

CASE REPORT

Acute urinary retention in a 14-year-old girl – diagnostic and therapeutic difficulties when initial therapy fails

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ABSTRACT

Acute urinary retention is rare in children and has various causes, but in 10% of cases has unclear aetiology. It is more common in boys and is often associated with urinary tract inflammation or mechanical obstruction. A 14-year-old girl presented with urinary retention preceded by haematuria and abdominal pain. Catheterisation drained 900 ml of urine, and symptoms initially subsided after taking α -blockers and oxybutynin. However, urinary retention reoccurred and persisted. Cystometry demonstrated bladder insensitivity, decreased detrusor activity, and increased sphincter tone. Suprapubic urinary diversion was performed. Neurological and magnetic resonance imaging examinations were normal, but cerebrospinal fluid showed IgG antibodies that reacted with sulfatide antigens. Immunosuppressive treatment was ineffective. Eventually administration of distigmine and baclofen permanently restored bladder function within a week. Persistent urinary retention is very distressing. Prompt diagnosis is possible, but managing idiopathic cases poses challenges, requiring a multidisciplinary approach. Evaluation based on knowledge of organ innervation is crucial.

KEY WORDS:

adolescent, urinary retention, baclofen, neurogenic urinary bladder, distigmine.

INTRODUCTION

Acute urinary retention (AUR) is described by a sudden and distressing inability to void urine [1]. It is a urologic emergency, often witnessed in the population of mature males [2]. However, its incidence in children is a rare event, typically intertwined with more complex causes, thus demanding a detailed evaluation for management. Over the past 3 decades there have been a limited number of studies published on the prevalence and aetiology of AUR in children [3–6].

The aetiology of AUR in the paediatric population is varied, and in about 10% of cases it is unknown [7].

Depending on the study, AUR is approximately 2–3 times more prevalent in the male paediatric population compared to females [3, 7, 8].

Acute urinary retention in boys is most often caused by infection and inflammation (e.g. balanitis, febrile systemic infection, urinary tract infection, urethritis) (~43%), functional elimination disorders (e.g. constipa-

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tion/faecal impaction, psychological) (~15%), mechanical causes (urethral obstruction, post-procedural, tumours) (~15%), idiopathic causes (~14%), trauma (~9%), and neurogenic causes (~3%) [3]. Acute urinary retention in girls is most often caused by infection and inflammation (e.g. urinary tract infection, other, vulvovaginitis) (~38%), functional elimination disorders (e.g. constipation/faecal impaction, psychological) (~25%), trauma (~16%), mechanical causes (e.g. tumours) (~9%), idiopathic causes (~9%), and neurogenic causes (~3%) [3]. The occurrence of AUR in children accounts for approximately 30 per 100,000 emergency department visits [3].

However, the greatest diagnostic and therapeutic challenge remains in patients for whom the cause of urinary retention cannot be determined.

CASE REPORT

We report the case of a previously healthy 14-year-old girl who presented with acute urinary retention. The episode was preceded by haematuria and abdominal pain, and despite the resolution of haematuria, the girl was unable to urinate. Catheterisation yielded 900 ml of urine, and further evaluation and treatment were initiated in the paediatric urology department. Initially, doxazosin, an α -blocker, and oxybutynin, an anticholinergic drug, provided improvement. However, after a week, urinary retention reoccurred, this time without concomitant symptoms of haematuria or abdominal pain. The patient's past medical history was negative for chronic diseases and significant injuries. Urethral catheter was placed again, and a urodynamic study was conducted, revealing a lack of intravesical sensation and detrusor activity (Figure 1).

During the filling phase, the detrusor muscle remained stable without additional contractions or urge to urinate. When the volume reached 257 ml, an attempt at micturition was made. Despite activating the abdominal press, no urine leakage occurred. No contractile activity of the detrusor was observed, and an increased tension in the urethral sphincter was noted during the micturition attempt. Based on the clinical course and test results, the presence of subvesical obstruction or other defects of the lower urinary tract was not anticipated. A ultrasonography scan of the urinary system did not reveal any pathological findings. Given that the problem appeared to be of a functional rather than anatomical origin, it was concluded that cystoscopy under general anaesthesia would not yield significant diagnostic information. Because of a lack of spontaneous urination after attempts of removing urethral catheter the patient was fitted with a permanent suprapubic urinary catheter (Cystofix®). This solution was intended to enable periodic closing of the catheter to enable the patient to actively micturate.

A neurological examination, along with a comprehensive magnetic resonance imaging scan of the brain and spinal cord with contrast revealed no abnormalities. The nerve conduction study result was normal. The cerebrospinal fluid analysis was normal. Nevertheless, to exclude multiple sclerosis (MS) or other demyelinating immune-mediated neuropathies, tests were planned to detect the presence of antibodies against aquaporin 4, oligodendrocyte proteins, myelin, and gangliosides.

While awaiting results and seeing no clinical improvement, the cause of the urinary retention remained undetermined based on the current findings. Treatment with doxazosin was maintained, and physiotherapy using

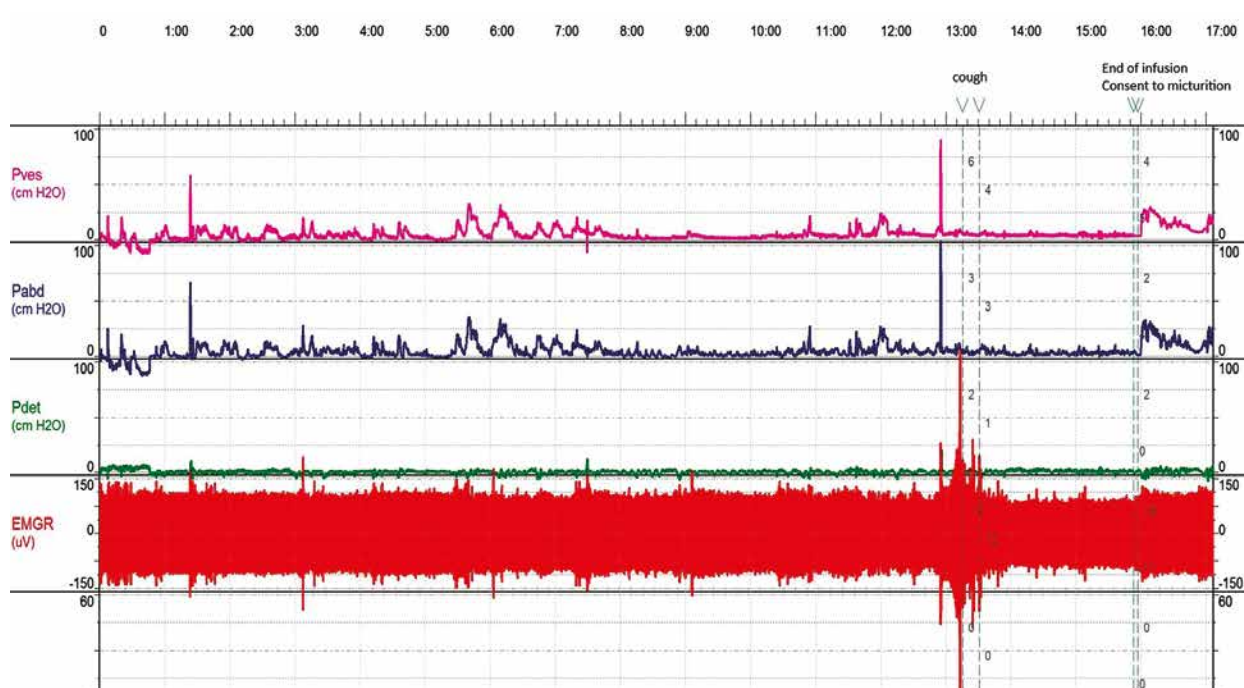


FIGURE 1. Urodynamic study results

biofeedback techniques was planned and set for the following month.

After 2 weeks, the test for antibodies against gangliosides in the cerebrospinal fluid confirmed the presence of IgG antibodies reacting with recombinant sulfatide antigens, which could be suggestive of some type of neuropathy. However, there was no presence of IgM antibodies reacting with recombinant antigens of sulfatides, GM1, GM2, GM3, GM4, GD1a, GD1b, GD2, GD3, GT1A, GT1b, or GQ1b.

Due to the complete lack of improvement and suspecting an autoimmune process, 3 sessions of immunosuppressive treatment were conducted – initially with IVIG, but because of poor tolerance, the therapy was modified to administer pulses of methylprednisolone. The girl reported some symptoms suggesting improvement, but attempts to close the urine drainage catheter failed – there was no independent micturition.

The data regarding the disease course were re-analysed. Based on the understanding of bladder innervation, therapy was modified in the fourth month of observation to include distigmine and baclofen. Distigmine 5 mg and baclofen 10 mg was introduced twice a day. Within a week, the child regained the sensation of bladder pressure and the ability to urinate independently. After 3 weeks, due to the complete return of micturition functions, the catheter from the urinary bladder was removed. Medication doses were gradually reduced – half of the previous dose was recommended for 2 weeks and eventually withdrawn, without recurrence of symptoms. The entire diagnostic and therapeutic process lasted 6 months.

DISCUSSION

Sudden urinary retention in a child poses a significant diagnostic and therapeutic challenge. It raises concerns not only among parents but also among doctors facing this issue. However, the greatest diagnostic challenge is presented by cases of unknown aetiology, meaning those for which treatment is not obvious. In the present case the aetiology of urinary retention was not clear at the beginning, but the initial use of an α -blocker and a cholinolytic drug brought improvement and raised hopes for successful treatment. A-adrenergic receptors are located at the urinary bladder neck, and their blockade with α -blockers results in smooth muscle relaxation and decreased bladder outlet resistance [9]. α -blockers are indicated for conditions including valve-bladder syndrome, dysfunctional voiding, bladder neck dysfunction, underactive detrusor, voiding postponement, and overactive bladder syndrome [10]. There are a lot of data in the literature about the use of α -blockers in urinary retention in adult men [11]. α -blockers are most commonly used in the paediatric population for dysfunctional voiding and urinary retention [12, 13].

Anticholinergics, such as oxybutynin, block muscarinic receptors in the bladder wall, inducing relaxation of its smooth muscle. They are commonly used as the initial treatment for neurogenic bladder in both children and adults [14].

In cases of urinary retention where the underlying cause is not clear and noninvasive treatment proves ineffective, a Cystofix® cystostomy can serve as a short-term solution for urinary drainage. It provides time for extended diagnostic evaluation of the cause of AURs. In some research articles it is noted that when catheterisation lasts for more than 5 days on average, both intermittent and suprapubic catheterisation methods have considerably lower risk of urinary tract infection compared to the transurethral approach, with respective odds ratios of 0.173 (95% CI: 0.073–0.412) and 0.142 (95% CI: 0.073–0.276) [15].

The most commonly described causes of AUR were excluded at the very beginning. Because no improvement was made, other causes were considered. The search for the aetiology of this rare case led to the analysis of Fowler's syndrome. Fowler's syndrome (FS) occurring in adult women is estimated at a rate of 0.2 instances per 100,000 each year. Fowler's syndrome manifests with an enlarged bladder capacity, diminished sensation, heightened maximal urethral closure pressure, and underactive detrusor muscle. This results from an unusual stabilisation of the muscle membrane, an inability of the urethral sphincter's striated muscle to relax, and amplified urethral afferent activity. These factors collectively enhance a spinal mechanism for urinary continence, preventing bladder signals from reaching the brain, leading to urinary retention [16].

More than 80% of females with FS exhibit one or multiple gynaecological conditions, such as endometriosis or polycystic ovarian syndrome [17]. However, these conditions were not confirmed in the discussed patient, and eventually this diagnosis was rejected.

Another potential diagnosis considered was polyneuropathy, of which AUR is a possible symptom. In the literature, AUR has been described as occurring during neurological conditions, specifically within the spectrum of Guillain-Barré syndrome and Miller-Fisher syndrome [18]. From the realm of neurological diseases, when searching for the causes of urinary retention, it is hard to overlook MS in differential diagnosis, which occurs with a certain frequency. Urinary retention is prevalent in patients with MS. According to cross-sectional self-reported survey data, one in four MS patients undergoes intermittent catheterisation [19]. In the patient, the presence of IgG antibodies reacting with recombinant sulfatide antigens was detected. Therefore, a suspicion of an ongoing autoimmune process was raised, so a decision was made to initiate immunosuppressive therapy. However, for the lack of improvement, the case was once again re-analysed.

Considering the anatomy and neurophysiology of urinary bladder function, therapy was modified with the introduction of distigmine and baclofen.

Upon bladder distension, afferent signalling elevates parasympathetic tone and diminishes sympathetic activity, resulting in the relaxation of the internal urethral sphincter and detrusor muscle contraction. Both parasympathetic pre-ganglionic and post-ganglionic neurons release the neurotransmitter acetylcholine (ACh) [20]. Receptor studies have identified the M2 receptor subtype as predominant in the human bladder, with M3 also present. Acetylcholine can activate multiple muscarinic receptors in the detrusor muscle of the bladder, inducing contractions. M3 receptors mediate cholinergic-induced contractions by hydrolysis of phosphoinositol, followed by the liberation of intracellular Ca^{2+} . M2 receptors amplify the effects of M3 receptor activation by inhibiting adenylate cyclase, thereby attenuating sympathetically led detrusor muscle depression. Parasympathetic endings innervating the internal sphincter of the urethra are nitrergic (they release nitric oxide and carbon monoxide), leading to its relaxation [21]. Distigmine is mainly used in the management of myasthenia gravis and underactive bladder (UAB) conditions. Distigmine is a reversible and long-acting synthetic carbamate acetylcholinesterase inhibitor, which increases the level and duration of the presence of ACh in neuromuscular junctions. Therefore, from a pharmacological perspective, distigmine may enhance voiding function by enhancing detrusor muscle contractility, and it can be considered one of the treatment options for UAB [22, 23]. Baclofen is used to manage reversible muscle spasticity, notably in conditions such as flexor spasms, clonus, and related pain, commonly resulting from spinal cord lesions and MS [24]. Baclofen is an agonist at the β subunit of γ -aminobutyric acid (GABA) in both mono- and polysynaptic neurons within the spinal cord and brain, leading to decreased release of excitatory neurotransmitters and increased inhibitory responses, which in turn alleviates spasticity [25]. When the bladder smooth muscle wall contracts and the internal bladder sphincter is relaxed, the external striated urethral sphincter muscle's somatic motor innervation prevents urine release [20]. The relaxation of the external urethral sphincter is influenced by GABA-responsive interneurons in the sacral spinal cord that receive signals from the pontine micturition centre. In accordance with this process, studies show that baclofen may be a useful treatment for dysfunctional voiding in paediatric population, thereby relaxing the external urethral sphincter [26].

The data regarding the use of baclofen and distigmine in patients with urinary retention are ambiguous. Adverse effects of baclofen include acute urinary retention, among others [24]. In some studies, clinical data regarding the use of distigmine for AUR treatment show conflicting results [22, 27]. Distigmine can be accompa-

nied by various side effects. Gastrointestinal reactions may include nausea and vomiting, often stemming from stomach irritation, as well as episodes of diarrhoea. Some patients may notice an unusual increase in salivation and perspiration. Additionally, distigmine can affect the visual system, occasionally leading to blurred or double vision, which could impact daily activities. Neurologically, it might induce muscle twitching or fasciculations, and although it is prescribed to strengthen muscle activity, it may paradoxically result in muscle weakness, especially if the prescribed dosage is not well calibrated to the patient's specific needs [28]. None of the symptoms mentioned above occurred in our patient. Even with inconclusive data, the patient in question exhibited notable improvement and relief from symptoms.

It must be emphasised that we did not determine the exact cause of AUR in the presented patient. Due to the IgG against sulfatides that were found, it can be hypothesised that urinary muscle dysfunction was secondary to an autoimmune disorder because of an unknown trigger. The immunosuppressive therapy could have improved the recovery. However, there is no evidence that an autoimmune process was actually active – no IgMs were present.

The consideration of non-standard therapy was predicated on an in-depth understanding of neurophysiology, and the pharmacological effects of the drugs in question were utilised in a clinical context in which alternative therapeutic modalities had been ineffective. Drawing from this precedent, it might be postulated that, in a comparable case, a regimen incorporating baclofen and distigmine could be contemplated without prior administration of immunosuppressive therapy. However, the broader application of these pharmacologic agents in a cohort with analogous conditions would unequivocally require further investigation.

CONCLUSIONS

Although sudden urinary retention in children is very rare, it causes great concern and discomfort for the child. Rapid diagnosis is possible, but in idiopathic cases, selecting the appropriate therapy is challenging and requires close collaboration between a urologist, nephrologist, and neurologist. If the treatment is ineffective, it is necessary to re-analyse the entire picture and relate it to the most basic knowledge about the innervation of the organs affected by the disease.

DISCLOSURES

1. Institutional review board statement: Not applicable.
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