

## Detubularized Sigmoid Neobladder Versus Detubularized W-Shaped Ileal Neobladder as a Bladder Substitute after Radical Cystectomy for Carcinoma of the Urinary Bladder: A Study of 60 Patients

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### ABSTRACT

**Objectives:** To compare the urodynamic parameters, continence rates, and complications between two different continent urinary reservoirs-the sigmoid neobladder (SN) and W-shaped ileal neobladder (IN).

**Material and Methods:** Sixty patients with bladder cancer underwent radical cystectomy and were divided into two groups. The first group comprised 33 patients who underwent detubularized sigmoid neobladder surgery. The second group included 27 patients who underwent detubularized W-shaped ileal neobladder surgery.

**Results:** Early post-operative complications occurred in 42% of patients in the sigmoid neobladder (SN) group and in 33% of patients in the ileal neobladder (IN) group. Most of these complications were minor, mainly due to wound infection or urinary leak, and were managed conservatively. No early post-operative mortality occurred in patients of either group. Day-time continence was achieved in 78.8% and 74% of patients in the SN group and the IN groups, respectively. Night-time continence was achieved in 45.5% of patients in the former group and 59.3% of patients in the latter. The mean neobladder capacity was 472.5cc in patients who underwent detubularized SN surgery and 463.8cc in patients who underwent detubularized IN surgery. The mean post-voiding residual volume was slightly lower in SN group (90.1cc) than in those of IN group (93.7cc). The pelvicalyceal systems were preserved in 94% of patients in the SN group and in 96.3% of patients in the IN group. No significant metabolic disturbances occurred in patients of either group.

**Conclusions:** Both methods are good alternatives as a bladder substitute. Surgeon preference, ease of construction and length of mesentery are among the factors that must be considered when choosing between them.

**Key Words:** *Invasive bladder cancer - Continent diversion - Neobladder.*

### INTRODUCTION

Camay described an orthotopic urinary reservoir in which a small tubular bowel segment was used as a bladder substitute by anastomosing it to the urethra. However, because of the volume triggered contractions of the tubular bowel segment in Camay's original U-shaped enterocystoplasty, trains of high pressure waves were inevitable, leading to nocturnal enuresis in up to 90% of patients when the reservoir volume exceeds 100 to 150ml [1].

Koch was the first to describe the fundamental principles of a detubularized and refolded bowel reservoir for low pressure continent urinary diversion with a stoma, and thus, specific drawbacks of the tubular reservoir were overcome. However, despite continence of the intra-abdominal urinary reservoir as described by Koch, the social and psychological stigma of the stoma remains [2].

The ileal neobladder is an orthotopic bladder substitute that avoids disadvantages of both methods (nocturnal incontinence and stoma). A W-shaped ileal neobladder was introduced as an excellent detubularized low pressure reservoir with high capacity [3]. Bassiouny, et al., reported successful use of the W-shaped ileal neobladder with a day-time continence rate of 89.4% and night-time control rate of 55.3% [4].

Detubularized sigmoid was initially reported by Reddy and Lange [5] to improve the urodynamic characteristics of the non-configured

sigmoid bladder. Bassiouny [6] was the first to introduce the detubularized sigmoid neobladder in Egypt using a partial detubularized large sigmoid pouch with a satisfactory day-time continence rate of 91.6% and night-time continence rate of 66.7%. Later, Bassiouny, et al. [7] successfully applied the detubularized U-shaped sigmoid neobladder in a large series and reported optimum continence rates of 86% for day-time and 72% for night-time.

It is our standard practice to create a continent neobladder whenever possible, but this procedure is limited to selected patients. Greater experience with the procedure and refinements in surgical techniques decreased the mortality and morbidity of continent orthotopic bladder substitution.

We conducted this prospective randomized study to compare between two continent orthotopic neobladders, the detubularized sigmoid neobladder and the W-shaped ileal neobladder.

## MATERIAL AND METHODS

Between January 1999 and April 2003, 60 patients with invasive bladder cancer (54 men and 6 women) with a mean age of  $56 \pm 7.5$  years in the SN group and  $50 \pm 9.4$  years in the IN group were treated. Males underwent a radical cystectomy and females underwent an anterior pelvic exenteration. In spite of randomization according to type of urinary diversion, the detubularized SN included 33 patients while the W-shaped IN included 27 patients. This was due to the surgical limitation of application of the assigned neobladder in each group—the presence of diverticular disease in one case, bilharzial pericolic mass in two cases and short intestinal mesentery in six cases.

### *Eligibility Criteria:*

*Inclusion Criteria:* It was required that preoperative evaluation of involvement of the prostatic urethra and bladder neck, as well as radiologic evaluation for metastasis yielded negative results in all patients included in this study.

*Exclusion Criteria:* Patients having P4 stage and those having evidence of prostatic and/or urethral invasions were excluded from this study. Patients who showed radiological evidence of distant metastasis and those with se-

verely compromised renal functions (serum creatinine  $>2.5$ mg/dl) were excluded.

In all cases CBC, serum chemistry studies, chest radiography, IVU, abdominal and pelvic CT examinations were carried out for all patients. Cystoscopy and examination under anesthesia were also performed for all patients. Barium enema or colonoscopy was performed routinely in all patients to preclude presence of an intracolonic mass or significant diverticular disease.

Histopathology, grade and pathological stages of the selected patients are shown in Table 1. Preoperative IVP was normal in 18/33 (54.5%) of SN patients and in 14/27 (51.8%) of IN patients. Mild to moderate pelvicalyceal hydronephrosis was seen in 14/33 (42.4%) SN cases, and in 13/27 (48%) IN cases. Huge unilateral dilatation was seen in 1/33 (3%) of SN patients (Fig. 1).

### *Surgical Technique:*

Radical cystoprostatectomy in men and anterior pelvic exenteration in women were performed standardly. The prostate was transected at its apex in all patients; however, in a few patients, the capsule of the prostate was transected near the apex and the rest of the prostatic tissue was cored out. This was done to facilitate urethral anastomosis due to narrow pelvis (Table 2).

Preservation of the neurovascular bundles was achieved in 18 patients (54.5%) in the SN group and in 19 patients (70.4%) in IN group, while preservation of only one bundle was performed in five patients (5.5%) in the SN group and in two patients (7.2%) in the IN group (Table 2).

### *Construction of the Sigmoid and W-Shaped Ileal Neobladder:*

Briefly, the sigmoid neobladder was constructed by skeletonizing a 30 to 35cm sigmoid segment in a U configuration isolated on a broad mesenteric pedicle fed by the sigmoid arterial branches of the inferior mesenteric artery. This segment was arranged in U-shape and then detubularized along the mesenteric border. Anti reflux uretero-intestinal anastomoses was done as originally described by Camay [1], followed by configuration to sphere form. Urethral anastomosis was done at the apex of prostate in

males and near the bladder neck in females [7]. The ileal neobladder was constructed by skeletonizing 60cm of ileum isolated on a broad mesenteric pedicle fed by terminal branches of superior mesenteric artery. This segment is arranged in W-shaped letter and then detubularized along the mesenteric border. Anti-reflux uretero-intestinal anastomoses was done as originally described by Camay [1], followed by configuration to sphere form. Urethral anastomosis was done at the apex of the prostate in males and near the bladder neck in females [4] (Fig. 2).

#### *Post-Operative Evaluation:*

Each patient was evaluated at one-month intervals during the first year, at three-month intervals during the second to third year and at six-month intervals thereafter. Routine examinations, including chest X-rays, urine cytology, renal ultrasonography, determination of serum electrolytes, blood urea nitrogen, and creatinine concentration liver function tests, and arterial blood gas analysis were performed every three to six months for five years. Abdominal and pelvic computed tomography were performed three and six months post-operatively and every six months thereafter. The upper urinary tract was assessed using intravenous urography every six months. Endoscopic evaluation of the reservoir and urethra was performed yearly. The incidence of local and distant recurrence was reported.

The continence status and voiding pattern in each patient were assessed at routine follow-up visits at least six months post-operatively according to the criteria described by Hautman, et al. [8].

Urodynamic studies were performed at the end of sixth months post-operatively. The following parameters were recorded: mean neobladder capacity, mean residual urine volume, mean basal pressure, mean pressure at maximal capacity, mean maximal flow rate and the mean average flow rate.

## **RESULTS**

Between January 1999 and April 2003, 60 patients (54 men and 6 women) with a mean age of  $53 \pm 9$  years, underwent radical cystectomy or anterior pelvic exenteration for invasive bladder cancer. Thirty-three underwent reconstruction with detubularized sigmoid neobladder

diversion and 27 underwent reconstruction with detubularized W-shaped ileal neobladder.

The mean age of patients was  $56 \pm 7.5$  years in the SN group and  $50 \pm 9.4$  years in the IN group (Table 1). The median follow-up time was 38.8 months.

There was no significant difference between the SN group and IN group regarding clinical staging, histological grade and type, tumor location, multiplicity, bilharzial infestation and nodal involvement (Table 1). However, SN patients showed a significantly higher pathological stage than IN patients (42.3% vs. 22.3%, respectively,  $p < 0.05$ ) (Table 1).

#### *Procedure Time and Blood Loss:*

The average operative time for cystectomy and reconstruction with the sigmoid neobladder was  $5.28 \pm 0.28$  hours, and  $5.72 \pm 0.31$  hours for those in the ileal neobladder group. The average blood loss for cystectomy and reconstruction with the sigmoid neobladder was  $1120 \pm 354.2$ cc, and  $1185 \pm 282.4$ cc for those in the ileal neobladder group (Table 2).

#### *Surgical Complications:*

There was no post-operative mortality and early post-operative complications were minor, 39.4% for SN patients and 33.3% for IN patients. However, most of these complications were unrelated to the type of diversion (Table 3).

*Early complications:* The reservoir-related early complications included urinary leakage in 6/33 patients (18%) in the SN group and 6/27 patients (22%) in the IN group. All were managed conservatively and no patients required open surgery for repair. The most common non-reservoir-related early complication was wound infection, which occurred in six SN patients (18%) and eight IN patients (29.6%). All were managed with repeated dressing and appropriate antibiotic therapy. One patient (3%) in the SN group developed burst abdomen and required surgical closure. One patient in the SN group (3%) developed DVT, and was given anticoagulant therapy.

*Late Complications:* Late complications included: Stenosis of the uretero-intestinal anastomosis in one patient in SN group (3%) that was managed with open surgical revision. Stenosis of urethral anastomosis occurred in one patient in the SN group (3%) and one patient

in the IN group (3.7%). Both were treated endoscopically (Table 3).

#### *Upper Urinary Tract Status:*

Excretory and ascending urogram showed no post-operative deterioration of the renal functions in 29/33 patients (87.8%) in the SN group and in 24/27 patients (88.8%) in the IN group. Gradual improvement was seen in 2/33 patients in the SN group and in 2/27 (7.4%) patients in the IN group. The pelvicalyceal system was preserved in 31/33 (93.9%) patients in SN group and in 26/27 (96.2%) patients in the IN group. Mild deterioration was seen in 1/33 (3%) patient and 1/27 (3.7%) patient in the SN group and the IN group, respectively. Severe deterioration was seen in one patient in the SN group. The two patients who showed mild deterioration of pelvicalyceal system underwent intermittent catheterization and the patient who developed severe deterioration was treated by ureteric reimplantation (Fig. 3).

Ultrasonic examination of both kidneys in all patients was performed every six months during the follow-up period and no change in the renal parenchyma in both groups was observed. The renal cortical thickness was preserved within  $1.5\pm 0.52$ cm (for the right kidney) and  $1.5\pm 0.031$ cm (for the left kidney) in the SN group and  $1.6\pm 0.43$ cm (for the right kidney) and  $1.4\pm 0.4$  (for the left kidney) in the IN group.

#### *Post-Operative Potency:*

With regard to the sexual functions in male patients, the mean time for regaining potency post-operatively was eight months in patients who underwent SN reconstruction and ten months in patients who underwent IN reconstruction. In the SN group, 5/30 patients (16.7%) achieved a good erection, while 13/30 patients (43.3%) had a weak erection and 12 patients (40%) had no erection at all. In this group, preservation of the neurovascular bundles was achieved in 18 patients (54.5%), while preservation of only one bundle was performed in 5 patients (5.5%). In patients who underwent IN reconstruction, 4/24 patients (16.6%) patients achieved a good erection, 10 patients (41.7%) had a weak erection, and 10 patients (41.7%) were completely impotent. In this group, 19 patients (70.4%) underwent preservation of the neurovascular bundles and 2 patients (7.2%) underwent preservation of only one bundle. Patients with a weak erection improved with

medical treatment. There is no statistically significant difference between both groups in this respect (Table 3, Fig. 4).

#### *Metabolic Status:*

Metabolic evaluation revealed that no patients had symptomatic hyperchloremic metabolic acidosis. The mean post-operative pH, sodium, chloride and serum urea expressed in mEq/L in patients who underwent SN reconstruction levels were  $7.398\pm 0.028$ ,  $139\pm 5.2$ ,  $96\pm 13.6$ ,  $28\pm 6.23$  respectively, while the levels in those who underwent IN reconstruction were  $7.387\pm 0.022$ ,  $137\pm 4.4$ ,  $98\pm 17.3$ , and  $31\pm 4.71$  respectively ( $p < 0.05$ ). The mean post-operative potassium bicarbonate and serum creatinine expressed in mEq/L was  $4.3\pm 0.4$  vs.  $4.2\pm 0.5$ ,  $22.8\pm 1.4$  vs.  $21.5\pm 2.1$  and  $1.1\pm 0.31$  vs.  $1.1\pm 0.42$  ( $p > 0.05$ ) for the two groups, respectively. The mean pre-operative and post-operative blood urea nitrogen, creatinine, sodium, and potassium concentrations were similar in both groups. None of the patients developed chronic renal failure. Serum vitamin B12 concentration was evaluated in a few IN patients, and it was normal.

#### *Voiding Status and Continence:*

All patients could void to completion without the need for catheterization. Urinary continence status evolved gradually and improved with time. The final status usually was attained after six months. Twenty-two patients (78.8%) who underwent SN reconstruction and twenty patients (74%) who underwent IN reconstruction were completely continent during the day. Night-time continence was achieved in 15 SN patients (45.5%) and 16 IN patients (59.3%). Stress incontinence developed in two SN patients (6%) and one IN patient (3.7%) ( $p < 0.05$ ). No patient required intermittent catheterization, since the residual volume was less than 100cc in both groups.

#### *Urodynamic Findings:*

The mean neobladder capacity of SN patients was significantly higher than those in the IN group ( $472\pm 123.6$  ml and  $463.8\pm 123.6$  ml, respectively,  $p < 0.05$ ). All patients relied on the sensation of suprapubic fullness, and with straining, SN patients voided at a mean maximum rate of  $18.1\pm 4.6$  cm/sec. IN patients had a mean maximum rate of  $17.8\pm 4.8$  cm/sec ( $p < 0.05$ ). The maximum reservoir basal pressure was not

significantly different for both groups ( $18.2 \pm 8.6$  and  $17.3 \pm 6.1$  cm H<sub>2</sub>O). However, the maximum pressure at maximum capacity was significantly lower in SN patients ( $57.22 \pm 21.1$  vs.  $52.9 \pm 4.6$  cm H<sub>2</sub>O for IN patients). The mean residual volume was significantly lower for SN patients ( $90.1 \pm 28.3$  ml) than for IN patients ( $93.7 \pm 34.5$ ,  $p$  0.05 ml).

#### Survival and Pelvic Recurrence:

Seven patients had distant metastases from their bladder cancer. Pelvic recurrence was seen in four cases without urethral involvement. This did not affect neobladder function. All eleven patients died, despite systemic chemotherapy and/or radiotherapy, six to fourteen months after the onset of the symptoms. Two other patients died of heart failure at eighteen and twenty-two months, post-operatively, without disease progression.

Table (1): Patients' characteristics.

Characteristics	Sigmoid neobladder group		Ileal neobladder group	
	No.	%	No.	%
<b>Age (in years):</b>				
Range	39-73		32-66	
Mean $\pm$ SD	56 $\pm$ 7.5		50 $\pm$ 9.4	
<b>Sex:</b>				
Males	30	91	24	89
Females	3	9	3	11
<b>T-Stage (EUA):</b>				
T3	28	85	22	81
T2	5	15	5	18.5
<b>Location of lesion*:</b>				
Vault	7	22	8	29.5
Lateral walls	16	48	8	29.5
Combined	10	30	11	41
<b>Multiplicity:</b>				
Single	29	88	21	78
Multiple	4	12	6	22
<b>Histological type:</b>				
Transitional cell carcinoma	16	48.4	13	48.1
Squamous cell carcinoma	15	45.4	11	40.8
Adenocarcinoma	2	6.2	3	11.1
<b>Histological grade:</b>				
G I	3	9.1	0	0
G II-III	30	90.9	26	62.3
G IV	0	0	1	3.7
<b>P-Stage:</b>				
P2a-b	14	42.3	6	22.3
P3a-b	19	57.6	21	67.7
Schistosomal infestation	21	63.6	15	55.5
Positive lymph nodes metastases	12	36.4	10	37

\* In all cases, the tumors were located 2 cm away from the bladder neck.

Table (2): Operative findings.

Item	Sigmoid neobladder group		Ileal neobladder group	
	Mean	SD	Mean	SD
Operative duration (in hours)	5.28	0.28	5.72	0.31
Intraoperative blood loss (in cc)	1120	354.2	1185	282.4
Preservation of neurovascular bundle	No.	%	No.	%
	Both bundles preserved	18 54.5	19 70.4	
	One bundle preserved	5 15.5	2 7.4	
	Both sacrificed	10 30	6 22.2	

Table (3): Surgical complications.

Item	Sigmoid neobladder group		Ileal neobladder group	
	No.	%	No.	%
D.V.T	1	3	0	0
<b>Wound infection:</b>				
Mild	4	12	1	3.7
Severe	2	6	2	7.4
Urinary leak	6	18	6	22
Burst abdomen	1	3	—	0
<b>Ureterointestinal stenosis:</b>				
Mild	1	3	1	3.7
Severe	1	3	0	0
<b>Erection*:</b>				
Weak erection	13	43.3	10	41.7
No erection	12	40	10	41.4

\* 30 patients in Sigmoid neobladder group and 24 in ileal neobladder group

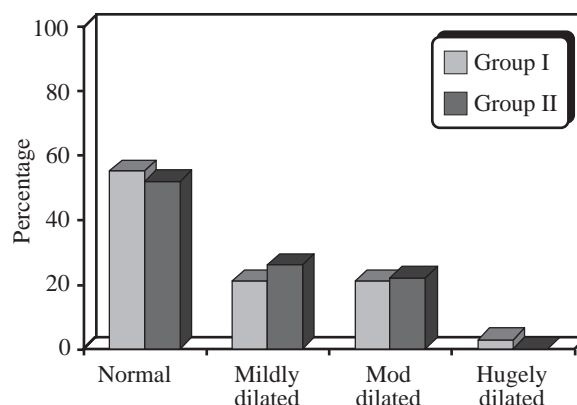


Fig. (1): A comparison of preoperative assessment of pelvicalyceal system by IVP and sonar.

Group I: Sigmoid neobladder. Group II: Ileal neobladder.

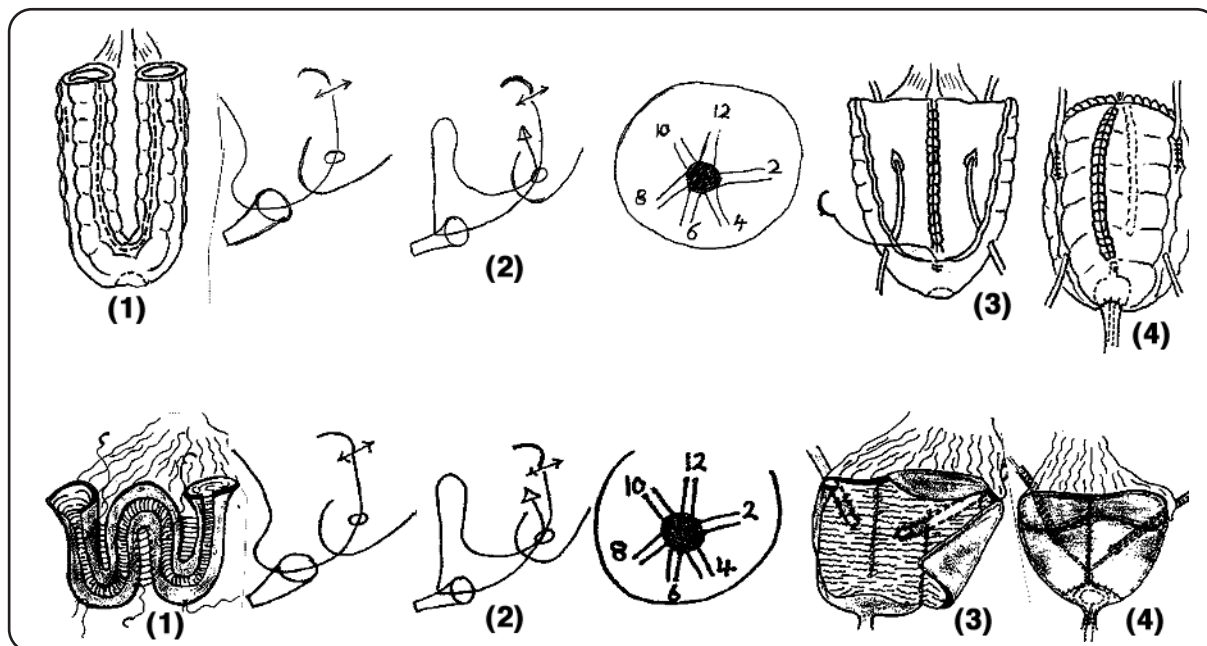


Fig. (2): A.1: Sigmoid neobladder isolation and arrangement in a U-shaped letter.  
 2- Urethral anastomosis.  
 3- Ureteric implantation (pseudosubmucosal tunnling technique [ Le Duc technique].  
 4- Pouch configuration into a spherical shape.  
 B.1: Ileal neobladder isolation and arrangement in a W-shaped letter.  
 2-Urethral anastomosis.  
 3- Ureteric implantation (pseudosubmucosal tunnling technique[ Le Duc technique].  
 4- Pouch configuration into a spherical shape.

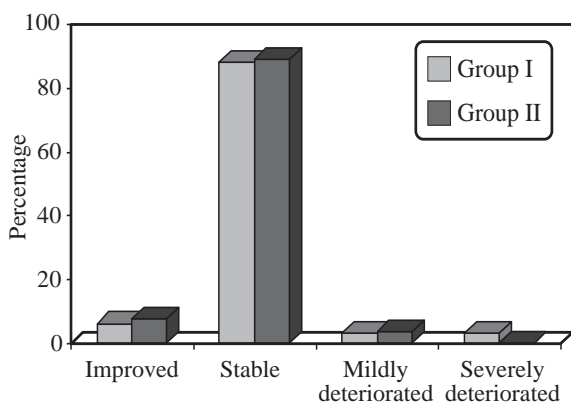


Fig. (3): A comparison of Postoperative assessment of pelvic/colyceal system by IVP

Group I: Sigmoid neobladder. Group II: Ileal neo bladder.

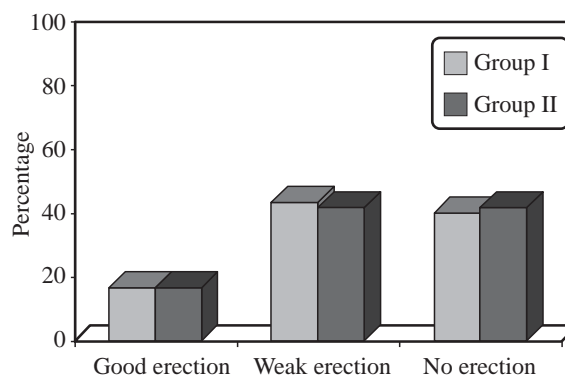


Fig. (4): A comparison of Postoperative potency in the studied male patients.

Group I: Sigmoid neobladder. Group II: Ileal neo bladder.

### DISCUSSION

The techniques for the construction of a neobladder have evolved remarkably in recent years, leading to lower mortality and morbidity rates. Reconstruction should result in adequate capacity with a low-pressure system, while conferring optimal continence and voiding with minimal distortion of metabolism [13]. Peri-

operative mortality rates in large series of radical cystectomy patients with orthotopic bladder substitution ranged from 1% to 3.8% [9-12]. These low rates were also comparable with that reported recently by Bassiouny, et al. [4,7] and with the present study.

The mean intravesical basal pressure in sigmoid neobladder was  $18.2 \pm 8.6$  cm H<sub>2</sub>O com-

pared to  $17.3 \pm 6.1$  cm H<sub>2</sub>O in the ileal neobladder. This is comparable to the mean basal intravesical pressure of 24.4 cm H<sub>2</sub>O obtained by Hautmann [14] with the ileal neobladder. Melchior [15] found that segments containing colon had higher average pressure spikes on urodynamic studies despite detubularization and are most likely related to the muscular nature of the sigmoid colon than those containing mostly ileum, such as with Hautmann. Similarly, these high pressure spikes may be responsible for the high incontinence rates with the ileocecal bladder substitute [36]. However, Reddy [16] found the mean basal pressure in the detubularized sigmoid pouch to be of 12 cm H<sub>2</sub>O, which is lower than that reported in the present study. The high mean basal pressure in our study may be due to the difference in the timing of performing urodynamic studies. With time, the low-pressure bladder substitute becomes more compliant and capacious.

The mean maximum cystometric capacity in sigmoid neobladder was  $472.5 \pm 123.6$  ml at a mean pressure of 57.2 cm H<sub>2</sub>O. While in the ileal neobladder, the mean maximum cystometric capacity was  $463.8 \pm 124.4$  ml at a mean pressure of 52.9 cm H<sub>2</sub>O. So the detubularized sigmoid neobladder had a greater capacity with higher pressure than that of the ileal neobladder in this study. Gonzalez, et al. [17] found that the mean maximum cystometric capacity in the sigmoid neobladder was 338.2 ml after two years with maximum intravesical pressure of less than 30 cm H<sub>2</sub>O. Hautmann, et al. [14] found that the mean maximum cystometric capacity in the ileal neobladder was 387 ml at a pressure of 60.1 cm H<sub>2</sub>O. The first sensation of micturition in a SN patient was recorded at a mean volume of 241.3 ml which represented about 51% of the maximum cystometric capacity, compared to 310.1 ml (about 69% of the maximum cystometric capacity) in an IN patient.

Continence rates after orthotopic bladder substitution have been reported to vary between 65% and 98% for day-time continence and 45.5% and 59.3% for night-time continence [4,7, 18-20]. Richard, et al. [21] reported in a comparative study between ileal and sigmoid neobladders that the latter was associated with greater incontinence rates. These results were comparable with other studies [22-24]. Compared to the present study, the mean continence rate was

low for SN patients (78.8% day-time, 45.5% night-time) and for IN patients (74 % day-time, 59.3% night-time). The reservoir expands to some extent over time, which may explain why the rate of incontinence, particularly at night, was relatively high soon after surgery when the reservoir capacity was small. Another explanation may be related to the advanced stage of the tumors with which we are dealing. This necessitated, for oncologic safety, to scarify the neurovascular bundles in 30% and 22.2 % of cases in the sigmoid neobladder group and the ileal neobladder group, respectively.

Self-catheterization due to poor emptying was not recorded in either group. Compared to the rate reported in other series, the ileal neobladder is associated with a rate of 1.7% and 15.4% for occasional and regular intermittent catheterization, respectively [12,25,26]. However, we have a comparatively higher mean post-voidal residual volume in both groups (90.1 cc for the SN and 93.7 cc for the IN) [4,7,16,17]. The increased residual urine in the present study can be attributed to neobladder outlet obstruction due to the possible presence of some residual prostatic tissue left behind in cases where the prostatic tissue was cored out after resection of its capsule near the apex. This outlet obstruction cannot be overcome by the flimsy detubularized intestinal musculature, in contrast to the unique contracting mechanism of the geniuss detrusor muscle.

Because reflux can lead to renal damage [27,28,31], prevention is one of the most important aspects of reconstruction. The reflux rate was 2% and 3.3% for the orthotopic Koch pouches with anti-reflux ureteral anastomoses [10,11]. Bassiouny [4,7] reported no reflux for sigmoid neobladder using the submucosal tunneling antireflux technique, while he reported a reflux rate of 8% using the same antireflux technique for the W-shaped ileal neobladder. Abol Enein and Ghoneim [29] reported a reflux rate of 3% with the use of the serous-lined extramural ureteral implantation technique. In the present study, the pelvicalyceal system was preserved in 31/33 of SN patients (94%) and in 26/27 of IN patients (96.3%), and there was no statistical difference between them. Studer, et al. [25] compared the use of an afferent isoperistaltic tubular ileal ureter with the use of an antireflux nipple valve. The long-term results

of this prospective, randomized study showed no major differences between both groups except for an increased rate of upper urinary obstruction in patients with antireflux nipples. Hautmann [30] recently demonstrated that there is no longer justification for the use of any antireflux mechanism. Reflux prevention in the neobladder is even less important than in a normal bladder.

Uretero-intestinal stenosis is a technical pitfall of any type of orthotopic bladder substitution and may result in long-term deterioration of renal function [33]. Studer, et al. [12] reported a 3% rate of obstruction using ureteral direct anastomoses. Roth, et al. [32] reported obstruction rates of 3.6% and 20.4% for direct ureteral anastomoses. In the present study, the rate of uretero-intestinal anastomotic stenosis using the submucosal tunneling technique was 6% in the sigmoid neobladder group and 3% in the ileal neobladder group, which is comparable with that reported by Bassiouny, et al. [4,7].

Koch reported that there is a progressive risk of vitamin B<sub>12</sub> or folic acid deficiency with the ileal neobladder [34]. Such complications are not associated with the sigmoid neobladder [7]. In the present study, the ileal neobladder group did not show such complications. This may be due to regular replacement therapy of vitamin B complex.

Studer [18] stated that metabolic acidosis may affect up to 50% of IN patients, and this is dependent on the length of the isolated ileum. McDougal and Koch [35] reported that 10-15% of patients with colonic urinary diversions might experience moderate to severe metabolic acidosis. In the present study, there were no significant disturbances in pre- and post-operative serum pH, and there is no statistical difference between both groups. The mean serum pH was  $7.398 \pm 0.028$  for the SN group and  $7.387 \pm 0.022$  for the IN group ( $p < 0.05$ ). The mean serum potassium in the SN group was  $4.3 \pm 0.4$  mEq/L compared to  $4.2 \pm 0.52$  mEq/L for the IN group ( $p > 0.05$ ). This does not coincide with what Koch, et al. [34] had reported, which that the ileum is more likely to reabsorb potassium concentrated in the urine than the colon.

#### Conclusion:

Our experience suggests that neobladders composed of sigmoid or ileum are good bladder substitutes and comparable to each other in

terms of adequate capacity with a low-pressure system. Surgeon preference, ease of construction and length of mesentery are among the factors that must be considered when choosing between them. However, sigmoid neobladders are easy to use, avoid small intestinal resection, reaches the pelvic cavity easily, and protects from metabolic acidosis in patients with borderline renal function. It is noteworthy that with ileal neobladders, on the other hand, the patient requires medical supervision to prevent the occurrence of symptomatic electrolyte disturbance.

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