**Introduction**

One century ago, Alexis Carrel, a vascular surgeon, was awarded the Nobel Prize in medicine for his work in organ transplantation. In 1902, he claimed that organ transplantation was a mere clinical curiosity, but it might be of practical interest in the future. Nowadays, kidney transplantation has a practical significance and represents a treatment modality for patients with end-stage renal disease. During the last decade, the number of deceased donor kidney transplantsations has increased, especially in Europe and the United States. Spain is one of the leading countries with 48.2 transplantsations per million population, out of which 10.4% of living donor transplantsations [1]. There are at least 3 reasons for the increasing number of living donors: the scarcity of deceased organ donors, better outcomes with living donor transplants, and improved safety for organ donors. One-year deceased donor graft survival was found among 88.1% to 95%, while three-year survival ranged from 83.7% to 87.5%. One-year living donor graft survival was 93% – 98% and three-year graft survival was 83.7% to 94.3% [2]. In 1995, Lloyd Ratner and Louis Kavoussi performed the first laparoscopic donor nephrectomy (LDN) [3]. The aim of this paper is to present the laparoscopic living donor nephrectomy (LLDN) technique.

**Laparoscopic living donor left nephrectomy technique**

For a kidney transplant, usually the left kidney is taken, because the left renal vein is significantly longer compared to the contralateral vein, and therefore, the technique of the left LLDN is described in this paper. The surgical technique of the right kidney removal is similar, with differences in patient’s positioning and anatomical relations.

Before the live donor kidney removal, both patients (donor and recipient) undergo standard preo-
operative preparation. Prior to LLDN, a check up instruments, suction device, irrigator, insufflator, and electrocautery is recommended. This procedure should be performed using atraumatic instruments and bipolar electrocautery.

After the induction of general anesthesia, an urinary catheter is placed, as well as a nasogastric tube. Then the patient is placed on the operating table in the right lateral position at the angle of 45 degrees. The angle of 45 degrees is obtained by placing a pillow behind the patient’s back. The patient is fixed to the operating table with two solid wide bands. One band is placed over the chest and the other over the pelvis of the patient.

The procedure of kidney removal begins after standard preparation of the surgical field. Mini-laparotomy is performed on the edge of the left rectus abdominis muscle (Hasson technique) in the level of the umbilicus. A 12 mm trocar is placed through the mini-laparotomy. This trocar is used for the creation of pneumoperitoneum; \( \text{CO}_2 \) is insufflated into the abdominal cavity until 12 mm Hg pressure is achieved. Pneumoperitoneum can also be created by a blind method using the Veress needle. Thereafter, a camera is introduced through this trocar for inspection of the peritoneal cavity and controlled placement of two additional trocars. A 10 mm trocar is placed between the umbilicus and the iliac crest, and a 5 mm trocar is placed in the middle of the left subcostal line (Figure 1).

The first step involves opening the parietal peritoneum along the line of Toldt from splenic flexure of the colon to the iliac vessels (Figure 2). The descending colon is mobilized and displaced medially. The left ureter is dissected from the level of iliac blood vessels up to the renal pelvis. The ureter should be dissected cautiously with the surrounding fat tissue to preserve blood supply (Figure 3). The next step is the dissection of renal blood vessels. The renal vein is dissected first. The gonadal and adrenal veins should be clipped and transected to assure adequate length of the left renal vein (Figure 4). Thereafter, the left renal artery should be dissected up to the aorta.

Subsequently, dissection of the left kidney from the surrounding fat tissue should be started at the lower pole. This step is completed with upper pole dissection, especially taking care during the separation of the left adrenal gland. Following complete dissection of the left kidney, blood vessels and the ureter, mannitol, furosemide and heparin 5000 units are administered intravenously.

The ureter is clipped at the level of iliac vessels and transected above the clip. The left renal artery is dissected with endoscopic gastrointestinal anastomosis (endo-GIA) stapler, and the left renal vein laterally (Figure 5).

Six to eight centimetres long laparotomy is made on the front abdominal wall and the kidney is removed. The wound is closed by layers using polydioxanone 1 surgical sutures.

Figure 1. Patient position on operative table and trocar placement [2]

Slika 1. Položaj pacijenta na operativnom stolu i postavljanje trokara [2]

Figure 2. Incision of parietal peritoneum along the line of Toldt [2]

Slika 2. Incizija parijetalnog peritoneuma duž Toldtovine linije [2]
Following the wound closure, pneumoperitoneum is re-established and hemostasis is controlled. After the drainage of the renal bed, trocars are removed and port sites are closed with surgical sutures.

Results

To date, only one laparoscopic donor nephrectomy was done at the Clinic of Urology in Novi Sad, with a functional graft 3 years after transplantation. Obviously, this procedure is feasible in our hands, and hopefully, improvement of financial resources will enable more procedures in our institution.

Discussion

In 2005, the United Network for Organ Sharing reported that 83% of all living donor nephrectomies in the United States were performed laparoscopically. In 27 European countries, 65% of donor nephrectomies were performed by laparoscopic approach [1, 4].

Following the first 175 laparoscopic donor nephrectomies, Chan et al. reported that this procedure was associated with shorter hospital stay, and less postoperative analgesic requirements, as well as lower complication rates compared to the open living donor nephrectomy. The average blood loss in this group was 220 ml, and the average operating time was 220 minutes. The donor returned to work in less than two weeks [5].

Tooher et al. reported 0 – 13.3% conversion rate for LLDN. The reasons for conversion were intraoperative hemorrhage due to vascular injuries or lesion of the spleen, difficult kidney exposure due to donor obesity, vascular stapler malfunction and loss of pneumoperitoneum [6].

Chan et al. reported an overall complication rate of 11%. Major complications were found in 7 (4%) patients: postoperative retroperitoneal bleeding requiring transfusion (1.14%), GIA malfunction (0.6%), epigastric artery injury (0.6%), bowel injury (0.6%), pneumonia (0.6%), and incisional hernia (0.6%). Minor complications were noted in 12 patients (6.9%): transient thigh paresthesia (4%), superficial wound infections (2.83%), urinary tract infections (1.14%), mucus plug/atelectasis (0.6%), ileus (0.6%) and epididymitis (0.6%). The authors reported 3 (1.7%) conversions [5].

Burgas Revilla reported results of 417 cases of LLDN from 4 European transplantation centers [7]. The overall complications rate was 7.7%; 1.6% were severe and 6.1% minor complications. Severe complications included: intestinal injuries, hemorrhage, peritonitis, and hernia, and minor: urinary retention, urinary infection, wound infection, hematoma, testicular pain, and atelectasis. Harper et al. reported 5.4% of complications in 750 cases [8]. The mortality rate related to LDN varied from 0.03% to 0.06%, but generally, this procedure is considered to be safe [9].

Conclusion

Laparoscopic living donor nephrectomy is a feasible procedure, but most of the authors agree that it should be performed by experienced laparoscopic surgeons. This method enables shorter hospitalization, less analgesics consumption, better cosmetic result, and earlier return to work. Laparoscopic living donor nephrectomy is a safe method associated with a low complication rate.

References