Purpose: To study the long term complications of ileal conduit urinary diversion in 36 patients with invasive urinary bladder cancer who lived more than 5 years after surgery.

Patients and Methods: A retrospective study included 36 long term survivors (survival 5 years or greater) with invasive bladder cancer who did radical cystectomy or anterior pelvic excentration with ileal conduit urinary diversion at the National Cancer Institute, Cairo University before January 2004.

Results: A total of 36 patients, 28 Males and 8 females, with median age at surgery of 62 years. Complications developed in 22 (61%) patients and surgical re-intervention was needed, in 14 patients (39%). Stoma related complications developed in 7 (19%) patients, bowel related complications developed in 4 (11%), urinary tract infection and pyelonephritis was observed in 9 (25%) patients, conduit/ureteral anastomosis related complications developed in 5 (14%) patients, urolithiasis developed in 4 (11%) patients. Renal function deterioration (morphological and functional) was observed in 9 (25%) patients, nephrectomy was required in 2 patients, hemodialysis was required in 1 patient, and 1 patient had persistent hyperchloremic acidosis.

Conclusion: Long term follow-up for patients with ileal conduit urinary diversion shows high complication and high surgical re-intervention rates following this technique. Longer follow-up period for 20 or more years is needed for all urinary diversion techniques to prove either the ileal conduit will remain the gold standard for urinary diversion or other newly developed techniques will take its place.

Key Words: Urinary diversion – Treatment outcome – Renal function tests – Postoperative complications.

INTRODUCTION

Bladder cancer is the most common reason for cystectomy [1]. Following cystectomy, reconstruction of the lower urinary tract should be performed to direct the urinary flow to the exterior [2,3]. Lower urinary tract reconstruction has always been a challenge for the urologists and oncology surgeons not only because of high short and long term complications following reconstruction procedures, but also because of different techniques available for reconstruction, for this reason the surgeon performing a urinary diversion after cystectomy must be familiar with several direction techniques [4]. Reconstructive procedures fall mainly into two general categories, either incontinent diversion, such as the ileal conduit, or continent reconstructions, which includes both cutaneous reservoirs and reservoirs connected to the urethra. Using ileal conduit diversion, urine drains directly from the ureters through a segment of ileum to the skin surface where it is collected in external appliances [5].

The ileal conduit introduced by Seiffert and popularized by Bricker has been used for more than fifty years, and it is still considered a standard form of urinary diversion following cystectomy for bladder cancer [6]. Among disadvantages of this method of diversion is the need of external appliances, urinary leak due to appliance problems and impaired body image [7,8]. Continent cutaneous diversion and orthotopic bladder substitution have been developed in an attempt to overcome shortcomings of this technique [9,10], however because of their technical difficulties, high early and late complication rates and concerns regarding oncologic
outcome, the question about safety and reliability of those techniques when compared to the gold standard ileal conduit diversion is raised [11-14]. Many studies have been carried out for many years in patients who underwent ileal conduit diversion and live for at least five years after surgery, which resulted in detailed information regarding the incidence of complications following this diversion. Among the complications that mentioned, stoma complications, bowel complications, urinary tract infection, stone formation and deterioration of renal functions [15,16].

The aim of this work is to study the long term complications after radical cystectomy and ileal conduit method of urinary diversion in patients with invasive urinary bladder cancer who lived more than 5 years after surgery.

**PATIENTS AND METHODS**

This retrospective study included 36 patients with the diagnosis of invasive bladder cancer. All patients had surgery before January 2004, at the National Cancer Institute, Cairo University. Data concerning diagnosis, surgery, follow-up were reviewed and retrieved from patient’s files and from NCI hospital-based registry. Living patients were followed-up for a period of minimum 5 years and maximum 10 years.

Preoperative evaluation included full medical history, complete physical examination, and laboratory work up including complete blood count with differential, urine analysis, serum electrolytes, blood urea nitrogen, creatinine, liver function tests. Diagnostic imaging evaluation included chest radiograph, ultrasonography, excretory urography, abdomen/pelvis computed tomography in some cases. Cystoscopy and biopsy were done for all patients to define the tumor location and to confirm malignancy.

All patients had surgery in the form of radical cystectomy or anterior pelvic excentration with ileal conduit urinary diversion and post operative radiotherapy was given to all patients.

**Follow-up:** Patients were followed-up at 3 and 6 months after surgery and at 6-months intervals thereafter for 5 years. After 5 years they were followed-up once a year if they were not symptomatic. Follow-up includes full medical history, physical examination, full blood count, serum creatinine, blood urea nitrogen, electrolytes, and blood gas analysis if needed. Urine cultures were not routinely obtained in asymptomatic patients. Follow-up imaging studies included excretory urography, ultrasonography. Comparison was usually made between the last preoperative and last postoperative examination. All ileal conduit complications observed 3 months after surgery were recorded.

**RESULTS**

Patient characteristics and follow-up: Thirty six patients were included; they were 28 males and 8 females with a ratio of 3.5:1. Median patient age at surgery was 61 years (range 48 to 72), and the median follow-up was 82 months (range 61 to 118). Invasive bladder cancer was the sole indication for surgery in all enrolled cases.

Complications occurred in 22 (61%) patients; more than one complication was recorded in the same patient with a total of 38 recorded complications.

(Fig. 1 shows frequency of ileal conduit related complication). Surgical re-intervention was needed in 14 patients (39%). (Table 1 shows surgical intervention in each ileal conduit complication).

**Stoma related complications:** Developed in 7 (18.4%) patients after a median of 50 months (range 8 to 141). Parastomal hernia was encountered in (4) patients, stenosis in (2) patients and prolapse with recurrent bleeding with skin irritation in one patient. Surgical intervention was necessary in 5 patients, (parastomal hernia 3, stenosis 1, and prolapse 1).

**Bowel related complications:** Were reported in 4 (10.5%) patients after a median of 50 months (range 8 to 141). Parastomal hernia was encountered in (4) patients, stenosis in (2) patients and prolapse with recurrent bleeding with skin irritation in one patient. Surgical intervention was necessary in 5 patients, (parastomal hernia 3, stenosis 1, and prolapse 1).

**Urinary tract infection and/or pyelonephritis:** Asymptomatic bacteriuria was not investigated in our cases; as routine urine culture is not part of our regular follow-up, only symptomatic urinary tract infections and/or pyelonephritis requiring hospitalization were investigated. The latter complication was observed in
9 (23.7%) patients, 5 patients with uretero-ileal anastomotic stricture, 2 patients with stomal stenosis, and 2 patients with urolithiasis. Median time between surgery and the first episode of urinary tract infection was 26 months.

Conduit/ureteral anastomosis: Related complications developed in 5 (13.2%) patients, all of them had anastomotic stricture. Three out of five patients required surgical re-intervention (2 refashioning of the anasomosis and 1 replacement by another ileal segment). Endourological procedures were done in 2 patients.

Urolithiasis: Developed in 4 (10.5%) patients with a median follow-up period from date of surgery of 50 months (range 46 to 108). Encountered urinary tract pathologies predisposing to urolithiasis were hydronephrosis in 2 patients, stomal stricture in 1 and uretero-conduit stricture in 1 patient.

Renal function deterioration: (Morphological and functional) was observed in 9 (23.7%) patients. The most common upper urinary tract changes were hydronephrosis (7 cases) and shrunken kidney (2 cases). Nephrectomy was required in 2 patients, 1 with pyonephrosis and another one with upper urinary tract tumor. Hemodialysis was required in 1 patient with already preoperative impaired renal functions, and another patient had persistent hyperchloremic acidosis cause of recurrent pyelonephritis.

Median follow-up was 92 months for all patients. However it was 142 months for patients less than 60 years and 72 months in patients above 60 years (Table 2 shows impact of age at surgery on the rate of long term complications after ileal conduit). The incidence of complications was increasing with increasing the follow up period. Complications were observed in 15 patients (41%) within first five years and gradually increasing with longer follow-up to involve 22 patients (61%) by the end of this study (Fig. 2, shows cumulative incidence of ileal conduit related complications).

The patterns of complications were different during follow-up period, bowel related complications were mainly observed during early follow-up period (within the first 2 years), while stoma and renal functions related complications were observed later (between 2 and 5 years). Morphological changes and urolithiasis were observed later mainly after 5 years of follow-up.

Table (1): Surgical intervention in each ileal conduit complication in patients with radical cystectomy for bladder cancer.

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. of patients</th>
<th>Surgical intervention</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoma related:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para-stomal hernia</td>
<td>4</td>
<td>Repair of para-stomal hernia</td>
<td>3</td>
</tr>
<tr>
<td>Stenosis</td>
<td>2</td>
<td>Refashioning of stoma</td>
<td>1</td>
</tr>
<tr>
<td>Prolapse</td>
<td>1</td>
<td>Refashioning of stoma</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>7/36</td>
<td></td>
<td>5/36</td>
</tr>
<tr>
<td>Bowel related:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstruction</td>
<td>2</td>
<td>Laparotomy and re-anastomosis</td>
<td>2</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>2</td>
<td></td>
<td>2/36</td>
</tr>
<tr>
<td>Total</td>
<td>4/36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduit/ureteral:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anastomotic stricture</td>
<td>5/36</td>
<td>Refashioning of anastomosis</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>Replacement of conduit</td>
<td>1</td>
</tr>
<tr>
<td>Renal morphology:</td>
<td></td>
<td>Endo-urology procedure</td>
<td>2</td>
</tr>
<tr>
<td>Hydronephrosis</td>
<td>7</td>
<td></td>
<td>5/36</td>
</tr>
<tr>
<td>Shrunken kidney</td>
<td>2</td>
<td>Nephrectomy</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>9/36</td>
<td></td>
<td>2/36</td>
</tr>
<tr>
<td>Urinary Tract infection</td>
<td>9/36</td>
<td>None</td>
<td>0/36</td>
</tr>
<tr>
<td>Urolithiasis</td>
<td>4/36</td>
<td>None</td>
<td>0/36</td>
</tr>
</tbody>
</table>
DISCUSSION

The primary goals in selection of a urinary diversion are to ultimately provide the patient with diversion that results in the best local cancer control, the lowest potential for complications both short and long, and the best quality of life while still allowing the timely completion of chemotherapy and therapeutic goals [17]. The ileal conduit introduced by Seiffert and popularized by Bricker, is one of the oldest, simplest, and most commonly performed techniques for urinary diversion. It has the longest follow-up available, and remains the gold standard to which all newer urinary diversions are compared. However many studies proved that this technique has shown equivalent health-related quality of life when compared with continent diversions [5,7,8]. At the National cancer Institute the ileal conduit urinary diversion is one of the most commonly used techniques. Patient related factors that support using this technique including, patients with short life expectancy, patients with significant medical comorbidities, and for those who cannot complete the rehabilitation and subsequently manage continent diversion either with cutaneous reservoirs or orthotopic bladder and it is acceptable and reliable technique when the urinary outflow tract is involved with the tumor.

The ileal conduit is a low pressure reservoir which has been used for many years, and detailed information is available regarding the incidence of complications, report from Madersbacher and his colleges in 2003 on 131 patients who underwent ileal conduit reconstruction and survived at least five years demonstrated an overall complication rate of 66 percent, with 24 percent stomal problems, 24 percent bowel complications, 23 percent urinary tract infection and 27 percent deterioration of kidney functions [5]. Our study demonstrates the high long term complication rates in survived patients (61%) as well as the high surgical re-intervention rates (39%), this is in accordance with many studies which shows long term high complication rates mainly related to the stoma [5,21,22]. In our patients, stoma related complications developed in 19 percent, bowel related complications developed in 11 percent, urinary tract infection and pyelonephritis developed in 25 percent, while conduit/ureteral anastomosis related complications developed in 14% percent, urolithiasis

Table (2): Impact of age at surgery on the rate of long term complications after ileal conduit following radical cystectomy for bladder cancer.

<table>
<thead>
<tr>
<th>Age at surgery</th>
<th>No. of patients</th>
<th>Median follow-up (months)</th>
<th>No. of complications%</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 or Younger</td>
<td>3</td>
<td>66</td>
<td>4</td>
</tr>
<tr>
<td>51-60</td>
<td>15</td>
<td>94</td>
<td>14</td>
</tr>
<tr>
<td>61-70</td>
<td>16</td>
<td>76</td>
<td>17</td>
</tr>
<tr>
<td>Older than 70</td>
<td>2</td>
<td>61</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>82</td>
<td>38</td>
</tr>
</tbody>
</table>

Fig. (1): Frequency of ileal conduit related complications.

Fig. (2): Cumulative incidence of ileal conduit related complications.
developed in 11% percent of our patients this is mainly explained by urinary stasis and by recurrent infection. No clinical evidence of severe vitamin deficiency was reported in our patients during follow-up period, this is explained by the routine technique followed at the National Cancer Institute which avoids resection of long ileal segment, as resection of an ileal segment less than 60cm is thought to be without malabsorption for patients with a normal terminal ileum, an intact ileocecal valve and normal kidney functions [5,8].

Following ileal conduit diversion, upper urinary tract changes is the most concerning issue, reflux and chronic infection are the most common reasons for this changes, Neal reported 47 percent upper tract changes and renal deterioration in 16 percent with a mean follow-up of 10 years [23], while Pernet and Jonas observed deterioration in a about a third of patients in a study included 110 patients followed 10 years postoperatively [7]. In our study, renal function deterioration (morphological and functional) was observed in 25% percent with hydronephrosis is the commonest change and shrunken kidney is the next.

Avoidance of stoma related morbidity and favorable long-term continence data following orthotopic bladder substitution particularly in men are strong argument for ileal conduit urinary diversion [24], however, preservations of the urethra in patients with urothelial tumors in order to construct an orthotopic neobladder raises the concerns about possible recurrence of cancer, since the transitional cell lining of the urethra may be particularly susceptible to the development of tumors in these patients, this concern is insignificant in ileal conduit diversion as the urethra is not needed in this type of diversion [25,26].

Quality of life (QOL) is a major concern in the choice of the method of diversion, while some reports have noted improvements in various aspects of QOL after orthotopic neobladder, a systematic overview of 15 published studies examined health related quality of life after radical cystectomy and urinary diversion concluded that the available data were insufficient to conclude that any one form of urinary diversion including ileal conduit diversion was associated with better QOL [27]. This conclusion emphasizes the fact that the ideal urinary diversion has yet to be developed, further improvement of current surgical techniques as well as developing newer techniques, together with long term follow-up is really needed to prove or disprove the safety and efficacy of various urinary diversion techniques [28,29].

**Conclusion:**

Long term follow-up for patients with ileal conduit urinary diversion shows high complication and high surgical re-intervention rates which is increasing progressively with longer periods of follow-up, however due to the relative ease of its formation, often application in patients with medical co-morbidities and satisfactory quality of life compared to continent diversions, ileal conduit remains to be one of the most commonly performed techniques in urinary diversion. Long term follow-up for 20 or more years is needed for all urinary diversion techniques to prove either the ileal conduit will remain the gold standard for urinary diversion or other newly developed techniques will take its place.

**REFERENCES**

10. Gburek BM, Lieber MM, Blute ML. Comparison of Studer ileal neobladder and ileal conduit urinary


