

# Laparoscopic intraperitoneal repair of high-up urinary bladder fistula: a review of 12 cases

Pramathes Das Mahapatra · Partha Bhattacharyya

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**Abstract** Conventional abdominal operations for urinary bladder fistula have limitations like increased morbidity, more hemorrhage, more postoperative pain, and longer hospital stay. Laparoscopic repair of bladder fistula was done to explore the potential role of laparoscopic surgery in this field. Twelve women with vesicovaginal (11) and vesicouterine (one) fistula, of both gynecological (seven) and obstetric (five) origins, were treated by laparoscopic intraperitoneal repair between 1991 and 2004. The bladder wall was mobilized and repaired by interrupted stitches in single-layer followed by omental interposition. All cases were completed laparoscopically without any significant intra- or postoperative complication. Gynecological cases were discharged on the fourth day. Urinary catheters of all women were removed on the 14th day, and all but one obstetric fistula (91% success) were closed. Long-term follow-up confirmed the cure. Laparoscopic repair is an excellent method of repairing urinary bladder fistula located near the vaginal apex.

**Keywords** Laparoscopic · Repair · Bladder fistula · Vesicovaginal fistula · VVF

## Introduction

A fistula between the urinary bladder and genital organs makes the life of a woman miserable from all aspects—marital, social, physical, emotional, and economical. Of all

these fistulas, the vesicovaginal fistula (VVF) is by far the commonest one and the other rare types are those involving the urinary bladder and the cervix or uterus. These conditions are uncommon in developed countries and, whenever met with, are mostly related to gynecological surgery like total abdominal hysterectomy. On the other hand, obstetric fistula is still the commonest variety in the developing countries and more so in the underdeveloped ones [1]. The situation in India is at the middle of this spectrum. The incidence of obstetric fistula is declining here with the improvement of reproductive health care system. However, the incidence of gynecological fistulas is rising proportionately.

Urinary bladder fistula is a condition that must be treated, and in most of the cases, surgical correction is the treatment of choice. A small proportion of cases of nonmalignant fistula of recent origin with size less than 1 cm, however, can be subjected to a trial with prolonged urinary catheterization.

The two basic principles of surgical repair of urinary bladder fistula are vaginal and abdominal approaches. Ideally, the route of the operation should be selected by individualization of a case considering the best suitability of a procedure in that particular clinical condition. It is, however, commonly observed that the choice is usually guided by the surgeon's own experience [2].

Majority of the surgeons, however, prefer the vaginal route. Vaginal closure is best indicated in single, easily accessible fistula located in the lower half of the vagina with available wide vaginal space. The principal benefits of this approach are minimal blood loss and less postoperative morbidity. The shortcomings of this approach are restricted access, inadequate exposure, and difficult instrumentation. These become really troublesome when the fistula is located in the apical part of the vagina, particularly in an

P. Das Mahapatra (✉) · P. Bhattacharyya  
Spectrum Clinic and Endoscopy Research Institute,  
6A & 6F, Neelamber, 28B, Shakespeare Sarani,  
Kolkata, West Bengal, 700017, India  
e-mail: promathe@cal.vsnl.net.in

obstetric fistula where the pelvis is usually non-roomy. Abdominal repair of bladder fistula, on the other hand, should be utilized liberally in any of the following conditions—large fistula, fistula near the vaginal apex, fistula opening into the uterus, concurrent ureteric involvement, multiple fistulas, and failure of repeated vaginal repair. The limitations of the conventional abdominal operations are more hemorrhage, more postoperative pain and morbidity, longer hospital stay, and higher incidence of infection and stone formation.

It is a common observation that when the route is properly selected, a single operation is usually enough to cure the condition [3]. It is also said that almost any incidence of failure after vaginal surgery generally suggests under-usage of the abdominal approach [2].

Laparoscopic repair of the vesicovaginal fistula after gynecological surgery was first reported by Nezhat et al. in 1994 [4]. They subsequently presented a series of 20 cases of laparoscopic repair of cystotomies produced during gynecological surgery [5]. Since then, there have been a handful of articles reporting laparoscopic repair of VVF. These were done by a variety of techniques in different conditions viz., omental J-flap by von Theobald et al. [6], laparoscopic repair of post-cesarean cervicovesical fistula by Hemal et al. [7], etc. Melamud et al. [8] did a unique job through laparoscopic repair of VVF using robotic technology. Our Medline and literature search did not reveal any incidence of laparoscopic repair of obstetric fistula.

We present a series of 12 women, 11 with “high-up” vesicovaginal fistula and one with vesicouterine fistula. By high-up fistula we mean a fistula located in the vicinity of the vaginal apex. This may otherwise be called “apical VVF” or “cuff VVF”. Laparoscopic intraperitoneal repair of the fistula with omental reposition was done in all these women between 1991 and 2004. The purpose of selecting laparoscopic procedure was to (1) establish the efficiency of a new method, (2) explore better technical applicability, and (3) exploit the general advantages of laparoscopic surgery.

## Materials and methods

The patients described in this series were referred to our clinic for continuous dribbling of urine from the vagina with a duration ranging from 3 to 38 months. The vesicovaginal fistulas were easily diagnosed by simple speculum examination, which was buttressed by blue dye test. Diagnosis of vesicouterine fistula required dye test through the uterus and simultaneous cystoscopy when dye was seen coming through the fistula into the bladder. Routine cystoscopy was done in all women to confirm the fistula site, and more importantly, its relation to the ureters and trigone of the bladder and to assure bilateral ureteral

patency. Intravenous urogram was done in the cases where the fistula had followed gynecological surgeries.

As the diagnosis of VVF or vesicouterine fistula was made, we offered them the option of laparoscopic repair of the fistula depending on some selection criteria. These were (1) dribbling of urine for more than 3 months, (2) single fistula, (3) location of fistula above 6 cm from the urethral orifice, (4) no history of failed vaginal or abdominal surgery for repairing the fistula, and (5) no concurrent ureteric involvement. The size of the fistulas ranged between 0.5 and 2.5 cm. Fistulas located within 6 cm from the urethral opening were not included in this series; those were repaired vaginally.

The salient clinical features of the 11 women with VVF are described in Table 1, which comprises the age, parity, and social origin of the patient, duration of symptom, event causing the fistula, time taken to develop the symptom, location, and size of the fistula.

The couples were counseled about the necessity of surgical intervention and the options of operation by laparotomy and laparoscopy. They were informed that it was a new technique and there was a chance of conversion to formal laparotomy should the laparoscopic procedure fail.

The operation was done under general anesthetic with the woman in Trendelenburg's position. A Foley's catheter, usually no. 6 or 8 depending on the size of fistula, was introduced into the bladder through the vaginal opening of the vesicovaginal fistula cases. Downward traction to the catheter after inflating the balloon helped to maintain distension of the bladder by sealing the fistula. This facilitated dissection and identification of the fistula while operating through the laparoscope. A uterine manipulator was used in the obstetric cases to push the uterus posteriorly to expose the uterovesical pouch. The vagina was tightly packed with roller gauzes. Cystoscopy was done after distending the bladder to identify the ureteric orifices and to introduce ureteric catheters to avoid ureteric injury. Pneumoperitoneum was created with carbon dioxide and a 0° 10-mm laparoscope was introduced through the infraumbilical primary port. Two 5-mm secondary ports were made in the iliac fossae and another 10-mm port through the infraumbilical midline. The adhesions were divided with bipolar forceps or high-frequency ultrasound probe (Harmonic scalpel™). The bladder peritoneum was incised and the bladder was dissected free from the anterior vaginal wall with snips of scissors and bipolar microforceps or Harmonic scalpel™ until the catheter became visible. The bladder wall was further separated from the vagina around the catheter to ensure adequate mobilization for tension-free suturing. Bladder dissection was aided by pushing up the uterus or the vault, thereby stretching the anterior vaginal wall. The fibrous bladder margin of the

**Table 1** Combined clinical features of the 12 patients with VVF and vesicouterine fistula who were treated by laparoscopic intraperitoneal repair

Serial and year of surgery	Age, parity, and origin of the patient	Duration of symptom (months)	Event causing the fistula and time taken to feel the symptom	Type of the fistula and approximate size (cm)
1. 1991	36, P <sub>3+0</sub> , rural	4	TAH + BSO, 2 days	VVF, 1.0
2. 1991	42, P <sub>3+0</sub> , rural	6	TAH + BSO, 4 days	VVF, 1.5
3. 1992	23, P <sub>2+0</sub> , rural	24	Unaided VD, 6 days	VVF, 1.0
4. 1992	40, P <sub>2+0</sub> , semi-urban	3	TAH + BSO, 3 days	VVF, 1.5
5. 1994	21, P <sub>1+0</sub> , urban	3	FD (prolonged labor), 5 days	VVF, 1.5
6. 1996	30, P <sub>3+0</sub> , remote rural	38	Unaided home VD, 4 days	VVF, 1.5
7. 1996	37, P <sub>4+0</sub> , urban	7	TAH + BSO, 3 days	VVF, 0.5
8. 1998	24, P <sub>3+0</sub> , rural	13	FD (big baby), 3 days	VVF, 2.5
9. 1999	48, P <sub>3+0</sub> , rural	12	TAH, 2 days	VVF, 1.0
10. 2001	24, P <sub>2+0</sub> , semi-urban	9	Repeat CS, 2 days	VUF, 1.0
11. 2002	43, P <sub>3+0</sub> , urban	6	TAH, 4 days	VVF, 1.5
12. 2004	40, P <sub>4+0</sub> , rural	8	TAH + BSO, 2 days	VVF, 2.0

VVF Vesicovaginal fistula, VUF vesicouterine fistula, VD vaginal delivery, FD forceps delivery, TAH total abdominal hysterectomy, BSO bilateral salpingo-oophorectomy

fistula was excised all around until healthy bladder muscle was exposed. The catheter was withdrawn after deflation of the balloon. The fistula was closed in a single layer excluding the mucosa by intracorporeal interrupted sutures with synthetic absorbable suture (2-0 Vicryl™, Ethicon) fitted in a “Ski” or half-circle needle. The first suture was passed at the lowest part when sutured longitudinally. Dye test was done to ensure perfect closure of the fistula.

Closure of the fistula was followed by interposition of a portion of the greater omentum over the bladder suture line. The principle was to mobilize an adequate bulk of greater omentum with visibly evident blood supply and to interpose it along the suture line on bladder with 2-0 Vicryl™ (Ethicon). We were able to bring a reasonable size of omentum down to the pelvis in nine cases without any definite mobilization. We believe that higher location of the fistula in the selected cases and relatively short stature of the women of our geographic area helped us in this respect. In the remaining three, the omental apron could be mobilized only after dividing the comparatively minor left gastroepiploic vascular supply.

Vaginal or uterine rent was not sutured, which acted as a drain and prevented hematoma formation. Continuous bladder drainage with Foley’s Catheter no. 16 was maintained in all women.

## Results

The mean operative time for obstetric and gynecological cases was 192 (range 180–220) and 140 (120–160) minutes, respectively. Average estimated blood loss was between 100 and 150 ml and transfusion of blood or blood product was not required in any of these cases. Two or three intra- and postoperative parenteral doses of antibiotic were

followed by oral formulations from the first postoperative day. Fluroquinolones viz., ciprofloxacin with metronidazole was the preferred choice of antibiotic in the early nineties; the former was replaced by second- or third-generation cephalosporin since 1995. There was no incidence of postoperative infection in this series.

Seven women with VVF of gynecological origin were discharged between the fourth and the seventh postoperative day with catheter in situ. Though it is usual to discharge patients on the second or third postoperative day after laparoscopic surgery and we also follow this norm in routine laparoscopic surgeries, these women were kept longer because of our relative inexperience with this type of operation. Oral antibiotics were prescribed to continue up to the tenth postoperative day. They were advised to come back after 2 weeks, to maintain strict personal hygiene and to abstain from intercourse for up to 3 months. Instruction was given to report immediately if there was any vaginal discharge or leakage of urine. One of these women had blockage of the catheter on the seventh day and was replaced with a new catheter. Five patients with obstetric fistula continued to stay in the hospital until the catheter was removed at the completion of second week.

The urinary catheter was scheduled to be taken out on the 14th postoperative day. The catheter was removed after 12 h of clamping to ensure that there was no leakage of urine. They were kept in our clinic overnight to check if there was any urinary leakage.

One woman with an obstetric VVF continued to leak urine after the removal of the catheter after 2 weeks. She was recatheterized for another 2 weeks, but the leakage continued. Examination under anesthetic after 3 months revealed partial closure. She was readmitted 4 months later and was reoperated by open abdominal transperitoneal suprapubic approach and the fistula healed completely.

All of the eleven women with successful laparoscopic repair were followed up at the end of the sixth and 12th postoperative weeks. The fistulas healed completely as evident by the absence of their complaint of urinary leakage and clinical examination. Healing of the vagina was complete in all women at the time of visit after 6 weeks. Five of these patients came to follow-up for 1 to 3 years and showed no evidence of further leakage. Postal or telephonic contact with the remaining six women confirmed complete relief of their symptoms at least 1 year after the surgery.

There was no incidence of incisional hernia. One woman presented with stress urinary incontinence after successful repair of obstetric fistula. The woman who had the fistula after forceps delivery conceived again 3 years after the repair and was delivered by elective cesarean section.

## Discussion

The patients with bladder fistula described in this series were all treated by the laparoscopic approach instead of conventional laparotomy or vaginal surgery.

As evident from Table 1, 11 women in this series had VVF, which were located in the uppermost part of the vagina. One woman had a vesicouterine fistula after a repeat cesarian section. Furthermore, as most of the obstetric cases were associated with narrow, predominantly android pelvis, the operations were to be done from a distant site where manipulation of the instruments would have been extremely difficult had the vaginal route been chosen.

We, therefore, felt that abdominal repair would be the most appropriate surgical approach for these women, whereas vaginal repair would be difficult with a higher chance of failure.

Operations on urinary bladder fistula usually follow the principles described by Moir [9] in 1967. These are (a) suitable equipment and lighting, (b) adequate exposure during the operation, (c) excision of fibrous tissue from the edges of the fistula, (d) approximation of the edges without tension, (e) use of suitable suture material, and (f) efficient postoperative bladder drainage. Corroborating with these principles, the abdominal approaches for repairing bladder fistulas are developed as:

1. *Supravesical transperitoneal approach* This operation is done by a suprapubic V-shaped incision (Turner Warwick) with the patient in PAPA (perineoabdominal progressive approach) position. It offers a good exposure, surgical access, and feasibility of omental grafting. More hemorrhage, postoperative pain and morbidity, and higher chance of infection are the main limitations of this approach.
2. *Retropubic transvesical approach* Incision is made on the anterior wall of the bladder and the fistula is repaired from the interior of the bladder. Symphysiot-

omy is sometimes required to facilitate the access. This method has many shortcomings like limited surgical access to the operative site and more chances of hemorrhage. A bulk of suture material has to be left inside the bladder at the end of the operation, which can be a nidus for infection and stone formation in future.

All of these conventional operations have another common problem of prolonged hospital stay, late return to domestic job or employment, and less bed utilization, which is an important factor in developing countries.

The author has been practicing laparoscopic surgery since 1990 and had done more than 150 vaginal and open abdominal repair of VVF since 1975. He felt that laparoscopic intraperitoneal repair might be employed in these cases to utilize the specific and general advantages of laparoscopic surgery. All the operations were done by himself with his same team of assistant surgeons and theater nurses, who were well-versed with the operative technique.

The principal advantages of laparoscopic intraperitoneal repair are wide, magnified, well-illuminated, and almost blood-free operative field. Clear identification of the ureters is possible, which adds to the confidence of the surgeon. Better surgical access enables meticulous bladder dissection with minimal bleeding and complete hemostasis. The fistula can be mobilized sufficiently and sutured without tension. Laparoscopic repair, however, has a limited role to play in previously failed cases or large fistulas where open repair would be a better option.

The general advantages of laparoscopic surgery are also worth to be considered here. The patient is ambulated and recovered from postoperative morbidity quite early and nursing help is hardly necessary from the third postoperative day onward. The patient can be discharged on the fourth or even as early as the second postoperative day. This early discharge from hospital helps more effective bed utilization in public hospitals. The incidence of delayed complications like incisional hernia is much less; there was none in our series.

Several issues were encountered during the operations that made the surgery technically more difficult and challenging. However, during the course of the study, we found out the ways to overcome these challenges. We encountered difficulty in distending the bladder despite the catheter being in place. Therefore, vaginal packing was placed to allow bladder to be distended for better visualization of the fistula.

Adhesion, sometimes dense and fibrotic, around the cuff was frequently met with in post-hysterectomy cases. Adhesion of small and large guts to the cuff was seen in three out of those seven women. We divided these adhesions carefully by dissection and desiccation with bipolar forceps. Bipolar forceps is of particular help in this regard as it minimizes the risk of electrical injury to the bowel. We used high-frequency ultrasound in the last three



cases done between 2001 and 2004—it is a more precise and safer instrument for this purpose.

Separating the bladder from the vaginal wall proved difficult in the long-standing cases because of extensive fibrosis around the fistula. Stretching and pushing the anterior vaginal wall with intravaginal pack facilitated the dissection. Bleeding from the bladder wall after excision of the fibrous ring was adequately controlled by micro-bipolar forceps or high-frequency ultrasound.

We sutured the bladder wall in a single layer instead of the traditional double-layered suture. Optimal dissection followed by single-layer suture proved quite adequate for apposition of the margins. It helped in maintaining a good blood supply for better healing without compromising the bladder capacity. Traditional double-layer suture, on the contrary, jeopardizes local blood supply. It is also sometimes difficult to get enough of the bladder tissue to bring the second layer together without tension. There is no human evidence, however, that clearly states which one is the best suturing method for repairing bladder—single layer or double layer.

Intracorporeal endoscopic suturing is a difficult and time-consuming procedure. Nevertheless, one can master the technique by perseverance and practice. It is preferable to suture the lowest angle first so that the thread can be used for traction and identification of the lower end. Single-layer suture through the bladder muscle wall should be done carefully. Adequate mobilization of the bladder rent is an important factor for good apposition and better healing. Fistula close to the trigone entails the risk of the ureteric orifice being caught up in the suture. It is, therefore, mandatory to pass a ureteric catheter beforehand and to suture transversely.

Omental interposition is a well-accepted technique in abdominal reparative surgery because of its unique property of facilitating neovascularization and resolution of inflammation. This is attributed to its rich blood and lymph supply, which favors rapid absorption of the inflammatory exudates. Omentum regains its elasticity as soon as the inflammatory reaction is over, and this helps tremendously in urodynamic reconstructive support [2]. In this regard, we have followed the traditional teaching of Turner-Warwick [10], who stated that in the absence of active tumor or infection, omental redeployment support significantly reduces the chance of failure after abdominal closure of the bladder fistula.

As the vagina was not closed, any blood collected could have trickled down into the vagina rather than forming a hematoma leading to an infection. Moreover, the apprehension of ascending infection through the vaginal opening is more of a theoretical issue, and we indeed had no incidence of postoperative wound infection.

We had failure in one case due to partial closure in a long-standing obstetric fistula of 2.5-cm diameter with extensive fibrosis all around. Inability to achieve an adequate mobilization of the bladder wall for tension-free

suturing was probably the prime factor for this failure. In addition, she had retention of urine due to blockage of the catheter for more than 12 h on the third postoperative day. This might have caused stretching up of the suture line by the time the catheter was replaced.

All but one in this series was successful in single attempt. We believe this high success rate (92%) was due to many factors. First and foremost was rational selection of cases. None of them had previous surgical attempt. We also achieved meticulous dissection, hemostasis, and repair without tension in all but one patient. Vaginal or uterine rent was left open to act as a natural drain of collected tissue fluid and blood. The operations were done using bipolar currents and ultrasound scalpel, but new modalities like laser and laser-activated bioglue can be used as well if the surgeon is at ease with any of the particular modality.

Laparoscopic repair of VVF is a technically demanding operation that requires sufficient surgical expertise. However, with global experience of more than two decades with a wide range of minimally invasive surgery, it is imperative that a good number of laparoscopic surgeons have already developed enough experience to perform this operation successfully. We conclude that laparoscopic repair of high-up bladder fistula either of obstetric or gynecological origin is an effective and dependable alternative to abdominal repair and a high success rate is achievable. One who is ultimately benefited is the patient, and the prize to the surgeon is the thankful smile of the lady who has gone to live a happy life again.

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