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## CLINICAL EXPERIENCE OF ORTHOTOPIC URINARY RESERVOIRS IN MALE PATIENTS WITH BLADDER CANCER

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Between 1988 and 1996, 23 male patients with bladder cancer underwent bladder substitution after cystectomy, using either the hemi-Kock, Hautmann, and Reddy procedures. The mean postoperative follow-up period was 36 months, with a range of 3 to 85 months. There were no perioperative deaths, and early postoperative complications occurred in 7 patients (30%); transient urine leak from the pouch in 4, wound infection in 3 and pyelonephritis in 2 patients. Twenty-two of the 23 patients (96%) were continent during the day, while 7 (30%) had nocturnal incontinence. All 3 patients with the Reddy procedure had nocturnal incontinence. Complete continence was preserved in 70% of the patients. Dysuria was seen in 4 patients, including retention in 1 patient. Late complications included urethral stricture in 3, wound hernia in 2, metabolic acidosis in 1, stone in the pouch in 1, and gallbladder stone in 1 patient. However, reoperation was necessary in 1 patient for internal urethrotomy and 1 patient for removal of a stone in the neobladder. Mild degree of hydronephrosis and unilateral reflux were seen in 3 patients each, and followed up conservatively. No urethral recurrence has occurred and only 1 patient died of cancer. The need for reoperation was very low and the high reservoir capacity resulted in continence from the beginning in most patients. We considered the neobladder useful as an alternative form of urinary diversion in selected cases.

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**Key words:** Orthotopic urinary reservoirs, Hemi-Kock, Hautmann, Reddy, Complications

### INTRODUCTION

Selection of supravescical urinary diversion after cystectomy due to pelvic malignancy such as invasive bladder cancer is most important for the patients, because it affects most of their quality of life after the operation. Since the introduction of the innovative idea of complete detubularization of the intestine and formation of a low-pressure urinary reservoir by Kock et al.<sup>1)</sup> and technical improvements by Skinner et al.<sup>2)</sup>, various types of useful continent urinary diversions have been reported. In accordance with the long-standing report by the Camey group<sup>3,4)</sup>, the orthotopic urinary reservoirs (OUR) by anastomosing the pouch to the urethra have been developed.

The hemi-Kock procedure was the first truly reliable bladder substitute<sup>5)</sup> However, a high complication rate regarding the afferent nipple valve limited its wide use. We adopted the hammock anastomosis for anti-reflux<sup>6)</sup>. Hautmann et al.<sup>7)</sup> reported a new W- or M-shaped ileal neobladder without any Kock nipple valves with a much lower

complication rates, implanting the ureters by the Le Duc-Camey procedure<sup>8)</sup>. In patients with the redundant sigmoid colon, the Reddy procedure<sup>9)</sup> was chosen as a neobladder due to its proximity for urethral anastomosis. We herein report our experiences with the neobladder reconstruction using the hemi-Kock, Hautmann, and Reddy procedure in 23 male patients undergoing radical cystectomy for bladder cancer.

### PATIENTS AND METHODS

Since 1988, 23 male patients with bladder cancer have undergone total bladder replacement by OUR. They were between 43 and 79 years old with a mean age of 60 years. All patients had transitional cell carcinoma; grade 2 in 2 patients and grade 3 in the other 21 patients. Pathological stage was pTis, pT1, pT2, and pT3 in 1, 7, 6, and 9 patients, respectively (Table 1). One patient with concomitant ureteral cancer underwent radical nephroureterectomy. The patients had been followed for 3 to 85 months (mean 36 months) after surgery.

Postoperative follow-up included urinalysis, serum

Table 1. Patient's profile and mode of procedure in 23 patients undergoing radical cystectomy and orthotopic urinary reservoirs (OUR)

Case	Age	Pathology	Mode of op.	Anti-reflux	Op. Date
1	79	TCC, G3, pT1b	hemi-Kock	Nipple valve	1988. 10
2	47	TCC, G3, pT2	hemi-Kock	Nipple valve	1989. 4
3	62	TCC, G2, pT2	hemi-Kock	Hammock	1989. 4
4	74	TCC, G3, pT3a	hemi-Kock	Hammock	1989. 6
5	56	TCC, G3, pT1b	hemi-Kock	Hammock	1989. 7
6	51	TCC, G3, pT3a	hemi-Kock	Hammock	1990. 8
7	70	TCC, G3, pT1b	hemi-Kock	Hammock	1990. 10
8	72	TCC, G3, pT2	hemi-Kock	Hammock	1992. 7
9	67	TCC, G3, pT1a	Hautmann	Le Duc	1993. 2
10	58	TCC, G3, pT3b	Hautmann	Le Duc	1993. 3
11	63	TCC, G2, pT2	Hautmann	Le Duc	1993. 4
12	43	TCC, G3, pT3b	Hautmann	Le Duc	1993. 9
13	61	TCC, G3, pT3a	Hautmann	Le Duc	1993. 9
14	43	TCC, G3, pTis	Hautmann	Le Duc	1993. 12
15	64	TCC, G3, pT3a	Hautmann	Le Duc	1993. 12
16	58	TCC, G3, pT3b	Hautmann	Le Duc	1994. 3
17	47	TCC, G3, pT2	Hautmann	Le Duc	1994. 7
18	51	TCC, G3, pT1b	Hautmann	Le Duc	1995. 9
19	67	TCC, G3, pT3a	Hautmann	Le Duc	1995. 10
20	54	TCC, G3, pT3b	Hautmann	Le Duc	1996. 8
21	61	TCC, G3, pT1b	Reddy	Goodwin	1993. 4
22	58	TCC, G3, pT1b	Reddy	Goodwin	1993. 4
23	73	TCC, G3, pT2	Reddy	Goodwin	1993. 11

creatinine and electrolytes, ultrasonography and computed tomography of the abdomen including the kidneys and neobladder, and an excretory pyelography (DIP). Postoperative urodynamic studies and continence situations were also examined.

The techniques of total bladder replacement used were the W-shaped Hautmann procedure in 12, the hemi-Kock procedure in 8, and the Reddy procedure in 3 patients. The techniques of implantation of the ureters to the ileum used were the Kock original nipple valve<sup>1)</sup>, the hammock procedure<sup>6)</sup> and the LeDuc procedure<sup>8)</sup> in 2, 6 and 12 patients, respectively. The Goodwin's transcolonic procedure<sup>10)</sup> was used for 3 patients with the Reddy procedure<sup>9)</sup>. Multiple tenotomy was applied to the sigmoid colonic pouch to obtain a highly compliant reservoir<sup>11)</sup>. The intestinal reservoirs were closed with one-layer running sutures using 3-0 polyglactin (Vicryl®) and were anastomosed to the membranous urethra with 5 interrupted sutures (1, 4, 6, 8, and 11 o'clock position) using 2-0 Vicryl®.

## RESULTS

### Early complications

There were no perioperative deaths. The blood transfusion ranged from 0 to 6,600 ml (mean: 3,510 ml). Total operation time including cystectomy and urinary reconstruction was 7 to 15 hours (mean: 12 hours). Early postoperative complications occurred

in 7 patients (30.4%), transient urine leak from the pouch in 4, wound infection in 3 and pyelonephritis in 2 patients. Re-suture was performed in 2 of the 3 patients with wound dehiscence. Early postoperative complications also included lymphocele in 1 patient (Table 2). These complications were treated conservatively. Prolonged ileus noted in 4 patients resolved spontaneously.

### Late complications

Late complications after surgery are summarized in Table 3. Late complications included urethral stricture in 3, wound hernia in 2, metabolic acidosis in 1, stone in the pouch in 1, and gallbladder stone in 1 patient. However, reoperation was necessary in only 1 patient for internal urethrotomy and 1 patient for removal of a stone in the neobladder. A mild degree of hydronephrosis and unilateral reflux was seen in 3 patients each who were followed up conservatively.

Local recurrence was noted in one patient, who died of tumor progression 10 months postoperatively. One patient committed suicide and another patient died of pulmonary embolism.

The upper urinary tract was examined by preoperative and postoperative DIP. Dilatation of the upper urinary tract was seen in 4 patients postoperatively. Hydronephrosis in 1 patient was transient. Percutaneous nephrostomy or placement of a ureteral stent was not necessary because of asymptomatic and mild upper tract dilatation.

Table 2. Early complications after OUR and their treatments

Complications	Treatment	Number of patients
Urine leak from pouch	conservative	4*
Wound dehiscence	re-suture (2) conservative (1)	3*
Pyelonephritis	antibiotics	2*
Lymphocele	conservative	1
Total		7

\* One patient suffered from urine leak and wound dehiscence and the other patient from urine leak and pyelonephritis.

Table 3. Late complications after OUR and their treatments

Complications	Treatment	Number of patients
Urethral stricture	Bouginate (2) Urethrotomy (1)	3*
Wound hernia	Follow-up	2*
Stone in pouch	Lithotripsy	1
Gallbladder stone	Conservative	1
Metabolic acidosis	Conservative	1
Total		7

\*: One patient suffered from stone in pouch and urethral stricture

Vesicoureteral reflux was found in 3 patients. All the patients had unilateral and low-grade reflux and were followed conservatively.

Twenty-two of the 23 patients (96%) were continent during the day, while 7 (30%) had nocturnal incontinence. All 3 patients with the Reddy procedure had nocturnal incontinence. Complete continence was preserved in 70% of the patients. Dysuria was seen in 4 patients (18%), including retention of 885 ml in 1 patient (Table 4).

#### Urodynamic studies

In most patients, voiding was initiated by abdominal straining when the patients felt an abdominal sensation resembling the original sensation of a full bladder. Evaluation of the micturition protocols revealed a relatively normal frequency of micturition; 7 times during the day (range 3 to 10) and 2 times at night (range 0 to 4). The volume of a single micturition averaged 254 ml (range 155 to 500 ml). The mean residual urine was 146 ml (range 8 to 885 ml). The mean maximum bladder capacity was 423 ml (range 190 to 885 ml).

### DISCUSSION

We found the total bladder replacement with a neobladder after cystectomy to be a relatively simple and safe technique, and the complication rate of the neobladder was acceptable. Although we investigated only a small number of patients during a short-term follow-up, the preliminary findings indicated that the neobladder is a favorable option for urinary diversion after cystectomy.

Our limited number of OUR is due to the strict indication for preservation of the urethra, since urethral cancer recurrence may bring an ominous prognosis for bladder cancer patients. The multivariate analysis of 169 male patients by Tobisu et al.<sup>13)</sup> revealed that the risk factors were 1) papillary cancers, 2) multiple cancers and 3) cancers arising in the bladder neck, prostatic urethra and intraprostatic tissue. The unanimous contraindications of urethral preservation are the presence of concurrent anterior urethral tumors and tumors invading the prostate. According to Sakamoto, prostatic invasion is often seen around the verumontanum<sup>14)</sup> Skinner's group, however, extended the indications to all patients except for the above contraindications, covering almost 90% of all patients with bladder tumor, including primary CIS<sup>5)</sup>, which is not in our present policy. No urethral cancer recurrence has been noted in our series.

The success of total bladder substitution largely depends on the degree of continence. Although daytime continence was reportedly well maintained in 95% of the cases by most techniques, most patients had a high frequency of voiding and were wet at night, unless they voided frequently or used a collection device. In the present study, daytime continence was maintained in 96%, whereas 30% had various degrees of nocturnal bed wetting. Seventy percent of all patients were completely continent day and night. These figures are compatible with the nocturnal incontinence between 65 and 95% reported by others<sup>5,12,15,16)</sup> Six patients had a mild degree of

Table 4. Postoperative status related to orthotopic urinary reconstruction

Case	Daytime incontinence	Nighttime incontinence	Dysuria	Residual urine(ml)	Hydro-nephrosis	Reflux
1	-	-	-	10	-	-
2	-	-	-	-	-	-
3	-	-	+	885	+	-
4	-	+	+	150	-	+
5	-	-	-	45	-	-
6	-	-	-	150	-	-
7	-	-	-	20	-	-
8	-	-	-	450	-	+
9	-	-	-	-	-	-
10	-	-	-	17	-	-
11	-	-	-	30	-	-
12	-	-	-	8	-	-
13	+	+	+	300	-	+
14	-	-	-	70	-	-
15	-	-	-	0	-	-
16	-	+	-	0	-	-
17	-	+	-	30	-	-
18	-	-	-	0	+	-
19	-	-	+	60	+	-
20	-	-	-	100	-	-
21	-	+	-	50	-	-
22	-	+	-	300	-	-
23	-	+	-	0	-	-

intermittent incontinence. Only one patient had severe daytime incontinence.

Several factors may contribute to the excellent continence rate of OUR. Detubularized bowel segments have a higher capacity and a lower intestinal pressure compared to the tubular bowel<sup>3,4)</sup>. This capacity allows the patient to be continent from the early postoperative period. In addition, the elastic properties of the bowel wall, and transection of the longitudinal and circular musculature of the bowel wall may contribute to the low internal pressure and the high compliance of the reservoir. It is noteworthy that nocturnal incontinence was present in all 3 cases with the Reddy procedure, even when we applied teniotomy to the reservoir.

The results of any form of bladder substitution also should be compared to the complication rate of standard urinary diversion such as the ileal conduit. The perioperative and postoperative complications of the neobladder were similar to those of the ileal conduit. In addition, there were no severe complications in this study. Complications that are typical of bowel reservoirs can be managed easily. Leakage of the enterourethral anastomosis was treated by prolonged catheter drainage and mucous tamponade due to excessive mucous production of the bowel was treated by evacuation. Urethral stricture was managed by endoscopic urethrotomy or

dilatation.

The tumor-related prognosis of the patients was not influenced by the method of bladder substitution. In this study, only one patient with stage pT3pN1 cancer died of tumor progression and local recurrence. In our study, OUR is practical only to males, although extension of OUR to women has been recently reported<sup>17,18)</sup>. While incontinence is relatively well maintained, dysuria may become a problem. Moreover, long-term prospective evaluation with careful follow-up will be required to evaluate the true risk of urethral recurrence in a retained urethra<sup>18)</sup>. In conclusion, our experience showed that the OUR in males had acceptable early and late complications. In spite of the short follow-up, these findings suggest that the OUR should be one of the routine applications according to patients' preference under substantial informed consent.

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## 男性膀胱癌患者に対する自然排尿型尿路再建術の臨床経験

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1988年から1996年に自然排尿型尿路再建術を施行した23例の男子膀胱癌患者の手術成績を検討した。術式は hemi-Kock 法8例，Hautmann 法12例，Reddy 法3例で，平均経過観察期間は36カ月である。手術関連死はなかった。早期合併症は7例（30.4%）にみられ，パウチからの尿瘻4例，創感染3例，腎盂腎炎2例であった。昼間尿禁制は22例（95.7%）でえられたが，夜間尿失禁は7例（30.4%）にみられ，Reddy 法では3例すべてにみられた。排尿困難は4例にみられ，うち1例は尿閉となった。晩期合併症としては，尿道狭窄2例，創ヘルニア2例，パウチ内結石1例，胆石症1例であった。その他軽度水腎症3

例，片側性逆流3例をみたが，すべて保存的に経過観察中である。尿道狭窄とパウチ内結石の各1例が内視鏡的手術で治療された。なお，予後に関しては癌死は1例のみで，尿道再発例はみていない。

自然排尿型尿路再建術の合併症発症率は高いが，再手術を要するような重大な合併症発症率は低い。また，夜間尿失禁は多いものの昼間尿禁制は良好に保たれ，症例を選べば膀胱全摘除術を受ける患者のボディイメージを損わない尿路再建として大いに評価できる。

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