Technical standardization of laparoscopic lymphatic sparing varicocelectomy in children using isosulfan blue

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Purpose: The lymphatic preservation to prevent hydrocele formation after laparoscopic varicocelectomy is essential. Lymphatic sparing procedures using scrotal injection give a rate of mapping failures of 20%–30%. The aim of the present study is to standardize the technique of injection to perform a lymphatic sparing procedure in case of laparoscopic varicocelectomy.

Methods: We retrospectively evaluated 50 patients who underwent laparoscopic varicocelectomy from July 2010 to July 2013. Patients were divided into two groups: G1 (25 patients) those who underwent a classical isosulfan blue scrotal intra-dartos injection and G2 (25 patients) those who underwent the new standardized isosulfan blue scrotal intra-dartos/intra-testicular injection.

Results: In G1 lymphatic vessels were identified as blue coloured in 19/25 of cases (76%), in G2 in 25/25 of cases (100%). The results were analyzed using test χ² with Yates’ correction and there was a statistically significant difference (χ² = 0.05,1) between G2 and G1. Postoperative hydrocele was noted in 2/6 patients of G1 in whom the lymphatic vessels were not identified.

Conclusions: Laparoscopic lymphatic sparing varicocelectomy is an effective procedure to adopt in children with varicocele. The intra-dartos/intra-testicular injection of isosulfan blue is significantly better than the previously described intra-dartos injection, permitting to identify lymphatic vessels in 100% of cases in our series. No allergy to isosulfan blue was reported in both groups.

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Laparoscopic varicocelectomy according to the Palomo technique is the most common procedure adopted in children with testicular varicocele [1,2]. This procedure involves the ligation of the internal spermatic vessels and is associated with a 3% to 5% incidence of recurrence and about 10% to 30% incidence of post-operative hydrocele [3,4].

Hydrocele and testicular edema following varicocelectomy are very common conditions that can lead to a testicular discomfort and sometime to a second surgical procedure to solve the problem [5]. For this reason, in recent years, lymphatic sparing procedures associated to varicocele repair have been described, decreasing the incidence of secondary hydrocele and ensuring a better andrological outcome [6–11].

A common lymphatic sparing procedure adopted in children with varicocele consists of a scrotal intra-dartos injection of Patent blue V, or its isomer isosulfan blue [12–14]. This procedure gives a rate of successful lymphatics mapping of 70–80% with about 20%–30% of mapping failures with no identification of lymphatic vessels [15,16].

After a previous experience with an intra-dartos injection with a mapping failure of about 20% [15], we have modified the technique of injection to standardize it and to obtain the 100% of lymphatic identification.

The aim of the present study is to report the results of a comparative study between 2 groups of patients using standard method of isosulfan blue injection and the new method of intra-dartos/intra-testicular injection.

1. Patients and methods

We retrospectively reviewed the files of 50 patients who underwent laparoscopic left varicocelectomy according to the Palomo technique from July 2010 to July 2013.

Patients had a mean age of 12.7 years (range 9–16 years) and all had primary grade III varicocele according to Horner classification on the left side. Indications for the intervention were in all patients the high degree of varicocele and the coexistence with a left testicular hypotrophy of more than 20% compared to contralateral side in 31 patients (62%), or testicular pain or discomfort in 19 cases (38%).

All the patients before surgery received a color Doppler testicular ultrasonography to confirm the diagnosis.
We adopted in all the patients isosulfan blue scrotal injection preoperatively to identify lymphatics (Fig. 1). Patients were divided into two groups: G1 (25 patients) those who underwent a classical isosulfan blue scrotal intra-dartos injection and G2 (25 patients) those who underwent a new standardized isosulfan blue scrotal intra-dartos/intra-testicular injection. As for the technical details of intra-dartos/intra-testicular injection of blue isosulfan, we used a 23 gauge needle that was inserted firstly into intra-dartos space with an angulation of about 30°. After aspiration to control the presence of blood with a syringe with a saline solution, we connected the needle to the syringe with 2.5% isosulfan blue solution. In G1 2 mL of 2.5% isosulfan blue solution was injected only in intra-dartos space as previously published; in G2 after injection of 2 mL of the solution into intra-dartos space as performed in G1, we inserted the needle with a 90° angle within the body of the testis and we injected further 0.5 ml of the solution into testicular parenchyma. The injection was performed 5 min before starting surgery.

1.1. Surgical technique

The surgical procedure was performed under general anesthesia with endotracheal intubation. The patients were placed in supine position with slight Trendelenburg. After scrotal injection of vital dye, a transperitoneal approach was used. We adopted a 5 or a 10 mm 0° optic according to available instruments introduced via an open approach. Two other 5-mm trocars were adopted in triangulation with the optic to have a better ergonomy. A peritoneal window was made at the level of dilated spermatic vessels at a distance of 3 to 5 cm from the internal inguinal ring. By using a curved dissector, all spermatic bundle was freed from the retroperitoneal tissues; if lymphatic vessels were identified (because they are blue coloured) they were spared (Fig. 2). Two 5-mm titanium clips were applied distally and 2 proximally on the spermatic vessels. Vessels were cut between the clips according to the Palomo procedure (Fig. 3). The surgical area was inspected for hemostasis at the end of procedure.

Pneumoperitoneum pressure during the procedure was 8 to 10 mmHg.

2. Results

All the procedures were completed in laparoscopy. Mean length of surgery was 15 min (5 to 40 min). In G1, the lymphatic vessels were identified as blue coloured in 19/25 of cases (76%). In G2, the lymphatic vessels were identified as blue coloured in 25/25 of cases (100%). As for quality of visualization of the coloured lymphatic vessels, we observed no significant difference between older and younger patients. However in older patients, probably for a faster lymphatic drainage, we observed a shorter duration of blue visualization of the lymphatic vessels that return to a normal colour in a shorter period of time. In all the patients we observed at least 2 lymphatics posteriorly to the bundle, which were always and easily spared, and we observed always 1 lymphatic anteriorly to the bundle that was spared rarely because it was difficult to dissect. Mean length of hospitalization was 36 h (range, 1–2 days).

All patients were followed-up clinically 7, 30, 180 days, then 1 and 2 years after surgery; after 2 years we stopped follow-up and the patients were invited to contact the hospital in case of problems (recurrence or hydrocele appearance).

The results were analyzed using the test $\chi^2$ with Yates’ correction and there was a statistically significant difference ($\chi^2 = 0.05, 1$) between G2 and G1 as for the lymphatic identification (Table 1). Postoperative hydrocele was noted in 2/6 patients of G1 in whom the lymphatic vessels were not identified. Hydrocele appeared always in the first year after surgery, 3 and 7 months after the procedure, respectively.

We had no problems related to allergy to the product in both groups.
Varicocele is a common disorder in children and adolescents, with an incidence of approximately 15%–20% [17]. Varicocele can lead to testicular damage with testicular hypotrophy and an increased risk of infertility [18]; therefore, surgical treatment is frequently required [1]. The majority of patients with varicocele are operated in pediatric age between 8 and 18 years [17,18].

Multiple methods exist for the treatment of varicocele. With recent advances in minimal access surgery, there have been many reports praising the safety and efficacy of laparoscopy for the surgical correction of varicocele. In particular the Palomo laparoscopic varicocelectomy is the most popular approach adopted in children according to the reports of the international literature [1,2,19].

The laparoscopic Palomo procedure has resulted in a significant decrease in the operative failure rate compared to the artery-sparing procedures, with no increase in the incidence of testicular hypotrophy/atrophy [7–9].

However, postoperatively, hydroceles are a potential problem with the standard Palomo procedure (10%–30%) because no attempt is made to preserve the lymphatic vessels that are difficult to identify, because they are similar to small veins [4,5]. Therefore, lymphatic sparing procedures have been considered during varicocelectomy to reduce the incidence of postoperative hydrocele [6–11].

Iosulfan blue is one of the products that can be used to perform lymphography. Patent blue V dye (PBV), or its isomer iosulfan blue, has been used since the 1960’s to perform lymphangiography to identify the sentinel lymph node(s) in breast cancer [12].

Oswald in 2001 was the first to recommend the use of subdartos scrotal injection of iosulfan blue dye in order to reliably and objectively identify and spare the spermatic lymphatic vessels [16].

The technique we adopted in G1 had been already reported and published in the international literature by several groups [9–11,15,16].

The problem is that if the technique of injection fails and lymphatic vessels are not identified, the patient is at the same risk of developing hydrocele as those who do not receive vital dye injection [6].

As from the data already published in the international literature and on the basis of a previous paper published by our group, the incidence of lymphatic identification after intra-dartos or intra-vaginal injection is variable between 50% and 80% of cases [15].

The aim of our paper is to standardize the technique of iosulfan blue injection.

The idea to change the technique of injection was born because in some cases of our experience, trying to perform an intra-vaginal injection, we performed wrongly an intra-parenchymal testicular injection.

We noted, after an intra-parenchymal injection of all the product, a massive blue coloration of the spermatic veins, lymphatics and posterior peritoneum located on spermatic vessels.

On the basis of this observation we standardized the technique of injection to increase its performance.

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>G2</th>
<th>G1</th>
<th>χ² 0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>lymphatic vessels identification</td>
<td>100 (25 pts)</td>
<td>76 (19 pts)</td>
<td>4.73 &gt; 3.84 Sign.</td>
</tr>
<tr>
<td>lymphatic vessels no identification</td>
<td>0 (0 pt)</td>
<td>24 (6 pts)</td>
<td></td>
</tr>
</tbody>
</table>

Pts = patients.

### 3. Discussion

On the basis of our series, it seems that in G2 (intra-dartos/intra-parenchymal injection) there is a statistically significant difference in lymphatic identification (χ² = 0.051) compared to G1 (standard intra-darts technique).

In addition in G2, in which we have a 100% identification of lymphatic vessels, there was 0% of hydrocele, compared to G1.

We underline that it is important not to inject more than 0.5 ml of iosulfan blue intra-parenchymally because if the amount of product injected intra-parenchymally is more than 0.5 ml there is a global blue coloration of the entire bundle and it is impossible to perform a correct lymphatic dissection.

As for incidence of complications related to the procedure of isosulfan blue injection such as orchitis, allergy, anaphylactic shock [20,21], we reported no adverse effect in our series.

However it is important to inform the patients and the parents that the scrotum and the urines will be blue/green coloured for 24–48 h [14].

On the contrary using other products to perform lymphography as methylene blue, in the literature a lot of adverse effects, such as orchitis, scrotal skin necrosis and allergic reactions are reported [13,22].

Before surgery it is always important that parents sign an informed consent focused on this technique because it has been reported in oncologic adult literature that, also rarely, some allergic reactions to the product can happen in about 0.1% of cases [15,20–22].

In conclusion, in our experience, the laparoscopic Palomo varicocelectomy using iosulfan blue is a safe and effective procedure to adopt in children with varicocele [15]. The intra-dartos/intra-testicular injection of isosulfan blue is significantly better than the previously described intra-darts injection, permitting to identify lymphatics in 100% of cases (χ² = 0.051). Using lymphatic sparing procedure we have 0% of hydrocele in G2 compared to 8% of hydrocele rate reported in G1. No allergy to isosulfan blue was reported in both groups.

### References


