World J Urol (2005) 23: 231–235
DOI 10.1007/s00345-005-0013-7

REVIEW

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Management of neobladder-vaginal fistula and stress incontinence following radical cystectomy in women: a review

Received: 15 May 2004 / Accepted: 16 February 2005 / Published online: 14 September 2005

Abstract Contemporary literature regarding the management of neobladder-vaginal fistula and stress urinary incontinence following radical cystectomy and neobladder reconstruction in women is reviewed in this article. Neobladder-vaginal fistula is uncommon but mandates meticulous repair. Compared to the native bladder, the wall of the neobladder is much thinner that may render it vulnerable to fistulization. Preservation of the anterior vaginal wall during radical cystectomy decreases the likelihood of pouch-vaginal fistula. Omental flap interposition between the vaginal stump and neobladder at cystectomy may not always prevent fistulization if anterior vaginal wall is violated or overlapping suture lines are not avoided. Surgery for intractable stress incontinence following neobladder reconstruction is fraught with severe complications and requires judicious use of allograft pubovaginal slingplasty possibly with bone anchors. Martius flap interposition appears to play a crucial role in improving the outcome following transvaginal repair of the neobladder-vaginal fistula in multiple non-overlapping layers.

Keywords Radical cystectomy · Neobladder
Neobladder-vaginal fistula · Vagina · Martius flap
Slingplasty

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Introduction

Radical cystectomy with orthotopic lower urinary tract reconstruction is now the accepted treatment in appropriately selected (bladder neck free of tumor) women with bladder cancer [1, 7]. Notwithstanding excellent clinical outcomes in the majority of women undergoing neobladder reconstruction, the functional complications of the neobladder include hypercontinence requiring intermittent catheterization, pouch calculus formation, persistent urinary incontinence, and pouch-vaginal fistula (neobladder-vaginal fistula) (Fig. 1) [9]. Eleven cases of neobladder-vaginal fistulae [1, 3–6, 8, 9] and two cases of neobladder-enteric fistulae [5] have been reported to date (Table 1).

Post-neobladder urinary incontinence in women

Meticulous surgical technique is crucial to preserve function of the pelvic floor and urethra. The fibers of the inferior hypogastric plexus supporting the urethra and vagina should be preserved. During traditional radical cystectomy, the posterior hypogastric vessels and autonomic nerve fibers are cut as they course behind the ureter. Preservation of these nerve fibers has been suggested to improve continence [4] (Fig. 2, 3). The innervation of the somatic sphincter by the pudendal nerve is not at risk during radical cystectomy. Preservation of intact vagina is important for the functional integrity of female striated urethral sphincter and the urethrovaginal sphincter mechanism [4].

Modifications in the technique during cystectomy and neobladder formation suggested by Ali El-Dein et al. [1] aimed at preventing the development of neobladder-vaginal fistula include vaginal transection so as to obtain a longer anterior flap, embedding of the vaginal stump (after the latter is closed) to ensure a posterior facing vaginal stump away from the urethroileal

Fig. 1 Cystogram demonstrating neobladder-vaginal fistula

anastomosis, suture fixation of the peritoneal edge from the anterior rectal wall to the top of the vaginal stump and most importantly, suturing of a mobile, pedicled omental flap to the anterior vaginal wall as pedicled interposition flap between the vaginal stump and urethroileal anastomosis. They believe that the omental flap provides a back support for the ileal pouch, preventing posterior displacement and angulation of the urethroileal junction.

One should be cautious using bulking agents for post-neobladder stress urinary incontinence, as the latter may not be as effective and innocuous as in those with a native bladder [8]. Pruthi et al. [8] suggest that fistulization may be avoided by smaller volumes of collagen localized away from the neobladder neck directed more anteriorly toward the 12 O' clock position. The other contributing factors for fistula formation include suture line proximity, disturbed tissue planes between the posterior bladder neck and vagina and compromised tissue vascularity between the urethra and anterior vaginal wall incident to surgical dissection.

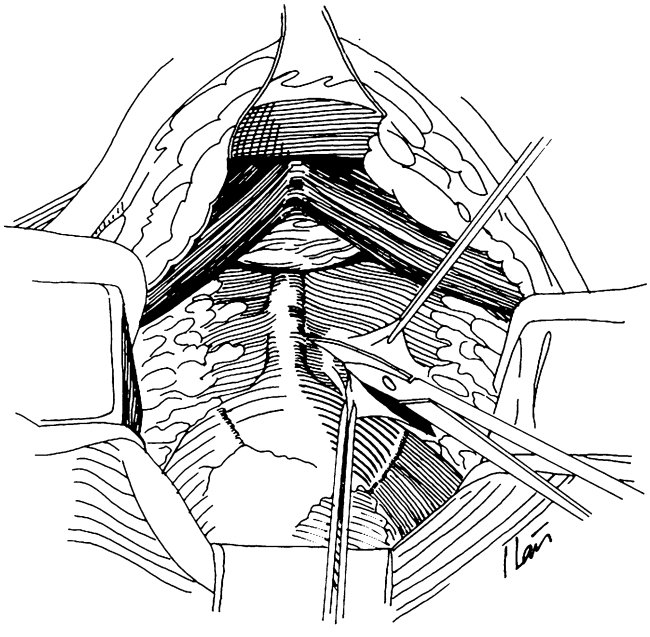

Fig. 2 Incision of the endopelvic fascia parallel to posterior urethra and urethrovesical junction
Adapted from: Hautmann RE, Paiss T, de Petriconi R. The ileal neobladder in women: 9 years of experience with 18 patients. J Urol 1996 Jan; 155(1):76–81

Avoidance of overlapping suture lines between the vagina and bladder neck and omental flap interposition prevent fistulization. We believe that even a concomitant pubovaginal sling placement may not be entirely safe during the repair of neobladder-vaginal fistula. Intraoperatively, transurethral passage of a Pollack catheter and documenting its exit from the neobladder into the vagina may identify fistula between the neobladder and the vagina (Fig. 4).

Martius flap interposition (Fig. 5) is extremely useful to protect fistula repair, especially when the repair is combined with pubovaginal slingplasty. Quek et al. [9] and Pruthi et al. [8] reported successful outcome following Martius labial flap interposition between the repaired neobladder-vaginal fistula (in multiple non-overlapping layers) and the anterior vaginal wall. Martius flap appears to be crucial for a successful repair, particularly in recurrent fistulas and when the repair is combined with pubovaginal slingplasty.

Infrapubic bone anchor placement has been suggested to improve the safety during slingplasty with the premise of avoiding extensive lateral or anterior pelvic dissection or trocar passage, minimizing the potential for neobladder injury.

Preservation of anterior vaginal wall and neobladder-vaginal fistula

Mills and Studer [7] advocated excision of a portion of the anterior vaginal wall with the specimen in an attempt to improve the urethral recurrence rate. However, others [2] believe that vaginal preservation decreases fistula rate with possible improvement in continence. Chang et al. [3] described preservation of the anterior vaginal wall during radical cystectomy with cephalad elevation of the vaginal vault to identify the apex and anterior vaginal wall. The bladder specimen is elevated cephalad out of the pelvis and the posterior plane is continued to the level of the bladder neck. The proximal urethra is circumferentially incised from anterior to posterior to connect the previously developed posterior plane preserving the endopelvic fascia. Following cystectomy, the posterior bed of resection is inspected to ensure that no defects in the anterior vaginal wall are created. Any incidental incisions are closed primarily. They believe that likelihood of anterior compartment pelvic organ prolapse is decreased by anterior vaginal wall and

Table 1 Review of literature on neobladder fistulae

Author	Surgery performed	Complication	Follow-up after neobladder	Management	Continence	Voiding pattern
Hautmann et al. [4] ($n=13$)	Nerve sparing cystectomy + ileal neobladder	One case of neobladder-vaginal fistula	3 months	Ileal conduit urinary diversion	N/A	N/A
Ali-El-Dein et al. [1] ($n=60$)	Radical cystectomy + ileal W-neobladder (47)/hemi-Kock reservoir (13)	Three cases of neobladder-vaginal fistula	20.2 months	Transvaginal repair	Normal	N/A
Hautmann et al. [5] ($n=443$: 401 male and 42 female)	Radical cystectomy + ileal neobladder	Two cases of neovesico-intestinal fistula	N/A	Colostomy in both and excision of the neobladder in one	N/A	N/A
Pruthi et al. [8] ($n=2$)	Radical cystectomy + ileal neobladder	Two cases of neobladder-vaginal fistula at the level of bladder neck (2 days after collagen injection in 1 month and 1 month later in the 2nd)	6 months	Transvaginal repair in multiple layers + cadaveric fascia pubovaginal sling in one and transvaginal repair + Martius flap interposition + cadaveric fascia pubovaginal sling with infrapubic bone anchors	Hypercontinent	Clean intermittent catheterization
Chang et al. [3] ($n=25$)	Radical cystectomy + ileal neobladder with omental flap interposition	One case of neobladder-vaginal fistula	N/A	N/A	N/A	N/A
Quek ML et al. [9] ($n=101$)	Radical cystectomy + T-pouch ileal neobladder	Two cases of pouch-vaginal fistula (one following DuraDerm allograft slingplasty for post-neobladder SUI and a 2nd pouch-vaginal fistula detected during slingplasty for post-neobladder SUI) and one case of enterocutaneous fistula	N/A	Failed transvaginal repair in the first case managed by a 2nd repair with Martius flap interposition; 2nd case managed by transvaginal repair with dermal graft pubovaginal sling with infrapubic bone anchors; patient with enterocutaneous fistula died because of sepsis	N/A	N/A
Lee et al. [6] ($n=22$)	Radical cystectomy and neobladder	Two cases of neovesicovaginal fistula	N/A	N/A	N/A	N/A

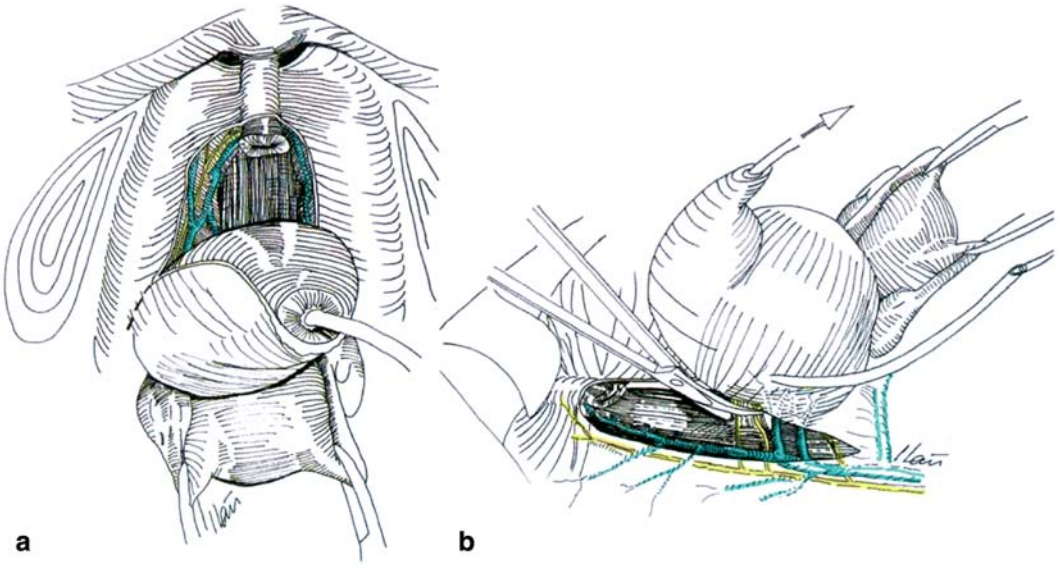

Fig. 3 Transection of posterior urethra: bladder neck is dissected off anterior vaginal wall; autonomic fibers (*yellow*) and vascular plexus (*blue*) are shown; autonomic nerve fibers run lateral to vascular plexus; nerve fibers towards vagina and urethra are saved
Adapted from: Hautmann RE, Paiss T, de Petriconi R. The ileal neobladder in women: 9 years of experience with 18 patients. J Urol 1996 Jan; 155(1):76–81

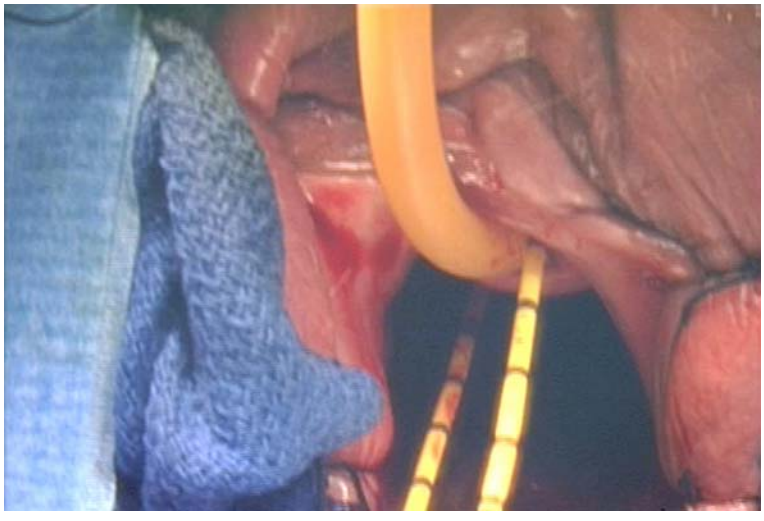

Fig. 4 Fistula between the neobladder and the vagina demonstrated by the transurethral ureteral catheter entering from the neobladder into the vagina

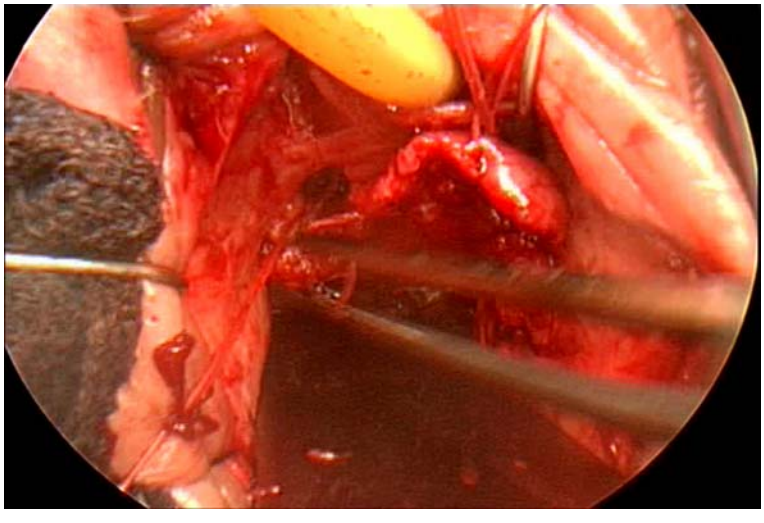

Fig. 5 Martius flap developed to interpose between the repaired neobladder-vaginal fistula and the anterior vaginal wall

pubourethral ligament preservation. Preservation of the anterior vaginal wall also may contribute to improved functional outcome by preservation of adequate vaginal length and caliber although further studies are warranted to settle this issue.

Conclusions

Neobladder-vaginal fistula formation is uncommon but mandates meticulous repair. Preservation of the anterior vaginal wall during radical cystectomy decreases the likelihood of pouch-vaginal fistula. Omental flap interposition between the vaginal stump and neobladder at cystectomy, although a sound practice may not always prevent fistulization if anterior vaginal wall is violated or overlapping suture lines are not avoided. Compared to the native bladder, the wall of the neobladder is much thinner that may render it vulnerable to fistulization.

Martius flap interposition appears to play a crucial role in improving the outcome following transvaginal repair of the neobladder-vaginal fistula in multiple non-overlapping layers. Surgery for intractable post-neobladder stress incontinence following is fraught with potential serious complications and requires judicious use of pubovaginal slingplasty possibly with bone anchors. Techniques such as transobturator tape need to be explored in this setting.

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