Objective: To present the surgical technique of laparoscopic ligation of spermatic vein in the treatment of varicocele as well as the results of this procedure.

Material and methods: The study was conducted at the Clinic of Urology, Clinical Centre of Serbia, during the seventeen months, from November 2012 till March of 2014. During this time, the thirteen patients underwent laparoscopic ligation of spermatic vein. Including factors for this type of surgical treatment were clinically manifest varicocele and/or bad finding of semen.

Results: During the seventeen months, thirteen patients underwent laparoscopic spermatic vein ligation. The youngest patient was 21 years old, while the oldest patient was 38 years old. The median was 28.46 years. 6 patients had varicocele Gr III, and with 7 patients we verified varicocele Gr II. The duration of surgery ranged from 15 to 70 minutes, with a median of 35.46 minutes. The amount of gas that was insufflated during surgery ranged from 14.1 l to 45 l, with a median of 23:32 litters. Three patients underwent laparoscopic ligation of spermatic vein with preservation of spermatic artery. Interruptions in which underwent preservation of artery lasted longer (median 60 minutes) than it was the case in the group of patients without preservation (the median 28.1 minutes).

Conclusion: Laparoscopic ligation of spermatic veins is a safe, minimally invasive, rapid and effective procedure. The level of postoperative complications is minimal learning curve fast and patient discomfort is minimized. The procedure is the financial cost effective, especially compared with the open surgical procedure.

Key words: varicocele, laparoscopy, laparoscopic ligation of spermatic veins, Valsalva maneuver, Tanner grading, Doppler ultrasound.

INTRODUCTION:

Varicocele by definition implied any abnormal dilation of spermatic veins within the spermatic cord of pampiniform plexus. Varicocele is often encountered in normal men, and is of often one of the major risk factors for adult male infertility.

Although it imply as congenital lesions, varicocele is rarely diagnosed before adolescence, and the frequency is directly proportional to age, type of diagnostic method, as well as Tanner stage. It is settled that varicocele lesions were mainly reserved for left hemiscrotum. Recent studies indicate that the varicocele occurs bilaterally in up to 7% to 10% of cases. The introduction of Doppler ultrasonography in the diagnosis of varicocele percentage bilateral varicocele was raised from 7% to 17% of cases. Major etiological factor for varicocele are a genetic predisposition, body habitus and/or venous abnormalities.

In Serbia, there is still absence of a program for the early detection of varicocele. Most of varicocele is detected accidentally, while in a minority of cases diagnosis is established on the base of medical history information, scrotal discomfort and edema of left hemiscrotum. Patients report pain sensations in the scrotum from 2% to 11% of the cases. The affected testicle is softer in most cases. Also it was noticed the geographic predisposition to the varices of pampiniform plexus. In rare cases, the existence of varicocele was detected after rupture pampiniform plexus in sport traumatism. At physical examination of the scrotum varicocele is manifested as a scrotal swelling with positive palpable findings of thickened spermatic cord, both in peace and during performing Valsalva maneuver.

Standard grading implied three degrees of varicocele:

- in the first degree varicocele is palpable only when performing Valsalva maneuver,
- the second level implied palpable but not visible enlargement of pampiniform plexus, while
- the third degree implied not only palpable but also clear visible varicocele.
Additional diagnostic assistance is a color Doppler ultrasound. During this diagnostic modality, attention is paid to the diameter of the spermatic vein, as well as the presence of venous reflux. In support of the existence of varicocele speak facts of the diameter of spermatic veins greater than 3 mm, as well as verification of venous reflux. A combination of these two parameters highly speaks in favor of manifest varicocele. Color Doppler ultrasound verified a high flow rate greater than 38 cm/s in conjunction with the high testicular asymmetry, also indicates the existence of significant varicocele. Both sides measurement of volume and dimensions (performed with orchidometers) of the testis is an optional diagnostic procedure (Tanner grading).

It is an indisputable fact of causal connection between varicocele with testicular growth, disturbance of spermatogenesis and infertility. Connection stems from the prolonged elevation of scrotal temperature, which is thought to be the primary etiological substrate. Adequate therapeutic modality for the treatment of varicocele is conducted primarily on the basis of the presence and assess the risk factors that lead to reduced fertility.

As a therapeutic approach, strict monitoring of patients is still one of the major modality, in the most adult varicocele. This modality is the treatment of choice for patients with mild symptoms and normal spermogram. Main indications for surgical treatment of varicocele are as follows:

- unilateral (dextral>20%) or bilateral testicular hypotrophy,
- scrotal pain,
- abnormal spermogram and
- Tanner stage 5.

For reparation of varicocele in adult one can use a number of surgical procedures from an open to laparoscopic or microsurgical procedures. The most frequently used are: inguinal or subinguinal reconstruction, laparoscopic retroperitoneal or trans peritoneal procedures and modalities of like as venography approach. The most commonly used procedure is the microscopic subinguinal ligature of spermatic veins. This procedure requires the proper equipment (microscope and micro instruments). The second frequent one is an open surgical high ligation of spermatic veins by Paloma with/or without preservation of spermatic artery. Last years as a therapeutic modality states also a robot-guided ligature of spermatic veins.

The decision on the type of surgical procedure is left to the urologist himself depend to his preferences, experience, and level of complications (Table 1).

### TABLE 1

**RESULTS OF VARICOCELE RECONSTRUCTION IN ADULT POPULATION** (Campbell-Walsh Urology, 9th ed.)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Recurrence/persistence</th>
<th>Hydrocele</th>
<th>Testicular atrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open supra inguinal procedure (Paloma)</td>
<td>2%-4%</td>
<td>0%-30%</td>
<td>/</td>
</tr>
<tr>
<td>Laparoscopic procedure without arterial preservation</td>
<td>0%-9%</td>
<td>11%-32%</td>
<td>/</td>
</tr>
<tr>
<td>Laparoscopic procedure with arterial preservation</td>
<td>1%-7%</td>
<td>0%-4%</td>
<td>/</td>
</tr>
<tr>
<td>Microscopic sub inguinal procedure</td>
<td>0%-10%</td>
<td>0%-6%</td>
<td>rarely</td>
</tr>
<tr>
<td>Microscopic inguinal procedures</td>
<td>7%-33%</td>
<td>8%-14%</td>
<td>/</td>
</tr>
<tr>
<td>Sclerotic therapy</td>
<td>6%-35%</td>
<td>occasionally</td>
<td>rarely</td>
</tr>
</tbody>
</table>

**FIGURE 1.**

POSITION OF THE PATIENT ON THE OPERATING AREA

The study was conducted at the Clinic of Urology at Clinical Centre of Serbia, during the seventeen months, from November 2012 till March of 2014. During this time, thirteen patients underwent laparoscopic spermatic vein ligation. Including factors for this type of surgical treatment were clinically manifested varicocele and/or poor findings of spermogram. For clinical verification of varicocele we used medical history, previous history of the disease, if it was the case of treatment of infertility, physical palpable examination with Valsalva test, and ultrasound examination of the scrotum, with morphological findings in the testes and color Doppler sonography of blood flow. To each patient was during prehospital diagnosis made spermogram. Monitoring of patients was car-
SURGICAL TECHNIQUE:

Patients are admitted after being done in ambulatory conditions complete diagnostic evaluation both in terms of evaluating the degree of varicocele and the consequence of the sterility. History data obtained basic information about the level of discomfort (primarily subjective assessment of varicocele size and intensity of pain or discomfort). Also, urologist becomes familiar with the earlier history of infertility related to the couple and any eventual steps taken towards the establishment of pregnancy until the moment when the patient addressed for urological assistance. Physical examination obtained a clear insight into the appearance of the external genitalia, paying particular attention to the size of the both testes, or at the level of testicular discrepancy. Physical examination provides insight into the degree of pain at testicles. Also, palpable one verify the size of varicocele. Ultrasonography examination of the scrotum provides insight into the width of pampiniform plexus, and the degree of venous reflux when performing Valsalva test, as well as the diameter of the spermatic veins. Ultrasound allows morphological examination of the testicles bilaterally, with an assessment of discrepancies in the dimensions of the testicles in quantitative terms. If the cause of hospital admissions for treatment of varicose vein is infertility, or poor spermogram findings, the patient is required to do spermogram preoperatively with time of sexual abstinence for a period of three to five days. The initial findings will serve for postoperative comparison and evaluation of the therapeutic effect. Patients on admission need to do an internist examination with the permission to operation in GETA (general endotracheal anesthesia). Based on the pre hospital diagnostics all patients are divided into three groups, as noted in the introductory part. Patients were hospitalized for a total of three days. On the first day, the day of admission, the patient undergo to analysis of CBCS, biochemical analysis, analysis of bleeding time, and the urine. The patient is displayed before anesthesiologist with all the documents purpose of preparing for surgery. There is no special require for bowel preparation before intervention. On the second day the patient undergoes surgical treatment. After surgery he was converted to a general ward care. On the third day the patient has been sent home to recover. Some studies describe laparoscopic ligation of spermatic veins in the ambulance conditions in the form of one-day surgery. On the day of surgery, the patient is administered with parenteral antibiotic, usually a third-generation cephalosporin, which are then continued in the next five days in the form of oral administration.

The setting of the patient immediately before the intervention. The patient is placed in supine position on the operating table in a completely horizontal position, lying on his back with his legs slightly spread.

Both operator and assistant are faced to the patient against the laparoscopic column and video output. Both operator and an assistant standing by the right side of the patient. Laparoscopic column is set to the left side of the patient opposite the operator and assistant. Nurse occupies a position lateral to the left of laparoscopic column with instruments table set just above the foot of the patient (Figure 1).

The instrumentarium (general):

- Scalpel;
- Two Alison grips;
- Surgical forceps;
- Scissors;
- Needle holder;
- Suture for Reconstruction list peritoneum, Vicryl 2/0;
- Suture for reconstruction of subcutaneous tissue (1/0);
• Suture for the reconstruction of the skin (3/0).

Ports:
• One 10 mm working port (metal port);
• One 11 mm optical port for the placement of the camera - plastic port;
• One 5-mm working plastic port;
• Reduction of 10 mm port;
• Bipolar cable A60003C;
• Monopolar cable A0357.

Laparoscopic instrumentarium:
• Monopolar scissors A64320A (WA608800C sleeve, handle WA60101C);
• Bipolar Maryland dissector WA6430C (sleeve WA60800C, handle WA60101C);
• Hem-o-lock medium size (L);
• Suction;
• Laparoscopic needle holder, Storz 26173KAF. All laparoscopic instruments are the Storz.

Description of the procedure. The patient is placed in supine position, with left hand placed away of body for anesthetic manipulation (iv. access and monitoring of vital parameters). The urinary catheter is not placed because of the short duration of the intervention because the measurement of fluid balance is not an important parameter.

The operative field is wide clean up and prepare for the intervention from the line xyphoid process to the scrotum. After that, the operative field is widely prepared including left hemiscrotum. This is necessary due to easier access to the left testicle so as to traction easily identified an intracorporal spermatic veins, and in order to perform massage of pampiniform plexus to evacuate the blood in the same way. Laparoscopic instrumentarium is prepare on the right side of the patient fixed by using clasps in order to be within easy reach of the operator in any moment of operation (Figure 2).

Via placement of the Veress needle the pneumoperitoneum is establish. The needle is placed 2 cm from the umbilicus, followed by the placement of the optical 11 mm trocars. The incision in the skin has to be 50% greater than the dimension of the trocar. After incision of the skin the dissociation of the subcutaneous adipose tissue is performed down to the level of the fascia. Then, with two Allis clamps fascia is to be comprise and the placement of Veress needle is next step. The Veress needle has two parts that are independently moved, the inner part of the needle is blunted at the top and is hollow, and the second one is external, sharpened structure for perforation. During placement of Veress needle one encounters the two barriers (the first is fascia and the second is peritoneum). Only after the second perforation it is reasonable to expect that the Veress needle is in the right place, in the lumen of the intra-abdominal space. The test is conducted in the way such as through the needle is injected 10 mL of physiological saline, which should be easy to enter, followed by the aspiration during which the fluid must not return to the syringe of the Veress needle. If the liquid is returned to the syringe, position of the needle tip is in the space between the fascia and the peritoneum.

If however, during aspiration through Veress needle an unclean brownish content appears, it is likely that during needle placement there was a bowel perforation and aspiration of intestinal contents. In this case, it is necessary to repeat the procedure to establishing pneumoperitoneum, followed by laparoscopic intestinal reconstruction or convert the operation 14. This strategy is also necessary during any other laparoscopic surgery when the bowel injury occurs while placement of Veress needle. After success-
Laparoscopic ligature of spermatic veins as a method of surgical management of varicocele (surgical technique)

Primary exploration allows the operator to orientate by identifying the internal inguinal ring and the position of spermatic vessels. At this point great assistance does gentle withdrawal of the left testicle which move spermatic vessels to simplify the identification. The patient in this point of operation sets to Trendelenburg position. This position allows easier elimination of blood from pampiniform plexus. After identifying the basic anatomical structures one can approach to deliberation of intestine for easy handling and access to the spermatic blood structures. Then, the incision of peritoneum can be made just above spermatic vessels with a length of 30 mm, as far as it is usually required for easy dissociation and subsequent placement of hem-o-lock clip. If the conditions require peritoneal incision can be longer. Then, the dissociation spermatic can be done. Identifying of the particular artery and spermatic vein or veins is next step. Vascular structures are dissociated with a length of 3-5 cm, taking care to avoid injury, as well as strict control of hemostasis of numerous nutritive blood vessels. With adequate deliberation of vascular structures one can approaches to placement of hem-o-lock clips ligating en-mass both venous structures and spermatic artery. At this level can be ligated spermatic artery without fear. Because of existing collateral vessels, in this case it will not occur the testicles ischemia. The placement of the two hem-o-lock clip is done to the spermatic vessels, after what the cutting can be done. Immediately prior to placement of hem-o-lock clips it is necessary to massage pampiniform plexus for blood evacuation. This maneuver reduces later post-operative pain in hemiscrotum that occur as a consequence of altered thrombosis of varicose plexus. The sample can be sent for histopathological analysis, but it is not standard practice. After ligation and resection of vascular structures one can approach to additional control of hemostasis and reconstruction of peritoneum with Vicryl 2/0 sutures. Placement of drain with this intervention is not necessary. Gas supply was stopped, the abdominal cavity was maximally discharged of gas and the ports was removed. Next step was reconstruction of the port openings by layers (Figure 4).

RESULTS:

During the seventeen months, as far as this modality of surgical treatment applied to the Clinic of Urology, Clinical Centre of Serbia, thirteen patients underwent laparoscopic spermatic vein ligature.

The youngest patient was 21 years old, while the oldest patient was 38 years old. Median was 28.46 years (Figure 1).

The duration of surgery ranged from 15 to 70 minutes, with a median of 35.46 minutes (Figure 2). Quantity of insufflated gas during surgery ranged from 14.1 liters to 45 liters, with a median of 23.32 liters (Figure 3).

All patients had either Gr II or Gr III clinical varicocele. 6 patients had varicocele Gr III, whereas 7 patients verified varicocele Gr II (Figure 4).

During the surgical procedure there was no intraoperative blood loss. None of the patients had a drain placed. Patients were hospitalized for three hospital days. Perioperative and postoperative pain is not registered. In two patients, there was appearance of a transient pain in the left hemiscrotum for up to three days.

Three patients underwent laparoscopic ligature of spermatic vein with preservation of spermatic artery, while the remaining ten patients underwent ligature of without preservation (Figure 5). Interventions with pres-
ervation of artery lasted longer (median 60 minutes) than was the case in the group of patients without preservation (the median 28.1 minutes). Only with one patient there was complicated reconstruction of spermatic veins. The main symptom was scrotal pain and discomfort. It was a tertiary operation, after patient underwent primary intervention with microsurgical Mar-Mar procedure, followed by secondary high inguinal ligature (Paloma). With this patient (28 years) it was a recurrent varicocele Gr III. The intervention lasted 30 minutes and did not include preserving spermatic artery. The quantity of CO2 was 20 liters. Postoperatively, the patient did not state the occurrence of pain in the left hemiscrotum. The control exam occurred two months after the intervention, spermogram was valid.

**DISCUSSION:**

Comparing with the results of similar studies, our preliminary experience with this procedure was pretty modest. Taking into consideration the age of patients, published experiences are quite similar to those to which we have faced. The mean age patients operated on in this manner are quite similar to those in comparative studies.

The degree of varicocele, duration of surgery, quantity of insufflated gas during surgery, intraoperative blood loss as well as a number of hospital days were also similar to comparative studies. Most of patient underwent procedure without arterial preservation, but similar as in other studies results were sufficient, and degree of scrotal pain was minimal.

**CONCLUSION:**

Laparoscopic ligature of spermatic vein is a safe, minimally invasive, rapid and effective procedures which is adequate substitute for microsurgical procedure which is limited with technical conditions of performance. The procedure requires a modest laparoscopic experience, level of postoperative complications is minimal, learning curve quick and patient discomfort is minimized. Led by modest experience, the intervention in near future may be reduced to a one-day intervention surgery. Last but not least, it is important to point out the economic aspect of the procedure; more cost effective, especially compared with open surgical ligation of spermatic vein (Paloma technique).

**SUMMARY**

Cilj rada: Prikazati hiruršku tehniku laparoskopske ligature vene spermatiske u lečenju varikoecele, kao i dosadašnje rezultate ove procedure.


Rezultati i diskusija: Tokom sedamnaest meseci, koliko se ovaj modalitet hirurškog lečenja primenjuje na Klinici za urologiju Kliničkog centra Srbije, trinaest pacijenata je podvrgnuto laparoskopskoj ligaturi spermatisne vene. Najmladiji pacijent je imao 21 godinu, dok je najstariji pacijent bio 38 godina star. Medijana je iznosila 28.46 godina. 6 pacijenata je imalo varikocelu Gr III, dok je kod 7 pacijenata verifikovana varikocela Gr II. Vreme trajanja operacije iznosilo je od 15 do 70 minuta, sa medijanom od 35.46 minuta. Količina insuffiranog gasa tokom hirurške intervencije iznosila je od 14.1 litara do 45 litara, sa medijanom od 23.32 litara. Kod tri pacijenta je učinjena laparoskopska ligatura spermatisne vene sa rezervacijom spermatisne arterije. Intervencije kod kojih je učinjena rezervacija arterije trajale su duže (medijana 60 minuta), nego što je to bio slučaj u grupi pacijenata bez rezervacije (medijana 28.1 minuta).

Zaključak: Laparoskopska ligatura spermatisne vene je sigurna, minimalno invazivna, brza i učinkovita procedura. Nivo postoperativnih komplikacija je minimalan, krivulja učenja brza a diskomfor pacijenata je sveden na minimum. Procedura je finansijski isplativija, naročito poredići se sa otvorenom hirurškom procedurom.

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