

COMPLICATIONS OF ORTHOTOPIC ILEAL RESERVOIRS

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Objectives To evaluate the early and late postoperative complications, upper urinary tract morphology and function and metabolic alterations which may occur after ileal continent orthotopic urinary diversion.

Patients and Methods Between July 1999 and January 2001, 42 male patients were subjected to radical cystoprostatectomy for bladder cancer and orthotopic urinary diversion at the urology departments of Cairo University and Suez Canal University Hospitals. All cases were evaluated clinically, bacteriologically, urodynamically and radiologically during the early and late postoperative periods (at 3 – 6 months and 6 – 18 months, respectively). The patients were divided into three groups: in Group I (22 cases) a W neobladder was fashioned with the uretero-ileal anastomosis done by creating extramural serosally lined tunnels. In Group II (12 cases) a Camey II pouch was done with ureteroileal anastomosis by direct end-to-end anastomosis in four and by Le Duc technique in eight pouches. In Group III (8 cases) a Kock's pouch was done with the ureters being directly implanted in the afferent loop above the constructed intussusception ileal nipple valve. In all types of reservoirs we used 45 cm of the ileum. Preoperatively all but four ureters were normal. These four ureters were dilated and uretero-ileal anastomosis was done by extramural serosally lined tunnels.

Results In the early follow-up period total diurnal continence was achieved in 72%, 75% and 75% of the patients of Groups I, II and III, respectively, versus 91%, 83% and 88% in the late postoperative period. Nocturnal continence was achieved in 64%, 67% and

63% during the early postoperative period compared to 73%, 75% and 75% in the postoperative period for the three groups, respectively. In the early postoperative period complications occurred in 33% of the patients including ureteroileal leakage (9.5%), a prolonged pouchourethral anastomotic leakage (11.9%), wound dehiscence (4.7%), deep venous thrombosis (2.3%), bronchopneumonia (2.3%) and a prolonged ileus (2.3%). Late complications occurred in 26.2% of the patients including urethral recurrence, pelvic recurrence and urethroileal anastomotic stricture in 4.8%, 14.2%, 4.8%, respectively and urethral stricture at the bulbomembranous junction in 2.4%. A higher incidence of renal deterioration was detected in cases where the ureters were implanted directly (60%) or in cases where the ureters were implanted by Le Duc technique (30%). Deterioration was noted in 12.5% of the cases where the ureters were implanted in an intussusception nipple valve and in 4.5% of the renal units where the ureters were implanted in an extramural serosally lined tunnel. At 9 months postoperatively metabolic acidosis occurred in one patient with a Camey II neobladder.

Conclusion A number of early and late postoperative complications were encountered after orthotopic neobladder. Metabolic complications were found in the form of metabolic acidosis in one patient. The lowest incidence of renal deterioration was reported in cases with extramural serosally lined ureteroileal anastomosis.

Key Words cystectomy, urinary diversion, orthotopic bladder, ileum, metabolic acidosis

INTRODUCTION

Bladder replacement by orthotopic substitutes is one of the real advances in modern urology. It has now become the treatment of choice for the patient whose bladder has been

surgically removed for malignancy and other conditions¹. A wide range of procedures involving almost all the segments of the gastro intestinal tract in different configurations has been used, with the detubularized ileum being the segment most often used².

Table 1: Early Postoperative Complications

Complication	No. of Patients			Total Number	%
	Group I	Group II	Group III		
A – Related to pouch construction					
- ureteroileal leakage	2	1	1	4	9.5%
- urethroileal leakage	3	1	1	5	11.9%
B – Not related to pouch construction					
- wound dehiscence	2	-	-	2	4.7%
- deep venous thrombosis	1	-	-	1	2.3%
- prolonged ileus	1	-	-	1	2.3%
- bronchopneumonia	-	-	1	1	2.3%
- acute pyelonephritis	2	1	1	4	9.5%

The question as to which intestinal segment should be used for the construction of the reservoir, its type and its length is still being debated. Each segment has its enthusiasts and its opponents depending on many factors including anatomical accessibility, the surgeon's preference, inherent physiologic characteristics of each segment and the possible complications resulting from the resection of the segment and/or its incorporation in the urinary tract^{2,3}.

In the present study we evaluated the early (3-6 months) and late (6-18 months) postoperative complications, upper tract morphology and function, and metabolic alterations which may occur after continent orthotopic urinary diversion using the ileum.

PATIENTS AND METHODS

Between July 1999 and January 2001, 42 male patients were subjected to radical cystectomy and orthotopic ileal reservoirs in the form of Camey II, Kock's pouch and W neobladder at the urology departments of Cairo University and Suez Canal University hospitals. The patient age at the time of surgery ranged from 26-70 years with a mean of 49.2 ± 9.1 years. All the patients were males and all had bladder cancer. The type of cancer pathology was squamous cell carcinoma in 20 patients (47.6%), transitional cell carcinoma in 16 pa-

tients (38.1%) and mixed transitional and squamous carcinoma in 6 patients (14.9%).

The tumors were staged according to the TNM classification⁴: 6 patients had stage T1, 12 patients had stage T2 and 24 patients had stage T3 diseases. The tumors were graded according to the Mostofi grading system: 6 patients had GI, 21 patients had GII and 15 patients had GIII tumors.

Patients with one or more of the following criteria were excluded from the study: carcinoma in situ or invasive tumor at the bladder neck or the prostatic urethra, extensive pelvic disease (T4) involving the prostate or extending close to the pelvic floor found intraoperatively (patients with one pelvic lymph node were included in the study). A compromised renal function with serum creatinine ≥ 2.5 mg / dl was also a contraindication for the procedure.

Standard radical cystectomy was done which entails removal of the bladder, prostate and seminal vesicles with a wide margin of surrounding adipose tissues and overlying pelvic peritoneum in mass with bilateral pelvic lymphadenectomy^{5,6}. The pouches constructed were W shaped ileal bladder⁷, Camey II pouches⁸ and urethral Kock's pouches⁹.

In this study 42 patients underwent cystoprostatectomy and detubularized ileal bladder

Table 2: Late Postoperative Complications

Complication	No. of Patients			Total Number	%
	Group I	Group II	Group III		
- urethral recurrence	2	-	-	2	4.7%
- pelvic recurrence	4	1	1	6	14.2%
- urethroanastomotic stricture	1	-	1	2	4.7%
- urethral stricture	1	-	-	1	2.3%
- stone formation	-	-	-	-	-

substitution. The pouches constructed in 22 patients were W shaped bladders (Group I) according to Hautmann⁷ with ureteroileal anastomosis being done by creating two extramural serosally lined tunnels¹⁰. Twelve patients (Group II) were subjected to Camey II pouch construction. Ureteroileal anastomosis was done by direct end-to-end anastomosis¹¹ in four and by Le Duc technique¹² in 8 pouches. Eight patients (Group III) received urethral Kock's pouches with the ureters being implanted directly in the afferent loop above the constructed intussusception ileal nipple valve¹³. In all types of reservoirs we used 45 cm of the ileum. Preoperatively all but four ureters were normal. Four ureters were dilated and ureteroileal anastomosis was done by extramural serosally lined tunnels.

Postoperatively, a total of 76 renal units were examined: 42 units in patients with W-shaped bladders, 18 units in patients with Camey II bladders and 16 units in patients with Kock's bladders.

In addition to the routine postoperative follow up including symptom analysis, physical examination and urodynamic testing, continence was evaluated both diurnally and nocturnally. The renal configuration was monitored at least three months postoperatively by IVP. Reflux was detected by ascending and micturating pouchograms. Renal function was evaluated by serum creatinine levels and evaluation of serum electrolytes was recorded.

The results were analysed and compared using different statistical methods, arithmetic mean, standard deviation, t-test, Fisher exact

test, Chi square test, Anova test and two way Anova test. A P value < 0.05 was considered significant, while a P value < 0.01 was considered highly significant.

RESULTS

Continence

In the early follow-up period, total diurnal continence was achieved in 72%, 75% and 75% of Groups I, II and III, respectively. 9.1%, 16.7% and 12.5% in Groups I, II and III, respectively, developed urge and / or stress incontinence. As regards nocturnal continence, it was achieved in 64%, 67% and 63% in the three groups, respectively. These results show that there was no statistically significant difference between the three groups with regard to continence during the early postoperative period (P > 0.05).

In the late follow-up period total diurnal continence was achieved in 91%, 83% and 88% in Groups I, II and III respectively representing a statistically significant difference. As regards stress and urge incontinence, 9% developed stress incontinence in Group I, 8.3% in Group II developed urge and stress incontinence and 12.5% in Group III suffered stress incontinence. Nocturnal continence was achieved in 73%, 75% and 75% in Groups I, II and III, respectively showing a statistically insignificant difference among the three groups.

A frequency of voiding of 3-5 times by day was recorded in 82% and 85% in Groups I and III, respectively, while 67% of Group II voided

Table 3: Evaluation of the Different Types of Ureteroileal Anastomosis

Type of ureteroileal anastomosis (n=76)	Refluxing Deteriorated Units		Obstructed Deteriorated Units		Total Deteriorated Units	
	No.	%	No.	%	No.	%
Le Duc (n = 33)	7	21.2%	3	9.1%	10	30.3%
Direct (n = 5)	3	60.0%	-	-	3	60.0%
Extramural serosally lined tunnel (n = 22)	-	-	1	4.6%	1	4.6%
Intussusception nipple valve (n = 16)	2	12.5%	-	-	2	12.5%

5-7 times by day. Nocturia of 2-3 times by night occurred in 63%, 67% and 67% in Groups I, II and III, respectively.

The uroflowmetric parameters recorded in the three bladder substitutes were also compared. As regards the mean volume voided, a statistically significant difference ($P = 0.04$) was encountered between patients having Camey II substitutes and those having W-shaped bladders, while a statistically insignificant difference ($P > 0.05$) was encountered between the mean volume voided recorded in W-shaped bladders and that recorded in Kock's bladders. A statistically insignificant difference was encountered between the maximum flow rate ($P = 0.24$), average flow rate ($P = 0.37$) and the voiding time recorded in the three groups.

Early Postoperative Complications

Early morbidity occurred in 14 patients (33%): four patients (9.5%) had a prolonged ureteroileal leakage (2, 1 and 1 patients in Groups I, II and III, respectively) and needed prolonged ureteral stenting for a mean of 6 ± 2.8 weeks. Five patients (11.9%) had a prolonged pouch urethral anastomotic leakage (3, 1 and 1 patients in Groups I, II and III, respectively) and needed prolonged urethral catheterization for a mean of 6 ± 1.7 weeks. Wound dehiscence occurred in two patients (4.7%) and was managed by closure with tension sutures. Deep venous thrombosis (DVT) developed in one patient (2.3%) on the 10th postoperative day and was treated by full heparinization. Bronchopneumonia developed in one patient (2.3%) and prolonged ileus in another (2.3%). Later on, four patients (9.5%) had

acute pyelonephritis with a tender renal angle and associated with fever. One of these patients (2.4%) developed metabolic acidosis and he had also palpable kidneys due to ureteroileal obstruction. The incidence of metabolic acidosis was statistically insignificant ($P > 0.05$) (Table 1).

Late Postoperative Complications

Late complications occurred in 11 patients (26.2%): Urethral recurrence occurred in two patients (4.8%) 8 and 12 months postoperatively, while pelvic recurrence occurred in 6 patients (14.2%) between 9 and 18 months following the intervention (mean 12.4 ± 4.5 months).

Urethroileal anastomotic stricture developed in 2 patients (4.8%) and was treated by transurethral incision of the strictured anastomosis. Urethral stricture at the bulbomembranous junction developed in one patient (2.4%) and was treated by visual internal urethrotomy. There was no stone formation because absorbable sutures were used instead of staples. No mucus complications and no valve complications (Kock's pouch) were recorded (Table 2).

Radiological Evaluation and Renal Function Deterioration

A higher incidence of renal deterioration was detected in renal units where the ureters were implanted directly (60% of units) or by Le Duc technique (30% of the units), while renal deterioration was only found in 12.5% of cases where the ureters were implanted in an intus

Table 4: Upper Urinary Tract Configuration

Configuration	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
Stationary	36	81.8%	11	61.1%	10	12.4%
Improved	6	13.6%	2	11.1%	4	25.0%
Deteriorated	2	4.6%	5	27.8%	2	12.5%

susception nipple valve and in 4.6% of the units where the ureters were implanted in extramural serosally lined tunnels (Table 3).

The lowest incidence of renal deterioration was detected in patients having W-shaped bladders, where only one of the evaluated units (4.6%) deteriorated. Patients with Camey II and Kock's neobladders showed deterioration in 5 units (27.8%) and 2 units (12.5%) of the evaluated units, respectively (Table 4). Reflux and ureterileal obstruction was the main cause of renal deterioration.

Evaluation of Serum Electrolytes

There was no statistically significant difference between preoperative and postoperative mean serum Na^+ , K^+ , Cl^- and arterial blood PH. When evaluating the serum electrolytes, the preoperative mean serum Na^+ was 139 ± 4.4 m Eq / L (138 – 145 m Eq / L), while the postoperative mean serum Na^+ was 141 ± 3.8 m Eq / L (134 – 143 m Eq / L). The preoperative mean serum K^+ was 4.3 ± 0.5 m Eq / L (3.6 – 4.9 m Eq / L), while the postoperative mean serum K^+ was 4.5 ± 0.4 m Eq / L (4 – 4.8 m Eq / L). The preoperative mean serum Cl^- was 103 ± 10.1 m Eq / L (97 – 105 m Eq / L), while the postoperative mean serum Cl^- was 107 ± 6.7 m Eq / L.

The mean preoperative arterial blood PH was 7.39 ± 0.19 (7.35 – 7.44), while the postoperative arterial blood PH was 7.34 ± 0.07 (7.29– 7.38). Clinically evident hyperchloraemic metabolic acidosis developed in one patient (2.4%) nine months postoperatively. His arterial PH was 7.29 and his serum Cl^- was 120 m Eq / L. This patient had a Camey II neobladder and a bilateral strictured Le Duc uretero-ileal anastomosis. He presented with generalized oedema, tachycardia and acidotic

breathing. No other metabolic complications were encountered, neither metabolic alkalosis nor hypochloraemic acidosis

DISCUSSION

Bladder replacement by orthotopic substitutes is one of the real advances in modern urology. It has become the treatment of choice for patients whose bladder has been surgically removed for malignancy or other conditions¹.

Continence in patients with orthotopic bladder substitutes depends on a balance between the urethral pressure exerted by the remaining urethra and the intra-reservoir pressure⁹. In 1979, Camey and Le Duc reported on their pioneering work with orthotopic neobladders with reasonable continence rates¹⁴. In 1982, Kock et al.¹⁵ described the continent uretero-ileal cutaneous reservoir. Few years later, Skinner et al.¹⁶ refined and popularized the surgical technique demonstrating excellent results in a large patient population. The next logical step was the placement of the reservoir in its orthotopic location.

For satisfactory results, some important aspects must be considered: The extent of radical surgery must not be compromised. The functional integrity of the upper tract should be maintained with avoidance of complications such as reflux, stones, stricture of the urethra, acidosis and infections. The patient should be dry day and night without a need for catheterization or collecting devices and he should experience a reasonable rate of voiding or waking up during night¹⁷.

In orthotopic diversion, the retained urethra might be the site of recurrence⁹. Wood et al.¹⁸ found that the incidence of concurrent carci-

noma of the prostate in cystoprostatectomies performed for bladder transitional cell carcinoma was 43%. Schellhammer and Whitmore¹⁹ reported urethral recurrence in 7% of the patients who underwent cystectomy only for the treatment of transitional cell carcinoma. Ghoneim et al.²⁰ and Skinner et al.²¹ reported urethral recurrence in 2-3% of the patients who underwent cystoprostatectomy with complete prostatic resection. In our study urethral recurrence was reported in 4.8% of the patients.

In this study, patients with complete prostatic resection and bladder reconstruction by W-shaped bladder, Camey II bladder or Kock's bladder attained comparable day and night time continence rates in the early and late post-operative periods. Stress incontinence was encountered in 9.1% to 16.7% of the patients in the early postoperative period compared to a percentage of 8.3% to 12.5% of patients in the late postoperative period. While urge incontinence was encountered in 8.3% to 12.5% of the patients in the early postoperative period, it was found in 0 to 8.3% of the patients in the late postoperative period representing a considerable improvement. In his series on S-shaped bladders, Foda²² reported a stress incontinence rate of 20% in the early postoperative period (3-6 months) which improved to 11% in the late postoperative period (6-18 months). He also reported urge incontinence in 10% of his patients in the early postoperative period, while none of his patients suffered from urge incontinence in the late postoperative period.

Nocturnal incontinence and nocturia were found to be distressing problems in patients with orthotopic bladder substitutes and have been reported by all authors. Iwariki et al.¹ using Kock's bladders reported nocturnal incontinence in 39% of their patients and nocturia (2 times per night) in 92% of the nocturnally continent patients. Hautmann et al.⁷ using W-shaped bladders reported nocturnal incontinence in 33% of their patients and nocturia (2-3 times / night) in 51% of the nocturnally continent patients. In our study we encountered these two problems in all groups of patients. In Group I nocturnal incontinence and nocturia were encountered in 27% and 63% of the patients, respectively, while in Groups II and III nocturnal incontinence was encountered in 25% and nocturia (2-3 times per night) in 67% of the patients in both groups. Melchior et al.²³ using Camey II bladders reported that most of their patients voided at intervals of 2-3

hours, while Casanova et al.¹⁷ using Kock's bladders reported voiding intervals of 3-4 hours in all the patients. In our study, patients with W-shaped bladders and Kock's bladders had longer diurnal voiding intervals than patients with Camey II bladders.

In our study the incidence of acute pyelonephritis was 9.5% which is comparable to the incidence of 5 – 12% reported by other investigators^{14,21}. The percentage of renal deterioration occurring with the different types of ureteroileal anastomosis used in this series was comparable to that reported by other authors. Abdalla²⁴ reported renal deterioration in 28% of the units when the Le Duc anti-reflux technique was used as compared to 30% reported in our series. Studer et al.²⁵ reported deterioration in 28% of the units when the ureters were implanted directly in a long afferent loop as compared to 60% in our series. Serum creatinine deterioration occurred in 8.7% of the patients who had Le Duc and direct ureteroileal anastomosis while no deterioration was detected in patients who had extramural serosally lined ureters or intussusception nipple valves for ureteroileal anastomosis. These results show that the highest incidence of renal deterioration was reported in the direct and Le Duc techniques followed by intussusception nipple valve, while the lowest incidence was reported with extramural serosally lined ureteroileal anastomosis.

In this study urethral recurrence occurred in 4.8% of patients. This is comparable to the results of Nieh²⁶ who reported urethral recurrence in the form of carcinoma in situ in 6 / 200 patients (3%) and urethral stricture in 6 / 200 patients (3%). In our study we encountered urethral stricture in 4.8%. Ureteroileal and urethroileal leakage accounted for 9.5% and 11.9%, respectively, in this series which is comparable to the results of other series mentioning rates of urinary leak of 15% and 22%^{13,25}.

The incorporation of ileum or colon within the urinary tract can lead to metabolic acidosis secondary to active absorption of urinary tract constituents particularly chlorides²⁷. In our study metabolic acidosis was clinically evident in 2.4% of the patients. This rate is higher than that reported by Studer et al.²⁸ who did not encounter any case of acidosis in their study, but lower than that reported by Boyd et al.²⁹ in whose series 10% of the patients developed clinically evident metabolic acidosis.

In our study no stone formation, mucus complications or other metabolic complications such as metabolic alkalosis or hypochloreaemic acidosis were encountered. McDougal in his series recorded a rate of 10% of stone formation³⁰. All the patients in our series were on alkalinizing therapy.

We conclude that early and late postoperative complications including metabolic acidosis may occur with all types of orthotopic ileal neobladders. However, the lowest incidence of renal deterioration was reported with the use of extramural serosally lined ureteroileal anastomosis.

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RESUME

Complications du Réservoir Iléal Orthotopique

Objectifs: Evaluer les complications postopératoires précoces et tardives, la morphologie et la fonction du haut appareil urinaire et les changements métaboliques qui peuvent se produire après la dérivation urinaire orthotopique continente iléale. **Patients et Méthodes:** Entre juillet 1999 et janvier 2001, 42 patients de sexe masculin ont été soumis à une cystoprostatectomie radicale pour un cancer de vessie et une dérivation urinaire orthotopique aux services d'urologie des hôpitaux de l'université du Caire et de l'université du Canal de Suez. Tous les cas ont subi une évaluation médicale, bactériologique, urodynamique et radiologique pendant les périodes postopératoires précoces et tardives (à 3 - 6 mois et 6 - 18 mois, respectivement). Les patients ont été divisés en trois groupes: dans le groupe I (22 cas) une neovessie en W a été façonné avec anastomose uretero-iléale extra-murale créant un tunnel séreux. Dans le groupe II (12 cas) une poche de Camey II a été réalisée avec anastomose uretero-ileale type bout à bout direct dans 4 cas et par la technique de Le Duc dans 8 cas. Dans le groupe III (8 cas) une poche de Kock a été réalisée avec des uretères directement implantés dans la boucle afférente au-dessus de la valve iléale construite de mamelon d'intussusception. Dans tous les types de réservoirs nous avons employé 45 centimètres de l'iléon. En préopératoire tous sauf quatre uretères étaient normaux. Ces quatre uretères ont été dilatés et l'anastomose uretero-iléale a été faite par des tunnels intraséreux extra-muraux. **Résultats:** Pendant la période précoce de suivi la continence diurne était totale dans 72%, 75% et 75% des patients des groupes I, II et III, respectivement, contre 91%, 83% et 88% vers la fin de la période postopératoire. La continence nocturne était totale dans 64%, 67% et 63% pendant la période postopératoire précoce comparée à 73%, à 75% et à 75% de la période postopératoire tardive pour les trois groupes, respectivement. Dans la période postopératoire précoce les complications ont été notées chez 33% des patients comprenant la fuite urétéro-ileale (9.5%), une fuite anastomotique prolongée entre la poche et l'urètre (11.9%), la déhiscence de la paroi (4.7%), la thrombose veineuse profonde (2.3%), le broncho-pneumonie (2.3%) et un ileus prolongé (2.3%). Les complications tardives se sont produites chez 26.2% des patients comprenant la récurrence urétrale, la récurrence pelvienne et la sténose anastomotique urethro-ileale dans 4.8%, 14.2%, 4.8%, respectivement et la sténose urétrale à la jonction bulbomembraneuse dans 2.4%. Une incidence plus élevée d'altérations rénales a été détectée dans les cas où les uretères étaient implantés directement (60%) ou dans les cas où les uretères étaient implantés par la technique de Le Duc (30%). La détérioration a été notée dans 12.5% des cas où les uretères ont été implantés dans une valve d'intussusception et dans 4.5% des unités rénales où les uretères ont été implantés dans un tunnel intra séreux extra-mural. À 9 mois postopératoire l'acidose métabolique s'est produite chez un patient présentant une neovessie de Camey II. **Conclusion:** Un certain nombre de complications post-opératoires précoces et tardives ont été constatées après neovessie orthotopique. Des complications métaboliques ont été retrouvées sous forme d'acidose métabolique chez un patient. L'incidence la plus limitée d'altérations rénales a été rapportée dans les cas avec anastomose urétéroileal intraséreuse extra-murale.

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