

Original Article

Augmentation ileocystoplasty in patients with neurogenic bladder due to spinal cord injury or spina bifida

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Study design: Retrospective analysis of augmentation ileocystoplasty for neurogenic bladder.

Objectives: To analyze the effects and complications of augmentation ileocystoplasty in patients with neurogenic bladder due to spinal cord injury (SCI) or spina bifida retrospectively.

Setting: Department of Urology, Kanagawa Rehabilitation Hospital, Japan.

Methods: We have treated 11 patients with neurogenic bladder due to SCI and 10 patients with spina bifida with augmentation ileocystoplasty since 1989. The purpose of the treatment was to stop vesicoureteral reflux (VUR) and/or amelioration of urinary incontinence. In 17 of 21 cases, the antireflux operation was received simultaneously. All cases performed clean intermittent self catheterization postoperatively.

Results: Urinary incontinence improved in all cases and only transient recurrence of VUR was observed in the follow-up term. Complications occurred in patients with SCI, but they could be treated conservatively.

Conclusion: Augmentation ileocystoplasty is a good treatment option for contracted bladder or VUR, which occurs in patients with neurogenic bladder.

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Keywords: augmentation ileocystoplasty; vesicoureteral reflux; spinal cord injury; spina bifida; neurogenic bladder

Introduction

When urinary incontinence or vesicoureteral reflux (VUR), which occurs due to low compliance bladder, detrusor hyperreflexia or detrusor-sphincter dyssynergia, fails to respond to conservative therapy, augmentation ileocystoplasty has become the treatment of choice. In our institution, we have performed ileocystoplasty for 21 patients with neurogenic bladder due to spinal cord injury (SCI) or spina bifida since 1989 according to Bramble's method.¹ The bladder was opened transversely in the coronal plane like a clam, and the opened bladder was patched up with the detubulized isolated ileum. Follow-up analysis, including complications associated with augmentation ileocystoplasty in those cases is reviewed in this study.

Patients and methods

We have treated 11 patients with neurogenic bladder due to SCI and 10 patients with spina bifida with

augmentation ileocystoplasty since 1989 (Tables 1 and 2). The patients with SCI consisted of 10 males and one female, and the mean age was 29.0 ± 9.59 (\pm SD) years with a range of 19 to 52 years. The causes of SCI were trauma in 10, and transverse myelitis in one. The mean period from injury to augmentation ileocystoplasty surgery was 73.5 ± 87.6 months with a range of 6 to 295 months. All patients with SCI demonstrated thoracic injuries. Their lesions were Th3 in one case, Th5 in one, Th6 in three, Th7 in one, Th8 in one, Th10 in two, Th11 in one and Th12 in one. Of 11 patients with SCI, one case with a Th12 lesion had incomplete paralysis and the other 10 cases had complete lesions. VUR occurred in 10 patients with SCI during the follow-up term; five cases with bilateral lesions, and five with unilateral lesions (all cases had right VUR). Before augmentation cystoplasty, clean intermittent catheterization (CIC) was performed in eight cases, while triggered voiding or manual suprapubic expression (Credé's maneuver)^{2,3} was performed in three cases (Table 2). All cases demonstrated urinary incontinence. At least eight cases performed CIC at inadequate frequencies (three to five times per day). The patients

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with spina bifida included three males and seven females, and the mean age was 16.2 ± 3.95 (\pm SD) years with a range of 10 to 23 years. VUR occurred in eight patients with spina bifida during the follow-up term; three cases with bilateral lesions, five with unilateral lesions. Before augmentation cystoplasty, clean intermittent catheterization (CIC) was performed in three cases, and Credé's maneuver was performed in seven cases (Table 2). All cases demonstrated urinary incontinence.

Augmentation ileocystoplasty was performed according to Bramble's method. The bladder was opened transversely in the coronal plane like a clam. An incision was made laterally between the main branches of the inferior vesical vessels anterior to the trigone and ureteric orifice to a point approximately 2 cm from the internal urethral meatus. A length of ileum of about 20 cm was isolated with its own blood supply, and opened on its antimesenteric border to form a patch. The ileal patch was sutured in position with continuous vicryl in one layer. The first antireflux operation was performed using Politano-Leadbetter's method⁴ (intravesical mobilization of the terminal ureter with subsequent reimplantation through a new hiatus and submucosal tunnel), while three patients from the second case to the fourth used by Cohen's cross trigone reimplantation technique⁵ and six cases after the fifth case used Orikasa's method.⁶ Where statistical analysis was appropriate, a paired *t*-test was used when comparing among the groups.

Results

Patients with SCI

The average follow-up term after the operation was 66.0 ± 42.9 months, with a range of 8 to 135 months.

Three patients who underwent triggered voiding or Credé's maneuver (the 2nd, 5th and 8th cases) wore an incontinence sheath on the penis. In all eight cases who underwent CIC, urinary incontinence was recognized. In five of eight CIC cases who underwent urodynamics before the operation, the mean maximal urethral closure pressure was 75.0 ± 16.0 cmH₂O and detrusor hyperreflexia was recognized in four cases, while one case demonstrated low compliance bladder. The mean vesical capacity before the operation was 150.9 ± 47.4 ml, with a range from 100 to 260 ml. Vesical capacity increased in all cases postoperatively; the mean vesical capacity was 396.0 ± 104.8 ml with a range from 300 to 600 ml ($P < 0.001$, Figure 1).

All cases were managed by CIC postoperatively. Persistent urinary incontinence was observed in only one case, although the leakage volume was less than 50 ml during the CIC interval, and his quality of life improved. As a short term postoperative complication, transient paralytic ileus occurred in four of 11 cases (36.4%). However, this was controlled with conservative treatment. VUR was recognized in four patients; contralateral recurrence in three cases and recurrence at the operated side in one case. The VUR was incomplete and transient in all cases and improved during the follow-up period. Wound infection and slight liver dysfunction occurred in one case, but this was conservatively treated. As a long-term complication, urethral stricture was observed in the first case, but direct causality with augmentation ileocystoplasty and antireflux operations was indistinct (Table 3). The third case produced vesical overextension (maximum 1000 ml), but this was improved by appropriate repeat CIC.

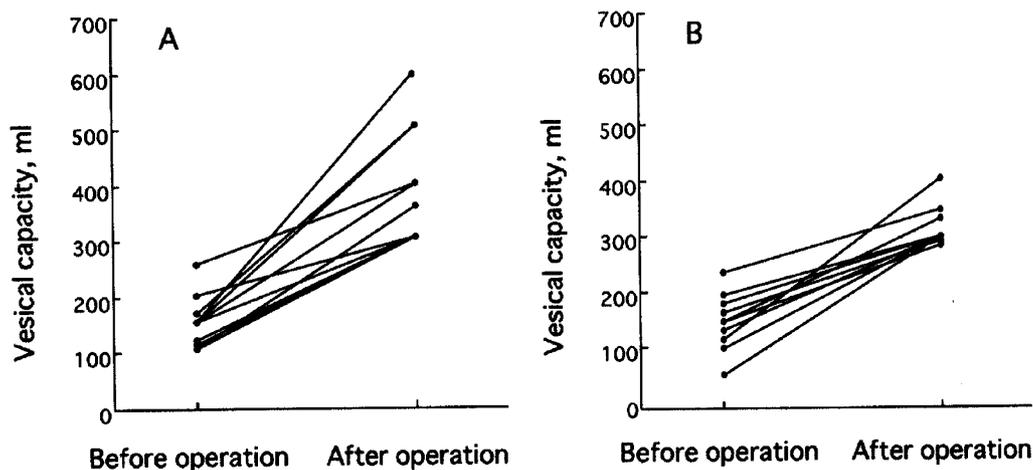


Figure 1 Alteration of vesical capacity for augmentation ileocystoplasty in patients with spinal cord injury (A) and spina bifida (B). Vesical capacity increased in all cases postoperatively. The mean vesical capacity increased from 150.9 ± 47.4 ml to 396.0 ± 104.8 ml in patients with spinal cord injury ($P < 0.001$, A), and from 148.5 ± 52.1 ml to 315.0 ± 36.0 ml in patients with spina bifida ($P < 0.001$, B), respectively

Patients with spina bifida

The average follow-up term after the operation was 51.8 ± 32.4 months, with a range from 12.4 to 111.1 months.

In all 10 cases, urinary incontinence was recognized. In six of 10 cases who underwent urodynamics before the operation, the mean maximal urethral closure pressure was 61.2 ± 16.7 cmH₂O, and no detrusor hyperreflexia was observed. All 10 cases demonstrated low compliance bladders. The mean vesical capacity before the operation was 148.5 ± 52.1 ml, with a range from 55 to 240 ml. The vesical capacity increased in all cases postoperatively; the mean vesical capacity was 315.0 ± 36.0 ml, with a range from 280 to 400 ml ($P < 0.001$).

Of six patients who had ventricularoperitoneal shunts, four underwent conversion to ventriculoatrial shunts preoperatively. Two patients underwent ventriculoperitoneal shunt ligation because the shunts did not drain the cerebrospinal fluid.

All cases were managed by CIC postoperatively. No persistent urinary incontinence was observed. Paralytic ileus and VUR did not occur in the follow-up term.

Discussion

Urinary incontinence was recognized in all 11 cases, and 10 cases were accompanied by VUR of various degrees. Since the seventh case in Table 1 was not accompanied by VUR, augmentation ileocystoplasty was performed to ameliorate the incontinence. The other 10 cases who were accompanied by VUR also underwent an operation to prevent renal dysfunction. Since renal dysfunction due to intravesical high pressure can occur in patients with neurogenic bladder due to SCI, we should carefully observe the urinary tracts of such patients. In this series, seven of eight cases who were treated with an anticholinergic agent developed VUR. These cases did CIC less than six times a day. There were episodes of overextension of the bladder of more than 400 ml in five cases. These five cases could have avoided VUR by doing CIC more frequently. However, when some cases could not avoid VUR or control urinary incontinence in spite of treatment with an anticholinergic agent and CIC, augmentation cystoplasty was considered as an option. It was reported that augmentation cystoplasty is

Table 1 Preoperative micturitional management and the VUR grade in subjects with spinal cord injury

Case	Age	Gender	Legion	Follow up (month)	Previous micturitional mangement	VUR (grade)
1	19	male	6	135	CIC	R(I)
2	25	female	7	116	Credé's maneuver	R(II)
3	30	male	3	106	CIC	R(III), L(I)
4	21	male	6	90	CIC	R(I)
5	21	male	5	74	Credé's maneuver	R(III), L(I)
6	24	male	10	65	CIC	R(II), L(III)
7	26	female	11	59	CIC	none
8	52	male	10	33	Credé's maneuver	R(I), L(II)
9	26	male	8	23	CIC	R(II), L(II)
10	33	male	12	15	CIC	R(III)
11	37	male	6	8	CIC	R(III)

Table 2 Preoperative micturitional management, VUR grade and management of ventriculoperitoneal (VP) shunts in subjects with spina bifida. VA shunt denotes a ventriculoatrial shunt

Case	Age	Gender	Follow up (month)	Previous micturitional mangement	VUR (grade)	Management of VP shunt
1	21	male	111	Credé's maneuver	R(II), L(III)	converted to VA shunt
2	17	male	101	Credé's maneuver	R(III), L(III)	converted to VA shunt
3	19	male	64	Credé's maneuver	L(IV)	converted to VA shunt
4	11	female	52	Credé's maneuver	L(III)	converted to VA shunt
5	16	female	52	CIC	previously operated	none
6	24	female	38	Credé's maneuver	R(III), L(I)	none
7	13	female	37	Credé's maneuver	L(IV)	ligated
8	13	female	28	CIC	previously operated	none
9	14	female	23	Credé's maneuver	R(II)	none
10	19	female	12	CIC	previously operated	ligated

Table 3 Complications of augmentation ileocystoplasty with or without antireflux surgery. All complications occurred in patients with spinal cord injury

Complication	Number of cases
Paralytic ileus	4
Contralateral occurrence of VUR	3
Reccurence of operated side VUR	1
Wound infection	1
Liver dysfunction	1
Urethral stricture	1

performed using the small intestine, colon, or dilated ureter.⁷ Recently, detrusor autoaugmentation, which is performed by incising or resecting the detrusor, has also been reported.⁸ We performed augmentation ileocystoplasty for the following reasons: Using the intestine is supposed to increase the vesical capacity; Using the small intestine is considered to be easier in preoperative or postoperative management and has fewer complications than using the colon. Nurse *et al*⁹ reported that a detubulized intestine should be used in augmentation cystoplasty. However, it was also reported that urinary incontinence was well controlled using an untubulized sigmoid colon in patients with high pressure maximal urethral closure pressure. We prefer using the detubulized ileum, because detubulization creates efficient drainage when a catheter is introduced into the bladder, and there are no significant disadvantages with ileum detubulization.

The many metabolic and surgical complications such as abnormal electrolyte metabolism, abnormal drug metabolism, calculus formation, osteomalacia or cancer associated with intestinal cystoplasty have been well documented in the urological literature.¹⁰ Although such complications did not occur in the follow-up term, careful observation is considered necessary.

We have performed antireflux operations according to Orikasa's method since 1993 because it is considered easier to perform in the contracted and trabeculated bladder than Politano-Leadbetter's or Cohen's method, and avoids recurrence when performing augmentation ileocystoplasty simultaneously.

How to deal with ventriculoperitoneal shunt in patients with spina bifida preoperatively is controversial. We have converted a ventriculoperitoneal shunt to a ventriculoatrial shunt when it was considered to be functioning, and to a ligated ventriculoperitoneal shunt when it was considered to be non-functioning. Printo *et al* reported that the incidence of post-

operative ventriculoperitoneal shunt infections after augmentation cystoplasty could be kept low when prophylactic antibiotics and short-term drains were used.¹¹ Matthews *et al* insisted that sterilization of the urinary tract was indicated before augmentation because ventriculoperitoneal shunt infection after bladder augmentation is common.¹²

Conclusion

When VUR or urinary incontinence in patients with neurogenic bladder cannot be improved with conservative treatment, and there are concerns about deterioration of the upper urinary tract function, augmentation ileocystoplasty and antireflux operations are recommended. Augmentation ileocystoplasty caused minor complications and good outcomes in the urinary tract in the long term.

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