

Single Case

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# Preservation of Peritoneal Dialysis in Liver Surgery with Robotic Technique: A Case Report

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## Keywords

Peritoneal dialysis · Robotic surgery · Catheter preservation

## Abstract

**Introduction:** During the last year, the features of peritoneal dialysis patients have changed, and the cases in which there is a need to perform abdominal surgery are growing. Reports of abdominal surgery in patients who are able to continue peritoneal dialysis are increasing. The minimally invasive techniques represent the preferred and safest approach. Such techniques are associated with reduced hospitalization time, less invasiveness, peritoneal integrity preservation, and reduced intra-abdominal inflammation due to regenerative processes. **Case Presentation:** In this case report, we present a case of major abdominal surgery, in the form of hepatic metastasectomy, performed with the robotic-assisted technique, which allowed catheter and intracorporeal dialysis preservation. The patient showed a strong determination to continue with peritoneal dialysis as long as possible. During the switch to hemodialysis, he performed prophylactic antibiotic therapy to preserve the peritoneal catheter, and the patient was instructed to have a reduced water intake, avoiding excessive ultrafiltration potentially deteriorating the residual renal function. Special care was also taken to avoid any nephrotoxic drug. The peritoneal treatment was restarted after 3 weeks with low volume exchange for the first 10 days, and the pre-surgery dialysis volumes were then re-established. After surgery, the patient showed adequate clearance of solutes and ultrafiltration similar to the preoperative period. The patient did not encounter any wound complications. **Conclusion:** Robotic surgery represents a further aid in peritoneal dialysis preservation after abdominal surgery. A detailed communication with the patient before performing this kind of procedure and a strong will to preserve the peritoneal method are essential.

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## Introduction

Over the years, the features of peritoneal dialysis patients have changed, and the presence of comorbidities has significantly increased. The number of cases in which there is a need to perform abdominal surgery is growing [1, 2]. Such surgical procedures have increased concerns about catheter preservation and the peritoneal technique. Reports regarding continuation of the peritoneal method after abdominal surgery experiences have been already published with encouraging results [3]. The majority of papers discussed classical and laparoscopic techniques, with only one case reporting robotic technique in the gynecological field [4]. Moreover, such studies often include very small sample size, and then there are no related shared guidelines regarding this topic. Herein, we present a case of major abdominal surgery in the form of hepatic metastasectomy, performed with the robotic-assisted technique, which allowed catheter and intracorporeal dialysis preservation.

## Case Report

The patient was a 65-year-old male, on automated peritoneal dialysis for 14 months. Fifteen days before the start of automated peritoneal dialysis (break-in period), the catheter with a straight intercuff segment, 2 cuffs, and straight tips was placed with an open surgical technique through a left periumbilical incision. A mini-laparotomy was performed under local anesthesia. A purse-string suture was placed around the peritoneal opening. A craniocaudal suture of the rectal muscle was performed to let the catheter tip remain oriented toward the pelvis. The exit site was located approximately 4 cm beyond the superficial cuff.

The patient's medical history showed hypertension and dyslipidemia on drug treatment. The underlying renal disease was nephroangiosclerosis. The patient had a residual kidney function with an eGFR of 4 mL/min/1.73 m<sup>2</sup> and a diuresis of about 1,500 mL per day. He had an active life and was in good clinical condition. During a colonoscopy performed for the transplant waiting list, he was diagnosed with a polypoid lesion in the descending colon. The patient underwent endoscopic polypectomy, and the pathological analysis showed evidence of malignant transformation.

The staging CT-scan and MRI-scan of the liver showed two hepatic lesions (about 2 cm each in segments 8 and 7), which, on histological examination, turned out to be metastatic bowel adenocarcinoma. The following Positron Emission Tomography showed no areas of hyperaccumulation outside the liver.

The case was discussed at the tumor board, with decision to perform a "liver first approach" in the form of metastasectomy with robotic technique. The patient showed a strong determination to continue with peritoneal dialysis as long as possible. For this reason, the day before surgery, he underwent the placement of a central venous catheter in the right jugular vein for a temporary shift to hemodialysis.

The liver resection was performed with the DaVinci Xi robotic system. This platform, using articulated surgical instruments, allows performing technically demanding procedures with a minimally invasive approach. The surgeon controls the procedures from a console with 3D-magnified view. A cart is placed bedside with four arms connected to the surgical devices. The patient was placed on the operating table with legs apart, in the reverse Trendelenburg position, and with a left-side tilt. After sterile draping, the pneumoperitoneum was established. Then, five ports were inserted in the upper abdomen (four robotic and one assistant). After docking and targeting the robot, the whole liver was inspected with intraoperative ultrasound (US), and the two metastases in the right lobe were confirmed. Under US-imaging guidance, two separate wedge resections in segments 8 and 7 were performed. The vascular

inflow to the liver was controlled with intermittent Pringle maneuvers, and the hemostasis during parenchymal transection was obtained with bipolar and radiofrequency instruments. The main vessels around the lesions were ligated with robotic clips and then divided. The procedure ended with the specimen removal through a mini-laparotomy and the placement of a sub-hepatic drain. Blood loss was minimal, around 200 mL. During the entire procedure, the dialysis catheter was not touched and left in place in the pelvis.

After surgery, the patient was monitored for 24 h in intensive care unit and then transferred back to the surgical ward. The postoperative course was complicated by a hematoma along the transection line that was conservatively treated with associated antibiotic prophylaxis (cephalosporin of third generation). The collection was monitored with US scans, and it spontaneously reabsorbed after 3 weeks. No further complications were observed.

Forty-eight hours after surgery, the “Luer-lock” and “Transfer-set” of the peritoneal catheter were replaced, performing a flushing of the catheter, and an empirical “lock-therapy” was started with Vancomycin 20 mg ( $\frac{1}{4}$  fl of 80 mg in 5 mL of saline). Peritoneal flushing and lock therapy were performed weekly. During this period, the patient was educated to have a reduced water intake, avoiding excessive ultrafiltration potentially deteriorating the residual renal function. Special care was also taken to avoid any nephrotoxic drug.

After 3 weeks, it was decided to resume the peritoneal technique. The start of the peritoneal treatment was delayed by a week as a precaution due to the presence of the hematoma. On the day scheduled to restart the peritoneal dialysis, the catheter showed a malfunction, probably induced by the presence of fibrin around the tube. A single dose of urokinase (100,000 IU diluted in 5 mL saline) into the obstructed catheter restored the flow without causing complications. Urokinase was left in the Tenckhoff catheter for 2 h.

The peritoneal treatment was restarted with low volume exchange (nightly cyclical treatments with 8 exchanges of 1,300 mL over 8 h). The pre-surgery dialysis volumes were re-established after 10 days of regular sessions (5 exchanges of 2,000 mL over 8 h).

After 12 months from surgery, the dialysis method runs normally, without any sign of infection or mechanical complications. Peritoneal dialysis adequacy estimated by urea kinetics and total weekly creatinine clearance are comparable to those prior to liver resection, and comply with the international purification standards recommended by the guidelines. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material (for all online suppl. material, see <https://doi.org/10.1159/000536139>).

## Discussion

We reported a successful case of preservation of peritoneal dialysis catheter after liver resection with full robotic technique. This minimally invasive surgical procedure allowed the preservation of the integrity of the peritoneal membrane and the reduction of the complications associated with an open approach. After surgery, the patient showed adequate clearance of solutes and ultrafiltration similar to the preoperative period.

The minimally invasive techniques represent the preferred and safest approach. Such techniques are associated with reduced hospitalization time, less invasiveness, peritoneal integrity preservation, and reduced intra-abdominal inflammation due to regenerative processes. Moreover, laparoscopic and robotic surgery decreases the risk of postoperative leakage of dialysis fluid. Peritoneal dialysis is usually restarted about 4–6 weeks after surgery, although there is a lack of shared indications among the community [5]. To our knowledge, there is only one report reporting the use of robotic surgery in this field, describing a case of uninterrupted peritoneal dialysis after robotic-assisted total laparoscopic hysterectomy [4].

In our case report, antibiotic prophylaxis and “lock-therapy” proved to be effective in avoiding contamination of the catheter. However, there is no clear scientific evidence in the literature confirming this approach. Moreover, the initial usage of low volumes prevented any risk of leakage and discomfort for the patient. When there is evidence of catheter obstruction, the injection of urokinase seems to be effective, releasing the blockage without complications. To minimize the risk of catheter clotting, regular catheter irrigation with heparinized dialyzate in the postoperative period should be evaluated, also considering the risks linked to possible bleeding. In the present case, the patient underwent a partial resection of the liver, which is a procedure associated with a known risk of hemorrhage also during the postoperative period, potentially leading to invasive treatment or reoperation. For this reason, we decided not to irrigate regularly the catheter with heparin. Lastly, it is essential to implement all the strategies to preserve residual renal function when shifting to hemodialysis.

## Conclusion

Robotic surgery represents a further aid in peritoneal dialysis preservation after abdominal surgery. Detailed communication with the patient before performing this kind of procedure and a strong will to preserve the peritoneal method are essential. Clinical trials or studies should be conducted in larger cohorts to implement shared guidelines on surgical techniques and perioperative management.

## Statement of Ethics

No animals were involved in the study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This retrospective review of patient data did not require ethical approval in accordance with local/national guidelines. All data generated or analyzed during this study are included in this article. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

## Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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## Author Contributions

P.R. and S.D. were responsible for designing the case report and contributed to writing the report. S.G., A.Z., and V.M. contributed to screening potentially eligible studies, updating reference lists, and writing the report. M.S., A.D.P., and M.N. contributed to data extraction and provided feedback on the report.

## Data Availability Statement

All data generated or analyzed during this study are included in this article and its online supplementary material files. Further inquiries can be directed to the corresponding author.

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