



Oncology

Minimally invasive management of urinary fistula following robot-assisted partial nephrectomy: Case report

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ABSTRACT

Urinary fistulas are a known complication that can occur after partial nephrectomy, potentially causing considerable morbidity if not properly treated. The present study examines the case of a 71-year-old male patient who developed a urinary fistula six months following a robot-assisted partial nephrectomy. Initial efforts to address the fistula through the placement of a double pigtail ureteral stent proved ineffective. Subsequent interventional radiology procedures successfully achieved fistula closure by administering adhesive fibrin directly within the fistulous tract. This case highlights the importance of a multidisciplinary approach in handling post-surgical complications like urinary fistulas.

1. Introduction

Urinary fistulas represent a recognized complication following partial nephrectomy, leading to significant morbidity if not managed appropriately. The incidence of urinary fistulas after partial nephrectomy varies from 0.5 % to 17.4 %, depending on multiple factors.¹ Notably, the incidence is higher following open surgical approaches compared to laparoscopic or robotic techniques. Although this difference may be due to selection bias, as larger and more complex partial nephrectomies are usually done with an open approach,² laparoscopic and robotic surgery offer better visibility, greater precision, and more delicate tissue handling. Several risk factors significantly correlate with an increased likelihood of urinary fistula formation following partial nephrectomy. These factors include tumor size, endophytic nature, ischemia time, repair of the collecting system, renal nephrometry score, and proximity to the urinary collecting system. Tumor size, often indicative of advanced disease, has been consistently associated with a higher risk of urinary fistula formation due to its potential to compromise the integrity of surrounding tissues and structures. Similarly, the endophytic growth pattern of tumors, characterized by their inward growth into the renal parenchyma, poses challenges during surgical

excision, increasing the risk of inadvertent injury to the urinary collecting system. Furthermore, the meticulous repair of the collecting system following tumor resection is crucial in preventing postoperative urinary leakage. Renal nephrometry scoring systems serve as valuable predictive tools in assessing the likelihood of urinary fistula formation preoperatively, guiding surgical planning and risk stratification. Acknowledging and mitigating these risk factors through meticulous surgical techniques, careful patient selection, and preoperative planning are imperative to minimize the occurrence of urinary fistulas and optimize patient outcomes following partial nephrectomy.^{1,3,4,5,6} The management of urinary leaks post-partial nephrectomy is varied and lacks a consensus on treatment approaches. Various methods, such as the use of gelatin sponges, fibrin adhesive, and endoscopic treatments, have been utilized.⁷

2. Case report

A 71-year-old man underwent a robot-assisted partial nephrectomy in 2022 at Azienda sanitaria territoriale Pesaro-Urbino, Italy, to treat a 5 cm mass located at the upper pole of his left kidney (7a according to the RENAL Nephrometry Score).⁸ Following appropriate preoperative

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preparation, the mass was enucleated with a clamp of renal artery of 21 minutes. Care was taken to close the renal wound meticulously using absorbable sutures and covered with sealing matrix (made by human fibrinogen and thrombin), and perirenal fat. Post-surgery, pathological analysis of the surgical specimens revealed stage pT1a, grade 2 renal cell carcinoma (RCC). The patient recovered well, with the temporary drainage tube removed on the fourth postoperative day, and he was discharged on the fifth day. However, six months later, was re-admitted with fever and elevated inflammatory markers, she had no history of urinary stones and did not report any recent trauma. CT urography showed a 8 cm perirenal collection at the upper pole of the left kidney, with contrast leakage from the upper calyx into the perirenal space. Subsequent retrograde pyelography confirmed the presence of a urinary fistula between the urinoma and the upper urinary calyx (Fig. 1). To address this complication, a retrograde double pig-tail stent was inserted in the collecting system and percutaneous US drainage was positioned by interventional radiologist in the perirenal collection. Cultural examination of urine and drainage fluid yielded negative results. However, at the one-month follow-up, the urinary fistula persisted. Along with the interventional radiologist, despite the non-dilatated collection system a US guided percutaneous access into the lower calyx was obtained with a vascular introducer sheath. After confirming the presence of the fistula from the upper calyx with contrast injection, a catheterization of the fistula was obtained with a Bern catheter and a microcatheter (Procreate 2.7 F Terumo). Adhesive fibrin, a solution comprising frozen aprotinin and thrombin-calcium chloride, was then introduced via the microcatheter in the fistula, following a sudden closure of the fistula, as indicated by the urogram (Fig. 2). The percutaneous nephrostomy was left with the distal tip within the upper calyx group after the procedure along with the double pig-tail stent, in order to optimize the drainage of the entire collecting system of the kidney. After three days, a pyelography control showed no contrast leakage in the upper calyx, which remained absent on subsequent controls at nine days and after a further 15-day period. With the urinary fistula resolved, the percutaneous drainage and nephrostomy were removed, while the double pig-tail stent remained. A final pyelography conducted one month after nephrostomy removal confirmed the sustained absence of the urinary fistula, prompting the decision to remove the double pig-tail ureteral stent (Fig. 3).

3. Discussion

The incidence of urinary fistulas has been decreasing with advancements in surgical techniques, especially the utilization of robotic surgery. Patrezke et al. reported an incidence rate of 0.8 % for urinary fistulas following robotic partial nephrectomy in a cohort of 1791 patients³. According to the literature, the median postoperative days to

detection is 3.5 as reported by Peyton C. et al.⁹ In this case, the delayed presentation of a urinary fistula at 6 months is indeed noteworthy. However, it is important to highlight that the patient had no history of urinary stones and did not report any recent trauma, which makes the possibility of these factors contributing to the delayed fistula development less likely. While some studies suggest that urinary fistulas may be influenced by factors like stone passage or trauma,¹⁰ in this particular case, these factors were not present. Further studies on delayed complications post-surgery may help clarify whether other underlying conditions or events could contribute to such delayed presentations.

The primary treatment for patients presenting with urinary fistulas typically involves the placement of a ureteral stent or percutaneous drainage of the calicopelvic system. These interventions aim to reduce urinary leakage and promote the spontaneous closure of the fistulous tract. However, these methods do not always result in the resolution of the fistula, as was observed in our patient. Despite the presence of both the stent and percutaneous drainage, our patient continued to exhibit a urinary fistula one month post-procedure. Consequently, it became necessary to explore an effective alternative treatment for the urinary fistula. Fibrin adhesive is increasingly utilized in the post-robotic-assisted partial nephrectomy (RAPN) setting to promote hemostasis and tissue adhesion. This bioadhesive substance, composed of plasma-derived fibrinogen and thrombin, is considered both safe and effective for managing urinary fistulas. It facilitates tissue adhesion and enhances the natural healing process by inducing coagulation through a normal biological reaction.¹¹ This minimally invasive procedure can be performed under local anesthesia or, in some cases, without anesthesia.

4. Conclusion

This case underscores the critical role of a multidisciplinary approach in managing post-surgical complications such as urinary fistulas. Collaboration between urologic surgeons and interventional radiologists improve the patient outcomes by offering effective and minimally invasive solutions. The success demonstrated in this instance supports the wider application of adhesive fibrin placement in the management of urinary fistulas following nephrectomy, advocating for additional research and refinement of these techniques.

CRediT authorship contribution statement

Emanuele Cappa: Data curation, Conceptualization. **Demetra Fuligni:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Funding acquisition, Data curation. **Leonard Perpepaj:** Writing – review & editing, Writing – original draft. **Alberto Rebonato:** Writing – review & editing, Validation, Supervision. **Edoardo Beatrici:** Supervision, Data curation. **Valerio Beatrici:**



Fig. 1. (a, b, c) depicts CT Urography conducted during hospital readmission. Notably, contrast leakage is observed at the upper pole of the left kidney, extending both upward (b) and posteriorly behind the kidney (c).

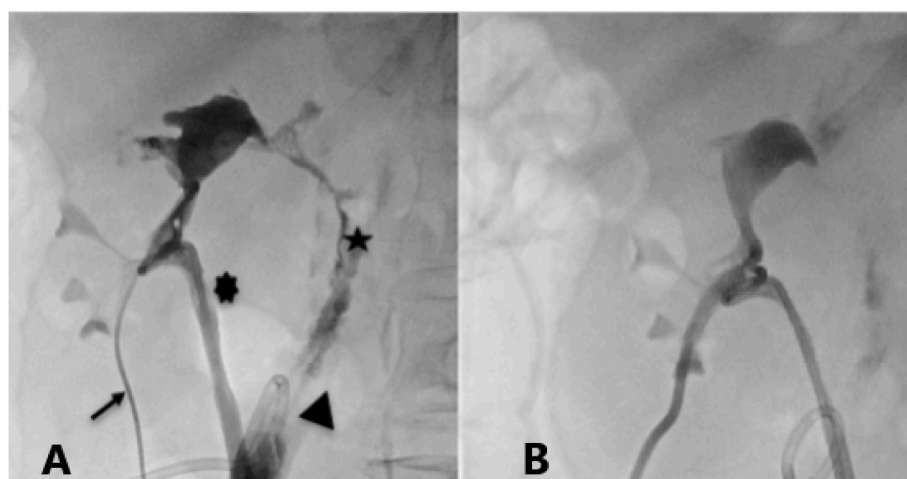


Fig. 2. (a,b) The left kidney exhibits a double pigtail (arrow) in the pelvis, with a guidewire inserted from the lower pole via percutaneous access (asterisk), terminating in the upper pole. Additionally, there is abdominal drainage (arrow head) with a pigtail drainage at the site of urinoma collection. Contrast leakage from the upper pole is observed (star), leading to fistula formation and collection (a). Following the application of adhesive fibrin using a vascular catheter through the fistula, there was an instantaneous cessation of contrast leakage within the fistula (b).

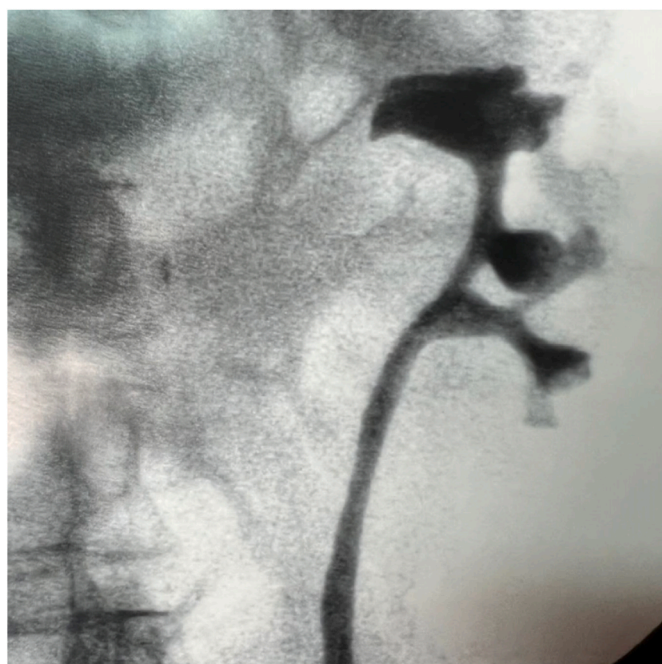


Fig. 3. Final pyelography after removing double pigtail ureteral stent one month after nephrostomy removal confirmed the sustained absence of the urinary fistula.

Validation, Supervision.

References

- Guliev BG. Urinary fistulas after partial nephrectomy in renal cell carcinoma. *Urology Herald*. 2021;9(2):111–124. <https://doi.org/10.21886/2308-6424-2021-9-2-111-124>.
- Kowalewski KF, Müller D, Kirchner M, et al. Robotic-assisted versus conventional open partial nephrectomy (robocop): a propensity score-matched analysis of 249 patients. *Urol Int*. 2021;105(5-6):490–498. <https://doi.org/10.1159/000513189>. Epub 2021 Mar 11. PMID: 33706322.
- Potretzke AM, Knight BA, Zargar H, et al. Urinary fistula after robot-assisted partial nephrectomy: a multicentre analysis of 1 791 patients. *BJU Int*. 2016 Jan;117(1):131–137. <https://doi.org/10.1111/bju.13249>. Epub 2015 Sep 6. PMID: 26235802.
- Kundu SD, Thompson RH, Kallungal GJ, Cambareri G, Russo P. Urinary fistulae after partial nephrectomy. *BJU Int*. 2010 Oct;106(7):1042–1044. <https://doi.org/10.1111/j.1464-410X.2010.09230.x>. Epub 2010 Mar 4. PMID: 20230384; PMCID: PMC4318244.
- Tachibana H, Takagi T, Kondo T, Ishida H, Tanabe K. Comparison of perioperative outcomes with or without renorrhaphy during open partial nephrectomy: a propensity score-matched analysis. *Int Braz J Urol*. 2018 May-Jun;44(3):467–474. <https://doi.org/10.1590/S1677-5538.IBJU.2016.0581>. PMID: 29244272; PMCID: PMC5996815.
- Meeks JJ, Zhao LC, Navai N, Perry Jr KT, Nadler RB, Smith ND. Risk factors and management of urine leaks after partial nephrectomy. *J Urol*. 2008 Dec;180(6):2375–2378. <https://doi.org/10.1016/j.juro.2008.08.018>. Epub 2008 Oct 18. PMID: 18930268.
- De Concilio B, Vedovo F, Mir MC, Silvestri T, Casarin A, Celia A. Gelatin sponge (Spongostan®) and N-butyl-2-cyanoacrylate: utility on percutaneous treatment of persistent urinary leakage after partial nephrectomy. Case report and review of the literature. *Arch Ital Urol Androl*. 2020 Oct 1;92(3). <https://doi.org/10.4081/aiua.2020.3.200>. PMID: 33016043.
- Kutikov A, Uzzo RG, The RENAL. Nephrometry score: a comprehensive standardized system for quantitating renal tumor size, location and depth. *J Urol*. 2009 Sep;182(3):844–853. <https://doi.org/10.1016/j.juro.2009.05.035>. Epub 2009 Jul 17. PMID: 19616235.
- Peyton CC, Hajiran A, Morgan K, et al. Urinary leak following partial nephrectomy: a contemporary review of 975 cases. *Can J Urol*. 2020 Feb;27(1):10118–10124. PMID: 32065869.
- Galgano SJ, Ricciardi R, Bellini MI, et al. Urinary fistulas after nephrectomy and nephron-sparing surgery: the role of perioperative factors. *J Urol*. 2013;190(5):1586–1591. <https://doi.org/10.1016/j.juro.2013.04.084>.
- Brennan M. Fibrin glue. *Blood Rev*. 1991 Dec;5(4):240–244. [https://doi.org/10.1016/0268-960X\(91\)90015-5](https://doi.org/10.1016/0268-960X(91)90015-5). PMID: 1782483.