Aust N Z J Obstet Gynaecol 2020; 60: 449–453

ANZJOG

DOI: 10.1111/ajo.13134

ORIGINAL ARTICLE

Vesicovaginal fistula following pelvic surgery: Our experiences and recommendations for diagnosis and prompt referral

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Conflicts of interest: no conflicts of interest.

Received: 4 June 2019; Accepted: 12 January 2020

Background: Vesicovaginal fistula (VVF) is an uncommon but known complication of pelvic surgery. Post-operative urine leakage should generate a high index of clinical suspicion for early diagnosis of VVF.

Aims: This study aims to identify areas for improvement and provide recommendations for timely and accurate diagnosis of VVF to minimise patient morbidity.

Materials and Methods: A retrospective observational study of all patients who underwent VVF repairs unrelated to malignancies in a ten-year period at two primary referral centres in Brisbane was performed to review the aetiology, performance of investigative tests and management of these cases.

Results: A total of 56 patients were studied with the identification of significant delays to diagnosis and referral, the performance of multiple unnecessary tests and low rates of primary surgeon referral.

Conclusions: Early recognition of VVF and assessment by outpatient methylene blue dye test can provide quick same-day diagnosis and minimise patient suffering. We hope this will alert gynaecologists and provide guidelines for diagnosis and improved management to allow for prompt referral and repair of genitourinary fistula.

KEYWORDS

complications, fistula, hysterectomy, pelvic surgery, vesicovaginal

INTRODUCTION

Vesicovaginal fistula (VVF) is an uncommon gynaecological complication with the formation of an abnormal connection between the bladder and the vagina. While the most common cause in low-resource regions is obstructed labour where there is pressure necrosis of the bladder and urethra, in high-resource regions, fistula formation most commonly occurs following injury to the genitourinary tract during pelvic surgery. Given patient morbidity and medicolegal implications for the surgeon, gynaecologists should maintain a high level of suspicion for fistula in patients who present post-operatively with urinary incontinence, to ensure prompt diagnosis and referral to an appropriate service for repair.

Approximately 70% of iatrogenic injuries to the genitourinary tract are not recognised at the time of surgery.[1] Mechanisms of fistula formation include unrecognised cystotomy during dissection, insufficiently repaired or breakdown of cystotomy repairs, inadvertent incorporation of the bladder with surrounding tissue while suturing, devascularisation injuries, and thermal injuries.[1,2] This results in urinoma formation with subsequent fistulisation to the vaginal cuff.[3] As a rare complication of gynaecological surgery, the most recent data on fistula rates were studied by Lee et al. in 1988 who reported 90% of VVFs in the USA resulted from surgical treatment of a benign gynaecological condition with total abdominal hysterectomy and vaginal hysterectomy accounting for 75% of these.[4] While these statistics are likely to have changed significantly since the advent

of laparoscopic-assisted and total laparoscopic hysterectomy, more recent studies by Forsgren et al. reinforce an ongoing incidence of pelvic organ fistula after hysterectomy of 0.1–4%. Risk factors for higher incidence rates are reported after radical hysterectomy compared to hysterectomy on benign indications, laparoscopic and total abdominal hysterectomy, increasing age, smoking, diverticulitis and pelvic adhesions, secondary to iatrogenic injury to the urinary tract or bowel during surgery and post-operative infections as the main etiologic factors.[5] Other possible causes include injury during laparoscopic pelvic surgery, anti-incontinence procedures, gastrointestinal pelvic surgery, and pelvic radiation.[1]

This paper provides a review of the aetiology and management of VVF in a high-resource country, which are not related to malignancy. Overall the aims of this study are to identify areas for improvement and provide recommendations for timely and accurate diagnosis of VVF to minimise patient suffering.

MATERIALS AND METHODS

Patients who underwent VVF repair unrelated to malignancies between January 2008 and September 2018 at two centres in Brisbane were identified using a casemix data search. Ethics committee approval was obtained from Metro South Human Research Ethics Committee and Greenslopes Research and Ethics Committee (HREC/12/QPAH/247, Protocol 12/24 GPH) and has been registered with the Australia and New Zealand Clinical Trials Registry (ANZCTR) (ACTRN12618000383268). Case notes were then reviewed and data collected. Particular emphasis was paid to the original surgery, intra-operative identification and management of cystotomy, post-operative diagnosis and diagnostic tests undertaken to reach the diagnosis of VVF, and time frame of referral to our urogynaecology services with expertise in fistula repair.

Basic research statistics were extrapolated using Microsoft Excel and the SPSS statistics version 25 package to outline the patient demographics, nature of the original surgery, intra-operative practices and the diagnostic behaviour of clinicians. Average length of time between original surgery, performance of investigative tests for VVF, and date of referral to the urogynaecology service was used to reflect on morbidity experienced by the patient.

RESULTS

A total of 56 patients were identified as having VVF repair between January 2008 and August 2018 at the two centres with an average age of 47.8 years (range 22–78 years). The majority of patients were referred from metropolitan Brisbane; however, referrals were also received from other parts of Queensland and interstate. Referrals were made by various clinicians with 67.9% (*n* = 38) of total referrals made by gynaecologists, 14.3% (*n* = 8) by urologists, and 17.9% (*n* = 10) by general practitioners. Of these only 50% (*n* = 28) were referred by their original surgeons yet 100% of patients had returned to the original surgeon for routine post-operative review with concerns of new post-operative urinary incontinence. Of all patients, 23.2% (*n* = 13) were referred on to other specialists and 26.8% (*n* = 15) re-presented to their general practitioner for direct referral to urogynaecology in 66.7% (*n* = 10) of these cases and to other specialities in 33.3% (*n* = 5). Following the primary surgery, an average of 1.63 different practitioners were involved in the care of each VVF in referral to fistula surgeons.

All cases were iatrogenic in nature secondary to pelvic surgery. Over half the patients (69.7%) underwent hysterectomy of some route as the causative procedure, with total abdominal hysterectomy associated with 30.4% of total cases, total laparoscopic hysterectomy with 28.6% and vaginal hysterectomy accounting for 10.7%. Continence and urethral surgery were involved in 12.5% of patients with suburethral slings, and removal of suburethral mesh. Furthermore, 7.1% had undergone other gynaecological procedures (gender reassignment surgery, suction curettage, abdominal sacral colpopexy), and 10.7% underwent obstetric procedures (cervico-isthmic cerclage, lower uterine segment caesarean sections, caesarean hysterectomy).

Of all the patients with VVF included in the study, at the time of referral 67.9% (*n* = 38) were referred with a diagnosis of VVF and the remaining 32.1% (*n* = 18) with a diagnosis of incontinence of unknown cause. Of those diagnosed with VVF, the diagnosis in 52.6% (*n* = 20) was made by the primary surgeon and in 47.4% (*n* = 18), made by other specialists or the general practitioner.

Of these 38 patients who were referred with a diagnosis of VVF, only 23.6% (*n* = 9) had a dye test performed. In these patients, eight of the nine had a diagnostic dye test which had prompted referral. In the 18 patients referred with unexplained incontinence, only four had a dye test performed and two of the four performed were positive but did not lead to diagnosis or appropriate referral (Table 1).

Patients underwent a variety of tests including computed tomography (CT) intravenous pyelogram, CT retrograde cystogram, voiding cystourethrogram, CT abdomen and pelvis, renal ultrasound, diagnostic cystoscopy and review by a pelvic physiotherapist. One patient had urodynamic studies performed twice, once by her original surgeon and then again by the secondary referrer as a primary investigation for urinary incontinence. Many of these tests were inconclusive or contributed little to the patient's overall management. Prior to referral to our services, all study cohort patients underwent an average of 1.66 diagnostic tests, with a range from zero to five tests each. No clear relationship was demonstrated between the size of the fistula and subsequent definitive diagnostic test with dye tests and cystoscopy appearing similarly useful in diagnosis of fistula of any size.

In 15 of the total 56 cases (26.8%), intra-operative recognition of the cystotomy occurred. Of these 15 cases, six were repaired intra-operatively and nine were not repaired. It is presumed in

TABLE 1 Dye test results and the performance of other tests prior to referral

Diagnosis	Dye test	Positive dye test	Other additional tests
VVF (38)	9	8	30
Unexplained incontinence (18)	4	2	13

VVF, vesicovaginal fistula.

these patients that management involved prolonged post-operative indwelling catheter use; however, clear data are not available. Despite intra-operative recognition of cystotomy, time to referral remained high at 114 days with significant delays in referral of the patients in this particularly high-risk group for whom a high degree of suspicion of VVF should be maintained. This compared to the average of 153 days. Correspondingly, performance of the tampon dye test post-operatively did increase in cases of recognised cystotomy but remained low, being performed in five of 15 cases (33.3%) compared to eight of 41 cases (19.5%) without intra-operative cystotomy (Table 2).

The mean length of time from original surgery to referral to our service was 151 days (range 0–576 days). This is excluding 12 outliers who had chronic VVFs who underwent precipitating surgery between 1975 and 2005. All patients were subsequently reviewed by our service within an average of 37 days (range 0–276 days) and underwent repair of the VVF within an average of 28.6 days after initial outpatient review for those identified to have a fistula. Indwelling catheter (IDC) was left *in situ* for two weeks and removed following trial of void at their post-operative outpatient appointment. Fifty-five of 56 patients made a full recovery with closure of VVF and one required repeat successful surgery after breakdown at post-operative three months. New stress incontinence requiring physiotherapy and/or continence surgery was identified in four of 56 cases post-operatively after the VVF repair.

DISCUSSION

VVFs, although an uncommon complication of gynaecological surgery, can cause significant morbidity to the patient. In our study, hysterectomy by any route accounted for 69.7% of patients with total abdominal hysterectomy being the most common causative surgery (30.4%).

Preventing fistula

Intra-operative fistula prevention techniques include adequate exposure of the surgical field, avoidance of blind clamping of vascular areas, direct visualisation of the ureters and mobilisation of the bladder.[6] Subsequent immediate identification of the cystotomy by the presence of blood-stained urine in the

TABLE 2 Positive rates of investigations for post-operative urinary leakage prior to referral

Test	Positive tests
Magnetic resonance imaging	1/1
Urodynamics	9/17 Small fistula (<10 mm): 4/10 Large fistula (>10 mm): 5/7
Dye test	10/13
CT cystourethrogram	7/13
Cystoscopy	6/14
CT IVP	4/10
CT abdomen/pelvis	3/10
Ultrasound renal/pelvis	1/8
Examination under anaesthesia	0/4

CT IVP, computed tomography intravenous pyelogram.

catheter bag or urine leaking into the operative field can prompt closure of the defect. To aid diagnosis, the bladder can be filled with up to 600 mL of irrigation fluid mixed with methylene blue dye, to confirm the presence and location of the cystotomy.[7] Defects should be closed using absorbable sutures, in two layers, the second being a reinforcing layer.[1] Universal cystoscopy is recommended, both routinely after hysterectomy, and additionally before cystotomy repair to check the defect and ensure there are no further defects requiring repair.[2] Cystoscopy does not detect all urinary tract injuries, particularly late ischaemic injuries; however, performance can lead to identification of inadvertent cystotomy and immediate repair.[8] In many cases injury is not suspected and routine performance of cystoscopy can lead to the detection of 95% of bladder injuries and 89% of urethral injuries.[8]

In the occurrence of a cystotomy, routine post-operative bladder drainage with prolonged placement of an IDC can lead to spontaneous resolution of the defect, with improved results in fistulae that are less than 10 mm in size.[9] No true consensus exists to define the required duration of drainage; however, the general opinion is that the catheter should remain *in situ* for 4–14 days following repair of the defect, depending on the location of the injury.[1] When watertight closure is performed and confirmed with dye test, adequate drainage reduces the risk of unplanned cystotomies to develop into VVFs.[10] Favourable conditions include size less than 10 mm and early bladder drainage to minimise the chance of secondary epithelialisation of the tract.[9]

Diagnosing fistula

As demonstrated by the presenting complaints of 100% of the study cohort, patients usually present early in the post-operative course (7–30 days) with continuous urine leakage not associated with abdominal straining or urinary urgency. Occasionally patients with usually very small VVF may present with symptoms

resembling stress urinary incontinence, making the recognition of VVF as a cause less obvious from clinical history alone.[3] Diagnosis can be readily made in the outpatients setting. Speculum examination is mandatory to try to identify urine in the vagina and a possible fistulous site, which following hysterectomy is usually expected at the apex of the vaginal vault.[3] If routine speculum examination is inconclusive and suspicions of a fistula remain, a tampon dye test must be performed and is the gold standard of diagnosis in all patients with new symptoms of any type of urinary incontinence in the post-operative course.[6] This is a simple test that can be performed easily in an outpatient setting. Diluted methylene blue dye to the volume of 250–300 mL is instilled in the bladder and leakage can be visualised with a speculum. This visualisation is a key tool to operative management of the VVF as it can aid the surgeon in their ability to plan the procedure and identify anatomical implications, unlike cystoscopy where the view obtained may be difficult to translate into the exact position in the vagina. If nothing is seen initially at dye test, the catheter is then spigotted and a tampon is placed in the vagina. Patients are requested to mobilise for some time, usually an hour will suffice, after which the tampon is removed. If the proximal tip of the tampon is stained blue, a VVF can be diagnosed.[6] If examination and dye test are unsuccessful in locating the fistula tract, and clinical suspicion persists, ensure that the bladder is adequately filled during the dye test. A sub-optimally filled bladder may produce a false-negative result, in particular if the fistula is small. This is reinforced by the positive predictive value of 76.9% with the tampon dye test in our results, a figure likely to be lowered by incorrect technique. If the dye test is negative and yet a high degree of suspicion exists, it is important to consider the phenomenon of ureteric fistula. While these were not identified in our study cohort, they would present differently on dye test as clear urine on the tampon despite a bladder filled with methylene blue dyed urine. This test result can be difficult to identify and thus further investigation with an ultrasound of kidneys, ureter and bladder or CT may be required to better assess for the presence and location of ureteric injury (Table 3).

After a positive dye test, further imaging is not necessary to confirm the presence of a VVF. If the original surgery is described as 'difficult', and concomitant disease of the upper urinary tracts is suspected appropriate imaging can be performed to exclude ureteric injuries.[6] CT and magnetic resonance imaging (MRI) may be performed.[2] It is however important to be aware of possible false-negative results. This is particularly a problem in the presence of small fistulae. In our study, of those patients with a fistula less than 10 mm, 77% underwent CT examinations, of which 70% then required further investigations due to inconclusive findings.

Most of our patients presenting with post-operative urinary leakage underwent at least two diagnostic tests before the diagnosis of VVF was made. This can be attributed to the low frequency and delay in performing the dye test, and the use of numerous non-specific, costly, invasive and time-consuming investigations which often result in false-negative results which both delay diagnosis and treatment. While this can be attributed to a low degree of suspicion, interestingly this is the case even in patients who had intra-operative cystotomy recognised and re-present with urinary incontinence. In this group, VVF is not excluded by the primary surgeon with 23.2% (n = 13) being referrals to other specialists and 26.8% (n = 15) re-presenting to their general practitioners for further investigation after the original surgeon discharged them from care.

TABLE 3 Dye test methodology

1	Diluted methylene blue dye to the volume of 250–300 mL is instilled in the bladder
2	Visualise leakage in the vagina with speculum
3	If nothing is seen initially, spigot the catheter and place tampon in vagina
4	Patients are requested to mobilise for usually half an hour
5	Re-examine: remove tampon, and assess colour

In our study, only one patient had a tampon dye test alone at the outset which prompted her referral and the remainder underwent various other diagnostic imaging tests. In 77% of these cases further testing included methods such as CT intravenous pyelogram, cystourethrogram and/or MRI as the initial investigative tests were inconclusive or falsely negative despite ongoing urinary incontinence.

Urodynamic studies are performed readily as an investigation of incontinence. In our study 85% of VVFs who had definitive diagnosis at referral, had diagnosis confirmed by urodynamic studies. It is important to note that this is not because of the test itself but rather that the performance of these studies allows for a comprehensive vaginal examination at which time urine or water from the filling catheter during cystometrogram can be seen in the vagina. These studies are invasive, expensive and subject the patient to undue stress and should not play a role in the setting of VVF diagnosis.

Due to the uncommon nature of this complication, the study is limited by a small patient cohort; however, patients have been referred from both private and public sectors, and across state borders, which reduces selection bias. Given the retrospective nature of this study, limitations include accuracy of written records and availability of important data.

Post-operative tampon dye test is the gold standard for VVF diagnosis in all patients where a post-surgical VVF is suspected through identification of intra-operative bladder injury or urinary symptoms. The tampon dye test is a cheap and easy investigation that can be performed in the outpatient setting, and allows also for surgical planning with good vaginal visualisation of the fistula position. This will avoid unnecessary and potentially invasive investigations which may also provide false-negative results. This ultimately reduces the lag time for the diagnosis of a post-surgical fistula. We recommend immediate referral of a suspected VVF for consideration of immediate or delayed surgical intervention by

a time and route determined to be clinically appropriate by the treating fistula surgeon after clinical assessment.

While the diagnosis of VVF can be simple and fast, complexities in diagnosis and delays in referral to a specialist centre occur if the surgeon does not have a high index of suspicion. This highlights the need to educate health professionals in prevention and diagnosis of fistulas by providing education to specialists and primary health service providers such as general practitioners and physiotherapists who may be the first point of contact for those suffering with urinary incontinence in the post-operative period.

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