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Initial urological evaluation and management of children with neurogenic bladder due to myelomeningocele

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Summary

Introduction
The proactive management of children with myelomeningocele (MMC) has contributed to decreasing their progression to end-stage renal disease, thanks to early urological evaluation and timing implementation of treatments.

Objective
To demonstrate that early urological evaluation of the urinary tract in MMC shows functional alterations in most cases, and that it requires medical intervention, even when in some cases the complementary imaging studies do not show any abnormalities.

Material and methods
A retrospective study including 60 patients aged <1 year with MMC who were followed by a multidisciplinary team. All of them underwent renal/bladder ultrasound, videourodynamic studies, renal scintigraphy/dimercaptosuccinic acid (DMSA), and laboratory tests for kidney function. The studied variables were: bladder capacity and pressure, presence of overactivity, vesicoureteral reflux (VUR), urinary dilations and abnormalities on renal scintigraphy/DMSA. All the patients received clean intermittent catheterization (CIC).

Results
See Summary Table all the patients showed alterations in at least some of the assessed urodynamic variables: reduced cystometric capacity, 21.6%; detrusor overactivity, 55%; end filling detrusor pressure >20 cm H_2O, 43.3%; inefficient bladder voiding, 98.3%; indirect dyssynergic patterns, 28.8%. The high-risk videourodynamic findings were observed in 28 cases (46.6%). DMSA was abnormal in 30%. Renal impairment was detected in 6.6% of cases. A total of 66% of cases received oxybutynin.

Discussion
Almost all the children in this sample population showed urinary dysfunction, and approximately half of them had high-risk videourodynamic findings. Although many cases showed reflex urinary contractions, almost the entire sample had inefficient bladder voiding. An important limitation of this work was the lack of simultaneity in obtaining each of the requested studies.

Conclusions
In the initial urological evaluation of patients with myelomeningocele, almost all the urodynamic studies showed abnormalities and one-third showed abnormal DMSA, which led to therapeutic actions being initiated, although imaging studies were normal in a great number of patients.
CIC alone, starting immediately after birth, is not sufficient. To eliminate or decrease upper tract damage, oxybutynin should be started in addition.

Summary table Characteristics of the patients, clinical findings and complementary studies.

	n	%
Patients	60	
Mean age (month)	8	
Males	32	53.3
Symptomatic urinary tract infections	21	35.0
Dilatation urinary	22	36.6
Vesicoureteral reflux	12	20.0
Abnormal scintigraphy-DMSA	18	30.0

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Introduction

Since the development of proactive management for children with spina bifida [1], the progression of kidney failure towards end-stage renal disease has been substantially reduced [2]. When a neonate is diagnosed with myelomeningocele (MMC), it is essential to stabilize the patient and resolve the defect with surgery. Afterwards, assessment of the urinary tract is crucial.

Before the urodynamic studies are performed, CIC is initiated in order to measure intravesical pressure (generally during the first 2 or 3 months of life) [1–3]. High bladder filling pressure and/or overactivity require the use of anticholinergic drugs [1,2,4,5]. If renal/bladder ultrasound reveals ureterohydronephrosis or the urodynamic records show poor compliance, VCUG is required to confirm VUR [6].

The aim of the present study was to demonstrate that the initial urological evaluation in MMC shows bladder and renal functional alterations in most cases, and requires early medical intervention, even when other complementary imaging studies may not show abnormalities in many of the cases.

Material and methods

This was a retrospective study with an algorithm approved by the Myelomeningocele team at the present center. It consisted of the following methods: renal/bladder ultrasound, videourodynamic studies, renal scintigraphy with DMSA and laboratory tests to assess kidney function.

Among the 175 cases with MMC, the population sample was selected. It consisted of 60 patients aged <1 year with a diagnosis of MMC, who were admitted at birth to the present institution between 2010 and 2014, and were evaluated and followed for 1 year by a multidisciplinary team.

Eligibility criteria included patients aged <1 year and being diagnosed with MMC. The exclusion criteria consisted of patients with previous evaluation performed in other centers; 115 patients were excluded. The renal scintigraphy and kidney function laboratory tests were performed within 30 days of each other, and if an episode of symptomatic and febrile UTI occurred, the scintigraphy was performed 6 months after the episode. Symptomatic UTI was diagnosed if there were signs and symptoms of infection (fever ≥38.5 °C, abdominal pain, change in continence pattern or change in the color or odor of urine) associated with a positive urine culture. A positive urine culture was established as $\geq 10^4$ colony-forming units/ml. The presence of urinary leukocytes was considered significant if ≥5 WBCs/HPF (white blood cells/high powerfield) were observed on microscopic examination of centrifuged urine.

The variables studied for renal/bladder ultrasound were pyelocaliceal antero-posterior diameter (in mm). Dilation was classified as follows: a) ectasia: pelvic diameter of up to 15 mm or Grade <2 (Society for Fetal Urology, SFU); b) hydronephrosis: pelvic diameter >15 mm or Grade >3 (SFU). For urodynamic/videourodynamic studies (following ICCS) [7]: maximum cystometric capacity (in ml) compared with the expected cystometric capacity following the formula: 30 + age (years) × 30 [8]. Bladder pressure (cmH_2O) at normal age-related or expected capacity and maximum cystometric capacity. Detrusor leak point pressure (DLPP). Presence of detrusor muscle overactivity: phasic increases of pressure. This neurogenic detrusor overactivity was expressed as: a) phasic overactivity, which appears in all the filling phase, and b) terminal overactivity, defined as an only reflex contraction happening prior to reaching the adequate cystometric capacity for age. Voiding pressure and classification of detrusor activity into: dyssynergia, underactive, acontractile and effective. Presence of VUR on videourodynamic studies.

Videourodynamic results were defined as high risk if at least one of the following variables was present: 1) pressure >40 cmH_2O at expected bladder capacity or DLPP >40 cmH_2O; 2) high pressure values in neurogenic detrusor overactivity >65 cmH_2O for girls and >80 cmH_2O for boys (indirect sign of dyssynergia); and 3) presence of VUR. Nonionic iodinated contrast at 28 °C and drip at a speed <10 ml/min were used. Medware equipment (Mar del Plata, Argentina), with infusion pump and conventional fluoroscopy was used. For images, the video processing used was PACS-Afga (4 avenue de l'Eglise Romane, 33370 Artigues près Bordeaux, France).

Abnormalities on renal scintigraphy/DMSA were: decrease in relative renal function with a difference >10% and/or hypocapturing area scarring or irregular distribution. During their first days of life, all the patients in the present study received CIC, performed by a specialized and trained nurse, and an overnight indwelling catheter.

Oral oxybutynin therapy at a dose of 0.25 mg/kg/day was started in patients who showed bladder overactivity and high-pressure bladder. Antibiotic prophylaxis with cephalexin at 25 mg/kg/day was indicated until 30 days after CIC training.

Signed informed consent was obtained from the legal parents or guardians of the children for each diagnostic study performed.

For the statistical analysis, descriptive statistics in percent were used. The association between potential predictors and response variable (renal scintigraphy/DMSA and febrile UTI was performed with Logistic Regression Analysis in SAS/STAT 9.2 [NC, USA] (univariate analysis). The results were reported in odds ratio (OR) and 95% confidence intervals (CI).

Results

The mean age of patients at the time the videourodynamic studies were performed was 8.2 months (range 2–12). The evaluation was performed at 6 months after birth in 13 cases; at 4 months in nine cases, and at 2 months in four cases. The other patients were evaluated beyond 6 months of age. In the present study, 32 patients (53.3%) were male. All cases had an open myelomeningocele defect that was closed within: the first 24 h of life in 70% of cases; 24–48 h of life in 15% of cases; 48–72 h in 6%; 72–96 h in 5%; and 4–7 days in 4%. Even though the children in the present study presented with Chiari malformation, 12% of them required Chiari surgery and 73% needed drainage in