

Urodynamic Evaluation in Patients with Anorectal Malformation: According to Spinal Cord Abnormalities

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Purpose: Anorectal malformation (ARM) is often accompanied by spinal cord abnormality or neurovesical dysfunction. However, only a few studies have comparatively assessed spinal cord abnormality and urodynamic data. We evaluated the effect of spinal cord abnormalities on perioperative neurovesical dysfunction and investigated the necessity of urodynamic study in patients with ARM.

Materials and Methods: From 1993 to 2007, 219 patients with ARM were newly diagnosed at our institution; A retrospective study was conducted on 20 patients who underwent preoperative and postoperative urodynamic examinations.

Results: Of 20 patients, 10 had abnormal spinal cords. Fourteen (70%) presented abnormal urodynamic findings (detrusor overactivity, dysfunctional voiding, detrusor sphincter dyssynergia, combined overactivity and dyssynergia, or detrusor acontractility). Preoperative urodynamic abnormalities were reported in 6 of 10 patients with abnormal spinal cords and 8 of 10 patients with normal spinal cords. New postoperative urodynamic abnormalities were reported in 2 patients in the abnormal spinal cord group, while 2 preoperative cases were resolved. In the normal spinal cord group, 2 preoperative cases were converted to other forms of urodynamic abnormality.

Conclusions: We advocate routine preoperative and follow-up urodynamic assessment of all patients with anorectal malformation, regardless of spinal cord abnormality.

Key Words: Urodynamics, Anorectal malformation, Spinal cord abnormality, Neurovesical dysfunction

INTRODUCTION

Lower urinary tract function is often disturbed in patients with anorectal abnormalities. Anorectal malformation (ARM) has been associated with spinal cord abnormality and neurovesical dysfunction (NVD).^{1,2} A significant proportion of ARM patients also have associated urologic abnormalities, which include vesicoureteral reflux (VUR), hydronephrosis,

and renal agenesis.³ Typically, patients require third-stage operations including pelvic surgery to correct ARM. Pelvic and perineal surgery may damage the nerve supply of the genitourinary tract and pelvic floor muscles, resulting in functional problems of the lower urinary tract.⁴ It has been suggested that lower urinary tract dysfunction occurs primarily in patients with spinal cord abnormalities.⁵⁻⁷ Some patients, however, may have abnormal urodynamic results before or after the operation, despite having a normal spine.

Few studies have focused on the incidence of perioperative neurovesical dysfunction. Therefore, we have evaluated the effect of spinal cord abnormalities on perioperative NVD in patients with ARM.

MATERIALS AND METHODS

The study included 219 patients of anorectal anomalies who were treated between June 1993 and February 2007. Among them, 79 patients (36.0%) were evaluated with associated preoperative urological anomalies and postoperative voiding symptoms. After further investigation, 20 cases (9.1%) of vesicoureteral reflux and 12 cases (5.5%) of hydronephrosis were noted. Further, 30 cases (13.7%) of fistula, including rectovesical fistula, vesicovaginal fistula, and rectourethral fistula, were also noted. Several cases of polycystic kidney (N=4), renal agenesis (N=2), crossed renal ectopia (N=2), ectopic kidney (N=1), duplicated ureter (N=1), megaureter with hydronephrosis (N=1), and hypospadias (N=6) were reported (Table 1).

Patients who did not show both preoperative and postoperative urodynamic results were excluded from the study. We selected 4 females and 16 males (2 female cloacal malformation patients and other 18 imperforate anus patients) who were previously treated for anorectal anomalies at our institution. Among 18 imperforate anus patients, only 1

patient had intermediate type disease. Functional and urodynamic evaluation was performed on patients aged 1 month to 11 years (median age: 6 months). All patients underwent magnetic resonance imaging (MRI) of the spinal cord. MRI images were evaluated by a neuroradiologist blinded to patient functional status. The bony spine was also evaluated using conventional X-rays. Urodynamic investigation was performed in all patients without sedation. Pre-catheterization uroflowmetry and postvoid residual urine were recorded. Abdominal and bladder pressure were measured with 6- or 8-Fr urethral catheter and rectal tube. Subtracted detrusor pressure was measured simultaneously with pelvic floor electromyography using surface electrodes and computerized equipment. Bladder filling was performed with a separate 6- or 8-Fr urethral tube at a rate of 5-10 ml/min, which corresponds to 10% of estimated bladder capacity. Pressure flow measurement was also conducted when the patient was able to cooperate.

To treat the underlying ARM, operations were performed according to the fundamentals described by Pena and Devries.⁸ In this study, we present preoperative and postoperative urodynamic outcomes to find the effect of sacroperineal dissections and spinal cord lesions on the voiding function. Based on such examinations, the data were classified as normal detrusor function, detrusor acontractility, detrusor overactivity, dysfunctional voiding for normal spinal cord patients and dyssynergia for neurovesical dysfunction patients, according to the definition of ICCS 2006.⁹

Table 1. Associated urologic abnormalities

Associated urologic anomaly	No. of abnormalities
Vesicoureteral reflux	20 (9.1%)
Hydronephrosis	12 (5.5%)
Polycystic kidney	4 (1.8%)
Renal agenesis	2 (0.9%)
Crossed renal ectopia	2 (0.9%)
Ectopic kidney	1 (0.5%)
Duplicated ureter	1 (0.5%)
Megaureter with hydronephrosis	1 (0.5%)
Hypospadias	6 (2.7%)
Fistula (Rectovesical fistula, vesicovaginal fistula, rectourethral fistula)	30 (13.7%)
No. of total abnormalities	79 (36.0%)
No. of total patients of ARM	219

RESULTS

Spinal MRI showed pathological findings in 10 patients, including tethered cord, syringomyelia, and caudal regression. The remaining 10 patients had normal spinal cords. Table 2 lists the relationships between spinal cord status and urodynamic abnormalities preoperatively and postoperatively. The incidence of preoperative NVD in various forms was found to be 70% (14/20 patients); the remaining 30% (6/20 patients) had normal neurovesical function. In normal spinal cord group, 2 patients including a intermediate type imperforate anus patient were diagnosed with normal detrusor function, 2 with detrusor overactivity, 1 with both detrusor overactivity and dysfunctional voiding,

Table 2. Association of spinal cord abnormality and urodynamic finding before and after operation

Urodynamics	Operation	
	Before	After
Normal spinal cord	10 patients	10 patients
Normal detrusor function	2	2
Detrusor acontractility	2	4
Detrusor overactivity	3*	1
Dysfunctional voiding	4*	3
Abnormal spinal cord	10 patients	10 patients
Normal detrusor function	4	4
Detrusor acontractility	1	1
Detrusor overactivity	3 [†]	4
Detrusor-sphincter dyssynergia	4 [†]	3
Total	20 patients	20 patients

*: same person, [†]: same 2 person

3 with dysfunctional voiding only and 2 with detrusor acontractility. In the abnormal spinal cord group, 4 cases of normal detrusor function, 1 of detrusor overactivity, 2 of combined detrusor overactivity and detrusor sphincter dyssynergia, 2 of detrusor sphincter dyssynergia and 1 of detrusor acontractility were reported. No significant difference in the incidence of NVD was observed in patients who had undergone Pena operations. In the normal spinal cord group, preoperative 1 case of pure detrusor overactivity and 1 case of combined dysfunctional voiding and detrusor overactivity were each changed into postoperative detrusor acontractility. Intermediate type imperforate anus patient maintained normal detrusor function, postoperatively. In the abnormal spinal cord group, detrusor sphincter dyssynergia and detrusor overactivity were each newly found in 2 patients, postoperatively who had normal preoperative urodynamics. On the other hand, another 2 patients with preoperative detrusor sphincter dyssynergia recovered normal neurovesical function postoperatively.

DISCUSSION

Among patients with ARM, particularly in those with high-level variants, late diagnosis as well as late treatment

of lower urinary tract dysfunction caused by NVD often leads to the development of permanent upper urinary tract damage.⁵ Previously, it has been suggested that in most patients, lower urinary tract dysfunction in cases of anorectal anomalies is associated with sacral or spinal abnormalities.¹ It has been also suggested that abnormal urodynamic findings are significantly related to sacral anomalies.⁵ However, our results show that the incidence of urodynamic abnormalities in ARM patients with spinal cord abnormalities (6/10 patients) was not higher than that of patients with normal spinal cords (8/10 patients), and that abnormal urodynamic findings were not clearly associated with the state of the spine. But the small number of patients in the current study may have skewed the analysis. None the less, regardless of spinal cord problems, NVD should be diagnosed as early as possible, because our study shows that even in patients who did not have spinal cord abnormalities, the urodynamic result was abnormal to treat. In cases of pathological results following urodynamic examination, the further investigation and management for NVD should be done immediately.¹⁰

NVD after rectal surgery has been considerably described in the literature.¹¹ Bladder denervation has been reported in patients with ARM after undergoing abdominoperineal pull-through operations, particularly in patients with high lesions.¹² During surgery for high cloacal malformations, rectoprostatic and rectovesical fistulas and bladder innervation are in close proximity to the surgical field, which may result in postoperative micturition disturbances.¹³ In patients with ARM, damage to the external vesical sphincter during ligation of rectourethral fistulas, iatrogenic injury to the sacral nerves during operation in the pelvis minor and associated malformations of the urogenital tract and vertebral column also play an important role in postoperative urinary incontinence and decreased urinary tract dysfunction.^{2,14,15} In the postoperative period, 70% (14 of 20) of patients had features of NVD. On comparing the preoperative and postoperative urodynamic findings, we found that 2 of 6 normal patients developed postoperative NVD, which might be attributed to iatrogenic nerve damage. However, delayed manifestation of NVD due to spinal cord abnormality cannot be excluded. Urodynamic values obtained preoperatively and postoperatively did not show significant difference, re-

ardless of whether the surgery was combined with a major transabdominal procedure. But preoperative urodynamic results is still important to predict a possibility of postoperative fecal incontinence.² In view of the above findings, functional as well as structural evaluation of the lower urinary tract should be performed before and after surgery as well as throughout follow-up, regardless of the spinal cord abnormality. Nevertheless, a larger study size is warranted in order to stratify ARM patients into subgroups according to the presence or absence of spinal defects.

CONCLUSIONS

The incidence of preoperative lower urinary tract dysfunction based on urodynamic evaluation is high in patients with ARM, even when no clinical or radiological evidence of spinal cord anomalies. This suggests that a normal spinal cord does not exclude dysfunction of the lower urinary tract in ARM patients. In view of the above findings, we advocate routine urodynamic assessment of patients with ARM during the preoperative as well as follow-up periods.

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