical outcome and sparing one or two lymphatics appears to be sufficient to avoid secondary hydrocele. J. Med. Invest. 61 : 151-155, February, 2014

Keywords **:** *Laparoscopic Palomo, Lymphatic sparing, Dye, children*

INTRODUCTION

Varicocele is generally considered to be the most common correctable cause of male infertility (1). Varicocele is a relatively rare disorder in children. Varicocele occurs in 10% to 15% of children and adolescents (2). Although uncommon before puberty, the incidence of varicocele in postpubertal children is similar to that of adulthood (3).

Multiple methods exist for the treatment of varicoceles, including spermatic vein sclerotherapy or embolization, open inguinal ligation of the spermatic vein, subinguinal microscopic varicocelectomy, and, most recently, laparoscopy. Classically, varicocelectomy may be performed either as a high retroperitoneal ligation of the spermatic vessels as described by Palomo (4) or as a low superficial inguinal ligation as described by Ivanissevich (5).

Varicocelectomy in children is still without a gold standard method. Though the microscopic low ligation technique appears to be effective in adults, there is a reported risk of testicular loss due to arterial injury. This risk is potentially higher in the hands of less experienced surgeons and if the vessels are smaller as in children. The Palomo method of retroperitoneal mass ligation of the spermatic vessels offers a low recurrence rate but with the risk of postoperative hydrocele in 10% short term and up to 30%

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with extended follow-up (1, 2). It is suggested that this is due to the interruption of the lymphatic outflow from the subservient testis by mass ligation of the spermatic vessels including the lymphatics (6).

We present our experience with dye-assisted lymphatic sparing laparoscopic Palomo varicocelectomy (LSLV) in children. We contribute novel insights regarding the number of lymphatic vessels which need to be preserved.

MATERIALS AND METHODS

Between 2009 and 2012, five consecutive left LSLVs were performed at two institutions. Clinical, operative and postoperative data were collected from a retrospective chart review.

Children had a mean age of 12±0.7 years (a range of 11 to 13 years) and all had primary varicocele on the left side. Clinical grading was done according to Dubin and Amelar. A grade 3 varicocele was detected in one child while four children had a grade 2 varicocele. Indications of operation were testicular volume asymmetry of greater than 20% in one patient (a grade 3 varicocele), scrotal pain or discomfort in three patients and family preference in one patient.

All patients had general anesthesia and were placed in the supine position with a slight Trendelenburg position. 2 ml of Indigo carmine dye was injected into the space between the tunica vaginalis and tunica albuginea using a 25-gauge needle at ten minutes before the start of an operation (Fig. 1).

A trans-peritoneal approach was used via a 5-mm umbilical incision. Pneumo-peritoneum was established followed by the placement of two 5 mm ports at the bilateral lower abdominal quadrants. A small posterior peritoneotomy was done over the spermatic vessels. Stained lymphatics were easily seen running alongside the spermatic artery and vein (Fig. 2a). If the stained lymphatics were not immediately seen after posterior peritoneotomy, the

Figure 1 : Dye injection procedure
2 ml of Indigo carmine dye is injected into the space between the tunica vaginalis and tunica albuginea using a 25-gauge needle.

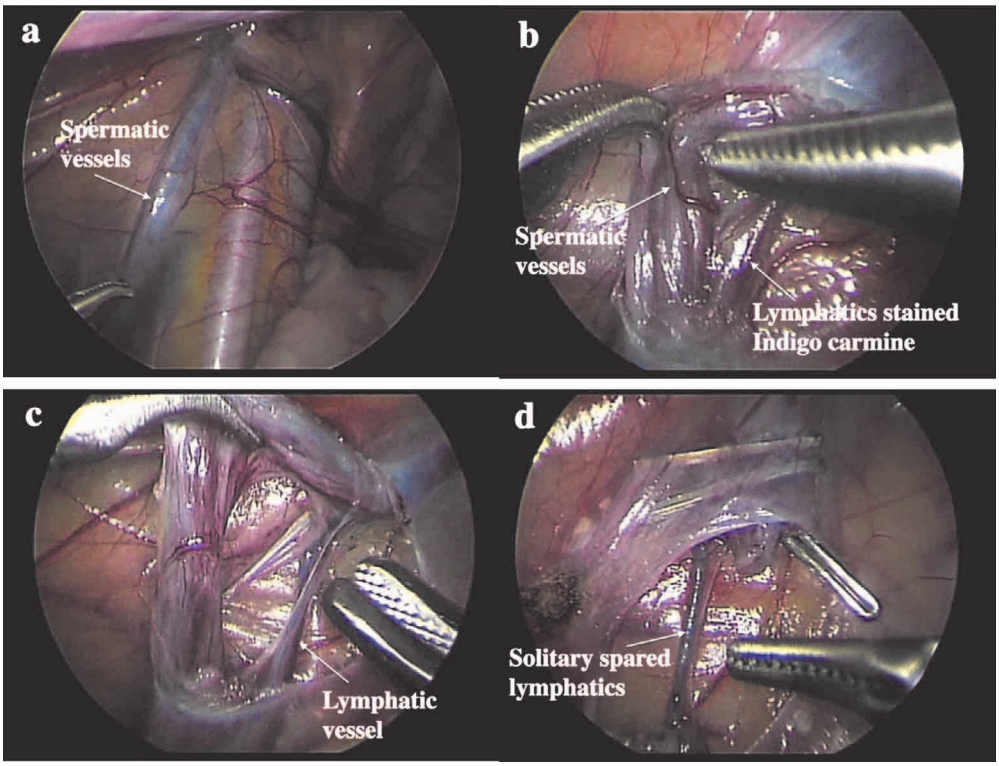

Figure 2 : Laparoscopic procedures
a. b. Lymphatics stained Indigo carmine are easily identified running alongside the spermatic vessels. Intentionally one or two lymphatic is spared.
c. d. Clipping and division of the remaining spermatic vessels. Solitary spared lymphatic is seen after division of the spermatic vessels.

massage of the scrotum resulted in a good dyeing of lymphatics (Fig. 2b). We intentionally spared one or two lymphatics (Fig. 2c) and the rest of the spermatic vessels were clipped and divided (Fig. 2d). Follow-up was routinely requested on one, six and twelve months, post-operatively.

RESULT

Dye-assisted LSLV was accomplished successfully in all patients with no intraoperative or postoperative complications. No open conversion was needed. All patients were discharged on the next day following the operation. One injection was all that was required to establish satisfactory lymphangiography in all patients. Table1 shows summary of cases performed dye-assisted LSLV.

Table 1 : Summary of cases performed dye-assisted lymphatic sparing laparoscopic Palomo varicocelectomy

case	age(Y)	side	Grade	Preserved lymphatics	Postoperative hydrocele	Residual varicocele
1	11	left	3	1	-	-
2	13	left	2	2	-	-
3	12	left	2	2	-	-
4	12	left	2	2	-	-
5	12	left	2	2	-	-

We spared one lymphatic channel in one patient (20%), two channels in four patients (80%). The mean operative time was 95 ± 26 minutes (the range from 75 to 130 minutes). One patient underwent ipsilateral laparoscopic hernia repair in the same setting for external inguinal hernia. The mean follow-up period was 23.3 months (the range from 12 to 38 months). There were no cases of hydrocele and residual varicocele noted. No testicular atrophy was observed at follow-up. Three patients who presented with scrotal pain or discomfort achieved complete resolusion of their symptoms. Catch-up growth couldn't be quantified in one hypotrophy patient with both pre and postoperative ultrasound at a follow-up of 24 months.

DISCUSSION

The techniques currently utilized for varicocele repair include the standard inguinal approach, the microscopic subinguinal approach, laparoscopic techniques, high retro- peritoneal Palomo procedure and radiological interventional sclerotherapy. However, each technique has advantages and disadvantages and there is no agreement on a gold standard in the pediatric age group. The laparoscopic approach for varicocelectomy was introduced into clinical practice in the early 1990s, and during the last decade, this procedure has gained popularity especially in children because it is a minimally invasive simple and safe technique with a high success rates of 98%, which is similar to that of the microsurgical technique. Even so, many surgeons were still reporting secondary hydrocele rates of 10~30% (1, 2).

It is suggested that the development of a secondary hydrocele is due to the interruption of the lymphatic outflow from the subservient testis by mass ligation of the spermatic vessels including the lymphatics. Kocvara *et al* (6) demonstrated interstitial edema and local reduced spermatogenesis with desquamation of the germinal epithelium, atrophy, and Sertoli cell only pattern in up to 16% of the seminiferous tubules on testicular biopsy after varicocelectomy. They, therefore, concluded that dividing the lymphatic vessels can aggravate testicular function and interfere with the hypothalamic-pituitary-testicular axis. They affirmed that lymphatic sparing is important not only to prevent postoperative hydrocele but also to optimize testicular function.

Oswald *et al* in 2001 were the first to recommend the use of subdartos scrotal injection of isosulfan blue dye in order to reliably and objectively identify and spare the spermatic lymphatic vessels (7). In a comparative study this was found to be superior to the standard Palomo procedure (8). This encouraging experience with the open Palomo procedure was then applied to the laparoscopic Palomo procedure.

Podkamenev *et al* (9) in a randomized controlled trial compared laparoscopic varicocelectomy in children, performed in 434 patients, to open varicocelectomy, performed in 220 patients, both after injection of methylene blue under the tunica albuginea. They considered laparoscopic Palomo procedure with lymphatic sparing to be the most effective for varicocele treatment in children and adolescents. Furthermore, Schwentner *et al* (10) in a prospective randomized trial demonstrated no secondary hydrocele with the dye-assisted approach. Since then many studies have reported nearly zero rates of secondary hydrocele with dye-assisted LSLV (11, 12).

As a lymphatic staining agent the use of isosulfan

blue is considered to be best (7, 10-12), because its use is well established in clinical practice and it is cheap. Tan *et al* (13) described the technique of in vivo methylene blue mapping of testicular lymphatic vessels during laparoscopic varicocelectomy. However, methylene blue dye can cause local complications such as skin and fat necrosis because of its tissue-reactive properties (14). We selected Indigo carmine as the lymphatic staining agents because it has been used to facilitate lymphatic mapping and the identification of sentinel nodes for staging in breast cancer and melanoma in Japan.

As to the injection space of dye, the techniques of subdartos or subcutaneous or intradartos scrotal injection of dye was reported. However, it seems that there was no difference in lymphatic vessel dyeing by the injection technique. We injected into the space between the tunica vaginalis and tunica albuginea using a 25-gauge needle at ten minutes before the start of an operation and confirmed a good dyeing of the lymphatic vessels. If the stained lymphatics were not immediately seen after posterior peritoneotomy, the massage of a scrotum got a good dyeing of the lymphatics. However, it is important to be aware of the deleterious effects of intratesticular injection (15).

In this procedure, we raised the question of how many lymphatic vessels need to be spared, since other series report sparing from two to four visualized channels (10, 16, 17). Capolicchio *et al* (12) described that they intentionally spared only one, since they noted that an additional lymphatic channel usually courses along the vas deferens. We also believed that it was important to spare one or two lymphatic channels to prevent a recurrence by the remnant of micro veins surrounding the lymphatics.

CONCLUSION

Dye-assisted LSLV in children is easily accomplished with excellent surgical outcome and sparing one or two lymphatics appears to be sufficient to avoid secondary hydrocele.

CONFLICT OF INTEREST

The author and co-authors disclose that there are no conflicts of interest associated with the present study.

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