

## Mini Review

# Integrative Pediatrics and Child Care

## Urological Disturbances in Children with Cerebral Palsy: Short Review

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### Abstract

**Background:** Cerebral palsy is the most common motor disability in childhood. Among the comorbidities associated with this condition are lower urinary tract symptoms and urinary tract infections.

**Objective:** The present review is aimed to the general pediatrician to adequately fulfill his/her needs regarding a proper understanding of the urinary tract functioning of children with cerebral palsy and which urodynamical findings are expected.

**Conclusion:** Lower urinary tract dysfunction is associated with cerebral palsy and should be promptly recognized. Non-invasive methods, such as ultrasonography and uroflowmetry do not correlate with clinical complaints in these patients. Children with detrusor-sphincter dyssynergia are more prone to upper urinary tract deterioration in adulthood when not recognized and properly treated. The main objective of adequate treatment of these patients is to reduce morbidity and to improve quality of life of them as well as their families.

**Keywords:** Children, Cerebral palsy, Urinary tract infection, Bladder, Urodynamics

**Abbreviations:** CP: Cerebral Palsy; MRI: Magnetic Resonance Imaging; LUT: Lower Urinary Tract; OD: Overactive Detrusor; CAKUT: Congenital Anomalies of the Kidneys and Urinary Tract; UDS: Urodynamics; RCC: Reduced Cystometric Capacity; DSD: Detrusor Sphincter Dyssynergia; VUR: Vesicoureteral Reflux; GMFCS: Gross Motor Function Classification System

### Introduction

Cerebral palsy (CP) is a heterogeneous condition and all patients share disorders of the development of movement and posture, leading to limitation of daily activities. It's non-progressive and the causal disturbances occurred in the developing fetal or infant brain [1]. Other associated conditions include disturbances of sensation, cognition, communication, epilepsy and secondary musculoskeletal problems [2]. Motor and cognitive disabilities are directly related to the damaged brain area, but the timing of their clinical manifestation vary according to the affected area. Recently, Himmelmann

et al [3]. proposed a magnetic resonance imaging (MRI) classification system for children with CP, which in turn may improve our understanding of the neural pathways involved with the lower urinary tract (LUT) symptoms in these patients. CP may be classified according to the gross motor function [4] as well as to manual ability and functional status, all of them with a good correlation [5]. However, the association between the grade of motor and cognitive impairment and urological dysfunction remains a matter of debate. Other factors that were not previously regarded (such as genetics) as impacting on the prevalence of CP were recently considered as having an important role on the development of prenatal

mechanisms linked to this condition [6]. Congenital anomalies of the kidney and urinary tract (CAKUT) are also more frequently observed in children with CP [7]. Urinary complaints are common in children as well as adults with this condition. The present review is aimed to verify the most recent research regarding this neurological condition and the accompanying urological dysfunction in the pediatric population.

### **Clinical Presentation of Urological Dysfunction of Patients with CP**

Micturition involves multiple anatomic sites and systems, but the complete and adequate control of the lower urinary tract (LUT) by the brain occurs many months after the birth of a normal child. Indeed, other conditions may also mimic CP, particularly the dyskinetic form, such as Wilson's disease, Lesch-Nyhan Syndrome, and Leigh syndrome and propionic acidemia among others [8]. In patients with CP, the urological dysfunction may vary widely and may cause delayed or incomplete voiding control. Lower urinary symptoms, such as incontinence, urgency, polakiuria and urinary tract infections have a variable frequency in medical literature between 30 and 78% [9-13]. Voiding complaints suggest the diagnosis of lower urinary tract dysfunction, but despite of being the gold standard to correctly analyze bladder functioning and voiding, urodynamics remains an invasive tool [14].

### **Urodynamical Investigation**

Urinary continence may also not provide a reliable sign of normal findings in urodynamics as demonstrated by Richardson & Palmer, since mean bladder capacity pressure, mean compliance, detrusor-sphincter dyssynergia, presence of uninhibited detrusor contractions were similar both in continent and incontinent children. Gundogdu and colleagues commented on the impression that children with spastic CP (mainly in the presence of quadriplegia) present LUT dysfunctional symptoms more frequently than children with other types of CP, despite lack of statistical difference described in their study [15]. Bross et al observed that urinary symptoms and pathological urodynamical findings are associated with the degree of motor function impairment shown, as classified by the Gross Motor Function Classification System (GMFCS) and that the presence of symptoms did not correlate with pathologic urodynamical findings [16,17]. Nevertheless, included patients in the study were highly selected as pointed out by the authors. Studies regarding urodynamical findings are presented in table 1.

The majority of these studies include a relatively small amount of patients, leading to limited conclusions regarding the prevalence, impact and analysis of concomitant urological findings. An attempt to improve data quality is to implement CP registries. A systematic review by Hurley and colleagues [18] showed that most registries were from Europe, Australia and Canada and that only 2% of the retrieved research was related to raising the profile of CP. In future studies, a challenge regarding the best moment to investigate urologically these children remains to be resolved. Distinctly from classical concepts, Guerra and colleagues pointed to a different functioning behavior of the LUT in infants [19]. The voiding stream tends to be interrupted due to a proper sphincter relaxation. However, despite similarities to mechanisms observed in older children with neurogenic bladder, this phenomena is considered normal in infants. Classical interpretation of urodynamical findings could not apply to infants.

### **Non-invasive Methods and Imaging for Evaluation of the Lower Urinary Tract**

Considering that urodynamical evaluation is an invasive procedure, some authors evaluated other methods in order to minimize invasiveness. The usefulness of ultrasonography in these children was evaluated by Silva et al [11]. Over activity of the detrusor tends to be associated with a thicker bladder wall as observed in ultrasonography. This theoretical finding was analyzed by the authors, assessing the bladder wall thickness in 72 children with cerebral palsy and concluded that this method was not relevant for the diagnosis of the LUT dysfunction. Another possible non-invasive method useful in LUT dysfunction is uroflowmetry. Van Laecke and colleagues were not successful to correlate uroflow and continence patterns in severely mentally and motor disabled children [12]. Improvements in understanding of the neural pathways involved in the proper function of the LUT may arise after prompt usage of the proposed MRI by Himmelmann and colleagues. It provides a qualitative classification system for children with cerebral palsy (CP) and describes pathogenic neuroimaging patterns related to timing of brain lesions. It also proved to be reliable and easy to use in future CP registries.

### **Voiding Cystography: Indications**

The eventual deterioration of the upper urinary tract is a risk directly linked to urological dysfunction in patients with CP. Vesicoureteral reflux is the most common urological condition associated with recurrent

urinary tract infections. It may be classified as primary or secondary. Its importance correlates with the formation of scars, which in turn may lead to chronic kidney disease, with consequences such as arterial hypertension, proteinuria and decrease of global renal function. In a retrospective study, Combs et al described a prevalence of 20 % of VUR in pediatric patients with CP [20]. Ninety percent of these patients with VUR had signs of sphincter dyssynergy, which occurred predominantly at the internal sphincter level.

A source of concern regarding these patients is an eventual progression of LUT dysfunction during growth until adulthood. A recent systematic review by Samijn and colleagues described a tendency of patients showing voiding symptoms and pelvic floor over activity to upper urinary tract dysfunction in adult life [21]. They also described storage symptoms as being more common than voiding symptoms due to the high prevalence of neurogenic detrusor overactivity.

Considering these studies, the need for voiding cystography in all children with CP that present clinically with recurrent urinary tract infections, as well as those with pelvic floor overactivity/detrusor-sphincter dyssinergia is imperative.

**Table 1:** Main studies on cerebral palsy and urological disturbances.

Author	Year	Reference	DO	DSD	Reduced bladder capacity
Silva et al	2009	11	35.10%	27%	54.00%
Richardson & Palmer	2009	15	51.60%	61.10%	74.10%
Gundogdu	2012	16	39.3%*	15.10%	81.80%
Combs et al	2018	20	20.00%	18.10%	NA

\* Included children with both isolated DO and with detrusor-sphincter dyssinergia.

NA: Not Available

DO: Detrusor Overactivity

DSD: Detrusor-Sphincter Dyssinergia

## Conclusions

Urological disturbances in children with cerebral palsy are frequent, despite many patients deny symptoms. Even in absence of clinical complaints, non-invasive methods should be used in order to evaluate the kidneys and urinary tract. Patients with altered results as well as those with recurrent urinary infections must Int Ped Chi Care, 1(1): 63-66 (2018)

be submitted to a complete urological evaluation. In the future, a MRI classification system will allow a profound comprehension of the interactions between brain lesions and lower urinary tract dysfunction. Improvements regarding international registries are needed in order to clarify issues concerning timing of investigation and therapy of these dysfunctions.

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## Competing Interests

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