

Orthotopic MAINZ pouch bladder substitution – long-term follow-up

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Introduction After radical cystectomy, orthotopic neobladder is one surgical strategy for urinary diversion. To assess the usefulness of an operation, long-term data are essential. We examined long-term complications and continence rates of orthotopic ileocecal (MAINZ pouch) bladder substitution.

Material and methods Between 1986 and 2011, 193 patients underwent orthotopic MAINZ pouch bladder substitution. Until July 2000, ureter implantation was performed into the ascending colon through a submucosal tunnel technique (Goodwin-Hohenfellner). After July 2000, ureters were implanted into the terminal ileum using the ileocecal valve to prevent reflux: the left spatulated ureter by an end-to-end (Wallace) and the right ureter by an end-to side technique (Nesbit). Surgical and medical follow-up reports were evaluated and a recent follow-up was obtained by a questionnaire.

Results Median follow-up in 183 patients was 72 months (1–336). A total of 74 patients (38%) died during the follow-up. A surgical intervention was required in 26 out of 193 patients with early complications while 45 out of 183 patients had late and 17 patients had both, early and late complications. Ureteral stenosis was found in 13% of submucosal implanted ureters, 13% with the Wallace technique, and 3.6% with the Nesbit technique. In total, 66 patients responded to the questions concerning long-term continence (minimal follow-up >2 years). Overall, 84.8% were completely continent, 1.6%, reported grade I and 9.8% grade II stress incontinence.

Conclusions The long-term continence and complication rates are comparable to those of other types of orthotopic bladder substitution. Orthotopic MAINZ pouch procedure can be considered as one of the options for orthotopic diversion, which stands the test of time.

Key Words: orthotopic bladder substitution ◊ long-term results ◊ bladder cancer ◊ urinary diversion

INTRODUCTION

Orthotopic urinary diversion is a well-established surgical strategy for bladder substitution in patients with bladder cancer. However, long-term data are rarely reported [1–6]. Nevertheless, those data are required to counsel patients. In 1985, orthotopic MAINZ pouch bladder substitution was introduced by Thüroff and colleagues [7].

The MAINZ pouch provides a low-pressure reservoir with good capacity and functional characteristics

that compare favorably with other types of orthotopic bladder substitution [7].

Because of a tedious and time-consuming surgical technique and the submucosal ureter tunnel implantation technique, which is difficult to apply to dilated, irradiated or short ureters, this technique is used in only a few institutions [8, 9]. The surgical technique was later simplified by implanting the ureters into the terminal ileum using the ileocecal valve as an antireflux mechanism [9, 10]. In this study, we examined the long-term complications with

respect to ureter implantation techniques and the late continence rates.

MATERIAL AND METHODS

Indication for an orthotopic urinary diversion was a tumor confined to the bladder, no involvement of the bladder neck and a negative frozen section of the urethral stump. All patients, who underwent orthotopic MAINZ pouch bladder substitution at the Mainz University Medical Center between 1986 and 2011 were included in the study. To obtain a minimum of a two-year follow-up for continence and for late complication rates, questionnaires were sent out in 2013. The medical and surgical reports from the patient's follow-up charts were evaluated for complications and continence.

The surgical technique has been described in detail by Thüroff et al. [7, 9]. Up to June 2000, the ureters were implanted through a submucosal tunnel into the ascending colon part of the pouch according to the Goodwin-Hohenfellner technique [11]. Henceforth, ureters were implanted into the terminal ileum using the surgical technique of Nesbit [12] for the right ureter and the technique of Wallace [9] for the left ureter.

RESULTS

Until 2011, a total of 193 patients, (6 women / 187 men) received an orthotopic MAINZ pouch bladder substitution. The median age at the operation was 59 years (range from 28–78). Three patients had to be excluded because of later conversion into another type of urinary diversion, such as an ileal conduit (n = 2) and a cutaneous MAINZ pouch with a continent umbilical stoma (n = 1). The median follow-up was 72 months (range 0 to 314 months, mean 85.5 months) (Figure 1). Ten patients had a follow-up <3 months. In 6 patients a recent follow-up could not be obtained, because they had moved to an unknown address, 4 patients died within 3 months after surgery from pulmonary embolism or cardiovascular failure. A total of 74 patients were deceased after a mean period of 65 months after surgery (longest survival time 27 years). There was no peak during the follow-up time.

A total of 153 patients (79.3%) developed 134 early (≤ 3 months after surgery) and 154 late complications (> 3 months). In 58 out of 134 patients of the early complications group (Table 1) and in 100 out of 154 patients of the late complications group (Table 2) required surgical revision. Because more than one surgical complication could occur in a single patient, numbers of operative interventions per patient are more

meaningful: 26 of 193 patients with early, 45 of 183 patients with late and 17 patients with both, early and late complications required an operative intervention. In 81 patients the complications occurred within the first year after surgery. One of the most common complication was ureteral stenoses (n = 44).

A total of 14 stenoses (13%) were observed after submucosal tunnel ureter implantation and 30 stenoses after ureter implantation into ileum, of which 3,6% were on the right side (Nesbit technique) and 13% on the left side (Wallace technique) (Table 3). Stenoses occurred after submucosal tunnelling of a median of 4.5 months and after Nesbit and Wallace techniques of a median of 5.5 months (Figure 2).

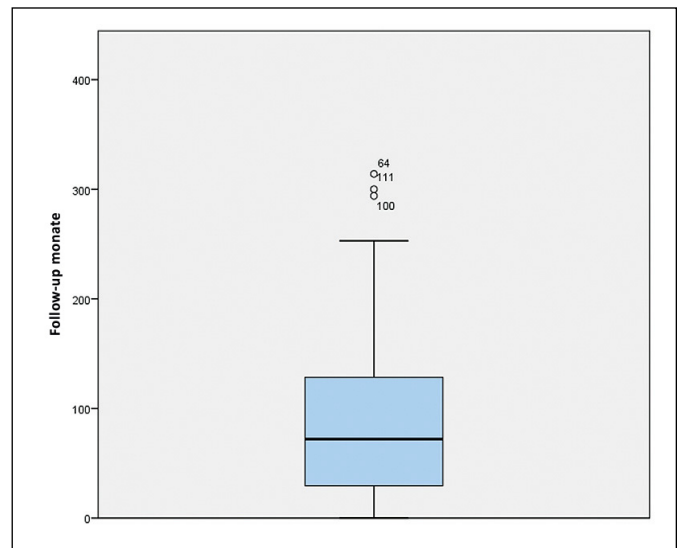


Figure 1. Follow-up period.

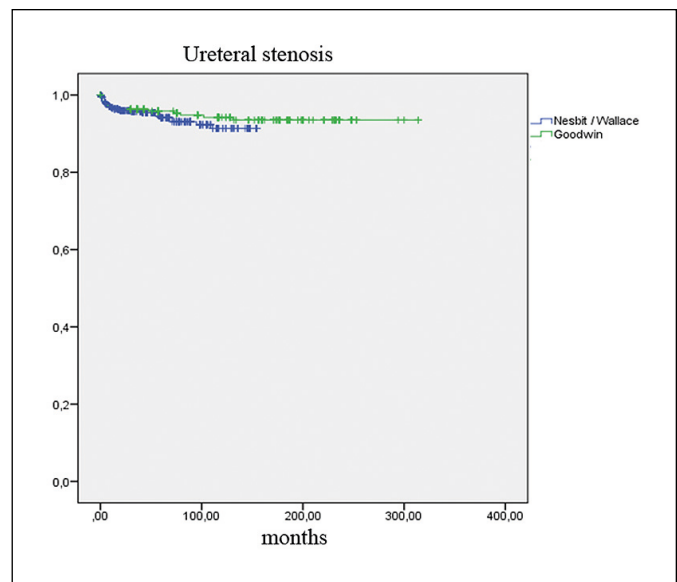


Figure 2. Ureteral stenosis.

Of the 44 ureteral stenoses, ureteral re-implantation was performed in 13 patients (Table 4). Of these, the submucosal tunnel technique had primarily been used in 6 patients and the Nesbit / Wallace technique in 7 patients. Interestingly, of those kidneys requiring nephrectomy, 3.8% were implanted according

to the Wallace-technique (left), and 6.3% to Goodwin on the left. All non-functioning kidneys due to stenosis were on the left side implanted according to Wallace-technique (5.8%).

Sixty-six patients responded to the questionnaire regarding their continence status. Overall, 56 patients

Table 1. Early complications

Early complications	Conservative	Surgical intervention	Unknown	Total
Pouch related complications				
Anastomosis leakage	0	2	0	2
Bladder neck obstruction	1	1	0	2
Metabolic acidosis	2	0	0	2
Pouchitis	2	0	0	2
Poucho-intestinal fistula	0	1	0	1
Pouch leakage	0	2	1	3
Pouch perforation	0	0	1	1
Pouch retention	6	1	0	7
Pouch rupture	0	1	0	1
Pouch-skin-fistula	1	1	0	2
Pouch tamponade	2	1	0	3
Ureteral stenosis	1	8	0	9
Urinoma	0	1	0	1
Urosepsis ureteral obstruction	0	1	0	1
Other complications				
Abdominal phlegmon	1	0	0	1
Acute coronary syndrome	0	1	0	1
Anastomosis insufficiency bowel anastomosis	0	1	0	1
Antibiotic-associated colitis (C. difficile)	1	0	0	1
Burst abdomen	0	6	0	6
Cardiogenic shock	1	0	0	1
Deep venous thrombosis	5	0	0	5
Incisional hernia	0	3	0	3
Ileus	1	3	0	4
Lymphocele	0	15	2	17
Nephrolithiasis	0	2	1	3
Nephrostomy-dislocation	0	1	0	1
Nerve lesion	5	0	0	5
Peritonitis	0	1	0	1
Pneumonia	2	0	0	2
Presbycusis	1	0	0	1
Pulmonary embolism	11	3	1	15
Pyelonephritis	19	0	0	19
Acute renal insufficiency	1	0	0	1
Subileus	5	1	0	6
Symptomatic transitory psychotic syndrome	0	0	1	1
Thrombosis	1	0	0	1
Wound dehiscence	0	1	0	1
Total	69	58	7	134

(84 %) stated that they were continent; whereas 9 patients stated, that they were incontinent (13.6%) and one had to carry out dialysis. Overall, 22 were continent at daytime (33.3%), 9 at night (13.6%) and 25 were continent by day and night (37.9%). However, asking for more details, 1.6% reported a stress incontinence Grade I (urine loss during coughing, sneezing, pressure and / or laughing), 9.8% Grade II (urine loss during lifting, running and/or climbing stairs) and the 9 incontinent patients classified as Grade III (14%) according to the classification of Ingelmann-Sundberg. In a total 8 out of 69 patients emptied their pouch by clean intermittent self-catheterization. All of them were male.

DISCUSSION

Radical cystectomy and urinary diversion after bladder cancer is a time-consuming surgery with high morbidity [13, 14]. Today, minimally invasive

surgery plays an important role in the treatment options for patients with muscle invasive bladder cancer [15]. Early and late complications of other, similarly large study groups seem to be lower than the one in our study. The Mansoura pouch series reports 53 early complications in 42 patients (9%) and 35 late complications in 32 patients (7%) [16], the T-Pouch series reports 63 early (30%) and 68 late complications (32%) [2]. In Ulm 86 early (24%) and 94 late complications (26%) were reported while in Berne 92 early (19%) and 164 late complications (34%) [5]. However, in these studies mostly urinary diversion related complications were recorded. In our study, we counted every complication (surgical & nonsurgical; pouch related and non-pouch related) that occurred up to three months after the operation as an early complication. All subsequent complications were counted as late complications. This leads to higher complication rates, namely 134 early complications (45.3%) and 154 late complications

Table 2. Late complications

Late complications	Conservative	Surgical intervention	Unknown	Total
Pouch related complications				
Bladder neck obstruction	0	20	0	20
Pouchitis	1	1	0	2
Pouch stone	0	3	0	3
Pouch perforation	0	1	0	1
Pouch retention	11	6	0	17
Pouch tamponade	3	0	0	3
Ureteral leakage	0	2	0	2
Ureteral stenosis	0	33	2	35
Other complications				
Cardiovascular failure	1	0	0	1
Chologenic diarrhea	1	0	0	1
Ileus	0	3	0	3
Incisional hernia	1	16	3	20
Lymphocele	0	1	0	1
Nephrolithiasis	2	3	0	5
Nephrostomy-dislocation	0	3	0	3
Pyelonephritis	22	1	0	23
Renal failure	1	0	0	1
Renal insufficiency	0	2	0	2
Subileus	2	2	1	5
Urethral polyp	0	1	0	1
Wound dehiscence	0	1	0	1
Urethral stenosis	3	0	0	3
Unknown	0	1	0	1
Total	48	100	6	154

Table 3. Ureteral stenosis according to the implantation technique

	Goodwin	Nesbit/ Wallace	Goodwin both sides	Wallace left	Nesbit right	Unknown Wallace/Nesbit
Patients	54	139				
Number of ureter implantations	108	278	108	139	139	
Number of ureteral stenosis	14	30	14	18	5	7
Ureteral stenosis in percentage (%)	25.93	21.58	12.96	12.95	3.60	5.04

Table 4. Surgical intervention for ureteral stenosis according to the implantation technique

Surgical intervention	Nesbit/Wallace	Goodwin	Total
Unknown	2	0	2
Conservative	0	2	1
Nephrostomy	8	4	12
Nephroureterectomy	2	0	2
Reimplantation	7	6	13
Nephrectomy	2	1	3
Balloon dilatation	0	1	1
Ureterolysis	1	0	1
Ureteral stent	7	0	7
Ureteral replacement	1	0	1
Total	30	14	44

(52%). Another factor contributing to these differences are the definitions of early complications and late complications. In the Mansoura pouch series, early complications were assessed within the first three weeks and late complications after discharge from the hospital. The T-pouch series counted early complications within the first 30 days. From Ulm and Bern similar periods as the Mansoura and T-pouch series can be assumed [2, 5, 16]. The same applies to late complications, considering that both the follow-up (median 72 months) (Figure 1) and the entire study period of our study was significantly longer (27 years) as compared to other study collectives (T-pouch: study period 4 years, median follow-up 33 months, Mansoura: study period 8 years, median follow-up 38 months, Ulm /Berne study period 20/22 years).

A total of 44 ureteral stenoses were observed. A total of 8 were treated within the first three months, and 33 later on. One of the most common early and late complications in the Ulm series was ureteral stenosis [(11) 3% and 43 (9.3%)]. These complications were less common in the Berne series. Especially at the early study series there was a higher rate of ureteral stenosis in Ulm (9.3%) as compared to Bern (2.7%). This was attributed to the Le-Duc antireflux technique [17] used in Ulm, which was also described

in the study by Pantuk et al. [18]. In 1997, Hautmann changed the technique with a drop of the ureteral stenosis rate in the Ulm collective to 2% [5, 18] over a shorter follow-up period. In the Mansoura-pouch series, 7 out of 32 patients (21.8%) had hydronephrosis due to ureteral stenosis as a late complication [16]. In the T-pouch series Stein and colleagues from California USA described 9 ureteral stenoses (13.2%) as late complications; in one case the stenosis was due to a tumor recurrence [2]. For those receiving a ileal conduit for urinary diversion, a meta-analysis showed in 14 out of 126 prospective followed patients a ureteral stenosis in 11% (median; 9–12%) and in 131 out of 1625 retrospective followed patients in 7% (median; 1–100%) [19].

In our series, there was almost no difference in the number of stenoses between the ureters implanted according to the Goodwin (12.96%, both sides) and those according to the Wallace technique (12.95% left side). In contrast, only 3.6% of ureteral stenoses were observed on the right side with the implantation technique of Nesbit. If this difference is due to the assumption of Nesbit that the spatulated, elliptically sewn ureter end-to-side anastomosis has the least complications [12], or rather related to an impaired capillary blood flow at the end of the left ureter due to its longer distance to the implantation site as well as a more extensive mobilization with pull-through of the ureter below the mesentery and above the great vessels to the right side, cannot be determined from our study. The latter explanation seems to be more likely, but it can only be proven in a prospective randomized study. The type of surgical intervention for ureteral stenosis in our series was depending on the surgeons and patient's preference. Whenever possible, a ureteral reimplantation was performed.

Concerning continence, similar results were reported in other studies: after 12 months, 92% of Bernese patients reported being continent during the day and at least 79% at night [5]. In Mansoura, 93.3% reported being completely continent during the day, 80% at night. The continence of the T-Pouches amounted to 87% with good continence during the day, at night 72% stated to be continent

[2, 16]. Furrer and colleagues showed, that in the Berne series the highest continence rates of 92% were achieved after two years. They were able to show that the continence achieved only slightly deteriorated over time; 92% up to 10 years, 90% up to 15 years and 75% beyond 15 years [20]. In our study 8 out of 69 patients were on clean intermittent self-catheterization. All of them were male. We could not detect a relationship between the patients age at the time of surgery and clean intermittent self-catheterization.

Comparison of continence rates between the different series is difficult; e.g. the intervals between surgery and the follow-up interviews were different. In Bern, patients were evaluated almost every year in a systematic way [5], whereas in our study - due to our health care system, in which the patients are usually followed by local doctors rather than the hospital - intervals were not consistent. However, we applied a very strict questionnaire and used

a minimum follow-up for the continence questionnaire of 2 years.

CONCLUSIONS

The high complication rate is most likely related to the cystectomy. One of the most common pouch related complication was ureteral stenosis. The number of stenoses decreased significantly after the change of implantation techniques in the middle of the year 2000. The higher rate for the left ureter is most likely due to ischemia of the longer and more mobilized left ureter. The long-term continence and complication rates are comparable to those of other types of orthotopic bladder substitution. Orthotopic MAINZ pouch procedure can be considered as one of the options for orthotopic diversion, which stands the test of time.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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