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Robotic vesicovaginal fistula repair using double-layer urachal and omental flap interposition: a retrospective case series

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Abstract

Vesicovaginal fistula (VVF) remains a challenging condition requiring precise surgical repair to achieve durable closure, and robotic-assisted techniques provide enhanced visualization and dexterity, particularly in complex or recurrent cases. This retrospective study evaluated the outcomes of a double-layer interposition technique using urachal and omental flaps in 5 patients who underwent robotic transabdominal VVF repair between January 2023 and June 2025, all of whom had supratrigonal fistulae confirmed by cystoscopy and computed tomography urography + cystography. The surgical approach involved layered closure of the fistula tract followed by placement of vascularized urachal and omental flaps, with perioperative parameters, postoperative complications, and fistula closure rates recorded. The mean patient age was 46.2 years; hysterectomy was the predominant etiology in 80% of cases; 3 patients had previously failed transvaginal repair, and the mean fistula size was 1.8 cm. The mean operative time was 178 minutes with a mean blood loss of 90 mL, and no intraoperative complications were observed; 1 patient developed a Clavien-Dindo grade II urinary tract infection postoperatively. Complete fistula closure was demonstrated in all patients on postoperative cystography, with catheter removal between 16 and 21 days, and at a mean follow-up of 8.6 months, all patients remained continent without recurrence, suggesting that robotic-assisted VVF repair with combined urachal and omental flap interposition is safe, feasible, and associated with excellent short-term outcomes, with dual-layer reinforcement providing improved vascular support and suture-line separation that may reduce recurrence in complex or previously failed cases, although larger prospective studies are required for further validation.

Key words: robotic surgery, vesicovaginal fistula, dual-layer flap.

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Introduction

Vesicovaginal fistula (VVF) remains one of the most distressing urogenital complications, often resulting from obstetric trauma, pelvic surgery, or radiation.[1] Successful repair requires a tension-free, watertight closure with adequate tissue vascularity to promote healing.[2] With the advent of minimally invasive surgery, robotic-assisted VVF repair has gained prominence due to enhanced visualization, precision, and ergonomic advantages, particularly in complex or recurrent cases.[3-5]

The incorporation of interposition flaps has been shown to improve success rates by providing additional vascular support and separating suture lines.[2,6] Dual-layer interposition using urachal and omental flaps may further enhance the durability of repair in complex cases.[7]

The aim of this study was to evaluate the perioperative, functional, and short-term outcomes of robotic-assisted VVF repair using a double-layer interposition technique with urachal and omental flaps in a retrospective case series.

Materials and Methods

We conducted a retrospective review of 5 patients who underwent robotic-assisted VVF repair using a double-layer interposition technique with urachal and omental flaps between January 2023 and June 2025 at Kauvery Hospitals, Bengaluru, at a tertiary care urology center. Institutional ethical approval was obtained before data collection, and all patients had provided informed consent for the surgical procedure. Figure 1 shows post-VVF repair with both the urachal and omental flap.

Patients included in this series had persistent urinary leakage per vaginum following prior gynecological or urological surgery and were confirmed to have a VVF based on clinical evaluation, cystoscopy, and contrast-enhanced computed tomography cystography. Patients with radiation-induced fistulae, extensive pelvic fibrosis, or active urinary tract infection at presentation were excluded.

All surgeries were performed using the da Vinci Xi® robotic surgical platform (Intuitive Surgical, Inc., Sunnyvale, CA, USA) *via* a transabdominal approach. Under general anesthesia, patients were placed in the low lithotomy Trendelenburg position. After

cystoscopic localization of the fistula, the bladder was mobilized from the anterior vaginal wall to delineate the fistulous tract. The tract was excised circumferentially, and the bladder and vaginal defects were closed separately in two layers using 3-0 barbed absorbable sutures (V-Loc™ Medtronic, Minneapolis, MN, USA) to ensure a watertight and tension-free closure.

Following primary closure, the urachal remnant was dissected from the umbilicus to the bladder dome, creating a vascularized flap that was rotated and interposed between the bladder and vaginal suture lines. An additional omental flap was mobilized and placed over the urachal layer to reinforce the repair and provide further vascular support. Both flaps were secured with interrupted 3-0 absorbable sutures. A pelvic drain and Foley catheter were placed at the conclusion of the procedure.

Patient data were obtained from hospital electronic medical records, operative logs, discharge summaries, and follow-up clinic records. Relevant clinical, radiological, and perioperative details were extracted retrospectively.

Postoperatively, patients received broad-spectrum antibiotics and were maintained on continuous bladder drainage for 14-21 days. Clinical assessment and cystography were performed prior to catheter removal. Follow-up evaluations were conducted at 1, 3, and 6 months postoperatively. All collected data were entered into a structured database and analyzed descriptively. Continuous variables were summarized using mean and range, while categorical variables were expressed as percentages. Data confidentiality was maintained throughout the study. Data collected included patient demographics, etiology, and size of the fistula, operative time, estimated blood loss, length of hospital stay, postoperative complications (graded according to the Clavien-Dindo classification), and success of fistula closure. There was no funding for the present study.

Results

A total of 5 patients underwent robotic-assisted VVF repair using the double-layer interposition technique with urachal and omental flaps. The mean age of the patients was 46.2 years (range 38-58 years). The most common etiology was iatrogenic injury following hysterectomy in 4 patients (80%), while 1 patient (20%) developed a fistula following previous pelvic surgery for endometriosis. All fistulae were supratrigonal, with a mean size of 1.8 cm (range 1.2-2.5 cm). A total of 3 patients (60%) had undergone prior failed repair attempts by the transvaginal approach. The detailed patient characteristics, operative parameters, and outcomes are summarized in Table 1.

The mean operative time was 178 minutes (range 160-210 minutes), and the mean estimated blood loss was 90 mL (range 70-120 mL). No intraoperative complications were encountered. All patients underwent successful interposition of both the urachal and omental flaps without technical difficulty. The mean hospital stay was 3.4 days (range 3-5 days).

Postoperative recovery was uneventful in all cases. One patient developed a Clavien-Dindo grade II febrile urinary tract infection, which was managed conservatively. All Foley catheters were removed between 16 and 21 days postoperatively following confirmation of fistula closure by cystography. At a mean follow-up of 8.6 months (range 6-12 months), all 5 patients remained continent, with no evidence of recurrent fistula or urinary leakage.

Discussion

Robotic VVF repair has demonstrated high success rates with reduced morbidity compared to open transabdominal approaches.[3-5] The enhanced visualization, improved ergonomics, and superior instrument dexterity offered by robotic platforms provide distinct advantages in deep pelvic dissections, particularly in complex or recurrent fistulae. In the present series, all 5 patients achieved durable fistula closure without recurrence, consistent with outcomes reported in previous robotic VVF repair studies.[6] Successful repair of VVF requires a watertight, tension-free closure supported by well-vascularized tissue interposition to minimize recurrence. The combined use of urachal and omental flaps provides dual vascular reinforcement and effective mechanical separation of suture lines, which may further reduce the risk of recurrence.[7] The

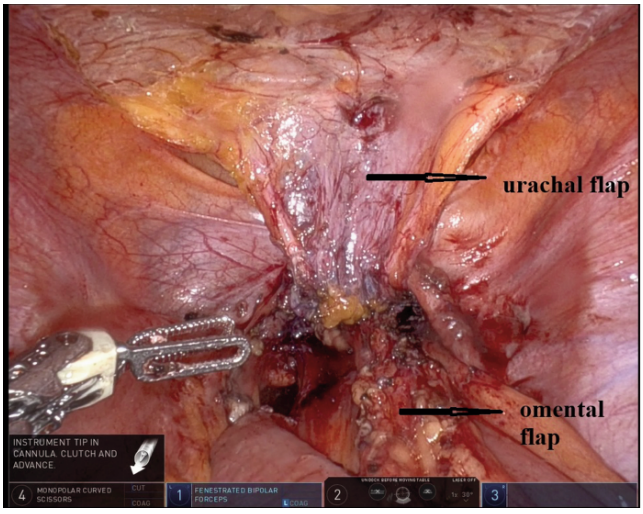

Figure 1. Post-vesicovaginal repair with both omental and urachal flap.

Table 1. Summary of patient characteristics, operative details, and outcomes following robotic vesicovaginal fistula repair with urachal and omental flap interposition.

Patient	Age	Etiology	Location	Size (cm)	Previous repair	Surgery time (min)	Blood loss (mL)	Stay (days)	Complication	Follow-up (month)	Outcome
1	38	Post-hysterectomy	Supratrigonal	1.5	No	160	80	3	None	12	Closure
2	45	Post-hysterectomy	Supratrigonal	2.0	Yes	180	100	3	None	9	Closure
3	52	Post-hysterectomy	Supratrigonal	1.8	Yes	190	120	4	Grade II UTI	8	Closure
4	48	Post-hysterectomy	Supratrigonal	2.5	Yes	210	90	5	None	7	Closure
5	58	Post-endometriosis	Supratrigonal	1.2	No	150	70	3	None	6	Closure

UTI, urinary tract infection.

urachal flap, derived from the median umbilical ligament, offers a readily accessible local vascularized tissue, while the omental flap enhances vascularity and promotes healing. Although the mean operative time of 178 minutes reflects the additional dissection required for flap mobilization, blood loss was minimal, hospital stay was short, and complications were negligible, supporting the feasibility and safety of this approach. Despite limitations including the retrospective design, small sample size, and lack of a control group, the consistently favorable outcomes observed suggest that dual interposition using urachal and omental flaps during robotic VVF repair may represent an effective strategy, particularly in recurrent or complex cases.

Conclusions

Robotic-assisted VVF repair using a double-layer interposition with urachal and omental flaps is a safe, feasible, and effective technique, particularly in complex or recurrent cases. The dual-flap approach provides excellent vascular reinforcement and mechanical separation between suture lines, contributing to durable fistula closure and favorable functional outcomes. Larger prospective studies with longer follow-up are warranted to further validate the benefits of this technique.

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Ethics approval and consent to participate: this retrospective study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for the study was obtained from the Kauvery Internal Review Board.

Informed consent: written informed consent for participation and surgical intervention was obtained from all patients prior to inclusion in the study.

Patient consent for publication: written informed consent was obtained from all participants for the publication of anonymized clinical data and images. No information enabling patient identification has been included in this manuscript.

Availability of data and materials: the datasets generated and/or analyzed during the current study are available from the corresponding authors on reasonable request.

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