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The Ileal W-Shaped Neobladder Following Radical Cystectomy for Carcinoma of the Urinary Bladder: Experience and Results of 50 Cases

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ABSTRACT

Purpose: The optimal urinary bladder substitute for patients undergoing radical cystectomy is still controversial. The ideal reservoir should provide a large storage capacity at low pressure achieving effective continence with less frequency and minimal renal reflux. In this study we present our experience with W-shaped ileal neobladder following radical cystectomy.

Material and Methods: Between April 1995 and September 1999, a total of 50 male patients underwent lower urinary tract reconstruction following radical cystoprostatectomy by means of ileal W-shaped neobladder. All patients had invasive bladder cancer proved by preoperative cystoscopy.

Results: Their mean age was 45.5 years. The median neobladder pouch capacity was 420 ml; daytime continence rate was 89.4%, while nighttime continence was noticed in 53.3% of cases. The ureterointestinal anastomoses were performed employing Le Duc technique in all patients. Renal units remained normal in 25 out of 30 evaluated patients. Dilatation of the pelvicalyceal system and the ureter, either unilateral or bilateral occurred in 5/30 of patients (16.6%). These were due to stricture at the urethro or uretero-pouch anastomosis that needed transurethral urethrotomy or revision of the anastomosis; however, renal functions were maintained in all patients. There were three postoperative mortalities (6%) and the early postoperative complications included urinary leakage (6%), prolonged ileus (10%) and deep venous thrombosis (4%). Late complications related to the neobladder were acceptable including metabolic acidosis (2%).

Conclusions: The ileal W-shaped neobladder is a good choice for male patients after radical cystectomy, provided that there is no evidence of prostatic or urethral tumor invasion.

Key Words: *Bladder cancer - Continent diversion - Ileal neobladder.*

INTRODUCTION

Radical cystectomy with enbloc pelvic lymph node dissection has been the gold standard treatment for patients with invasive bladder cancer. In an effort to preserve patient's body image and reduce the psychological trauma of urine diversion, a new focus has been placed on the successful reconstruction of continent bladder substitutions. As a result, a variety of continent voiding urinary pouches were developed for these patients to obtain a reservoir of low pressure and high capacity. This reservoir allows the patient to accommodate an ample amount of urine, initiate voiding by pelvic relaxation and Valsalva maneuver and consequently avoid renal reflux and damage. Camey and Le Duc [1] initially popularized these operations in 1979. Lilien and Camey [2] employed this procedure using an intact ileal segment in which the urinary control was maintained depending on the external sphincteric mechanism. Unfortunately Camey procedure with a high bowel activity produced a high intravesical pressure accounting for incontinence. A tunneled uretero-intestinal anastomosis was necessary to prevent urine refluxing up to the kidney [3,4,5]. The major undesirable sequelae of the original Camey procedure were circumvented by many investigators who utilized various forms of detubularized open segment of small bowel. Studer et al. [6] constructed the cross-folded ileal bladder and Hautmann [7] and his coworkers introduced the W-shaped ileal neobladder. Kock et al. [8] applied the hemiKock pouch and Camey [9] employed a detubularized U shaped ileal pouch.

In this study we present our experience using the W-shaped ileal neobladder for reconstruction of the lower urinary tract after radical cystectomy for patients with invasive bladder cancer.

PATIENTS AND METHODS

A total of 50 male patients were operated upon between 1995 and 1999 in the Department of Surgical Oncology, National Cancer Institute, Cairo University. All patients had invasive bladder cancer and were treated with standard radical cystectomy. Reconstruction of the lower urinary tract was completed using an ileal W-shaped neobladder.

Preoperative evaluation:

Data concerning the frequency of micturition and urinary incontinence were obtained. In all cases CBC, serum chemistry studies, chest radiography, IVU, abdominal and pelvic ultrasonography/or CT scan examination were done. Cystoscopy and examination under anaethesia were performed for all patients. Patients who showed evidence of prostatic and/or urethral invasion were excluded. Also, patients with severely compromised renal functions (serum creatinine > 2.5 mg/dl) were excluded.

Surgical technique:

Radical cystoprostatectomy and bilateral pelvic lymphadectomy were performed according to the standard technique. The endopelvic fascia was incised, the pubo-prostatic ligament was divided and suture ligature of the dorsal vein complex was performed. The prostate was divided close to its apex, the recto-urethralis muscle and the lateral pelvic fascia was then divided and eventually protection of the neurovascular boundles were the salient points. The urethra was transected as close as possible to the apex of the prostate, leaving 4-6 stay sutures of vicryl 3/0 on the urethral stump to prevent its retraction into the pelvic floor. A bowel segment of approximately 60-80 cm length was selected and mobilized sparing the distal 25-cm of the terminal ileum. The continuity of the small intestine was then re-established and the trap in the mesentery was closed. The isolated bowel segment was then arranged in a W-shaped letter, checking that one of the loops could reach the urethral stump easily without tension. The lateral limbs of the W segment were joined together by a seromuscular continuous suture of 3/0 vicryl (Fig. 1). The loop was irrigated with saline to clear the mucous, the antimesenteric border of the intestine was incised using a diathermy knife and the three adjoining edges were sutured together with a running through and through sutures to form a flat plate that folded upon itself forming a large chamber. A small hole was made about the tip of the little finger at the marked bottom of the pouch (Fig. 2). The inner end of the previously placed stay suture was passed through the hole and the outer end was inserted through the wall using Mayo's needle, tying the knots inside the bowel (Fig. 3A & B). The urethro-intestinal anastomosis was completed using one layer of interrupted 3/0 vicryl sutures (Fig. 3C). A trans-urethral 3-way silicone catheter was inserted; the anterior wall of the neobladder was then partially closed using running 3/0 vicryl sutures. The ureters were implanted from inside the neobladder through a small incision into the ileum at a convenient site (Fig. 4). The mucosa was incised to create a mucosal sulcus approximately 3-cm long and the right ureter was fixed to the lumen of the lateral segment from the right, the left one through the middle segment after it has traversed the mesentery. A curved hemostat was insinuated through the wall at the proximal end of the furrow from inside to outside to make a tunnel through which the ureter passed easily. The distal end of the ureter was spatulated and anastomosed directly to the ileal mucosa using interrupted sutures of 4/0 vicryl, making sure there was no tension. The two ureters were stented using number 8 French silicone tubes, the distal ends of these stents either passed through the urethra or tied to the tip of the urethral catheter (Fig. 5).

Postoperative care:

The ureteric stents were left for 12 days, while the urethral catheter was kept for 3 weeks postoperatively. The pouch was rinsed with 50cc saline every 6 hours through the 3-way indewling catheter. Follow up investigations including chest X-ray, relevant serum determinations and abdominal US were done every 3 months. Excretory urography and complete urodynamic studies were done periodically every 6 months. Cystoscopy was performed routinely after 6 months and if needed to determine possible causes of difficulty in voiding or unsatisfactory continence.

RESULTS

The median age of the patients was 45.5 years (range 36-57). The average operating time was 5 hours and 30 minutes and average blood loss was 1500 cc. Most patients had T2-T3 lesions (Table 1), grades 2-3 (90%).

There was no intra-operative mortality, however, three patients died postoperatively. Two patients died from myocardial infarction, another patient had massive cerebrovascular stroke. Early complications included wound infection in 5 cases and deep venous thrombosis in 2 patients; all patients were treated conservatively. Urinary leakage occurred in 3 patients that stopped spontaneously. Late complications included stricture at urethropuch anastomosis in 4 cases, which was treated with trans-urethral resection (TUR). Another two patients had ureteric stricture, both necessitated revisions of the uretero-ileal anastomoses (Table 2).

Forty percent of our patients suffered from mild temporary metabolic acidosis that was corrected with oral alkylating agents. Only one patient had severe electrolyte disturbances that required hospitalization, the patient responded well to conservative treatment.

By April 1999, 20 patients died (40%), one patient (2%) from metabolic disturbance and 5 (10%) from unrelated medical causes. Fourteen patients (28%) succumbed from disease relapse, 10 (20%) from metastatic disease and 4 (8%) patients from local tumor recurrence.

The renal units in the remaining 30 patients who survived the procedure remained unchanged in 25 patients (50 units). Only in five patients the renal units showed deterioration compared to the preoperative one and this was due to development of stricture at the urethro-intestinal anastomosis in 4 cases (8 units) and at the uretero-intestinal anastomosis in 2 cases (2 units). However, the renal functions remained good in all patients (Fig. 6a & b).

Daytime continence was achieved in 42/47 patients (89.4%), while nighttime continence was achieved in 26/47 patients (55.3%) but improved gradually with the passage of time. Mild stress incontinence with occasional spotting as moist sanitary pads occurred in 8/47 patients (17%). The urodynamic studies were done for 32 patients 6 months postoperatively. The ileal W-shaped neobladder had a mean capacity of 420-ml (Table 3). All patients voided by abdominal straining at a maximal flow rate of 20.6 ml/sec, with an average maximal neobladder pressure of 26.3-cm water. None of our patients required intermittent catheterization because of inability to void or to maintain postvoid residual urine of less than 100 cc (Fig. 7).

Table (1): Patients characteristics.

Character	No.	%
Histology:		
SCC	22	44
TCC	22	44
Mixed	5	10
Adenoca	1	2
Grade:		
G1	5	10
G2	26	52
G3	19	38
L.N. involvement:		
N0	41	82
N1	9	18

SCC : Squamous cell carcinoma.
TCC : Transitional cell carcinoma.
NL : Lymph node.

Table (2): Postoperative complications.

Early	No./%	Late	No./%
Wound infection	5 (10)	Urethral stricture	4 (8)
Deep venous thrombosis	2 (4)	Ureteric stricture	2 (4)
Prolonged ileus	5 (10)	Electrolyte disturbance	20 (40)
Urinary leakage	3 (6)		

Table (3): Urodynamic parameters.

Urodynamic test	Mean	Range
Cystometry:		
Reservoir capacity	420 ml	300-700
Residual urine	78.3 ml	20-200
Resting (basal) pressure	22.1 cm water	10-65
Maximal pressure	26.3 cm water	15-45
Uroflowmetry:		
Voided urine	355.2 ml	65-500
Voiding time	54.6 sec	20-135
Average flow rate	7.6 ml/sec	3.4-18
Maximum flow rate	20.6 ml/sec	7.3-40.6
Urethral pressure profilometry:		
Length of urethra	2.08 cm	1-3
Resting pressure	64.5 cm water	40-102
Voluntary pressure	116.11 cm water	60-180

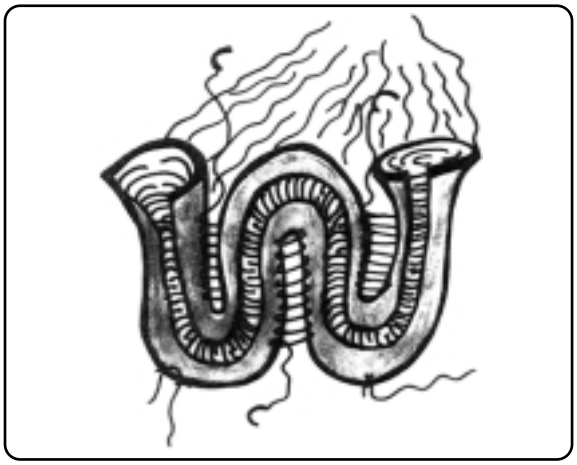

Fig. (1): The ileal segment is arranged into W-shaped segment using seromuscular stitches. The lumen was opened midway between the antimesentric borders with a scissors down the whole length. Silk suture marked the proposed site urethro-ileal anastomosis and another one marked the apex of the proximal ileal limb.

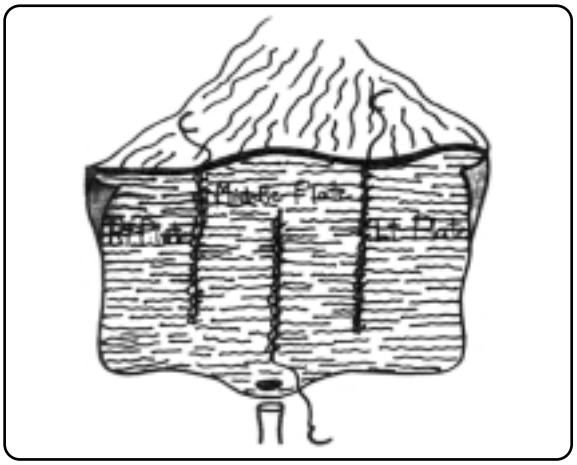

Fig. (2): Three rows of continuous sutures constructing the posterior surface of the neobladder converting the W-shaped segment into 3 plates. A small hole was made at the proposed site of urethro-ileal anastomosis.

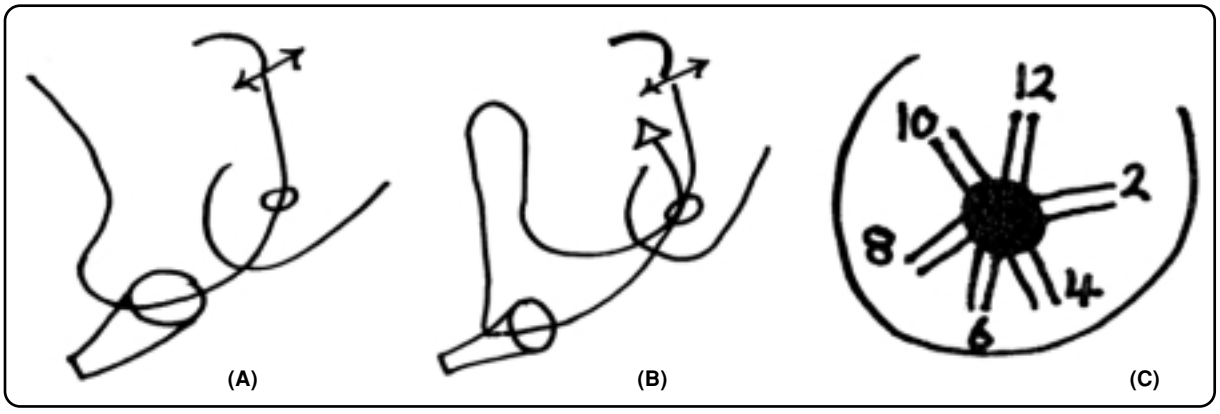

Fig. (3): A&B, The urethro-ileal anastomosis was done using 3/0 vicryl sutures that were previously placed as a stay suture. A, The needle holder passed from outside to inside the prostatic urethra, then brought from outside to inside. B, By using Mayo's needle the outer free end of the vicryl suture was brought through the wall of the ileum nears the silicon catheter. C, This was repeated at sites 2,4,6,8,10 and 12 o'clock tying the knots inside the bowel.

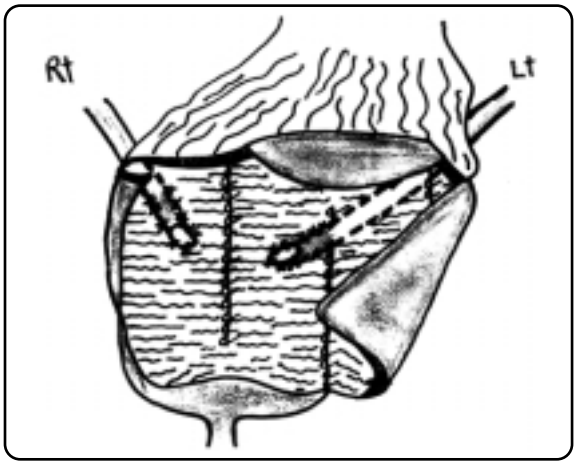

Fig. (4): By applying the Le Duc technique anon reflux uretero-intestinal anastomosis was performed. This was done by applying interrupted 6/0 vicryl sutures after opening the submucosal tunnel. The right ureter fixed to the right plate and the left one to the middle plate of the ileum.

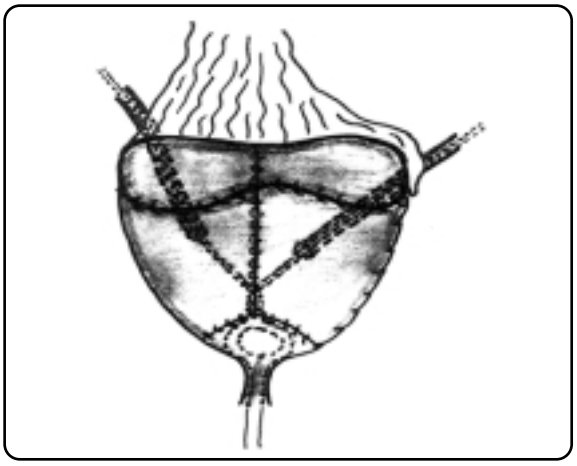

Fig. (5): Ureteric stents inserted and brought outside through the urethra or as shown in the figure. Closure of the anterior wall was completed.

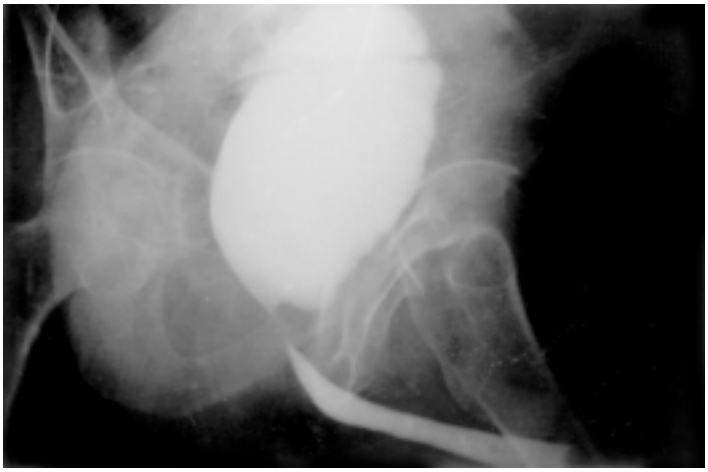

Fig. (6-A): Ascending pouchgram 6 month postoperativel showing good capacity with no reflux.

Fig. (6-B): IVU 6 months p.o. showing presevation of upper configuration.

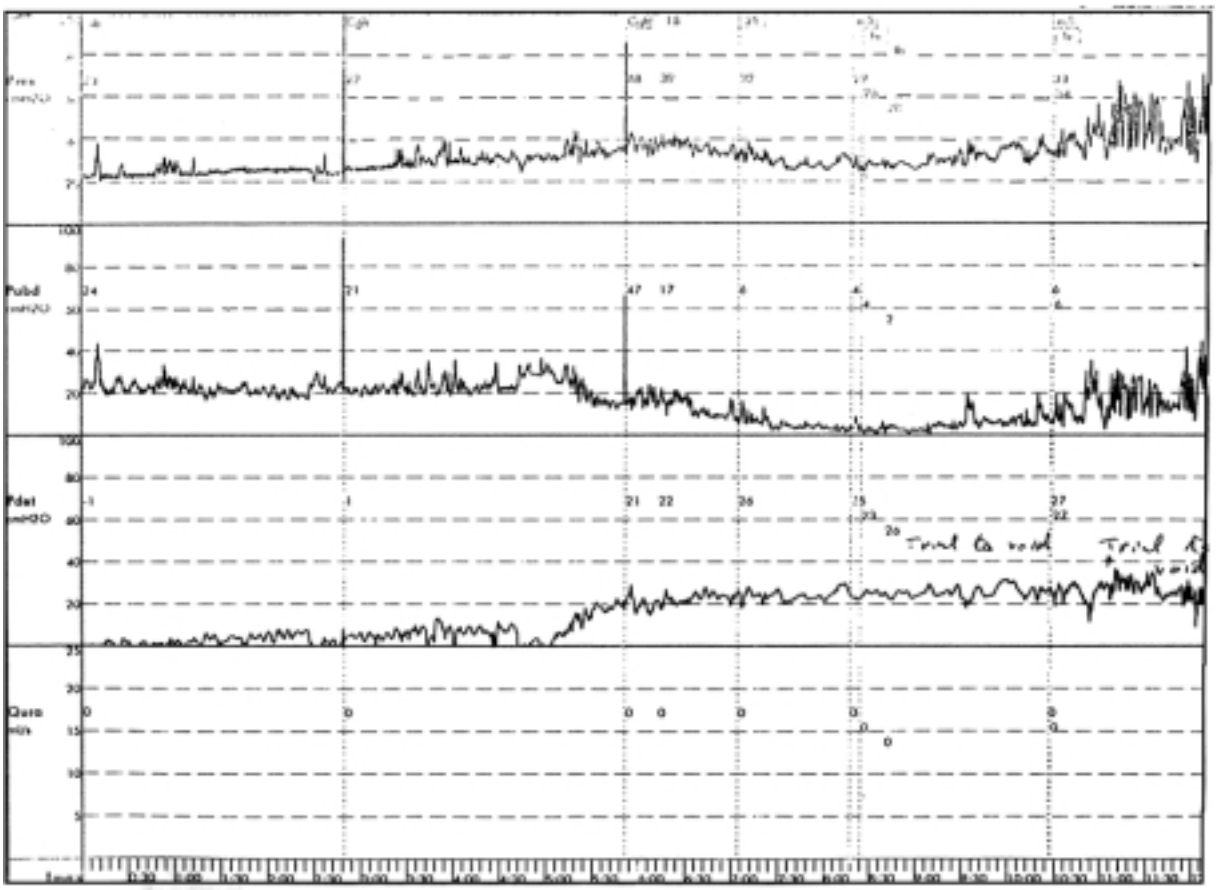

Fig. (7): Ileal W-neobladder urodynamic curve 6 months postoperatively showing basal pressure less than 20 cmh 20 with pouch capacity 500ml.

DISCUSSION

Over the last decades, many forms of urinary bladder substitutes have been described for patients undergoing radical cystectomy. Regardless of the part of the bowel used to create the neobladder, the ideal reservoir for urinary substitution should provide a large storage capacity at low pressure, avoid renal reflux and damage and achieve satisfactory continence. The successful creation of a neobladder from the intestine by Camey and Le Duc [1], with preservation of urethral sphincter mechanism during cystectomy confirmed that such a procedure was feasible using readily available organ.

Detubularization of bowel segments markedly increases its capacity as changing the bowel configuration and doubling of its diameter has an impact on volume. Thus, when the detubularized bowel segment is arranged in a W-shape, the radius of the reservoir is increased 4 folds and the height is decreased to one quarter of the original length resulting in approximately 4 folds increase in the volume of the reservoir [10]. In addition, detubularization and folding of the small intestine prevents rapid rise of mural tension due to urine filling and consequently maintain a low reservoir pressure [11]. Furthermore, elimination of peristaltic pressure waves maintains this low pressure and allows the pouch to accommodate a large amount of urine without producing neuromuscular effect.

The detubularized bowel segment increases its capacity gradually during the first 6 months after which the wall becomes maximally compliant and associated with a substantial distensibility [12]. The volume to surface area ratio is also maximized, which allows the use of less intestinal length for a given pouch capacity, therefore, offers the further advantages of minimizing the resorptive surface area of the pouch and consequently reduces the risk of metabolic and functional abnormality. On the other hand, our previous experience with ileocaecal segment to reconstruct the bladder showed significant bowel activity whenever a closed segment was used [13]. Furthermore, fluoroscopic contraction control of Mainz [14] and Le Bag [15] pouches derived from the large bowel segments were dampened by small bowel segments of these reservoirs.

Kock et al. [16] reported that several factors contributed to the excellent continence rate of the ileal neobladder. Hautmann [7] and his colleagues mentioned that the continence following creation of this highly compliant low pressure reservoir depends on the inherited function of the residual sphincter mechanism, if it is absent or malfunctioning, incontinence is expected. This was parallel with our experience; all of our continent patients showed the presence of normally functioning distal sphincter following cystoprostatectomy. Voiding at suitable intervals helped our patients to achieve both diurnal and nocturnal continence; they gradually resumed sensation of fullness closely simulating those of the normal bladder. Bassiouny [17] reported a similar finding from the study of patients with sigmoid neobladder. The daytime continence was 89.4%, which was considered satisfactory and even improved with time probably due to increase in the pouch capacity, preservation of maximum length of the membranous urethra and preservation of the neurovascular bundles. It is our trend to preserve the neurovascular bundles as long as the tumor remains intravesically and its preservation would not affect the oncologic safety of the procedure. In reference to other series, Aboul-Enin and Ghoneim [18] reported 90% day continence, in the original Hautmann et al. [7] series day continence was only 72.7%; however, in their series in 1994 [19] the continence rate reached 85%. Walsh et al. [20] reported the highest incidence of day continence and it was 99% and the lowest incidence was 66.6% in Studer series [21]. Our night time continence was only 55.3% despite an optimum reservoir capacity. This may be explained by the nocturnal output of urine which exceeds the reservoir capacity due to water shift by the intestine to render the concentrated nocturnal urine isoosmolar. Moreover, loss of the afferent limb of the sacral bladder-sphincter reflex prevents the increase in the sphincter tone in response to the increase in pouch volume resulting in relative sphincter insufficiency. This factor together with the absence of the feedback to the brain stem via the bladder afferents, which awake the patient when the reservoir is full, results in a relatively high incidence of nocturnal enuresis but it improves gradually with time when the new sensation of fullness appears. In Hautmann [7] initial report the night continence was 36.4%, which markedly improved in their 1994 [19] series to reach 78%. Kock [16] reported a 100% night

continence. Our stress incontinence rate was 17%; that was comparable to Hautmann results which was 12% in their series in 1994 **[19]**.

In our study the mean pouch capacity of 420 ml (range 300-700 ml) compared favorably with that of the detubularized sigmoid pouch reported by Bassiouny **[17]** of 267-610 ml range. The mean residual urine of 78.3 ml and the mean urinary flow of 20.6 ml/sec were found to be similar to other reported series **[16]**. Compared to Camey series **[1,2]**, our ileal neobladder had a lower basal pressure (mean 22.1 cm H_2O), while the urethral pressure (mean 64.5-cm) was similar.

The complication rate of the present study was high when compared with those reported by other series. We reported early complications of 6% urinary leakage and 10% prolonged ileus, while these were only 0.4% and 4% in Hautmann **[19]** series, that could be attributed to our small number of patients. In our study, the urethro-ileal stricture together with uretro-ileal ones reached 4%, which compared favorably with that reported by Miller et al. **[22]** and Wenderoth et al. **[23]**, who gave figures of 4% and 1.4%, respectively. In our series, the renal units remained normal in most of our patients (83.3%). Renal unit dilatation appeared in only 16% of cases and was due to stricture formation at either urethro-pouch or uretero-pouch anastomosis. Aboul-Enin and Ghoneim **[18]** reported renal unit deterioration in only 3% when they implanted the ureters in extra-mural serous lined tunnel.

In conclusion, we believe that W-shaped ileal neobladder is a reasonable substitute to the natural urinary bladder. It has the lowest pressures of all types of reservoirs reported in the literature and it avoids resection of the terminal ileum and ileo-colonic junction. It should be offered as an option for appropriate patients with invasive bladder cancer.

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