Daytime wetting in children and acquisition of bladder control


Abstract

Daytime wetting is a common problem in early childhood. This article explains how the infant's bladder develops and how children are able to develop bladder control. The need for more structured toilet training at an earlier age than is standard today is proposed to prevent children having difficulty attaining and maintaining bladder control, which may be associated with delays in becoming continent and the development of daytime wetting. The article discusses common daytime wetting problems and describes how they can be assessed using a structured, standardised approach to history taking. Management using bladder retraining in the form of modified urotherapy is outlined, which aims to retrain the bladder without the need for surgery or pharmaceutical treatment.

Aims and intended learning outcomes

The aim of this article is to give an overview of the development of bladder control and common daytime wetting problems in children. It explains how to assess and treat children with this problem. The article is intended for anyone who is involved with the care of young children.

After reading this article and completing the time out activities you should be able to:

■ Summarise the process of toilet training and acquisition of daytime bladder control.
■ Define terms associated with daytime wetting.
■ Outline daytime wetting problems and indicate their prevalence.
■ Describe the assessment process.
■ Discuss appropriate interventions.
■ Implement a basic treatment programme.

Now do time out 1.

Physiology

Write a short paragraph summarising the physiology of the bladder and micturition. Check your account.

1 Time out

Introduction

It was previously presumed that voiding in infants occurred when the bladder reached a specific volume, however studies such as Yeung et al (1995) have since suggested that the infant's bladder is regulated by cortical control early in the neonatal period. These findings suggest that the voiding reflex disturbs sleeping children even if voiding is not conscious or voluntary (Zotter et al 2006).

A number of studies that have explored what happens when infants void have found that, even in newborns, micturition only occurs during wakefulness or on arousal from sleep, with cortical arousal identified in response to a full bladder (Yeung et al 1995, Holmdahl et al 1996, Jansson et al 2000). The study by Yeung et al (1995) also identified that voiding often occurred with poor co-ordination between the detrusor contractions and sphincter relaxation, which they concluded could be considered normal in this age group.

A later study by Sillén (2001) found that in the healthy neonate the bladder was emptied frequently, with incomplete voiding occurring in 30 per cent of those studied. Other studies have shown that bladder emptying can remain incomplete up to when the child becomes toilet trained when residual urine is no longer observed (Yeung et al 1995, Jansson et al 2000, Sillén 2001). The bladder volume gradually increases

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Conflict of interest
None declared

Keywords

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from approximately 30mL at birth to around 300mL in teenagers (Nevéus et al 2006). Figure 1 shows the anatomy of the urinary system.

There has also been some consideration of P2X3 receptors and their role in the release of adenosine triphosphate in the infant bladder (Lunacek et al 2009). The P2X3 receptor is a transmembrane ion channel that allows specific cell messenger traffic. When the bladder is distended during filling, adenosine triphosphate is released and, combined with P2X3, it regulates the degree of bladder distension (Lunacek et al 2009). A study carried out by Lunacek and colleagues (2009) investigating the presence of P2X3 in the fetal and infant bladder found that up to the age of toilet training there was a higher level of these receptors.

It has been shown that bladders lacking the P2X3 receptor gene exhibit hyporeflexia, which results in poor or absent detrusor contractions and reduced voiding frequency (Ruan et al 2004). Lunacek et al (2009) therefore postulated that the overexpression of P2X3 in non-toilet trained children was a normal physiological phenomenon and a possible cause of overactive bladder (OAB). They found that after children became toilet trained and developed voluntary control of voiding, P2X3 receptor expression gradually decreased with age.

It is not common for healthy neonates and infants to have OAB, but it is seen in some infants with the bladder contracting when it contains a very small volume of urine and with subsequent leakage of urine. This low bladder capacity is also accompanied by high voiding pressure levels (Sillén 2001).

There has been some debate about whether it is the wet nappy that disturbs the infant rather than the actual act of voiding. However, a study by Zotter et al (2007) examined 34 sleeping infants to see whether stimulated bladder voiding was able to wake them. The voiding was replicated by administering water into the nappy while the infants were connected to polygraphic recordings. The infants’ electroencephalogram frequency, heart rate and respiration did not change during this process and infants did not wake or move. Zotter et al (2007) therefore concluded that it was the cortical activity of the voiding process that induced the arousal response rather than the wet nappy.

### Toilet training

Over the past 50-100 years, trends in toilet training have changed, reflecting not only a more relaxed approach to childcare but also perhaps the change from washable Terry towelling nappies to modern day ‘super absorbent’ disposable nappies. This is indicated by the later age at which toilet training is now initiated.

Bakker and Wyndaele (2000) identified a move in the age of initiating toilet training from 12-18 months in parents born in the 1920s-1940s to over 18 months in parents born between 1960 and 1980. This was felt to be due partly to the labour-saving introduction of disposable nappies, and those of us that can remember soaking buckets of Terry towelling nappies, rinsing by hand and then boiling them can vouch for the motivational effect this had on getting a child toilet trained and out of nappies as soon as possible.

Toilet training now begins at 21-36 months of age, with only around half of children toilet trained by 36 months (Blum et al 2004). Although no clear definition can be found in the literature, the consensus appears to be that a child is toilet trained when he or she no longer requires help or supervision to use the toilet or potty, is aware of the need to go and can remain clean and dry in between times. A child is completely toilet trained when he or she no longer requires prompting or support from parents or carers.

Now do time out 2.
Continuing professional development

Developing control
To become continent children need to be ready physiologically and socially. In our society this usually occurs between the age of two and three years.

Children need to learn to postpone micturition until they can get to a socially acceptable, appropriate place in time. With practice they are able to inhibit micturition voluntarily until they can reach the toilet. For this control to develop, complex feedback loops need to be established between the bladder and the brain (Wen et al 2007). These enable the bladder to contract at the same time as the sphincter so that the bladder can empty completely.

However, children need to master a number of different skills to achieve this control. They need to be able to recognise signals that tell them their bladder is full and they then need to act on these signals even if they are busy playing. They need to understand the urgency and strength of the signal, so that they are better able to postpone micturition until the potty or toilet is reached.

Children need the manual dexterity and mobility to carry out toileting skills independently, such as opening and shutting doors, and managing clothing, including zips and buttons. They also need to learn how to use toilet paper to wipe their bottom, including understanding how much to use, as well as how to flush the toilet and how to wash and dry their hands.

There are also a number of social issues that they need to understand. For example, in our society most boys, once they start school, need to stand to pass urine, although a number of boys may choose to sit to pass urine if the facilities are available.

Figure 2 shows the internal anatomy of the female genitourinary system and Figure 3 shows the internal male anatomy. Boys and girls may have to use different toilets. Most people will also close the door of the toilet before they open their bowels.

Evidence from previous studies indicates that children would benefit from a structured toilet training programme (Bakker and Wyndaele 2000, Hellsstrom 2000, Mota and Barros 2008). This would include regularly sitting the child on the potty and/or the toilet from around 18 months, progressing to a more formal programme with regular ‘toilet time’ when a void is expected when the child is physically ready (typically at 24-30 months) – when he or she stays dry for longer periods of time and is waking up dry after a nap.

There is some evidence that changing to washable training pants, particularly in children over three years old, helps speed up the process by raising the child’s awareness and by providing negative feedback during wetting episodes (Tarbox et al 2004, Simon and Thompson 2006). It is prudent to check for underlying constipation if the child is having problems with toilet training, as there is evidence that underlying constipation is linked to a delay in toilet training (Schonwald et al 2004).

Now do time out 3.
Daytime wetting

Approximately 10 per cent of children will have varying degrees of daytime wetting problems over the age of five years (von Gontard et al 2010). A number of studies have suggested that the increase in the number of children presenting with lower urinary tract dysfunction, that is the bladder or urethra that is not functioning normally, is directly related to the changes in potty training that have occurred over the past 60 or so years (Bakker and Wyndaele 2000, Hellström 2000).

Bakker and Wyndaele (2000) looked at the changes in the way children in Belgium had been potty trained over the previous 60 years and found that the previously formal approach of regularly sitting the child on the potty no longer occurred, with a more liberal ad hoc approach often being the method used. They concluded that there was a similarity between the bladder training programmes used for older children with daytime problems and the traditional potty training methods that were used by parents 60 years ago. They argued that rather than using an ad hoc approach, timely introduction of potty training in a structured way might help reduce the incidence of bladder dysfunction.

A more recent study, involving more than 8,000 children, examined the link between the age that children started toilet training and their subsequent development of daytime bladder control (Joinson et al 2009). The authors found evidence that delaying the start of toilet training until the child was over the age of two years was linked to problems with attaining and maintaining bladder control. They concluded that this might result in delays in achieving continence and the possibility of relapses in daytime wetting. Today many toddlers of toilet training age are cared for by childminders or nurseries while their parents are working and this may result in confusion about whose responsibility it is to undertake potty training. Unless a parent is proactive and factors in potty training as part of the contract or starts the training at home, then the commencement of toilet training can often be delayed.

An interesting but potentially concerning finding has been identified regarding bladder overdistension in nursery children aged three to four years, which was shown to increase the incidence of post-void residual urine – a potential risk for urinary tract infections (Yang and Chang 2008, Chang and Yang 2009). This clearly has implications for practice – particularly in nursery and reception classes when children are encouraged to ‘hold on’ and wait until the session has finished before they go to the toilet.

Emotional needs

Find out what written information is available in your area for parents regarding potty training. If no leaflets are available, identify where suitable resources can be obtained (such as www.promocon.co.uk).
Clinicians should make school staff aware that this practice should be avoided with younger children because of the risk of them developing dysfunctional voiding. This condition occurs when the pelvic floor does not relax during normal voiding, which often results in the child using abdominal pressure to void and an inability to empty the bladder to completion.

**Daytime bladder problems**
The International Children’s Continence Society (ICCS) has agreed new definitions and standardised terminology for children presenting with daytime lower urinary tract symptoms (Nevéus et al 2006). The main reason for developing this new classification was so that children can receive the most appropriate interventions regarding any presenting lower urinary tract symptoms.

The guideline advised that any presenting problems should be classified as to whether the problem relates to the storage and/or the voiding phase of bladder function (Nevéus et al 2006).

However, it also needs to be remembered that during times of illness or stress, such as the arrival of a new sibling or parental separation, children might temporarily lose bladder control. This of course should not be considered as significant. This article will only discuss the most common daytime wetting problems.

**Storage symptoms** Storage symptoms relate to the ability of the bladder to store urine and the estimation of voiding frequency is a significant factor and particularly relevant from the age of five. Children who void more than eight times a day are said to have increased daytime frequency, while those who void fewer than three times per day are said to have decreased daytime frequency.

Urinary urgency is a sudden and unexpected desire to urinate and only becomes relevant after the age at which the child has become toilet trained. It should not be confused with the urgency some children experience if they have waited until the very last minute to dash to the toilet. Children with urgency often have an underlying OAB, but the diagnosis of detrusor overactivity can only be made after urodynamic investigations.

Children with a low voiding frequency of fewer than three voids a day are said to have an underactive bladder and they often need to raise intra-abdominal pressure by straining to commence micturition and to maintain a complete stream.

The term incontinence now relates to any leakage of urine, whether it is continuous or intermittent, with continuous wetting almost exclusively associated with congenital abnormalities (Nevéus et al 2006). The intermittent leakage of urine could be anything from a few drops to almost a full bladder.

**Voiding problems** Dysfunctional voiding occurs when the child’s pelvic floor fails to relax during voiding. It is sometimes an unconscious learned behaviour following problems with daytime wetting when the child (usually a girl) constantly contracts her pelvic floor to try to stop herself having a wetting accident. In other cases the cause is unknown, but possible causes include inappropriate toilet training or a response to urgency or pelvic discomfort.

Initiating urgency could be due to detrusor overactivity or urinary infection. Accompanying constipation may aggravate urinary symptoms. Dysfunctional voiding may result from persistent infantile voiding patterns, have familial or hereditary origins, get triggered inadvertently by toilet issues at school or may be associated with behavioural problems (Sinha 2011).

Children with dysfunctional voiding often present with urinary incontinence both during the day and at night. They may also have associated storage symptoms, including urinary frequency, urgency, urge incontinence or nocturnal enuresis (Chase et al 2010). These storage symptoms may result from associated detrusor overactivity, urinary infection and may be aggravated by constipation or behavioural disorders.

**Other causes of daytime wetting**
*Giggle micturition* Giggle micturition is a rare condition in which a child’s bladder empties completely when laughing. The child otherwise has normal bladder control and does not experience stress incontinence.

It is believed that laughter triggers impulses from the hypothalamus that cause the detrusor muscle to contract. There is no conclusive treatment for this condition, which is managed with bladder and pelvic floor retraining, but there has been some success reported in patients using methylphenidate (Chang et al 2011).

*Vaginal reflux* Vaginal reflux is characterised by wetting accidents following a normal void in the absence of any other symptoms in pre-pubertal girls. Wetting occurs a few minutes after urinating and is a result of urine refluxing into the vagina during voiding. Reassurance and advice about changing position on the toilet is the only treatment required. The girl should be advised to either sit comfortably on the toilet with her legs wide apart or if necessary to sit backwards on the toilet facing the cistern (Deshpande et al 2012).

Now do time out 4.

**Assessment**
A structured, standardised approach to history taking is important to establish the nature of incontinence and to exclude urinary tract infections or underlying
constipation. The ICCS identified four parameters that are important to record as part of the assessment process (Nevéus et al 2006):

- Wetting incidences, including timing and volume. As families often describe wetting to different degrees, giving them clear descriptive measurements enables the amount of loss to be better quantified. Families could use the following descriptions when recording wetting episodes:
  
  Damp pants only = +
  Wet pants/clothes = ++
  Wet pants/clothes/socks/puddle on floor = +++

- Voiding frequency. A bladder diary should be used to indicate how often wetting occurs as well as the degree of wetting.

- Voided volumes. To estimate the child’s maximum bladder capacity, they are asked to pass urine into a receptacle when they feel a strong urge to void and the contents are then measured and recorded. It is suggested that the voided volumes are measured at least three times with the largest volume passed identified as the maximum voided volume. It is important not to include the first void of the day in this measurement because this void is always larger than what would normally be passed during the day. The average maximum bladder capacity expected for a child of a particular age can be estimated by multiplying their ages in years by 30 and adding 30 which will give the volume in mL (Rogers 1996).

- Fluid intake. Families are asked to record the type, volume and times that drinks are taken. Children should be advised to drink six to eight drinks throughout the day.

Any underlying constipation should be excluded, any previous urinary tract infections recorded and relevant surgery as well as a general history noted.

The increased use of portable bladder scanners in the community has enabled the estimation of post-void residual urine to be carried out easily. However, a detailed discussion of further investigations, including urodynamics, is beyond the scope of this article. If assessment identifies any of the following problems, the child should be referred for further investigations (Rogers 1996).

- More than one previous urinary tract infection.
- A history of always having wet pants (usually in girls).
- Long-term bowel problems.
- Intractable wetting despite appropriate interventions.

Management

The problem should be explained clearly to the child and his or her parents. The family should be advised about the child’s appropriate fluid intake and the importance of regular toileting, and this should be reinforced with written information. Incentive or motivational charts may be recommended to reward achievable progress for increasing the number of drinks consumed throughout the day or going to the toilet at the required intervals throughout the day.

Modified urotherapy forms the basis of management. This involves a non-surgical, non-pharmaceutical treatment approach for lower urinary tract problems. Standard urotherapy includes providing information and explaining how the bladder works, with individualised explanation of the particular problems the child is having, accompanied by the use of a bladder diary to monitor progress, encouraging regular fluid intake, regular/timed voiding, correct posture for micturition and providing continuing support and encouragement (Nevéus et al 2006).

Standard therapy aims to teach the child how and when to void and how often, by providing education and positive feedback regarding progress. Specific urotherapy also includes various forms of behavioural modification, as well as specific pelvic floor training, biofeedback, electrical stimulation and catheterisation, and is mainly carried out in specialist centres.

The following outlines an adapted form of standard therapy that can be carried out in the community with limited resources (Rogers 1996).

It may take a few weeks before improvements are made and the family should be advised to follow the programme until the child is free of symptoms.

Education

The child is given age-appropriate information about how their bladder and kidneys work. They are shown how to sit on the toilet with their feet placed flat on the floor or on a step or stool. They are informed to relax and to try to pass urine in one go. They are encouraged to try to empty their bladder regularly. The prevention of constipation is important and the problem of a loaded rectum and its effect on the bladder are also explained.

The importance of drinking throughout the day, including three drinks while at school, is emphasised. The role a good fluid intake has in helping the bladder to store urine is explained to the child,
as many children limit their drinks believing that it will help keep them dry. An instruction sheet should also be provided.

**Motivation** It is important that the child and family are motivated to follow the programme. Talking to the child about the benefits of being dry may encourage their progress and parents should be informed about the need for positive reinforcement using stickers and reward charts. Regular contact with the family will encourage compliance with the programme and will identify any problems or non-progress in a timely fashion.

**Toileting advice** Although most children with OAB will feel the urge to pass urine very frequently, some children do not get the urge to go often enough. Therefore the aim of therapy is for the child to pass urine about seven times a day. To encourage this, a child may be given stickers numbered one to seven to use on a reward chart every time they pass urine, with a specific instruction to aim to use sticker three before lunchtime for example.

Children should be instructed to listen when they pass urine, to see whether it sounds as though it comes in one go, or whether it stops and starts. With the help of a parent the child may be asked to measure the volume of urine passed. By calculating their expected bladder volume following the ‘Voided volumes’ guidelines summarised on page 31, it will be clear whether or not they are emptying a full bladder.

Double micturition might help children who do not empty their bladder completely. The child should go to the toilet and then remain on the toilet for a short time after passing urine to have another go or should get off and then try again a few minutes later.

A wetting alarm is an option for children who do not recognise when they are wet. This is placed in their pants and an alarm will sound when it becomes wet to indicate that the child should go to the toilet immediately. It is advised that this should only be used at home.

**Medication**

The use of anticholinergics should be considered for children with OAB who do not respond to bladder retraining.

Anticholinergics work by blocking the action of acetylcholine, which causes the detrusor muscle in the bladder wall to contract and therefore triggers bladder emptying. Anticholinergics relax the detrusor muscle, increasing bladder capacity and reducing the need to pass urine frequently. There are a number of common side effects associated with anticholinergics, however, including dry mouth, facial flushing and constipation, and in some cases it can also cause the bladder to relax to the extent that it fails to empty completely.

**Improving communication**

With the aim of compiling an information leaflet, write down on one side of A4 paper basic advice for a child aged five to seven years who experiences daytime wetting. As you do this, think carefully about the terms that you use and what you believe a child of this age might understand.

**Support strategy**

Discuss with colleagues how you could support parents to introduce potty training in a more timely fashion.

As with all other medications, these should be discussed with the family.

Oxybutynin is the only anticholinergic licensed for use in children. However, other anticholinergics have been developed that may prove helpful but research is needed into these as well as into the use of combination therapy, such as bladder retraining and biofeedback, and botulinum toxin in children (Schröder and Thüroff 2010).

Now do time outs 5 and 6.

**Conclusion**

Toilet training is strongly influenced by cultural variations and is universally seen as an important milestone in a child’s development. While daytime urinary problems in children are not uncommon, it is important when evaluating any delay in bladder control to take into account the child’s developmental age and early urological history, including potty training history. The fact that children are acquiring bladder control at a later age than previously appears to correlate with an increased incidence of daytime wetting problems.

The effect of becoming toilet trained in stabilising the child’s bladder needs to be examined further and this certainly has implications for practice. Historically, it has been suggested that potty training should be delayed until the child’s bladder has stabilised, when they are able to stay dry for two hours or more. The hypothesis that toilet training in fact helps to establish stable bladder filling and emptying supports the notion of much earlier intervention.

For children who present with daytime wetting, over the age at which toilet training has been expected to be achieved, it is important that a structured approach to the assessment is carried out. Identification of any underlying problems and differentiating between a storage or voiding disorder will help ensure the most appropriate treatment regimen is put in place.
There seems to be some similarity in the current standard therapy for treating daytime wetting problems and how potty training was approached more than 50 years ago. Families should be informed about the best way to introduce potty training and to help their children achieve bladder control. A structured approach to timely potty training may help avoid future bladder problems.

Now do time out 7.

References


