Ileal Orthotopic Bladder Replacement without Stenting of the Ureterointestinal Anastomosis-10 Years Observation

Abstract

Background: Stenting of ureterointestinal anastomosis is a standard precautionary measure, irrespective of the method of constructing the anastomosis; however no convincing scientific data exists to support this procedure.

Objective: Clinical assessment of patients - radical cystectomy and ileal orthotopic bladder replacement without requirement for stenting of the ureterointestinal anastomosis or suprapubic cystostomy.

Design, Setting, and Participants: To establish feasibility of ureterointestinal anastomosis without stenting. 426 radical cystectomies were performed between 1999 and 2009.

Intervention(s): Ileal orthotopic bladder replacement with afferent loop was performed in 124 patients.

Measurements: The following were evaluated: frequency of postoperative symptomatic urinary tract infections, duration of peritoneal drainage, length of hospitalization, duration of surgery, number of ureteral strictures type and number of major perioperative complications.

Results and Limitations: Symptomatic pyelonephritis was observed in 10 patients (8%). The mean surgical time was 6.0 hours (4.5-9.0). The mean time of hospitalization was 14.1 days (7-40). Ureterointestinal anastomosis strictures were observed in 7 patients (5.6%). Major postoperative complications were observed in 12 patients (9.7%). Limitations: This is retrospective study without the control group.

Conclusions: Meticulous and atraumatic ureterointestinal anastomosis and efficient urine and mucus evacuation from the reservoir in our experience, removes the requirement for stenting of the ureterointestinal anastomosis.

Keywords: Cystectomy; Orthotopic bladder; Bladder cancer; Ureter; Stents

Introduction

Radical cystectomy is a standard procedure in invasive urinary bladder cancers and in superficial high-risk cancers. The ileal orthotopic bladder replacement is the most efficient way to reconstruct the urinary tract, both in women and in men [1-4]. Methods for orthotopic bladder construction described in literature recommend stenting of the ureterointestinal anastomosis as a standard precautionary procedure, irrespective of the method of constructing the anastomosis [5-21]. The rationale for stenting of the anastomosis includes protecting from the consequences of urine extravasation, and facilitating the fusion of intestinal and ureteral mucosa. Additionally, a tortuous ureter and oedema at the anastomotic site can lead to upper tract urinary stasis and both can be mitigated by preoperative stenting.

Furthermore, the evacuation of urine and retained mucus from the ileal reservoir is efficiently dealt with by the suprapubic cystostomy. Optimal duration of stenting remains a topic of much debate and suggestions from several author ranges from 7 to 14 postoperative days [5-21]. The procedure of radical cystectomy with orthotopic bladder replacement carries a high risk of complications, mostly in the early postoperative period. According to the data available in the literature, the risk of early complications is 23-27% [22-24]. One of the most common complications is acute pyelonephritis, which is observed in 1.3 -12.3% of patients [25-27]. Factors that predispose to the infection of the upper urinary tract are stents left in-situ and the necessity of regular and repeated flushing of the reservoir in the postoperative period [28,29].

Urine leakage which does not require reoperation is observed in 0.3-6.6% of cases [25,26]. Ureterointestinal anastomosis stricture as a late complication is observed in 2.2-11.6% of patients [25,26]. The frequency of major complications, such as death, myocardial infarction, pulmonary embolism, septic shock, respiratory insufficiency or reoperation is 4.9-5% [25,35]. Improvements in operative techniques and perioperative care have led to a reduction in the rates of complications post-radical cystectomy. Routine stenting of the ureterointestinal anastomosis has not been universally accepted and reports from transplantation cases have demonstrated higher risk of infection in comparison with the group of patients in whom stenting was not performed. According to some reports, stenting of the ureterointestinal anastomosis should be restricted to a selected group of patients [36-38].
The number of studies on ureterointestinal anastomosis without stenting is limited, and their conclusions are ambiguous [39,40]. In our opinion, refraining from stenting of the ureterointestinal anastomosis lowers the risk of upper urinary tract infections, reduces both surgical time and hospital stay and improves postoperative recovery without exposure of the patient to any additional risk of complications.

Clinical evaluation was performed on a group of patients in whom neither stenting of ureterointestinal anastomosis nor suprapubic cystostomy was performed.

Materials and Methods

There were 426 cystectomies performed between June 1999 and December 2009 in the Department and Clinic of Urology in Wroclaw, Poland. In 124 patients, ileal orthotopic bladder replacement with afferent loop was performed. Stenting of the ureterointestinal anastomosis was not performed in any patient in the observed group. The detailed characteristics of the studied population, including age, sex, TNM staging and histological type of tumor are presented in Table 1.

The following were evaluated in the studied group:

I. Frequency of symptomatic urinary tract infections
II. Time of maintaining the peritoneal drainage
III. Incidence of the postoperative stricture of the ureterointestinal anastomosis
IV. Duration of surgery
V. Number of days of postoperative hospitalization
VI. Number of major complications in the postoperative period.

a) Acute pyelonephritis was diagnosed by the presence of fever above 38°C in the postoperative period. Other potential causes of postoperative bacteraemia including pneumonia, peritonitis, wound infection, phlebitis and epididymitis were excluded. MSU was sent for culture in all patients with fever.

b) Peritoneal drains were removed when the amount of drained fluid did not exceed 50 mL on two consecutive days. In cases that required peritoneal drainage for over 14 days, the measurement of creatinine concentration in the fluid was performed to differentiate the presence of urine and lymph.

c) Ureterointestinal anastomosis stricture was diagnosed by intravenous pyelogram. The examination was performed only subsequent to demonstration of upper tract dilatation on an ultrasound performed with an empty intestinal orthotopic bladder.

d) Duration of the surgery was measured from the moment of the incision of the abdominal wall to its closure.

e) Time of hospitalization was measured in days, excluding the day of surgery.

f) Major postoperative complications included death, myocardial infarction, pulmonary embolism, septic shock, respiratory insufficiency and the need for early reoperation (up to 30 days after cystectomy).

| Total number of patients | 124 |
|--------------------------|-----|
| Age [years]              |     |
| Median                   | 60  |
| Range                    | 14-77|
| Number of Women (%)      | 10 (8)|
| Men (%)                  | 114 (92.0)|

| Histological Grade       |     |
|--------------------------|-----|
| G0 (%)                   | 2 (1.6)|
| G1 (%)                   | 5 (4.0)|
| G2 (%)                   | 28 (22.6)|
| G3 (%)                   | 84 (67.7)|
| Not evaluated            | 5 (4.0)|

| Histological type of tumor |     |
|---------------------------|-----|
| Urothelial carcinoma (%)  | 107 (86.3)|
| Anaplastic carcinoma (%)  | 3 (2.4)|
| Neumendocrine carcinoma (%)| 3 (2.4)|
| Planeopithelial carcinoma (%)| 1 (0.8)|
| Urothelial + planeopithelial carcinoma (%)| 5 (4.0)|
| Adeno-carcinoma (%)       | 2 (1.6)|
| Angiogenic sarcoma (%)    | 1 (0.8)|
| Aggressive fibromatosis    | 1 (0.8)|
| Urinary bladder cirrhosis | 1 (0.8)|

| Number of pts with tumor stage |     |
|-------------------------------|-----|
| CIS (%)                       | 6 (4.8)|
| T0 (%)                        | 15 (12.0)|
| T1 (%)                        | 17 (13.7)|
| T2a (%)                       | 17 (13.7)|
| T2b (%)                       | 25 (20.2)|
| T3a (%)                       | 10 (8.0)|
| T3b (%)                       | 18 (14.5)|
| T4 (%)                        | 15 (12.0)|
| Tx (%)                        | 1 (0.8)|

| Number of patients |     |
|--------------------|-----|
| No regional lymph node involvement N0 (%)| 103 (83.0)|
| Involvement of regional lymph nodes N+ (%)| 20 (16.1)|
| Not evaluated (%) | 1 (0.8)|

| Number of patients |     |
|--------------------|-----|
| No distant metastasis M0 (%)| 122 (98.4)|
| Distant metastasis present M1 (%)| 2 (1.6)|

| Number of patients |     |
|--------------------|-----|
| Presence of preoperative hydronephrosis (%)| 36 (29)|
| No preoperative hydronephrosis (%) | 88 (71)|

| Time of observation (months) |     |
|-------------------------------|-----|
| Mean                          | 24.7|
| Range                         | 0.25-68|
Cystectomy with bilateral pelvic lymph node dissection was performed in all patients. Orthotopic bladder with afferent loop was created from the ileum. In all patients an S-shaped reservoir was formed. In all patients, the ureterointestinal anastomosis was created with end-to-side method with continuous monofilament 5.0 suture. Suprapubic cystostomy was not used in the observed group. Couvelaire catheter size Ch 22 with additional side apertures was left in the intestinal reservoir, allowing the drainage of urine and intestinal mucus.

In the postoperative period the greatest attention was paid to the hourly diuresis by noting down the urine volume every 2-3 hours. Lack of urine or low urine volume with appropriate hydration of the patient was an indicator of a mucus or clot blockage in the catheter. A simple massage of the catheter was in these cases a sufficient maneuver to restore the urine flow. Patients did not require a routine flushing of the reservoir. The Couvelaire catheter was removed on the 21st day after surgery.

In all patients, peritoneal suction drainage with Redon drains was performed. Two drains were left in the area of the ureterointestinal anastomosis and one in the area of ureterointestinal anastomosis. In all patients, a similar antibiotic treatment plan was used - cephalosporin plus metronidazole for seven days after surgery. In every patient the urine culture was obtained before the surgery.

**Results**

a. Pyelonephritis was diagnosed in 10 patients (8%) (Table 2).

**Table 2: Results of urinary culture in patients with symptoms of urinary tract infection.**

| Type of bacteria    | Number of patients |
|---------------------|--------------------|
| Enterococcus fecalis| 9                  |
| Sterile             | 1                  |

b. Symptoms of pyelonephritis were on average first observed on day 10 (range: 7-15) (Table 3).

**Table 3: The beginning of infection after surgery.**

| Group   | n [days] | S [days] | Me [days] | $x_{min}$ [days] | $x_{max}$ [days] |
|---------|----------|----------|-----------|------------------|------------------|
| Group A | 5        | 10.0     | 1.9       | 10               | 7                |

n: number; - mean; s: standard deviation; $x_{min}$: minimal value; $x_{max}$: maximal value

c. Mean time of surgery was 6.0 hours (4.5-9.0) (Table 4).

**Table 4: Duration of surgery.**

| Group   | n [days] | S [days] | Me [days] | $x_{min}$ [h] | $x_{max}$ [h] |
|---------|----------|----------|-----------|---------------|---------------|
| Group A | 124      | 6.0      | 1.1       | 6.0           | 4.5           |

n: number; - mean; s: standard deviation; Me: median; $x_{min}$: minimal value; $x_{max}$: maximal value; h: hours

d. Mean duration of peritoneal drainage was 7 days (range: 3-40) (Table 5).

**Table 5: Duration of peritoneal drainage.**

| Group   | n [d] | S [d] | Me [d] | $x_{min}$ [d] | $x_{max}$ [h] |
|---------|-------|-------|--------|---------------|---------------|
| Group A | 124   | 9.1   | 6.2    | 7             | 3             |

n: number; - mean; s: standard deviation; Me: median; $x_{min}$: minimal value; $x_{max}$: maximal value; d: days

e. Postoperative days of hospitalization averaged 12 days (range: 7-40) (Table 6).

**Table 6: Duration of hospitalization after surgery (d-days).**

| Group   | n [d] | S [d] | Me [d] | $x_{min}$ [d] | $x_{max}$ [h] |
|---------|-------|-------|--------|---------------|---------------|
| Group A | 122*  | 14.1  | 6.1    | 12            | 7             |

n: number; - mean; s: standard deviation; Me: median; $x_{min}$: minimal value; $x_{max}$: maximal value

*Two patients died in the 1st and 7th day after the surgery.

Major complications were observed in 12 patients (9.7%): 1 death on the 6th day after surgery due to pulmonary embolism, evisceration (1 pt), dehiscence of the intestinal anastomosis (3 pts), lymphorrhea requiring additional drainage (2 pts), urine leakage and the need for reoperation (2 pts), fistula between the intestinal reservoir and vagina in 2 patients (surgical correction), myocardial infarction (1 pt).

**Discussion**

Ureteral stents are commonly used in everyday urology practice, although there use is not free of complications. The main purpose of stenting the ureterointestinal anastomosis is to mitigate the consequences of urine leakage and upper urinary tract urinary stasis both of which can be a consequence of kinking of the ureter or temporary edema at the level of the ureterointestinal anastomosis. On the basis of a number of clinical and experimental studies, it has been shown that maintaining the ureteral stents for more than 7 days predisposes to a deleterious consequence, including epithelial metaplasia, incrustation of the ureteral mucosa, stone formation, and edema ulceration of the mucosa and development of moderate hydronephrosis [41-43].

Stents left in the urinary tract in order to facilitate urine flow, may in the postoperative period paradoxically predispose to infectious complications. Reid’s study demonstrated that the mechanism for this ascending urinary tract infection is facilitated bacterial colonization of the stent’s surface [28,29]. In patients with intestinal orthotopic bladder, the small intestine mucosa is the focus of bacterial colonization [29-31,44]. Draser et al. [45] have shown the presence of over 10000 microorganisms per 1 milliliter of healthy ileal intestine. Significant bacteriuria is observed in most patients in whom an intestinal segment was used for reconstruction of the lower urinary tract [33-38].

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patients within a month [39,40,56-59]. In the 1950s, Kass [54]
showed that maintaining the catheter in the bladder in the open
system facilitates urinary tract infections and the presence of
bacteriuria was confirmed by the author in a 100% of patients
after only 4 days. It is worth mentioning that in patients with
orthotopic bladder with maintained ureteral stents there is a need
for systematic flushing of the reservoir (every 3-4 hours) in the
open system, which facilitates ascending urinary tract infection
[60-61]. Ramsay & Nickel [28,62-63] have shown the presence of
bacterial biofilms on the surface of all catheters which were left in
the bladder for more than 7 days. The additional factor favoring
upper urinary tract infection is the retrograde flow of infected
contents, which takes place during the essential postoperative
reservoir flushing. The stents left in the urinary tract undoubtedly
facilitate this process.

Iwakiri [59] has shown that many patients with orthotopic
bladder and pyuria had negative urine cultures. Therefore, in
patients with intestinal segment used for the reconstruction of
the urinary tract, a urinary tract infection cannot be diagnosed
solely on the basis of leukocyturia. The studies of Suriano et al.
[56] confirm this. They demonstrated inversely proportional
relations between the number of leukocytes in urine and the
number of bacteria in the urinary culture. A small number of
leukocytes with a positive urine culture are explained by the
tolerance of the intestinal epithelium to bacterial pathogens, (E.
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analysis in children after Bricker’s surgery, Bishop has shown the
presence of multiple intestinal epithelial cells, which in routine

Urine culture obtained at the moment of removal of the
catheter from the intestinal reservoir; approximately 3 weeks
postoperatively, is positive in all patients [31,39-41]. This should
be linked to a prolonged presence of a fomite; the catheter in the
urinary tract and the need for systematic flushing of the reservoir
in the postoperative period. Bacteriuria is usually asymptomatic
and does not require treatment. Routine use of antibiotics in
asymptomatic patients with positive urine culture (over 100,000
bacteria per 1 ml of urine) may lead to selection of highly resistant
pathogens, difficult to eradicate in case of a symptomatic urinary
tract infection or urosepsis. Therefore, it is not recommended
[29,33,42-44].

Reid et al. [45] was the first to demonstrate the formation of
biofilms on the ureteral stents and he confirmed the presence of
bacterial colonies on the surface of 90% of silicone double-J
stents, although clinical symptoms were observed in only 27%.
Subsequently, Farshi has confirmed the presence of bacterial
colonies on the surface of 68% of ureteral stents; although in only
30% of patients was the urine culture was positive [28,29,45].
This author has also shown the correlation between the urinary
tract infection and the duration of ureteral stenting [46-49].
Lifshitz [9] has confirmed the presence of bacterial colonies on the
surface of 28-90% of ureteral stents and significant bacteriuria
in only 7-34% of patients. Therefore, a negative urine culture
does not exclude the presence of bacteria on the surface of the
stents. Additionally, the author has shown that prophylactic use of
antibiotics does not impede bacterial adherence to the surface of
the ureteral stents [50-55]. Liedl & Hofstetter [52,53] have shown
that each day of maintaining the catheter in the bladder in a closed
system (catheter-bag) increases the risk of urinary tract infection.

On this basis bacteriuria will be present in almost a 100% of
patients within a month [39,40,56-59]. In the 1950s, Kass [54]
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reservoir flushing. The stents left in the urinary tract undoubtedly
facilitate this process.

Similarly, Gittes [66] observes the possibility of two dangerous
consequences of the use of the stents. Firstly, there is a risk of
blocking the stent by mucus or a blood clot and impeding the urine
flow from the upper urinary tract. Secondly, the direct contact of
the rigid stent with the ureter wall in the area of anastomosis
may cause ischemia and late strictures. In a prospective study
evaluating two groups of patients-with and without stents-Mattei
has observed three cases of strictures in the group of stented
patients. These results have not been statistically significant, due
to a small number of patients in the studied groups (29 and 25
patients) [67]. Statistically significant differences were observed
in cases of better draining, quicker improvement of intestinal
peristalsis and lower frequency of metabolic acidosis in the group
with ureterointestinal anastomosis stents [68].

The urine leakage is improved by good operative technique
and efficient drainage of urine from the reservoir. In the group of
patients without stenting of the ureterointestinal anastomosis, a
Couvelaire catheter with additional side apertures was left in the
orthotopic bladder. This catheter allows for efficient flow of urine
and intestinal mucus. In light of the presented data, we contend
that the routine use of ureteral stents for the supposed facilitation
of urine flow is often unnecessary.

The authors found three publications in the urological
literature which mentioned that the stenting was not always
required after ileal bladder replacement [39,69]. In the authors’
opinion, meticulous and atraumatic ureterointestinal anastomosis

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and efficient evacuation of urine and mucus from the reservoir (facilitated by the use of a Couvelaire catheter with additional side apertures and regular 2 hourly diuresis), in our experience, obviates the requirement for stenting of the ureterointestinal anastomosis.

**Take Home Message**

Meticulous and atraumatic ureterointestinal anastomosis and efficient evacuation of urine and mucus from the reservoir (facilitated by the use of a Couvelaire catheter), in our experience, obviates the requirement for stenting of the ureterointestinal anastomosis.

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