EC14: ICS Core Curriculum (Free) Step by Step Basic Neurourology Teaching

Workshop Chair: Emmanuel Chartier-Kastler, France
14 September 2016 08:35 - 10:05

Start	End	Topic	Speakers
08:35	08:40	Introduction	Emmanuel Chartier-Kastler
08:40	08:55	Functional anatomy of lower urinary tract	Márcio Averbeck
08:55	09:10	Neurologic control of lower urinary tract dedicated to continence and voiding function	Jalesh Panicker
09:10	09:25	Diagnosis of neurogenic lower urinary tract symptoms	Thomas Kessler
09:25	09:40	Urodynamics in the diagnosis of neurogenic lower urinary tract symptoms	Jalesh Panicker
09:40	09:55	Main voiding dysfunctions of spinal cord injuries	Thomas Kessler
09:55	10:05	Main voiding dysfunctions of supra spinal lesions	Márcio Averbeck

Aims of course/workshop

Todays teaching processes are moving from academic teaching to more didactic and concise information letting the audience learn more through readings and everyday's clinical experience. A new teaching method appeared in medical schools: MOOC for Massive Online Open Course. As the ICS Neurourology Promotion Committee is used to giving courses all around the world for many years, it appeared that it could be great to start this process for our committee itself. During 90 minutes, there will be 6,12 minute talks given by members of the ICS Neurourology Promotion Committee on a design which allows video recording of slides and speaker. The 6 talks are dedicated to the basic knowledge which is necessary to practice and to train in neurourology.

Learning Objectives

After this workshop participants should be able to:

1. Focus on basic knowledge for management of neurourology
2. Obtain basic information to discuss with patients
3. Be able to understand how to start its own neurourology team building

Learning Outcomes

After the course attendees will be able to read more on neurourology and to prepare themself to organize their team for the management of neurourological patients.

Target Audience

Medical doctors and non-medical doctors working in the field of neurourology or at least of disabled patients, whatever the type.

Advanced/Basic

Basic

Conditions for learning

Limited to 90 delegates in the aim to record MOOC teaching.

Suggested Learning before workshop attendance

None

Márcio Averbeck

The lower urinary tract (LUT) has its function related to the storage of urine at low pressure and the normal voiding process, which depends on the effective contraction of the detrusor and synergic relaxation of the urethral sphincter. This activity is regulated by complex neurophysiological interactions between the sacral nerves and the cerebral cortex that coordinates the urinary bladder and bladder outlet (1,2).

A proper understanding of the neurophysiological control of the bladder is essential to predict possible patterns of neurogenic lower urinary dysfunction (NLUTD). The control of storage and voiding functions is related to the pons; on the other hand, suprapontine influence act to switch from one state to the other (e.g. storage vs. voiding). In health subjects the decision when to void is determined by the perceived state of bladder fullness together with an assessment of the social appropriateness to do so. Connections between the pons and the sacral spinal cord, as well as the peripheral innervation, which arises from the most caudal segments of the sacral cord, must be intact to promote normal bladder function (2). The motor nerve supply of the LUT is provided by the parasympathetic outflow arising from S2–S4. The external (striated) urethral sphincter is innervated by the pudendal nerve, arising from the Onuf's nucleous (S2-S4). The peripheral innervation passes through the cauda equina to the sacral plexus and via the pelvic and pudendal nerves to innervate the bladder and sphincter. Above the sacral segments, the thoracolumbar segments

(T11-L2) provide the sympathetic outflow from the spinal cord to the bladder and the proximal urethral sphincter (hypogastric nerve). The sympathetic innervation is mainly related to the storage function.

Lower urinary tract symptoms (LUTS) and long-term complications often do not correlate (3). This non-recognition or delayed recognition can lead to the most serious long-term complication of renal damage secondary to elevated storage pressure in the bladder (4). This is more common in suprasacral infrapontine spinal lesions causing sustained elevated storage pressure in the bladder, due to a combination of detrusor overactivity and detrusor-sphincter dyssynergia. In all other patients with NLUTD, the risk of renal damage is significantly lower (1,5,6).

KEY POINTS:

- *Innervation needed for physiological bladder control is extensive, requiring suprapontine inputs, intact spinal connections between the pons and the sacral cord, as well as intact peripheral nerves.*
- *Pontine micturition center is responsible for coordination of the bladder contraction and sphincter relaxation at the same time to empty the urine.*
- *The lower urinary tract is innervated by three principal sets of peripheral nerves involving the parasympathetic (S2-S4), sympathetic (T11-L2), and somatic (Onuf's nucleus) nervous systems from 3 major nerves, namely the pelvic, hypogastric and pudendal nerves, respectively.*
- *These nerves contain afferent (sensory) as well as efferent (motor) axons.*

REFERENCES

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4. Gerridzen RG, Thijssen AM, Dehoux E. Risk factors for upper tract deterioration in chronic spinal cord injury patients. J Urol 1992 Feb; 147[2]:416-8.
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6. Madersbacher H. The various types of neurogenic bladder dysfunction: an update of current therapeutic concepts. Paraplegia 1990 May; 28(4):217-29.

Jalesh Panicker

Neurologic control of lower urinary tract dedicated to continence and voiding functions

In health, the coordinated activity between the detrusor and sphincter muscles is responsible for low-pressure filling and periodic voluntary emptying of the lower urinary tract (LUT). A complex neural network distributed throughout the central and peripheral nervous system controls a switching circuit to maintain a reciprocal relationship between the reservoir function of the bladder and sphincter function of the urethra. Voiding lasts only 2 to 3 minutes in 24 hours and therefore the LUT is in the storage phase for more than 99% of the time. Switching to the voiding phase is determined by the perceived state of bladder fullness and an assessment of social appropriateness.

The control of this switching circuit requires that the connections between the pons and the sacral spinal cord are intact. During bladder filling, sympathetic and pudendal nerves mediate contraction of the internal and external sphincters. Their contraction maintains continence, whereas parasympathetic mediated inhibition of the detrusor prevents contractions and ensures a low pressure. When it is deemed appropriate to void, the pontine micturition centre (PMC) is released from the tonic inhibition of "higher centres", and the activation-inhibition of the sphincter-detrusor is reversed. Parasympathetic mediated detrusor contraction results in effective bladder emptying. Functional imaging experiments have demonstrated the significance of the periaqueductal grey (PAG) of the midbrain, the insula and anterior cingulate gyrus as important regions for interoceptive awareness of visceral sensations. The prefrontal cortex plays a role in planning complex cognitive behaviours such as voiding, and expression of appropriate social behaviour. This region has multiple connections with the anterior cingulate gyrus, and both have connections with the PAG.

Urodynamics in the diagnosis of neurogenic lower urinary tract symptoms

Urodynamics forms an important investigation in the assessment of neurological patients reporting LUT symptoms. Uroflowmetry is a valuable non-invasive investigation, particularly when combined with a measurement of the post void residual (PVR), and provides information about voiding functions. Invasive urodynamic tests, usually combined as cystometry and pressure-flow study, assess detrusor and bladder outlet function and provide information about detrusor pressures and compliance. Urodynamic tests provide considerable information about the cause for LUT symptoms and the underlying LUT pathophysiology. Upper urinary tract damage, such as vesico-ureteric reflux, hydronephrosis, renal impairment and even end-stage renal disease, may occur as a consequence of neurogenic LUT dysfunction and urodynamics is a useful tool to assess the risk for these changes.

Cystometry is not available in all centres however, and also is an invasive test not without complications, and therefore the need for this test as a routine in all neurological patients prior to initiating treatment for LUT symptoms is often a point of discussion.

History, bladder diary and non-invasive tests often provide sufficient information about the nature of the LUT symptoms and dysfunction. Moreover, the risk for upper tract damage differs between neurological conditions. Patients with spinal cord injury and spina bifida, for example, have a higher risk of developing upper tract damage and renal failure compared with the general adult population. In contrast, the prevalence of upper urinary tract damage and renal failure is much lower in patients with slowly progressive non-traumatic neurological disorders, such as multiple sclerosis or Parkinson's disease. The reasons for this are still unclear, but duration of multiple sclerosis and severity of disability are risk factors for upper urinary tract complications. The recommendations for performing urodynamics in the high-risk group are often therefore inappropriate for the low-risk group.

Guidance from the International Consultation on Incontinence, as well as from different stakeholder societies involved in the care of neurological patients have addressed this issue and help to define the role of urodynamics in the evaluation of neurological patients reporting LUT symptoms.

Thomas Kessler

Diagnosis of neurogenic lower urinary tract symptoms

History taking is the cornerstone of neurogenic lower urinary tract symptoms (LUTS) assessment. It needs to gather information on congenital and neurological abnormalities, prior urogenital complications and treatments, medication, urinary tract, sexual, bowel, neurological and gynaecological function. Evaluation of lifestyle factors and quality of life are also important, and attention should be paid to physical and mental handicaps.

Bladder diary is a highly useful tool in clinical practice as it provides an objective measure of LUTS mirroring day-to-day reality. Physical examination includes the abdomen, flanks and external genital organs, as well as sensation and reflexes in the urogenital area. Anal sphincter and pelvic floor functions must be tested extensively. Urinalysis and urinary culture, blood chemistry (if not already performed by the referring physician), free uroflowmetry and post void residual measurement are part of a basic neuro-urological assessment.

Urodynamic investigation, with simultaneous fluoroscopic monitoring (i.e. video-urodynamics), is essential to assess detrusor and bladder outlet function. Generally accepted risk factors jeopardizing the upper urinary tract are high detrusor pressure during storage phase due to low compliance bladder and/or detrusor overactivity combined with detrusor sphincter dyssynergia and urodynamic investigations are needed to identify these conditions.

Urethro-cystoscopy (combined with bladder washing cytology if appropriate) is used to detect urethral and bladder pathologies (urethral stricture, urethral/bladder stones, bladder tumors including carcinoma in situ).

Serum creatinine, cystatin c and corresponding estimations yield a reasonable estimation of renal function. Creatinine clearance provides a more precise assessment and most accurate measurement is isotopic glomerular filtration rate.

Main lower urinary tract dysfunction in patients with spinal cord injury

Spinal cord injury (SCI) is a devastating event with far-reaching consequences for the individual's health and the family's economic and social future. It affects each year 15-53 new individuals per million in Western countries and will result in neurogenic lower urinary tract dysfunction (LUTD) in most of these patients. In the past, renal disease was responsible for more than 40% of deaths following SCI. The introduction of intermittent self-catheterization and the use of regular urodynamic investigations have since revolutionized the neuro-urological care of SCI patients. Hence, nowadays, urinary disease accounts for only about 13% of deaths in SCI patients and the most common cause of death now is related to pneumonia. It follows that adequate function of the urinary tract is essential to prevent morbidity and mortality in SCI patients.

Acute SCI lead to a state named "spinal shock": Muscles are generally in a flaccid state because of the loss of neurological reflexes and urinary tract function is characterized by detrusor acontractility/hypocontractility and urinary retention/voiding dysfunction. After a period of time of usually around 4-12 weeks, detrusor overactivity mostly combined with detrusor sphincter dyssynergia develops in the case of a suprasacral lesion (today the vas majority of SCI) as a result of reorganization of neuronal circuitry. Disconnection from supraspinal centers means that voiding is not centrally driven but induced by from volume-determined reflex detrusor connections. Detrusor sphincter dyssynergia may lead to high bladder pressures jeopardizing the upper urinary tract. The emergence of these dysfunctional patterns is a complex, not yet fully understood process but C-fiber-mediated spinal reflex pathways seem to be involved.

Importantly, SCI is not a stable condition and so neuro-urological treatment strategies need to be flexible as they often need to be modified in almost all patients throughout life.

Autonomic dysreflexia is a sudden and exaggerated autonomic response to stimuli in patients with SCI or spinal dysfunction generally above level T6. Hypertension is relatively common manifestation of autonomic dysreflexia and can have life-threatening results if not properly managed.