

Pure retroperitoneoscopic donor nephrectomy in duplication of inferior vena cava: A series of four cases

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Abstract

Aim: Complex vascular anatomy poses a major challenge to the donor surgeon. Here, we have described the technical nuances in retroperitoneoscopic living donor nephrectomy for the left kidney in the situations of a rare vascular anomaly of duplication of inferior vena.

Materials and Methods: Between September 2005 and June 2016, 1460 retroperitoneoscopic living donor nephrectomy were carried out in single surgical unit of our institution. Out of these four donors were found to have duplication of inferior vena cava (IVC). We retrospectively analyzed the prospectively collected data of these donors and studied the operative details for managing the duplicated limb of the IVC.

Results: The mean age of the donors was 42.5 (range 30–54) years. Mean body mass index was 26.9 (range 25.2–28.6) kg/m². Mean operative time (defined as between giving skin incision to the skin closure [O. T]), was 230 (range 185–310 min). Mean Warm ischemia time (defined from clamping of the renal artery to the starting of the cold HTK perfusion, [WIT]) was 136 s (range 105–178 s). In two cases, the renal vein could be controlled distal to the duplicated limb. In one case, the duplicated limb was clipped while in another a stapler was used to take a cuff of IVC.

Conclusion: Retroperitoneoscopic donor nephrectomy can be performed safely in cases of duplication of IVC. Preoperative computerized tomography angiography with vascular reconstruction and surgical expertise is desirable in carrying out the procedure.

Keywords: Donor nephrectomy, duplication of inferior vena cava, laparoscopy, retroperitoneoscopy, transplantation

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INTRODUCTION

Laparoscopic donor nephrectomy has become the standard of surgery for the procurement of the kidneys for transplantation. Retroperitoneoscopic donor

nephrectomy (RDN) has the added advantage of early vascular pedicle visualization and avoidance of any intraperitoneal organ injury besides having shorter hospitalization, faster recovery, and less analgesic

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requirement in the postoperative period.^[1,2] Complex vascular anatomy poses a major challenge to the donor surgeon during RDN. However, with the availability of better imaging modality and surgical expertise RDN can also be extended to donors having complex vascular anatomy.^[3-6]

Here, we describe a series of four RDN performed in cases of duplication of inferior vena cava (IVC). The purpose of this paper is to describe the technical nuances for retroperitoneoscopic living donor nephrectomy for the left kidney for a rare vascular anomaly of duplication of IVC.

MATERIALS AND METHODS

Between September 2005 and June 2016, 1460 retroperitoneoscopic living donor nephrectomy was carried out in a single surgical unit of our institution. Out of these four donors were found to have duplication of IVC. We retrospectively analyzed the prospectively collected data of these donors.

Basic workup

The suitability of the donor was evaluated by an interdisciplinary team comprising urologist, nephrologists, anesthetist, transplant coordinator, and a psychologist.

After a complete history, the physical examination required laboratory investigations and a basic radiological workup in the form of sonography of the abdomen and X-ray kidney, ureter, and bladder donors were subjected to diethylene triamine pentaacetic acid renal scan for the functional assessment and computerized tomography (CT) renal angiography for the anatomical assessment [Figure 1].

The laterality of the surgery was decided on the basis that the better kidney remains with the donor. If the difference in function is <10% the kidney having simple vascular anatomy is preferred however if the difference in the function is >10% then the kidney having lesser function is preferred irrespective of the status of renal vascular anatomy.

Surgical technique

At the outset in RDN instruments of open surgery are made available before the commencement of the procedure so that if a need arises at all, the open conversion can be done rapidly.

After general anesthesia and urethral catheterisation, the donor is secured in right lateral decubitus position and the table is flexed to open the space between the ribcage and the iliac crest. A 1.5 cm incision is given in

the midaxillary line below the rib. Retroperitoneum is entered by separating the muscle fibers and incising the lumbodorsal fascia. Retroperitoneum is dissected gently in the cranial and posterior direction with the help of peanut dissector. A double gloved finger balloon is used to create the retroperitoneal space. Ten-millimeter laparoscopic port is placed, brought near just inside the edge of lumbodorsal fascia and fixed. Pneumoretroperitoneum is created with the pressure at 15 mmHg. Under vision, additional 10 mm and 5 mm Ports are placed at renal angle and anterior axillary line, respectively. Gerota's fascia over the psoas muscle is incised with the hook electrocautery, and the incision is extended caudally beyond the common iliac artery bifurcation and cranially up to the upper pole of the kidney. The ureter is identified with its characteristic peristalsis. The ureter gonadal complex is dissected together. As the flimsy layer of loose areolar tissue between the psoas and perirenal fat is dissected the duplicated limb of the IVC is visualized with its blue color and characteristic wavy venous pulsation. As we move cranially and medially, the hilum is reached where the pulsation of renal artery is observed. Lumbar vein complex is found in the vicinity of renal artery. It is dissected and is preserved. The fibrofatty tissue surrounding the renal artery is dissected and freed from the aortorenal junction. The duplicated limb drains into the left renal vein. Intervening lymphatic tissue between the artery and vein is released with the help of hook electrocautery and LigaSure. The posterior pannus of the perirenal fat is excised from the upper to lower pole. Anteriorly, the flimsy loose areolar tissue between the renal capsule and the perirenal fat is freed with hook electrocautery and the kidney is mobilized. The upper pole is freed completely and is retracted inferiorly to visualize the renal artery from anterior aspect. The adrenal gland is identified anterior to the artery with its distinct lemon yellow color. It is freed from the fat. The adrenal vein is identified. With it as a guide, the anterior surface of the renal vein is dissected. Adrenal vein is controlled with (LigaSure®). Residual lymphatic tissue between the renal artery and the renal vein is dissected and severed with LigaSure. The lower pole of the kidney is mobilized and the insertion of the gonadal vein is seen with the renal vein. The gonadal vein is controlled with LigaSure. The Ureter is clipped distally over the bifurcation of common iliac artery and cut. A modified Gibson incision of 7–8 cm is given for retrieval. External oblique muscle and its aponeurosis are incised. Internal oblique and transversus abdominis muscle fibers are split up to fascia transversalis. The artery is divided with endoshears distally after applying two Hem-o-lok clips (Weck Closure Systems, Research Triangle Park, NC, USA) on it. The renal vein is divided distally after applying two Hem-o-lok

clips. If there is difficulty in dissecting the upper edge of the renal vein then the duplicated limb of the IVC can be clipped and cut [Figure 2]. In this scenario, the lumbar and gonadal veins are preserved. Lubricated palm of the hand is introduced through the retrieval incision, and the kidney is glided over psoas and brought out. The excised fat is removed. Kidney is perfused with cold HTK solution in ice slush. The retrieval wound is closed in layers using vicryl 2-0 (Polyglactin 910). The fossa is inspected for any minor bleeding or lymphatic ooze which is taken care of. Skin is closed by absorbable suture.

RESULTS

Table 1 shows the donor variables. The mean age of the donors was 42.5 (range 30–54) years. Mean body mass index was 26.9 (range 25.2–28.6) kg/m². Mean operative time (defined as between giving skin incision to the skin closure [O. T]), was 230 (range 185–310) min). Mean warm ischemia time (defined from clamping of the renal artery to the starting of the cold HTK perfusion, [WIT]) was 136 s (range 105–178 s). In two cases, the renal vein was controlled distal to the duplicated limb towards the kidney. In one case, the IVC cuff was taken by the help of Endo TA stapler. In another case, the duplicated limb of the IVC was clipped and cut just at its confluence with the renal vein. During the bench surgery in two cases where the renal vein was clipped distally toward kidney, the vein required hilar

dissection to gain additional length. The renal vein required repair after removal of clip where the duplicated limb of IVC was clipped. After the bench surgery, the successful renal transplantation was performed in all the recipients. In two recipients who received kidneys with relatively short renal vein the internal iliac vein was tied off to make the external iliac vein more superficial. All the donors had smooth postoperative recovery and were discharged on the 3rd postoperative day. One of the donors developed left lower limb edema which disappeared over a period of few weeks. All the recipients had good urine output with decreasing serum creatinine in the early postoperative period. At 1 month of follow-up, mean serum creatinine was 1.3 (range 1.2–1.5) mg% in the recipients.

DISCUSSION

Duplication of IVC is a rare venous anomaly with an incidence of 0.5%–3%.^[7] It occurs due to the persistence of supracardinal veins. Retroperitoneoscopic management of such cases is rarely described in the literature.^[8,9] We feel that retroperitoneoscopic is advantageous in this scenario as the duplicated limb is visualized early and completely.

The challenges which were encountered are (a) thick lymphatics are found around the duplicated limb of IVC which requires gentle and sharp dissection. Larger lymphatics which ooze lymph require clipping to prevent retroperitoneal lymph collection. Gentle dissection at the



Figure 1: Venous phase of computerized tomography angiography showing duplication of inferior vena cava

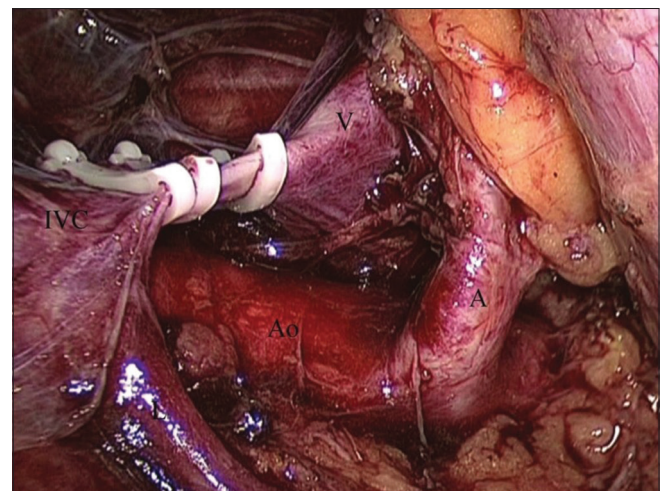


Figure 2: Clipped duplicated limb

Table 1: Data of donors with duplication of inferior vena cava

Age (years)	Sex (male/female)	BMI (kg/m ²)	Renal artery	OT (min)	WIT (s)	Blood loss (mL)
30	Female	26.8	R2, L1	185	105	25
38	Female	27.2	R1, L1	215	110	20
54	Male	28.6	R1, L1	310	178	50
48	Female	25.2	R2, L1	210	152	50

BMI: Body mass index, WIT: Warm ischemia time, OT: Operative time

level of IVC is desirable to prevent venous thrombosis. (b) The superior edge of the renal vein requires meticulous dissection for the proper application of the clip. The dissection of the renal vein from posterior aspect results in significant stretch on the renal artery. To avoid it, once the duplicated limb of IVC and the renal artery are dissected from the posterior aspect, the kidney is mobilized from the anterior aspect, and the upper pole of the kidney is made free. This allows to have an access to the adrenal vein which acts as a guide to reach the superior edge of the renal vein and ensure for the proper application of clip. Besides, the junction of the renal vein with IVC is very close to the concavity of the hilum, and extra care is taken during dissection at this point to avoid any injury to the renal vein or artery.

(c) When a need arises to sacrifice the duplicated limb of IVC, the IVC is compressed, and the congestion of the venacava distal to compression and hemodynamic instability is observed. If none of these occur then only the duplicated limb can be clipped. The gonadal and the lumbar veins are preserved in this scenario for the better venous drainage.

The kidneys were retrieved successfully in all the cases without any complication. On the recipient side, two cases required tying off of the internal iliac vein to facilitate in venous anastomosis. The recipient surgeon did not encounter any problem in performing the venous anastomosis.

Pelvic girdle congestion and hydrocele have been described as complications in the literature when dealing with such cases.^[10,11] In our series, one of the donors had mild left lower limb edema in the postoperative period which settled over a period of few weeks. The edema probably disappeared because of the development of new venous collaterals.

CONCLUSION

RDN can be safely performed in cases having duplicated IVC with proper care and technique. Preoperative imaging

by CT angiography with venous reconstruction should be contemplated to plan and perform safe surgery in these donors.

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Conflicts of interest

There are no conflicts of interest.

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