

## Orthotopic ileal and sigmoid neobladder after radical cystectomy: functional results: A prospective study and retrospective study

Saied A.A. Mostafa<sup>1</sup>, Ismail M. Khalaf<sup>1</sup>, Ali M.H. Farag<sup>1</sup>, Hassan A. Abdel-Baky<sup>1</sup>, Mostafa M.M. Shakweer<sup>2</sup>, Tarek M. Omran<sup>3</sup>

Departments of <sup>1</sup>Urology, Radiology<sup>2</sup> and Clinical Pathology<sup>3</sup>, Faculty of Medicine, Al-Azhar University, Egypt

### Abstract

**Background:** bladder cancer is common among genitourinary tract. Radical cystectomy with urinary diversion is the widely accepted treatment. However, no consensus exists regarding the best orthotopic neobladder creation intestinal segment.

**Aim of the work:** to evaluate functional and oncological outcome of ileal and sigmoid orthotopic urinary diversion.

**Patients and methods:** The study included two groups of 40 patients in each group (ileal and sigmoid groups). Each group was further divided in two twenty subgroups; prospective and retrospective. Ileal group operated in Urology and Nephrology centre (UNC) and Al-Azhar University hospital (Damietta), while patients in sigmoid group were operated in Al-Azhar University hospital (Cairo). All underwent full history taking, clinical examination, and laboratory investigations. Then, postoperatively, all were followed up for 6 months. In each postoperative follow up visit, patients were assessed clinical, radiological, urodynamic study and by laboratory investigations and patients' quality of life were evaluated.

**Results:** In ileal orthotopic diversion, early postoperative complications were bleeding (2.5%), urine leakage (2.5%) and wound infection (25%). Diurnal continence was achieved in 90%, while nocturnal continence was achieved in 70%. The early postoperative complications were urine leakage (2.5%), obstruction (2.5%), and ileus (12.5%). The late complications were DVT (2.5%) and intestinal obstruction (5.0%). In addition, 2.5% were died from disease. Tumor recurrence was pelvic in 7.5%, distant (hepatic) in 2.5%. Only 25% of patients were potent and urine culture revealed E-coli in 40.0%. In the sigmoid orthotopic diversion group, the early postoperative complications were urine leakage (17.5%), obstruction (2.5%), ileus (7.5%), bleeding (2.5%), DVT (2.5%) and faecal leak (2.5%). Late complications were pouch stones (10.0%), stricture urethra (12.5%), ureterocolic stricture (7.5%), pouch stones plus stricture urethra in 5.0%, DVT (2.5%), intestinal obstruction (10.0%) and hematemesis in 2.5%. In addition, 12.5% were died. Tumor recurrence was pelvic in 25.0%. Only 7.5% of patients were potent and urine culture revealed E-coli in 35.0%. Diurnal continence was reported in 92.5%, while nocturnal continence was reported in 60%.

**Conclusion:** both sigmoid and ileal orthotopic neobladder provided a satisfactory outcome. Sigmoid neobladder was associated with lower rate of complications and better functional outcome. However, there were many late-term complications detected in this group.

**Keywords:** bladder cancer, urinary diversion, orthotopic neobladder, sigmoid, ileum.

### Introduction

Bladder cancer is a common type of genitourinary cancer. Radical cystectomy with urinary diversion is the most effective local surgical intervention for invasive bladder cancer. However, radical cystectomy is associated with frequent complications (19-64%)<sup>(1)</sup>.

After radical cystectomy (RC), the orthotopic neobladder (ON) is the chosen technique of urinary diversion<sup>(2)</sup>.

Various intestinal segments and techniques have been explored and used for

ON reconstruction. Ileum and sigmoid, the most common substitutes for an ON, and ileal neobladder (IN) and sigmoid neobladder (SN) were seen to be suitable alternatives to ON with IN providing better continence and sigmoid neobladder confer better voiding. However, these neobladders are often created by the detubularization technique, occasionally with complex reconfiguration, and they are time-consuming<sup>(3)</sup>. However, urinary diversion had many complications (e.g., metabolic acidosis, electrolyte imbalance, bacterial growth,

infection, urolithiasis and renal dysfunction)<sup>(4)</sup>.

As regards quality of life (QoL), including urinary, sexual and social function, daily activities and body image satisfaction, orthotopic continent, diversions are considered the 'gold standard' among reconstructive procedures<sup>(5)</sup>. However, there was no consensus on

### Patients and methods

This study included two patient's setups, one is prospective and the other is retrospective evaluation. The study comprises two group of patients 40 patients in each group. **Group I:** was again divided in two twenty prospective and another retrospective operated in Urology and Nephrology centre (UNC) and Al-Azhar University hospital (Damietta). **Group II:** Included also two sets of patients each of them had twenty patients in both equally divided twenty patients in each. The patients in this group were operated in Al-Azhar University hospital (Cairo). The Study period was from January 2015 to January 2016.

Inclusion criteria included the following: Informed consent for participation in the study (for the prospective groups); patients were less than 70 years; no female patients were included; good general condition and health status including renal, cardiac and hepatic profile.

Group I patients underwent ileal neobladder following Hautmann technique as described by **Hautmann**<sup>(6)</sup>. After surgical intervention, the transurethral catheter needs to be washed with 60 mL of saline every 6 h. The ureteric catheters were removed 13 and 14 days after surgery, following confirmation that the ileo-ureteric anastomoses were watertight. A quinolone antibiotic is used as prophylaxis for 2 weeks. The patient is taught to void while seated and to slowly extend the neobladder volume to 500 mL, which usually assures continence.

Group II: perceived sigmoid orthotopic neobladder as described by **Reddy et al.**<sup>(7)</sup>. For those who were assigned for sigmoid neobladder, adequate anatomical configuration of sigmoid and descending colon obtained via water soluble contrast enema and or colonoscopy if needed.

In this study, the main concern is follow up and evaluation of patients after being discharged from the hospital. The follow up program was scheduled to see the patient in

the ideal procedure.

### Aim of the work

It is to evaluate functional and oncological outcome of ileal and sigmoid orthotopic urinary diversion.

outpatient service at 3, 6 months and at one year. In each visit, the patient underwent detailed physical examination including the history of voiding pattern, issue of continence, clinical evidence of metabolic acidosis and bowel habits. Laboratory investigations were carried out in each visit including blood picture, serum electrolytes, acid-base profile, renal and hepatic function tests. Radiological evaluation including abdomino-pelvic ultrasonography screening in each visit with careful attention of the hydronephrosis and the presence of significant post-voiding residual urine, computed tomography (CT) scan with contrast for the evidence of oncological failure or tumor recurrence and evaluation of the integrity of the upper tract in addition to screening of the other intra-abdominal abnormalities. Renography was required in cases of suspected obstructed renal unit.

In concern of suspicious of skeletal bony complaints not responding to simple non-steroidal anti-inflammatory drugs, bone scan was required in such conditions. It is worthily to identify the definition of continence in patients with orthotopic neobladder as complete dryness during daytime and using maximum one protective pad during night time without use of any medications. **The study was approved by the Ethics Board of Al-Azhar University.**

**Statistical analysis of data:** The collected data analysed by statistical package for social science (SPSS) version 16 (SPSS Inc., USA). Arithmetic mean and standard deviation were calculated for quantitative data while frequency and distribution were calculated for qualitative data.

### Results

#### I- Results of ileal orthotopic diversion

In ileal orthotopic diversion groups, patient age ranged from 38 to 69 years; the mean age was  $62.22 \pm 7.45$ . Associated medical diseases was reported in 20% of all studied populations: chronic liver disease in 2.5%, heart disease in 2.5%, diabetes mellitus in 10% and

hypertension in 5.0%. The most common pathological tumor stage was T3b (70.0%) and the most common histological type of tumor was TCC (72.5%). The majority of tumors were of high grade (77.5%) and lymph node involvement was reported in minority of patients (10.0%).

As regard to perioperative data in ileal orthotopic diversion, blood transfusion was reported in 72.5% of all studied patients, and units of transfused blood ranged from 1 to 2, with a mean of  $1.13 \pm 0.35$ . The duration of hospital stays ranged from 8 to 36 days with a mean of  $16.72 \pm 6.02$  days. Early postoperative complications were in the form of bleeding in 2.5%, urine leakage in 2.5% and wound infection in 25%. The ClavianDindo grade was 0 in 15%, 1 in 7.5%, 2 in 5% and 3a in 2.5% (table 1).

In the ileal orthotopic diversion group, diurnal continence was achieved in 90% of patients at 6 months, while nocturnal continence was achieved in 70% of studied patients.

Results of EORTC QLQ-C30 revealed that, the global score ranged from 3 to 7; the mean value was  $5.08 \pm 1.16$ . The mean physical function score was  $1.59 \pm 0.53$  (range 1-3), the mean role function score was  $1.79 \pm 0.69$  (range 1-4); the mean emotional function was  $1.09 \pm 0.27$  (range 1-2), cognitive function score was  $1.13 \pm 0.27$  (range 1-2), the mean social function was  $1.61 \pm 0.57$  (range 1-3). These data indicated that of function scales, the physical function, cognitive and social functions were the mainly affected scales. In addition, the most common high symptoms score was appetite

loss, nausea and vomiting and pain.

As regard to complications among ileal orthotopic diversion group, the early postoperative urologic complications were in the form of urine leakage in 2.5% and obstruction in 2.5%. The early non-urologic complications were in the form of ileus in 12.5% and no bleeding, DVT or faecal leak. Uretero-ileal obstruction was bilateral in 2.5%. The late urologic complications were in the form of stricture urethra in 5.0%, uretero-ileal stricture in 5% and pouch stones plus stricture urethra in 2.5%. The Orthotopic complications were in the form of stricture urethra in 5.0%. Finally, the late non-urologic complications were in the form of DVT in 2.5% and intestinal obstruction in 5.0% (table 2).

As regard to follow up data among ileal orthotopic diversion group, 2.5% were died from disease, while 90.0% were living and free and 7.5% living with disease. Tumor recurrence was pelvic in 7.5%, distant (hepatic) in 2.5%. Postoperative creatinine was above 2 in 2.5% and postoperative clinical acidosis was reported in 7.5%. Only 25% of patients were potent and urine culture revealed E-coli in 40.0%, Klebsiella in 2.5% and proteus in 5.0%. finally, diarrhoea was reported in 10.0%.

As regard to postoperative urodynamic study among ileal orthotopic diversion group, the  $Q_{max}$  ranged from 7.90 to 29.10, with a mean value of  $16.91 \pm 4.99$ . Pouch pressure waves were frequent (high) in 2.5%, frequent (low) in 30.0% and occasional in 30.0%. Residual urine was < 100 in 60%, and > 100 in 2.5%. Neo-bladder capacity was around 450cc (table 3).

Table (1): Perioperative data in ileal orthotopic diversion

Variable		Statistics
Blood transfusion	No	11(27.5%)
	Yes	29(72.5%)
	Number of transfused units	$1.13 \pm 0.35$ ; 1- 2
Duration of hospital stay		$16.72 \pm 6.02$ ; 9 - 36
Early PO complications	None	28(70.0%)
	bleeding	1(2.5%)
	Urine leakage	1(2.5%)
	wound infection	10(25.0%)
ClavianDindo grade	None	28(70.0%)
	Grade 0	6(15.0%)
	Grade 1	3(7.5%)
	Grade 2	2(5.0%)
	Grade 3a	1(2.5%)

Table (2): Postoperative complications among ileal orthotopic diversion group

Variable	n	%
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Early postoperative Urologic complications	Leakage	1	2.5%
	Obstruction	1	2.5%
Early postoperative Non-urologic complications	Ileus	5	12.5%
	Bleeding	0	0.0%
	DVT	0	0.0%
	Faecal leak	0	0.0%
Ureterocolic obstruction	Right uretero-ileal obstruction	0	0.0%
	Left uretero-ileal obstruction	0	0.0%
	Bilateral obstruction	1	2.5%
Late urologic Complications	Pouch stones	0	0.0%
	Stricture urethra	2	5.0%
	Uretero-ileal stricture	2	5.0%
	Pouch stones plus stricture urethra	1	2.5%
Orthotopic complications	Stone (small)	0	0.0%
	Stone (large)	0	0.0%
	Stricture urethra	2	5.0%
Late non-urologic complications	DVT	1	2.5%
	Intestinal obstruction	2	5.0%
	Hematemesis	0	0.0%

Table (3): PO urodynamic study among orthotopic sigmoid diversion group

		n	%
Q max		16.91±4.99; 7.90 – 29.10	
Pouch pressure waves	Data not available	15	37.5%
	Frequent (high)	1	2.5%
	Frequent (low)	12	30.0%
	Occasional	12	30.0%
Residual urine	Data not available	15	37.5%
	<100	24	60.0%
	> 100	1	2.5%

## II- Results of sigmoid orthotopic diversion

In the sigmoid orthotopic diversion group, patient age ranged from 28 to 69, the mean age was 52.30±9.40 years. The preoperative condition of the kidney was normal in 82.5% and dilated in 17.5%. tenectomy was done in 77.5% and not done in 22.5%.

In sigmoid orthotopic diversion, the right ureter anastomosis was submucous tunnel in 75%, tenectomy trough in 17.5% and direct nipple in 5%; the right ureter pathology was absent in 55%, it was thick in 17.5% and dilated in 17.5%. On the other hand, left ureterocolic anastomosis was submucous in 45%, tenectomy trough in 37.5% and direct nipple in 17.5%. Furthermore, left ureter pathology was absent in 45%, thick in 25%, and dilated in 22.5% (table 4).

In sigmoid orthotopic diversion group, the most common tumor stage was PT3a (42.5%) followed by PT3b in 37.5%. The most common tumor type was TCC in 52.5%; the tumor grade was low in 50% and high in 50%; and lymph node involvement was reported in 10.0%.

As regard to complications among sigmoid orthotopic diversion group, the early postoperative urologic complications were in the form of urine leakage in 17.5% and obstruction in 2.5%. The early non-urologic complications were in the form of ileus in 7.5%, bleeding in 2.5%, DVT in 2.5% and faecal leak in 2.5%. Ureterocolic obstruction was on the right ureter in 10%, left ureter in 7.5% and bilateral in 2.5%. The late urologic complications were in the form of pouch stones in 10.0%, stricture urethra in 12.5%, ureterocolic stricture in 7.5% and pouch stones plus stricture urethra in 5.0%. The Orthotopic complications were in the form of small stone in 2.5%, large stone in 2.5% and stricture urethra in 2.5%. Finally, the late non-urologic complications were in the form of DVT in 2.5%, intestinal obstruction in 10.0% and hematemesis in 2.5% (table 5).

As regard to follow up data among sigmoid orthotopic diversion group, 12.5% were died, 10% from disease and 2.5% from unknown causes, while 67.5% were living and free and 20% living with disease. Tumor

recurrence was pelvic in 25.0%, distant (hepatic) in 5% and pelvic plus distant in 5.0%. Postoperative creatinine was above 2 in 7.5% and postoperative clinical acidosis was reported in 5%. Only 7.5% of patients were potent and urine culture revealed E-coli in 35.0%, Klebsiella in 2.5% and proteus in 7.5%. finally, constipation was reported in 12.5%.

In sigmoid orthotopic diversion group, the diurnal continence was reported in 92.5%, while nocturnal continence was reported in 60%. The diurnal frequency ranged from 4 to 10 with a mean of  $6.25 \pm 1.72$ ; while nocturnal frequency ranged from 1 to 10, the mean values were  $3.55 \pm 1.78$  (Table 6).

As regard to renal unit condition postoperatively, it was normal in 75%, showed mild dilatation in 2.5% and significant

dilatation in 22.5%.

The postoperative ascending cystogram among orthotopic sigmoid diversion group revealed that, no reflux was reported in 81.25% of renal units, while reflux was reported in 18.75% of renal units; the reflux was grade 1 in 7.5%, grade 2 in 3.75% and grade 3 in 7.5% of renal units.

As regard to postoperative urodynamic study among orthotopic sigmoid diversion group, the Qmax ranged from 5.80 to 28.60, with a mean value of  $14.41 \pm 5.58$ . Pouch pressure waves were absent in 15%, frequent (high) in 7.5%, frequent (low) in 30.0% and occasional in 2.5%. Finally, residual urine was none in 40%, < 100 in 20%, and > 100 in 10%. Neo-bladder capacity was around 520 cc.

Table (4): Implantation of ureter among sigmoid orthotopic diversion group

Variable		n	%
Right ureter Anastomosis	Inapplicable	1	2.5%
	Submucous tunnel	30	75.0%
	Tenectomy trough	7	17.5%
	Direct nipple	2	5.0%
Right ureter Pathology	None	22	55.0%
	Thick	7	17.50%
	Dilated	7	17.50%
Left ureterocolic Anastomosis	Submucous	18	45.0%
	Tenectomy trough	15	37.5%
	Direct-nipple	7	17.5%
Left ureter pathology	None	18	45.0%
	Thick	10	25.0%
	Dilated	9	22.5%

Table (5): Postoperative complications among sigmoid orthotopic diversion group

Variable		n	%
Early postoperative Urologic complications	Leakage	7	17.5
	Obstruction	1	2.5
Early postoperative Non-urologic complications	Ileus	3	7.5
	Bleeding	1	2.5
	DVT	1	2.5
	Faecal leak	1	2.5
Ureterocolic obstruction	Right ureterocolic obstruction	4	10.0
	Left ureterocolic obstruction	3	7.5
	Bilateral obstruction	1	2.5
Late urologic Complications	Pouch stones	4	10.0
	Stricture urethra	5	12.5
	Ureterocolic stricture	3	7.5
	Pouch stones plus stricture urethra	2	5.0
Orthotopic complications	Stone (small)	1	2.5
	Stone (large)	1	2.5
	Stricture urethra	1	2.5
Late non-urologic complications	DVT	1	2.5
	Intestinal obstruction	4	10.0
	Hematemesis	1	2.5

Table (6): Continence and frequency among orthotopic sigmoid diversion group

		n	%
Diurnal	Continent	37	92.5%
	Stress incontinence	3	7.5%
Nocturnal	Continent	24	60.0%
	Incontinent	14	35.0%
	hypercontinence	2	5.0%
Diurnal frequency		6.25±1.72; 4-10	
Nocturnal frequency		3.55±1.78; 1 – 10	

## Discussion

The functional results after the orthotopic neobladder reforming, such as voiding pattern and continence status, have been extensively studied<sup>(8)</sup>. However, there is still controversy regarding which type of neobladder offers the most favourable outcome and patient's satisfaction. Therefore, the present study was designed to evaluate functional and oncological outcome of ileal and sigmoid orthotopic urinary diversion.

In ileal orthotopic diversion, blood transfusion was reported in 72.5% of all studied patients, and units of transfused blood ranged from 1 to 2, with a mean of 1.13±0.35. The duration of hospital stays ranged from 8 to 36 days with a mean of 16.72±6.02 days. Early postoperative complications were in the form of bleeding in 2.5%, urine leakage in 2.5% and wound infection in 25%. The Clavien-Dindo grade was 0 in 15%, 1 in 7.5%, 2 in 5% and 3a in 2.5%. These results are comparable to **Yadav et al.**<sup>(9)</sup> who reported that, early complications were seen in 12 patients out of 42 patients (28.6%), whereas late complications were observed in 5 patients (12%). Among early complications, grades 1 (2.4%), 2 (4.8%), and 3 (7.1%) complications were observed in 8 (19%), 3 (7.1%), and 1 (2.4%) patient, respectively. No grade 4 or 5 complications were reported. The most common complications related to the surgical wound. Fever needs the change of antibiotics reported in 2 patients (4.8%) without any proof of pyelonephritis. One patient required diverting ileostomy for ileal anastomotic leakage.

In the present work, in the ileal orthotopic diversion group, diurnal continence was achieved in 90% of patients at 6 months, while nocturnal continence was achieved in 70% of studied patients. Continence after ileal orthotopic diversion depends on multiple factors, the most important is an intact striated sphincter and formation of a low-pressure

compliant urinary reservoir<sup>(10)</sup>. Daytime continence rates are around 80%-100%, but nighttime continence have a tendency to be much lower, with reports ranging from 45% to 90%<sup>(11)</sup>. However, this disparity may be due to inconsistencies (difference between lower and higher reported percentages) and variations in definition of continence<sup>(12)</sup>.

Also, the duration at the time of assessment is vital as continence rates do improve with time<sup>(13)</sup>. **Aleksic et al.**<sup>(14)</sup> reported satisfactory continence rates of 71% at 3 months and 81.6% at 12 months. In addition, **Yadav et al.**<sup>(9)</sup> found that in postoperative period, most patients had some grade of incontinence, which progressively improved with time as the pouch matured.

Nighttime continence has been relatively difficult to achieve, probably due to loss of local spinal reflex arc, decreased rhabdosphincter tone, and nocturnal diuresis<sup>(15)</sup>. **El Bahnasawy et al.**<sup>(12)</sup> found that PVR, frequency and maximum amplitude of uninhibited contractions significantly affected nocturnal continence.

In the present work, postoperative wound infection was reported in 25.0% of ileal group, and this complication was confined to this group. The possible causes of increased such complication included the following: the patient is usually older in age. Moreover, this surgery often involves major blood loss, so autologous blood often needs to be stored preoperatively for transfusion to avoid homologous blood transfusion, especially for immune-compromised patients at specific risk of the existence of post-operative infections, because severe anemia could lead to severe infectious adverse events post-operatively<sup>(16)</sup>. In addition, surgical time for radical cystectomy with orthotopic neobladder urinary diversion by means of the bowel is longer than other urological surgeries<sup>(17)</sup> and the cases often

involve older patients with various risk factors or complications with the potential to cause post-operative infections<sup>(16)</sup>.

In ileal group, results of quality of life scales reported acceptable levels on different functional pivots. In addition, the most common high symptoms score was appetite loss, nausea and vomiting and pain. These results agree with **Gakis and Stenzl**<sup>(18)</sup> who reported that, the orthotopic neobladder substitution (OBS) is the chosen diversion after RC and better than all other forms of diversion in terms of better QoL. In addition, **Arata et al.**<sup>(19)</sup> reported that European Organization for Research and Treatment (EORTC) QLQ-C30 functional evaluation showed no significant differences in any items between ileal and sigmoid subgroups; and in contradiction to results of the present work, they reported that diarrhoea was recognized as being worse in the ileal group. However, our results agree with **Kramer et al.**<sup>(20)</sup> who reported that 46% of patient's experience changes in bowel habit after radical cystectomy but only 26% of patients reported experiencing related dissatisfaction. Primary cause of dissatisfaction was diarrhea and stool loss.

In addition, an interesting study done by **Honeck et al.**<sup>(21)</sup> reported that, regarding defecation frequency, significant differences could be observed between the two groups. Patients with a sigmoid neobladder had a mean defecation frequency of 1.1/day, whereas patients with ileal neobladder had a frequency of 3.1/day. They added, the reduced defecation frequency is one of the main advantages of a sigmoid neobladder

In sigmoid group, the mortality rate in the present work was 12.5% (5 patients) (10% died from the disease and 2.5% died from other unknown aetiology). This percentage is higher than those reported in previous work by **Quek et al.**<sup>(22)</sup> who reported overall mortality rate to be 2.0%. The high mortality rate in the present work can be attributed to older age and advanced disease and high recurrence rate in such patients. Also, **Miyake et al.**<sup>(23)</sup> reported that, two men (2.4%) died perioperatively from pulmonary emboli or liver dysfunction in their patients who underwent sigmoid orthotopic neobladder after radical cystectomy for bladder cancer. Furthermore, different studies reported rates were 1–3%<sup>(24)</sup>.

As regard to complications among sigmoid orthotopic diversion group, the early postoperative urologic complications were in the form of urine leakage in 17.5% and obstruction in 2.5%. The early non-urologic complications were in the form of ileus in 7.5%, bleeding in 2.5%, DVT in 2.5% and faecal leak in 2.5%. Ureterocolic obstruction was on the right ureter in 10%, left ureter in 7.5% and bilateral in 2.5%. The late urologic complications were in the form of pouch stones in 10.0%, stricture urethra in 12.5%, ureterocolic stricture in 7.5% and pouch stones plus stricture urethra in 5.0%. The Orthotopic complication were in the form of small stone in 2.5%, large stone in 2.5% and stricture urethra in 2.5%. Finally, the late non-urologic complications were in the form of DVT in 2.5%, intestinal obstruction in 10.0% and hematemesis in 2.5%. **Miyake et al.**<sup>(23)</sup> reported that, there were 45 early complications in 28 patients (35%). The first, second and third most common were wound infection, ileus and pyelonephritis, respectively. Only one need reoperation, due to deep venous thrombus. Late complications were reported in 19%. Neobladder stone, uretero-intestinal stricture and entero-urethral stricture were the most common. Surgical intervention was done for 16 of the 19 late complications.

The results of the present work revealed that, patients in ileal group were significantly older in age, had significant high stage of tumor, but significant lower rate of lymph node involvement. The overall early complications were significantly lower in sigmoid (17.5%) versus ileal group (35%). However, wound infection is restricted to the ileal group. Night continence was higher in sigmoid group. **Guan et al.**<sup>(25)</sup> reported that, the neobladder-related complications were common in both types of orthotopic neobladder renovation. Common early complications included infection, urinary leakage and ileus.

In addition, other reports found that, early complications were higher in sigmoid than in ileal group. In addition, the common late complications included uretero-enteric and vesico-urethral strictures, incisional hernias, neobladder calculi and intestinal obstruction<sup>(8)</sup>.

The possible explanation for reversal of incidence of complications in this study than reported in literature<sup>(26)</sup> can be attributed that, the sigmoid approach was adopted by Al-Azhar

University since 1992<sup>(26)</sup>; and the work nearly confined to this approach. Thus, the rate of complications decreased by time. However, the ileal approach was introduced more recently and practiced line by line to other approaches to Al-Mansoura Oncology Center<sup>(27)</sup>. The recent instruction of the approach may be responsible to high rate of complications. However, the rate of complications reported after ileal neobladder approach in the present work is less than reported incidence in literature<sup>(27)</sup>, which reflecting the competency and good results in Mansoura Oncology Center.

Furthermore, **Tao et al.**<sup>(28)</sup> in their meta-analysis reported that, the overall incidence of late complications was similar between the two groups. **Steven and Poulsen**<sup>(29)</sup> reported that, these complications were common in neobladder reconstructions. However, most could be managed conservatively. The incidence could be reduced with the development of procedures and the improvement of surgical techniques.

Among some serious complications related to orthotopic neobladder, voiding dysfunction was an important factor unfavorably affecting the patient's satisfaction. Most previous reports reinforced that sigmoid neobladder provide a better satisfactory voiding function than ileal neobladder<sup>(23)</sup>.

In the present study, voiding function was assessed after sigmoid orthotopic neobladder reconstruction and revealed that the residual urine was none in 40%, < 100 in 20%, and > 100 in 10%. Neo-bladder capacity was around 520 cc, which reflect the good voiding function. It was reported in literature that, sigmoid neobladder could assist more subjects in spontaneous voiding than ileal one. It might be explained by several reasons linked to physiologic properties of the sigmoid. The functions of sigmoid segment could be profusely supplied by nerves of the sacral parasympathetic plexus originating from the S2 to S4 of the spinal cord<sup>(30)</sup>. For the over-extension of thin ileal wall, the weak contraction of new ileal bladder amplified the risk of voiding dysfunction, and the incidence increased with time. In addition, factors due to different voiding state should be evaluated, for example, the experience of surgeons involved in each type of NB creation<sup>(31)</sup>.

Continence status is another significant factor affecting the patient's quality of life.

According to the results of **Tao et al.**<sup>(28)</sup> meta-analysis, the incidences of daytime continence in patients with sigmoid and ileal neobladders were 66.7-90% and 74.1-97%, respectively. The nighttime continence rates ranged from 23.8% to 65.2% and from 57.1% to 90%, respectively. This meta-analysis revealed that patients could achieve better continence status in ileal neobladder group than in sigmoid neobladder group (also this is in contradiction to results of the present work), particularly during the night-time<sup>(32)</sup>.

Most surgeons improved the continence by forming a compliant urinary reservoir from a detubularized intestinal segment and preserving as much of the distal urethral sphincter as possible. The purpose of detubularization is to create a reservoir with high capacity and low pressure. Surgical preparation of sphincter-active membranous urethra has a great influence on continence status, particularly during daytime<sup>(28)</sup>.

Furthermore, **Honeck et al.**<sup>(21)</sup> conducted a study to compare between ileal and sigmoid orthotopic diversion and concluded that, orthotopic bladder substitution with sigmoid segments has shown equivalent results regarding micturition parameters, continence rates and quality of life compared to orthotopic ileal bladder substitution. One advantage seems to be the reduced defecation frequency in patients with sigmoid neobladder compared to the ileal neobladder. The sigmoid neobladder meets the functional day and night requirements for a bladder substitution and is a useful alternative to the ileal neobladder.

The present work revealed that, on the short-term, sigmoid orthotopic diversion was associated with a better outcome than ileal group. However, on the long-term, results of the sigmoid group showed a high rate of complications. These results agree with **Miyake and Fujisawa**<sup>(33)</sup> who reported that, there are some advantages in selecting sigmoid neobladder such as the low incidence of urinary tract infection in its use (as found in the present work). It also has little effect on metabolic and nutritional status and preserves the renal function. In addition, sigmoid neobladder is likely to acquire an adequate voiding status by emptying the reservoir. Furthermore, a small post-void residual urine, which has been shown to influence continence with a neobladder, may also have contributed to the favorable



continence status in sigmoid neobladder<sup>(23,30)</sup>.

Collectively, these findings suggest that the reconstruction of orthotopic sigmoid neobladder could facilitate at least equivalent or even better clinical outcomes than that of ileal neobladder, particularly in women, considering their favorable postoperative voiding status<sup>(33)</sup>.

### Conclusion

Both sigmoid and ileal orthotopic neobladder provided a satisfactory outcome. On short-term follow up the sigmoid neobladder

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