CHARACTERISTICS OF PEDIATRIC NEUROGENIC BLADDER PATIENTS AT HASAN SADIKIN HOSPITAL PERIOD 2019 -2024

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ABSTRACT

Objective: *The purpose of this study was to characterize pediatric neurogenic bladder patients in order to recognize, treat, and avoid the related problems.* ***Material&Methods:*** *a retrospective study was conducted in the urology department's at Hasan Sadikin Hospital in Bandung, Indonesia. Data from pediatric neurogenic bladder patients who had urodynamic tests performed during the study period were evaluated.* ***Results:*** *Participants were predominantly female with 7 subjects (58.3%) while there were 5 male subjects (41.7%). The mean age of patients was 9.2 ± 5.44 years. Conservative management was the course of treatment for 10 patients (83.3%). The majority of this patient's bladder capacity-10 participants, or 83.33% of the total-have small capacities of less than 250. Seven patients (58.33%) had normal contractility, according to the bladder contractility index (BCI) inspection. Up to 7 participants (58.3%) had detrusor sphincter dyssynergia (DSD).* ***Conclusion:*** *Pediatric neurogenic bladder patients typically have small bladder capacities, according to urodynamic examination results. The most common symptoms that patients experience was those related to incontinence. The fundamental principle of treatment for children with neurogenic bladder is conservative therapy. Understanding the characteristics of neurogenic bladder patients and routinely carrying out urodynamic examinations allows early detection and appropriate treatment for this condition.*

Keywords: *Pediatric, neurogenic bladder, urodynamic, incontinence.*

ABSTRAK

Tujuan: *Penelitian ini bertujuan untuk mengkarakterisasi pasien kandung kemih neurogenik pada anak-anak guna mengenali, mengobati, dan menghindari masalah terkait.* ***Bahan & Cara:*** *Penelitian retrospektif dilakukan departemen urologi Rumah Sakit Hasan Sadikin di Bandung, Indonesia. Data dari pasien kandung kemih neurogenik anak-anak yang menjalani uji urodinamik selama periode penelitian dievaluasi.* ***Hasil:*** *Peserta penelitian sebagian besar adalah perempuan dengan 7 subjek (58.3%), sementara ada 5 subjek laki-laki (41.7%). Rata-rata usia pasiena dalah 9.2 ± 5.44 tahun. Pengelolaan konservatif merupakan jalur pengobatan untuk 10 pasien (83.3%). Mayoritas kapasitas kandung kemih pasien ini 10 peserta, atau 83.33% dari total memiliki kapasitas kecil kurang dari 250. Tujuh pasien (58.33%) memiliki kontraktilitas normal, berdasarkan indeks kontraktilitas kandung kemih (BCI). Hingga 7 peserta (58.3%) mengalami disfungsi detrusor sfingter (DSD).****Simpulan:*** *Pasien kandung kemih neurogenik pada anak-anak umumnya memiliki kapasitas kandung kemih yang kecil, sesuai dengan hasil pemeriksaan urodinamik. Gejala yang paling umum dialami oleh pasien terkait dengan inkontinensia. Prinsip dasar pengobatan untuk anak-anak dengan kandung kemih neurogenik adalah terapi konservatif. Memahami karakteristik pasien kandung kemih neurogenik dan secara rutin melakukan pemeriksaan urodinamik memungkinkan deteksi dini dan pengobatan yang sesuai untuk kondisi ini.*

Kata kunci: *Anak-anak, kandung kemih neurogenik, urodinamik, inkontinensia.*

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INTRODUCTION

The term "neurogenic bladder" refers to a condition of bladder dysfunction caused by damage to the nervous system, either due to trauma, disease or other neurological disorders. Urinary tract infections, incontinence, and urine retention are problems with bladder control that are frequently brought on by this illness. The prevalence varies depending on the cause and characteristics of the population studied.[1-2]

In the United States, neurogenic bladder affects 40% to 90% of multiple sclerosis patients, 37% to 72% of Parkinson's disease patients, and 15%

of stroke patients. Study indicates that neurogenic bladder dysfunction affects between 70 and 84 percent of people with spinal cord injury.[2-3] Neurogenic bladder is frequently the result of congenital defects such spina bifida or other neurological problems in the pediatric population.[4] In these patients, some type of bladder dysfunction is present permanently.[2,5] Patients with neurogenic bladder can experience urinary incontinence, urinary tract infections (UTIs), vesicourethral reflux (VUR), and eventually kidney scarring and kidney failure. Vesicoureteral reflux occurs in 40% of cases in children by age 5 years, and up to 60.9% of adults with spina bifida experience some degree of urinary incontinence.[6] Without treatment, urological disorders can occur in up to 70% of patients in the first years of life.[7]

Neurogenic bladder describes lower urinary tract (LUT) dysfunction characterized by damage to the central nervous system, autonomic nervous system or peripheral nervous system.[4] This disease can persist without symptoms and in some cases cause lower urinary tract symptoms (LUTS). This can reduce quality of life and cause significant long-term costs.[5] Some causes include multiple sclerosis (MS), spinal cord injury (SCI), traumatic brain injury (TBI), cerebrovascular accident (CVA), spina bifida, cerebral palsy, transverse myelitis, and diabetes mellitus (DM).[6] The location of the neurologic lesion will often determine the type of LUT dysfunction.[7-8]

From decreased bladder function leading to urinary dysfunction to major consequences like pyelonephritis or kidney damage, the effects of neurogenic bladder in children can differ substantially.[9] A weak or twitchy pelvic floor, detrusor hyperactivity, dyssynergy of the detrusor sphincter, or a mix of these conditions are potential causes of voiding dysfunctions. There is a higher chance of vesicoureteral reflux and subsequent kidney injury when high bladder pressure is observed.[10]

Along with the history and initial physical examination, several tests such renal ultrasonography, urodynamic studies, and post-void residual assessment are required in order to establish the diagnosis.[7-8] Where the neurological lesion is located along the efferent (motor) or afferent (sensory) segments of the sacral arch pathway is typically correlated with the clinical findings. The classic presentation of a neurogenic bladder patient is complaints of a sensation of a full bladder and inability to empty the bladder (motor neurogenic bladder) and a patient who is able to urinate but the sensation is decreased (sensory neurogenic bladder).[2,11]

BUN/serum creatinine, creatinine clearance, urine culture and sensitivity, and urinalysis should all be part of the laboratory examination for individuals with neurogenic bladder. In order to assess the bladder's capacity to empty entirely, post-void residual (PVR) involves transurethral catheterization to measure the amount of urine that remains in the bladder right after voiding. When beginning an intermittent catheterization program as part of a bladder retraining program, PVR determination should always be carried out after completing Foley catheterization. Preventing excessive bladder distension and figuring out how often catheterizations are required to keep residual urine volume below 400 cc are two reasons why PVR is essential. A residual urine volume less than 100 cc was linked to a lower chance of developing bacterial cystitis, while a residual volume larger than 100 cc or more than 20% of the voided volume was considered abnormal. One non-invasive way to measure the amount of urine left over after urinating is via ultrasound.[2,12,13]

Urine flowmetry, bladder cystometrogram/electromyogram (CMG/EMG), Valsalva leak point pressure (LPP), and urethral pressure profile (UPP) should all be included of a urodynamic evaluation to evaluate urinary tract function. When diagnosing anomalies in the bladder and urethra during the filling/storage phase and the voiding phase of neurogenic bladder dysfunction, urodynamic testing is the most conclusive and objective method.[2,12,13]

The main goal in treating neurogenic bladder is to protect the upper urinary tract from damage and minimize permanent damage to the bladder. Secondary goals are to maintain urinary continuity and improve the patient's quality of life.[14] The specific treatment chosen will depend on the etiology of neurogenic bladder, patient preferences, comorbidities, and the patient's ability to undertake therapy when necessary. Treatment is generally divided into behavioral interventions, medication, catheters, neuromodulation, and surgery, either alone or in combination.[13-14]

People with cognitive impairment may benefit from conservative and behavioral

interventions. In addition to lowering residual urine volume, decreasing incontinence, increasing bladder capacity, and inducing bladder muscle relaxation, medical intervention can also lower bladder outlet resistance. Sphincterotomy, a destructive technique in which the external urinary sphincter is removed, is one form of surgery treatment. Sphincterotomy results in permanent, uncontrollable urine incontinence but also minimizes backflow, lowers bladder pressure protecting the upper urinary tract, and lessens episodes of autonomic dysreflexia.

Given the variety of treatment options available, it's critical to understand which patient characteristics are best suited for a given therapy. The particular type of bladder dysfunction encountered is one feature that is crucial to comprehend in the context of neurogenic bladder in children. Some patients may experience incontinence, while others may experience urinary retention.[15] Study has shown that this type of bladder dysfunction can vary depending on the degree of nerve damage and other individual factors.[16]

In addition, additional factors such as patient age, gender, and the presence of comorbid conditions can also influence the characteristics of neurogenic bladder in children. For example, study has shown that girls may have a higher risk of incontinence compared to boys.[17,18] In addition, the presence of other diseases or conditions such as diabetes mellitus can worsen neurogenic bladder symptoms and lead to a worse prognosis.[19-20]

OBJECTIVE

The studies on pediatric neurogenic bladder have yet to be conducted in Indonesia. Therefore, this study aimed to identify and analyze the characteristics of pediatric patients with neurogenic bladder in Indonesia particularly at Hasan Sadikin Hospital. In order to diagnose, treat, and manage this disease, it is believed that helpful patterns in the above characteristics will be found through a deeper knowledge.

MATERIAL&METHODS

This is an observational study that investigates various aspects of the patients at once. The purpose of this study is to categorize and assess the features of pediatric neurogenic bladder patients treated at Hasan Sadikin Hospital between 2019 and 2024. This type of study examines the features of a specific population. Each study subject is observed only once, contingent upon the conditions or status at the time of observation, as these qualities or their impacts are noticed concurrently. Primary data from medical records are used in study data. Variables studied included gender, age, symptoms, duration of symptoms, neurological abnormalities, duration of hospitalization, and urodynamic findings.

The subjects of this study were all pediatric patients diagnosed with neurogenic bladder who received treatment at the Hasan Sadikin Hospital in Bandung from April 2020 to August 2024. Sampling was carried out using the total sampling method. Every pediatric patient who meets the study criteria is included in the study for a certain period of time. Inclusion criteria include, patients with a diagnosis neurogenic bladder and aged <17 years. Patients with incomplete medical record data will be excluded.

There were multiple steps to the study process. Verifying the information in the medical record is the goal of the first step. After evaluating the inclusion and exclusion criteria, samples were collected. Patients undergo anamnesis, physical examinations, and imaging tests as part of the data collection process. Following the acquisition of data that satisfies the study's requirements, the data is processed and analyzed.

Several steps of data processing, including editing, scoring, coding, input, and cleaning have been performed in this investigation. Stages editing involves identifying whether all of the data has been entered correctly. Scoring is the stage of giving a score to the variable to be studied. Coding carried out with the aim of classifying data, by giving a code for each category of the data obtained. The data that has been coded is then entered into a computer system using a computer program (entry). The computerized program used to process data in this study is SPSS (Statistical Product and Service Solution). The last step involves cleaning, which involves reexamining the data that has been input into the computer system. By examining the frequency distribution of the variables under investigation, this step helps identify data entry problems.

Primary data from the researcher's observations was used in this study. Software statistics was then used to gather and process the data. Descriptive analysis was used to explain the correlation in this study.

RESULTS

The subjects in this study were predominantly female with 7 subjects (58.3%) while there were 5 male subjects (41.7%). The mean age of patients was 9.2 ± 5.44 years. The ages of the patients range from 1 year to 19 years. The majority of patients, or 5 individuals (41.7%), were between the ages of 12 and 19. Within the remaining age groups, there were 0% of patients under 1 year, 3 patients between 1-3 years, 1 patient between 4-7 years, and 3 people between 8-11 years (25%). Patients report symptoms such as LUTS and urine incontinence, with a 50% lifetime prevalence for both. With a median stay of two days, patients were hospitalized for a duration of two to three days. In the patients in this study, the only part of the kidney that was disturbed was the right kidney in 2 (16.7%), the left kidney in 0 (0%), the kidneys both (41.7%) and not disturbed in 5 (41.7%) of the patients. Ten patients, or 83.3% of the total, received conservative management as their course of treatment. Concurrently, 2 individuals (16.7%) had surgery.

This patient's bladder capacity is primarily dominated by a modest capacity <250, or 10 persons, or 83.33% of the total. Two additional individuals, or 16.7% of the total, had normal bladder capacity. All patients had normal bladder compliance. Patients in this study also showed no results stress urinary incontinence (SUI). A total of 7 people or equivalent to 58.3% showed bladder overactivity (DO) while 5 other people or equivalent to 41.7% did not experienced. Urodynamic examination related to bladder overactivity incontinence showed that 3 people or the equivalent of 25% experienced it while 9 people or the equivalent of 75% did not experienced. The results of the bladder outlet obstruction index (BOOI) examination showed that 2 patients experienced intravesical obstruction (16.7%), 1 patien had equivocal obstruction (8.3%), and 7 patients (58.3%) had non-obstruction. Inspection bladder contractility index (BCI) showed that 2 patients (16.7%) had strong contractility, 3 patients (25%) had normal contractility, while 7 other patients (58.33%) had normal contractility. Other examinations assessed are related detrusor sphincter dyssynergia (DSD) which showed that as many as 7 people (58.3%) experienced DSD, 3 people did not experience it (25%), and the other 2 people (16.7%) could not be concluded from the examination results. All patients who were the subjects of this study had bladder contractions.

Tabel 1. Study characteristics.

Variable	N	%
Gender		
Male	5	41.7
Female	7	58.3
Age	9.2 ± 5.44	
< 1 year	0	0
1-3 years	3	25.0
4-7 years	1	8.3
8-11 years	3	25.0
12-16 years	5	41.7
Manifestation		
LUTS	6	50.0
Urinary retention	0	0
Incontinensia	6	50.0
Dysuria	0	0
Hospitalization (median, min-max)	12	2 (2-3)
Kidney affected		
None	5	41.7
Right	2	16.7
Left	0	0
Bilateral	5	41.7
Management		
Conservative	10	83.3
Operative	2	16.7

Table 2. Urodinamic findings.

Urodinamic findings	Total	Neurologic impairment			
		Congenital (n = 5)	Infection (n = 2)	Trauma (n = 1)	Others (n = 4)
Bladder capacity					
Small (<250)	10 (83.33)	5 (50)	2 (20)	0	3 (30)
Normal (250-500)	2 (16.67)	0	0	1 (50)	1 (50)
Large (>500)	0 (0)	0	0	0	0
Compliance					
Normal	12 (100)	5 (61.67)	2 (16.67)	1 (8.33)	4(33.33)
Low	0 (0)	0	0	0	0
High	0 (0)	0	0	0	0
SUI					
Yes	0 (0)	0	0	0	0
No	12 (100)	5 (61.67)	2 (16.67)	1 (8.33)	4(33.33)
DO					
Yes	5 (41.7)	2 (28.57)	1 (14.28)	0	2 (28.57)
No	7 (58.3)	3 (60)	1 (20)	1 (20)	2 (20)
DOI					
Yes	3 (25.0)	2 (66.67)	0	0	1 (33.33)
No	9 (75.0)	3 (33.33)	2 (22.22)	1(11.11)	3 (33.33)
BOOI					
N/A	2 (16.7)	1 (50)	0	0	1 (50)
Intravesical obstruction	2 (16.7)	0	0	0	2 (100)
Equivocal obstruction	1 (8.3)	1 (100)	0	0	0
Non obstructive	7 (58.3)	3 (42.86)	2 (28.57)	1 (14.28)	1 (14.28)
BCI					
N/A					
Strong (>150)	2 (16.7)	1 (50)	0	0	1 (50)
Normal (100-150)	3 (25.0)	1 (33.33)	0	0	2 (66.67)
Weak (<100)	7 (58.33)	3 (42.86)	2 (28.57)	1 (14.28)	1 (14.28)
DSD					
Yes	7 (58.3)	2 (28.57)	2 (28.57)	1 (14.28)	2 (28.57)
No	3 (25.0)	1 (33.33)	0	0	2 (66.67)
• Inconclusive	2 (16.7)	2	0	0	0
Bladder contractility					
Yes	12 (100)	5 (61.67)	2 (16.67)	1 (8.33)	4 (33.33)
No	0 (0)	0	0	0	0

DISCUSSION

In table 1, the results show the basic characteristics of the patients who were the subjects of this study. The mean age of patients was 9.2 ± 5.44 years. Neurogenic bladder (NB) is defined as changes in the physiological function of the bladder due to central or peripheral neurological lesions. The most common etiology of NB in children is spina bifida (SB) and the most common malformation is lumbosacral myelomeningocele (MMC).[21] There were more female participants in this study than

male participants. There isn't currently a specific study available that compares the number of NB cases in children between men and women. However, the total male:female ratio in affected childrens with myelomeningocele, spina bifida, and cranial deformities is reported to be 0.82, and the number of males with high-grade neural tube defects is comparatively lower.[22]

Neurogenic bladder patients may develop vesicoureteric reflux (VUR), urinary incontinence, urinary tract infections (UTI), and eventually renal failure and scarring.[21,23] In the current study, there was no significant difference in the prevalence of LUTS and urine incontinence among the patients' complaints. Increased intravesical pressure has been linked to the onset of hydronephrosis in neurogenic bladder dysfunction, causing the ureters to empty urine into the bladder at progressively higher pressures until hydronephrosis is achieved.[24] The majority of the renal involvement in this case is bilateral and did not result in hydronephrosis. In the meantime, the right kidney alone exhibits more involvement than the left kidney alone. The incidence of congenital hydronephrosis in children is approximately 0.13-0.16%, with a higher prevalence in boys, and infants account for 25% of cases. Congenital hydronephrosis occurs more frequently in the left kidney, accounting for up to 2/3 of cases in newborns, whereas bilateral involvement occurs in approximately 10-40% of cases.[25] This difference in results could be due to differences in the etiology of hydronephrosis and the small number of subjects in this study.

Within the first few years of life, up to 70% of patients in the untreated group may develop urological issues; less than 5% go on to become continent. Preventing urinary tract infections (UTIs) and urinary tract damage is the primary objective of urinary tract treatment, along with maintaining or improving kidney function. Currently, there is debate over whether conservative or being proactive is preferable for the early treatment of neurogenic bladder. Nonetheless, the odds appear to be in favor of the proactive option because a proactive strategy lowers the risk of chronic kidney disease (CKD). The most aggressive approach, which combines medication and clean intermittent catheterization (CIC), is now the cornerstone of the first line of treatment for neurogenic bladder. Invasive procedures and reconstructive surgery for older patients, even those in their teens, are starting to be abandoned. This can also be seen in the results of this study where the majority of patients were treated conservatively.[21,23,26]

Urodynamic findings were obtained during the filling and emptying phases. Patients were evaluated for bladder capacity, bladder compliance, urodynamic stress incontinence (USI), detrusor overactivity (DO), and detrusor overactivity incontinence (DOI) during the filling phase, as well as bladder outlet obstruction index (BOOI), detrusor underactivity (DU), the bladder does not contract, and detrusor sphincter dyssynergia (DSD) during the emptying phase. Bladder capacity was categorized as small (<250 ml), normal (250-500 ml), or large (>500 ml).[16] The majority of study participants (83.33%) had small bladder capacities. This is consistent with a prior study by Widia et al. that demonstrated the small bladder capacity of neurogenic bladder patients. According to one study, the most prevalent urodynamic result (68-90%) following a stroke was detrusor overactivity (DO) with uncontrollably contracted bladder muscles. Widia et al., on the other hand, discovered that detrusor underactivity (DU) was the most typical urodynamic finding.[16] This conclusion is consistent with the study's findings, which showed that DOI was the most typical urodynamic finding. The term used to describe the urodynamics of neurologically caused bladder outlet obstruction is detrusor sphincter dyssynergia (DSD). In this study, almost 58.3% of the patients experienced DSD.

Due to the retrospective methodology of this study, there are gaps in the database containing certain data. Furthermore, because of the small sample size in this study, more research involving a greater number of subjects is required this is the limitation of this study. And also because of urodnynamic was not routine evaluation protocol.

CONCLUSION

Pediatric neurogenic bladder patients typically have small bladder capacities, according to urodynamic examination results. The most common symptoms that patients experience was those related to incontinence. The fundamental principle of treatment for children with neurogenic bladder is conservative therapy. Recognizing certain characteristics of neurogenic bladder patients and performing urodynamic exams on a regular basis facilitates early identification and suitable management of this disease.

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