

# 15 years' experience in the single-port laparoscopic treatment of pediatric varicocele with Ligasure® technology

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## ABSTRACT

**Introduction.** Varicocele is an abnormal dilatation of the internal spermatic veins of the spermatic cord. It has an estimated prevalence of 15% in young male adults. Even though most of them are asymptomatic, scrotal pain and testicular hypotrophy are frequent in children and adolescents. There is controversy regarding the indications and optimal approach for treatment purposes. We present the results of our 15-year series in the laparoscopic repair of pediatric varicocele.

**Materials and methods.** 238 patients diagnosed with varicocele and undergoing laparoscopic repair from 2006 to 2020 were reviewed. Variables collected included age, symptoms, grade, testicular atrophy, hospital stay, perioperative complications, recurrences, and formation of reactive hydrocele. Mean follow-up was 5.6 years (6 months-9 years).

**Results.** Mean age was 14.1 years. 188 patients had grade III varicocele. In 14 cases, varicocele was bilateral. Testicular atrophy at diagnosis was found in 42% of patients, 74% of whom were over 15 years old. 51 patients had testicular pain. All patients underwent laparoscopic treatment. Mean operating time was 36 min. Median hospital stay was 31 h. Recurrence rate was 2.1%. 43 patients (18%) developed hydrocele, but only 27 (11.2%) required hydrocelectomy according to Lord's plication at least 1 year following laparoscopy. Of the remaining 16 cases, 2 spontaneously resolved and 14 remained stable in the mean 7-year follow-up. In 7.1%, paresthesias were noted in the anterior-internal aspect of the left thigh.

**Conclusion.** Based on our series, we believe laparoscopy should be regarded as the gold standard technique in the pediatric population. Laparoscopic varicocelectomy is technically easy and fast, causes no pain, and has a recurrence rate of 1%. The procedures involving lymphatic vessel preservation could reduce reactive hydrocele rates as a long-term complication to a minimum.

**KEY WORDS:** Varicocele; Ligasure®; Laparoscopy; Children.

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## QUINCE AÑOS DE EXPERIENCIA EN EL TRATAMIENTO LAPAROSCÓPICO DEL VARICOCELE PEDIÁTRICO CON UN SOLO PUERTO DE TRABAJO Y TECNOLOGÍA LIGASURE®

### RESUMEN

**Introducción.** El varicocele es una dilatación anormal de las venas espermáticas internas del cordón espermático. Su prevalencia se estima en 15% de varones adultos jóvenes. Aunque la mayoría son asintomáticos, en niños y adolescentes el dolor escrotal y la hipotrofia testicular son frecuentes. Existe controversia sobre las indicaciones y el abordaje óptimo para su tratamiento. Presentamos los resultados de nuestra serie de 15 años en la reparación laparoscópica del varicocele pediátrico.

**Material y métodos.** Revisamos 238 pacientes diagnosticados de varicocele y sometidos a corrección laparoscópica desde 2006 hasta 2020. Las variables registradas fueron: edad, síntomas, grado, atrofia testicular, duración de la estancia, complicaciones perioperatorias, recidivas y formación de hidrocele reactivo. El seguimiento medio fue 5,6 años (6 meses-9 años).

**Resultados.** La edad promedio fue 14,1 años. 188 pacientes presentaban varicocele grado III. En 14 casos el varicocele era bilateral. Se observó atrofia testicular en 42% al diagnóstico, de los que el 74% eran mayores de 15 años. Cincuenta y un pacientes refirieron dolor testicular. Todos los pacientes se sometieron al tratamiento laparoscópico. El tiempo operatorio promedio fue 36 min. La mediana de estancia fue 31 horas. La tasa de recidiva fue 2,1%. Cuarenta y tres pacientes desarrollaron hidrocele (18%); pero solo 27 precisaron hidrocelectomía según plicatura de Lord al menos un año poslaparoscopia (11,2%). De los 16 restantes, dos se resolvieron espontáneamente y 14 se mantuvieron estables en el seguimiento medio de siete años. En 7,1% se notificaron parestesias en la cara anterointerna del muslo izquierdo.

**Conclusión.** Basándonos en nuestra serie, creemos que la laparoscopia debe considerarse el *gold standard* en edad pediátrica. La varicocelectomía laparoscópica es técnicamente fácil y rápida, indolora y con una tasa de recurrencia del 1%. Los procedimientos de preservación de los linfáticos podrían reducir al mínimo las tasas de hidrocele reactivo como complicación a largo plazo.

**PALABRAS CLAVE:** Varicocele; Ligasure®; Laparoscopia; Niños.

## INTRODUCTION

Varicocele is defined as a palpable dilatation of the pampiniform plexus within the spermatic cord. It is regarded as the most common cause of male infertility. General prevalence is 15-20% in the healthy male adult population<sup>(1,2)</sup>. In male patients assessed as a result of primary infertility, varicocele is identified in 21-41% of cases, and in up to 75-81% in patients with secondary infertility<sup>(3)</sup>. According to the WHO, 25.4% of patients with abnormal seminogram and 11.7% of patients with normal semen analysis were diagnosed with varicocele<sup>(4)</sup>. More than 90% of cases are left varicoceles, and less than 10% are bilateral. The adverse effect of varicocele on spermatogenesis can be attributed to many factors, such as increased testicular temperature, increased intratesticular pressure, hypoxia associated with distorted blood flow, reflux of toxic metabolites from the adrenal glands, oxidative stress, and distorted hormonal profile balance due to Leydig interstitial cell dysfunction<sup>(5,6)</sup>.

Varicocele's prevalence in the pediatric and adolescent population varies widely according to age group and varicocele grading. It is infrequent in children under 10 years of age, but it significantly increases at puberty<sup>(7,8)</sup>. Varicocele is usually asymptomatic. It is typically detected as an incidental finding during medical check-ups in adolescents. The classification developed by Dubin and Amelar in 1970 is the most widely used assessment tool, with varicoceles being classified as grades I-III<sup>(9)</sup>. Grade III varicoceles are visible without resorting to the Valsalva maneuver and are traditionally known to have a "bag of worms" appearance<sup>(10)</sup>. Ultrasonography is the optimal imaging test for the assessment of scrotal pathologies.

Laparoscopic varicocelectomy is conceptually similar to the high retroperitoneal approach (Palomo's technique), but overall success rates of the laparoscopic approach are even higher than those of the open procedure, with a failure rate close to 1% and very few complications<sup>(11)</sup>.

Indications for surgical repair vary<sup>(12,13)</sup>. In children and adolescents, testicular hypotrophy and/or pain, along with grade III varicocele, are accepted to be an indication for repair. However, hypotrophy grade and surgery timing are an issue of discussion.

The main objective of this study was to analyze the results of our 15-year series of laparoscopic varicocele repair in the pediatric population.

## PATIENTS AND METHODS

### Study design

A descriptive, observational, retrospective, longitudinal study of pediatric and adolescent patients (under 20 years of age) diagnosed with varicocele and treated with

Palomo's single-port laparoscopic technique and bipolar sealing at Santiago de Compostela's University Hospital Complex from 2006 to 2020 was carried out.

### Data recorded

Variables analyzed included age at diagnosis, Tanner stage, associated symptoms, grade, ultrasound findings, surgical indication, operating time, complications, reactive hydrocele, and progression. The relationship between age at surgery and symptoms, as well as between age and occurrence of reactive hydrocele and other postoperative complications, was assessed.

### Diagnostic methods

Patients are referred from their pediatrician, family doctor, or urologist. In the first visit, the clinical record is created, with diagnosis being established. Lesion grade, testis involved, and size according to Prader orchidometer, as well as the presence of pain, are determined through physical exploration in a supine and a standing position. The three-grade Dubin and Amelar's clinical classification is used to catalogue patients<sup>(9)</sup>. They all undergo ultrasonography to demonstrate retrograde flow in the spermatic veins following Valsalva's maneuver, which also helps establish varicocele grading and provides an objective measurement of the transversal and longitudinal diameters of the relevant testis. Ultrasonography also allows the presence of abdominal and pelvic compressive masses to be ruled out.

### Criteria for surgery

Surgery was indicated in patients with grade III varicocele, or in patients with grade II varicocele where reduced ipsilateral testicular size was obvious (>20% discrepancy) or in the presence of scrotal pain or testicular discomfort. None of our patients presented at our consultation due to infertility problems.

### Single-port laparoscopic procedure with bipolar sealing

The repair surgery is carried out through an openly-inserted 5 mm umbilical scope using a 5 mm single working port in the right lower quadrant. Following the opening of a peritoneal window some 2 cm above the internal inguinal ring, the adventitial tissue surrounding the testicular vessels is dissected in a limited fashion to avoid inadvertently dividing the peripheral lymphatic vessels. No attempts to locate and preserve the spermatic artery are made. Using a dissector, the spermatic vessels are freed from the retroperitoneal connective tissue and the psoas muscle. The veins are sealed "en bloc" and divided using the Ligasure® (Tyco Healthcare) device. The peritoneal window is left unclosed once hemostasis has been secured. The patient usually spends one night in hospital.

### Outpatient follow-up protocol

At the pediatric surgery consultation, follow-up of all patients is carried out at 1 month, 6 months, 1 year, and then annually. In these consultations, the operated testis is measured and compared with the contralateral one to check for potential growth or hypotrophy, as well as for the presence of reactive hydrocele. In patients with moderate hydrocele, control ultrasonography is requested starting from month 6 to assess its content and mid- to long-term progression. Reactive hydrocele cases considered severe or causing scrotal discomfort in the patient underwent surgery using Lord's albuginea plication technique at least one year following laparoscopic division.

### Statistical analysis

Variables were recorded in an Excel (Microsoft Office) database and analyzed using the SPSS statistical 17.0 (SPSS; IBM Corp, USA) software. All variables were initially assessed to determine data normality and homogeneity. A descriptive analysis of all study variables was carried out. Quantitative variables were expressed as mean  $\pm$  standard deviation and median, while qualitative variables were expressed as absolute value and percentage, along with 95% confidence interval. Groups were compared using the Student's t-test for independent samples, and medians were compared through a Mann-Whitney U test. Differences in qualitative data proportions were evaluated using Fisher's exact test. The Chi-squared test was used for correlation analysis purposes. Statistical significance was established at  $p < 0.05$  for all comparisons.

### Ethical aspects

Through an informed consent form, parents were requested authorization for the use of the data recorded in the electronic medical records for study purposes. Data collection was carried out in accordance with the Declaration of Helsinki regarding research patient protection, while ensuring the confidentiality and anonymity of the information collected, as well as its use for scientific purposes only.

## RESULTS

### Global series

Over this 15-year period (January 2006-January 2020), 238 patients under 20 years of age diagnosed with varicocele were surgically treated using Palomo's single-port laparoscopic technique with high-energy bipolar sealing. Patients with incomplete data were excluded from this retrospective study. Mean age at diagnosis was 14.1 years (range: 9-20 years).

### Clinical data of the series

97.9% of our cases were left varicoceles, whereas only 14 patients had bilateral involvement – however, in these

cases, the right varicocele had no clinical signification and was not visible at exploration. In patients with bilateral involvement, no right grade III varicoceles were noted. Therefore, bilateral surgery was ruled out, and the procedure was carried out on the left side only. 188 of the patients had been catalogued as grade III varicocele according to Dubin and Amelar's classification. The reduction in testicular size ipsilateral to the varicose dilatation of the pampiniform plexus was obvious in 42% of patients (100 cases). No statistically significant relationship was found between testicular hypotrophy and age at diagnosis ( $p = 0.4$ ), even though 74% of patients with reduced testicular size were adolescents over 15 years of age. 51 patients reported testicular pain, which covered a large spectrum, from mild testicular discomfort to incapacitating testicular pain in terms of physical activity. No significant relationship was found between presentation with testicular pain and age at diagnosis ( $p = 0.6$ ). 78% of patients had Tanner IV-V pubertal development.

### Surgical procedure

Mean operating time was 36 min (range: 18-89 min). Mean hospital stay was 31 hours (range: 1-7 days). Patients were generally discharged first thing in the morning on the day following surgery. In 34 adolescents, outpatient surgery was decided upon as per the patients' and their family's preference. In the first 50 patients, only 2 conversions took place, which we considered part of the learning curve, as it has been previously described<sup>(14)</sup>.

### Follow-up and complications

1 patient had significant bleeding as a result of an inadvertent lesion in an epigastric vessel with a port, which required transfusion. 12 adolescents reported considerable pain in their right shoulder in the first 24 hours following surgery. 17 patients (7.1%) described numbness and paresthesias in the anterior-internal aspect of their left thigh. We attributed this to thermal damage of the genitofemoral nerve, which descends over the psoas muscle in its pelvic trajectory, namely involving the sensitive branch.

Doppler ultrasonography showed varicocele resolution in 97.9% of cases, and persistent varicocele in 5 cases. Only 1 of these 5 patients required re-intervention – again using Palomo's laparoscopic technique – due to the presence of high retrograde flow at ultrasonography. The other 4 patients remain under observation owing to the low flow shown by the venous plexus at ultrasonography. No cases of testicular atrophy following laparoscopic division have been recorded – on the contrary, 63% of patients had increased ipsilateral testis after two years of follow-up.

43 patients were diagnosed with reactive hydrocele during follow-up (18%). On average, the occurrence of significant hydrocele was delayed 13 months following laparoscopic surgery. Owing to the size and the scrotal discomfort caused by the hydrocele, surgical repair using

Lord's technique was carried out following laparoscopic ligation in 27 patients (11.3% of the total cases). Of the remaining 16 patients, 14 are stable, with a discrete hydrocele size, and in 2 cases, the hydrocele has resolved (mean follow-up of 7 years in these patients). 10 patients developed hydrocele 2 years following laparoscopic surgery, but all cases requiring surgical repair already had mild hydrocele 3 months after the procedure. Being over 15 years old was a prognostic factor for hydrocele development following laparoscopic repair ( $p < 0.05$ ). In our experience, patients under 15 years of age are not likely to develop clinically significant hydrocele following Palomo's laparoscopic technique. Varicocele grading showed no statistically significant correlation with the occurrence of reactive hydrocele. Mean follow-up of all patients was  $5.2 \pm 4.5$  years.

## DISCUSSION

In spite of the many literature instances published in this respect over the last 10 years, pediatric varicocele remains controversial. In adults, varicocele is the most frequent cause of male infertility, and indications for surgery are well established. Varicocele repair has been demonstrated to improve seminal and fertility parameters. Contrarily to adults, most adolescents have asymptomatic varicocele and unknown future fertility. Therefore, determining which patients would benefit most from surgery is a difficult task. Discrepancies in the choice of the repair technique also contribute to this unresolved debate in the treatment of pediatric varicocele. Even diagnostic methodology in children and adolescents is controversial, because seminogram is the gold standard technique to measure fertility potential in adults, but in children and adolescents, this test sparks an ethical debate – ethical concerns and the anxiety of pediatric urologists, patients, and parents about fertility issues and masturbation have limited seminograms in this age group<sup>(15)</sup>.

Chronic testicular pain may occur in 10% of patients. Varicocele-related orchialgia is an exclusion diagnosis<sup>(16)</sup>. Persistent pain in children and adolescents once other causes have been excluded should be an absolute indication for surgical repair<sup>(17)</sup>. Varicocele repair seems effective to mitigate or resolve pain in up to 90% of patients<sup>(18)</sup>.

Adolescent varicocele is believed to be related to the increase in testicular blood flow occurred during puberty. When a preadolescent develops varicocele, this represents a unique situation for pediatric urologists. Is preadolescent varicocele just a varicocele in a child who has initiated puberty at an earlier age? Assessment in this age group is limited to controlling testicular asymmetry and pain. The distorted growth of the testis involved may be more significant in the first Tanner stages during preadolescence. Unless children are physically developed and both their

parents and they accept masturbation for seminogram purposes, semen cannot be analyzed. Consequently, surgical indication is controversial in this age range, since fertility potential is unknown. However, significant testicular hypotrophy and incapacitating pain should suffice to indicate surgical repair<sup>(18,19)</sup>.

When analyzing the literature, there seems to be a strong correlation between ipsilateral hypotrophy and abnormal seminal parameters both in adults and adolescents with left varicocele<sup>(19)</sup>. In addition, volume distortion can worsen over time, which evidences the progressive nature of this condition. Avoiding varicocele surgical repair and waiting until infertility problems arise is seemingly not the best option for these patients. Therefore, early treatment during childhood and adolescence is widely accepted in order to prevent testicular damage<sup>(20,21)</sup>.

The recent evidence that varicocele is frequently a bilateral disease makes it necessary to perform a careful assessment of the right testis in all patients. So far, varicocele bilaterality has not been acknowledged in most studies. Bilaterality rate in our series was very low (2.1%, 14 patients) as compared to the literature reviewed<sup>(22)</sup>.

Establishing which varicocele repair technique is the most adequate in pediatric and adolescent patients remains an issue of discussion. For any given technique to be optimal, recurrence rates and incidence of reactive hydrocele should be as low as possible. Most procedures with low persistence/recurrence rates are generally associated with high incidences of reactive hydrocele. This is believed to be due to the fact attempts to leave the lymphatic vessels intact often give rise to the persistence of small spermatic veins that go unnoticed during the procedure and pose a high risk of dilatation in the mild-term<sup>(23)</sup>. Technical simplicity and low recurrence rates should be associated with lower hydrocele rates, but combining these three factors together is not easy, and none of the techniques has demonstrated to be superior to the others in this respect<sup>(24-26)</sup>. Anterograde sclerotherapy involves recurrence rates of up to 18%. Selective embolization of the testicular veins is an invasive technique with high radiation levels over the course of the 3 hours the procedure lasts for, on average<sup>(27)</sup>. The microsurgical subinguinal approach has the lowest complication rates, but failure rates can be as high as 15%<sup>(28)</sup>. The inguinal approach described by Ivenissevich has a recurrence rate of 16%, whereas the open high retroperitoneal approach (Palomo) has the lowest recurrence rate<sup>(29,30)</sup>. Palomo's laparoscopic technique has demonstrated to be easy to learn and to have very low recurrence rates, but this has not been accompanied by lower reactive hydrocele rates – on the contrary, they remain stable, ranging from 12-20%<sup>(31)</sup> (Table 1). The en-bloc high inguinal ligation of the spermatic vessels almost guarantees having to transversely divide the efferent lymphatic vessels of the ipsilateral scrotum. Attempts to preserve these lymphatic vessels, which are intimately adhered to the spermatic veins and



**Table 1. Comparison of the various techniques used for the treatment of varicocele.**

<i>Procedure</i>	<i>Hydrocele</i>	<i>Persistence</i>	<i>Increase in testicular size</i>	<i>Advantages</i>	<i>Drawbacks</i>
Palomo retroperitoneal (Barroso et al.)	9.7%	2.9%	37-100%	High dissection of the spermatic vessels far away from the ductus deferens	High hydrocele rate
Ivenissevich inguinal (Pintus et al.)	10%	15%	70%	Easy access to the spermatic cord	High recurrence rate
Microsurgery subinguinal (Schiff et al.)	1%	4.2%	75%	Optimal visualization of the collateral vessels	Slow. Requires microsurgery training
Palomo laparoscopic (Barroso et al.)	6.9%	4.4%	37-100%	Easy and fast	Possibility of intraperitoneal lesion
Retrograde embolization (Malekzadeh et al.)	0%	13%	-	No damage to lymphatic vessels or artery	High persistence rate and high radiation dose
Anterograde embolization (Keene et al.)	1%	12%	93%	No damage to lymphatic vessels or artery	High persistence rate and high radiation dose

*Barroso U et al. Surgical treatment of varicocele in children with open and laparoscopic Palomo technique: a systematic review of the literature. J Urol. 2009; 181: 2724-8. Pintus C et al. Varicocele in pediatric patients: comparative assessment of different therapeutic approaches. Urology. 2001; 57: 154-7. Schiff J et al. Managing varicoceles in children: results with microsurgical varicocelectomy. BJU Int. 2005; 95(3): 399-402. Malekzadeh S et al. Varicocele percutaneous embolization outcomes in a pediatric group: 7-year retrospective study. Int Urol Nephrol. 2016; 48: 1395-9. Keene DJB et al. Antegrade sclerotherapy in adolescent varicocele patients. J Pediatr Urol. 2017; 13: 305.e1-6.*

artery during laparoscopic dissection, involve a significant increase in operating times, technical difficulty, and risk of recurrence as a result of the inadvertent preservation of small spermatic vessels that are left unsealed<sup>(32)</sup>.

Even though the subinguinal microscopic approach has seemingly become the gold standard technique for the treatment of varicocele in adults – thanks to the lower recurrence rates and acceptable complication rates it is associated with –, this has not been unanimously adopted in the adolescent population. According to a recent article, only 2% of the children and adolescents undergo this technique in the hands of pediatric urologists<sup>(20)</sup>. This discrepancy is likely to be due to two factors – the lack of experience with the microscopic technique, which may be the most significant hurdle, and the technical difficulty it involves, since the testicular artery is smaller and systemic arterial pressure is lower, thus making arterial identification more difficult in the subinguinal or inguinal approach. In spite of this complexity, various groups have conducted microsurgical subinguinal varicocelectomy in children and adolescents with success rates comparable to those observed in adults<sup>(26,31)</sup>. Anyway, over the last decade, there has been an increasing tendency by pediatric urologists to resort to the laparoscopic technique<sup>(20)</sup>. Laparoscopic varicocele repair is associated with shorter operating times, a shorter learning curve, lower technical difficulty, minimal analgesic requirements in the postoperative period, possibility of outpatient surgery, similar usefulness in re-interventions, and lower recurrence rates as compared to the microscopic subinguinal approach and anterograde sclerotherapy, which results in a better cost-effectiveness ratio<sup>(33)</sup>.

Palomo's open technique – high division of the spermatic vessels at the retroperitoneal level – has been traditionally associated with high rates of reactive hydrocele – close to 15-20%<sup>(34)</sup>. However, the techniques involving lymphatic vessel preservation have reported reactive hydrocele rates even below 5%<sup>(35)</sup>. The importance of reactive hydrocele should not be underestimated, since it causes discomfort as a result of increased scrotal volume, and it may also distort the testis' temperature regulation mechanism, with implications on fertility. In spite of that, we believe it is preferable to have reactive hydrocele rates close to 15% with minimal recurrence rates (around 2%), since attempts to minimize the occurrence of hydrocele following varicocelectomy have caused recurrence rates to increase by even 10%<sup>(36)</sup>. Pediatric varicocele may be a different entity from adult varicocele, as confirmed by other authors<sup>(18,21)</sup>. This can be seen even in the complications occurred following surgery. In our series, great differences were found between the adolescent group and the under 15 group in terms of results and occurrence of reactive hydrocele. Therefore, the laparoscopic surgical approach may be different in both groups, placing special emphasis on lymphatic vessel preservation in adolescents as a result of the higher probability of developing hydrocele<sup>(21,34)</sup>. Multiple authors have reported a decrease in hydrocele rates using colorants – isosulfan blue and methylene blue. These colorants allow the lymphatic vessels to be dyed and help identify them so as to avoid division, but their use is disputable. Even the colorant injection site – subdartos, intravaginal, or intraparenchymatous – is controversial. The subdartos injection is easy, safe, and fast, but it requires

larger amounts and early injection. The intravaginal injection is difficult. The intraparenchymatous injection is a quicker and more specific approach, but is possibly the least safe, since pathological changes in testicular tissues have been observed<sup>(37,38)</sup>. In short, reliability and potential side effects have not been demonstrated yet.

In our view, the key to the success of the laparoscopic approach in varicocele repair has been the standardization of the surgical technique:

- Introducing a second working port has demonstrated not to be necessary, which allows for shorter operating times and lower risk of damage when using the ports. Various groups have already reported good results with the single-port approach<sup>(39,40)</sup>. The initial open access for the umbilical scope has minimized complications secondary to the use of the Veress needle<sup>(41)</sup> 5 mm blunt-tip, bladeless ports are used, which avoids many minor complications such as incisional pain, hematoma, and fascial defects<sup>(42)</sup>.
- Port position is well established – an umbilical scope and a right quadrant port. This allows for easy access to the region of the left internal inguinal ring. Adhesions of the sigma to the posterior peritoneum are usually detached. Monopolar coagulation is always used, with dissecting forceps and scissors to minimize bleeding. The peritoneum is divided in a 1cm window. The artery is not preserved, since this would cause an excessive number of recurrences. No optimal technique for lymphatic vessel preservation has been found, which means lymphatic vessels are only preserved if clearly observed.
- Most authors use clips or sutures for vessel ligation purposes. We believe coagulation is more effective using a high-energy bipolar vessel-sealing device (Ligasure®)<sup>(41)</sup>. Standard bipolar cauterization is only capable of coagulating small vessels, and it has some drawbacks, such as carbonization, adhesion, and thermal diffusion. The high-pressure bipolar vessel-sealing technology causes minimal thermal diffusion to the surrounding tissues<sup>(43)</sup>.

## CONCLUSIONS

The laparoscopic repair of varicocele is a safe, effective, and adequate technique in pediatric and adolescent patients. The most unwanted and frequent complication is reactive hydrocele, which may occur more than one year following surgery. Owing to this, the incidence of hydrocele described in the studies published may be even lower than the actual one. In our view, Palomo's laparoscopic procedure should be the gold standard technique for pediatric varicocele repair as it is associated with low failure rates and is technically easy. Laparoscopic varicocele division can be performed in a safe and rapid manner using only one 5mm working port and an electrothermal

bipolar vessel-sealing device (Ligasure®) for spermatic vessel coagulation, thus avoiding the use of metallic clips. We believe this technique should be integrated within the laparoscopic training program for Urology and Pediatric Surgery residents.

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