

CONTINENT CUTANEOUS URINARY CONVERSION

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Objective: After ileal or colon conduit diversion some patients, in particular in adolescence, desire a conversion into a continent form of diversion, thus removing external devices and improving the quality of life. We report our long-term results of conversion from conduits into a continent cutaneous diversion.

Methods: Between July 1986 and February 2001, a total of 32 patients (mean age: 18 years, range 6 to 49 years) underwent conversion of a colon ($n=19$) or ileal conduit ($n=13$) into an ileo-caecal pouch with a mean follow-up of 97 months (range 11-185 months). Conversion was performed using a simplified technique incorporating the preexisting colon/ileal conduit into ileocaecal Mainz pouch I. The morphology of the upper urinary tract, renal function, continence and metabolic changes were analyzed.

Results: A total of 17 patients (53%) showed complications requiring surgical intervention; these included stoma stenosis (13%), pouch calculi (28%) as well as ureteric

stenosis in 4/61 renal units (7%). Continence was achieved in 97% of patients. Faecal frequency was unchanged in 75% of patients without treatment while the rest required medical therapy (cholestyramine, loperamide). During follow-up, early substitution of alkalinizing agents was performed at a base excess of < -2.0 mmol/l for 15 patients (47%), thus preventing acidosis. The renal function remained stable during follow-up. All patients are completely satisfied, in particular as compared to the previous situation.

Conclusion: The inclusion of the preexisting colon or ileal conduit facilitates continent cutaneous conversion and decreases bowel requirements. An acceptable complication rate, a stable renal function and the patient's comfort support the conversion of a conduit into Mainz Pouch I as a safe and viable option in the long run.

Key Words: urinary diversion, conversion, colon conduit

INTRODUCTION

In children, the ileal/colon conduit was used in the past for supravescical diversion in cases of irreversibly damaged or diseased bladders^{1,2}. However, pitfalls with conduit diversion include complications with regard to the stoma such as stenosis and dermatitis, possible renal deterioration mediated by obstruction or reflux resulting in high complication rates²⁻⁵. Developments in the field of continent reservoirs in the last 15 to 20 years have made continent urinary diversion a standard therapy⁶⁻⁹. In particular, improvement of the body image, freedom of life style and the elimination of external devices are its advantages, despite being a more complex procedure^{10,11}.

The ileocaecal pouch (Mainz pouch I) has been used for continent urinary diversion in children yielding a low-pressure, high capacity reservoir with good functional results⁷. For continent conversion from a preexisting colon or ileal conduit, this procedure has been modified. The existing conduit with intact antirefluxive ureteric implantation is incorporated into an ileocaecal pouch to spare as much bowel as possible¹². In the young age group with benign diseases and a normal life expectancy, the long-term outcome of this procedure is of a paramount interest.

Herein we report our long-term experience of continent urinary conversion with the modified technique with regard to the protection of

Table 1: Indications for Urinary Diversion in our Patients

	No.
<u>Neurogenic disease:</u>	13
Meningomyelocele	8
- Caudal regression	2
- Sinus urogenitalis	1
- Sacral dermoid	1
- Idiopathic	1
<u>Bladder exstrophy/incontinent epispadias</u>	11
<u>Tumor disease</u>	5
- Rhabdomyosarcoma	1
- Neurofibroma (Morbus Recklinghausen)	1
- Bladder carcinoma	1
- Cervix carcinoma	1
<u>Functional/morphological bladder disease</u>	3
- Interstitial cystitis	1
- Incontinence	1
- Vesicovaginal fistula	1

the upper urinary tract, continence and metabolic status.

PATIENTS AND METHODS

A total of 32 patients (19 females and 13 males) underwent conversion of a colon or ileal conduit into ileocaecal Mainz pouch between July 1986 and February 2001. Previous methods for urinary diversion included colon conduit in 19 and ileal conduit in 13 patients with an average age of five years (range 8 months to 38 years). The indications for urinary diversion were neurogenic disorders, bladder exstrophy and epispadias, tumor disease and morphological/functional bladder alterations (Table 1). All patients required continent urinary diversion due to recurrent urinary infections in 12 (37%), stomal stenosis or prolapse in six (19%) and in view of ureteral obstruction in 12 (37%). Following urinary diversion, 12 patients underwent laparotomy for surgery on the upper urinary tract. In addition, the eleven patients with epispadias/exstrophy underwent bladder sur-

gery before or during urinary diversion. Four patients were subjected to radiotherapy; in two of them it was combined with chemotherapy.

Continent urinary diversion was performed at an average age of 18 (range 6 to 49 years) as described by Fisch and Hohenfellner¹². In one patient a sigma rectum pouch (Mainz II) was carried out prior to continent ileocaecal urinary diversion.

The operative technique can be briefly described as follows: After detaching the conduit from the abdominal wall and pulling it through the old mesenteric window, the conduit is opened antimesenterically. A pouch plate is created by ileo-ileal and colo-ileal side-to-side anastomosis. The invaginated and intussuscepted ileal nipple is formed as the commonly used outlet continence mechanism. For incorporation into a Mainz pouch I, a short intestinal segment is transposed for pouch formation and incorporated by side-to-side anastomosis to the ileal pouch margin (Fig. 1A).

In the patients with colon conduits, 31 renoureteral units were non-refluxive. In the seven refluxive renoureteral units the ureters were newly reimplemented by creating a submucosal tunnel. (Fig. 1B) For those patients with ileal conduits, a submucosal tunnel was created in 16 renal units while a serous-lined extramural tunnel¹³ was created in 10 renal units (Fig. 2B). For the continence mechanism, an invaginated ileal nipple¹⁴ was used in 25 patients, the appendix¹⁵ in three, the seromuscularis bowel flap tube¹⁶ in another three and the Monti procedure¹⁷ in one patient. In addition – starting from 1992 – the ileocaecal valve was reconstructed in 11 patients where the risk of faecal incontinence was considered to be elevated¹⁸. In three patients, one kidney was removed because of recurrent pyelonephritis and subsequent deterioration of its function.

The morphology of the upper urinary tract was investigated based on preoperative and the latest postoperative urography and ultrasound. The dilatation of the upper urinary tract was analyzed according to the classification of Emmet and Witten¹⁹ and divided into three groups: Group I (no dilatation or Emmett I), Group II (Emmett II and III) and Group III (Emmett IV and V). The renal function was assessed by radionuclide renography. Reflux of the ureterointestinal anastomosis was investigated preoperatively by performing a loopogram and regularly four weeks after surgery

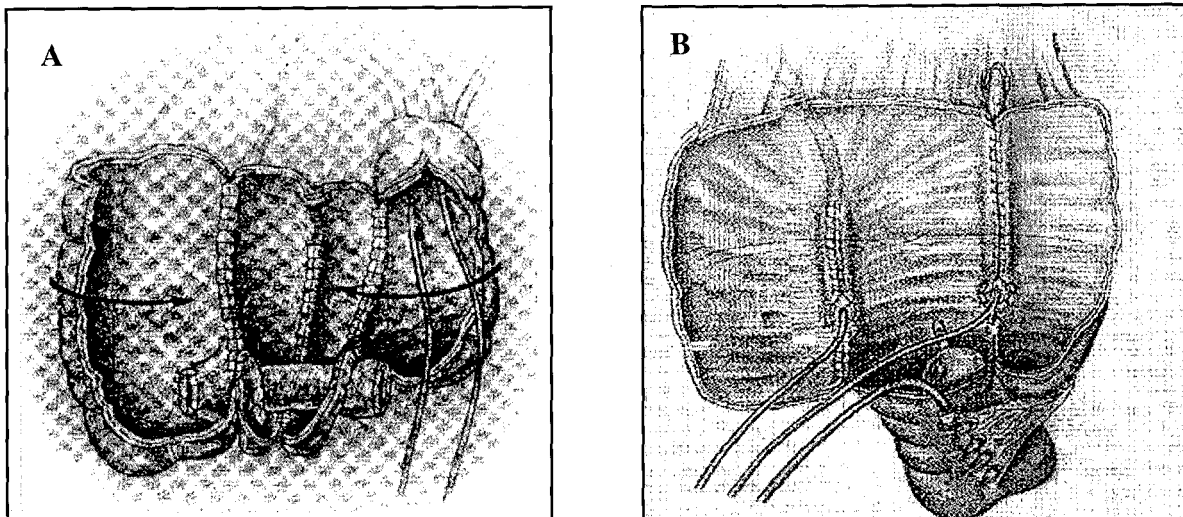


Fig. 1: Conversion of colon conduit into ileocaecal pouch. **A:** After creation of the pouch plate by ileo-ileal and colo-ileal side-to-side anastomosis and the formation of the standard invaginated and intussuscepted ileal nipple, the opened conduit is incorporated into the pouch by side-to-side anastomosis with the ileal pouch margin¹². **B:** The ureters are implanted in a submucous tunnel.

by conducting a pouchogram. Reflux was classified according to the classification of Parku-lainen²⁰ into three groups: Group I (grade I), Group II (Grade II and III) and Group III (Grade IV and V).

With respect to the metabolic workup after urinary diversion, vitamin B12 (cyanocobalamin) was quantified by means of chemiluminescence²¹. The acid-base balance was determined and at a base excess < -2.0 mmol/l alkalinizing agents such as sodium bicarbonate were administered.

The mean follow-up was 97 months (range 11-185 months). The follow-up data included renal function, metabolic variables and morphology of the upper urinary tract. In addition, patients were asked to answer a standardized life-style questionnaire SF-36. Twenty eight patients (88%) answered this questionnaire. Data are given, unless otherwise mentioned, in median and range.

RESULTS

In 15 patients, the outcome was satisfactory (Fig. 2A, B). A total of 17 patients (53%) showed complications requiring surgical intervention. These complications were minor in 13 (40%) and occurred in the form of pouch cal-

culi or stoma stenosis, while 7 patients (22%) had surgical intervention for ureteral reimplantation, nipple revision, ileus or hernia. Postoperative complications included two episodes of ileus, one of the patients required laparotomy due to ileal invagination, and urinary infection in two cases. Late complications included the formation of pouch stones (28%) which were mostly removed endoscopically, but in three cases open surgery via a small flank incision was required (Table 2). Four patients suffered from recurrent stoma stenosis requiring endoscopic correction or open surgery by Y-V plasty. The continence mechanism had to be revised by open surgery in four patients (13%). Reimplantation of the ureter due to stenosis was done in 3 cases (9%); among them two reno-ureteric units had the procedure twice due to recurrent stenosis. Two cases required the repair of incisional hernia.

In terms of reflux, among the group in which the ureters had been initially implanted with an antireflux mechanism, 22 cases (71%) remained unchanged during continent urinary conversion. Two reno-ureteral units were dilated but maintained a stable function while five improved after continent urinary conversion. Four ureterointestinal anastomoses (6%) had to be newly implanted due to stenosis. Two patients (5%) developed pyelonephritis due to obstruction requiring temporary ureteral

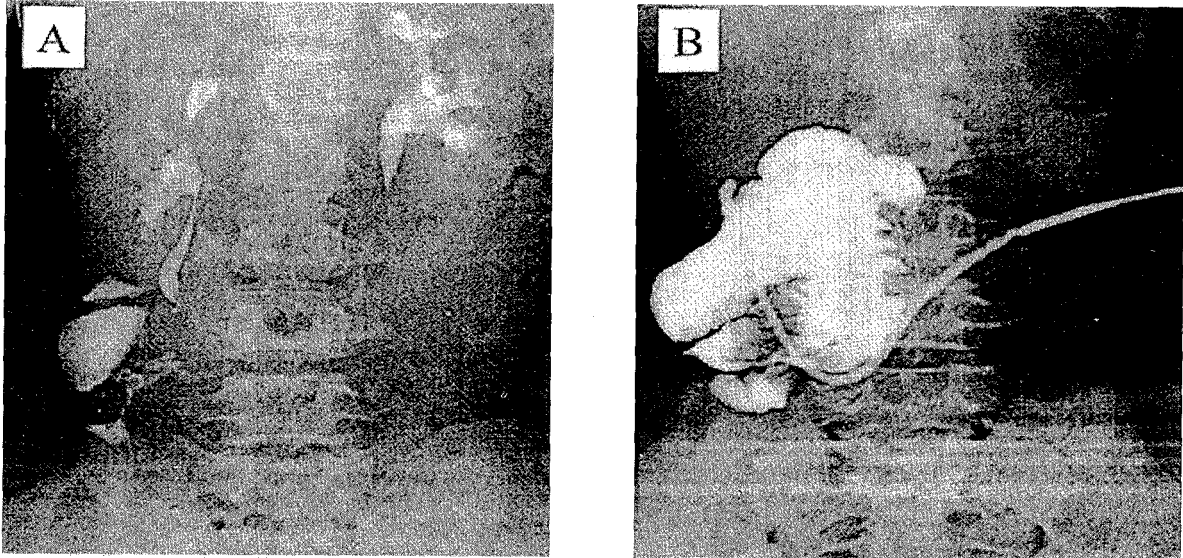


Fig. 2: Mainz Pouch I converted from a colon conduit. A: IVP showing prompt drainage into the pouch. B: Pouchogram showing an adequate capacity without reflux.

Table 2: Late Complications Requiring Surgical Intervention

Complication	No.	%	Months Passed Since Operation	
			Average	Range
Pouch calculi	9	28%	6	1-13
Stoma stenosis	4	13%	3	1-5
Incontinence	4	13%	2.5	0-8
Ureteral stenosis	3	9%	1	1-8
Hernia	2	6%	1	1-8

stenting or nephrostomy. Fourteen of 19 (74%) patients investigated with radionuclide renography showed a stable renal function. After reimplantation all anastomoses were non-refluxive except two. Dilatation of the upper urinary tract was diagnosed in two cases but remained nearly stable. Two of the seven refluxive reno-ureteric units revealed dilatation of the upper urinary tract.

Continence (defined as the lack of urinary leakage during day and night) was achieved in 31 patients (97%). However, in four patients (13%) revision of the continence mechanism had to be performed due to incontinence, three

of them had the standard invaginated and intussuscepted ileal nipple and one the sero-muscularis bowel flap tube as continence mechanism. One patient had to use an external appliance.

In 24 patients (75%) faecal frequency did not change; eleven (73%) of them had undergone ileocaecal valve reconstruction. Eight patients had to take at times antidiarrhoeal agents such as cholestyramin or loperamide. Three patients, one of them from the ileocaecal valve reconstruction group, suffered from therapy-refractory diarrhoea.

The vitamin B₁₂ level was investigated in 18 patients at the last visit and found to be 356 ng/l (range: 157 to 965 ng/l; normal value above 200 ng/l) which is slightly decreased compared to the normal population²⁰. Three patients (17%), two of them being previously irradiated, were supplemented with subcutaneous administration of vitamin B₁₂. During follow-up, the acid-base balance was determined routinely in 28 patients. The mean base excess was -0.2 (range: 2 to -14.6) mmol/l, -1.2 (range: 1.8 to -5.3) mmol/l and -0.4 (-2.7 to 2.8) mmol/l one, five and ten years after continent urinary diversion, respectively. At a base excess of < -2.5 mmol/l alkalinizing agents were administered in 15 patients (47%). None of the patients developed acidosis.

DISCUSSION

Although the rate of complications after ileal or colonic conduits has greatly decreased, there are some major problems related to this type of urinary diversion. Many patients are dissatisfied by the need to wear an external appliance. Studies on quality of life describe problems associated with urinary leakage and body image. These psychological issues emphasize the demand for converting a conduit to a continent form.

Generally, Mainz pouch I has an overall complication rate of 15 to 30% with a high continence rate²². The construction of the Mainz pouch is well established and technically safe and reliable. To preserve as much bowel as possible we have adopted this technique to incorporate the pre-existing colon or ileal conduit into Mainz pouch I. When preoperative radiography of the loop or urography shows sufficient anastomosis, the remaining conduit with the anti-refluxive ureters is incorporated as a part of the reservoir. Thus, 26 cm of ileum are required to augment and complete the reservoir. Avoiding dissection of the proximal conduit and ureteral anastomosis has simplified the procedure. Storage capacity normally allows a catheterization interval of 4 to 5 hours.

Critical points in creating continent reservoirs include the continence mechanism, the ureteric implantation and metabolic changes. In terms of continence, nearly all patients were dry. However, in four patients (13%) the continence mechanism had to be revised. Stomal stenosis at the skin level occurred in 13% of the patients and was treated endoscopically or by open Y-V plasty. Regarding faecal incontinence, exclusion of the ileocaecal valve from bowel continuity may shorten the intestinal transit time. Patients at risk of developing diarrhoea, as those with meningomyelocele, bowel resection or irradiation, underwent ileocaecal valve reconstruction¹⁸. Following this concept, only one out of 11 patients suffered from therapy-refractory diarrhoea postoperatively.

Nearly 40% of the renoureteral units of patients subjected to continent conversion showed dilatation. Forty percent of the preoperatively dilated renoureteral units improved, while only in 10% the upper urinary tract showed a slight increase of dilatation at the last follow-up visit. Six percent of the renoureteral units had to be reimplemented due to stenosis. The remaining renoureteral units remained

stable during follow up. Thus, in two cases (12%) reflux persisted and in two other cases (12%) dilatation of the upper urinary tract worsened, one of them (6%) needed revision in terms of ureteral reimplantation. In all patients the serum creatinine levels remained stable. None of the cases has progressed to renal failure or has required dialysis.

Nutritional disturbances may occur after loss of a bowel segment. The resection of more than 60-80 cm of terminal ileum may result in malabsorption of vitamin B₁₂, decreased bile absorption, fat malabsorption and decreased absorption of fat-soluble vitamins. The degree of disturbed metabolism depends upon the length of the ileal segment removed. Configuration of a pouch by incorporating the pre-existing colon conduit generally requires 30 cm of ileum. Three patients were temporarily supplemented with vitamin B₁₂ because their blood levels had dropped below normal values (below 200 ng/l). None of the patients became symptomatic. Another important metabolic complication caused by urinary diversion is electrolyte abnormalities²². Hyperchloraemic metabolic acidosis represents the most common electrolyte disturbance occurring when the ileum or colon is used for intestinal urinary diversion. Some institutions measure bicarbonate and chloride and treat the patients when they develop hyperchloraemia. In contrast, in our patients the acid-balance is determined and corrected at an early stage, starting when the base excess is below - 2.0 mmol/l. Thus, nearly 50% of the patients were treated orally with alkalizing agents such as bicarbonate. Following this concept, none of the patients developed severe acidosis.

In summary, with an acceptable complication rate, stable renal function and patient satisfaction the present data support the conversion of a conduit into Mainz Pouch I as a safe and viable option. The inclusion of the existing colon or ileal conduit facilitates conversion, decreases bowel requirements and is effective for preventing reflux and minimizing anastomotic strictures. Furthermore, the appendix stoma remains as a sound and reliable continent cutaneous mechanism.

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Editorial Comment:

This is a good paper, well written, concerning a surgical conversion method after conventional cutaneous diversion. The authors describe the Mainz Pouch I technique to get a cutaneous continent diversion in young patients. The number of patients included is certainly relevant and the conversion of a conduit to a Mainz Pouch I is certainly a good solution for those young patients.

The authors have presented honest figures on the complication rate of this type of surgery. They should maybe more emphasize on the fact that a continent urinary diversion does not solve all the problems.

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RESUME

Dérivation Urinaire Cutanée Rendue Continente

Objectifs: Après dérivation par l'iléon ou le colon certains patients en particulier dans l'adolescence souhaitent une conversion sous une forme continente de dérivation en supprimant le dispositif externe et en améliorant la qualité de vie. Nous rapportons les résultats à long terme de la conversion des conduits en dérivation cutanée continente. **Patients et Méthodes:** Entre juillet 1986 et février 2001, un total de 32 patients (âge moyen de 18 ans, extrêmes de 6 à 49 ans) avaient bénéficié d'une conversion d'un conduit colique (n=19) ou iléal (n=13) en une poche iléo-cæcale avec un suivi moyen de 97 mois (extrêmes de 11 à 185 mois). La conversion a été réalisée selon une technique simplifiée incorporant le conduit colique/iléal préexistant en une poche iléo-cæcale de Mainz I. La morphologie du haut appareil urinaire, la fonction rénale, la continence et les perturbations métaboliques ont été analysées. **Résultats:** Un total de 17 patients (53%) avait présenté des complications nécessitant une intervention chirurgicale. Il s'agissait : d'une sténose de la stomie (13%), une lithiase dans la poche (28%); une sténose urétérale chez 4/61 (7%). La continence a été obtenue chez 97% des patients. La fréquence d'exonération fécale n'avait pas changé dans 75% des patients sans traitement tandis les autres patients avaient nécessité un traitement médical (Cholestiramine, Lopéramide). Au cours du suivi, une substitution précoce des agents alcalinisant avait été réalisée pour un base excès < -2,0 mmol/ml pour 165 patients (47%) prévenant ainsi une acidose. La fonction rénale était restée stable durant le suivi. Tous les patients sont complètement satisfaits, en particulier comparé à la situation précédente. **Conclusion:** L'inclusion du conduit colique ou iléal préexistant facilite la dérivation cutanée continente et réduit les exigences de l'intestin. Un taux acceptable de complications, une fonction rénale stable, et le confort du patient plaident en faveur de la transformation d'un conduit en une poche de Mainz I comme option sûre et viable à long terme.

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