Ureterosigmoidostomy: A Gold Standard in Orthotopic Bladder Era

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Abstract: Ureterosigmoidostomy is the oldest technique for continent urinary diversion since 19th century. As carcinoma of the urinary bladder is the commonest (40%) of solid tumors in males in Egypt, thousands of this procedure has been done since the fifties of last century. In this study, we will assess the long term follow-up and complications of this technique at our institution. Between 1988 and 2004, bilateral ureterosigmoidostomy using Leadbetter tunneled technique was performed for 112 patients with invasive carcinoma of urinary bladder at Theodor Bilharz Research Institute. 61 patients (55%) with transitional cell carcinoma (TCC) and 51 patients (45%) with squamous cell carcinoma (SCC). Only 53 living patients are available for evaluation. In the available 53 patients for the study, the mean follow-up is 14 years ± 3.1 years. No case needed to change to another form of diversion. 46 patients (87%) are continent day & night and the remaining 7 (13%) have mild nocturnal incontinence. 18 patients (34%) developed acute pyelonephritis, (bilateral in 7 and unilateral in 11). 12 of the 18 patients (66%) have less than 2 attacks in their follow-up period, while the remaining 6 (33%) had between 2-5 attacks. All cases were managed conservatively with hospitalization required in 3 cases only and for a maximum of 48 hours. Non obstructive upper tract dilation was observed in 8 patients, bilateral in 5 and unilateral in 3, however, 3 cases only were symptomatic and were managed conservatively as well. Ureteroenteric stricture developed in another 5 cases, 2 bilateral and 3 unilateral. In conclusions, Long term follow-up of more than 17 years of ureterosigmoidostomy showed that it is a successful operation, giving a very good quality of life for a select group of patients with no more complications than many other forms of urinary diversion.

Key words: Ureterosigmoidostomy, Urinary diversion, Continence, Ureteroenteric stricture.

INTRODUCTION

Intestinal segments have been used to improve or replace lower urinary tract function for more than a century. The main indication is bladder cancer; however, there are other indications, such as neurogenic bladder dysfunction, detrusor overactivity and chronic inflammatory conditions, eg interstitial cystitis, tuberculosis, schistosomiasis and post radiation bladder contraction [9]. As carcinoma of the urinary bladder is the commonest (40%) of solid tumors in males and to a lesser extent in females in Egypt, thousands of this procedure has been done since the fifties of last century.

Ureterosigmoidostomy is the oldest technique for continent urinary diversion since 19th century. It was 1st performed by Simon in (1852), but became popular since 1911 after Coffey introduced the idea of tunneling the ureter into the colon [1]. Since the introduction of ileal conduit diversion by Bricker (1950), intestine have been used in various configurations (continent diversion, bladder reconstruction and bladder replacement), primarily aimed at avoiding the problems associated with an abdominal stoma and urine collecting devices.

There are now reports of numerous variations of the major types of such surgery, often with claims of one type being better than other type. The lack of adherence to a universally accepted standardized terminology, limited objective outcome evaluation and large differences in the reported experience make decision making difficult for patients and clinicians [5,13]. Complications as effects on fluid & electrolyte imbalance in addition to complications of reflux, ureterointestinal obstruction and pyelonephritis were common in ureterosigmoidostomy. However, these also occur with ileal conduit form of diversion as long term studies have shown that there is a high incidence of late complications with progressive deterioration of the upper renal tracts, electrolyte disturbances, pyelonephritis and calculus formation [14,7].

In contrast, although continent urinary diversions are reported to result in higher patient satisfaction, it is also recognized that they generally have higher incidence of early and late complications and the reoperation rates are higher than those of classic forms of diversion [11,4,16]. We believe that ureterosigmoidostomy after radical cystectomy for bladder carcinoma is still a useful form of urinary diversion, it is simple to
perform, offers good continence with minimal interference with life style. In this study, we aimed to review our long term results of uretersigmoidostomy and to determine the quality of evidence currently available to support the notion that outcome after this technique is comparable to the results of other more recent forms of continent urinary diversion in a select group of patients.

**MATERIALS AND METHODS**

Between 1988 and 2004, bilateral uretersigmoidostomy using Leadbetter tunneled technique was performed for 112 patients with invasive carcinoma of urinary bladder at Urology department of Theodor Bilharz Research Institute (TBRI), Cairo, Egypt. 61 patients (55%) with transitional cell carcinoma (TCC) while 51 patients (45%) had squamous cell carcinoma (SCC).

Retrospective data analysis of those patients was performed for the only 53 living patients who are available for evaluation. They were 48 males and 5 females, their age ranged between 38 to 65 years with a mean = 45±2.3 years. Preoperative assessment included: serum creatinine measurements with evaluation of upper tracts by excretory urography (IVU) & ultrasound examination of abdomen and pelvis (U/S). To assess patient's continence status, they were given a saline retention enema (400-500 ml) and requested to hold it with mobility for 60 minutes. In addition, to test continence status at night the same procedure was repeated for 2 consecutive nights 2 weeks preoperatively and only patients who can hold the enema with only one wet pad per night were elected for the procedure, otherwise other form of urinary diversion was offered to them.

In addition to continence test (both during day and night times), exclusion criteria include patients with dilated ureters, creatinine > 2.0 mg%, compromised liver functions. In patients with past or family history of colonic diseases or if were symptomatic, barium enema or colonoscopy was performed accordingly.

72 hours before planned time of surgery, patients took low residue diet, underwent standard mechanical (laxative & enema) and chemical bowel preparation, including oral metronidazole and erythromycin base. Parenteral broad spectrum antibiotic is administered 6 hours preoperatively.

The operative technique: After completing the radical cystectomy with lymphadenectomy, the ureters which were previously transected at the beginning of surgery were brought to the sigmoid colon. The chosen area is made as low as possible in the rectosigmoid, but with sufficient mobility to reach the ureteral extremity without tension.

To simplify the creation of the submucosal tunnel, two tissue forceps are placed at the anterior tenia at a distance of 10 cm, one proximal to the site chosen for submucosal tunnel and the other distal to it. The forceps are pulled and a curved intestinal clamp is placed on the sigmoid, excluding the area of anastomosis from the rest of the colonic lumen. Eight to ten ml of saline is injected subserosally to aid in separating the serosa and muscles properly. We usually start with right one 1". A trough is made in anterior colonic wall and a 4 cm incision is made through the serosa and muscle layer which are separated laterally by a combination of sharp and blind dissection to expose the mucosa distally. Mucosa is incised distally by a number 15 blade and opening is completed by scissors. After spatulation of ureter, watertight mucosa-to-mucosa anastomosis between ureter and colon with 4-0 polyglycolic (vicryl) sutures over 8/10 French stent. The ureter is the placed in the previously created trough and seromuscular layer is closed by 3-5 interrupted 3-0 vicryl sutures making sure to make the most proximal one not too tight. The same procedure is then repeated for the left ureter which is placed at a more proximal position. At the end of the procedure, the intestinal clamp is removed and seromuscular sutures are made ensuring final hemostasis. The colon is drained by a 28 French rectal tube. Wound is closed in layers with drainage after retroperitonealization of the ureters.

Immediately post-operatively, patients were maintained on continuous oral sodium bicarbonate supplementation and were followed-up at 1, 3, 6 months and every 6 months thereafter. At each visit, renal function tests, serum electrolytes were evaluated. Excretory urography and/or ultrasound of abdomen and pelvis were done periodically, while diuretic renal scintigraphy scan was done only in certain cases & urine/stool was tested for blood every month. Colonoscopy was done annually starting from 6th year post-operatively. Complications, including incontinence, ureteroenteric stricture, pyelonephritis, hydronephrosis, stone formation & azotemia (creatinine greater than 2.0 mg %), were recorded.

**Statistical Analysis:** The statistical analysis of the results was done with analysis of variance (chi-square test) and to assess the correlation between early and late complications. Analysis was conducted using the SPSS software program, version 11. In all tests, P < 0.05 was considered to be significant.
Table 1: Clinical & radiological end points

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Early Complications % (Less than 2 years post-operatively)</th>
<th>Late Complications % (More than 2 years post-operatively)</th>
<th>Pearson chi square (P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day &amp; night time continence</td>
<td>85%</td>
<td>89%</td>
<td>P=0.386 N.S</td>
</tr>
<tr>
<td>Nocturnal incontinence</td>
<td>15%</td>
<td>11%</td>
<td>P=0.223 N.S</td>
</tr>
<tr>
<td>Fecal incontinence</td>
<td>12%</td>
<td>7%</td>
<td>P = 0.05 S</td>
</tr>
<tr>
<td>Flatus leakage</td>
<td>3%</td>
<td>---</td>
<td>P= 0.220 N.S</td>
</tr>
<tr>
<td>Ureteroenteric stricture</td>
<td>9%</td>
<td>---</td>
<td>P=0.210 N.S</td>
</tr>
<tr>
<td>Non obstructive dilation</td>
<td>15%</td>
<td>16%</td>
<td>P=0.667 N.S</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>15%</td>
<td>19%</td>
<td>P=0.421 N.S</td>
</tr>
</tbody>
</table>

Pearson chi square test, NS = Not Significant, N = Significant at p<0.5

Fig. 1: Histogram showing the percentage of early and late complications throughout whole period of follow-up

RESULTS

Of the 112 patients, 4 died in early post-operative period, 2 from massive myocardial infarction (MI) and the other 2 from pulmonary embolism (PE). Of the remaining patient, 7 died of metastatic diseases at 11, 14, 18, 22, 23, 40 & 47 months postoperatively. 48 patients were either non compliant with post-operative visits or lost for follow up. So, Follow-up is current in the remaining 53 patients. The mean follow-up period of the 53 living patients those are available for the study is 14 years ±3.1 years. All the patients were operated upon for invasive carcinoma of urinary bladder.

There were 48 males and 5 females with mean age for both sexes = 45 ± 2.3 years, with a range of 38 to 65 years. 46 patients (87%) are day & night time continent and the remaining 7 (13%) have mild nocturnal urinary incontinence during the whole period of follow-up (mild incontinence is defined as the use of no more than one pad). Within the 1st 2 years post-operatively, 85% had day & night time continence and 15% had nocturnal incontinence, while after 2 years post-operatively 89% are continent all time and the incidence of nocturnal incontinence decreased to 11%.

As regards bowel complication, fecal incontinence occurred in 12% of patients within the 1st 20-24 months post-operatively and became 7% thereafter. While flatus leakage was encountered in 3% of patients in the 1st 2 years and in none thereafter.

Ureteroenteric stricture with progressive upper tract dilation and obstruction confirmed by nuclear renal scintigraphy developed in 5 cases (9%), 2 bilateral and 3 unilateral. In those 5 cases, 4 underwent surgical management by direct re-implantation of the ureter to the sigmoid colon, bilateral in 2 and unilateral in another 2 while the 5th patient needed nephrectomy for poor renal function. Time to identification of these strictures ranged from 6 to 19 months post-operatively and no case of stricture was diagnosed afterwards. Non obstructive upper tract dilation was observed in another 8 patients (15%), bilateral in 5 and unilateral in 3, however, 3 cases only were symptomatic and were managed conservatively as well by nightly rectal evacuation by rectal tube for 3-6 weeks.

Eighteen patients (34%) developed clinically overt acute pyelonephritis, bilateral in 7 and unilateral in 11. Of the 18 patients (66%) have less than 2 attacks in their follow-up period, while the remaining 6 (33%) had between 2-5 attacks. All cases were managed...
conservatively with hospitalization required in 3 cases only and for a maximum of 48 hours. Time to presentation of the pyelonephritis was less than 24 months post-operatively in 8 patients and in the remaining 10 were more than 24 months.

Renal function remained stable in 48 patients (90%) and the remaining 10% experienced mild stable rise in serum creatinine. The mean pre-operative serum creatinine was 0.95 mg % (range 0.7 to 1.5), while post-operatively, the mean was 1.2 mg % (range 0.6 to 1.8). No patient had blood in urine/stool. Colonoscopy that was part of the routine annual follow-up starting from 6th year was negative for gross malignant lesions in all patients. Clinically and radiologically, there is no statistical difference in all end points (except fecal incontinence that improved significantly) between early and late follow-up periods (Table 1 & Figs. 1, 2, 3).

**DISCUSSION**

The first attempt at continent urinary diversion was reported by Simon who performed the first ureterosigmoidostomy in 1852. Krynski is credited as being the first to create an antireflux mechanism using a submucosal tunnel, but in 1911 Coffey reported the first successful anastomosis of ureters into bowel. Nesbit (1949) attempted a direct mucosal to mucosal ureterocolonic anastomosis. In (1951) Leadbetter and Clarke described a combined technique with a long, extracolonic, seromuscular Coffey-type tunnel with Nesbit direct mucosal anastomosis. Its advantages include: urinary continence, a fast learning curve, relative easiness and rapidity of performance, no need for catheters or external appliances wide acceptance by patients offering good continence with minimal interference in life-style.

Complications Include: ureterocolic stricture, reflux, acute pyelonephritis, hyperchloremic metabolic acidosis, stone formation and late development of colonic malignancy at anastomosis site. However, these complications are not unique to ureterosigmoidostomy and can occur with other forms of urinary diversion. In an elegant systematic review of more than 400 studies including 32,795 patients by Nabi and colleagues in 2005, they failed to find evidence that continent urinary diversion is better than older classic forms or vice versa.

In our cases the day & night continence rate is (87%) which is comparable to Allen results which is around (92%). The problem of nocturnal incontinence is a real
problem in (13%) of patients; we tried to decrease this complication beforehand by adding the trial of holding enema not only as a retention enema during patient’s daytime activities, but also during 2 consecutive nights during sleep, so we can select the most appropriate candidates for this form of surgery, so, our nocturnal incontinence rate decreased to only 11% in late follow-up cases and only wetting one pad per night. One other aspect to overcome such a problem is to do simple detubularization of a segment of the sigmoid colon to decrease intraluminal pressure and hence decrease incidence of nocturnal incontinence as described by Fisch and colleagues in 1993.

Also, the incidence of mild fecal incontinence decreased significantly in late follow-up cases from 12% to only 7% and flatus leakage as well, both improving the patient's image and satisfaction. The probable cause of this decline of incidence is that we employed the use of anticholinergics and antispasmodics to relieve the complaint of rectal tenesmus and frequent evacuation.

One major problem have been the development of hydronephrosis that occurred in (15%) of our cases, which in some instances is the result of mechanical obstruction at the site of uretersigmoid anastomosis as proven in 9% only and warranting surgical re do. This is in contrast to other studies where ureteral obstruction at the level of anastomosis occurred in 32% of cases according to Wear in 1973 and 62% according to Zincke [18] this high incidence can be explained by either non adherence of sound surgical principles of mucosa-to-mucosa anastomosis, persistent post-operative leakage or employing the transcolonic (Goodwin) technique.

However, hydronephrosis, in many cases seems to be secondary to the intracolonic pressure and responds well to conservative measures. As suggested by McGuire and associates in 1981, the colon seems to have compliance problems as does the bladder. The pressure in the intact sigmoid colon can reach up to 200 cm H₂O during defecation and pressure waves that reach the distal colon with mass movements are about 60-80 cm H₂O. More significantly, with increasing storage volumes the resting basal pressure in the sigmoid rises. With volumes as little as 200 ml, basal pressure can begin to rise above 40 cm H₂O.

However, patients without hydronephrosis tend to remain free of complications otherwise, that's why we strongly advocate examination of the upper tract by annual ultrasound with comparison of previous ones so that we can manage any early changes in upper tract appropriately.

Clinically overt acute pyelonephritis occurred in 34% of our cases, this is in accordance to Wear [15] who reported that 67% incidence. Zincke [19] noticed 57% incidence of acute pyelonephritis and suggested that reflux of fecal stream to the ureter is the main cause of this affliction which is a logical explanation of that problem. To decrease this incidence we recommend the use of prophylactic antibiotics in the first 3 months post-operatively with frequent rectal emptying.

Hyperchloremic metabolic acidosis is present in 35 to 100% [18,12] mostly in a subclinical form. Selective reabsorption of chloride and bicarbonate secretion through colonic mucosa seems to be the main causes of these disturbances. Frequent intestinal evacuation and continuous oral administration of sodium bicarbonate or potassium citrate is advocated by us and others to correct this electrolyte disorder.

The most distressful complication of the procedure is development of adenocarcinoma of the colon. The mean latency period of colonic tumors is approximately 25 years (range 6-50 years) [7,6]. Though, we didn’t encounter any case in our patients in follow-up, as the mean age of our patients (45 ± 2.3 years) and none of our patients was operated for benign bladder condition, however, we did examination of urine/stool in each follow-up visit and annual colonoscopy starting 6 years after the procedure and all revealed negative results for colonic malignancy. Therefore, we recommend that uretersigmoidostomy should be avoided in patients with benign disease of the bladder and who are young with a long life expectancy.

In our opinion, we should not overlook the problems of uretersigmoidostomy, which are well recognized, but on balance, the operation has performed well with no more complications than many other forms of urinary diversion.

CONCLUSION

We believe that uretersigmoidostomy is still a good & convenient alternative as a continent form of urinary diversion after radical cystectomy for invasive carcinoma of urinary bladder. Long term follow-up of more than 17 years of uretersigmoidostomy showed that it is a successful operation, offering good continence with minimal interference with life style for a select group of patients with no more complications than many other forms of urinary diversion.

REFERENCES


