Objectives: To revaluate ileocolonic pouch for orthotopic neobladder reconstruction, a cohort of patients with bladder cancer was selected to undergo radical cystectomy and modified Le Bag pouch. Evaluation concentrates on continence and associated morbidity observed on close follow-up.

Patients and Methods: A total of 37 patients including 16 females with T2-3 bladder cancer (19 transitional, 15 squamous and 3 adenocarcinoma) were treated by radical cystectomy and totally detubularized ileocolic neobladder. Post operative morbidity, continence and urodynamic studies were evaluated. Mean time to have full daytime continence was tested against age, gender, postoperative complications, technique of pouch creation either stapler or hand suture and adjuvant irradiation.

Results: Cystometry 12 months post surgery showed 493 ml median capacity with basal and maximum reservoir median pressures of 16 and 38 cmH2O respectively. Uroflowmetry had maximum voiding volume of 370ml, voiding time 45s and maximum flow rate of 11.6ml/s. Within the first 2 months post operative 44% were continent by day, 33% by night and 67% had stress incontinence. By 12 months post surgery 89% were continent by day, 73% by night and 27% had stress incontinence. Two years post surgery 94% were continent by day and 81% had complete day and night control of urine. Urinary leakage was the most frequent early complication (10.8%). Late complications were urinary tract infection (13.5%), metabolic acidosis (13.5%) and reflux (10.8%). Pouch over distension (5.4%) was consistent with bladder neck obstruction. Patient’s gender and postoperative morbidity were statistically significant factors to increase the mean time to continence; whereas, age, use of stapler and adjuvant radiotherapy had no significant effect.

Conclusion: Modified Le Bag pouch is a simple technique with adequate pouch capacity that offers excellent slowly progressing continence rates with minor morbidity rate. Post operative morbidity and female sex delayed continence satisfaction.

Key Words: Continent urinary diversion – Orthotopic neobladder – Ileo colonic pouch – Modified Le Bag pouch.

INTRODUCTION

Regardless of the type of urinary diversion, the procedure should not compromise cancer control, and should have an acceptable complication and reoperation rates. In addition, the reservoir should provide adequate urine storage at low pressure (compliance) to protect the upper urinary tracts, has a sufficient degree of continence day and night and approximate normal voiding as closely as possible [1,2].

The concept of detubularization has encouraged a plethora of studies on bladder replacement using almost every portion of the intestine. Each technique has its advantages and drawbacks; however, ileal pouches had become the most common technique of orthotopic diversion [3,4].

Ileocolic segment is particularly well suited for orthotopic diversion because of its consistent ileocolic vessels and the easy descent into the pelvis. High-pressure contractions of the colon must be overcome by complete detubularization or the creation of a teniomyotomy within the bowel wall [5-7]. Several authors have described the use of combined terminal ileum and cecum in the construction of a continent neobladder by using the principles of both detubularization and antireflux surgery. Light and Engelmann [8] reported their experience with ileocolonic pouch which they termed “Le Bag”. This technique incorporated either a continent stoma to...
the skin or an orthotopic urethral anastomosis via a tail of ileum. The ureters were implanted into the colonic portion of the pouch in the standard way of uretero-neocystotomy as described by Goodwin [9]. This orthotopic Le Bag pouch had several modifications aiming at improving continence and preserving upper urinary integrity [5,10,11].

This study adopted the modification of complete detubularization of both ileum and cecum to form a semispherical pouch [5] and this modified Le Bag pouch was assessed regards post operative complications and continence.

MATERIAL AND METHODS

Starting with November 2000 through September 2008, a sequential series of 37 patients including 21 males and 16 females with invasive T2-3 bladder cancer were selected to undergo radical cystectomy together with lower urinary tract reconstruction using orthotopic completely detubularized ileocolic pouch. Patients had a median age of 51 years (30-62) and their histologic pictures were transitional (n=19), squamous (n=15) and adenocarcinoma (n=3).

Study design and ethical points were approved by the National Cancer Institute, Cairo University, Egypt as an institutional review board.

Cases were selected according to specific criteria:
1- Invasive T2-3 tumor with no in situ element and 2cm at least from the bladder neck on cystoscopy.
2- No history of urinary incontinence, diabetes or urethral stricture.
3- Serum creatinine less than 150umol/l.
4- No known disease of the intestine.
5- Documented informed consent.

Preoperative preparation:

Cystoscopy was helpful to assess tumor location and histological diagnosis. Patients were hospitalized preoperatively for mechanical bowel preparation and correction of any fluid and electrolyte imbalance. Locoregional and metastatic tumor assessment were performed to all cases using abdominopelvic CT and lungs X-ray together with intravenous urography in some cases to delineate upper urinary tract anatomy and function. Base line renal function, blood gases and electrolyte were performed for all cases.

Surgical technique:

Cystectomy and pelvic lymph node dissection were performed in the standard fashion via a transabdominal midline incision. Apical dissection, with preservation of urethral length and striated urethral sphincter, was performed identical to that described for radical retropubic prostatectomy [12,13]. For 16 females anterior pelvic excentration was performed including uterus, tubes and ovaries if patient was postmenopausal otherwise ovaries were preserved and fixed above the true pelvis.

Mobilization of the right colon till the hepatic flexure was the following step and segments of 10-15cm of equal length were isolated of both the ileum and the cecum and ascending colon Bowel continuity was restored with ileocolonic anastomosis. Isolated bowel was prepared by irrigation with saline and povidone iodine and removal of the appendix and other adhesions.

The antimesenteric borders of both the ileum and cecum were approximated with running absorbable sutures, followed by complete incision of these borders 5mm away from the sutures. The free edges were sutured to form the second posterior layer.

Distal end of the opened pouch was then sutured to the urethra first, to avoid tension on the ureteric-pouch anastomoses, using 4-6 interrupted 3/0 vicryl over 22F Foley silicon triple lumen catheter.

Ureters were implanted using the submucosal tunneling of Goodwin technique [9] with 4/0 interrupted vicryl sutures over ureteric stents brought through the abdominal wall. Pouch anterior wall was then closed in two layers allowing the ureteric stents to come through.

In 14 cases detubularization was performed using stapler in 2-3 sequential steps till the ileocecal valve was opened (Fig. 1). The anterior and posterior longitudinal cuts were undermined by inverting continuous mucosal sutures using 4/0 vicryl to avoid stone formation.

A pedicled omental flap raised on a single gastroepiploic artery was fashioned and brought down to fill the pelvic cavity. This flap serves
as an interposition material between the rectum or vaginal stump and neobladder, preventing a pouch-vaginal fistula. Furthermore, it provides back support to the neobladder. At the end of the operation the pouch was suspended near its dome to the back of the rectus muscle.

**Post operative care and follow-up:**

Immediately after surgery, the pouch was rinsed every 2 hours with saline through the 3-way indwelling catheter. On the 12th day, the ureteric stents were removed. On the 14th to the 21st day, after exclusion of leaks by cystography, the indwelling catheter was removed and patients initiated spontaneous voiding via the Valsalva’s maneuver in a sitting position every 2 hours. Patients were encouraged to avoid going longer than 4 hours between voidings and to set an alarm to awaken once during the night to urinate.

Arterial blood gases were investigated routinely every 4-7 days and on suspecting acidosis. Base defects more than –2.5mEq/L was considered a sign for impending acidosis and oral alkalinizers were prescribed.

Patients were seen at 3-months intervals for 2 years and 6-months intervals thereafter. Follow-up consisted of abdominal US to assess residual urine volume and renal back pressure, chest X-ray, excretory urography, CT abdominopelvic and relevant serum investigations. (Fig. 2).

Cystoscopy was performed to determine causes of difficult voiding or for unsatisfactory continence. Intermittent self catheterization was advised for cases with residual volume more than 150ml as determined by post-voiding ultrasound and if the patient experienced difficulty with spontaneous evacuation of mucous.

Post operative data were analyzed according to complications (early & late) and continence (diurnal & nocturnal).

The functional voiding patterns were obtained from detailed patient interviews and questionnaire. Continence was defined as completely dry with or without occasional or sporadic episodes of leakage but no need for protection. If more than a single pad was required the patient was considered incontinent.

Urodynamic studies (UDS) were done 6 and 12 months after surgery to allow the pouch to have its capacity and pass the period of adjuvant treatment. UDS included 3 main categories: (1) Uroflowmetry: The voided volume, maximal flow rate, and the voiding time. (2) Water cystometry: Including the intra pouch capacity, the resting and maximal intrareservoir pressure and the residual volume. (3) Pressure flow studies and urethral pressure profilometry.

Data was analyzed using SPSSwin statistical package version 12. Numerical data were expressed as mean ± standard deviation (SD), median, minimum and maximum. Qualitative data were expressed as frequency and percentage. Chi-square test or Fisher’s exact test was used to examine the relation between qualitative variables and regression analysis for quantitative factors. Survival analysis was done using Kaplan-Meier method. Multivariate analysis was done using Cox-regression method for the significant factors affecting mean time to complete day continence. p-value ≤0.05 was considered significant.

**RESULTS**

Median operative time for radical cystectomy and diversion was 185 minute (147-380), whereas, cases with stapler had an average 35 minutes (15-60) less time. Mean estimated blood loss was 550±460ml and the average blood transfusion was 2 units (0-3). The median post operative hospital stay was 15 days (10-32) and patients without complications had on average 12 days.

Pathological examination revealed 12 PT2 specimens and 25 PT3 bladder tumors with perivesical fat invasion in 7 specimens. Prostate and distal bladder neck margin were free (R0) for all specimens. There were 5 specimens with obturator nodal metastases.

**Morbidity:**

Adjuvant irradiation was given to 27 patients due to deep muscle invasion (pT3) and nodal metastases.

**RESULTS**

Median operative time for radical cystectomy and diversion was 185 minute (147-380), whereas, cases with stapler had an average 35 minutes (15-60) less time. Mean estimated blood loss was 550±460ml and the average blood transfusion was 2 units (0-3). The median post operative hospital stay was 15 days (10-32) and patients without complications had on average 12 days.

Pathological examination revealed 12 PT2 specimens and 25 PT3 bladder tumors with perivesical fat invasion in 7 specimens. Prostate and distal bladder neck margin were free (R0) for all specimens. There were 5 specimens with obturator nodal metastases.
Modified Le Bag Pouch after Radical Cystectomy

patients to allow healing monitored by decreasing drain amounts in average of 5 days (1-13). Three cases including one stapler pouch had the leaking point at the pouch urethral anastomosis and the 4th had leak at the pouch sutures. These patients had other complications (ileus and wound sepsis) and conservative treatment was curative for all.

Temporary minor degree of metabolic acidosis was noticed in 10 patients (27%) evidenced by differences between median preoperative and postoperative bicarbonate level (28 versus 26mEq/L respectively). Excess base deficit more than -2.5mEq/L (minor metabolic acidosis) associated with CL more than 110mEq/L was seen in 4 cases 3-7 months post surgery. Oral therapy could maintain normal serum bicarbonate level. One patient presented 60 days post surgery with pyelonephritis, dehydration and pH changes. She was hospitalized for 5 days as severe metabolic acidosis and treatment included catheter reinsertion to ensure good drainage, rehydration with intravenous saline, antibiotics and correction of acidosis with sodium bicarbonate.

Repeated urinary retention and bladder overdistension was found in 2 males 8 and 19 months post surgery with residual urine of 260 and 350 ml. They had catheterization and cystoscopy which revealed bladder neck obstruction. Cystoscopic stricture incision was enough. No pouchcele was found during the period of follow-up for all patients.

Mean preoperative and post operative serum creatinine levels did not differ significantly; 90±35 versus 130±50μmol/l (p=0.34) and the renal units had radiological changes in 2 patients who developed new hydronephrosis 4 and 6 months post surgery (Figs. 3, 4). Patients had temporary percutaneous nephrostomy of that unit and antegrade dilatation was successful in one case who had stable unilateral hydronephrosis. Other patient underwent surgical repair; where, the ureter had stricture 5cm above the anastomosis. This was the only patient to have pouch related complication and reoperation (2.7%).

Bacteriuria was seen in all cases in the first postoperative 6 months but symptomatic urinary tract infection as evidenced by fever and flank pain occurred in 5 patients (13.5%). Four cases had reflux and one patient had ureteric stricture. They responded to antibiotics, alkalinization of urine and catheterization.

Ascending urography post operatively did not reveal reflux in any case. Seven refluxing units were seen in 4 patients after average of 14 months (8-34). Antibiotics, alkalinizers and intermittent catheters were advised and only two units in two patients (left side) suffered further renal hydrenephrosis.

Nineteen patients had pouch cystoscopy at variable time post surgery (5-48 months). There was no pouch stone formation or suture line encrustation in any case. Random mucosal biopsy did not reveal dysplastic or metaplastic changes and the mucosal lining of the colon kept its columnar epithelium (Fig. 5).

Second hospital admission was indicated for 8 patients for an average of 12 days (2-33) including second surgery to repair ureteric stricture.

Oncologic results:

Median follow-up was 58 months (16-83) and 4 patients were lost after 18, 23, 26 and 27 months respectively. Out of 23 patients with follow-up more than 60 months, 18 were free of recurrence with 78.2% 5-year disease free survival. Seven mortalities were observed following tumor recurrence (18.9%). Recurrence time had a median of 18 months (11-32) and was mainly local in the lateral pelvic wall with no central or urethral recurrence and 4 cases had associated lung metastases.

Functional results:

UDS data were available 6-months for 32 patients including 14 females at and after 12 months for 31 patients including 14 females; whereas, other patients declined the test because of variable reasons (Table 2). Median reservoir capacity significantly increased 424ml to 493ml 6 to 12 months post surgery and the residual volume decreased (53.4, 40ml 6 and 12 months) (Fig. 6).

All tested patients voided by abdominal straining. Abdominal leak point pressures were measured after 6 months post operatively and 10 females had leakage at 80cm water. The remaining (22 patients) had no leak despite intra-abdominal pressure of 200cm water.
Fig. (1): Detubularization of the ileocolonic segment using stapler in two steps including the ileocecal valve.

Fig. (2): Pelvic CT one year after Le Bag neobladder with pouch distension and smooth wall lining.

Fig. (3): IVU of a female patient one year after resection and reconstruction showing preserved upper urinary tract function, normal ureters, good pouch capacity and a semispherical smooth outline.

Fig. (4): Oblique view of IVU with normal right upper unit and left ureteric stricture above uretero intestinal anastomosis with hydronephrotic upper unit. There smooth pouch outline indicating loss of colon haustrations, good capacity and urine continence.

Fig. (5): Low power microscopic picture of mucosal lining of the modified Le Bag pouch 48-months post surgery with no metaplastic or dysplastic changes and persistence of the normal colon epithelial lining. There is associated inflammatory cell infiltration.

Fig. (6): Urodynamic study of a 39 years male patient 6-months post operative. There were delayed sensation, 481ml pouch capacity and no contraction during filling phase or during voiding. Patient voided by abdominal contraction with 6.7ml/s max flow rate, 3.2ml/s average rate and there was 210ml post voiding residual urine.
Modified Le Bag Pouch after Radical Cystectomy

Table (1): Postoperative complications observed in 37 patients post Le Bag neobladder.

<table>
<thead>
<tr>
<th>Complication</th>
<th>N (%)</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early complications (40 days):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound infection</td>
<td>3 (8.1%)</td>
<td>Conservative</td>
</tr>
<tr>
<td>Urinary leakage</td>
<td>4 (10.8%)</td>
<td>Conservative</td>
</tr>
<tr>
<td>Prolonged ileus</td>
<td>3 (8.1%)</td>
<td>Conservative</td>
</tr>
<tr>
<td><strong>Total No.</strong>:</td>
<td>4 (10.8%)</td>
<td></td>
</tr>
<tr>
<td><strong>Late complications:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ureteric stricture</td>
<td>2 (5.4%)</td>
<td>Percutaneous dilatation and reoperation</td>
</tr>
<tr>
<td>Urinary retention with pouch overdistension</td>
<td>2 (5.4%)</td>
<td>Cystoscopy and catheterization</td>
</tr>
<tr>
<td>Hyperchloremic metabolic acidosis</td>
<td>5 (13.5%)</td>
<td>Conservative</td>
</tr>
<tr>
<td>• Mild &amp; temporary</td>
<td>4</td>
<td>Conservative</td>
</tr>
<tr>
<td>• Sever</td>
<td>1</td>
<td>Conservative and catheterization</td>
</tr>
<tr>
<td>Reflux</td>
<td>4 (10.8%)</td>
<td>Conservative and catheterization</td>
</tr>
<tr>
<td>Upper urinary tract infection</td>
<td>5 (13.5%)</td>
<td>Conservative and catheterization</td>
</tr>
<tr>
<td><strong>Total No.</strong>:</td>
<td>9 (24.3%)</td>
<td></td>
</tr>
</tbody>
</table>

* = More than one complications in patient.

Table (2): Le Bag neobladder urodynamic changes post surgery in 32 patients and 31 patients 6-and 12-months respectively.

<table>
<thead>
<tr>
<th>Urodynamic test</th>
<th>6-months (N = 32)</th>
<th>Median (Range)</th>
<th>12-months (N = 31)</th>
<th>Median (Range)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cystometry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir capacity (ml)</td>
<td>424 (367-587)</td>
<td>493 (362-600)</td>
<td>.043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual urine (ml)</td>
<td>53.4 (15-285)</td>
<td>40 (0-347)</td>
<td>.092</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir basal pressure (cm H₂O)</td>
<td>18 (9.1-23.5)</td>
<td>16 (9.24-3)</td>
<td>.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir maximal pressure (cm H₂O)</td>
<td>39 (28-45)</td>
<td>38 (19-48)</td>
<td>.711</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance ml/cm H₂O</td>
<td>20.2 (19.4-27.3)</td>
<td>22.4 (16.9-38.4)</td>
<td>.512</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Uroflowmetry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. voiding volume (ml)</td>
<td>195 (120-388)</td>
<td>370 (280-590)</td>
<td>.031</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voiding time (s)</td>
<td>39 (21-55)</td>
<td>45 (22-90)</td>
<td>.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum flow rate (ml/s)</td>
<td>8.5 (2.5-23.4)</td>
<td>16.5 (4.4-34)</td>
<td>.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average flow rate (ml/s)</td>
<td>3.2 (1.3-6.4)</td>
<td>4.6 (2.1-12.4)</td>
<td>.213</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Urethral pressure profilometry:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladder neck pressure (cm H₂O)</td>
<td>22.2 (14-30)</td>
<td>23.4 (15.5-36)</td>
<td>.915</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voluntary urethral pressure (cm H₂O)</td>
<td>81 (51-112)</td>
<td>78 (35-123)</td>
<td>.456</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continence progress with follow-up is discussed in Table (3). The median time to have satisfactory daytime continence was 7 months and 94% were continent by 24 months post surgery. Nighttime continence and improvement of stress incontinence had longer median times (11 and 17 months respectively) to achieve satisfactory results.

Post operative radiotherapy was associated with day and night incontinence in 18/27 of patients (66.6%) and this was observed for average of 34 days (15-62) but there was no long term effect.

Six patients had residual urine more than 150ml for which catheters were inserted for 7 days and advised to have intermittent self catheterization for further one month.

Five factors were statistically analyzed for their effect on mean time to complete day continence. Variables were age (≥55 years), sex, post operative morbidity, stapler application and adjuvant irradiation. Age, stapler application and adjuvant post operative radiotherapy had no significant p-value (0.483, 0.31 and 0.09 respectively). Post operative complications had
a significant effect and the mean time was lower for non complicated patients (7.3±4.3 Vs. 12.7±2.7 months) for the complicated cases (p=0.046). Males had also shorter mean time than females (6.4±3.6 Vs. 10.5±4.2 months) with p≤0.0312. At the end of the first year 4/16 of females were still day and night incontinent (25%) and 9 had stress incontinence (56.25%). UDS at 12 months post surgery showed that males had significantly higher bladder neck pressure and maximum voluntary urethral pressure with equivalent cystometry results. Table (4) shows significantly higher median maximum flow rate 23 versus 11ml/s in females.

Table (3): Continence progression and associated urgency and stress incontinence in 37 patients with Le Bag as detected by questioners.

<table>
<thead>
<tr>
<th>Time post surgery</th>
<th>Continence</th>
<th>Urgency and stress incontinence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day</td>
<td>Night</td>
</tr>
<tr>
<td>2 months</td>
<td>16 (43.2%)</td>
<td>13 (35%)</td>
</tr>
<tr>
<td>6 months</td>
<td>29 (78.4%)</td>
<td>24 (64.9%)</td>
</tr>
<tr>
<td>12 months</td>
<td>33 (89.2%)</td>
<td>27 (73%)</td>
</tr>
<tr>
<td>24 months</td>
<td>32/34 (94%)*</td>
<td>30/34 (81%)*</td>
</tr>
<tr>
<td>Median time to continence (range)</td>
<td>7 month (1-17)</td>
<td>11 months (1-36)</td>
</tr>
</tbody>
</table>

* Number of patients evaluable without mortalities and lost follow-up cases.

Table (4): Urodynamic results of 17 males in comparison to that of 14 females 12-months post surgery.

<table>
<thead>
<tr>
<th>Urodynamic test</th>
<th>Males Median (Range)</th>
<th>Females Median (Range)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystometry:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir capacity (ml)</td>
<td>476 (362-600)</td>
<td>519 (387-586)</td>
<td>.26</td>
</tr>
<tr>
<td>Residual urine (ml)</td>
<td>36 (0-347)</td>
<td>41 (16-120)</td>
<td>.411</td>
</tr>
<tr>
<td>Reservoir basal pressure (cm H₂O)</td>
<td>20.5 (13.7-24.3)</td>
<td>13.5 (9-16.5)</td>
<td>.102</td>
</tr>
<tr>
<td>Reservoir maximal pressure (cm H₂O)</td>
<td>40 (30.7-48)</td>
<td>25 (19-36)</td>
<td>.056</td>
</tr>
<tr>
<td>Compliance ml/cm H₂O</td>
<td>22.4 (16.9-25.3)</td>
<td>28.4 (21-38.4)</td>
<td>.061</td>
</tr>
<tr>
<td>Uroflowmetry:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voiding time (s)</td>
<td>32 (22-56)</td>
<td>40 (32-90)</td>
<td>.431</td>
</tr>
<tr>
<td>Maximum flow rate (ml/s)</td>
<td>11 (4.4-22.5)</td>
<td>23 (9-34)</td>
<td>.011*</td>
</tr>
<tr>
<td>Average flow rate (ml/s)</td>
<td>4.6 (3.6-12.4)</td>
<td>7.5 (2.1-11)</td>
<td>.06</td>
</tr>
<tr>
<td>Urethral pressure profilometry:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladder neck pressure (cm H₂O)</td>
<td>23.4 (15.5-36)</td>
<td>14.5 (11-21)</td>
<td>.002*</td>
</tr>
<tr>
<td>Voluntary urethral pressure (cm H₂O)</td>
<td>81 (48-123)</td>
<td>50 (35-85)</td>
<td>0.011*</td>
</tr>
</tbody>
</table>

* Significant.

**DISCUSSION**

A main advantage of this pouch derives from its technical feasibility with adequate axis of rotation. Completely detubularized ileocolonic pouches can also attain semispherical shape with adequate reservoir capacity [5]; nevertheless, pouch over distension is less frequent and residual urine post micturation is generally small in amount [6,7].

Although the patients’ number in this series was small, valuable informations could be observed. Surgical procedure had a relatively short average operative time without extra blood loss. Stapler application shortened time with no effect on continence and post operative complications. The relative pouch wall limited distensibility and omentoplasty together with pouch fixation to the rectus sheath proved its effect with no formation of pouchocle or hypercontinence and limited number of overdistension. Early and late complications were limited and could be managed without mortality and only one reoperation.

This type of diversion offered slowly progressive continence rate with a reasonable median compliance (22.4ml/H₂O); though, compliance did not change significantly during the
interval between the dynamic studies. Two months postoperative day and night continence was limited to 13 patients (35%) and 12 patients were continent and free of stress incontinence (32.4%). Total day and night continence progressed to 64.9% 6-months after surgery and 46% were free of stress incontinence. Two years post surgery 81% had day and night continence and 79.4% were free of stress incontinence.

Females had significantly lower continence rate, although reservoir capacities and compliance were similar to that of males. UDS showed lower average reservoir basal pressure relative to bladder neck pressure in males; whereas, in females it was similar or in some patients higher than bladder neck explaining the higher stress incontinence in females.

Ileo colic segment use for lower urinary reconstruction passed several stages. Khafagy et al. [14,15] used the intact tubularized ileocecal segment for bladder substitution more than 30 years ago. Long experience with this pouch had accumulated; however, this neobladder had high rates of nocturnal incontinence. In a recent comparative study with ileal Studer’s pouch they showed equivalent daytime continence but with lower mean residual volume (90 Vs. 20ml) and lower rate of metabolic disturbance [16].

Light and Engelmann [8] results were excellent in terms of continence and preservation of renal function; however, nocturnal incontinence persisted in a substantial number of patients. Others [10] used the same technique but by performing urethral cecal anastomosis with improved nocturnal continence. Further modifications included complete detubularization of both the ileum and colon to create a pouch with low internal pressure. Kolettis and his group [5] used this modification for 38 male patients. Bejany and Politano [11] rotated the pouch 90 degrees and anastomosed the ureters to the pouch near each other and close to the urethral anastomose creating a new trigone.

Detubularization of bowel segments is an essential step for pouch creation [2]. This maneuver substantially enhances reservoir capacity, delays the onset and reduces the amplitude of the pressure rise produced by contractions. There is markedly improved nocturnal continence (80% Vs. 17% at 2 years), longer voiding intervals (4 Vs. 2.5 hours at 1 year) with detubularized versus tubularized bladder substitution; however, detubularization predisposed also to urinary retention (25% Vs. 0% at 1 year) [17].

Comparing Le Bag to ileal pouches, certain advantages and disadvantages need consideration. Enthusiasm for ileal pouches is attributed to their distensibility and lower rate of metabolic changes. In addition, small bowel pouches attain spherical shape which, decrease wall tension according to La Place’s low.

No difference has been discerned between ileal and colonic mucosa with regard to sodium-absorbing capacity. However, in the colon, chloride absorption and bicarbonate excretion are more pronounced, and evidence increasingly suggests that inherent chloride absorption is maintained when in contact with urine [18]. In this study, random biopsies of the pouch mucosa in 19 patients (51%) over the follow-up time did not show mucosal changes; nevertheless, the metabolic disturbance were limited to the first year only indicating that the absorptive ability is not the only factor responsible for the acidosis.

Ileal neobladder pressures are lowest of all types of reservoirs reported in the literature [19-21]. However, this higher ability of the detubularized ileum to accommodate pressure seems to be unlimited leading to overdistension and spontaneous rupture. Multiple cases of spontaneous rupture of continent ileal urinary diversion have been reported. The most common cause was acute or chronic overdistention of the diversion. This complication was observed with long-term follow-up, as pouch capacity may enlarge and the efficiency of voiding by Valsalva straining may be reduced [22,23]. This serious complication has been also reported with ileocolonic pouches but with less frequency [24].

Small bowel pouches avoid the use of terminal ileum, and the theoretical problems of vitamin B12 deficiency and bile salt malabsorption. Ileal pouches do not disturb the ileocecal valve with its consequences of diarrhea. Roth et al. [25] found two times risk of diarrhea for ileocecal diversion versus ileal pouches; however most patients responded spontaneously or to medical treatment. In this study persistent diarrhea was not reported in any patient and
medical treatment together with vitamin supplementations was sufficient.

Continence after orthotopic urinary diversion is dependent on an intact urethral sphincter and pelvic floor, which are able to maintain resistance pressure across the urethral continence zone that exceeds the pressure generated within the diversion[26-28]. Pouch intraluminal pressure is influenced by the size and configuration of the intestinal segment used for the diversion, in accordance with the law of La Place. Additional factors that may influence continence include urethral length and sensitivity, patient age and mental status, intact pelvic nerve supply to the rhabdosphincter, completeness of voiding, and presence or absence of bacteriuria[27-29].

Any intestinal segment (ileal, ileocecal, folded right colon or with ileal patch, or sigmoid) reconfigured in many ways can achieve large capacity (>300mL) [17]. Continence improves over time during the initial 6 to 12 months postoperatively as compliance of the diversion increases [30,31] and daytime continence is achieved earlier postoperatively compared with nighttime continence [3,21].

Bejany and Politano [11] reported 100% daytime continence and 92% night time. Kolettis et al. [5] using reported day time continence of 91%. Night time continence was complete for 46% and 34% had mild incontinence. There was no indication for the time the patients achieved these rates. The median reservoir capacity was 600cc (244-962) and median residual volume was 90cc (25-500). Other authors [32] reported on 29 patients treated by ileocolonic neobladder with a chimney (B-bladder). Daytime continence was 96%, nighttime continence was 89% and mean time to achieve continence was 3.8±3.6 months. Mean reservoir capacity was 493±165ml and the mean flow rate was 22.2±6.5ml/s.

Chen et al. [33] addressed a comparative study between ileocolonic and ileal pouches. By 6 months postoperatively, Daytime continence was nearly equal for both types (90.9% and 89.4% respectively) but ileal neobladder had significantly higher nighttime continence (76.3% versus 48.5%). Whether these differences in compliance and continence would still be significant at 1 year or longer is not known.

In this study, 11 months median time to achieve nighttime control was equal to that reported for ileal pouches. Nevertheless, this incontinence improved with time in a good percentage of cases by pelvic floor training and decreasing fluid intake before bedtime. Nighttime urine control reported in literature for ileal neobladder required 6 to 12 months to reach maximum levels as the capacity and the compliance of the diversion increase. Most series on ileal pouches reported a prevalence of nighttime leakage of 20% to 30% [4,7,21,34,35].

Nocturnal incontinence in any orthotopic neobladder reflects the loss of the normal reflex rise in urethral pressure during reservoir filling due to the loss of the afferent input from the detrusor after radical cystectomy [36]. Also, nocturnal input of urine exceeds reservoir capacity because of the intestinal water shift to render the concentrated nocturnal urine iso-osmolar. This shift decreases by time with mucosal atrophy and adaptation [5,21].

This pouch was a safe orthotopic diversion with average early and late complication rates and 2.7% reoperation rate was a minor one. Morbidity rates in literatures are variable. Abol-Enein and Ghoneim [34] reported on 53 cases (9%) with early complications including urinary leaks in 450 patients with W neobladder. All were treated conservatively except 3 cases. Besides, they found 9% late complications including pouch stones, urethero-ileal stricture and other complications. Hautmann et al. [4] reported on 11 years follow-up of 263 patients with W pouch. They had 3% perioperative deaths; while, neobladder related early and late complications occurred in 56 (15.4%) and 85 (23.4%) respectively. Neobladder related early and late abdominal reoperation rates were 0.3 and 4.4%, respectively.

Reported prevalence of acidosis among patients with neobladder has a wide range. Varol and Studer [31] found that with careful study, nearly all patients with ileal neobladder demonstrate metabolic acidosis in the early postoperative period and should receive sodium bicarbonate 2 to 6g daily for 3 to 6 weeks.

Alcini et al. [7] found no evidence of metabolic acidosis in 30 patients with ileocecal neobladder who were followed over a mean of 21.2±14.8 months. In a later study [37], the same
investigators compared metabolic parameters between patients with ileal neobladder and ileocecal neobladder, at a mean follow-up of 51 months. The incidence of acidosis with or without hyperchloremia was 5.5% versus 8.9% and 5.5% versus 13.3% for ileal versus ileocecal neobladders, respectively. No differences were noted between the 2 groups in serum pH, PCO$_2$, PO$_2$, bicarbonate, chloride, and potassium.

Bacteriuria in most patients with neobladder is asymptomatic and represents colonization rather than a clinical infection. Wood et al. [38] found positive urine cultures in only 50% of patients despite bacteriuria in 78%. Nevertheless; they reported incidences of clinical upper tract infection and urosepsis of only 39% and 12%, respectively.

Reflux in low pressure reservoirs has not the same impact on the kidney parenchyma as high pressure reservoirs and anti reflux procedures may had no such expected benefit and on the reverse increase the risk of uretero-intestinal stricture [17].

In conclusion: Completely detubularized ileocolonic (modified Le Bag) pouch had excellent continence rate and complication rate. Long term follow-up revealed few pouch over distension, no rupture complication, small volume of residual urine, preserved upper urinary tract integrity and function and relatively low incidence of transient metabolic acidosis.

REFERENCES


31- Varol C, Studer UE. Managing patients after an ileal orthotopic bladder substitution. BJU Int. 2004, 93: 266-70.


