

SOME OBSERVATIONS OF 31 SPINAL CORD INJURY PATIENTS ON WHOM THE BRICKER PROCEDURE WAS PERFORMED

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Abstract. Only one-half of 31 spinal cord injury patients had good to fair results following cutaneous uretero-ileostomy. Poor results and deaths with urinary complications were more prevalent in the cervical and upper thoracic than in the more caudad cord lesions. There was a spread of $\frac{1}{2}$ to 19 years in time interval from onset of spinal cord injury to performance of the Bricker procedure. A tendency for unsatisfactory postoperative courses was more associated with the longer time intervals.

Key words: Bricker procedure; Contra-indication; Uretero-ileostomy.

Introduction

THE question: How fare spinal cord injury individuals with the Bricker procedure?

Bricker (1950) reported on four patients with cutaneous uretero-ileostomy after pelvic evisceration.

He listed the operative features that produced good results (Bricker, 1956). The essential advantages of the ileal segment is that active peristalsis tends to keep the segment empty when brought to the skin surface so that it acts as a conduit rather than a reservoir, reducing stasis and subsequent ascending infection and electrolyte reabsorption (MacKenzie & Ankenman, 1960).

The history of use of isolated segments of small intestine for the urinary tract, appears in DeWeerd's paper (1959).

Comarr (1972) has shown that patients with Schneider's central cord syndrome of cervical injury can have normal return of bladder function as long as 8 months after injury. Insoft *et al.* (1971) suggest that diversion be postponed for at least 1 year to allow an adequate period for recovery.

Watt (1974) has a lucid article on nursing care for urinary diversions.

The routine irrigation of the infected bladder with antiseptic solutions has prevented the development of early pyocystitis (Kambouris *et al.*, 1976).

Cordonnier and Bowles (1970) reported on 60 cases of ileal loop diversion for neurogenic bladder. They thought it was especially applicable in traumatic paraplegia when progressive upper urinary tract deterioration is occurring. Their total of 436 ileal loops for many conditions were followed up to 15 years.

Kambouris *et al.* (1976) reported on 26 patients with spinal cord injury followed up to 6 years after the Bricker procedure.

Woodhead and Porch (1964) followed patients an average of 20 months from the time of surgery. They remarked that it was beginning to appear that by judicious use of prophylactic cutaneous uretero-ileostomy on those who have not yet sustained significant urinary tract damage, such damage can be largely prevented.

A favourable report on 11 Bricker procedures on paraplegics came out of Richmond VA Hospital in 1965 (Hackler *et al.*, 1965). Kenealy (1965) in discussing this paper noted that once anatomic scarring occurs in the collecting

system and renal parenchyma, stasis tends to be perpetuated. Ten years later Reece and Hackler (1975), at Richmond, reported 3 to 5 year poor results with three ileal conduits following successful bilateral vesico-ureteroplasty.

Thirty-five per cent of Bors and Comarr (1971) observed 20 cases of cutaneous uretero-ileostomy died. Comarr (1971, 1972), for up to 13 years after Bricker procedure, followed 11 cases performed at hospitals elsewhere.

Guttmann (1973) commented on unfavourable results of ileal conduits urinary diversion.

Duggan *et al.* (1974) showed the disadvantages of reflux in uretero-ileal cutaneous anastomosis. Skinner and others (1975) have demonstrated that ureteral reflux from ileal conduits produces histologic evidence of pyelonephritis.

At Memphis we didn't think the uretero-ileal anastomosis was adequate unless reflux occurred on ileogram!

Comarr and Bors (1971, 1972) point out the desired ability to performed retrograde catheterisation being negated by the Bricker procedure.

Materials

I reviewed the available records and X-ray films to find out what happened to spinal cord injury individuals after the Bricker procedure.

A markedly incomplete central cord syndrome and all individuals with known neoplasm were excluded from the study. This left 31 patients who were followed an average of 4.8 years after cutaneous uretero-ileostomy. Fourteen of the 31 followed 5 to 15 years. Twenty-two of these patients had their uretero-ileostomies performed at elsewhere hospitals, nine at Veterans Administration Hospital, Memphis.

The nine Memphis procedures were performed in adult paraplegics for similar reasons to Bors and Comarr (1971) observed 20 cases. These were: recurrent urinary infection (Flickinger & Walker, 1958), with and without reflux, hydronephrosis and/or deterioration of renal function.

Method

The spinal cord region involved in traumatic myelopathy, age of patient at time of injury and at time of Bricker procedure and number of years known alive with a Bricker bladder were tabulated. The pertinent aspects of urinary tract status were used to classify results into good, fair, poor and death categories.

Results

C4-C8 MYELOPATHY

Patient and age injury	Age at Bricker	Alive W Bricker	Remarks
			Upper Motor Neuron (UMN) Bladder
<i>Good Results</i>			
No. 14 H. R. 24 yr	35 yr	7 yr	Bilateral hydroureters and hydronephrosis cleared on 6 yr post-Bricker IVP
No. 26 A. C. W. 36 yr	43 yr	3 yr	1 yr post-Bricker IVP and renal function normal
No. 30 A. K. W. 24 yr	29 yr	11 yr	11 yr post-Bricker caliectasis left upper kidney pole. Creatinine clearance normal

Patient and age/injury	Age at Bricker	Alive W/Bricker	Remarks
<i>Fair Results</i>			
No. 29 T. J. M. 20 yr	20 yr	1 yr	1 yr post-Bricker ileo loopgram reflux only right ureter. IVP normal
No. 10 W. L. C. 32 yr	42 yr	3 yr	Hypertension 3 yr pre-Bricker 1 yr post-Bricker cerebrovascular accident
<i>Poor Results</i>			
No. 5 F. N. G. 24 yr	26 yr	5 yr	Postoperative temp 107° brain damage. IVP prior and 3 yr post-Bricker normal
No. 4 J. S. F. 35 yr	38 yr	4 yr	2 yr pre-Bricker right pyelolithotomy. 1 2 yr post-Bricker right nephrectomy
Operative Lower Motor Neuron (LMN) Bladder			
<i>Poor Results</i>			
No. 2 W. H. B. 45 yr	51 yr	3 yr	Prior to Bricker bilateral ureteral reflux to pelves. 2 yr post-Bricker right pelviolithotomy
No. 8 B. L. M. 20 yr	39 yr	4 yr	1 3 yr post-Bricker stenosed left distal ureter revised. 2/3 yr post-Bricker creatinine clearance 60 cc/min. (126 cc/min pre-Bricker)
T4 MYELOPATHY			
UMN Bladder			
<i>Good Results</i>			
No. 16 J. B. B. 21 yr	26 yr	2 yr	Pre-Bricker IVP normal. 1 yr post-Bricker mild right ureteropyeloectasis. No obstruction on ileoconduitgram. 24 hr creatinine clearance normal pre and 2 yr post-Bricker
T7-T12 MYELOPATHY			
UMN Bladder			
<i>Good Results</i>			
No. 34 C. L. B. 49 yr	49 yr	2 yr	IVP normal 2 yr post-Bricker
No. 12 F. W. C. 41 yr	44 yr	3 yr	Infusion IVP prior Bricker bilateral pyelocaliectasis. 1 yr post-Bricker IVP normal. 2 yr post-Bricker blood creatinine normal
<i>Fair Results</i>			
No. 20 E. M. 34 yr	37 yr	10 yr	Post-Bricker: 5 yr—stenotic left ureter, ileo site reanastomosed. 6yr—conduitgram: bilateral caliectasis. 10 yr—24 hr creatinine clearance 117 cc/min
<i>Poor Results</i>			
No. 15 I. A. H. 37 yr	44 yr	5 yr	3 yr post-Bricker right pelviolithotomy and nephrostomy. 5 yr post-Bricker right uretero-ileostenosis. IVP decrease function left kidney. Creatinine clearance 77 cc/min. (pre-Bricker 58 cc/min)
LMN Bladder			
<i>Good Results</i>			
No. 18 W. P. F. 50 yr	50 yr	3 yr	IVP normal 1 yr post-Bricker
No. 31 W. E. N. 28 yr	46 yr	5 yr	Pre and 4 yr post-Bricker IVP. Grade I hydro-nephrosis 4 yr post-Bricker 24 hr creatinine clearance 99 cc/min
<i>Poor Results</i>			
No. 1 J. E. B. 26 yr	40 yr	7 yr	6 yr post-Bricker non-functioning right kidney excised
No. 25 D. T. T. 26 yr	41 yr	4 yr	Bricker to remaining left kidney. 4 yr post-Bricker marked renal insufficiency and hypertension

LI-CAUDAL RADICULOPATHY			
Patient and age/injury	Age at Bricker	Alive W/Bricker	Remarks
LMN Bladder			
<i>Good Results</i>			
No. 19 S. R. P. 36 yr	38 yr	3 yr	IVP pre-Bricker Grade II hydronephrosis and ureterectasis. 2 yr post-Bricker IVP and 24 hr creatinine clearance normal
No. 21 D. M. 38 yr	44 yr	5 yr	Reflux to right ureteropelvic junction pre-Bricker. 5 yr post-Bricker patient reported marked lessening of urinary tract infections
<i>Fair Results</i>			
No. 22 B. J. P. 30 yr	39 yr	15 yr	14 yr post-Bricker IVP compatible with bilateral chronic pyelonephritis
No. 7 J. B. H. 33 yr	35 yr	6 yr	IVP 3 yr post-Bricker hydronephrosis Grade I right, Grade II left. 24 hr creatinine clearance normal
<i>Poor Results</i>			
No. 13 J. W. G. 55 yr	60 yr	3 yr	3 yr post-Bricker bilateral pelviolithotomy

DEATHS AND URINARY COMPLICATIONS

Patient and age/injury	Age at Bricker	Died after Bricker	Remarks
C6 UMN Bladder			
No. 17 B. R. E. 23 yr	30 yr	3 yr	Pre-Bricker BUN 20 mg%. IVP slight blunting calices, rt. 1 yr post-Bricker IVP delayed function, right kidney. 2 yr post-Bricker BUN 37 mg%. Stones from conduit prior to death by telephonic report
No. 33 R. D. P. 35 yr	44 yr	5 yr	Pre-Bricker IVP normal. Bilateral reflux to pelves. 5 yr post-Bricker non-function left kidney and 9 mm flat calculus. Death due thrombotic occlusion abdominal aorta and renal arteries
C6 OPERATIVE LMN BLADDER			
No. 24 A. D. S. 47 yr	51 yr	3 yr	Post mortem: recent myocardial infarction, bilateral pyelonephritis and left pyohydronephrosis
T1 UMN BLADDER			
No. 35 T. O. W. 38 yr	45 yr	7 yr	3 yr pre-Bricker small right renal calculus. Pre-Bricker reflux to calices. 2 months post-Bricker bilateral small renal calculi
T11-T12 LMN BLADDER			
No. 11 C. L. S. 32 yr	38 yr	8 yr	IVP pre-Bricker bilateral reflux to dilated calices. 4 yr post-Bricker IVP no function left, poor 20 min. function right. Pre-Bricker BP 110/80, 6 yr post-Bricker BP 184/100. Post mortem: lobular pneumonia. Severe bilateral pyelonephritis, chronic hydronephrosis, several calyceal stones, right

Urinary complications occurred in 14 of the 31 patients with 61 renal units (see Table I). Time intervals for complications after the Bricker procedure are listed in Table II.

Herein listed are deaths and urinary complications:

TABLE I
Complications in 14 of 31 patients with 61 renal units

	Renal units
Non-function kidney, left	2
Kidney excised, right	
1 non-function and infected	
1 had pre-Bricker pyelolithotomy	2
Ureteral stenosis	3
Hydronephrosis	3
Perforation ureteroileal sites	
death 40 days post-Bricker	2
Renal calculi	9
	—
	21

TABLE II
Time after Bricker complications

Bricker time from injury	Time from Bricker	No.	Right kidney	Left kidney	Deceased after Bricker
3 yr	1/2 yr	4	Nephrectomy	—	3 yr (report of stones from conduit)
7 yr	1 yr	17	IVP delayed function	—	—
6 yr	2 yr	2	Pelviolithotomy	—	—
7 yr	2 yr	27	Revision uretero-ileal site and ileal stoma	—	3 yr (necrotic renal papillitis and perirenal abscess)
7 yr	3 yr	15	Pelviolithotomy and Nephrostomy	—	—
5 yr	3 yr	13	Pelviolithotomy	Pelviolithotomy	
4 yr	3 yr	24	—	Pyohydronephrosis	3 yr (myocardial infarction)
6 yr	4 yr	11	—	No function	8 yr (lobular pneumonia and pyelonephritis, bilateral)
7 yr	5 yr	20	—	Uretero-ileal site reanastomosed	
9 yr	5 yr	33	—	Non-function	5 yr (thrombotic occlusion aorta and renal arteries)
11 yr	5½ yr	32	IVP no function and stones	IVP no function and stones	6 yr (bilateral renal abscess formation)
14 yr	6 yr	1	Nephrectomy	—	—
8 yr	40 days	36	—	—	40 days (bilateral uretero-ileal perforation)
17 yr	2 months	35	Small calculi	Small calculi	7 yr

There were three primarily urinary tract deaths:

Patient and age, injury	Age at Bricker	Died after Bricker	Remarks
C7 OPERATIVE LMN BLADDER			
No. 27 B. J. D. 17 yr	24 yr	3 yr	6 yr pre-Bricker right pelviolithotomy. Pre-Bricker IVP good function. 2 yr post-Bricker revision right uretero-ileal anastomosis and ileal stoma. Post mortem: chronic pyelonephritis with necrotising papillitis right. Right perirenal abscess, septicemia. Secondary amyloidosis liver, spleen, renals and adrenals
No. 36 R. C. H. 26 yr	34 yr	40 days	40 days post-Bricker uretero-ileal perforation, pelvic abscess and septicaemia
T5 UMN BLADDER			
No. 32 R. W. 39 yr	50 yr	6 yr	1 yr pre-Bricker calcification right lower pole. 1/2 yr post-Bricker bilateral hydronephrosis. 5 1/2 yr post-Bricker IVP no function. Bilateral renal stones. Post mortem: bilateral pyelonephritis, hydronephrosis, nephrolithiasis and abscess formation

TABLE III

				Deaths and urinary complications	
	Good	Fair	Poor	Deaths-urinary	Deaths-urinary
C4-8 UMN bladder	3	2	2	2	
C6-7 LMN bladder			2	1	2
T1-5 UMN bladder	1			1	1
T9-12 UMN bladder	2	1	1		
T7-12 LMN bladder	2		2	1	
L1-Caudal LMN bladder	2	2	1		
Totals	10	5	8	5	3

Correlation of results and dermatome levels of 31 patients with Bricker procedures is shown in Table III.

Discussion

One-half of operated patients had a satisfactory urinary tract course during review period.

Following the Bricker procedure, there were known urinary complications and deaths of:

5 of the 14 cervical cases within a median of 3 years.

2 of the 3 upper thoracic lesions, 6 and 7 years postoperative.

1 of the 9 lower thoracic lesions in 8 years.

None of five cauda equina lesions were known dead. The five averaged being alive 6.4 years after Bricker. (Range 3 to 15 years.)

Of the eight deaths, three were primarily due to urinary tract complications.

Conclusions

The 1946-76 known death rate of the 3790 spinal cord injury patients from Memphis Veterans Administration Hospital is 12.7 per thousand per year.

During an average of 4.8 years, 8 of 31 patients with cutaneous uretero-ileostomy died (about 53.8 per thousand per year).

Only one-half of the patients with Bricker procedure had a fair to good result. As a therapeutic procedure for the non-neoplastic urinary tract complications of spinal cord injury, the Bricker procedure is contra-indicated.

ZUSAMMENFASSUNG

Nur die Hälfte der Patienten, die eine Bricker Operation halten, zeigten gute Resultate. Die Bricker Operation ist für nicht-neoplastische Prozesse der Brickenmarks, *i.e.* traumatische Läsionen kontraindiziert.

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REFERENCES

- BORS, E. & COMARR, A. E. (1971). *Neurological Urology. Physiology of Micturation, Its Neurological Disorders and Sequelae.* University Park Press, Baltimore, pp. 247-253.
- BRICKER, E. M. (1950). Bladder substitution after pelvic evisceration. *Surgical Clinics of North America*, **30**, 1511-1521.
- BRICKER, E. M. (1956). Substitution for the urinary bladder by the use of isolated ileal segments. *Surgical Clinics of North America*, **36**, 1117-1130.
- COMARR, A. E. (1971). Follow-up on patients having undergone ileal conduit and vesicostomy operations. *Proceedings of the Eighteenth Veterans Administration Spinal Cord Injury Conference. Joint Meeting with The International Medical Society of Paraplegia*, pp. 179-182, October 5-7.
- COMARR, A. E. (1972). Renal complications of the ileal conduit and cutaneous vesicostomy among patients with traumatic cord bladders. *J. Urology*, **107**, 762-765.
- CORDONNIER, J. J. & BOWLES, W. T. (1970). Ileal loop-urinary diversion. Surgery of the ureter and urinary conduits. In: *Urology*, ed. M. F. Campbell and J. H. Harrison. W. B. Saunders Company, Philadelphia, 3rd edition, Chap. 58, pp. 2321-2337.
- DEKERNION, J. B. *et al.* (1969). Treatment of late complications of ileal conduit. *J. Urology*, **102**, 320-324.
- DEROSA, F. P. (1958). Complications incident to the ileal conduit. *J. Urology*, **79**, 834-837.
- DEWEERD, J. H. (1959). Urinary diversion via an ileal segment. *Surgical Clinics of North America*, **39**, 907-925.
- DICUS, D. R. (1974). New perspectives in the construction of the ileal stoma. *J. Urology*, **112**, 591-592.
- DUGGAN, F. J., JR, SANFORD, E. J. & ROHNER, T. J., JR. (1974). The disadvantages of reflux in uretero-ileal cutaneous anastomoses for supravvesical urinary diversion. *Urological Research*, **2**, 85-90.
- FLICKINGER, T. L. & WALTER, W. H. (1958). The use of the Bricker procedure in vesical-ureteral reflux. *Proceedings of the Seventh Annual Clinical Paraplegia Conference*, p. 56-71, November 18-20, 1958. VA Medical Teaching Group Hospital, Memphis, Tn.
- GUTTMANN, L. (1973). *Spinal Cord Injuries. Comprehensive Management and Research.* Blackwell Scientific Publications, London, pp. 401-407.
- HACKLER, R. H., DALTON, J. J., JR., & BUNTS, R. C. (1965). Changing concepts in the preservation of renal function in the paraplegic. *J. Urology*, **94**, 107-111.
- INSOFT, J., GALLEHER, E. P., JR. & YOUNG, J. D., JR. (1971). Urinary diversion for neurogenic bladder: use of retroperitoneal ileal loop. *J. Urology*, **105**, 211-213.
- KAMBOURIS, A. A. *et al.* (1976). Ileal loop uretero-ileostomy in patients with neurogenic bladder. *American J. Surgery*, **131**, 224-227.
- KENEALY, J. C. (1965). Considerations in urinary diversion of paraplegic patients. *J. Urology*, **94**, 112.

- LEADBETTER, W. F. & SHAFFER, F. G. (1965). Ileal loop diversion: its application to the treatment of neurogenic bladder dysfunction. *J. Urology*, **75**, 470-479.
- MACKENZIE, A. D. & ANKENMAN, G. J. (1960). Urinary diversion to the isolated ileal segment. *Canadian J. Surgery*, **4**, 43-49.
- REECE, R. W. & HACKLER, R. H. (1975). Vesico-ureteroplasty in the paraplegic: long-term follow-up in 77 patients. *J. Urology*, **113**, 474-476.
- SKINNER, D. G., GOTTESMAN, J. E., & RICHIE, J. P. (1975). The isolated sigmoid segment: its value in temporary urinary diversion and reconstruction. *J. Urology*, **113**, 614-618.
- WALKER, W. C. & WISE, M. F. (1969). Uretero-ileostomy in management of neurogenic bladders in the adult. *J. Urology*, **102**, 325-329.
- WATT, R. C. (1974). Urinary diversion. *American J. Nursing*, **14**, 1806-1811.
- WOODHEAD, D. M. & PORCH, P. P., JR. (1964). Cutaneous uretero-ileostomy for neurogenic vesical dysfunction. *J. Urology*, **91**, 253-255.
- WYATT, J. K. (1974). Ileal conduit diversion for benign disease: a critical review and long-term follow-up. *Canadian J. Surgery*, **17**, 270-273.