

Female Urology

FEMALE ORTHOTOPIC BLADDER SUBSTITUTION: A GOOD OPERATION IN THE RIGHT CIRCUMSTANCES

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ABSTRACT

Purpose: We present the long-term results of orthotopic bladder substitution in women.

Materials and Methods: We prospectively assessed 15 female patients undergoing orthotopic bladder substitution between October 1984 and April 1998. The indication for diversion was bladder carcinoma in 8 cases, gynecologic malignancy in 2 and benign disease in 5.

Results: At a median followup of 19 months daytime and nighttime continence was 100% and 80%, respectively. All but 1 patient voided spontaneously. Two patients who were initially able to void successfully had voiding difficulties in the initial 10 months due to prominent mucosal tissue at the bladder neck. In each case this condition was successfully managed by endoscopic resection. There has been no local recurrence of bladder carcinoma.

Conclusions: With strict selection criteria and vigilant followup female orthotopic bladder substitution produces excellent long-term functional results comparable to those in men. However, the limits in women who require radical cystectomy for invasive bladder cancer cannot be determined from our results. Further long-term data on the local recurrence rate of invasive urothelial malignancy are needed before the true risk may be quantified accurately.

KEY WORDS: bladder; cystectomy; urinary diversion; surgical procedure, reconstructive

Orthotopic bladder reconstruction is widely performed in men. Approximately 50% of male patients who undergo cystectomy for invasive bladder cancer are suitable candidates for this type of surgery. Female orthotopic reconstruction has been much less widely practiced, mainly due to anatomy as well as the perceived increased risk of local recurrence and voiding dysfunction after urethral sparing surgery. As a result of detailed histological evaluations of cystourethrectomy specimens from women with bladder cancer^{1–3} and a more comprehensive understanding of the female continence mechanism,^{4–6} female orthotopic reconstruction is now becoming more widely practiced. However, published results are still sparse with limited followup. The largest series to date includes 34 patients.⁷ We report our results in a group of highly select, consecutive women who underwent orthotopic reconstruction during the last 15 years.

METHODS

Between October 1984 and April 1998, 15 female patients underwent orthotopic ileal bladder reconstruction with an isoperistaltic tubular afferent limb. The indication for surgery was bladder carcinoma in 8 cases, gynecologic malignancy in 2 and benign disease in 5 (see table). In the 5 women with invasive bladder cancer pathological stage was pT3aN0 (2), pT3bN0 (2) and pT3bN1 (1), according to 1992 International Union Against Cancer terminology. Preoperative assessment of bladder cancer involved cystoscopy, physical examination using anesthesia, and full thickness bladder biopsy from the bladder neck and trigone to exclude overt tumor and carcinoma in situ from a zone of at least 1 cm. around the bladder neck.

Preoperative diagnosis in 15 women who underwent orthotopic reconstruction

| Diagnosis | No. Pts. |
|--|----------|
| Transitional bladder Ca: | 8 |
| Multifocal grade 3 stage pT1 | 5 |
| Invasive | 3 |
| Adenoca. | 2 |
| Gynecologic malignancy (recurrent cervical Ca after radiotherapy) | 2 |
| Benign disease: | 5 |
| Small bladder capacity after tuberculosis | 1 |
| Small capacity bladder with vesicovaginal (1) or vesicointestinal (1) fistula after radiotherapy for cervical Ca | 2 |
| Neuropathic bladder | 1 |
| Interstitial cystitis | 1 |

The 5 patients with benign disease underwent simple cystectomy without opening the vagina and the 3 with superficial bladder cancer underwent limited lymphadenectomy. The uterus and vagina were preserved in 2 cases. In the remaining woman who previously underwent hysterectomy the vaginal stump was not disturbed. Bilateral nerve sparing was attempted in each case.

The 5 patients with invasive bladder cancer underwent radical cystectomy with complete pelvic lymphadenectomy. Preservation of the uterus and vagina was possible in 1 case of adenocarcinoma in the bladder dome and anterior wall. Hysterectomy was performed with excision of the anterior vaginal wall en bloc with the specimen in 3 cases. In the remaining patient who previously underwent hysterectomy for benign disease the anterior vaginal wall only was excised with the specimen. Although resection of the anterior vaginal

wall was necessary in 4 of these 5 patients, the vaginal wall was incised only after the lateral paravaginal tissues were clearly identified, mobilized, severed and ligated. This dissection immediately along the whitish vaginal wall was facilitated by an empty sponge holding forceps in the vagina. To remove lymphatic glands draining the bladder base on the tumor bearing side the paravaginal tissue was widely excised as far as the pararectal region. In contrast, dissection on the opposite side proceeded no further than the 2 or 10 o'clock position, dividing the autonomic nerve supply from the pelvic plexus passing to the bladder while attempting to preserve the paravaginal fibers passing more dorsally to the urethra (fig. 1). On each side paravaginal dissection did not proceed beyond the bladder neck. Anterior dissection remained as close to the bladder as possible to limit damage to the urethropelvic ligaments and urethral innervation at this level. To minimize damage to the intrapelvic somatic fibers from the pudendal nerve, which also contribute to urethral innervation,⁶ the endopelvic fascia overlying the pelvic floor was disturbed as little as possible in all patients. The urethral resection line was just distal to the bladder neck in those with malignant disease and the woman with interstitial cystitis. In the remaining 4 patients who underwent surgery at the beginning of our series a 1 to 10 mm. cuff of bladder neck was preserved.

Creation of the reservoir, which is not particular to women, has been described previously.⁸ However, we emphasize that the anastomosis was not fashioned at the funnel shaped lower end of the anterior suture line, which is the most dependent part of the pouch, but offset 3 to 4 cm. from this point. In some cases after completing the anastomosis the

anterior pouch wall was fixed to the posterior aspect of the symphysis to prevent collapse of the reservoir wall onto the urethral outlet. Total anterior pelvic exenteration was done with simultaneous creation of an ileal neovagina from the most distal part of the resected ileal segment in the 2 patients with recurrent cervical carcinoma.

Postoperative management, which was the same as in our male patients, has also been described previously.⁹ We removed the ureteral stent between days 5 and 7, and the cystostomy tube after radiography of the pouch on day 10 postoperatively. On day 12 the urethral catheter was removed and patients were taught to void by pelvic floor relaxation without abdominal straining. Initially they were asked to void at 2 and 3-hour intervals during the day and night, respectively, even if this resulted in incontinence. With time and in the absence of complications the voiding interval was gradually increased. This process is essential to increase reservoir capacity, which is approximately 120 ml. during convalescence. Post-void residual urine was excluded by daily ultrasound. Regular blood gas analysis was done and acidosis was treated with sodium bicarbonate as necessary.

Functional results were recorded prospectively as part of our standard protocol of interviews, a validated questionnaire, frequency volume charts and post-void residual urine volume assessment. Patients were regarded as continent while no more than a few drops of urine were lost once or twice weekly. Regular urethral washout cytology was performed in those with bladder cancer using a short stiff catheter with multiple side holes, a syringe and 60 ml. of saline. The catheter was advanced and withdrawn in the urethra to collect the washout from the meatus in a kidney dish. We have not routinely obtained voided specimens. Vaginal examination was done in all patients with a history of pelvic malignancy.

RESULTS

Median patient age at surgery was 56 years (range 27 to 75) and median followup was 19 months (range 6 to 153). Of the 15 women 13 were alive at the last followup. One of the 2 patients with cervical carcinoma had local recurrence and each died of widespread metastatic disease at 7 and 19 months, respectively. Pelvic recurrence developed at 33 months in another woman with a fistula after radiotherapy for cervical carcinoma 4 years previously but no evidence of recurrent disease at surgery. The orthotopic reservoir was excised with the anterior vaginal wall and an ileal conduit was constructed.

None of the 8 patients with bladder cancer had evidence of local recurrence. However, the woman with node positive disease had lung metastasis and another in whom disease was pathological stage T1 at cystectomy had bone and liver metastases at 14 months. Postoperative obstructive renal impairment in 2 cases was due to recurrent cervical cancer in 1. The other patient had a ureteroileal stricture in a single functioning renal unit as well as a rectovaginal fistula at 4 and 6 months, respectively. She had received 60 Gy. of external beam radiotherapy for cervical carcinoma 5 years earlier. Treatment involved ureteral reimplantation and end colostomy with preservation of the orthotopic reservoir.

Daytime continence rates were 79%, 83% and 100% at 6, 12 and 24 months of followup, respectively. These rates include 2 patients who were fully continent at 6 months and 1 at 12 and 24 months each who had occasional loss of a few drops of urine no more than once or twice weekly. Nighttime continence rates were 71%, 83% and 89% at 6, 12 and 24 months of followup (fig. 2). There was a mean of 6 (range 4 to 8) and 2 (range 1 to 4) voids during the day and night, respectively, at 6, 12 and 24 months.

At the last followup median bladder capacity was 475 ml. (range 250 to 850) and median post-void residual urine vol-

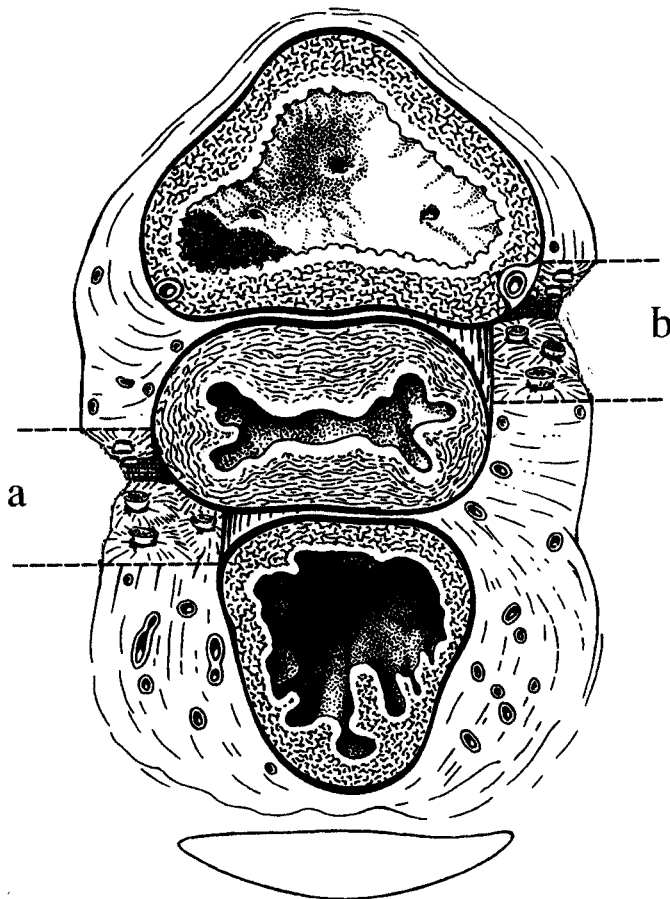


FIG. 1. Proposed nerve sparing dissection. Paravaginal dissection extends as far back as pararectal region on tumor bearing left side (a). In contrast, on nontumor bearing side dissection remains closer to bladder base at anterolateral vaginal aspect (b).

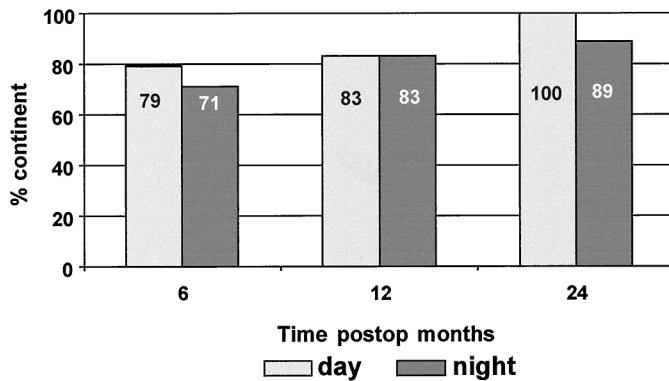


FIG. 2. Patients who achieved daytime and nighttime continence during initial 24 months.

ume was 5 ml. (range 0 to 400). Of the 15 patients 13 voided with a post-void residual urine volume of less than 50 ml. One patient voided with a post-void residual volume of 150 ml. at a followup of 8 years. A woman who was congenitally blind, diabetic and wheelchair bound did not void postoperatively and underwent urethral catheter placement at 12 months, explaining the high end of the post-void residual volume range in our study.

Two patients with a distal resection margin below the bladder neck who initially voided without significant post-void residual urine (less than 50 ml.) had chronic urinary retention at 4 and 10 months, respectively. Endoscopic assessment revealed prominent mucosal tissue just above the anastomosis in each case. The tissue was resected at 1 operation in 1 patient and at 2 in the other, after which each again voided to completion.

DISCUSSION

The aim of orthotopic bladder reconstruction is to provide a compliant, low pressure continent urinary reservoir that may be emptied completely at socially convenient intervals. It is now accepted that the female urethra may be preserved in cases of invasive bladder cancer that do not involve the trigone and the female continence mechanism may function adequately after cystectomy. Although it is not ideal, we believe that when patients are suitable candidates, orthotopic reconstruction is currently the best type of urinary diversion available.

The indications for female orthotopic reconstruction include invasive bladder carcinoma, superficial bladder carcinoma resistant to conservative measures, other pelvic malignancies requiring exenteration and benign conditions resulting in a small shrunken bladder or intractable irritative symptoms with preserved sphincter function. When performed for malignant disease, the desire to achieve a functionally good result should not compromise surgical resection. The primary concern in invasive bladder carcinoma should be tumor clearance by cystectomy. Cordonnier and Spjut reported local urethral recurrence after incomplete urethrectomy during cystectomy for bladder cancer¹⁰ but we are not aware of any urethral recurrences after female orthotopic reconstruction for bladder cancer. Only 5 of our female patients had invasive bladder cancer, whereas a further 90 during the same period underwent cystectomy for invasive bladder cancer at our department. Our approach undoubtedly changed during the study period and we would probably now offer orthotopic reconstruction to some patients who previously underwent diversion by alternative means. However, it is not uncommon for the primary tumor to involve the trigone. Coloby et al reported a 44% incidence in 43 cystectomy specimens in patients with transitional cell carcinoma.¹

Care must be taken when assessing these patients for ortho-

topic reconstruction if local recurrence is to be avoided. There is no anatomical barrier, such as Denonvilliers' fascia, between the bladder base and anterior vaginal wall. Therefore, we excise the anterior vaginal wall with the specimen when invasive tumor is present in the bladder base or encroaches on the trigone. Lymphatic drainage from the bladder base and trigone occurs along the lateral vaginal wall to nodes along the hypogastric artery. This tissue should also be removed on the tumor bearing side. Stein et al indicated that transitional carcinoma at the bladder neck need not necessarily be a contraindication to orthotopic diversion if, as in 50% of these patients, the urethra is free of tumor.⁷ We think that the risk of persistent disease is too high, particularly since radical surgery with a safe margin still provides the best chance for cure in these cases. Stein et al recommended intraoperative frozen section at the urethral resection margin as the best method for determining patient suitability for orthotopic reconstruction and they relied on this technique only. We believe that preoperative assessment is preferable because the quality of permanent paraffin embedded sections is superior, particularly since small tumor clusters and mucosal atypia may be missed by frozen section. Furthermore, it seems preferable to excise the area of the bladder neck, proximal urethra and surrounding tissue en bloc at a safe distance from a diseased bladder neck rather than discover that this area is involved with tumor only after incising it for frozen section analysis at surgery. We also think that it is desirable to provide patients with the best possible information on the types of urinary diversion available before surgery. Longer followup of a larger number of patients is required than currently available in the world literature before the true risk of local recurrence may be quantified accurately.

The reported functional outcome differs among series, particularly in regard to voiding ability. Some reported a 53%¹¹ and 41%¹² rate of intermittent catheterization, whereas others noted a much lower rate of 0%¹³ and 3%.¹⁴ Our functional results with excellent daytime and nighttime continence, good bladder capacity, 93% of patients voiding without catheterization and acceptable voiding frequency are as good as our results in men. These results reflect the highly select nature of our patient group with no evidence of gross sphincter dysfunction. However, operative technique and followup are equally important.

Intraoperatively we believe that nerve sparing is important to optimize continence and voiding ability. The extrapelvic pudendal nerve to the external striated sphincter is not at risk but the intrapelvic extra pudendal somatic supply from the second and third sacral roots may easily be damaged as well as the autonomic branches of the pelvic plexus. To our knowledge the absolute contribution to sphincter function of these latter 2 sources is not clear. However, in canine experiments Hubner et al demonstrated a pressure increase in the distal urethra after pudendal nerve stimulation and in the proximal urethra after stimulation of the pelvic plexus.¹⁵

We emphasize that one may never be certain whether nerve sparing has been achieved. A successful outcome may also be due to careful operative technique that avoids direct injury to the sphincter mechanism. Stein et al⁷ and Ghoneim¹³ think that nerve sparing is not important and justify this approach by their results. They believe that continence is provided by the resting tone of the striated muscle component supplied by the pudendal nerve, the elastic fibers of the urethral wall and mucosal apposition. We agree that nerve sparing should not compromise the radical nature of the operation but we also believe that autonomic innervation has functional significance. Without nerve sparing patients may be continent most of the time but have leakage during stress due to shortened functional urethral length. Conversely, just as a preserved but dysfunctional bladder neck may theoretically result in obstructed voiding, a denervated floppy proximal urethra may lead to ineffective active relaxation or simply kinking during voiding and, thus, incomplete empty-

ing. Nerve sparing may in fact be more important in women since there is a substantial smooth muscle component in the female urethra compared to the male membranous urethra.¹⁶

Sensory innervation of the urethra from the intrapelvic branches of the pudendal nerve or branches of the pelvic plexus may also have a role in preventing urinary leakage. Division of these nerves may result in loss of the afferent limb of an external sphincter guarding reflex stimulated by urinary leakage into the proximal urethra.¹⁷ To our knowledge the effect of attempted nerve sparing on sexual function is unknown to date but it requires further investigation.

Other important technical considerations include preservation of the urethral support mechanism, optimal reservoir capacity and anastomotic site. We aim for an initial bladder capacity of approximately 100 to 200 ml., which increases to 400 to 500 ml. in the first 12 months postoperatively. Daytime frequency, nocturia and leakage are greater when final capacity is less than 300 ml. However, large floppy bags are undesirable because they have lower reservoir pressure for a given radius and, therefore, empty less well. Anastomotic site away from the most dependent part of the reservoir provides a broad contact of reservoir wall with the pelvic floor, which avoids a narrow funnel shaped outlet that would kink during voiding, leading to obstruction.

In the postoperative period voiding re-education is of paramount importance. Patients must clearly understand the principle that lowering outlet resistance is the key to success. Increasing intra-abdominal pressure only does not allow voiding. Instruction on pelvic floor relaxation, regular voiding to prevent over distention and regular followup are essential.¹⁸ A dedicated liaison nurse whom patients may contact directly is invaluable. Complications in our series confirm the higher risk of surgery after radiotherapy. The patient who had a stricture at the ureteroileal anastomosis and a rectovaginal fistula previously underwent 60 Gy. external beam radiotherapy. Our patient who was blind, diabetic, wheelchair bound and unable to void was not a suitable candidate for any type of urinary diversion. Although this situation was clearly not ideal, to date she and her caregivers have managed the urethral catheter by intermittent spigotting and regular washouts, preventing catheter blockage and symptomatic infection of urine.

An interesting complication in 2 cases was chronic retention during year 1 despite initial good voiding. These women were successfully treated with the resection of prominent mucosal tissue at the bladder neck. This problem, which we have not encountered frequently in male patients, may be due to a relative lack of support in the more capacious female pelvis, predisposing to collapse of the reservoir wall toward the outlet. Therefore, in some patients we now fix the anterior wall of the reservoir to the anterior pelvic wall, maintaining its position as the reservoir empties. Further followup is required to determine whether this technique proves beneficial.

CONCLUSIONS

A successful functional outcome comparable to that in men may be achieved after female orthotopic bladder substitution. To date our patients have been highly select, although the number undergoing this form of surgery is likely to increase. To maintain good long-term results certain elements are essential, including careful patient selection, a surgeon ex-

perienced in pelvic surgery, meticulous operative technique and vigilant followup. It is imperative that the radical nature of cancer surgery not be compromised by the desire for reconstruction if local recurrence of bladder carcinoma is to be avoided.

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