Results of Closed Loop Ileocystoplasty

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ABSTRACT

We herein presented the results of twenty-one closed loop ileocystoplasties which were performed solely for the contracted tuberculous bladder during the 10 year period beginning in 1963.

In general the results, except two deaths; an operative mortality rate of 9.5 percent, have been fairly encouraging. After ileocystoplasty, hydronephrosis improved in 11 kidney units, remained unchanged in nine and was reversely deteriorated in one. In the group of 12 patients with impaired preoperative renal function, there were eight improvements and two deteriorations. The other two patients' renal function remained unchanged. One patient, in the group of patients with normal preoperative renal function, was considered to have become worse following the operation.

Early and late complications were reviewed; there were one acute renal failure and one obstructive anuria as serious early complications, and two ileo-cystostomy stenoses, one acute intestinal obstruction, one spontaneous perforation of the ileal segment, three urinary tract stones and two metabolic acidoses associated with electrolyte imbalance as severe late complications.

The inquiries by mail indicated that closed loop ileocystoplasty may afford nearly complete symptomatic relief except for a weak pulsive force of the ileobladder to evacuate urine, and persistent mucus formation.

The contracted tuberculous bladder is gradually becoming less common, as tuberculous diseases are succumbing to antituberculous chemotherapy. However, it is sporadically found in Japan, where tuberculosis is found to be much more liable in bladder contractions than any other etiology. As the contraction progresses to such a degree that the upper urinary tracts are affected, the kidneys gradually lead to

destruction. Surgical correction is necessary in order to reverse the threat of this deterioration and to relieve the patient from such complaints as frequent miction and/or overflow incontinence. Ileocystoplasty, one of the available surgical corrections, has been widely used for bladder contractions with various etiologies. However, it is not without criticism. Extensive literature has grown up in which various series of the operation have been reported from a number of urological centers, some of them drawing attention to several drawbacks of this operation in contrast to other kinds of intestinocystoplasty.

Until two years ago, when we adopted the colocystoplasty operation, we had performed closed loop ileocystoplasties for ten years. In summerized fashion, we herein report the results of our experience of the operation on 21 patients.

PATIENTS AND ILEOCYSTOPLASTY

Twenty-one ileocystoplasties were performed in this hospital, solely for the contracted tuberculous bladder during the 10 year period beginning in October 1963. The ages of the 21 patients ranged from 13 to 56 and the average age was 31.4. Male patients numbered two and half times that of the females (Table 1). The storage capacity of the bladder of the patients ranged from 15 to 80 ml, of which more than half fell within the range from 30 to 60 ml (Table 2). Retrograde urethrograms revealed that tuberculous cavities of the prostate gland were present in 10 of 12 male patients who received the examination, and urethral stricture in five of the twelve. Four of the five patients with urethral stricture were treated either by periodic urethral dilatation prior to ileocystoplasty, or by internal urethrotomy simultaneously with the operation, both producing good results. Tuberculous epididymitis was diagnosed in six of the 15 patients either from surgical specimen, the patient's history, or by physical examination (Table 2).

At the time of the ileocystoplasty, only four patients had kidneys on both sides of this group, one non-visualizing kidney was left un-operated and therefore excluded from the group in the evaluation of surgical effect. In the other 17 patients, a unilateral nephrectomy had been carried out for renal tuberculosis prior to the operation, therefore the group included 24 kidney units (Table 5). Excretory urograms showed that hydronephrosis appeared in 19 kidneys, the remaining five being normal. Hydronephrosis was diagnosed to be slight to moderate in 18 of them and fairly advanced in the other (Table 3). Dilatation of the ureter was observed in 16 of 24 kidney units. V-U reflux was demonst-

rated on urethrocystograms and/or cystograms in 17 of 22 kidney units. Concurrent extra-genitourinary tuberculousis seen in this series is shown in Table 4.

All the patients received anti-tuberculous chemotherapy for a period of at least 2 years. Six nephrostomies and a cutaneous ureterostomy were temporarily completed on seven patients three to six months before

Table 1. Results of ileocystoplasty (21 cases)

Age:	
10–19	5
20–29	6
30–39	3
40–49	5
50–59	2
Range: 13–56 years	
Average Age: 31.4 years	
Sex:	
Male	15
Female	6

Table 2. Results of ileocystoplasty

Contraction of the bladder:	
0–30cc	4
30–60cc	11
60–90cc	6
Tuberculous cavities of the prostate:	
No evidence	2
Small	7
Large	3
Unknown	3
Urethral stricture:	
No evidence	7
Single	3
Multiple	2
Slight	2
Moderate	3
Marked	0
Unknown	3
Periodic dilatation	3
Internal urethrotomy	1
Tuberculous epididymitis	6

Table 3. Results of ileocystoplasty

Dilatation of remaining upper urinary tract:		
Hydronephrosis	N*	5
	A	6
	B	8
	C	4
	D	1
	E	0
Hydroureter	Not evident	8
	Slight	11
	Marked	5
V-U reflux:		
Evident		17
Not evident		5
Unknown		2

*Fujino's classification

Table 4. Results of ileocystoplasty

Pulmonary tuberculosis:	
No evidence or primary complex only	10
Minimal	4
Moderately advanced	5
Far advanced	0
Pott's disease	1
Lymphadenitis colli	1

Table 5. Results of ileocystoplasty

Remaining kidney unit:	
Right kidney	6
Left kidney	12
(Contra-lateral nephrectomy 17)	
(Non-functioning, unoperated 1)	
Bilateral	3
Previous temporary diversion in 24 kidney units:	
No diversion	17
Nephrostomy	6
Cutaneous ureterostomy	1

the ileocystoplasty for the purposes of reducing augumenting intrapelvic pressure, preserving renal functions for the duration of the chemotherapy, and also making it easier to maintain urinary drainage for the postoperative period (Table 5).

The closed loop ileocystoplasty was performed on all the patients, where the whole dome of the bladder was removed leaving a very wide opening for anastomosis of the intestinal loop. If the bladder contracted to such a degree that its storage capacity was reduced to 30 ml. or less, we felt this technique was difficult to perform. In 17 patients, the horn method, U or T method, which was described by Pyrah and Raper[12] in 1955, was adopted. The remaining four received the cat-tail or I patch method which was presented by Cibert[1] in 1953 (Table 6). Reimplantation of a ureter into the loop was combined with the ileocystoplasty procedure in eleven kidney units. In all cases of the cat-tail method and in two of the right ureteroileostomy in which the ileocystoplasty was performed by the horn patch, the distal end of the ureter was anastomosed to an end of the ileal loop by the end-to-end anastomosis of anti-reflux fashion which had been invented by us[8]. For the first four years in this series, intestinal continuity was re-established in patients by ileoileostomy with the use of a side-to-side anastomosis. However an end-to-end anastomosis has since replaced the side-to-side method.

Table 6. Results of ileocystoplasty

Ileoileostomy:		
End-to-end		12
Side-to-side, isoperistaltic		6
Side-to-side, antiperistaltic		3
Ileocystostomy:		
T-bladder (J-or U-bladder)		17
Without ureterostomy	11	
With right ureterostomy	2	
With left ureterostomy	3	
With bilateral ureterostomy	1	
Cat-tail bladder (I-bladder)		4
With right ureterostomy	2	
With left ureterostomy	2	

RESULTS

Of the 21 cases of the ileocystoplasty, two patients died, an operative mortality rate of 9.5 percent. One patient in this series died 3 days postoperaively of paralytic ileus, pneumonia and acidosis. The patient was considered to be able to withstand the magnitude of the operation even though the remaining single kidney was grossly hydronephrotic prior to the operation. It has since been made a rule to perform a temporary urinary diversion in advance of an ileocystoplasty in all cases of hydronephrosis of more than a moderate degree. The other patient suddenly died of embolism of the basilar artery on the fifteenth postoperative day. Autopsy revealed the ileo-bladder was almost completely healed and in satisfactory condition. The result would have been expected to be excellent had the patient lived.

In general the results, except the two deaths, have been fairly encouraging. However, we do not of course regard ileocystoplasty as the ideal method of enlargement of the bladder, because various complications can occur. Early and late complications which had been encountered in this series are tabulated in Tables 7 and 8.

Six, who had a single moderate-hydronephrotic kidney, all tended to have slight acidosis and azotemia during the postoperative period, although in no case has there been any evidence of severe derangement of the serum electrolyte concentration. The anti-reflux fashioned end-to-end anastomosis method of a ureter into a loop was considered to be responsible for obstructive anuria which developed in one case.

As late complications, ileo-cystostomy stomal stenosis was found in two patients whose preoperative bladders were as a small as approximately 20 ml. One was treated by periodic dilatation and the other repaired by re-anastomosis. Perforation of the ileal segment of the ileo-bladder was seen in a 21-year old girl two years after the ileocystoplasty with unknown origin. The pinhole perforation was closed with satisfaction. Mucus formation has usually persisted in the urine after ileocystoplasty[3]. This is no major problem for the majority. Three years following the operation a 23-year old girl complained of acute urinary retention due to mucus plug lodging at the urethra. Six years after the ileocystoplasty a stone (Fig. 1) was found in the kidney of one of the patients. In another patient a stone was detected in the lowermost ureter, occurring three years after the operation had been performed. In a third patient several stones (Fig. 2) were found in the ileo-bladder ten years after the ileocystoplasty. The stones in all three patients were surgically removed. A low grade urinary tract infection has persisted in almost all

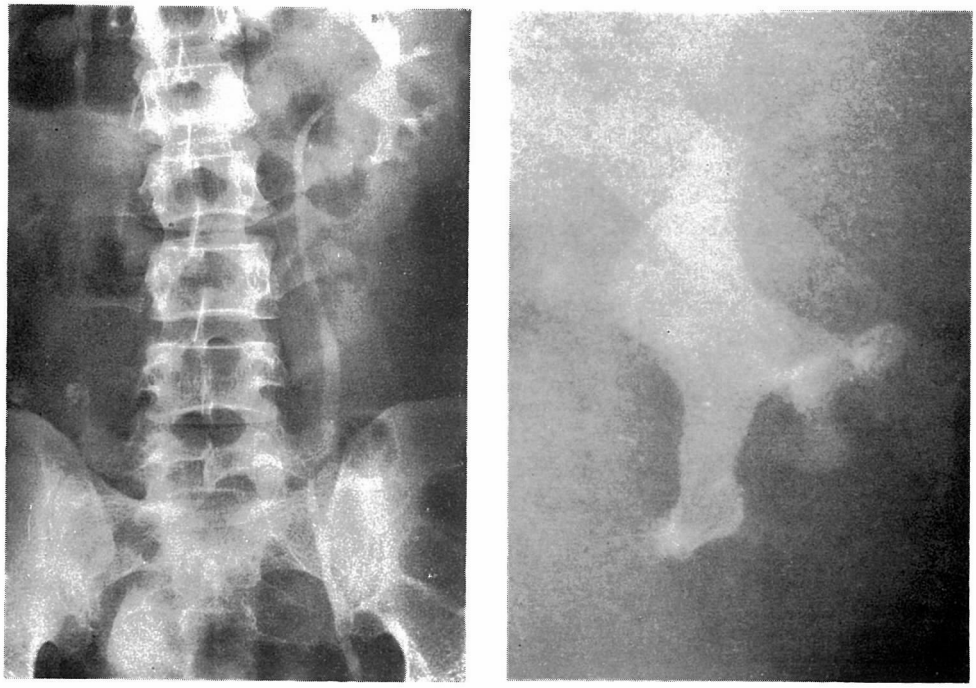

Fig. 1. A plain film of the abdomen (right) and an intravenous urogram (left) showing a less radiopaque coral stone in the remaining left kidney.

Fig. 2. A plain film of the bladder revealing four stones in the ileo- bladder.

Table 7. Results of ileocystoplasty

Operative mortality	2 (9.5%)*
Early complications:	
Acute renal failure	1 in 19
Obstructive anuria	1 in 19
Acute pyelonephritis	4 in 19
Metabolic acidosis & electrolyte imbalance	6 in 17

*Deaths caused by embolism of the basilar artery, and by paralytic ileus and pneumonia.

Table 8. Results of ileocystoplasty

Alive at present	19
Late complications:	
Ileo-cystostomy stenosis	2 in 18
(1 : bouginage, 1 : reanastomosis)	
Acute intestinal obstruction	1 in 18
Perforation*	1 in 18
Episodes of acute pyelonephritis	1 in 18
Kidney stone	1 in 18
Ureteral stone	1 in 18
Ileo-bladder stone	1 in 18
Acute urinary retention	1 in 18
Persistent dull CVA-pain	1 in 18
Metabolic acidosis & electrolyte imbalance	2 in 17
Anxiety	3 in 18
Interruption of gestation (curettage)	3 in 2
Permanent nephrostomy	1 in 19

*Spontaneous perforation of the ileal segment of the ileo-bladder.

Table 9. Results of ileocystoplasty

Hydronephrosis:	
Improved	11
Unchanged	9
Deteriorated	1
Unknown	3
Renal function:	
Impaired renal function group	
Improved	8
Unchanged	2
Deteriorated	2
Normal renal function group	
Improved	0
Unchanged	4
Deteriorated	1
Unknown	2

Table 10. Results of Ileocystoplasty

	Before operation	1mon, after operation	At present
Frequency of micturition:			
-6 during the day	0	2	8(1)*
7-10	0	8	8(3)
11-20	8(1)	7(4)	1
21-50	8(3)	0	0
51-	1	0	0
-2 during the night	1	4	11(2)
3- 5	4	6(1)	5(2)
6-10	5(3)	7(3)	1
11-30	5(1)	0	0
31-	2	0	0
Miction pain:			
Severe	8	0	0
Mild	4	1	1
Disfomfort	1	12	6
No pain	4	4	10
Incontinence:			
Sometimes all day	1	1(1)	1(1)
Often while sleeping	2	0	1(1)
Sometimes while sleeping	3	4(3)	3(2)
Never	13	13	14
Urinary stream at present:			
Forceful			1
Weak			14(3)
Intermittenly			2(1)
In drops			0
Turbid urine at present:			
Markedly turbid urine with floccule			2
Slightly turbid urine with floccule			7
Almost clear urine with floccule			8
Turbid urine without floccule			0
Normal urine			0
Aid of micturition:			
Credé's micturition			13
Choking			1
Concurrently with peristalsis			1
Without aid			2

patients since the operation. Only one patient each year has complained of several episodes of acute pyelonephritis. Metabolic acidosis and electrolyte imbalance has persisted a long time after the post-operative period in two patients with a single deteriorated kidney. One of them gradually became more deteriorated with both hydronephrosis and renal function following the ileocystoplasty. Eventually the loop was removed and a permanent nephrostomy completed instead.

After ileocystoplasty, hydronephrosis improved in 11 kidney units, remained unchanged in nine and was reversely deteriorated in one (Table 9). In the group of 12 patients with impaired preoperative renal function, there were eight improvements and two deteriorations where metabolic acidosis persisted, one of which a nephrostomy as described above was demanded. The other two patients' renal function remained unchanged. One patient, in the group of patients with normal preoperative renal function, was considered to have become worse following the operation.

Recently, we inquired by mail each patient about act of micturition. The inquiries indicated that closed loop ileocystoplasty may afford nearly complete sympotomatic refief to the patient, except for a weak pulsive force of the ileo-bladder to evacuate urine, and persistent mucus formation (Table 10). It was also shown that almost all the patients need to use manual compression above the pubes to empty the bladder. Considered to be the most intersting feature seen in this review is that overflow incontinence still persisted for a long time following the operation, especially in the patients who underwent cat-tail patch method.

DISCUSSION

In general, an encouraging degree of relief has been afforded to most of the patients with contracted tuberculous bladder following ileocystoplasty. When one remembers the extreme misery in which some of these patients have lived, the relief has made the operation well worth while, even though their act of micturition after ileocystoplasty is far from restored to normal. A successful ileocystoplasty will greatly increase the storage capacity of the bladder, will usually reduce V-U reflux and will surely overcome the threat of renal deterioration. Most authors[1,2,4,7,11,12,13] who have reported series of closed loop ileocystoplasty have been satisfied with the results obtained. Their satisfaction might depend partially on the greater feasibility and more time-saving procedure of the operation compared with any other type of intestinocystoplasty. Some authors,[3,4] however, have drawn attention

to a pronounced drawback of this type of the ileocystoplasty. This is related to the fact[4,5,11] that even when the ileo-bladder functions fairly well, the blind distal loop does not satisfactorily evacuate urine at any time. It occasionally works as a narrow-mouthed diverticulum and the enlarged bladder holds an appreciable amout of residual urine. This may sometimes cause the marked dilation and elongation of the ileal loop which was first described by Houtappel and Gründemann[6] in 1960, and happily was never encountered in our series, although all the loop had tendency towards dilatation and elongation. Urethral stricture and tuberculous prostatitis are often very likely to accompany the tuberculous contracted bladder, and easily cause abnormal dilatation and elongation of the loop like an ileo-cystostomy stenosis does. Therefore, careful examination of the urethra and the prostate gland is necessary, especially if the patient is a male. Distal obstruction in the urethra or at the bladder neck would be a contra-indication to ileocystoplasty[3,11], unless it can be repaired with satisfaction before or during the operation. The dome of the bladder must be widely resected in order to prevent the site of anastomosis from becoming stenosed. Too small a bladder may sometimes make it difficult to do this, particularly when the cat-tail method is used, because of a narrow distal end of the ileal loop which is joined to the dome with use of end-to-side anastomosis. In fact, two ileo-bladder stenosis seen in this series both occurred in cat-tail fashioned ileocystoplasty. This is a major fault of the cat-tail method, coupled with the tendency towards nearly permanent persistence of overflow incontinence. The advantage is, however, that a cat-tail segment can almost always be made to evacuate all urine in the ileo-bladder[5], in contrast to the poor emptying by the distal loop of the U patch method.

The open cup type of ileocystoplasty provides a new bladder which functions as a total unit. It is preferable to and is less liable to complications than the closed loop operation[11]. However, the open type operation is considered to be much more time-consuming and complicated to perform. A disadvantage common to both types of ileocystoplasty is that the masculature of the ileum is much weaker than the detrusor muscle of the bladder. Any resistance to such a degree that the colonic wall would be overcome, might often cause dilatation of the ileal segment[6].

It would be recommended to use colocystoplasty[6,9,10], as a surgical correction for the tuberculous contracted bladder, if open cup ileocystoplasty is adopted at all. The use of an isolated piece of sigmoid colon for enlargement of the bladder is prefered to any type of ileocystoplasty because only small amounts of electrolytes will be absorbed and there

will be reduced secretion of mucus. Moreover, the sigmoid is located anatomically closer to the bladder and its wall is accustomed to higher pressure as is the ileal wall.

Whichever is used for the intestinocystoplasty, the ileal loop or the colonic segment, it is fairly dangerous to make the segment too long, because that provides a large absorptive bowel surface, especially in a patient suffering from renal impairment[3,7,11]. Hanley[4,5], in contrasting their results of the closed loop operation with those of the open patch operation, reported that a very great increase in capacity is not necessary because the volume of urine passed at each act of micturition is not related to the total available bladder capacity.

Another matter disturbing us with intestino-cystoplasty is pregnancy. It seems improper to expose a fertile woman to the risk of complications due to pregnancy following the operation. Surgical sterilization, in such cases, would be an acceptable and ideal policy[11]. Difficulties may often be encountered in accomplishing this policy because the patient may wish to remain fertile and refuse the operation. In our series, gynecologists presuaded two patients to receive artificial terminations of their pregnancies. From our previous experience with a patient out of this series who gave a full-term and normal birth following the ileocystoplasty, and through reports written about simmilar cases we fell that most of the patients who underwent the intestinocystoplasty probably could have delivered with saftey.

REFERENCES

1) Cibert, J.: Ileo-cystoplasty for the contracted bladder of tuberculosis: Report of a case. *Brit. J. Urol.*, 25 : 99–102, 1953.
2) Ferris, D. O.: Enlargement of the urinary bladder with a segment of ileum. *J. Urol.*, 77 : 826–834, 1957.
3) Goodwin, W. E., Turner, R. D. and Winter, C. C.: Results of ileocystoplasty. *J. Urol.*, 80 : 461–466, 1958.
4) Hanley, H. G.: The emptying mechanisms of various ileal loops studied with the x-ray image amplifier. *Brit. J. Urol.*, 28 : 402–416, 1956.
5) Hanley, H. G.: Ileocystoplasty: A clinical review. *J. Urol.*, 82 : 317–321, 1959.
6) Houtappel, H. C. E. M. and Gründemann, A. M.: Observations on ileocystoplasty. *Brit. J. Urol.*, 32 : 255–266, 1960.
7) Kerr, W. K., Gale, G. L. and Peterson, K. S. S.: Reconstructive surgery for genitourinary tuberculosis. *J. Urol.*, 101 : 254–266, 1969.
8) Kiriyama, T., Takara, M., Fukuda, K., Hayashida, S., Hironaka, H. and Kamiryo, Y.: An end-to-end ureteroileal anastomosis. *Nishinihon J. Urol.*, 34 : 595–603, 1972.
9) Küss, R.: Colo-cystoplasty rather than ileo-cystoplasty. *J. Urol.*, 82 : 587–589, 1959.
10) Küss, R., Bitker, M., Camey, M., Chatelan, C. and Lassau, J. P.: Indications and late results of intestino-cystoplasty: A review of 185 cases. *J. Urol.*, 103 : 53–63, 1970.

11) Maged, A.: Evaluation of different techniques of ileocystoplasty: An analysis of complications in 32 cases. *J. Urol.*, 99 : 276-280, 1968.
12) Pyran, L. N. and Raper, F. P.: Some uses of an isolated loop of ileum in genitourinary surgery. *Brit. J. Surg.*, 42 : 337-345, 1955.
13) Roblejo, P. G. and Malament, M.: Late results of an ileocystoplasty: A 12-year followup. *J. Urol.*, 109 : 38-42, 1973.