available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Brief Correspondence

The Underactive Bladder: A New Clinical Concept?

Christopher R. Chapple[a,*], *Nadir I. Osman*[a], *Lori Birder*[b], *Gommert A. van Koeveringe*[c], *Matthias Oelke*[d], *Victor W. Nitti*[e], *Marcus J. Drake*[f], *Osamu Yamaguchi*[g], *Paul Abrams*[f], *Philip P. Smith*[h]

[a] *Department of Urology, Royal Hallamshire Hospital, Sheffield, UK;* [b] *Department of Medicine, University of Pittsburgh, Pittsburgh, PA, USA;* [c] *Department of Urology, Maastricht University Medical Centre, The Netherlands;* [d] *Department of Urology, Hannover Medical School, Hannover, Germany;* [e] *Department of Urology, New York University Medical Center, New York, NY, USA;* [f] *Bristol Urological Institute, Southmead Hospital, Bristol, UK;* [g] *Division of Bioengineering and LUTD Research, Nihon University School of Engineering, Koriyama, Japan;* [h] *Department of Surgery and Center on Aging, University of Connecticut Health Center, Farmington, CT, USA*

Article info

Article history:
Accepted February 25, 2015

Keywords:
Detrusor underactivity
Lower urinary tract symptoms
Underactive bladder

Abstract

Detrusor underactivity (DU) is an increasingly recognised cause of lower urinary tract symptoms in both men and women. There has been a lack of research into all aspects of this dysfunction, and as yet, no effective treatments exist. DU can be diagnosed at present only on the basis of an invasive urodynamic study. An international consensus group met at the International Consultation on Incontinence–Research Society and International Continence Society annual meetings in 2014 to consider the feasibility of developing a working definition of a symptom complex associated with DU. Drawing an analogy to detrusor overactivity (urodynamic diagnosis) and overactive bladder (symptom complex), the aim of this process is to help identify affected patients and facilitate further clinical and epidemiological research.

Patient summary: Bladder underactivity is an underresearched but important cause of urinary symptoms in men and women. In this paper, an international expert group presents a working definition for the symptoms that characterise bladder underactivity, with the aim of facilitating further research in this area.

* Corresponding author. Department of Urology, Sheffield Teaching Hospitals NHS Foundation Trust Glossop Road, Sheffield S10 2JF, UK. Tel. +44 114 271 3048; Fax: +44 114 279 7841.
E-mail address: c.r.chapple@shef.ac.uk (C.R. Chapple).

In recent years, there has been a rise in interest in detrusor underactivity (DU) [1–3], a bladder dysfunction that affects both sexes and causes bothersome symptoms. DU is defined by the International Continence Society (ICS) as "a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or failure to achieve complete bladder emptying within a normal time span" [4].

As much as 48% of older men and 45% of older women undergoing evaluation for lower urinary tract symptoms (LUTS) show evidence of DU [5,6]. These patients may be affected by symptoms or require catheterisation for bladder drainage. Despite this apparent frequency, DU is largely underresearched in comparison to other lower urinary tract dysfunctions, such as detrusor overactivity (DO) or bladder outlet obstruction (BOO). Moreover, there is no simple, effective treatment.

At present, it is widely thought that the LUTS experienced by patients with DU overlap significantly with the LUTS associated with BOO and that it is not possible to reliably differentiate the two without an invasive urodynamic study. This has hampered the acquisition of epidemiological data and, in turn, has led to a lack of comprehensive evaluation of

http://dx.doi.org/10.1016/j.eururo.2015.02.030
0302-2838/

the true scale of the problem, its natural history, and its effects in terms of symptoms, symptom bother, and complications (eg, urinary retention, impairment of renal function).

Clinical experience and evidence from available urodynamic case series suggest that DU occurs in diverse patient groups, pointing towards the existence of multiple aetiological factors. These factors are likely to manifest in DU by disrupting the processes involved in the generation of an effective coordinated voiding contraction [2,7]. Interruption to efferent neural pathways secondary to traumatic injury or disease and intrinsic myogenic dysfunction due to fibrosis are well-recognised mechanisms. More recently, the potential importance of the urothelium and the afferent system has been suggested [8,9].

There is currently a remarkable lack of consensus on many aspects pertaining to DU as a diagnosis. A plethora of terms are used to refer to DU and/or its associated symptoms, despite the ICS terminology having been published more than a decade ago. Moreover, no accepted diagnostic criteria exist. Furthermore, the ICS report falls short in specifying parameters for *reduced contraction strength, prolonged bladder emptying*, or *normal time span*. Most current criteria focus on strength, either applying specific cut-offs for maximum flow rate (Q_{max}) and maximum detrusor pressure Q_{max} or using indices and calculations such as the bladder contractility index [10] or the Watt factor, which estimate isovolumetric contraction strength [11]. The application of these criteria to DU is limited for several reasons:

- The criteria do not consider definitional aspects, such as contraction speed or how effectively the bladder empties, mostly related to the duration of the contraction.
- Assumptions regarding bladder volumes and energetics are contained within these calculations, which likely are not applicable to some or all instances of DU.
- The rise in detrusor contraction strength with increasing BOO grade in elderly men suggests that it is difficult or impossible to define single threshold values for DU [12].
- Normative data in highly affected populations (eg, the aged) are not available.

There is a need for further research on all aspects of DU. In contrast, DO is well researched, and it is worth revisiting the development of the OAB symptom complex as a concept. This was based on recognition that patients present with symptoms that may not always correlate with an underlying urodynamic abnormality (ie, DO). This has proved to be an effective means of categorising patients in clinical practice to guide the instigation of therapy, particularly at the primary-care level. Consequently, an expansion of research followed that has contributed to our understanding of bladder storage function and pathophysiology and that allowed the development of novel therapies.

In terms of DU, a definition currently exists but is fairly nonspecific due to the extremely limited evidence base from which it was derived. Nevertheless, the urodynamic abnormality is clearly related to a group of recognised symptoms (eg, slow flow, hesitancy). In addition, there are some associated, poorly defined, clinical presentations (eg, impaired or absent bladder sensation) and sequelae (eg, raised postvoid residual and urinary retention). A variety of patient groups are affected, both with and without neurologic disease or injury. In this context, it is easy to recognise some parallels to the example of DO and OAB. Categorisation of the symptoms and/or signs of DU seems like a logical initial step to facilitate standardisation and further research in this area.

A consensus group met at the International Consultation on Incontinence–Research Society and ICS annual meetings in September and October 2014 to review the available evidence base and consider the feasibility of developing a working definition of a symptom complex for underactive bladder (UAB). It was agreed that although patients with DU can present with a variety of storage, voiding, and postmicturition LUTS, the voiding symptoms often predominate. These symptoms appear to be variably associated with the symptoms and signs of incomplete bladder emptying and impaired bladder sensation.

It was clearly recognised that the clinical features of DU may show significant overlap with those of BOO. Despite this, it was felt that a definition of a symptom complex for UAB would be of potential clinical value and could form the basis of a definition on which further qualitative and quantitative epidemiological studies could be conducted.

We propose the following working definition: *The underactive bladder is a symptom complex suggestive of detrusor underactivity and is usually characterised by prolonged urination time with or without a sensation of incomplete bladder emptying, usually with hesitancy, reduced sensation on filling, and a slow stream*.

Associated factors that need to be considered include sex, age, and any known neurologic pathology. It should be pointed out that the underactive bladder symptom complex is not synonymous with DU, which can be confirmed only by urodynamic testing. The definition and the role of impaired detrusor contractility in DU and UAB also remain to be elucidated.

It must be emphasised that the proposed definition has been developed on the basis of expert opinion and discussion rather than the results of prospective studies. Such studies are now in progress, as are efforts to obtain qualitative data from focus groups. These efforts should help refine this working definition further. Nevertheless, we feel that the development of the definition presented in this paper represents a significant step in the right direction and will help raise the profile of this much-neglected problem and facilitate further research.

In summary, DU is a common but poorly understood lower urinary tract dysfunction that occurs in a heterogeneous group of men and women and that arises due to multifactorial aetiologies. Currently, it can be confirmed only after urodynamic testing. We propose a working definition for a complex of symptoms that we suggest are known as *underactive bladder* and associated with DU. We feel UAB could prove useful as a means of identifying affected patients, rather analogous to the relationship between DO and OAB,

and could provide a basis for further definitive qualitative and quantitative research on the subject.

Author contributions: Christopher R. Chapple had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Chapple, Osman, Birder, van Koeveringe, Oelke, Nitti, Drake, Yamaguchi, Abrams, Smith.
Acquisition of data: Chapple, Osman, Birder, van Koeveringe, Oelke, Nitti, Drake, Yamaguchi, Abrams, Smith.
Analysis and interpretation of data: Chapple, Osman, Birder, van Koeveringe, Oelke, Nitti, Drake, Yamaguchi, Abrams, Smith.
Drafting of the manuscript: Chapple, Osman, Birder, van Koeveringe, Oelke, Nitti, Drake, Yamaguchi, Abrams, Smith.
Critical revision of the manuscript for important intellectual content: Chapple, Osman, Birder, van Koeveringe, Oelke, Nitti, Drake, Yamaguchi, Abrams, Smith.
Statistical analysis: None.
Obtaining funding: None.
Administrative, technical, or material support: None.
Supervision: Chapple.
Other (specify): None.

Financial disclosures: Christopher R. Chapple certifies that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received, or pending), are the following: Dr. Chapple is a consultant and researcher for Astellas, Pfizer, Recordati, Allergan, and Lilly. Dr. van Koeveringe is a consultant and researcher for Astellas, Solace Therapeutics, and Allergan. Dr. Oelke is a consultant and researcher for Apogepha, Astellas, Biocompatibles, GSK, Lilly, Mundipharma, Pfizer, and Recordati. Dr. Nitti is a consultant for Allergan, Astellas, Ipsen, and Pfizer and an invesigator for Astellas, Allergan, and Ion Channel. Dr. Drake is a consultant, lecturer, and researcher for Allergan, Astellas, Ferring, and Pfizer and a consultant for Apogepha. Dr. Yamaguchi is a consultant and researcher for Astellas, Ferring, Taiho, and Hisamitsu. Dr. Abrahms is a consultant and researcher for Astellas, Ferring, and Proctor and Gamble. The other authors have nothing to disclose.

Funding/Support and role of the sponsor: None.

References

[1] Miyazato M, Yoshimura N, Chancellor MB. The other bladder syndrome: underactive bladder. Rev Urol 2013;15:11–22.
[2] Osman NI, Chapple CR, Abrams P, et al. Detrusor underactivity and the underactive bladder: a new clinical entity? A review of current terminology, definitions, epidemiology, aetiology, and diagnosis. Eur Urol 2014;65:389–98.
[3] van Koeveringe GA, Vahabi B, Andersson KE, Kirschner-Herrmans R, Oelke M. Detrusor underactivity: a plea for new approaches to a common bladder dysfunction. Neurourol Urodyn 2011;30:723–8.
[4] Abrams P, Cardozo L, Fall M, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn 2002;21:167–78.
[5] Jeong SJ, Kim HJ, Lee YJ, et al. Prevalence and clinical features of detrusor underactivity among elderly with lower urinary tract symptoms: a comparison between men and women. Korean J Urol 2012;53:342–8.
[6] Abarbanel J, Marcus EL. Impaired detrusor contractility in community-dwelling elderly presenting with lower urinary tract symptoms. Urology 2007;69:436–40.
[7] van Koeveringe GA, Rademakers KL, Birder LA, et al. Detrusor underactivity: pathophysiological considerations, models and proposals for future research. ICI-RS 2013. Neurourol Urodyn 2014; 33:591–6.
[8] Smith PP, DeAngelis A, Kuchel GA. Detrusor expulsive strength is preserved, but responsiveness to bladder filling and urinary sensitivity is diminished in the aging mouse. Am J Physiol Regul Integr Comp Physiol 2012;302:R577–86.
[9] Smith PP. Aging and the underactive detrusor: a failure of activity or activation? Neurourol Urodyn 2010;29:408–12.
[10] Abrams P. Bladder outlet obstruction index, bladder contractility index and bladder voiding efficiency: three simple indices to define bladder voiding function. BJU Int 1999;84:14–5.
[11] Griffiths DJ. Assessment of detrusor contraction strength or contractility. Neurourol Urodyn 1991;10:1–18.
[12] Oelke M, Rademakers KL, van Koeveringe GA. Detrusor contraction power parameters (BCI and W max) rise with increasing bladder outlet obstruction grade in men with lower urinary tract symptoms: results from a urodynamic database analysis. World J Urol 2014;32:1177–83.