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Review

The choice of surgical approach in the treatment of vesico-vaginal fistulae

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Abstract Vesico-vaginal fistula is a global healthcare problem that has a high prevalence in sub-Saharan Africa, where obstetric complications lead to the development of this condition. Despite this, comparatively few fistula repairs are performed in well-resourced countries, where iatrogenic injury is the leading aetiological factor. As a consequence, much of our knowledge results from the experience of relatively few fistula surgeons in areas of high prevalence borne out of large case series or retrospective cohorts rather than high level evidence. At present, debate surrounds the exact timing of repair and the most appropriate surgical approach for this condition. Certain fistulae can be selected for conservative management, while those that do not demonstrate factors associated with spontaneous closure can be selected for surgery. Fistula surgeons should be aware of several potential repair options and the principles of contemporary fistula surgery, as the first attempt at repair is likely to be the best opportunity to achieve a successful outcome. We review the available literature and provide evidence on the optimal timing of repair, the appropriate surgical approach and the use of tissue interpositioning in fistula surgery.

1. Introduction

Urogenital fistula is a global health problem and is significantly more prevalent in low-resourced countries (LRC) than in well-resourced countries (WRC). Estimates suggest that over 3 million women worldwide have an untreated fistula [1], with an incidence of one in every 800 births in sub-Saharan Africa alone [2].

Vesico-vaginal fistula (VVF) is the most common type and in LRC most often occurs as a result of prolonged obstructed neglected labour, due to the pressure necrosis that develops as the bladder becomes compressed between the foetus and the pubic symphysis. Meanwhile, the VVFs that are seen in WRC commonly develop following iatrogenic injury, with over 60% following a hysterectomy [3], and one in every 788 hysterectomies associated with urogenital fistulae [4].

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VVFs are certainly far less common in WRC, with approximately 120 urogenital fistula repairs performed on an annual basis in the UK alone [5]. As a result, the contemporary management of this infrequently encountered condition is performed in areas of high fistula prevalence and an association between volume and outcome has already been demonstrated [5].

Consequently, much of our knowledge results from the opinions of comparatively few individuals on the basis of case series, rather than clinical trial data, which have an impact on the standardization of treatment protocols and outcome measures.

We therefore review the current literature and aim to draw conclusions on the management of VVFs worldwide.

2. Aetiology of VVF

There is little high-level evidence that reflects the aetiology of VVF. In their recently published systematic review on the aetiology of urogenital fistulae, Hillary et al. [3] concluded that the majority of evidence available in the literature relates to case series published by individual surgeons. In LRC, the majority of fistulae that occur are due to prolonged obstructed neglected labour. The underlying pathological process in this context is due to ischaemia that occurs between the symphysis pubis and presenting portion of the baby. Any instrumentation of this area that occurs subsequent to this process risks fistula formation. Similar processes occur in the context of the iatrogenic fistulae that are seen in WRC. It is important to bear in mind that the fistulae that occur in this situation develop as a result of haematoma formation, infection, poor tissue healing and wide field necorosis rather than inadvertent organ injury or surgical misadventure. The clinical consequence of this become apparent as these devitalized tissues slough-off at a later period and the fistula becomes evident.

Hillary et al. [3] demonstrated that over 95% of the fistulae that are seen in LRC have an underlying obstetric aetiology, while over 80% of fistulae in WRC occur as a result of surgery. There is evidence to suggest that the proportion of iatrogenic fistulae in LRCs is increasing [6], however this may relate to the incorrect classification of a post-caesarean section fistula as iatrogenic, when in fact there is an underlying ischaemic element that occurs during prolonged labour. Meanwhile, the caesarean section fistulae seen in WRC are more akin to other surgical fistulae, due to a lack of ischaemic necrosis of the tissues in this context. Fistulae that develop following radiotherapy becomes manifest months to years after the initial intervention and are associated with chronic small vessel inflammatory changes that lead to tissue ischaemia.

3. Fistula management

The contemporary management of VVF is to perform a "delayed" surgical closure following a period of prolonged catheter drainage, a process, which allows necrotic and inflammatory material to slough and for local inflammatory responses to subside. Using this approach, a small proportion of fistulae may close spontaneously as a result of catheter drainage alone, while those that do not heal can be treated surgically. Clearly, the exact route of repair is dependent to a significant extent on surgical expertise but also on several anatomical factors, including fistula size, location on the bladder wall and involvement of other structures. Several issues exist in the management of urogenital fistulae:

- What proportion of fistulae close spontaneously?
- What is the optimal timing of repair?
- Which surgical approach is appropriate?
- What is the definition of success?

3.1. Conservative management

In WRC, the usual practice is to perform a period of catheter drainage prior to surgical repair, to allow local inflammatory responses to subside, to avoid the debilitating symptoms of urinary leakage for the patient, and to promote spontaneous healing by diverting urine away from the visceral communication to avoid epithelialization to occur along the fistulae track. The exact rates of spontaneous fistulae closure that result from prolonged catheter drainage alone are likely to be underestimates, given that successfully treated fistulae in this context are not referred for surgical management and are therefore not reported.

Hilton [7] demonstrated that 24 patients in his UK series (6.9% of total) achieved spontaneous fistulae closure following a 6—8-week period of continued catheter drainage alone. Meanwhile, both Waaldijk [8] and Tayler-Smith et al. [9] have demonstrated success rates in excess of 10% using conservative management of obstetric fistulae when early catheter drainage is instituted. The group concluded that spontaneous closure is more likely to occur if the time-to-fistulae development was short, the fistulae were small, and the fistulae were immature [9]. The spontaneous closure of radiotherapy-induced fistulae, however, rarely if ever occurs and therefore surgical management should be performed as appropriate [7].

3.2. Timing of surgical intervention

What is considered an "immediate" or "delayed" repair is a matter of debate in fistula surgery. Few published studies exist in the literature that describe the "immediate" repair of fistulae, however exactly what constitutes an "immediate" repair differs between series. Intuitively, we would suggest that a period within 4 weeks of the index insult be considered "immediate", as it is certain to be more technically challenging to perform a repair between the 4th and 12th post-operative weeks. Waaldijk [8] used a definition of $<$3 months from fistulae creation for "immediate" repair and demonstrated successful closure rates of 95.2%. Certainly, using an "immediate" approach, distress to the patient and the physical effects of urinary leakage are minimized and this is certainly important in LRC, where social isolation is a significant health problem. There is currently a distinct lack of adequate data in the published literature to support the use of an immediate approach over a delayed repair.

3.3. Surgical approach

It is difficult to make conclusions about one particular surgical approach over another, due to differences in fistulae characteristics and individual surgeon preference and expertise between series. Furthermore, most larger series do not specify whether a trans-abdominal approach or trans-vaginal approach is used or indeed if particular interposition grafts are used. This is particularly true for series originating from LRCs, where the sheer volume of patients and lack of specific operative data make reporting on approach unfeasible.

Fistulae aetiology is clearly an important factor in dictating the exact surgical approach for repair. The vast majority of fistulae that occur in WRC result from iatrogenic causes and these are much less likely to close with catheter drainage alone. Furthermore, these fistulae are commonly located higher on the bladder wall, are much larger, or involve the ureter(s) or uterus. The consequence of this is that iatrogenic VVFs are less likely to be accessible using a trans-vaginal attempt at repair and a trans-abdominal approach is preferred. The fistulae that occur in LRC however, are commonly obstetric in origin and are therefore more likely to be low VVFs or urethro-vaginal fistulae. As a result, a much higher proportion of trans-vaginal repairs are performed in this context. Hillary et al. [3] demonstrated that a trans-vaginal approach was performed in 70.7% of WRC and 84.4% of LRC. However, it is difficult to draw conclusions based on data from these non-randomised cohorts, as patients are more likely to be selected for one particular intervention based on individual fistulae characteristics or surgical expertise.

Three studies [7,10,11] specifically reported on the outcomes of trans-vaginal versus trans-abdominal fistulae repairs, which includes a pooled cohort of over 500 patients. Of these, the overall fistulae closure rates were 260/286 (90.9%) and 210/250 (84.0%) for trans-vaginal and trans-abdominal repairs respectively (Fisher's exact test, $p = 0.0176$). Again, it must be emphasized that these series include non-randomised cohorts and it is therefore not valid to perform a direct comparison of outcomes.

Both laparoscopic and robot-assisted variants of the trans-abdominal approach exist. Nezhat et al. [12] were the first to report on the outcomes of laparoscopic VVF repairs in 1994, while Melamud et al. [13] reported on the first robot assisted VVF repair in 2005. A recent systematic review of the literature performed by Miklos et al. [14] in 2015 included 44 studies and a total of 256 patients. This demonstrated overall success rates of between 80% and 100%, however all included studies consisted of case series or retrospective cohorts, with high heterogeneity, which prevented quantitative data analysis.

Tissue interposition flaps are used during repair to fill dead-space, improve vasculogenesis and reinforce the repair. The greater omentum can be transposed where available during a trans-abdominal approach to provide an additional barrier between the bladder and vaginal repair. A Martius bulbocavernosal graft is accessible during a trans-vaginal repair and this can be readily deployed in this context. An absence of these tissues during fistulae repair is common in those who have undergone multiple abdominal surgeries or previous attempts at fistulae repair and other tissues can therefore be utilised, such as perivesical peritoneum, gracilis myocutaneous flaps or labial skin. A variety of other synthetic and biological materials have been investigated to promote healing. Abou-Elela et al. [15] investigated FloSeal haemostatic matrix during the trans-abdominal repair of complex VVFs and demonstrated a 100% closure rate during long-term follow-up. Farahat et al. [16] investigated the use of de-cellularised porcine small intestinal mucosa as an interposition graft during both trans-vaginal and trans-abdominal repairs. Overall success rates were 91.3% after 6 months of follow-up, with all of the seven patients undergoing a trans-vaginal repair and 14 out of the 16 undergoing an abdominal repair demonstrating successful closure.

Many patients with radiotherapy-induced fistulae will ultimately undergo urinary diversion, either due to the complexity of the fistulae, poor tissue viability, patient performance status or surgeon preference [5]. Pushkar et al. [17] described the largest series of radiation induced VVFs, which include a cohort of 210 patients, the majority of whom underwent a trans-vaginal repair and a Martius flap or a Latzko colpocleisis, with a much smaller proportion of patients undergoing an abdominal repair. Success rate after the first attempt at repair was 51%, while the cumulative success rate in this series was 80%. Despite this, urinary diversion is seen as the treatment of choice in a proportion of these patients, owing to the significant wide-field tissue damage that occurs following radiotherapy. Others argue that repair can be attempted in carefully selected patients. Hilton [7] demonstrated a 95% closure rate in those with radiotherapy-induced fistulae undergoing a primary repair operation.

3.4. Post-operative management

Exactly what constitutes surgical success varies between series. A successful outcome in contemporary fistulae surgery is commonly defined as "anatomical closure of the fistulae", "anatomical closure of the fistulae but residual leakage", or "failed repair". Others use a definition of failure as "need for repeat procedure". Clearly, the exact definition of "success" needs to be carefully considered to allow comparisons to be made between series.

There is currently an absence of appropriate guidance for the post-operative management of patients following fistula repair. Most investigators would consider performing a post-operative cystogram to demonstrate the absence of contrast extravasation prior to removing catheters, while others would remove catheters in the absence of any post-operative assessment methods, with catheter re-insertion if leakage is present. Many patients do describe urinary leakage following catheter removal and there may therefore be some discrepancy in the reporting of urinary leakage that is due to failed fistulae closure from that which is caused by stress or urgency urinary incontinence. Stress urinary incontinence is a common complication following VVF repair, and occurs at an estimated rate of 6.5% in WRC and 10% in LRC [3]. Many series quote a wide range of post-operative incontinence rates, a finding that is likely to reflect the route of repair that is performed.

4. Discussion

The successful management of VVF depends upon several factors, including fistula aetiology, the spatial relations and complexity of the fistula itself, and surgical experience. There is a marked difference between the fistulae that occur following iatrogenic injury from those that occur in LRC as a result of obstructed labour. Obstetric fistulae tend to be more accessible by a vaginal approach, while the wide-field defect that occurs following ionizing radiation can make any attempt at repair difficult. If the VVF is detected early following the initial insult, before epithelialization along the fistula tract has begun, a 6—8-week period of catheterization can facilitate the spontaneous closure of the fistulae in up to 28% of patients [18]. Radiation induced fistulae however, rarely close spontaneously, owing to the sheer extent of ischaemic damage that occurs. Where a fistulous tract is mature, spontaneous closure is unlikely to occur and therefore surgical repair should be performed as appropriate.

There is a debate surrounding the optimal timing of surgical repair following the initial insult, immediate or delayed. Furthermore, exactly what is considered "immediate" differs between series. An argument exists for the immediate surgical repair of fistulae, which can prevent the physical, psychological and social debilitation that can occur as a result of significant urinary leakage. In the opinion of the authors however, surgical intervention is certainly more difficult within a 4—12-week period, which is due to post-intervention haematoma and local inflammatory reactions and a period of catheterization can allow this to settle before repair. There is no convincing evidence that exists in the literature to support an immediate repair over a delayed approach.

A further area of debate surrounds the appropriate route of surgery. There are no randomized trial data that compare an abdominal versus vaginal approach and clearly there would be ethical issues with the conduct of such a study, given that the choice of approach is based upon individual fistulae characteristics and surgeon preference. Where there is ureteric or uterine involvement, or access to the vagina is difficult, and then an abdominal approach is more likely to be indicated [19].

Laparoscopic and robot assisted repairs are performed, however there are trial data available at present that demonstrate a significant outcome benefit as compared to conventional open surgery. Furthermore, only two of the included articles in the review performed by Miklos and colleagues [14] contained a sample size in excess of 15 patients. It is likely that clinical judgement has been exercised by investigators, which renders these cohorts highly selected. Nevertheless, with minimally invasive approaches, the same surgical principles are utilized as used with open surgery, namely separation of the vagina from the bladder and the use of well-vascularised interposition flaps between both organs.

Vascularised tissue flaps are used to fill dead space, induce healing mechanisms, promote angiogenesis and attenuate local inflammatory responses. Despite this, there is no high level evidence in the literature that demonstrates a significant benefit of using interposition flaps [3]. However the greater omentum or Martius flaps are often readily accessible during abdominal or vaginal repair and can provide an adjunct to the principles of contemporary fistulae surgery, namely non-overlapping suture lines. A variety of alternative biological grafts and synthetic materials have been investigated in this context, namely porcine small intestinal submucosa [16], FloSeal haemostatic matrix [15], and fibrin glue [20]. However, it is likely that even in the absence of suitable quantities of omentum or labial fat, appropriate tissue interposition can be achieved with peritoneum, labial skin, or even autologous bladder mucosa flaps without a significant increase in morbidity [21,22].

5. Conclusion

The spontaneous closure of early fistulae can occur and a prolonged period of catheterization can be performed in this context, which will also serve to allow local inflammatory reactions to subside before closure is attempted. Fistulae surgeons should be well versed in several aspects of abdominal and vaginal repair, in addition to certain tissue transfer techniques that may be required as local factors dictate. The most successful outcomes are more likely to be achieved at the first attempt at repair and an association between workload and outcome has already been demonstrated [5]. These factors lend support for the centralisation of management in areas of high workload by an experienced multidisciplinary team.

Conflicts of interest

The authors declare no conflict of interest.

References

[1] Wall LL. Obstetric vesicovaginal fistula as an international public-health problem. Lancet 2006;368:1201—9.
[2] Vangeenderhuysen C, Prual A, Ould el Joud D. Obstetric fistulae: incidence estimates for sub-Saharan Africa. Int J Gynaecol Obstet 2001;73:65—6.
[3] Hillary CJ, Osman NI, Hilton P, Chapple CR. The aetiology, treatment, and outcome of urogenital fistulae managed in well- and low-resourced countries: a systematic review. Eur Urol 2016;70:478—92.
[4] Hilton P, Cromwell DA. The risk of vesicovaginal and urethrovaginal fistula after hysterectomy performed in the English National Health Service—a retrospective cohort study examining patterns of care between 2000 and 2008. BJOG 2012;119:1447—54.
[5] Cromwell D, Hilton P. Retrospective cohort study on patterns of care and outcomes of surgical treatment for lower urinary-genital tract fistula among English National Health Service hospitals between 2000 and 2009. BJU Int 2013;111: E257—62.
[6] Hilton P. Trends in the aetiology of urogenital fistula: a case of 'retrogressive evolution'? Int Urogynecol J 2016;27:831—7.
[7] Hilton P. Urogenital fistula in the UK: a personal case series managed over 25 years. BJU Int 2012;110:102—10.
[8] Waaldijk K. The immediate surgical management of fresh obstetric fistulas with catheter and/or early closure. Int J Gynaecol Obstet 1994;45:11—6.
[9] Tayler-Smith K, Zachariah R, Manzi M, van den Boogaard W, Vandeborne A, Bishinga A, et al. Obstetric fistula in Burundi: a

comprehensive approach to managing women with this neglected disease. BMC Pregnancy Childbirth 2013;13:164. https://doi.org/10.1186/1471-2393-13-164.
[10] Hadzi-Djokic J, Pejcic TP, Acimovic M. Vesico-vaginal fistula: report of 220 cases. Int Urol Nephrol 2009;41:299—302.
[11] Ockrim JL, Greenwell TJ, Foley CL, Wood DN, Shah PJ. A tertiary experience of vesico-vaginal and urethro-vaginal fistula repair: factors predicting success. BJU Int 2009;103:1122—6.
[12] Nezhat CH, Nezhat F, Nezhat C, Rottenberg H. Laparoscopic repair of a vesicovaginal fistula: a case report. Obstet Gynecol 1994;83:899—901.
[13] Melamud O, Eichel L, Turbow B, Shanberg A. Laparoscopic vesicovaginal fistula repair with robotic reconstruction. Urology 2005;65:163—6.
[14] Miklos JR, Moore RD, Chinthakanan O. Laparoscopic and robotic-assisted vesicovaginal fistula repair: a systematic review of the literature. J Minim Invasive Gynecol 2015;22:727—36.
[15] Abou-Elela A, Alfaiomy H, Torky H, Reyad E, Azazy S. The use of rotational bladder flap and hemostatic matrix sealant (FloSeal): a modified transabdominal approach to repair supratrigonal and complex vesicovaginal fistula. Surg Technol Int 2012;22:44—8.
[16] Farahat YA, Elbendary MA, Elgamal OM, Tawfik AM, Bastawisy MG, Radwan MH, et al. Application of small intestinal submucosa graft for repair of complicated vesicovaginal fistula: a pilot study. J Urol 2012;188:861—4.
[17] Pushkar DY, Dyakov VV, Kasyan GR. Management of radiation-induced vesicovaginal fistula. Eur Urol 2009;55:131—7.
[18] Waaldijk K. Immediate indwelling bladder catheterization at postpartum urine leakage—personal experience of 1200 patients. Trop Doct 1997;27:227—8.
[19] Blaivas JG, Heritz DM, Romanzi LJ. Early versus late repair of vesicovaginal fistulas: vaginal and abdominal approaches. J Urol 1995;153:1110—3.
[20] Safan A, Shaker H, Abdelaal A, Mourad MS, Albaz M. Fibrin glue versus martius flap interpositioning in the repair of complicated obstetric vesicovaginal fistula. A prospective multi-institution randomized trial. Neurourol Urodyn 2009;28:438—41.
[21] Brandt FT, Lorenzato FR, Albuquerque CD. Treatment of vesicovaginal fistula by bladder mucosa autograft technique. J Am Coll Surg 1998;186:645—8.
[22] Eilber KS, Kavaler E, Rodriguez LV, Rosenblum N, Raz S. Ten-year experience with transvaginal vesicovaginal fistula repair using tissue interposition. J Urol 2003;169:1033—6.