Transperitoneal Transvesical Laparoscopic Repair of Vesicovaginal Fistulae: Experience of a Tertiary Care Centre in Northern India

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Key Words

Transperitoneal approach • Laparoscopic surgery • Vesicovaginal fistulae

Abstract

Objective: To present our experience of treating supratrigonal vesicovaginal fistulae by laparoscopic technique and their long-term follow-up. **Material and Methods:** Between January 2008 and June 2012, 28 cases of supratrigonal fistulas were repaired by laparoscopic transperitoneal transvesical technique with interposition flap. The obstetric fistula was present in 18 and gynecologic fistula in 10 patients. Single supratrigonal fistula was present in 26 patients and in 2 patients there were 2 fistulae lying side to side. The vaginal opening was closed as single layer interrupted suture and cystotomy closed as single layer continuous suture by 3-0 polygalactin. The omentum was used as interposition flap in all except 2 cases in whom postero-superior vesical fold of peritoneum was used. The open conversion was required in 2 cases. The urethral catheter was removed in 4 weeks following a micturating cystogram. **Result:** The mean fistula size was 1.2 cm (range 0.8–2.5 cm). Open conversion was performed in 2 cases of whom one had excess carbon-dioxide retention and cardiac arrhythmia and in another case the needle of 3-0 polygalactin was avulsed and lost in peritoneal cavity which was recovered following laparotomy. All patients were continent following the catheter removal. The median follow-up is 24 months. None developed any complication related to laparoscopic repair till last follow-up.

Conclusion: Laparoscopic repair of supratrigonal vesicovaginal fistulae is an effective and safe minimally invasive treatment with excellent result.

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Introduction

Vesicovaginal fistula (VVF) is most common acquired urogenital fistula, cause great psychological morbidity to the patients. Majorities of low lying fistulae (trigonal fistulae with or without urethral extension) can be repaired by transvaginal route [1, 2]. The abdominal route is indicated if fistula is associated with ureterovaginal fistula, high-up fistulas, small capacity bladder requiring augmentation, and multiple failed vaginal attempt of repair with vaginal shortening and stenosis and in cases of multiple VVF [3–5]. Over the past 15 years there have been consistent efforts on the laparoscopic repair of high-up supratrigonal fistulas which can not be repaired transvaginally. Nezhat et al. [6] first reported the laparoscopic repair of VVF in 1994. They further presented the experience of laparoscopic repair of intentional and unintentionally performed cystotomies on 19 patients [7]. Von Theobald et al. [8] reported a laparoscopic repair of VVF with omental J flap and claimed to be a modification of the technique. Miklos et al. [9] reported the utility of laparoscopic repair even in recurrent fistula. Chibber

Table 1. Demographic characteristics and operative parameters of patients

Characteristics	Result/observation	Range
Age, years	24 ± 7.0	18–45
Type of fistula		–
Obstetric	18	
Gynecologic	10	
Duration of urinary incontinence, months	14 ± 7.3	6–36
Location of fistula	supratrigonal	–
Number of fistula		–
Single	26	
Two	2	
Size of fistula, cm	1.2 ± 0.39	0.8–2.5
Patient's height, cm	145 ± 5.5	136–154
Body weight, kg	52 ± 16.34	32–82
BMI, kg/m ²	22.76 ± 3.6	17.3–28.6
Operative time, minutes	160 ± 16.40	140–200
Blood loss, ml	70 ± 14.93	50–100
Visual pain analog score on day 1	4.5 ± 0.33	4–5
Visual pain analog score on day 2	1.5 ± 0.47	0–2
Mean dose of Tramadol in mg required in first 24 hours	200 ± 29.05	150–250
Tramadol required in 24–48 hours, mg	70 ± 15.91	50–100
Hospitalization, days	6 ± 0.79	5–7
Time to return of bowel sounds, hours	14 ± 2.15	12–24
Follow-up, months	24 ± 14.13	4–54

et al. [10] reported the experience of laparoscopic repair of both vesicovaginal and vesicouterine fistula with high success rate. Hemal et al. [11] also reported the technique of laparoscopic repair of cervico-vaginal fistula developed following cesarean section. Erdogru et al. [12] in an interesting modification reported the use of fleece-bound sealing system for laparoscopic repair of recurrent VVF. Robot assisted laparoscopic fistula repair with excellent result has also been reported [13]. Herein, we present our experience of laparoscopic transperitoneal transvesical repair of supratrigonal vesicovaginal fistula and their long-term follow-up.

Materials and Methods

Between January 2008 and June 2012, 28 cases of VVF were selected for laparoscopic repair. Ethical clearance was obtained from institutional ethical committee and informed written consent was obtained prior to surgery. Preoperative cystoscopy was performed to record the site, size, number of fistula and their relation to the ureteric orifices. Vaginoscopy was also performed to assess the location of fistula and status of cervix/vaginal vault, vaginal lumen in patients having history of hysterectomy. Our inclusion criteria were based primarily on supratrigonal or very high-up fistulas less than 2.5 cm with stenosed or incapacious vagina. In all

patients complete hemogram, renal function tests, liver function tests, total serum protein and serum albumin and intravenous urogram were performed. The chest X-ray PA view and ECG were performed for assessing the fitness for anesthesia. The patients who had anemia (hemoglobin level < 10 g/dl) were given preoperative blood transfusion and in patients who had hypoproteinemia, they were put on high protein diet for 4–6 weeks. Empirically, in patients who had anemia were given oral antihelminthics to eradicate intestinal worm infestations. In 2 patients the psychiatric consultation for moderate depression was obtained before the operative intervention and treated adequately for 4–6 weeks using antidepressants.

Technical Steps

The operative steps are described in details in table 1. Step I includes cystoscopy and bilateral ureteric catheterization and insertion of different colored catheter in fistula. Step II includes patient positioning, ports placement and creation of pneumoperitoneum. A 10 mm infraumbilical open port placement for camera was performed in all cases and carbon dioxide pneumoperitoneum was created with a pressure of 12 mmHg. The patient was then put in 30° to 40° Trendelenburg position and another 12 mm port in right iliac fossa and 5 mm port in left iliac fossa were placed. Step III involves dissection of fistula, closure of vaginal opening, cystotomy closure and interposition of vascularized flaps. This is the most crucial step in fistula closure. The bladder at this stage was inflated with 200–300 ml saline and a deliberate posterior midline cystotomy was performed. The Foley catheter at this stage was clamped to prevent the loss of pneumoperitoneum. Through

the cystotomy inside of bladder was inspected and fistulous tract identified by presence of different colored ureteric catheter (fig. 1). The cystotomy was extended upto the fistula. A plane between the bladder and vaginal wall was developed by sharp dissection. The fistula was circumferentially dissected to make completely free from bladder wall (fig. 2). In cases having two fistulae lying side to side (fig. 3) the thin bladder wall between two fistulae was cut to make the single fistulous opening. The anterior bladder wall and dome were lifted up and tucked gently against the inner surface of anterior abdominal wall by a silk thread inserted percutaneously mounted on laparoscopic fascial port closure needle. The silk thread was removed at the end of the procedure. The vaginal opening of fistula was closed by 3-0 polygalactin as interrupted single layer. The ureteric catheter lying in fistulous opening was pulled out before tying the final knot. The omentum was tucked at the suture line (fig. 4). The bladder was then closed as single layer continuous suture by 3-0 polygalactin. The bladder was filled by 200 to 300 ml of normal saline under gravity to check any apparent leakage and additional interrupted suture was taken at leakage sites. The omentum was also tucked to the bladder suture line in its most distal part. In 2 cases there was deficient omentum for interposition in which the peritoneal covering from posterosuperior bladder wall was placed as interposition flap and tucked to the vaginal suture line following closure of bladder. Step IV The final finishing step includes insertion of peritoneal closed suction drain and shifting of the patient to specialized postoperative recovery room.

There were 2 laparoconversions. First case was due to avulsion of needle which was lost in peritoneal cavity and recovered by laparotomy and in another case open conversion was done because of excessive carbondioxide retention and cardiac arrhythmia.

The visual pain analog score was recorded on first and second postoperative days. Intravenous tramadol on demand was given to the patients. The patients were allowed liquids on first postoperative day following return of bowel sounds and semisolid and solids are allowed from second postoperative day. They were discharged between 5 and 7 days and then called after 4 weeks from the date of operation and a cystogram was performed before catheter removal. All patients were asked to abstain from sexual intercourse for 3 months from the date of operation.

Results

The mean age of patient was 24 ± 7.0 years. The obstetric fistula was present in 18 patients and gynecologic type in 10 patients respectively (table 2). The mean duration of urinary incontinence was 14 ± 7.3 months (range 6–36 months) and the mean fistula size was 1.2 ± 0.39 cm (table 2). In 2 patients there were 2 fistulae lying side to side, larger was 1.5 cm and smaller 10 mm. The laparoscopic repair was completed successfully in 26 cases and open conversion was required in 2 cases. The mean operating time was 160 minutes (range 140–200 minutes) and the mean estimated blood loss was 70 ml (range 50–100 ml). The mean visual pain analog score on first postoperative day was 4.5 ± 0.33 (range 4–5) and on

second postoperative day it was 1.5 ± 0.47 (range 0–2) (table 2). The mean dose of tramadol on first postoperative day was 200 ± 29.05 mg and on second postoperative day it was 70 ± 15.91 mg (table 2). None of patient developed paralytic ileus or any bowel related complication. All patients were continent following catheter removal. The frequency of urine was seen in 5 patients managed by oral anticholinergics for 2–4 weeks. The mean period for hospitalization was 6 ± 0.79 days (range 5–7 days). The median follow-up was 24 ± 14.13 months (table 2).

Discussion

Laparoscopic repair of vesicovaginal fistula was reported first by Nezhat et al. [6, 7] in 1994 and they further reported the bladder repair in intentionally and unintentionally performed cystotomies in 19 patients. The laparoscopic VVF repair has distinct technical advantages (table 3) reported in various studies [10, 12, 14–16]. There are many case reports and series on laparoscopic technique of VVF repair [6–19]. These studies have variations in the basic techniques of approaching the fistula either by transvesical or extravesical routes, number of ports used, laparoconversions, differences in operative time, hospital stay, duration of catheterization, complications and overall success rate (table 4). There are 2 basic principles of laparoscopic repair. These are transperitoneal nontransvesical approach [9, 14, 17, 18] and transperitoneal transvesical approach respectively [10–12, 15–17]. In present study, laparoscopic transvesical VVF repair was performed in all cases. In the technique of transperitoneal nontransvesical approach, Lee et al. [14] described that posterior longitudinal cystotomy is not given rather they develop a plane between posterior bladder wall and anterior vaginal wall to reach the fistula. The vaginal and vesical fistulous openings are repaired separately without any interposition graft. The main drawback of this study is that it does not provide information about the position of ureteric orifices and surgeons have fear of injuring ureters. Contrary to this, the technique of transperitoneal transvesical VVF repair allows visualization inside the bladder which gives direct information of location of ureteric orifices and hence gives confidence to surgeons [10, 12, 16].

Most of the vesicovaginal fistulae can be repaired by transvaginal route which is associated with least morbidity [20, 21]. The abdominal approach is indicated selectively and these are the fistulae suitable for laparoscopic repair [10–21]. In present study our inclusion criteria

Fig. 1. The ureteric catheters inserted in ureter are shown blue colored and the fistulous opening containing yellow colored ureteric catheter.

Fig. 3. Two fistulae (denoted by presence of blue colored ureteric catheter) lying side to side with thin bladder wall in between.

Fig. 2. The fistulous opening was circumferentially dissected and made free from bladder wall.

Fig. 4. The omentum insertion in process between bladder and vaginal repairs.

were based primarily on supratrigonal or very high-up fistulas less than 2.5 cm with stenosed or incapacacious vagina which makes them unsuitable for transvaginal repair. The laparoscopic repair certainly has advantages (table 3) which decrease the morbidity of transabdominal VVF repair and at the same time maintaining the high

success rate comparable to open repair. To best of our knowledge, our series is the largest series of laparoscopic repair with 100% success rate of fistula repair. Though the laparoscopic repair has excellent success, the major disadvantage with this technique is the difficult intracorporeal suturing. The robotic assistance has the potential

Table 2. The technical steps in laparoscopic VVF repair

Technical steps	Elaboration of the procedure
Step I	1. Under general anesthesia patient placement in lithotomy position for cystoscopy and bilateral ureteral catheterization by 6 F ureteric catheter. A different colored ureteric catheter insertion in fistula to recognize it intraoperatively 2. Vaginal packing with Vaseline soaked cotton gauze 3. Foley catheterization and securing the bilateral ureteric catheters
Step II	1. Patient placement in supine position with both arms lying by side of patient 2. Trendelenburg position of 30°-40° 3. Infraumbilical open port (10 mm) placement for camera and creation of pneumoperitoneum 4. Other 2 ports (one 12 mm and one 5 mm) placement under vision as closed port placement in bilateral iliac fossa
Step III	1. Inspection of the pelvic peritoneal cavity and assessment of the location of fistula 2. Dissection of the fistula and making planes between bladder and vagina 3. A midline posterior cystotomy is made to recognize the fistulous opening by presence of different colored ureteric catheter and more precise dissection between bladder wall flap and vaginal wall 4. Lifting and securing anterior bladder wall against inner anterior abdominal wall by silk thread mounted on laparoscopic fascial port closure needle. 5. Closure of vaginal opening by 3-0 polygalactin as interrupted intracorporeal suturing 6. The bladder closed as running suture of 3-0 polygalactin 7. Assessment of watertight closure of bladder by gentle distension with 200-300 ml of normal saline filled under gravity 8. Omental flap interposition and tucked at the vaginal suture line
Step IV	1. Soft silastic drain placement under vision in pelvis by side of bladder 2. Termination of the pneumoperitoneum and port site closure 3. Change of the vaginal packing with antiseptic soaked cotton gauze piece 4. Patient shifting to specialized postoperative recovery room

Table 3. The advantages of laparoscopic VVF repair

Advantages	
1	Respects the basic surgical principle of transabdominal VVF repair
2	Wide magnified, well illuminated and almost blood free surgical field
3	Wide exposure allows excision of fibrotic and unhealthy tissue
4	Clear identification of ureteric orifices avoids the risk of injury and also adds confidence to the surgeon
5	Tension free closure of fistulous opening including cystotomy
6	Suture material of any choice can be used for intracorporeal suturing
7	Interposition flaps such as omentum, peritoneal folds, posterosuperior peritoneal covering of bladder and tinea epiploic of sigmoid colon can be used
8	Effective postoperative drainage and closed peritoneal drainage can be similarly employed like transabdominal repair
9	Associated pelvic pathology can be dealt simultaneously
10	Early ambulation and recovery
11	Less postoperative morbidity
12	Less postoperative pain reflected as less analog visual pain score
13	Less hospital stay in comparison to open VVF repair
14	Comparatively shorter convalescence

of bridging the limitations of laparoscopic surgery while maintaining the benefits of minimally invasive surgery. The robotic view is superior because of 3-dimensional picture with a 10 magnification, with wristed instru-

mentation, ergonomic manipulation. In robot assisted VVF repair, the initial dissection and excision of fistulous tract are done laparoscopically; the robot is used for suturing of vaginal lumen and closure of cystotomy. The

Table 4. The published results of laparoscopic VVF repair

Author	Approach	Cases, n	Fistula	Ureteric catheterization with duration	Ports used	Mean operative time in minutes	Laparoscopic conversion	Mean hospital stay in days	Interposition flap/artificial substance interposition	sub-tension	Mean duration of catheterization in days	Mean blood loss in ml	Success rate	Mean follow-up in months
Nezhat et al (1994) [6]	TPTV	1	Gy	removed following repair	fol- 4	85	–	1	peritoneal fold		14	100	100%	10
Nezhat et al (1996) [7]	TPTV	19	Gy	NA	NA	NA	NA	NA	NA		7–14	NA	95%	6–48
Theobald et al (1998) [8]	TPEV	1	Gy	NA	3	70	–	8	omentum		7	100	100%	6
Miklos et al (1999) [9]	TPEV	1	Gy	removed following repair	fol- 4	NA	–	NA	omentum		21	NA	100%	6
Hernal et al (2001) [11]	TPTV	2	Gy	–	4	140	1	3	omentum		14	100	100%	6
Melamed et al (2005) [13]	TPTV	1	Gy	1 day	5	280	–	2	fibrin glue		14	50	100%	4
Sotelo et al (2005) [19]	TPTV	15	Gy & Ob	removed following repair	fol- 5	170	–	3	omentum & tinea epiploic		10.4	NA	93.3%	26.2
Chibber et al (2005) [10]	TPTV	8	Gy	removed following repair	fol- 4	220	1 (12.5%)	3	omentum and tinea epiploic		14	NA	87.5%	3–40
Mahapatra et al (2007) [16]	TPTV	12	Gy & Ob, one had vesico-uterine fistula	removed following repair	fol- 4	166	–	5.5	omentum		14	125	91.7%	3–36
Nagrati et al (2007) [15]	TPTV	13	Gy	in some cases upto 3–4 days removed following repair	4	130	1 (7.7%)	4.5	omentum/tinea	epiploic/	15	NA	91.6%	21
Tiong et al (2007) [18]	TPEV	1	Gy	removed following repair	fol- 4	260	–	1	omentum		21	100	100%	6
Endogru et al (2008) [12]	TPTV	1	Gy	bilateral JJ ureteric catheters were removed after 21 days with foley catheter	5	185	–	3	fleece-bound sealing system, a combination of collagen sponge coated with coagulation factors such as fibrinogen and thrombin		21	50	100%	6
Lee et al (2010) [14]	TPEV	5	Gy	not done	NA	95	–	5	none		14	NA	100%	56
Abdel-Karim et al (2011) [17]	TPEV	15	Gy & Ob	removed following repair	fol- 4–5	172	–	3	omentum		21	110	100%	19
Present study	TPTV	28	Gy & Ob	removed after 4–5 days	3	160	2	6	omentum & posterosuperior vesical fold of peritoneum		28	70	100%	24

TPTV = Transperitoneal transvesical; TPEV = transperitoneal extravesical; Gy = gynecol; Ob = obstetric; NA = not available.

interposition could be the fibrin glue inserted between the suture lines [13]. In pure robotic VVF repair the entire procedure is done under robotic control with omentum as interposition flap [20, 21]. The major limitation of robotic VVF repair is the high cost in comparison with lower cost of laparoscopic VVF repair which maintains high success rate similar to robotic repair [20].

The interposition flap particularly omentum is well vascularized tissue which provides vascularity, prevents the apposition of the suture lines and its rich lymphatics enhances the drainage of inflammatory fluids from surgical field. Proponents of omental interposition reports the increase success rate of fistula closure [10–12, 14, 16, 19] while some of the studies have not used the omentum [15, 17, 18]. In transvaginal or transabdominal VVF repair, interposition flaps are traditionally being used but recently some of the studies showed that it is of no use. Browning in a interesting study claimed that Martius flap raised in transvaginal repair is of no use in enhancing the success of repair, but the main drawbacks of this study are the retrospective study in which author suggested that flap should only be omitted by experienced fistula surgeons [22]. Rangnekar et al. [23] supports the use of Martius flap to increase the success of repair. In laparoscopic VVF repair the experience of intracorporeal suturing varies from surgeon to surgeon and the outcome of fistula surgery also depends upon on nature of fistula e.g. obstetric versus gynecologic fistula and hence interposition flap must be used. In present study we employed the omentum in 26 cases including two open conversions and posterosuperior vesical fold of peritoneum in 2 cases respectively.

The ideal surgical approach to a case of VVF depends upon the cause, location, size, number, and time of onset and the experience of surgeon. The inclusion criteria for laparoscopic repair in published papers are the single, supratrigonal, < 2.5 cm, not amenable to transvaginal repair. The majorities of studies included gynecologic fistula [11, 15–19] and a few of them have both obstetric and gynecologic types [10, 12, 14, 16]. In present study the gynecologic fistula was present in 10 and obstetric fistula in 18, of whom one patient had previous history of obstructed labour with ruptured uterus and bladder for which she was managed by exploratory laparotomy, repair of uterus and bladder. She developed supratrigonal fistula following this surgical intervention. In present study 2 patients had 2 fistulae lying side by side, which were repaired successfully in the same operation.

The ports placement and the internal dissections are the main cause of postoperative pain following laparo-

scopic repair. Some of the studies have used 4 ports [11, 12, 15, 16, 18, 19] while others have used 5 to 6 ports [10, 14, 15, 17]. In present study all cases were done using 3 ports only (table 4). The duration of Foley catheterization in reported studies varies between 10 days to 28 days [14]. In our patients we kept the bilateral ureteric catheters in all cases for 4 to 5 days with urethral catheters. The ureteric catheter additionally drains the pelvicaliceal system apart from the bladder drainage by Foley catheter. The Foley catheter was removed after 4 weeks all our patients.

The operative time in literature ranges from 70 to 280 minutes [10–19]. In present study our mean operative time is 160 minutes (range 140–200 minute). The operative time might depend on patient characteristics such as the presence of previous abdominal surgery and history of failed fistula repair. It also depends on surgical skill of laparoscopic surgeon. The mean reported follow-up in different series varies between 6 months and 40 months (table 4). In present study the median follow-up is 24 months (range 4–54 months). There was no recurrence in any of the case. The reported overall success rate in literature is 86 to 100% [10–19]. In our series the success rate is 100% which was due to good preoperative preparations such as correction of anemia & hypoproteinemia, meticulous dissection and interposition flaps in all cases and use of suitable suture material (3-0 polygalactin). The good bladder drainage was ensured by putting 18 F Foley catheters and ureteric catheters in all cases and also for 48 hours we put the patient in reverse Trendelenburg (15°) position to ensure the minimal contact of urine to the bladder suture line. All repairs were performed by single experienced urologist trained in laparoscopy and intracorporeal suturing.

Conclusions

Laparoscopic transperitoneal transvesical VVF repair is safe, effective minimally invasive procedure with excellent outcome. In select subgroup of supratrigonal fistulae it should be the procedure of choice.

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