APPENDIX A: NON OBSTETRIC URINARY FISTULA

A.1 Introduction

The evidence relating to diagnosis and treatment of urinary fistula is generally poor and this review inevitably relies largely on numerous case series and other consensus statements. In particular, the epidemiology, aetiology, diagnosis, treatment and prevention of non obstetric fistula have been described in detail during the recent International Consultations on Incontinence (ICI) [1, 2]. Most non obsteric fistulae are iatrogenic in origin, causes including pelvic surgery (particularly hysterectomy for benign or malignant conditions) (caesarean section and obstetric injuries. The risks during pelvic surgery increase relative to the complexity of the resection, the extent of primary disease and when there has been prior radiotherapy (especialy for recurrent disease). When fistula occurs following radiotherapy for primary treatment, this may be an indication of tumour recurrence.

A.2 Diagnosis of fistula

Clinical diagnosis

Leakage of urine is the hallmark sign of a fistula. The leakage is usually painless, may be intermittent if it is position dependent, or may be constant. Unfortunately, intraoperative diagnosis of a GU or GI injury is made in only about half of the cases that result in fistula [3].

The diagnosis of VVF usually requires clinical assessment often in combination with appropriate imaging or laboratory studies. Direct visual inspection, cystoscopy, retrograde bladder filling with a coloured fluid or placement of a tampon into the vagina to identify staining may facilitate the diagnosis of a VVF. A double-dye test to differentiate between an ureterovaginal and VVF may be useful in some cases [4]. Testing the creatinine level in either the extravasated fluid or the accumulated ascites and comparing this to the the serum creatinine levels will confirm urinary leakage.

Contrast-enhanced CT with late excretory phase reliably diagnoses urinary fistulae and provides information about ureteric integrity and the presence of associated urinoma. Magnetic resonance imaging, particular with T2 weighting, also provides optimal diagnostic information regarding fistulae and may be preferred for urinary - intestinal fistulae [5].

A.3 Management of vesicovaginal fistula

*A.3.1 **Conservative management***

Before epithelialisation is complete an abnormal communication between viscera will tend to close spontaneously, provided that the natural outflow is unobstructed or if urine is diverted. Combining available data gives an overall spontaneous closure rate of 13% ± 23% (2) though this applies largely to small fistulae (less than 3 diameter) [2]. Hence, immediate management should be by urinary catheterisation or diversion.

*A.3.2 **Surgical management***

Timing of surgery

Findings from uncontrolled case series suggest no difference in success rates for early or delayed closure of VVF.

A.3.2.1 Surgical approaches

Vaginal procedures

There are two main types of closure techniques applied to the repair of urinary fistulae, the classical saucerisation/partial colpocleisis [6] and the more commonly used dissection and repair in layers or ‘flapsplitting’ technique [7]. There are no data comparing their outcomes.

Abdominal procedures

Repair by the abdominal route is indicated when high fistulae are fixed in the vault and are inaccessible through the vagina. A transvesical repair has the advantage of being entirely extraperitoneal. A simple transperitoneal repair is used less often although it is favoured by some using the laparoscopic approach. A combined transperitoneal and transvesical procedure is favoured by many urologists and is particularly useful for fistula repair following Caesarean section. There are no randomised studies comparing abdominal and vaginal approaches. Results of secondary and subsequent repairs are not as good as primary repair [8].

A single RCT compared trimming of the fistula edge with no trimming [9]. There was no difference in success rates but failed repairs in trimed cases ended up with larger recurrences than untrimmed cases, which were smaller.

Laparoscopic and Robotic
Very small series (single figures) have been reported using these techniques, but whilst laparoscopic repair is feasible with and without robotic assistance, it is not possible to compare outcomes with alternative surgical approaches.

Tissue Interposition
Tissue flaps are often added as an additional layer of repair during VVF surgery. Most commonly, such flaps are utilised in the setting of recurrence after a prior attempt at repair, for VVF related to previous radiotherapy (described later), ischemic or obstetrical fistulae, large fistulae, and finally those associated with a difficult or tenuous closure due to poor tissue quality. However, there is no high level evidence that the use of such flaps improves outcomes for either complicated or uncomplicated VVF.

Postoperative management
There is no high level evidence to support any particular practice in post operative management but most reported series used catheter drainage for at least 10 days and longer periods in radiation associate fistulae. (up to 3 weeks)

A.4 Management of radiation fistula
Modified surgical techniques are often required, and indeed, where the same techniques have been applied to both surgical and post-radiation fistulae, the results from the latter have been consistently poorer [10]. Because of the wide field abnormality surrounding many radiotherapy-associated fistulae, approaches include, on the one hand,permanent urinary and/or faecal diversion [11, 12] or alternatively preliminary urinary and faecal diversion, with later undiversion in selected cases following reconstruction. This may in some cases extend life perhaps inappropriately, and where life expectancy is deemed to be very short, ureteric occlusion might be more appropriate.

A.5 Management of ureteric fistula
General principles
Patients at higher risk of ureteric injury require experienced surgeons who can identify and protect the ureter and its blood supply to prevent injury and also recognise injury promptly when it occurs. Immediate repair of any intraoperative injury should be performed observing the principles of debridement, adequate blood supply and tension free anastomosis with internal drainage using stents [13]. Delayed presentation of upper tract injury should be suspected in patients whose recovery after relevant abdominal or pelvic surgery is slower than expected, if there is any fluid leak, and if there is any unexpected dilatation of the pelvicalyceal system. Whilst there is no evidence to support the use of one surgical approach over another, there is consensus that repair should adhere to the standard principles of tissue repair and safe anastomosis, and be undertaken by an experienced team. Conservative management is possible with internal or external drainage, endoluminal management using nephrostomy and stenting where available, and early (< 3 months) or delayed (> 6 months) surgical repair when required [14]. Functional and anatomical imaging should be used to follow up patients after repair to guard against late deterioration in

Ureterovaginal fistula
Ureterovaginal fistula occurring in the early postoperative phase predominantly after hysterectomy is the most frequent presentation of upper urinary tract fistula in urological practice. An RCT in 3,141 women undergoing open or laparoscopic gynaecological surgery lasting found that prophylactic insertion of ureteric stents made no difference to the low risk (1%) of ureteric injury [15].

Endoscopic management is often possible [16] by retrograde stenting, percutaneous nephrostomy and antegrade stenting if there is pelvicalyceal dilatation, or. ureteroscopy [17].

If endoluminal techniques fail or result in secondary stricture, the abdominal approach to repair is standard and may require end-to-end anastomosis, re-implantation into the bladder using psoas hitch or Boari flap, or replacement with bowel segments with or without reconfiguration.

A.6 Management of urethrovaginal fistula
Aetiology
Whilst they are rare, most urethrovaginal fistulae in adults have an iatrogenic aetiology. Causes include surgical treatment of stress incontinence with bulking agents or synthetic slings, surgery for urethral diverticulum and genital reconstruction in adults. Irradiation, and even conservative treatment of prolapse with pessaries can lead to the formation of fistulae.

A.6.1 ***Diagnosis***

Clinical vaginal examination, including the three swab test, is often sufficient to diagnose the presence of a urethrovaginal fistula. Urethroscopy and cystoscopy can be performed to assess the extent and location of the 6 January 2015 typeset version 49 fistula. In cases of difficult diagnosis, voiding cystourethrography (VCUG) or ultrasound can be useful. 3D MRI or CT scan is becoming utilised more widely to clarify anatomy [18, 19].

A.6.2 ***Surgical repair***

Choice of surgery will depend on the size, localisation and aetiology of the fistula and the amount of tissue loss. Principles of reconstruction include identifying the fistula, creation of a plane between vaginal wall and urethra, watertight closure of urethral wall, eventual interposition of tissue, and closure of the vaginal wall.

A.6.2.1 Vaginal approach

Goodwin described in his series that a vaginal approach yielded a success rate of 70% at first attempt and 92% at second attempt, but that an abdominal approach only leads to a successful closure in 58% of cases. A vaginal approach required less operating time, had less blood loss and a shorter hospitalisation time.

Most authors describe surgical principles that are identical to those of vesicovaginal fistula repair: primary closure rates of 53-95.4% have been described. Pushkar et al. described a series of 71 women, treated for rethrovaginal fistula. 90.1% of fistulae were closed at the first vaginal intervention. Additionally, 7.4% were closed during a second vaginal intervention. Despite successful closure, stress incontinence developed in 52%. The stress incontinent patients were treated with synthetic or autologous slings and nearly 60% became dry and an additional 32% improved. Urethral obstruction occurred in 5.6% and was managed by urethral dilation or urethrotomy [20].

Flaps and neourethra.

The simplest flap is a vaginal advancement flap to cover the urethra lsuture line.

Labial tissue can be harvested as a pedicled skin flap. This labial skin can be used as a patch to cover the urethral defect, but can also be used to create a tubular neo-urethra [21, 22]. The construction of a neo-urethra has mostly been described in traumatic aetiologies. In some cases a transpubic approach has been used [23]. The numbers of patients reported are small and there are no data on the long-term outcome of fistula closure and continence rates. The underlying bulbocavernosus tissue can be incorporated in the pedicled flap and probably offers a better vascularisation and more bulking to the repair. This could allow a safer placement of a sling afterwards, in those cases where bothersome stress incontinence would occur postoperatively [24, 25].

Martius flap

While in obstetrical fistula repair it was not found to have any benefit in a large retrospective study in 440 women, the labial bulbocavernosus muscle/fat flap by Martius is still considered by some to be an important adjunctive measure in the treatment of genitourinary fistula where additional bulking with well vascularised tissue is needed [26]. The series of non-obstetrical aetiology are small and all of them are retrospective. There are no prospective data, nor randomised studies [27]. The indications for Martius flap in the repair of all types of fistula remain unclear.

Rectus muscle flap

Rectus abdominis muscle flaps have been described by some authors [28, 29].

A.6.2.2 Abdominal approach

A retropubic retrourethral technique has been described by Koriatim [30]. This approach allows a urethrovesical flap tube to be fashioned to form a continent neourethra.

Evidence Summary	LE
Spontaneous closure of surgical fistulae does occur, although it is not possible to establish the rate with any certainty.	3
There is no evidence that the timing of repair makes a difference to the chances of successful closure of a fistula.	3
There is no high quality evidence of differing success rates for repair of vesicovaginal fistulae data by vaginal, abdominal, transvesical and transperitoneal approaches.	3
A period of continuous bladder drainage is crucial to successful fistula repair but there is no high level evidence to support one regime over another.	3
A variety of interpositional grafts can be used in either abdominal or vaginal procedures, although there is little evidence to support their use in any specific setting.	3
Post radiation fistula	
Successful repair of irradiated fistulae requires prior urinary diversion and the use of non irradiated tissues to effect repair.	3
Ureteric fistula	
Prophylactic ureteric stent insertion does not reduce risk of ureteric injury during gynaecological surgery.	2
Antegrade endoluminal distal ureteric occlusion combined with nephrostomy tube diversion often palliates urinary leakage due to malignant fistula in the terminal phase.	4
Urethrovaginal fistula	
Urethrovaginal fistula repair may be complicated by stress incontinence, urethral stricture and urethral shortening necessitating long-term follow-up.	3

Recommendations	GR
General	
Surgeons undertaking complex pelvic surgery should be competent at identifying, preserving and repairing the ureter.	C
Do not routinely use ureteric stents as prophylaxis against injury during routine gynaecological surgery.	B
Suspect ureteric injury or fistula in patients following pelvic surgery if a fluid leak or pelvicalyceal dilatation occurs postoperatively or if drainage fluid contains high levels of creatinine.	C
Suspect uretero-arterial fistula in patients presenting with haematuria with a history of relevant surgery.	C
Use three dimensional imaging techniques to diagnose and localise urinary fistulae.	C
Manage upper urinary tract fistulae by conservative or endoluminal technique where such expertise and facilities exists.	B
Surgical principles	
Surgeons involved in fistula surgery should have appropriate training, skills, and experience to select an appropriate procedure for each patient.	C
Attention should be given as appropriate to skin care, nutrition, rehabilitation, counselling and support prior to and following fistula repair.	C
if a vesicovaginal fistula is diagnosed within six weeks of surgery, consider indwelling catheterisation for a period of up to 12 weeks after the causative event.	C
Tailor the timing of fistula repair to the individual patient and surgeon requirements once any oedema, inflammation, tissue necrosis, or infection are resolved.	B
Where concurrent ureteric re-implantation or augmentation cystoplasty are required, the abdominal approach is necessary.	C
Ensure that the bladder is continuously drained following fistula repair until healing is confirmed (expert opinion suggests: 10-14 days for simple and/or postsurgical fistulae; 14-21 days for complex and/or post-radiation fistulae).	C
Where urinary and/or faecal diversions are required, avoid using irradiated tissue for repair.	C
Use interposition grafts when repair of radiation associated fistulae is undertaken.	C
In patients with intractable urinary incontinence from radiation-associated fistula, where life expectancy is very short, consider performing ureteric occlusion.	C
Repair persistent ureterovaginal fistula by an abdominal approach using open, laparoscopic or robotic techniques according to availability and competence.	C
Consider palliation by nephrostomy tube diversion and endoluminal distal ureteric occlusion for patients with ureteric fistula associated with advanced pelvic cancer and poor performance status.	C
Urethrovaginal fistulae should preferably be repaired by a vaginal approach.	C

5. REFERENCES

1. De Ridder D, et al., Committee 18. Fistula. In: 5th International Consultation on Incontinence, Paris February 2012.
http://www.icud.info/incontinence.html
2. De Ridder D, et al. Surgical Treatment of Obstetric Fistula. In: Obstetric Fistula in the developing world. 4th International Consultation on Incontinence, Committee 18. Paris July 5-8, 2008. Plymouth: Health Publication Ltd, 2009.
http://www.icud.info/incontinence.html
3. Ostrzenski A, et al. Bladder injury during laparoscopic surgery. Obstet Gynecol Surv 1998 53(3): p. 175-80.
http://www.ncbi.nlm.nih.gov/pubmed/9513988
4. Hadzi-Djokic J, et al. Vesico-vaginal fistula: report of 220 cases. International Urology & Nephrology 2009 41(2): p. 299-302.
http://www.ncbi.nlm.nih.gov/pubmed/18810652
5. Narayanan P, et al. Fistulas in malignant gynaecologic disease: Etiology, imaging, and management. Radiographics 2009 29(4): p. 1073-1083.
http://www.ncbi.nlm.nih.gov/pubmed/19605657
6. Latzko W. Postoperative vesicovaginal fistulas: genesis and therapy. Am J Surg.1942;58:211-218
7. Wall LL. Dr. George Hayward (1791-1863): a forgotten pioneer of reconstructive pelvic surgery. Int Urogynecol J Pelvic Floor Dysfunct. 2005 16(5):330-3.
http://www.ncbi.nlm.nih.gov/pubmed/15976986
8. Hilton P, et al. Epidemiological and surgical aspects of urogenital fistulae: a review of 25 years experience in south-east Nigeria. Int Urogynecol J Pelvic Floor Dysfunct. 1998;9(4):189-94.
http://www.ncbi.nlm.nih.gov/pubmed/9795822
9. Shaker H, et al. Obstetric vesico-vaginal fistula repair: should we trim the fistula edges? A randomized prospective study. Neurourol Urodyn. 2011 Mar;30(3):302-5.
http://www.ncbi.nlm.nih.gov/pubmed/21308748
10. Jovanovic MD, et al. Efficiency of urinary fistulas surgical treatment. Eur Urol Suppl 2010;9(6):572.
http://www.europeanurology.com/article/S1569-9056(10)61340-1/abstract/s54-efficiency-of-urinaryfistulas-surgical-treatment
11. Krause S, et al. Surgery for urologic complications following radiotherapy for gynecologic cancer. Scand J Urol Nephrol. 1987;21(2):115-8.
http://www.ncbi.nlm.nih.gov/pubmed/3616502
12. Langkilde NC, et al. Surgical repair of vesicovaginal fistulae--a ten-year retrospective study. Scand J Urol Nephrol. 1999 33(2):100-3.
http://www.ncbi.nlm.nih.gov/pubmed/10360449
13. Djakovic N, et al. Members of the European Association of Urology (EAU) Guidelines Office. Guidelines on Urological Trauma. In: EAU Guidelines, edition presented at the 24th EAU Annual Congress, Stockholm 2009. ISBN 978-90-79754-83-0.
http://www.uroweb.org/guidelines/online-guidelines/
14. Brandes S, et al. Diagnosis and management of ureteric injury: An evidence-based analysis. BJU Int. 2004 94(3):277-89.
http://www.ncbi.nlm.nih.gov/pubmed/15291852
15. Morton HC, et al. Urethral injury associated with minimally invasive mid-urethral sling procedures for the treatment of stress urinary incontinence: A case series and systematic literature search. BJOG. 2009 Jul;116(8):1120-6
http://www.ncbi.nlm.nih.gov/pubmed/19438488
16. Shaw M, et al. The management of bilateral ureteric injury following radical hysterectomy. Adv Urol. 2008:524919.
http://www.ncbi.nlm.nih.gov/pubmed/18604294
17. Narang V, et al. Ureteroscopy: savior to the gynecologist? Ureteroscopic management of post laparoscopic-assisted vaginal hysterectomy ureterovaginal fistulas. J Minim Invasive Gynecol. 2007 14(3):345-7
http://www.ncbi.nlm.nih.gov/pubmed/17478367
18. Abou-El-Ghar ME, et al. Radiological diagnosis of vesicouterine fistula: role of magnetic resonance imaging. J Magn Reson Imaging 2012 36(2): p. 438-42.
http://www.ncbi.nlm.nih.gov/pubmed/22535687
19. Quiroz LH, et al. Three-dimensional ultrasound imaging for diagnosis of urethrovaginal fistula. Int Urogynecol J. 2010 21(8):1031-3.
http://www.ncbi.nlm.nih.gov/pubmed/20069418

20. Pushkar DY, et al. Management of urethrovaginal fistulas. Eur Urol. 2006 50(5):1000-5. http://www.ncbi.nlm.nih.gov/pubmed/16945476
21. Pushkar D. Editorial comment on: Transpubic access using pedicle tubularized labial urethroplasty for the treatment of female urethral strictures associated with urethrovaginal fistulas secondary to pelvic fracture. Eur Urol. 2009 56(1):200. http://www.ncbi.nlm.nih.gov/pubmed/18468776
22. Xu YM, et al. Transpubic access using pedicle tubularized labial urethroplasty for the treatment of female urethral strictures associated with urethrovaginal fistulas secondary to pelvic fracture. Eur Urol. 2009 Jul;56(1):193-200. http://www.ncbi.nlm.nih.gov/pubmed/18468778
23. Huang CR, et al. The management of old urethral injury in young girls: analysis of 44 cases. J Pediatr Surg. 2003 38(9):1329-32. http://www.ncbi.nlm.nih.gov/pubmed/14523814
24. Candiani P, et al. Repair of a recurrent urethrovaginal fistula with an island bulbocavernous musculocutaneous flap. Plast Reconstr Surg. 1993 92(7):1393-6. http://www.ncbi.nlm.nih.gov/pubmed/8248420
25. McKinney DE. Use of full thickness patch graft in urethrovaginal fistula. J Urol. 1979 122(3):416. http://www.ncbi.nlm.nih.gov/pubmed/381691
26. Browning A. Lack of value of the Martius fibrofatty graft in obstetric fistula repair. Int J Gynaecol Obstet. 2006 93(1):33-7. http://www.ncbi.nlm.nih.gov/pubmed/16530766
27. Baskin D, et al. Martius repair in urethrovaginal defects. J Pediatr Surg. 2005 40(9):1489-91. http://www.ncbi.nlm.nih.gov/pubmed/16150356
28. Atan A, et al. Treatment of refractory urethrovaginal fistula using rectus abdominis muscle flap in a six-year-old girl. Urology 2007 69(2): p. 384 e11-3. http://www.ncbi.nlm.nih.gov/pubmed/17320687
29. Bruce RG, et al. Use of rectus abdominis muscle flap for the treatment of complex and refractory urethrovaginal fistulas. J Urol. 2000 163(4):1212-5. http://www.ncbi.nlm.nih.gov/pubmed/10737499
30. Koraitim M. A new retropubic retrourethral approach for large vesico-urethrovaginal fistulas. J Urol. 1985 134(6):1122-3. http://www.ncbi.nlm.nih.gov/pubmed/4057401