



# Long-Term Outcome and Quality of Life in Patients after Conversion of the Ileal Conduit to Abdominal Continent Ileal Reservoir

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## Abstract

**Purpose:** To investigate the long-term outcome and Health-Related Quality of Life (HRQoL) in patients after conversion of the ileal conduit to abdominal continent ileal reservoir.

**Methods:** From June 2001 to November 2007, 10 patients with Bricker conduit underwent a procedure to convert their existing ileal conduit to abdominal continent ileal reservoir. The patients' own opinions about their reservoir function and HRQoL (SF-36) were assessed during follow-up. In addition, urodynamic study of the efferent tubes and pouch was performed at three and 12 months post-op.

**Results:** All patients successfully underwent the operation without perioperative complications and were followed for 102 to 180 months (mean 142 months). All patients expressed satisfaction with the reservoir function and preferred the abdominal continent reservoir compared to previous ileal conduit. Eight patients were continent day and night. All patients had stable renal function and metabolic balance. There was no significant difference in six of the eight scales of SF-36 between patients and general population in china ( $p>0.05$ ). The urodynamic study showed that the maximum close pressure of the tapered ileum was significantly higher when the pouch was full than when it was empty at both three and 12 months ( $p<0.05$ ).

**Conclusion:** Our study indicated that patients with abdominal continent reservoir had a good long-term outcome and HRQoL. The abdominal continent reservoir is a therapeutic option when patients require conversion from an incontinent type of urinary diversion to continent type.

**Keywords:** Urinary diversion; Quality of life; Continent; Urinary reservoir; Ileal conduit

## Introduction

Urinary diversion is one of common surgical approaches in urology. In 1950, Bricker first described the ileal conduit urinary diversion, which has become the standard for urinary diversion during the last 30 years [1]. However, patients with ileal conduit have to wear cumbersome collection devices all of the time and urine leakage often leads to skin erosion around the abdominal stoma, which not only inconveniences patients, but also influences patients' body image, sexual attractiveness and sexual performance. Thus, the ileal conduit was not acceptable for every patient requiring urinary diversion.

In 1982, Kock et al. initially described the continent ileal reservoir with low pressure as an approach for urinary diversion [2]. The emergence of the continent ileal reservoir was an important turning point for the conversion of urinary diversion approaches. Thereafter, several techniques using a continent reservoir have been described [3-7]. In the present study, we reported a technique for converting an existing ileal conduit to abdominal continent reservoir and evaluated the long-term outcome and quality of life in patients with conversion to abdominal continent reservoir.

## Materials and Methods

### Patients

From June 2001 to November 2007, 10 patients (eight men and two women) with Bricker conduit after cystectomy due to malignant (N=7) and benign (neurogenic bladder, N=3) underwent a conversion procedure of their ileal conduit to abdominal continent ileal reservoir. The median age at operation was 55.7 years (range, 32-68 years). The patients had a two to 18 years (median

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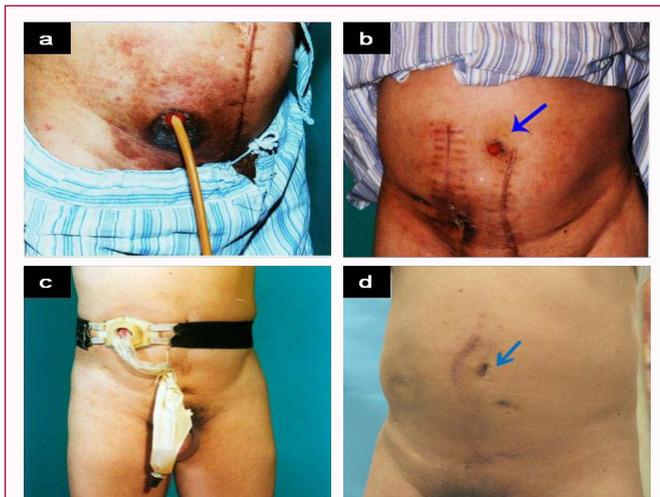
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**Figure 1:** a) Severe skin erosion due to urine leakage around the abdominal stoma. b) Skin erosion has been cured at one month postoperatively; A stoma at the umbilical hole and complete continence has been achieved day and night (arrow). c) The abdominal appearance of a patient with severe neurogenic bladder before the continent ileal reservoir. d) Good appearance of an abdominal stoma after the conversion of an ileal conduit to a continent reservoir 12 years postoperatively and with complete continence day and night (arrow).

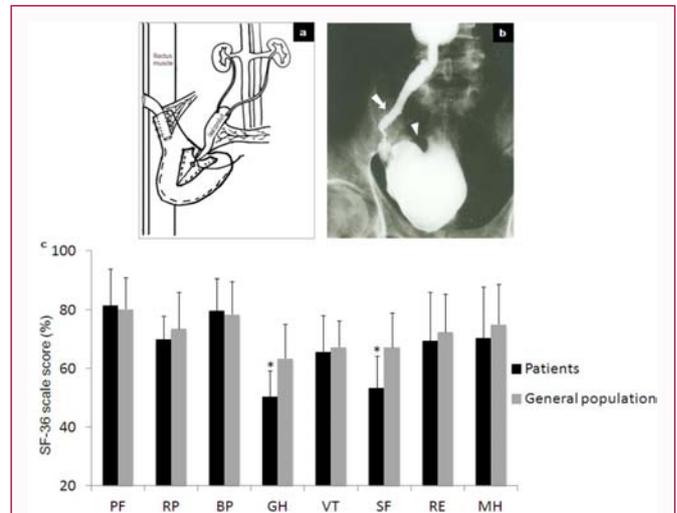
six years) history of Bricker conduit. Of the 10 patients, seven had several complications, including renal insufficiency due to adhesive obstruction of the intestinal segment in three patients, repeated retrograde urinary infection and high fever due to obstruction of the ileal conduit at the abdominal part in three patients and severe skin erosion due to urine leakage around the abdominal stoma in one patient (Figure 1a); The remaining three patients hated wearing the urine collection devices (Figure 1c).

**Surgical technique**

The ileal conduit of the abdominal wall was resected, and the remaining conduit, approximately 20 cm in length, was freed from the abdominal wall and divided into two vascularized segments (14 cm and 6 cm). The distal conduit (14 cm) was detubularized. A new 35 cm long ileal loop with the blood pedicle isolated from the intestinal tract was divided into two vascularized segments (25 cm and 10 cm), and the 25 cm segment was detubularized. The detubularized ileal segment was anastomosed with the detubularized conduit to form a new U-shape pouch. A 5-6 cm segment of the proximal conduit, which was approximately 4 cm away from the ureteroileal anastomosis, was tapered over a 22 Fr catheter and replanted into the U-shape pouch by an extramural serous lined tunnel (Figure 2a). The short 8 cm to 10 cm ileal segment was tapered over a 16 Fr catheter constructed with an efferent tube. An end of the tapered ileum was anastomosed to the pouch by an end-to-side all layer procedure using an interrupted 4-zero polygalactin suture. The other end of the tapered ileum was then brought out to the umbilical hole to form a stoma (Figure 2a). The enhanced continent mechanism technique has been described previously [7]. Briefly, a portion of the tapered ileum approximately 4 cm long was embedded and fixed between the tubular segment of the pouch and the abdominal wall by a 3-zero nylon sutures passing through the mesenteric windows of the tapered ileum (Figure 2a).

**Follow-up**

Ureteral drainage tubes (8 Fr single-J-tubes) were removed 10



**Figure 2:** a) The tapered ileal conduit was replanted into the U-shape pouch by an extramural serous lined tunnel and the tapered ileal segment was fixed between the back surface of the rectus muscle and the ileal pouch wall. b) Retrograde radiography of the efferent tube and the pouch demonstrated that the efferent tube was fixed straight between the abdominal and pouch wall (white arrow), and there was no contrast medium in the ureters (arrow head). c) A comparison of the SF-36 scores among patients with continent reservoir and the general population of the china. \*Significantly lower than the general population (P<0.05).

days postoperatively and the pouch was maintained on drainage (16 Fr catheters) for 21 days. All patients regularly took sodium bicarbonate (1 g each time, twice a day) for one to two years postoperatively, especially for patients with preoperative renal dis function. All patients were followed every three months for the first 12 months, and every one to two years thereafter. Follow-up testing included blood gas analysis, blood renal function, serum electrolytes, upper urinary tract ultrasonography, abdominal plain film, and Intravenous Urogram (IVU). Urodynamic study, retrograde radiography of the efferent tube and radiography of the pouch were postoperatively performed at three months. The urodynamic study was postoperatively performed again at 12 months.

A questionnaire survey was carried out to assess the patients' own opinions on their reservoir function and Health-Related Quality of Life (HRQoL) at an outpatient clinic at least 12 months after conversion from ileal conduit to continent reservoir. The questionnaire survey included two questionnaires. One questionnaire included questions about reservoir function and reservoir-related problems. The other was the Short Form-36 survey (SF-36) to assess the HRQoL. The SF-36 contains 36 questions assessing eight aspects of HRQoL, including Physical Functioning (PF), Role-Physical Functioning (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-Emotional Functioning (RE) and Mental Health (MH). Each question is given a score of 0-100 and a mean score obtained for each scale (range 0-100). The higher the score, the better the result [8].

**Statistical analysis**

The data were presented as the mean ± Standard Deviation (SD). Data comparisons between the groups were analyzed using the paired Student two-tailed t-tests. Differences were considered statistically significant at P values <0.05.

**Results**

All patients successfully underwent the operation without

**Table 1:** Patients' opinions of their reservoir function and reservoir-related problems.

All patients	
Reservoir function	
Total	10
Very good	7
Good	3
Less good	0
Poor	0
Leakage	
Total	10
Never	8
Seldom	0
Sometimes	2
Often	0
Always	0
Catheterization problems	
Total	10
Never	8
Seldom	2
Sometimes	0
Often	0

perioperative complications. Two patients died of cancer metastasis six and seven years postoperatively, and all patients were followed for 102 to 180 months (mean 142 months). All patients expressed satisfaction with the reservoir function (Table 1). Eight patients were completely continent day and night at 4 hr to 5 hr intervals, with urine production less than 400 ml, while only two patients were partially incontinent during sleep, with more than 400 ml of urine produced. However, the two patients who had some leakage problems did not change the stomal pad between the catheterizations. All patients reported never or seldom experiencing stomal catheterization problems (Table 1). Good appearance of abdominal stoma after conversion of the ileal conduit to a continent reservoir was found in all patients (Figure 1b and 1d). All patients preferred the abdominal continent reservoir compared with the previous ileal conduit.

IVU revealed normal upper tracts in all patients. Blood renal function became totally normal postoperatively in three patients with preoperative renal insufficiency. The results of the repeated renal function indicated that serum creatinine increased somewhat with longer follow-up in seven patients, but it remained within the normal range at all times. Additionally, after the slight increase at three months postoperatively in six patients, the chloride levels remained stable during follow-up. The acid-base balance was assessed by base excess from blood gas analysis and the values were in the normal range in all patients during the follow-up. Clinical manifestations due to serum electrolyte disorder and metabolic acidosis were not observed in any of the patients, and the serum potassium and sodium were normal during follow-up.

Mean score obtained for each scale of SF-36 for patients and for sex-and age-matched general population of china was showed in (Figure 2c). Mean scores for GH and SF in patients were significantly low compared to those in the general population ( $p < 0.05$ ). However, there was no significant difference in other six scales between patients

and general population ( $p > 0.05$ ).

At three months postoperatively, retrograde radiography of the tapered tube demonstrated that the tube was fixed straight between the abdominal and pouch walls without stenosis. Radiography of the pouch at a gravity pressure of 50 cm. water showed no contrast medium in the ureters (Figure 2b). Urodynamic analysis showed that the maximum closure pressure (MCP) for the efferent tube was 48 cm to 84 cm water (mean  $69.00 \pm 10.92$ ) when the pouch was empty. When the pouch was filled with saline, the MCP was 82 to 114 cm. water (mean  $96.60 \pm 9.17$ ) (Table 2). The difference in the mean MCP between the empty and full pouch was statistically significant ( $p < 0.05$ ).

At 12 months postoperatively, urodynamic analysis showed that the reservoir capacity was 360 ml to 550 ml (mean  $431 \pm 65.90$ ). The reservoir pressure was 6 cm to 9 cm. water (mean  $6.23 \pm 1.21$ ) when the pouch was filled with 50 ml water and 16 cm to 35 cm water (mean  $23 \pm 5.77$ ) when it was filled to maximum capacity (Table 2). There was no contraction wave during filling in any patient. The MCP in the efferent tube when the pouch was empty was 56 cm to 75 cm water (mean  $67.60 \pm 6.29$ ). When the pouch was filled with saline, the MCP was 77 cm to 101 cm water (mean  $94.50 \pm 7.3$ ) (Table 2). The difference in the mean maximum closure pressure between the empty and full pouch was also statistically significant ( $p < 0.05$ ).

## Discussion

Urinary diversion is a common choice for urologists after total cystectomy due to bladder carcinoma or benign disease, such as neurogenic bladder. The orthotopic neobladder is now commonly used as a type of urinary diversion in both genders and should be offered to male and female patients who lack any contraindications [9]. However, some patients are not suited for an orthotopic neobladder after total cystectomy, such as patients with a tumor affecting the urethra or bladder neck or with severe neurogenic bladder, and need ileal conduit or other options.

The Bricker Ileal conduit is acknowledged as an alternative choice for these patients who are not suited for orthotopic neobladders after total cystectomies. However, persistent complications, including obstruction leading to renal damage, stomal stenosis and urinary tract infections, continue to be associated with ileal conduits [10,11]. The patients with ileal conduits have to wear cumbersome collection devices at all times, which are not only inconvenient but also influence the patients' body images. In addition, stomal leakage, odor, and lack of sexual attractiveness and performance were common complaints among patients with ileal conduits [12,13]. In response to these problems with the ileal conduit, the continent reservoir has become an option when orthotopic bladder is not possible.

In general, we do not recommend conversion for patients with a diversion system functioning normally because the procedure requires a major operation. In the present study, however, seven patients had several complications after their initial Bricker conduit, including renal insufficiency due to adhesive obstruction of the intestinal segment in three patients, repeated retrograde urinary infection and high fever due to obstruction of the ileal conduit at the abdominal part in three patients and severe skin erosion around the abdominal stoma due to urine leakage in one patient. In addition, three younger patients with benign disease strongly wished to have a later conversion to continent diversion to avoid external appliances and to improve their quality of life. Thus, we devised conversion

**Table 2:** Urodynamic study results.

Patient (No.)	Age	Catheter (Fr)	Postop. Time (mon.)	MCP(cm. water)		Pouch was filled with saline	
				Empty	Full	Capacity (ml)	Pressure (cm water)
1	68	16	3	48	82	450	16
			12	56	77		
2	66	16	3	54	87	530	35
			12	60	96		
3	61	16	3	72	102	380	21
			12	70	98		
4	35	16	3	74	102	420	26
			12	62	98		
5	65	16	3	66	92	360	20
			12	68	88		
6	62	16	3	72	94	380	18
			12	68	92		
7	32	16	3	80	114	550	18
			12	75	101		
8	67	16	3	68	98	380	22
			12	71	101		
9	59	16	3	84	104	400	26
			12	72	98		
10	42	16	3	72	94	460	28
			12	74	96		
Mean ± SD			3	69.00 ± 10.92	96.60 ± 9.17*	431 ± 65.90	23 ± 5.77
			12	67.60 ± 6.29	94.50 ± 7.3*		

MCP: Maximum Closure Pressure of the Tapered Ileum  
\* $p < 0.05$  compared with the empty group

of previous ileal conduit to abdominal continent reservoir. After resolving the obstruction and constructing the continent reservoir, blood renal function returned to normal, and the patients did not need to wear urine collection devices and only needed interval catheterization because the pouch could store 400 ml to 500 ml urine without urine leakage, thereby leading to improved patients' body images and sexual attractiveness and performance. In addition, the patient has suffered from severe skin erosion due to urine leakage for one year in half a year after ileal conduit, which led to not use urine collection device. After reconstruction of the continent reservoir, the complication was totally resolved and the skin around the abdominal stoma had consistent good appearance. Thus, the patients were satisfied with the reservoir function and preferred the abdominal continent reservoir compared with the previous ileal conduit.

It is generally accepted that continent urinary diversion enables the patient greater freedom in bathing, sporting, travelling and facilitates social activities [14-16]. Whether the continent reservoir improves quality of life compared with the ileal conduit is controversial. Some studies have reported no difference in the quality of life between the continent reservoir and the ileal conduit [14,17]; while other studies have indicated a better quality of life with the continent reservoir compared with the ileal conduit [15]. However, the opinions of patients who have experienced both types of diversions have been published in several previous studies [17,18]. The studies have reported that patients who converted from an ileal conduit to a continent reservoir were most satisfied with their

diversion status, which were consistent with our results in the present study. To investigate HRQoL in patients with abdominal continent reservoir, mean score of each scale of SF-36 for patients was compared with sex-and age-matched general population. The result showed that all scores except GH and SF in patients were similar to those in the general population. Therefore, patients with conversion of previous ileal conduit to continent reservoir were generally satisfied with their overall health and quality of life.

Critical points in creating a continent reservoir from an existing conduit are the continent mechanism, ureteral implantation and metabolic changes after urinary diversion [19]. In terms of continence eight of ten patients were completely continent day and night at 4 hr to 5 hr intervals, when the produced urine was less than 400 ml. In the present study, we modified the technique through tapering the ileal as the efferent tube, fixing the partial efferent tube between the back surface of the rectus muscle and the ileal pouch wall, anastomosing the internal orifice of the tapered ileum to the ileal pouch and anastomosing its external orifice to the umbilicus. When supported by the pouch-abdominal wall, the tapered ileum worked effectively as a continent valve. The MCP of the tapered ileum was significantly higher when the pouch was full than when it was empty at both three and 12 months ( $p < 0.05$ ). This suggests that the continent mechanism of the efferent tube is greatly enhanced with an increase in the volume and pressure of the pouch, even when the tapered ileum was not tunneled submucosally into the pouch, which is based on either the flap valve principle or Laplace's law.

To avoid ureteral reflux, we tapered the terminal ileum over a 22 Fr catheter and then replanted it into a U-shaped pouch using an extramural serous lined tunnel in all patients. A pouch gram with a gravity pressure of 50 cm water showed no contrast medium in the ureters, which indicated that the approach can prevent urine from refluxing.

The results of repeated renal function testing indicated that the serum creatinine increased somewhat over longer term of follow-up in seven patients, but it remained within the normal range at all times. This increase with time in the conversion patients may be explained by the increase in renal function with increasing age, especially in older patients [20]. Thus, the continent reservoir does not appear to impair renal function. Metabolic disturbances are a consequence of incorporating any segment of the bowel into the urinary tract. Thus, we regularly monitor the acid-base balance and gave early medical intervention (sodium bicarbonate) for balancing a base deficit prevents metabolic acidosis. Clinical manifestations due to serum electrolytes disorder and metabolic acidosis were not observed in any patients, and the serum potassium and sodium were in the normal range during follow-up.

Our study has some limitations. Firstly, this is a retrospective, non-randomized study in a small number of patients. It caused a lack of information about pre-conversion HRQoL evaluation. Therefore, the study did not compare difference of HRQoL between pre-conversion and post-conversion, even if patients preferred the abdominal continent reservoir. Secondly, the study investigated the renal function by monitoring serum creatinine level during follow-up. However, serum creatinine alone may not be enough to evaluate true renal function in urinary diversion, because serum creatinine usually underestimates the decrease in Glomerular Filtration Rate (GFR) in the elderly [21]. Therefore, we should choose to use more valuable and sensitive method to evaluate the renal function in further study, such as <sup>99m</sup>Tc-diethylenetetraminepentaacetic acid (<sup>99m</sup>Tc-DTPA) renal scintigraphy. Moreover, further randomized and prospective large study will be needed to investigate long-term outcome and HRQoL in patients with conversion of previous incontinent diversion to continent type.

## Conclusion

Our study indicated that the conversion of an existing ileal conduit to an abdominal continent ileal reservoir has a good long-term outcome and HRQoL. The abdominal continent reservoir is a therapeutic option when patients require conversion from an incontinent type of urinary diversion to continent type.

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