Urological Aspects of Perineal Surgery and Reconstruction

4

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4.1 Introduction

The perineum is a key component of urological anatomy, with the urological functional outcomes of a wide variety of procedures being dependent on the maintenance and restitution of the perineum. Many of the pathologies described in other chapters in this book will have significant urological components; the importance of proper Multidisciplinary Team planning cannot be overstated in complex pelvic cases. All too frequently, involvement of key urological structures, particularly in the perineum, is overlooked with potentially significant and life-changing consequences to the patient. Awareness of these structures and careful planning are keys to the early identification and preservation of these structures.

Urological malignancies involving the perineum are uncommon, though centralization of urological cancers has meant that increasingly these are dealt with in higher volume centers [1, 2]. Occasionally though, these malignancies can present unexpectedly and benign urological conditions involving the perineum can present acutely requiring emergency intervention. More frequently, due to the close proximity of urological structures to other areas of the perineum, urological involvement in perineal surgery is common in nonurological pathologies and it is therefore important for all surgeons operating around the perineum to have an awareness of the potential for complications.

4.2 Key Urological Anatomical Considerations

Although most surgeons will have an awareness of the anatomy of the perineum and the pelvis, the proximity and relationship of certain key urological structures can be overlooked, with potential significant consequences. The urogenital triangle, representing the anterior half of the perineum is associated with the urological structures of the perineum. In females, the urethra, external sphincter, and vagina sit within the deep perineal pouch, formed by the deep fascia of the pelvic floor anteriorly and the perineal membrane inferiorly. In males, the deep perineal pouch contains the bulbourethral glands and deep perineal muscles. The superficial perineal pouch is separated from the deep by the perineal membrane, a tough fascia that acts as an attachment for the musculature of the external genitalia. The inferior border is formed by the superficial perineal fascia and it contains the erectile tissue of the penis and clitoris, along with the bulbospongiosus, ischiocavernosus, and super-

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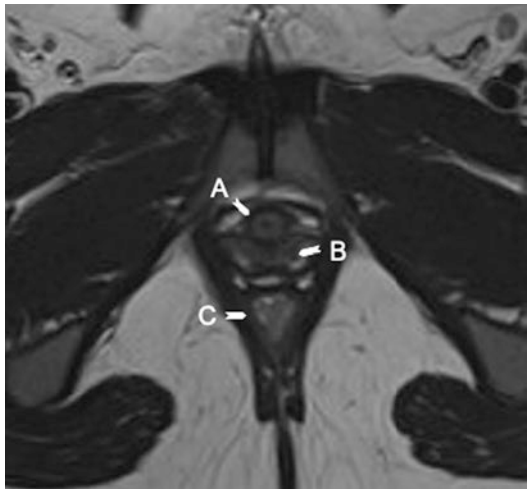

Fig. 4.1 Female perineum. Axial T2 MRI views of the female perineum. The uretha (A) can be seen anterior to and in close proximity with the anterior wall of the vagina (B). Posterior to the vagina is the rectum (C)

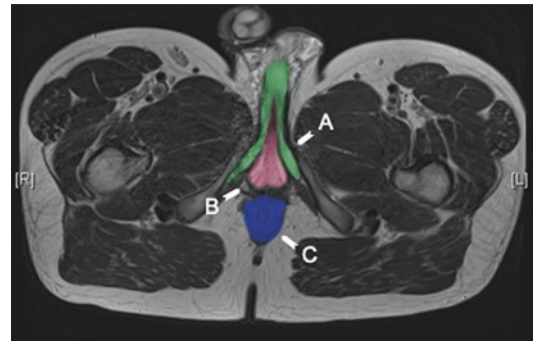

Fig. 4.2 Male perineum. The male perineum, showing the crus of the penis (A), the bulb of the penis (B) and the rectum (C). The crus is a continuation of the corpus cavernosa, which form the erectile bodies of the shaft of the penis; damage to these structures can result in erectile dysfunction. The bulb (B) contains the urethra and is covered by the bulbocavernosal muscle. Close proximity of the anorectum to the bulb results in vulnerability to damage during perineal surgery

ficial transverse perineal muscles. The posterior border is formed by the perineal body, a tough fibromuscular body at the center point of the perineum that divides the perineum in the urogenital and anorectal triangle.

In the female, the short nature of the urethra and the close proximity of the urethral sphincter to both the perineum and the anterior vaginal wall, means that there is a high risk of injury during perineal surgery (Fig. 4.1). Equally, any damage to the muscles of the superficial pouch or damage to the perineal body in particular can result in disruption to the support of the bladder neck. Either of these issues can result in significant problems with stress urinary incontinence, or even insentient, total incontinence. In the context of complex perineal wounds, this type of incontinence can have a huge impact on the patient and can be extremely challenging to manage, let alone treat definitively. Incontinence can also disrupt or prevent the healing of perineal wounds, compromising further care.

In the male, the external sphincter sits somewhat deeper than in the female and as such is less prone to injury (Fig. 4.2). However, the proximal penile and bulbar urethra sit more superficial that is often suspected, and as such are prone to injury. Incomplete urethral injuries can be managed conservatively with a Foley catheter, though often result in urethral stricture disease. More extensive injuries often require multistage repairs and will require the input from specialist urethral reconstruction teams. For this reason, at our institute we would strongly recommend the use of a urethral catheter to help facilitate the identification and localization of the urethra whenever perineal surgery is being considered.

The crus of the penis diverges and becomes more lateral, as it progresses posteriorly through the perineum (Fig. 4.3). As such, they are potentially susceptible to damage in the lateral perineum and damage can result in significant impairment to erectile function through disruption to the erectile mechanism. Similarly, the neurovascular bundles that are essential for erectile function are vulnerable as they enter the perineum adjacent to the bulb of the penis.

Sexual dysfunction in females following perineal and pelvic surgery is often overlooked and disregarded by surgeons, but can be significant and can have a major impact on quality of life postoperatively. Sexual dysfunction can occur in up to 60% of women undergoing low anterior resections or APRs, due to issues including loss of clitoral and distal vaginal sensation, vaginal dryness, and length loss. Radical Cystectomy for bladder cancer is associated with anorgasmia or reduced ability to orgasm in 45% [3]. Preservation of the lateral walls of the vagina can help pre-

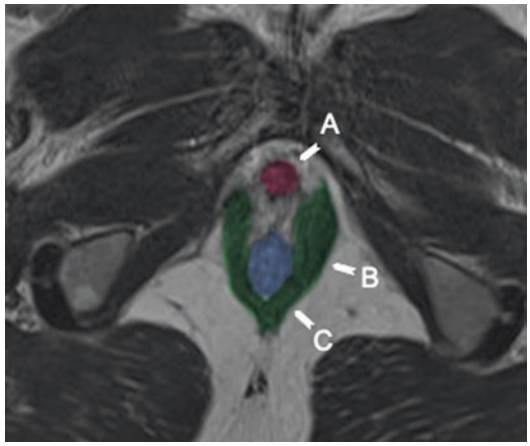

Fig. 4.3 Male Sphincters. Outlining the proximity of the urethra (A) and rectum (C) in the male as they pass through the pelvic floor. The puborectalis, part of the pelvic floor musculature, is marked (B)

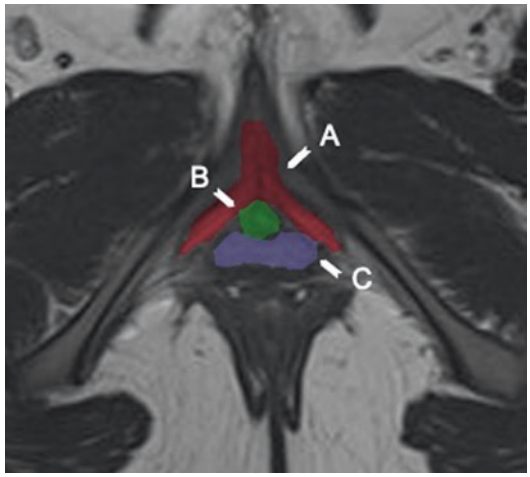

Fig. 4.4 Crus of clitoris. Showing intimate relationship of crus of the clitoris (A, in red) and its close relationship with then urethra (B, in green) and the vagina (C, in purple)

serve the plexus fibers supplying the distal urethra, which along with preservation of the neurovascular bundles in the pelvis can help maintain orgasmic function. Care must be taken whenever operating anterior to the vagina to preserve the crus of the clitoris and the bulb, which sits slightly superior and medial to the crus (Fig. 4.4). Unrecognized damage to either of these structures can result in sexual dysfunction postoperatively.

4.3 Urological Cancers and the Perineum

Despite the close proximity of urological structures to the perineum, the more common pelvic urological malignancies generally do not involve the pelvic floor and when they do, surgery is not normally a viable treatment option due to the inherent advance nature of the disease. However, there are situations when the management of these malignancies will require more extensive surgery, often involving the perineum.

4.3.1 Prostate Cancer

Prostate cancer is the most commonly encountered pelvic malignancy but disease progression into the pelvic floor and beyond is uncommon and surgical resection when there is involvement is unlikely to offer the patient long-term benefit. On rare occasions, there may be a palliative role for exenterative surgery (for example, in patients with impending rectal obstruction unable to receive radiotherapy). An example of such cases is given in Fig. 4.5, showing axial and sagittal views of a T4 prostate cancer infiltrating into the anterior rectum. Although radiotherapy to achieve local control is normally the treatment of choice, these patients occasionally require pelvic total exenteration, normally with the lower rectum and anus removed en-bloc with the bladder and prostate. The colorectal aspects of this procedure are broadly similar to Abdominoperineal resection (APR) and the perineal management aspects are as described in the chapter on colorectal surgery.

Although on occasions it may be technically possible to preserve the bladder in this setting, functional outcomes (particularly in terms of urinary incontinence) are poor due to likely involvement with the pelvic floor, urethral sphincter, and bladder neck. It is the practice of our institute to perform a urinary diversion in this situation, normally with an ileal conduit, which is generally associated with better quality of life outcomes as compared to attempts to perform bladder preservation.

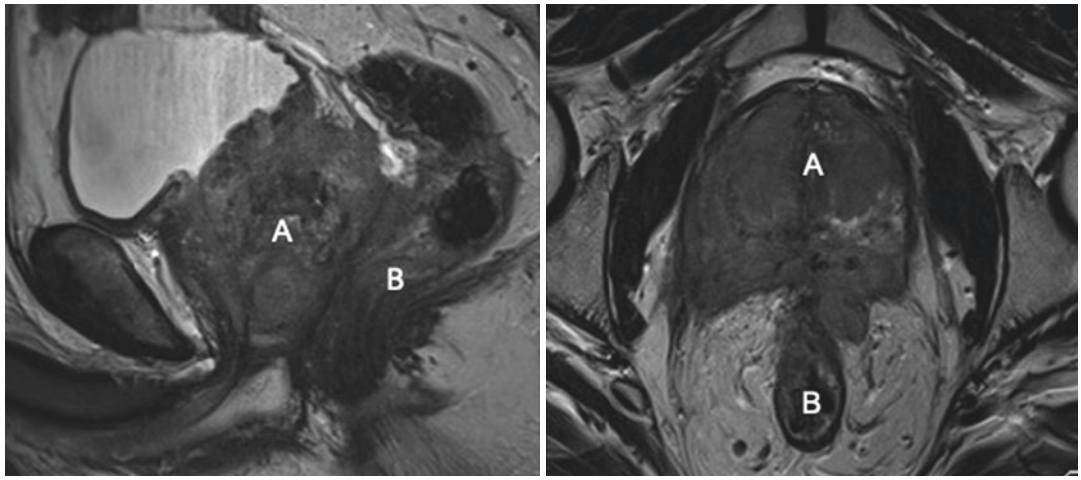

Fig. 4.5 T4 Prostate. Showing an advanced T4 Prostate cancer (A) infiltrating into the rectum (B), with clear tethering of the rectum at 12 o'clock on the axial views. In this case, the patient is known to have Lynch Syndrome, meaning that radiotherapy would result in a very high risk of malignant transformation in the rectum. Although it was felt that surgical resection of this gentleman's disease would be unlikely to cure his prostate cancer, it was felt by the MDT that due the very high risk of bowel and ureteric obstruction, a total pelvic exenteration would be his best option for long term disease control and maintenance of quality of life

4.3.2 Bladder and Urethral Cancer

The urinary tract is lined with transitional-cell epithelium (urothelium), which a specialized epithelial layer with waterproof and chemo-resistant properties to effectively store and transit urine. The transitional epithelium is frequently exposed to carcinogens resulting in urothelial cancers, particularly in the bladder where exposure is greatest due to its storage function [4]. A small percentage of tumors arise from or include the urethra, which can be of significance to the perineum, particularly in women due to the close proximity of the urethra and bladder neck to the perineum.

Superficial bladder cancer, which represents 65–75% of urothelial disease, is generally managed endoscopically and has a low risk of progression. Invasive disease affecting muscular layer is a very different and much more aggressive disease; more than 10% of patients present with a metastatic disease and even when localized and treated radically, 5-year survival is rarely more than 70% [5]. For those with metastatic disease, the prognosis from presentation is normally less than 12 months. Radical surgery involves the removal of the bladder and distal ureters, along with the prostate in a man due to the integral nature of the urothelium-lined prostatic urethra.

In women, cystectomy is normally performed as an anterior pelvic clearance due to the close proximity of gynecological structures to the female bladder. This would usually include excision of the anterior vaginal wall adjacent to the posterior bladder wall, along with the urethral meatus. Extensive involvement of the female urethra will therefore necessitate a much more extensive resection of the vagina and vulva, and this resultant defect may require a flap to achieve adequate closure.

This is also true of rare, primary urethral malignancies in females (such as urethral melanoma or malignancies arising from urethral diverticulum). In primary urethral malignancies, generally a wider resection of the vagina is required, resulting in a greater likelihood of a significant defect. However, in more distal urethral disease, it is not always necessary to perform a cystectomy/anterior clearance. In this situation, the urethra will be mobilized to the bladder neck via a laparotomy then divided and

closed, with a suprapubic catheter left in situ for long-term bladder drainage. This is an often-used strategy in the elderly or frail as it avoids the significant morbidity associated with an anterior pelvic clearance, though at the cost of a slightly increased risk of positive resection margins. Flap closure of the defect is often required, both due to the likely wider resection of the anterior vaginal wall but also due to the need to ensure adequate separation of the defect from the suture line of the bladder neck. If the bladder neck closure is allowed to sit in close proximity to the vaginal wall, closure without the interposition of healthy, vitalized tissue, there is a high likelihood of the formation a vesicovaginal fistula. This can have a devastating impact on patient in terms of quality of life, particularly as it can prevent the healthy establishment of a flap or healing of the perineal wound. Moreover, closure of these fistulae is likely to require a complex pelvic procedure that many patients in this situation would not be fit enough to tolerate.

4.3.3 Penile Cancer

Penile cancer is predominantly a squamous carcinoma, mainly arising from the distal aspect of the phallus and is more common in uncircumcised men. Like cervical carcinoma, it is strongly associated with Human Papilloma Virus [6]. Penile cancer is a rare malignancy and although adequate oncological outcomes can be achieved with radical surgery, centralization of cancer services has led to a dramatic increase in organ preserving surgery. The management of nodal disease, particularly in the groins, is frequently required and high-volume expertize is essential to limit the complications associated with potentially morbid procedures.

When feasible, organ preservation can achieve good cosmetic and functional outcomes even when the glans penis or distal penis requires resection [7]. If a total penectomy is required, due to splitting of the crus of the penis within the perineum, it is often possible to preserve the proximal urethra and importantly the external urethral sphincter. It may be possible therefore to create a continent perineal urethrostomy, with the residual distal urethra spatulated onto the perineum in the midline. If the disease involved the bulb of the penis, resection may well compromise the integrity of the urethral sphincter and although in these situations it may be feasible to create an incontinent perineal urethrostomy, it would normally be preferable to insert a long-term suprapubic catheter as long-term perineal catheters are rarely well tolerated and often cause spatulation or "fish-slicing" of the perineum.

Although there has been an increasing move toward penile preserving surgery, due to patient self-neglect, there remains a significant number of patients who present with advanced disease, often involving the perineum [8]. Although surgery may not be curative in these situations, often radical debridements and extensive resections are required due to the symptomatic nature of these conditions. Large lesions often fungate, causing the patient discomfort but also can become infected and frequently present with sepsis. There is also the risk of metastatic nodal disease eroding into vital structures, including major vessels.

Management of defects left by these extensive resections can be challenging, more often than not due to the infective nature of the lesion at presentation, but also due to the need to preserve and protect the testes, as resection in these circumstances can often include the scrotal wall. If the defect is clean and healthy, the use of flaps for closure of these defects is often beneficial. If not, these defects often create long-term difficulties to manage problematic wounds, which could affect the timing of adjuvant or palliative cytotoxic regimens.

4.3.4 Pelvic Exenteration

The occasional need for pelvic exenteration has been discussed in the colorectal chapter and although main indications for this procedure are colorectal, there are instances where there is a Urological primary cancer. For example, a bladder tumor may be involving the sigmoid or rectum, though generally with locally advanced

urological tumors, such resections are performed for palliative purposes as the chance of long-term cure is small.

From a urological perspective, total pelvic exenterations involves the anterior and lateral mobilization of the bladder (and prostate in a man) along with other pelvic organs. Urinary diversion is achieved normally with the creation of an ileal conduit, though occasionally other part of bowel, for example sigmoid colon, can be used depending on the clinical picture (Fig. 4.6).

Total pelvic exenteration is a complex procedure that requires specialized and experienced multidisciplinary input, from the planning stages to the operation itself. Other specialties often offer differing viewpoints, as well as identifying potential pitfalls and hazards that the primary specialty may not be aware of. Although a capable surgeon could perform each stage of multivisceral resections, it is the view of our institution and many similar units that multivisceral resections should be performed by multispecialist teams, to achieve the best possible outcome.

Fig. 4.6 Male pelvic mass. Showing the intimate relationship between pelvic structures and how a large mass can impact on them. In this case, a young male with a large benign retroperitoneal mass, the mass appears to be arising from the prostate (B), displacing the bladder (A) anteriorly as well as the seminal vesicles (C) posteriorly. Although the rectum (D) appears separate to the lesion, axial views reveal that the mesentry of the sigmoid is likely to be involved. In planning his case, it was felt that although surgical resection was feasible, there was however a high risk of rectal injury and complications which could have significant implications to the patient

4.4 Benign Conditions Affecting the Perineum

4.4.1 Infection

In most nonspecialized centers, the most common encounter with complex urological perineal issues occurs with infectious processes, most frequently Fournier's gangrene. Fournier's is a rare but a potentially catastrophic fulminant form of infective necrotizing fasciitis affecting the genital, perineal, and perianal tissues. It is frequently associated with diabetes or other immune-compromising conditions, though not exclusively so and Fournier's can present in otherwise healthy individuals [9].

Infective process normally originates from infected skin in the perineum, penis or scrotum, though occasionally, can occur after anorectal or urogenital trauma, or even through iatrogenic causes. The destructive, infective process progresses rapidly and requires immediate and aggressive intervention. Debridement is required to healthy uninfected tissue; although the infection tends to travel along, rather than through Bucks fascia, the lateral extent of the debridement can be very extensive. It is not uncommon to see the whole of the penoscrotal tissue involved, along with the anorectal and perineal skin. The anus may require circumscribing, and in this situation a defunctioning colostomy is required as defecation would be challenging and could compromise wound healing. Careful consideration of siting of the colostomy is required as occasionally the anterior abdominal wall may be involved (Fig. 4.7).

Normally, as the debridement tends to be relatively superficial, skin grafting alone is required for adequate wound management. However, if the ischiorectal fossa is involved, occasionally there may well be the need for filling of a defect in the perineum. In these situations, as the abdomen is unlikely to have been opened, the desir-

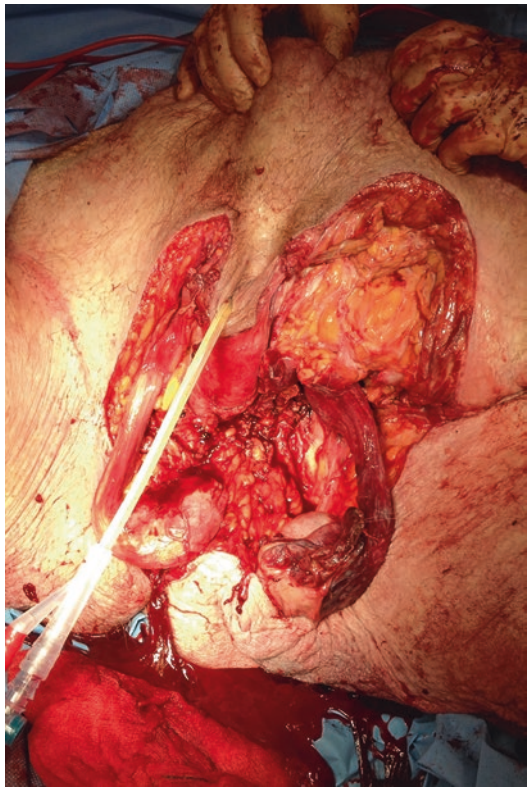

Fig. 4.7 Fournier's Gangrene. Views of the perineum after an aggressive debridement of a typical presentation of Fourneir's gangrene. The patient is characteristically obese with underlying poorly controlled diabetes mellitus. All that was visible externally was a small black lesion, though the subcutaneous extension was extensive, involving the scrotum, penis and perineum. On this occasion, the anus and perianal tissue was not involved, so defunctioning colostomy was not required

able management option would be a flap closure of the defect. However, as with skin grafting, this is likely to be performed in a delayed setting due to the frequent need for secondary debridements as there is often residual infected or necrotic tissue that needs removing on second or even third debridement, before definitive wound management can be achieved (Video 1).

Less commonly, the bulb of the penis or the corpora can be involved in an infective process, which can be an extremely challenging scenario and requires the early involvement of specialist penile surgical teams. If the corpora are involved, it is likely that erectile mechanism will be permanently compromised. Although it is unlikely that a specialist team would be able to preserve penile function in the case of gross infection, it may be possible if involvement is negligible or uncertain. If there is corporal destruction, early involvement of the penile team will aid the plans for further reconstructive plans including penile prosthesis or even phalloplasty, if there is substantial fascial destruction which prevents implants. In these situations, the specialist penile team's involvement can ensure that the patient is given the best chance of successful and functional reconstruction in the future.

4.4.1.1 Urethral Surgery

Masses in the female perineum and lower pelvis should always be carefully assessed to exclude potential involvement of the urinary tract. It is not uncommon to find benign lesions in the vulva and anterior vagina originating from the urethra; urethral diverticulum, for example, is often mistaken for simple cysts. Similarly, lesions identified within the pelvis can often originate from urethra at or even below the level of the pelvic floor. Figure 4.8 shows a urethral diverticulum, in close proximity to the urethral sphincter in a 25-year-old female [10]. This patient was planned for surgery to excise a "simple vulval cyst"; it is

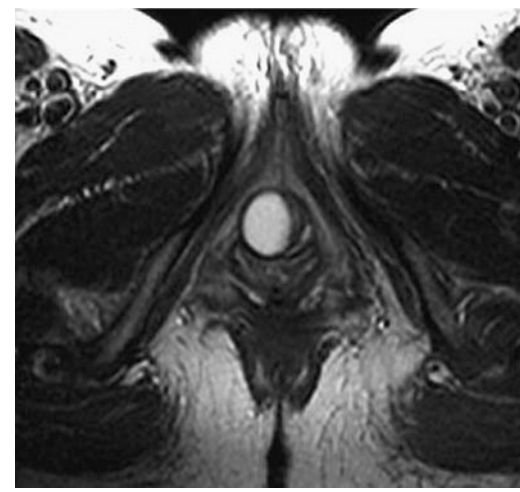

Fig. 4.8 Urethral Diverticulum. T2 weighted axial MRI, showing a fluid filled spherical lesion anterior to vaginal vault. Clinical and endoscopic examination revealed a small communication with the intra-sphincteric urethra, consistent with a urethral diverticulum

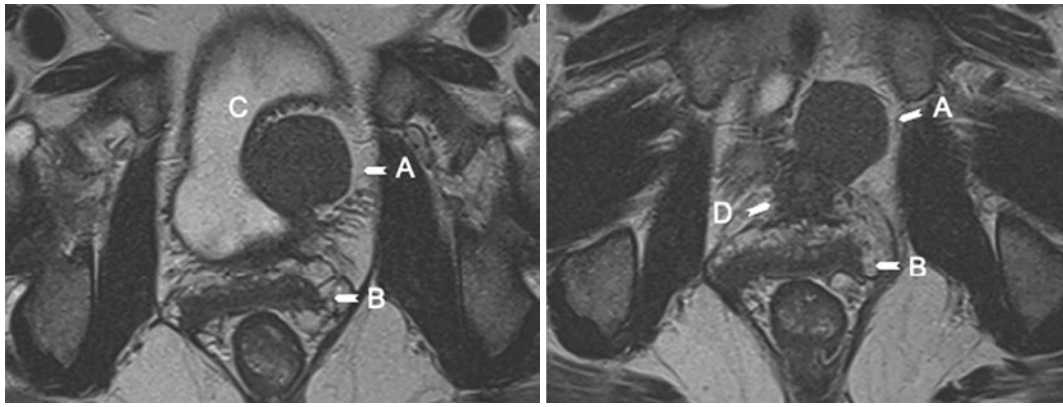

Fig. 4.9 Perivesical Mass. 37 year old female presenting with an incidental finding of a perivesical mass indenting the bladder. The left-hand image appears to suggest the mass (A) is located adjacent to the bladder (C) and superior to the perineal structures including the vagina (B). However, more caudal images reveal that the mass is in very close proximity to the urethra and urethral sphincter. Attempts to remove periurethral masses without careful planning and consideration of perineal structure often results in significant, and potentially life-changing, urinary incontinence. Excision of such lesions should only be undertaken by experienced teams and only after thorough work-up. In this case, an EUA was performed which reveal a well-defined, mobile mass and USS-guided biopsies reveal a leiomyoma. Given benign histology and the risks of damage to the urethral sphincter from resection, it was elected to offer this lady observation

likely that this would have resulted in sphincteric injury. Figure 4.9 shows what was initially thought to be a perivesical mass, though after careful assessment with examination under anesthesia, endoscopy, and MRI, it became apparent that the lesion was adherent to the urethra. Ultrasound-guided biopsies confirmed a benign leiomyoma which, given the risk associated with resection and asymptomatic status, was managed conservatively.

As described in other sections above, the key to managing such lesions is an appreciation of the structures of the perineum, then a comprehensive assessment prior to any management.

4.5 Conclusions

The key urological consideration for perineal surgery and reconstruction is the early identification of key structures to enable their preservation. Urological sequelae of perineal surgery are common and often unexpected, yet can have devastating impact on a patient's quality of life and the overall success of their treatment. Multidisciplinary decision making and planning can often prevent or mitigate these issues, and is key for successful outcomes to complex perineal surgery. Surgical approach and successful reconstruction also require careful planning to ensure that any risk of urinary leakage or fistulation is minimized, as the consequence to wound healing and overall quality of life can be profound.

References

1. Mayer E, Bottle A, Darzi A, Athanasiou T, Vale J. Provision of radical pelvic urological surgery in England, and compliance with improving outcomes guidance. BJU Int. 2009;104:1446–51.
2. Finks J, Osborne N, Birkmeyer J. Trends in hospital volume and operative mortality for high-risk surgery. N Engl J Med. 2011;364:2128–37.
3. Zippe C, Raina R, Shah A, Massanyi E, Agarwal A, Ulchaker J, Jones S, Klein E. Female sexual dysfunction after radical cystectomy: a new outcome measure. Urology. 2003;63(6):1153–7.
4. Burger M, Catto J, Dalbagni G, Barton Grossman H, Herr H, Karakiewicz P, Kassouf W, Kiemeney L, La Vecchia C, Shariat S, Lotan Y. Epidemiology and risk factors of urothelial bladder cancer. Eur Urol. 2013;63(2):234–41.
5. Compérat E, Larré S, Roupret C, Neuzillet Y, Pignot G, Quintens H, Houéde N, Roy C, Durand X, Varinot J, Vordos D, Rouanne M, Bakhri M, Bertrand

P. Clinicopathological characteristics of urothelial bladder cancer in patients less than 40 years old. Eur J Pathol. 2015;466(5):589–94.
6. Arya M, Li R, Pegler K, Sangar V, Kelly J, Minhas S, Muneer A, Coleman M. Long-term trends in incidence, survival and mortality of primary penile cancer in England. Cancer Causes Control. 2013;24(12):2169–76.
7. Kamel M, Bissada N, Warford R, Farias J, Davis R. Organ sparing surgery for penile cancer: a systematic review. J Urol. 2017;198(4):770–9.
8. Vanthoor J, Thomas A, Tsaur I, Albersen M. Making surgery safer by centralization of care: impact of case load in penile cancer. World J Urol. 2020;38(6):1385–90.
9. Chernyadyev S, Ufimtseva M, Vishnevskaya I, Bochkarev Y, Ushakov A, Beresneva T, Galimzyanov F, Khodakov V. Fournier's gangrene: literature review and clinical cases. Urol Int. 2018;101(1):91–7.
10. Greenwell T, Spilotros M. Urethral diverticulum. Nat Rev Urol. 2015;12(12):671–80.