Research and Reports in Urology

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REVIEW

Refractory Bladder Neck Contracture (BNC) After Radical Prostatectomy: Prevalence, Impact and Management Challenges

Sabine Uguzova[1], Christian Beisland[2,3], Alfred Honoré[2,3], Patrick Juliebø-Jones[2,3]

[1]Department of Urology, Stepping Hill Hospital, Manchester, UK; [2]Department of Urology, Haukeland University Hospital, Bergen, Norway; [3]Department of Clinical Medicine, University of Bergen, Bergen, Norway

Correspondence: Patrick Juliebø-Jones, Email jonesurology@gmail.com

Abstract: Bladder neck contracture is a recognised complication associated with radical prostatectomy. The management can be challenging, especially when refractory to initial intervention strategies. For the patient, the burden of disease is high and continence status cannot be overlooked. This review serves to provide an overview of the management of this recognised clinical pathology. Consideration needs to be given to minimally invasive approaches such as endoscopic incision, injectables, implantable devices as well as major reconstructive surgery where the condition persists. For the latter, this can involve open and robotic surgery as well as use of grafts and artificial sphincter surgery. These elements underline the need for a tailored and a patient centred approach.

Keywords: prostate cancer, bladder neck contracture, radical prostatectomy

Introduction

Prostate cancer (PCa) is the second most common cancer with an estimated 1.41 million new cases diagnosed in 2020.[1] Among these new cases, approximately 40% will have clinically significant PCa[2,3] and within this group approximately 38% of patients will undergo radical prostatectomy (RP).[4,5] One of the late complications is bladder neck contracture (BNC) and based on the Cancer of the Prostate Strategic Urological Research Endeavor (CaPSURE) database, the risk is estimated between 1% and 8.4%.[6] In the context of RP, this can also be referred to as vesicourethral anastomotic stenosis (VUAS). The commonest cause is healing by secondary intention, often precipitated by ischemia, wound distraction and/or poor apposition associated with post-operative complications.[7] When occurring after RP as opposed to radiotherapy (RTx), the onset of BNC is typically more rapid such as 6 months.[8] First-line treatment for BNC post RP is currently dilatation or endoscopic incision of the fibrotic tissue.[9–11] Reported success rates range between 80% and 100%.[12] Where initial treatments fail, patients are left with refractory BNC (rBNC), which can be difficult to manage. The aim of this article was to summarise the available evidence on the treatment options of rBNC after RP.

Methods

A comprehensive but non-systematic review of the literature was performed on surgical management options for refractory BNC after RP. Search was performed of bibliographic databases including PubMed/MEDLINE, Scopus and Google Scholar. Reference lists of studies were also searched as well as relevant grey literature eg, conference abstracts. Search terms included the following: "refractory", "recurrent", "recalcitrant", "vesicourethral anastomotic", "bladder neck", "posterior urethral", "stenosis", "stricture", "contracture", "radical prostatectomy" and "devastated bladder outlet". All study types were considered eligible for inclusion, and there were no time limits applied. Articles reporting bladder neck stenosis with prostate in-situ were excluded. Only articles in the English language were considered. The findings were evaluated and have been evaluated and summarised in a narrative fashion, which has been grouped according to the following key areas: (1) Definition, prevalence, and socioeconomic impact, (2) Treatment options and challenges, (3) Minimally invasive options, and (4) Surgical reconstruction.

Received: 28 July 2023
Accepted: 2 November 2023
Published: 7 November 2023

Refractory BNC: Definition, Prevalence, and Socioeconomic Impact

In 2007, Elliott et al reported one of the largest published series on BNC post RP and determined the incidence was 8.4%.[6] With the advent of robotic surgery, new operative techniques and advances in peri-operative care, the risk of BNC has decreased to 0–2%.[13–17] However, the risk increases to 22–40% in patients who undergo salvage prostatectomy after initial RTx.[15] Selvi et al[18] studied initial treatment success rates and reported the risk of recalcitrant disease to be approximately 20% of all BNC cases. At present, there is also no universal definition on when BNC can be defined as refractory. Reported definitions range between failure after one to >3 procedures.[19–24] The treatment carries an economic burden. It is estimated that in the UK, an elective bladder neck incision (BNI) procedure costs £1204-2987 in the elective setting and this cost rises threefold if it is performed in the emergency setting.[25]

Treatment Options and Challenges

Given that following RP, the posterior urethra is shorter, there is less tissue to either incise or augment without risking further complications. Therefore, treatment options and their outcomes for BNC post RP differ when compared to BNC where the prostate is still in situ. The majority of BNC patients will be treated with minimally invasive approaches. However, the small proportion of patients who develop a recurrence pose a major challenge, especially when long-term intermittent self-dilatation (ISD) is not an option. Currently, there are three main guidelines that outline the treatment rationale and options for patients with BNC post RP: American Urology Association (AUA, 2023), European Association of Urology (EAU, 2023) and Société Internationale d'Urologie (SIU, 2010).[11] The consensus among these guidelines is that most patients can be successfully treated with simple measures such as dilatation and scar incision or resection. However, for more severe and recalcitrant cases, or cases of complete loss of patency (often referred to as ´devastated bladder outlet´), these should be offered open or robotic surgical reconstruction. Outcomes of both minimally invasive and surgical procedures are summarised in Table 1 and Table 2.

Table 1 Comparative Summary of Minimally Invasive Techniques for VUAS Repair

Procedure	1st Time Success* Rate	Success Rate* After Additional 1–2 Procedures	De novo Incontinence
Dilatation[8,18,26]	39–80% *1 report = 0%	86–100%	n/a
Balloon Dilatation[27]	59–80%	100%	0%
DVIU / BNI with cold knife[8,18,26–34]	25–88%	91%	0–31%
DVIU / BNI with electrocautery[35]	91.5%	n/a	n/a
DVIU / BNI with laser[8,36–39]	69–100%	n/a	n/a
DVIU / BNI with plasmakinetic[35,40]	82–97.2%	89.2%	n/a
Deep BNI[41]	81.4%	97.7%	88.1%
Deep BNI + balloon dilatation[42,43]	72–82%	86–94.3%	n/a
Trans urethral resection (TUR)[8,29,34,44]	37–87%	n/a	0–12%
Endourethroplasty[45,46]	50–54.5%	n/a or 100%	0–100%
BNI and transverse mucosal realignment (endoscopic YV plasty)[47]	89%	100%	0%
BNI and MMC instillation[48–54]	58–79%	75–90%	n/a
BNI and steroid (triamcinolone)[55–59]	70.8–85%	83–100%	n/a

Note: *Definition of success – no evidence of re-stricture requiring further treatment.
Abbreviations: DVIU, direct visual internal urethrotomy; BNI, bladder neck incision; MMC, mitomycin C.

Table 2 Comparative Summary of Surgical Reconstructive Techniques for VUAS Repair

Procedure Type			Year	n	Stricture Length (cm)	Median FU Length (Months)	1st Time Success* Rate	Major Complications (> Clavien Grade 3)	Continence (≤*1 Pad Per day*)
ABDOMINAL APPROACH									
Open	Retropubic end-to-end[21]		2011	20	n/a	63	60%	0	64%
	Subtrigonal inlay patch with buccal mucosa graft[60]		2021	3	n/a	11 (5–14)	100%	0	100%
Robotic	Trans-peritoneal	End-to-end anastomosis[23]	2018	4**	n/a	16.5	75% ** (2 of 4)	Osteitis pubis and pubo-vesical fistula (n=1)	100% **
		YV plasty[61]	2017	2**	n/a	4 and 50	100%**	0	100%**
		Anterior bladder flap[62]	2022	9	n/a	4.8	78%	Abdominal wall abscess (n=1)	100%
	Extra-peritoneal	End-to-end anastomosis[63]	2019	6	n/a	18.7	50%	0	50%
		Inverted YV plasty[64]	2023	30	n/a	27	93.3%	GI haemorrhage (n=1) Urosepsis requiring ICU admission (n=1)	n/a
PERINEAL APPROACH									
Open	Open end-to-end[19]		2017	23	n/a	45	87%	Intra-op rectal injury (n=1) Osteitis pubis (n=1)	n/a (all incontinent pre-op)
	End-to-end anastomosis + subsequent AUS implantation[65]		2022	4**	1.8 ** (1.5–2.3)	61.5** (21–99)	75%**	Erosion of AUS (n=2)	All incontinent before AUS
	Urethroplasty with pull-through technique + subsequent AUS[66]		2012	11	n/a	65	91%	Erosion of AUS (n=1)	81.8%
	Anterior Sagittal Transrectal Approach (ASTRA)[67]		2023	1	n/a	5	100%	0	0%
	Dorsal Buccal Mucosal Graft Urethroplasty[68]		2019	4	2.5	3	100%	0	n/a (all incontinent pre-op)
Robotic	Perineoscopic bladder neck reconstruction[69]		2021	16	n/a	13.2 ± 7	81.25%	Pubo-vesical fistula (n=1)	0%

(*Continued*)

https://doi.org/10.2147/RRU.S350777 DovePress

Table 2 (Continued).

Procedure Type		Year	n	Stricture Length (cm)	Median FU Length (Months)	1st Time Success* Rate	Major Complications (> Clavien Grade 3)	Continence (≤1 Pad Per day)
ABDOMINO-PERINEAL (AP) APPROACH								
Open	AP dissection, partial pubectomy, omental wrapping, repeat anastomosis[70]	1995	2	>1.5	7–18	100%	0	100%
	AP excision and end-to-end anastomosis + AUS ± clam ileo-cystoplasty[20]	2000	6	2.5–3.5	8–56	83%	Anastomotic leak and AUS erosion (n=1)	83.3% (all incontinent pre-op)
Robotic	Robotic AP approach (with separation of corpora cavernosa)[71]	2017	1	4.5	12	100%	0	1pad/day
	Single-port AP, urethroplasty with buccal mucosa graft with rectus abdominis, omental or gracilis flaps as needed[72]	2021	7**	3.9 (2.5–6.5)	11.7	57.14%** (4 of 7)	Hernia with bowel obstruction needing laparotomy (n=1)	100%**
MIXED REPORTS INCLUDING ALL APPROACHES								
Open	Nikolavsky et al[73]	2014	12	2.5 (1–5)	75.5	66.7%	Persistent urinary extravasation after abdominal approach (n=1)	33.3%
	Wessels et al[74]	1998	4	n/a	33.8	75%	0	0%

Notes: Definition of success – no evidence of re-stricture requiring further treatment. ** - actual reported sample size of patient who had BNC after prostatectomy, outcomes adjusted accordingly.
Abbreviations: GI, Gastrointestinal; ICU, Intensive care unit; AUS, Artificial urinary sphincter.

There is no set number of procedures that patients should undergo before proceeding with major surgery. Ultimately, it is dependent on the scar morphology (length, extent and surrounding tissue involvement, degree of obliteration), patient factors (performance status and patient wishes), surgeon experience and available resources. Overall, patients usually need two procedures to resolve BNC[8] or at least, achieve a greater than 80% chance of improving their functional status. Mean time to stricture recurrence is approximately 6 months. Multiple previous attempts and tobacco use are associated with a higher risk of procedural failure.[8,12] De novo incontinence is one of the major risks of any BNC treatment. EAU guidelines highlight rates of 0–11%; however, some studies have reported it to be as high as 88%.[41] Therefore, patient expectations need to be managed prior to the initiation of any treatment. Appropriate counselling regarding the risks of recurrence, potential complications and multiple procedures is key.

Minimally Invasive Approaches

Given the definition of rBNC varies as well as the need for a tailored approach, minimally invasive techniques can be attempted initially.

Endoscopic Procedures

Dilatation can be attempted but recurrence rates are high. Following failure of initial dilatation, the next step is usually BNI, which is also referred to as direct visual internal urethrotomy (DVIU). This can be performed with either a cold or a hot knife as well as various other energy sources (electrocautery with monopolar or bipolar, laser, or plasmakinetic systems). Similar to dilatation, the initial and secondary success rates with BNI have been reported at 74% and 98%,[27–33] respectively. Outcomes between cold and hot knife methods appear comparable. Lasers that have been employed for this purpose include Nd: YAG, Thulium: YAG and Holmium: YAG systems. Their properties allow for effective cutting power while maintaining good haemostasis and lower risk of scar formation.[8,36–39,75] DVIU with the plasmakinetic energy source has reported patency rates from 82% to 97.2%, although only two studies have been performed to date.[35,40] The latter technique uses bipolar energy with axipolar electrode in an electro-conductive solution causing formation of ionized plasma corona and ultimately vaporisation or resection of the tissue.[76]

Irrespective of the energy source, incisions are made at 3 and 9 o'clock. Incisions at 6 and 12 o'clock are discouraged in order to avoid injury to the rectum and/or pubic symphysis.[9] The depth of incision depends on the thickness and extent of the scar but must be generous enough to establish a lumen of reasonable size. Shinchi et al reported the first-time success rate of *deep* BNI approach as 81.4%, but this was matched by an equally high percentage of de novo incontinence.[41] As such, albeit there is evidence to support performing deep BNI down to fat it does not increase the success rate significantly enough to justify the additional risks.[41] These outcomes are also not further improved by combination of simultaneous balloon dilatation, as patency rates for this are similar, and range from 72% to 81% after a single procedure.[42,43] More extensive intervention with transurethral resection (TUR) yields success rates between 37% and 87%.[8,21,34,44] Similar to hot knife DVIU/BNI, various energy sources can be employed. However, success rates are similar to simple incision, but the associated risks can be higher. In 2004, Kropfl et al reported on a trial of endoscopic incision or resection followed by brachytherapy delivered over 3 days at 4Gy x3 or x4 scheme with the aim to prevent recurrence. The principle behind the technique is considered to be like that of endovascular radiotherapy to prevent hypertrophic scar formation. Two of 15 patients in the cohort had BNC post RP and even though the overall cohort success rate was 46%, the two BNC post RP patients were free of recurrence at 22 months follow-up.[77]

Finally, there have been attempts at reconstructing the scar endoscopically with endourethroplasty. Chiou et al described a two-step technique carried out in a series of two patients. The patients underwent scar incision at 2, 4, 8 and 10 o'clock followed by creation of a grafting bed with a paediatric resectoscope a few days later. This was achieved by pulling through a tubulised preputial skin graft via a suprapubic tract and fixing it with two perineal sutures. One patient had good patency at 25 months follow-up, but the second required one more dilatation.[45] This technique was further modified and tested by Kuyumcuoglu et al; however, the first-time success rate in 11 patients was only 54.5% and graft necrosis occurred in two patients.[46] A more recent study by Abramowitz et al had also described a technique of BNI combined with transverse mucosal realignment. In this procedure, the scar was incised, and healthy bladder mucosa

brought over the defect and fixed with laparoscopic suturing device in a Y-V plasty technique. Their success rate was 89% after the first treatment and 100% following two procedures.[47]

Injectables (Scar Modulators)

Intralesional injections serve to prevent re-fibrosis of the incision or resection site and thereby stabilise the scar. It is used primarily as an adjunct following primary surgical scar treatment. There have been a multitude of injectables trialled in urethral stricture disease.[78] However, specifically for BNC there are two main scar stabilisers that are used most commonly: triamcinolone and mitomycin C (MMC). The former is a glucocorticosteroid, and the usual dosages are 40–80mg without any significant difference in outcomes. Its first-time success rate ranges between 70% and 85%.[55–59] MMC gives a first-time success rate between 45% and 79%.[48–54] An anti-fibrinogenic DNA alkylating agent, it prevents DNA replication and therefore cell growth.[79] Concentrations are usually 0.1 to 1 mg/mL with up to 10mg diluted in saline. MMC extravasation into perivesical fat following bladder instillations for bladder cancer is known for its potentially devastating effect.[52] Similarly, potential side-effects of MMC injections at VUAS can include osteitis pubis, rectourethral fistula, chronic bladder pain and tissue necrosis.[52] As such, EAU guidelines advise against MMC injections for posterior urethral strictures outside the context of clinical trials.[9] In recent years, there has been research on use of stem cells and their role in mitigating tissue hypoxia. Wiafe et al reported that bone-marrow derived stem cells co-cultured with human bladder smooth muscle cells resulted in the inhibition of inflammation and fibrosis.[80] However, human trials are still awaited.

Implantable Devices / Stents

Several stents have been employed in the setting of rBNC including the Allium Round Posterior Stent. This is a temporary nitinol stent coated with a co-polymer and can be left in position for up to 1 year.[81,82] An alternative is Memokath®045, which is a thermo-expandable tightly knit nitinol alloy stent, available in 3 and 7cm lengths, and is designed to prevent urothelial ingrowth[83] Overall, success rates are low, and they carry a high risk of ingrowth and de novo incontinence. The former can worsen the fibrotic changes of an already dense stricture, which renders extraction and repeat treatment more difficult. This can be further compounded by stent encrustation, which McNamar et al reported to occur in 23% of their series.[84] Given the posterior urethra shortens post RP, stent incontinence rates have been reported from 19% up to 100%. This can be mitigated by subsequent artificial urinary sphincter (AUS) placement. However, this can be complicated by sphincter device erosion in up to 19.5% of patients.[84] To this end, EAU guidelines advise against their use in the setting of posterior urethral strictures.[9]

Surgical Reconstruction

Surgical reconstruction of rBNC post RP can be technically challenging. However, it represents the mainstay treatment when minimally invasive treatments have failed. Tissue viability is invariably further compromised following repeated attempts at minimally invasive procedures, as well as adjuvant or salvage RTx. There are three main elements that are important to consider when planning surgical approach: first-time treatment success, continence and risk of a serious adverse event.

Regarding how to surgically expose the defect, there are 3 main choices: abdominal, perineal or abdomino-perineal. This can be achieved either open or robotically. When deciding upon how to approximate the anastomosis after scar excision, numerous methods have been described in the literature. These range from simple end-to-end anastomosis to variety of augmentations, grafts and flaps. In terms of continence, this can be challenging, as apart from the risk of sphincter injury, it can also unmask an already incompetent sphincter which has been compensated by the scarring.[12,85] It is thus important to perform a thorough pre-operative work up in order to determine the length of obliteration and involvement of the membranous urethra/external sphincter so as to appropriately counsel patients regarding the need for additional incontinence surgery. Comparisons between the different surgical reconstructive techniques are summarised in Table 2.

Access to Defect

One of the earliest reports of posterior urethra repair was in the setting of pelvic fractures by Young in 1929. Later in 1953, he described a technique of retropubic reconstruction of the bladder neck in a paediatric population.[86,87] It was not until 1995 when Schlossberg et al[70] published one of the first case series on open reconstruction of BNC post RP and this was followed by a further series by Wessels et al in 1998.[74]

Transabdominal approach is the most described approach and can represent a preferred choice where longer segments are involved.[73] Both trans/extraperitoneal techniques have been described and the first reports of robotic cases were reported in 2018.[23,61,88] Fibrotic changes within the Retzius space, hypertrophy of the bladder muscle, potentially short urethral segment often adherent to the urogenital diaphragm and variable depth of the pelvis can all deliver challenges. As described by Schlossberg et al, "the easy plane is the wrong plane" and as such, an open approach may be accompanied by vertical partial pubectomy to facilitate the view.[70] The anterior bladder wall can be adherent to the pubic bone and dissection must be delicate so as to avoid shredding of the tissue. After dissection of the Retzius space, the bladder neck is then freed beneath the pubic symphysis and dropped from the anterior abdominal wall. Therein it allows for identification of the proximal extent of the stricture via opening the anterior bladder wall. This should preferably be done with cold scissors to avoid further compromise of blood supply to the scar. The posterior bladder wall is mobilised from the anterior rectal wall via the Pouch of Douglas. Scarring can then be excised completely or a Y-V plasty can be used to avoid dissection of the posterior bladder wall in cases where rectal injury is a concern. If there is any doubt about the proximity of the ureteric orifices to the resection site, it is important to protect them by inserting small calibre feeding tubes or catheters to delineate their location.[12,21,24,60]

With robotic surgery, while the anatomy remains challenging, the flexibility of the instruments and tissue magnification allows the surgeon to avoid performing pubectomy, which reduces the morbidity usually associated with the open transabdominal approach. The patient is placed in a Trendelenburg ± dorsal lithotomy position and the robotic arms are most commonly set up in a similar way to the approach used for robotic RP. On-table flexible cystoscopy can be used to map the distal extent of the stricture and a "cut-to-the-light" technique can be performed. However, it is advised to reserve this for short strictures (<0.5cm) only.[17,23,61–63,70,88–93] The majority of robotic reports are transperitoneal, but Lavolle et al[94] and Diamant et al[64] also trialed extraperitoneal access with end-to-end anastomosis. However, outcomes were worse when compared to the transperitoneal approach and first-time treatment success was only 50% and continence rates ranged from 37.5% to 50%. In 2023, Youssef et al[65] reported superior outcomes with the extraperitoneal approach and inverted Y-V plasty. The authors reported a success rate of 83.3% in a 30-patient series.

Of note, if the patient is incontinent pre-operatively or develops de-novo incontinence at a later stage then the abdominal approach could improve durability of an AUS due to the lack of perineal scarring.[12,17]

Perineal dissection is similar to radical perineal prostatectomy. Although it is mainly preferred for more distal strictures, it has been used as an alternative to avoid entering rigid perivesical tissue. Extensive urethral mobilisation can result in a high risk of devascularising and injuring the external sphincter, which is reflected by high incontinence rates associated with this approach in the literature (Table 2). To this end, a high proportion of these patients ultimately require artificial sphincter surgery at some stage.[22,95] The patient is usually placed in an exaggerated lithotomy position and a simple vertical, "Y", "lambda" or "half-moon" perineal incision is used. The proximal bulbo-membranous urethra is mobilised, similar to a trans-perineal bulbar urethroplasty with division of the bulbospongiosus muscle and central perineal tendon with or without division of corpus spongiosum. The distal extent of the scar tissue is identified, with or without the aid of a flexible ureteroscope and the urethra is transected at that level. To identify the proximal extent of the scar, the vesicourethral wall and bladder base must be dissected away from surrounding tissue including the rectal wall. The crura often needs to be divided or inferior partial pubectomy performed to facilitate surgical access and to re-create an adequate bladder neck with a tension-free anastomosis. In cases of complete obliteration, access can be facilitated by use of a flexible cystoscope via a supra-pubic catheter tract. Opening of the bladder neck can then be done with the aid of endoscopic visualisation.[19,22,24,63,67,68,91,95,96]

A modified perineal approach has been recently described by Pinto et al[69] and is referred to as the Anterior Sagittal Transrectal Approach (ASTRA). The authors described a technique where the patient is placed in a Jackknife position.

A vertical incision is made through the perineum with extension into the anterior border of the rectum, which allows for an improved access to the bladder neck and avoiding a pubectomy. The authors reported that 92 such ASTRA procedures have been performed with no incidence of fecal incontinence, similar rates of urinary incontinence to the conventional perineal approach and two cases of rectourethral fistula in previously irradiated patients.

Finally, a robotic approach has also been described for perineal dissection in 2021 by Simsek et al.[71] The robot is used more as an adjunct for tissue visualisation with the camera arm rather than the traditional dissection with working robot arms. This can allow for extended dissection with corporal separation and pubectomy to be avoided and facilitates creation of the anastomosis and facilitates ergonomic operating. A success rate of 81.3% was reported.

For the abdomino-perineal approach, patients are often not placed in an exaggerated lithotomy position. Anatomical landmarks can be more challenging to identify during perineal dissection, especially between the bladder anastomosis and anterior rectal wall. This combined approach is best utilised in longer strictures (>3cm) and especially in those with prior RTx to the pelvis.[70,73,74] With this method, maximal scar excision is allowed for as well as a higher success rate for creating a patent lumen. However, this is arguably most extensive of the approaches and can result in a longer post-operative recovery for the patients. However, bearing this in mind, there have been two robotic approaches described including a "single port" access.[72,97]

Closure of Defect and Anastomosis

Following excision of the stricture, a tension-free and water-tight anastomosis with a wide enough lumen must be fashioned. The most commonly described technique is an end-to-end anastomosis following mobilisation of the urethra and bladder base, with or without spatulation of the healthy urethra. This is the preferred option if the tissue is malleable.[12,85,96] However, if the defect is larger than expected and the primary anastomosis would be under tension then the gap can be bridged with variety of autologous grafts, flaps or augmentation techniques.

Grafts

Since early 1990s, the most popular graft material has been buccal mucosa. This was first described by Sepezhko et al in 1894 and re-investigated by Burger et al in 1992.[98,99] It is primarily used in anterior urethral strictures with good success rates. However, it has also been applied by Shahrour et al in 2017[67] via a perineal approach, Bozkurt et al in 2022[60] via a trans-abdominal onlay technique and Liu et al in 2022[97] via the abdomino-perineal approach with reports showing success rates between 89% and 100%. However, Orandi et al in 1968[100] reported that any part of the genital skin can be used as a patch with a dartos pedicle. As such, there are several reports with the use of penile skin grafts being employed in the context of rBNC.[73,74,101] There are a multitude of options for graft orientations (dorsal or ventral onlay, double inlay, subtrigonal inlay, etc.), but there is no data to support the superiority of one particular technique.

Flaps

Following approximation of the tissue for the anastomosis, it can be further reinforced by numerous flaps with a goal to improve tissue vascularity and promote healing. For abdominal procedures, it is often the omental pedicle flap,[102] peritoneal or rectus abdominis muscle flap based on inferior epigastric artery that is chosen. For those with perineal access, gracilis, penile fasciocutaneous flap or dartos pedicle flaps can be used.[73,74,97]

Augmentation

In cases where complete scar excision is not feasible, various augmentations can be used as an alternative. Most known is the YV-plasty, first described by Young in 1953[103] and involves identification of the contracture, division of anterior bladder wall in an inverted "Y" incision and then reconstruction of the bladder neck into a "V" shaped incision.[88] Although this procedure is more commonly described in rBNC following surgery for bladder outflow obstruction with the prostate still in situ, it has been described after RP with success rates between 83.3% and 100%.[61,65,88] Recently, a modification, the T-plasty, has also been described by Reiss et al.[103] However, it is yet to be applied in the setting of a rBNC post RP patient sample.

Another alternative is an anterior bladder flap (also known as tubularisation of the bladder neck) which was first described in 1972 by Tanagho for treatment of urinary incontinence.[104] Its aim is to imitate the urethral sphincter by tubulising the circularly oriented muscle fibers of the anterior bladder wall.[105] It was trialed by Boccan-Giddon in 1985[66] in a mixed group of 10 patients with incontinence after both simple retropubic or transurethral prostatectomy. Although only 3 patients in the cohort had bladder neck stenosis, the success rate was 80% and of note, the two failures were in patients after suprapubic prostatectomy with a fibrotic anterior bladder wall. Most recently, Zhao et al in 2022,[62] have reported their experience with trans-abdominal robotic VUAS reconstruction using the anterior bladder flap technique Although a series of only nine patients, the success rate was 78% for patency and 100% for continence.

Finally, Simonato et al[26] have a described a "pull-through urethroplasty" approach, performed via combined suprapubic and perineal approach where the scar is resected perineally and healthy urethra is gently pulled through the suprapubic tract, placed under traction and sutured to the pelvic diaphragm with interrupted sutures. This is then followed by delayed insertion of AUS with an overall success rate of 91%.

Conclusion

rBNC post RP is relatively uncommon but the associated functional burden for patients is clinically significant and the surgical management can present many challenges. While endoscopic and minimally invasive methods can be attempted initially, open or robotic surgical reconstruction is usually required. A tailored surgical plan is required that takes into consideration the most appropriate access and method for vesicourethral anastomotic reconstruction. Consideration needs to be made for the continence status. Given the complexity and associated risks, thorough patient counselling is essential.

Disclosure

The authors report no conflicts of interest in this work.

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