

Mainz II Pouch: A Simple Continent Urinary Diversion after Cystectomy

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ABSTRACT

Purpose: The type of urinary diversion after radical cystectomies for bladder cancer does not influence survival substantially, but it may influence the quality of life very much. The aim of this study was to assess the Mainz II (sigma pouch) as a new modification of ureterosigmoidostomy in our patients in comparison to the more commonly used rectal bladder diversion.

Material and Methods: Twenty one patients, 10 females and 11 males, with invasive bladder cancer in 18 and carcinoma of cervix uteri in 3 were operated upon by radical cystoprostatectomy or anterior pelvic exenteration during the period from 1999 to 2001.

Detubularized rectosigmoid pouch with sub-mucosal tunneling ureterocolic implantation was used. This group was compared to 31 patients with bladder cancer treated at the same time period by cystectomy, rectal bladder diversion and terminal iliac colostomy.

Results: All 21 patients were continent day and night except one case who had night soiling for 2 months. Six patients (28.6%) developed early post operative complications including 3 urinary leakages, 2 wound sepsis, one case of intestinal obstruction and a case of deep vein thrombosis (DVT). There was no postoperative mortality. Late complications (14.3%) were upper urinary dilatation in 2 patients (2/21), one severe metabolic acidosis and one pyelonephritis. The other group of patients showed more or less similar early and late complications (32.2% & 16%) but with persistent incontinence in 3 cases (9.6%).

Conclusion: The sigma pouch urinary diversion is a simple technique with excellent continence rate and lower complication rate than the classic ureterosigmoidostomy. It is a good alternative to orthotopic bladder substitution when the urethra cannot be used. Late complications could be controlled by conservative treatment in most of the cases. Rectal bladder diversion has similar rate of late complications but with the addition of external colostomy and its specific complications.

Key Words: *Continent urinary diversion - Recto sigmoid pouch - Mainz II pouch.*

INTRODUCTION

Uretrosigmoidostomy was the first form of supravescical continent urinary diversion and enjoyed broad popularity during the first half of the 20th century. Primary enthusiasm was followed by disappointment when serious problems, such as electrolyte imbalance, pyelonephritis, renal function deterioration and renal calculi became evident. In the 1950s these life threatening complications led to the abstinence from this urinary diversion in favor of uretero intestinal conduits [3].

In 1967 Hanley used the rectosigmoid as a reservoir of urine and diverted stool to a terminal colostomy and this technique (rectal bladder) gained much popularity due to its simplicity and safety to the upper urinary tract [12].

Anti refluxive ureteral implantation, antibiotics, alkalizing agents and the development of newer absorbable suture material have solved primary renal complications and minimized the risk of serious metabolic imbalance accompanying the old classical ureterosigmoidostomy.

Long term follow-up of alternative methods of urinary diversion revealed a considerable complication rate including similar upper urinary tract dilatation, repeated pyelonephritis, and many stomal complications as hernia, prolapse, stricture and peristomal skin changes and many patients refuses stomas and their appliances [13].

Interest for ureterosigmoidostomy regained its enthusiasm because of simplicity and appliance free benefits besides many patients with bladder cancer are not suitable for orthotopic substitutes [5-9]. Presently, upper urinary tract

dilatation secondary to uretero colic obstruction and reflux as well as continence problems are the major reasons for failure of classical ureterosigmoidostomy [18,19].

In 1988, Hinmann [14] introduced his principles of detubularization technique for bladder substitution. Following this study Fish and his group in the University of Mainz used the detubularized sigmoid colon to form a low pressure, high capacity pouch and render bowel contractions ineffective [6]. With this reservoir full, the basal pressure was 24 cm water and the highest peak pressure recorded was 35 cm water. This low pressure improved continence and protected the upper urinary tract. They titled this pouch as Mainz pouch II or sigma rectum pouch [6,7,8].

This study aims at testing the validity of the Modified Mainz pouch (MM) post radical cystectomy in our bilharzial bladder cancer patients and its effect on the upper urinary tract and continence in comparison to the classical rectal bladder diversion (RB).

PATIENTS AND METHODS

During a period of 33 months from March 1999 to December 2001, 21 patients, 10 females and 11 males, were selected for ureterosigmoidostomy using the Mainz II pouch as a urinary diversion post radical cystectomy. Invasive bladder cancer was the indication for cystectomy for 18 patients and carcinoma of the cervix uteri with bladder invasion for 3 cases. All patients were operated upon in the National Cancer Institute, Cairo University mostly by the author.

At the same period, 31 patients (25 male and 6 females with invasive bladder cancer) were operated upon in the National Cancer Institute by radical cystectomy and rectal bladder as a continent urinary diversion with terminal iliac colostomy. This diversion is the most common diversion with a long past history of application in Egypt. It is considered the corner stone type of diversion and its surgical technique is well known. These operations were performed by different surgeons including the author.

Criteria of selection and preparation:

Patients were considered eligible for this diversion if they were:

- Younger than 70 years (decreasing sphincter competence with increasing age).

- Had sufficient renal function to compensate for potential hyperchloremic acidosis i.e. serum creatinine level less than 1.5 mg/ml and bilateral normal upper urinary tract on IVU to allow antireflux implantation of the ureters.
- No history of diabetes mellitus or other neurological diseases.
- No colonic or proctological diseases.
- No previous colonic surgery or irradiation.

A rough clinical test [9] was used to assess the anal continence in some patients particularly for post menopausal females. The patient was asked to retain clear water enema 350-400 cm for a period of 4 hours with normal daily activity. The sensation of urge to defecation or insensible soiling was taken as a sign of weak anal continence.

Colonic preparation was mainly mechanical by saline enema, low residue diet and oral erythromycin.

Surgical technique:

Radical cystoprostatectomy or anterior pelvic excentration for females was performed in the usual way and hemostasis is secured.

At the junction between the sigmoid colon and the rectum a marking stay suture is inserted in the taenia coli. A running seromuscular sutures using 4/0 polygalactin suture material is used to approximate the two sides at the taenia coli for 12 cm. The colon and rectum are opened 3 mm near the suture using diathermy knife and by traction on the stay suture the opened intestine looks like inverted V and the pouch plate is further enforced by continuous mucosal suture of the inner two cut edges using 4/0 polygalactin which forms a dog-ear at the proximal end (Fig. 1). Two stay sutures were placed at the serosa at the site of ureteric implantation.

Ureteral implantation started by excising a circular area double the diameter of the ureter from the mucosa 4-5 cm distal to the stay suture, followed by tunneling the sub mucosa upward to the serosal stay sutures where another circular area double the diameter of the ureter was removed from the serosa. These circular areas are important to avoid later stenosis and obstruction. The ureter was pulled through the tunnel and fixed to the serosa by 2 stitches of 4/0 polygalactin and stitched mucosa to mucosa by 4/0

polygalactin 4-6 sutures according to the ureteric diameter. To secure the ureteral implantation 8F ureteric stents are placed and led down with the rectal tube.

To avoid excessive mobility of the pouch and kinking of the ureters, the proximal end of the middle outer seromuscular suture is evaginated and fixed to the anterior longitudinal ligament of the sacral promontory by 2 sutures. Anterior pouch wall is closed by approximating the two lateral cut walls of the colon and rectum by two layers of running 4/0 polygalactin sutures. The pouch is drained by a bowel tube for 14 days and the ureteric tubes are removed 8-10 days postoperatively. Abdomen is drained by 2 suction drains till cessation of fluid drainage and removed after performing IVU on the 8th postoperative day.

All patients start prophylactic alkalization when they start oral feeding.

Follow up:

Patients were seen monthly in the first year, every 3 months for the second year and every 6 months thereafter. Patient follow up included full continent history (day & night), symptoms of renal infection or dysfunction in addition to the routine symptoms of underlying malignancy. Excretory urography and US are performed 6 monthly to assess the configuration of the upper urinary tract in addition to ascending proctogram once to test for the antireflux procedure or leakage (Figs. 2-4). Blood gases were assessed in the first post operative week and monthly thereafter for the first year. Base excess defect below (2.5 mmol/l.) was a sign of impending metabolic acidosis. For these cases, increasing the dose of alkalinizers and laxatives might improve the condition.

Evaluation of the outcome concentrated mainly on post operative complications related to the diversion, effects on the upper urinary tract and continence.

RESULTS

Operative time was on average 3 hours and 20 minutes ranging between 2.30 and 5.15 hours. Operative time includes iliac LN dissection and cystectomy or anterior pelvic exenteration in addition to the diversion. Average blood transfusion was one unit per case (0-5 units). Opera-

tive time was shorter in rectal bladder group compared to Mainz technique (3.20 to 2.30 hours), but blood transfusion and hospital stay were nearly the same in both groups (Table 1).

After removal of the rectal tube for the MM group, all patients were continent except 4 patients who were incontinent for 1 to 3 days and improved after that (Table 2). Ten patients had initial voiding interval of 2-4 hours for the first 5 days post operative which improved by time. One month post operative, all patients were continent by day and night except one female who had persistent night incontinence for another month.

The RB patients were continent in all except 9 patients who had night incontinence and voiding interval of 2-4 hours. Night time incontinence improved for 5 patients after one month while for three cases two and half months were needed to achieve right incontinence. In two patients continuous bedtime soiling persisted.

For the cases operated by MM technique no perioperative mortality and 6 patients had early post operative complications as follows (Table 3):

- 3 patients (2 males and one female) had moderate urinary leakage (less than 500 ml/day) which was managed by continuous drainage for 5, 7 and 12 days. Conservative management success was assessed by decreasing the amount of drainage till complete cessation.
- 2 patients developed wound sepsis one of them had in addition urinary leakage that persisted for 12 days.
- One case developed adhesive intestinal obstruction 21 days postoperative and re-explored to release adhesions and she had smooth post operative after that.
- One patient developed iliofemoral DVT on the 8th postoperative day and minor pulmonary showers.

Follow up ranged from 10 months to 44 month with a mean follow up period of 23±10 months.

Upper urinary tract did not change without any back pressure signs in 16 patients depending on serial follow up urography and ultrasonography (Fig. 5).

In 3 patients there were no kidney function

on one side and 6 months postoperative IVU showed improvement in function on both sides. For 2 cases there was more dilatation of the upper tract. One case had progressive dilatation on one side and the renal function tests were within normal range for a long time (2 years). Both sides were affected in another case who suffered back pressure changes and repeated pyelitis with deterioration of the renal function that necessitated bilateral nephrostomy.

Severe metabolic acidosis was noticed in one patient who was hospitalized and it was temporary for 6 days. Increasing the dose of alkalinizing treatment and encouraging him to evacuate his rectum frequently, improved his condition. Pyelitis developed in one patient and it was severe enough to be rehospitalized. He, later on, developed pelircelycial dilatation and nephrostomy was done.

After RB diversion one patient developed severe wound sepsis and dehiscence followed by peritonitis and died 15 days post operative with multiple organ failure

Early complications were of the same frequency as for the MM group. However, the late complications were more frequent. Upper urinary dilatation was noticed in 4 cases (13%). This dilatation started 2 to 6 months with progressive course and back pressure changes. This was noticed in 3 cases necessitating temporary bilateral nephrostomy. Cutaneous uretostomy was performed for one patient.

Colostomy related complications appeared in 5/31 cases (16.1%) including 3 parastomal hernias and two colostomy prolapses. These cases had surgical repair after a variable time.

Recurrence was found in 38% in MM patients and 35.5% in the RB group with no difference in the pattern of recurrence between the two groups (Table 3).

Table (1): Operative time and hospital stay for Modified Mainz and Rectal bladder.

	Modified Mainz	Rectal bladder
Age	Mean 49y (37-58 y)	Mean 51y (41-75y)
Sex ratio M : F	11 : 10	25 : 6
Operative time	Mean 200 min. Range (150-315)	Mean 160 min Rang (120- 340)
Blood transfusion	Mean 1 (0-5) unit	Mean 1 (0-4) unit
Hospital stay	Mean 10 (8- 23) days	Mean 9 (7- 26) days

Table (2): Incontinent cases in the two diversion groups.

	Modified Mainz (21 patients)	Rectal bladder (31 patients)
<i>First month:</i>		
Day time	0	2
Night time	4	9
<i>Second month:</i>		
Day time	0	0
Night time	1	4
<i>>2 months:</i>		
Day time	0	0
Night time	0	3
Persistent	0/21	3/31 (9.6%)

Table (3): Postoperative complications (early & late) and recurrence.

	Modified Mainz	Rectal bladder
<i>Early complications:</i>		
Urinary leakage	3 (14%)	2 (6.5%)
Intestinal obstruction	1 (4.7%)	2 (6.5%)
Wound sepsis	2 (9.5%)	3 (9.7%)
DVT & pulmonary embolism	1 (4.7%)	0
Mortality	0	1 (3.2%)
Total affected patients	6/21 (28.6%)	10/31 (32.2%)
<i>Late complications:</i>		
Pyelitis	1 (4.7%)	3 (9.7%)
Metabolic acidosis	1 (4.7%)	1 (3.2%)
Upper urinary dilatation	2 (9.5%)	4 (12.9%)
Total affected patients	3/21 (14.3%)	5/31 (16%)
<i>Recurrence:</i>		
Local	4	6
Systemic	2	2
Both	2	3
Total	8 (38%)	11 (35.5%)

Table (4): Short and long term complications in 4 studies on sigmoid pouch.

	El-Mekresh et al. [5] (n = 57)	Gerharz et al. [9] (n = 34)	Obek et al. [17] (n = 60)	This study (n = 21)
Early complications	8(14%)	4(11.7%)	2(3.3%)	6(28.6%)
Late complications				
Metabolic acidosis	0	2(5.8%)	3(6%)	1(4.7%)
Upper urinary dilatation	3(5.3%)	1(2.9%)	3(5%)	2(9.5%)
Pyelonephritis	2(3.5%)	1(2.9%)	3(8%)	1(4.7%)

Fig. (1): The rectosigmoid area is suspended and a running seromuscular 4/0 stitch is used to approximate the two sides for 12 cm at the anti-mesenteric borders. The two sides are opened at the anti-mesenteric border and the site of the ureteric implantation is marked by a stitch at the serosa. The ureter is pulled through a sub-mucosal tunnel and fixed to the bowel mucosa with a ureteric stint.

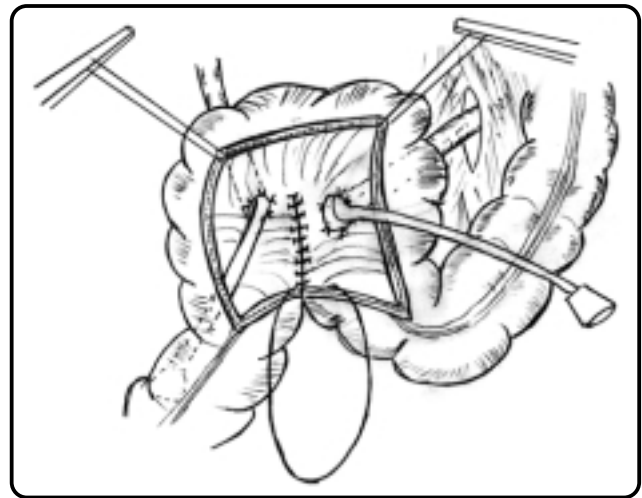


Fig. (2): 10 days postoperative IVU showing the sigma pouch capacity and loss of bowel haustrations with preserved kidney function. The proximal bowel does not show back-wash of dye.



Fig. (3): 6-months postoperative IVU showing a case of rectal bladder urinary diversion. Colonic haustrations are present with dilatation of the upper urinary tract and ureteric kink.



Fig. (4-A): A pouchogram done 20 days postoperative shows the pouch capacity and absence of reflux.



Fig. (4-B) Same case post evacuation. There was no sign of reflux in spite of the raised intra colonic pressure during evacuation and the residual volume was small indicating complete evacuation.



Fig. (5-A): 10 days post operative IVU for a 38 years old lady with bladder cancer treated by anterior pelvic exenteration and Mainz II pouch.



Fig. (5-B): Same lady one year post operative where IVU shows some improvement in the upper urinary dilatation and the persistent wide capacity of the pouch without back wash of dye in the proximal colon.

DISCUSSION

Despite explicit recommendation to abandon ureterosigmoidostomy because of its serious complications and a restricted lifestyle with poor quality of urinary control the affinity of urologists to a rectal urinary reservoir never vanished completely from the literature, recurring in an almost cyclical fashion [9]. Rabinovitch [18] considered its revival in children in the early 1980s and Stockle and his colleagues [20] re-evaluated this forgotten procedure in 1990 questioning its status as an outdated approach.

This time and possibly lasting breakthrough in promoting its renaissance has been the observation that the distressing bowel frequency and urge incontinence in conventional ureterosigmoidostomy are virtually abolished if the recto sigmoid part is detubularized [1,6,10].

The pressure in the intact sigmoid colon can reach up to 200 cm water during defecation and the pressure wave that reach the distal colon with mass movements are approximately 60 to 80 cm water. The high pressure in addition to the less compliance in the colon in comparison to that of the bladder explain the problem of continence and reflux in the different methods of diverting the urine to the colon as in the old ureterosigmoidostomy and the commonly used Hanley's rectal bladder [6-9, 12]. This last reservoir

in addition to its non compliance with significant enuresis had the pitfall of the terminal colostomy and its care.

The first attempt to lower the pressure in the rectal reservoirs was made by Kock and associates [16] when they reported a method of diversion to the rectum augmented by an ileal patch in addition to an intussuscepted nipple valve at the colorectal junction and antireflux implantation of the ureters in the ileal patch. This procedure had two main drawbacks namely complexity of the procedure in addition to the defunctioning colostomy necessary for it [9,10].

Fisch [6-8] introduced the Mainz II pouch as a simple detubularized ureterosigmoidostomy procedure. Detubularization of intestinal segments has been demonstrated to reduce the frequency and amplitude of contractions and allows the creation of a reservoir with the highest capacity for a given length of bowel. The resulting low-pressure system carries a significant lower risk of pyelonephritis and backwash of urine in an antiperistaltic direction [1,4,5,8,17].

The excellent results of other authors (Table 5) can be corroborated by the present series with all patients being continent by day and with perfectly socially acceptable intervals between emptying of the reservoir. The longer follow up will show whether these high rates of continence can be maintained with increasing age.

Table (5): Published series of daytime and night-time Continence in patients with Mainz II pouch.

Study	Year	No. of patients	Continence	
			Day	Night
Fisch et al. [6]	1993	47	47	46
Fisch et al. [8]	1996	73	69	72
El-Damanhoury et al. [4]	1996	51	51	51
Atta [1]	1996	15	15	15
Gilja et al. [11]	1996	18	18	18
El-Mekresh et al. [5]	1997	57	57	53
Woodhouse and Christofides [23]	1998	15	15	14
Gerharz et al. [9]	1998	34	34	33
Obek et al. [17]	2001	60	59	59
This study	2002	21	21	20

Comparing early complications of MM and RB, there was no significant difference except for a higher risk of leakage in MM. This complication was noticed by other authors but with a lesser percentage i.e. 5.3% [5,11,23]. Leakage was noticed in the first 10 cases, but in the next cases no such complication was noted indicating building up experience.

Long term complications had also more or less equal frequency between MM and RB cases. However, pyelonephritis and upper urinary dilatation were both more common in RB cases (9.5% vs. 13%). This could be explained by the high pressure inside RB and the possibility of reflux. This study showed more upper urinary dilatation than other studies but the frequency of metabolic acidosis and pyelonephritis were similar (Table 4). Upper urinary dilatation due to stenotic complication was reported in 19% of cases in other studies, which was attributed to the sub mucosal tunneling [20].

Fisch and colleague [8] reported 11% incidence of late complications on further experience with 73 patients offered MM post cystectomy after a mean follow-up period of 127 months and stenosis at the ureteral implantation site was the most common one (6.8%).

Although urine is stored for a longer time in the rectosigmoid pouch than with the original ureterosigmoidostomy, the surface area available for the resorption of ions is smaller. Even without the intussusception's valve in the rectosigmoid to prevent retrograde colonic urine ascend as suggested by Kock [16] and later by Ghonim and

his co-workers [10], no significant backwash of contrast dye into the rest of the colon has been observed [9,17,23]. Hyperchloraemic acidosis can now be prevented reliably by regular monitoring of the acid-base status and oral administration of alkalinizing agents. Arterial blood gases monitoring was more important than serum electrolyte levels in prediction of impending metabolic acidosis. Patients were put on bicarbonate treatment whenever the base excess decreased below 2.5 mmol/L [9].

The risk of secondary malignancy that may follow the ureterointestinal anastomosis has not been changed by the numerous modifications of ureterosigmoidostomy [9,15,21] with a mean latent period of 26 years and a range of 5 to 53 years [15, 19, 21]. This issue was not important in our present study because most patients were above 45 years and these reported malignancies were noticed after a long latent period. Follow up sigmoidoscopy on regular base is needed to snare any developing polyps [2].

In conclusion Mainz II pouch is a safe, simple and stoma free urinary diversion with excellent continence results and easily manageable complications. It is suitable for our Moslem patients who want to be free of fecal and urine soiling. It is also suitable for the prospective laparoscopic cystectomy and diversion [22].

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