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Microsurgical Subinguinal or Laparoscopic Palomo Varicocelelectomy in Adolescent Patients, Which Technique is Better?

Adölesan Varikoselektomide Mikrocerrahi Subinguinal veya Laparoskopik Palomo, Hangi teknik daha iyi?

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Abstract: The indications for surgical intervention in adolescent varicocele cases are restricted. When intervention is necessary, treatment options include the open subinguinal approach, laparoscopic surgery, or embolization. This study aimed to compare outcomes between microsurgical sub-inguinal varicocelelectomy and laparoscopic varicocelelectomy in adolescent patients. Forty-nine patients under 18 years old who underwent varicocelelectomy between 2010 and 2023 were categorized into two groups based on the surgical approach 19 patients underwent laparoscopic varicocelelectomy by pediatric urologists, and 30 patients underwent subinguinal varicocelelectomy by the urology department. Patient records were retrospectively analyzed for age, preoperative symptoms, physical examination findings, ultrasound results, surgical techniques, and postoperative outcomes. There was no significant difference in recurrence rates between subinguinal varicocelelectomy and laparoscopic varicocelelectomy techniques. However, statistically significant differences were noted in operative duration, hospital stay length, and patient age at the time of surgery between the pediatric urology and urology department groups employing different techniques. Both subinguinal varicocelelectomy and laparoscopic varicocelelectomy techniques can be considered based on the surgeon's expertise and institutional resources. Regardless of the approach chosen, preserving arterial and lymphatic structures to maintain testicular blood supply and minimize complications is paramount.

Keywords: Laparoscopic Palomo procedure, Microsurgical Varicocelelectomy, Varicocele

Özet: Adölesan varikozel vakalarında cerrahi müdahale endikasyonları kısıtlıdır. Müdahale gerekli olduğunda, tedavi seçenekleri arasında açık subinguinal yaklaşım, laparoskopik cerrahi veya embolizasyon yer almaktadır. Bu çalışmada adölesan hastalarda mikrocerrahi subinguinal varikoselektomi ve laparoskopik varikoselektomi sonuçları karşılaştırıldı. 2010-2023 yılları arasında varikoselektomi uygulanan 18 yaş altı 49 hasta cerrahi yaklaşıma göre iki gruba ayrıldı. 19 hastaya pediatrik ürologlar tarafından laparoskopik varikoselektomi, 30 hastaya üroloji bölümü tarafından subinguinal varikoselektomi uygulandı. Hasta kayıtları yaş, ameliyat öncesi semptomlar, fizik muayene bulguları, ultrason sonuçları, cerrahi teknikler ve ameliyat sonrası sonuçlar açısından retrospektif olarak analiz edildi. Laparoskopik varikoselektomi ve subinguinal varikoselektomi teknikleri arasında nüks oranları açısından anlamlı bir fark yoktu. Bununla birlikte, farklı teknikler kullanan çocuk ürolojisi ve üroloji bölümü grupları arasında ameliyat süresi, hastanede kalış süresi ve ameliyat sırasındaki hasta yaşı açısından istatistiksel olarak anlamlı farklılıklar kaydedildi. Cerrahin uzmanlığına ve kurumsal kaynaklara bağlı olarak hem subinguinal varikoselektomi hem de laparoskopik varikoselektomi teknikleri düşünülebilir. Seçilen yaklaşım ne olursa olsun, testiküler kan akımını sürdürmek ve komplikasyonları en aza indirmek için arteriyel ve lenfatik yapıları korumak çok önemlidir.

Anahtar Kelimeler: Varikozel, Palomo Varikoselektomi, Subinguinal Mikrocerrahi Varikoselektomi

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1. Introduction

Varicocele, which is characterized by dilatation of the pampiniform plexus and internal spermatic veins, accounts for 15-20% of primary male infertility cases. Numerous studies have shown a direct correlation between delayed treatment of varicocele and infertility (1).

Currently, there is no consensus on the optimal age and technique for varicocele treatment in children and adolescents. Known and applied treatment options include open subinguinal approach, laparoscopic surgery or embolization methods. Laparoscopic procedures may involve retroperitoneal access, while open inguinal and subinguinal approaches may utilize magnification tools such as microscopes or magnifying rings (2).

In this study, we retrospectively compared the outcomes of varicocelectomy using laparoscopic varicocelectomy (LV) and microsurgical subinguinal varicocelectomy (SV).

2. Materials and Methods

This retrospective study involved 49 adolescent patients who underwent surgical treatment for varicocele between February 2010 and February 2023. Patients were categorized into two groups based on the surgical approach: Group 1 (LV) and Group 2(SV), and their data were compared retrospectively. Parameters recorded included age, preoperative symptoms, physical examination findings, ultrasonography results, surgical techniques, and postoperative outcomes.

Varicocele examination included scrotal inspection, palpation, and the Valsalva maneuver performed in both standing and lying positions. Ultrasonography was utilized to assess differences in testicular volume, diameter of internal spermatic veins, and the presence of venous reflux. Significant testicular volume difference was defined as $\geq 10\%$ (1). Internal spermatic vein diameter greater than 2-3 mm and the presence of spontaneous or Valsalva-induced reflux were considered indicative of varicocele.

Patients demonstrating varicose veins on postoperative ultrasound and clinical examination were classified as experiencing recurrence. Those with ultrasound findings suggestive of varicocele but lacking clinical symptoms and palpable varicose veins were categorized as having subclinical recurrence.

Ethical approval for this study was obtained from the Non-Interventional Ethics Committee of

Eskisehir Osmangazi University Faculty of Medicine under Decision No: 6 dated 05.02.24.

Statistical Analysis

The statistical analysis employed in this study utilized the Independent Samples T-Test. Statistical calculations were performed using Jamovi (Jamovi for MacOS, v.2.3.28.0). A significance level of $p < 0.05$ was considered statistically significant.

Surgical Techniques

Laparoscopic Palomo Technique

The surgical procedure followed the Laparoscopic Palomo technique.

1-The patient was positioned in the semilateral position under general anesthesia. To facilitate access and visibility, the Trendelenburg position was used to displace the intestines.

2-Initial access to the abdomen was gained through a 5 mm port inserted at the umbilicus, using a 30-degree optical lens for visualization. Carbon dioxide (CO₂) gas was insufflated into the abdomen to maintain a pressure of 12-14 cmH₂O. Additional 5 mm ports were placed—one near the midline close to the pubis and another on the right lateral midline between the umbilical and pelvic ports.

3-The peritoneal cavity was traversed through a peritoneal window created approximately 5-6 cm cranial to the vas deferens and internal ring, at the point where the internal spermatic artery and vein were located. All vascular structures were meticulously ligated.

The literature emphasizes the critical balance between preserving the spermatic artery to protect testicular function and ligating it to prevent a recurrence. It is noted that collateral circulation from the vas deferens and cremasteric artery can adequately supply blood to the testis despite ligation of the spermatic artery away from the internal ring.

Additionally, ligating the internal spermatic artery may potentially reduce venous return and lower the local temperature by alleviating vascular pressure in the region.

4-Proximal and distal application of two 5 mm endo-clips was performed without distinguishing between arteries and lymphatics, followed by cutting the vessel at its midpoint. The peritoneal window created during the procedure was left open (Figure 1 A-B-C).

Subinguinal Microscopic Varicocelectomy

Subinguinal microscopic varicocelectomy was performed under general or spinal anesthesia, the procedure was started by making a transverse incision approximately 2 cm in length, positioned 1 cm below the external inguinal ring. The surgical steps proceeded as follows:

1. The skin, subcutaneous tissues, and superficial fascia were incised to access the spermatic cord.
2. The spermatic cord was carefully isolated and suspended.
3. By gently manipulating the testis towards the incision, the gubernacular and external spermatic veins were exposed, ligated, and divided.
4. Subsequently, the external spermatic fascia was opened, followed by meticulous dissection under a microscope brought into the surgical field.
5. The internal spermatic fascia was carefully opened to reveal and preserve the internal spermatic artery(s), lymphatics, and vas deferens.
6. Under microscopic visualization, all visible internal spermatic veins were identified, ligated, and transected (Figure 2).

This technique emphasizes precise anatomical dissection and preservation of vital structures to minimize postoperative complications and ensure optimal outcomes in varicocele treatment.

3. Results

Data from 19 patients who underwent LV in group 1 and 30 who underwent SV in group 2 were evaluated. The mean age was 14.21 years (11-17 years) in Group 1 and 17.1 years (14-18 years) in Group 2. When the mean age of the patients was

compared, it was 14.2 years in patients who underwent LV and 17.1 years in patients who underwent SV. A significant difference of $p < 0.001$ was observed between the two groups.

The main complaint in both groups was pain and swelling in the scrotum. In group 1, left varicocelectomy was performed in all patients, 14 and 5 patients were suffering from grade 2 and grade 3 varicocele, respectively. In group 2, left varicocelectomy was performed in 28 patients and bilateral varicocelectomy in 2 patients with 3 of all patients being grade 1, 16 of them being grade 2 and 11 of them being grade 3 varicocele.

The operation time was 24.9 minutes (20-25) in Group 1 and 40.5 (30-50) minutes in Group 2. When the operation times were compared, a significant difference was found in favor of group 1, $p < 0.001$.

The hospitalization period of the patients in group 1 was 1 day. In group 2, the hospitalization period was 0-1 day (0.66) days. When the hospitalization duration of the patients was analyzed, a significant difference was found $p < 0.004$.

Recurrence was detected in three patients in group 1 and they were operated on again. Hydrocele developed in one patient and hydrocelectomy was performed. One patient had mild hydrocele which resolved with follow-up. In group 2, recurrence of varicocele was observed in 2 patients. One patient developed pain. In 2 patients, minimal hydrocele was observed with follow-up. There was no significant difference between groups 1 and 2 in terms of recurrence.

Statistical analyses are given in Table 1

Levene's test is significant ($p < 0.05$), suggesting a violation of the assumption of equal variance.

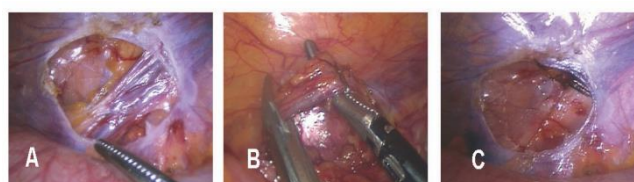


Figure 1. The key stages of the laparoscopic Palomo procedure for varicocele treatment.

A: The retroperitoneal window is opened during the laparoscopic Palomo operation.

B: Visualization of the testicular artery and vein.

C: Ligation of the testicular artery and vein using an endoclip just above the internal inguinal ring.

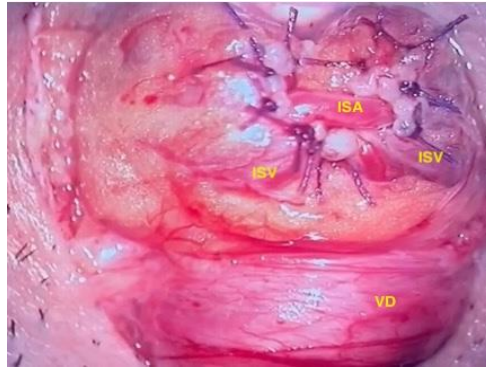


Figure 2. The anatomical structures identified and preserved during the microsurgical procedure for varicocele treatment. ISA: Internal Spermatic Artery, ISV: Internal Spermatic Vein, VD: Vas Deferens

Table 1. Independent Samples T-Test, Group Descriptives

	Grup	N	Mean±Sd	Median	P
Age	Grup 1 (LV)	19	14.21±1,75	14	<.001
	Grup 2 (SV)	30	17.1±1,845	17.00	
Duration of surgery	Grup 1 (LV)	19	24.95±4,02	25	<.001
	Grup 2 (SV)	30	40.233±6,956	41	
Hospitalisation	Grup 1 (LV)	19	1±0,479	1	0.004
	Grup 2 (SV)	30	0.667±0.47	1	

4. Discussion

The incidence of varicocele in adolescents is approximately 15%, one of the most common correctable anomalies in adolescent males (3). A fundamental challenge associated with adolescent varicocele is to determine which patients require treatment. Recommendations suggest monitoring testicular volume loss or growth arrest as the primary determinant for intervention to maintain or increase fertility (4). The American Society for Reproductive Medicine Practice Committee recommends that adolescent varicocele patients with objectively assessed testicular volume loss may be candidates for varicocele repair (5). Many guidelines consider a testicular volume difference of more than 20% as an indication for surgery (6).

In a study conducted on fifty-seven children, it was found that a volume difference of 10-20% between the right and left testes was associated with a total motile sperm count below normal in 11% of cases. When the volume difference exceeded 20%, the total motile sperm count was found to be below normal in 59% of the cases (7). The literature suggests that testicular dysfunction can be detected long before the onset of testicular asymmetry (8). However, due

to the difficulties of semen analysis in pediatric patients, evaluation of testicular volumes becomes very important. In our study, decreased testicular volumes were used as a criterion to decide on surgery.

A statistically significant difference was found when the age at surgery was compared $p < 0.001$ (Table 1). The mean age of the patients was 14.2 years in pediatric urology and 17.1 years in the urology clinic. The difference was thought to be related to the patient group referred to the clinics. While adolescent and adult patients were referred to the urology clinic, pediatric and adolescent patients were referred to pediatric urology.

In adult infertile patients, microsurgery using an inguinal or subinguinal approach has reported high success rates and low morbidity despite relatively long operative times (9,10). Among pediatric urologists, laparoscopic approaches are preferred in 38% of cases (11). This preference may be due to the familiarity and comfort of the team with the technique (2). In our study, the laparoscopic approach was preferred in the pediatric urology

clinic, whereas microsurgical procedure was preferred in the urology clinic. The mean duration of laparoscopic procedures was 24.9 minutes (range: 20-35), while microsurgical procedures lasted 40.5 minutes (range: 30-50).

Student's t-test showed a significant difference of $p < 0.001$ (Table 1). The longer duration of open surgery may be attributed to the use of a microscope (12).

The varicocele recurrence rate after surgical repair varies between 1% and 45% depending on the procedure and the use of magnification. Venography has identified recurrent varicoceles arising from collateral periaarterial, parallel inguinal, midretroperitoneal, gubernacular, and trans-scrotal veins (13).

In a study published in 2016 involving adult patients who underwent varicocelectomy with subinguinal and high inguinal microsurgery, total recurrence and hydrocele rates 24 months after surgery was reported as 0% and 1.3%, respectively (12). In our study, recurrence was observed in 2 of 30 patients who underwent microsurgery. These patients were followed up closely because they did not have reoperation complaints.

Laparoscopic application of the Palomo technique has a success rate of 98-99 % but is accompanied by a hydrocele rate ranging from 12-23 % (14). In contrast, studies report a recurrence incidence in adolescent varicocele ranging from 0-31% for open varicocelectomy and 0-8% for the laparoscopic technique. When the laparoscopic technique is performed with the preservation of lymphatics, recurrence rates have been reported to be 0-2% and hydrocele rate has been reported as 14% in patients whose lymphatics are not preserved (15).

In our study, only one patient required reoperation after laparoscopic varicocelectomy and mild hydrocele was observed in one patient. However, no hydrocele was detected in the microsurgery group. No significant difference was found between the two groups.

An analysis of 278 varicocelectomy operations ranging in age from 8 to 40 years revealed that after subinguinal microsurgical varicocelectomy, 88% of cases had complete relief of pain complaints and 5% had partial relief (16). In another 2017 study, it was reported that approximately 90% of patients with

painful varicocele experienced symptomatic relief after varicocele repair (17). A meta-analysis of twelve studies concluded that the subinguinal approach with microsurgical technique is more effective in pain relief. Although blunt pain relief performed better than sharp pain relief, no significant relationship was found between varicocele severity and pain relief (18).

In our study, although scrotal pain was the most common complaint, persistent pain was observed in 4 of 19 patients who underwent LV during postoperative outpatient clinic controls. In the SV group, persistent pain was found in one patient.

When the length of hospital stay of the patients was evaluated, a significant difference of $p < 0.004$ was found between the two groups. This was thought to be related to the procedures of the clinic regarding the follow-up periods.

The meta-analysis of the twelve RCTs revealed that varicocele treatment improved testicular volume (mean difference 1.52 ml, 95% CI 0.73-2.31) and increased total sperm concentration (mean difference 25.54, 95% CI 12.84-38.25) when compared with observation. Lymphatic sparing surgery significantly decreased hydrocele rates ($p=0.02$) and the OR was 0.08 (95% CI 0.01, 0.67). Due to the lack of RCTs, it was not possible to identify a surgical technique as being superior to the others. It remains unclear whether open surgery or laparoscopy is more successful for varicocele treatment (OR ranged from 0.13 to 2.84) (19).

5. Conclusion

There is no clear consensus in the literature about the approach to adolescent varicocele. In our study, the data of patients who underwent LV and those who underwent microsurgical SV were compared in terms of age, pain status, operation time, hospital stay, postoperative pain, and complications. While a significant difference was observed in favor of the laparoscopic varicocelectomy group in terms of operation time, no significant difference was found in terms of recurrence frequency and complications. In our study, we found that LV may be a more effective treatment in terms of anesthesia time. Both methods may be preferred according to the experience and knowledge of the surgeon. More case reports are needed to determine which management is best.

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