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What should the neurologist know about the lower urinary tract?

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In many populations of neurological patients
(*stroke, multiple sclerosis, polyneuropathies, neurodegenerative diseases*)
autonomic dysfunction (including „neurogenic bladder“) is common.

Therefore, competence in

**basic diagnostics of lower urinary tract
(LUT) dysfunction**

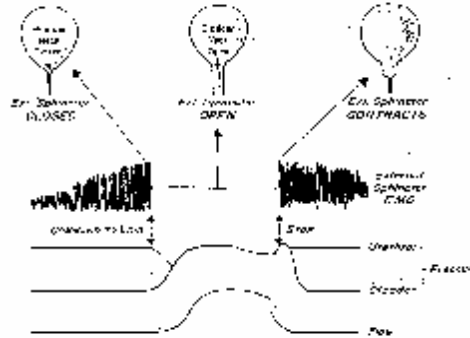
&

**first line management of lower urinary tract
(LUT) dysfunction**

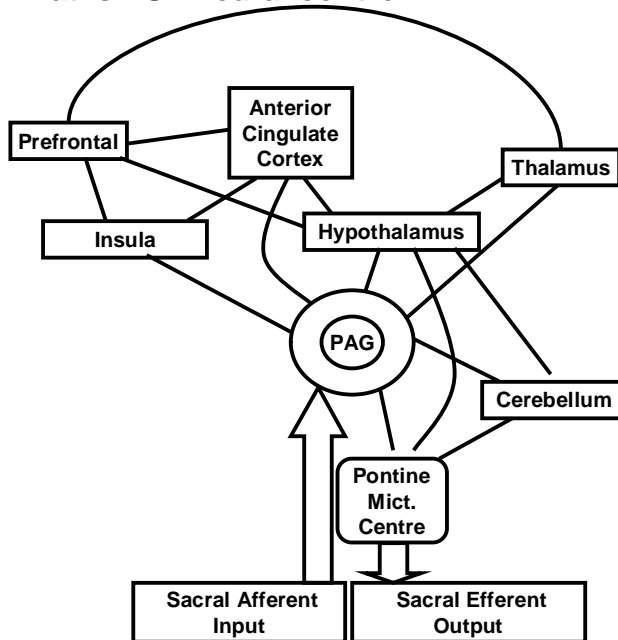
is required knowledge for neurologists!

What is lower urinary tract (LUT) function?

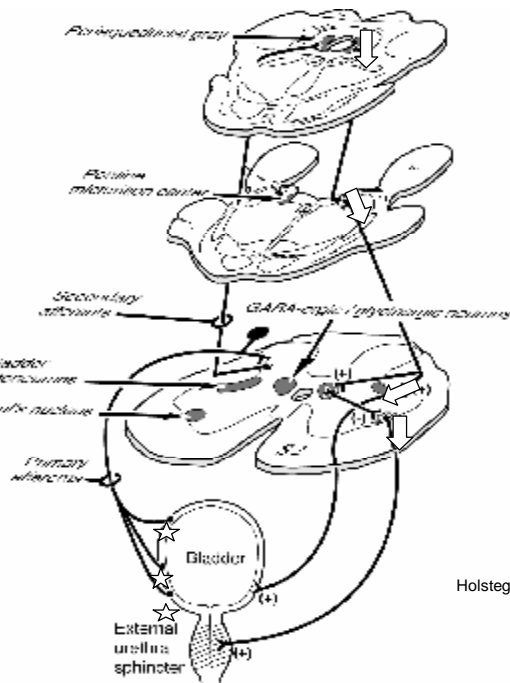
- Storage
- Emptying
- Sensory control



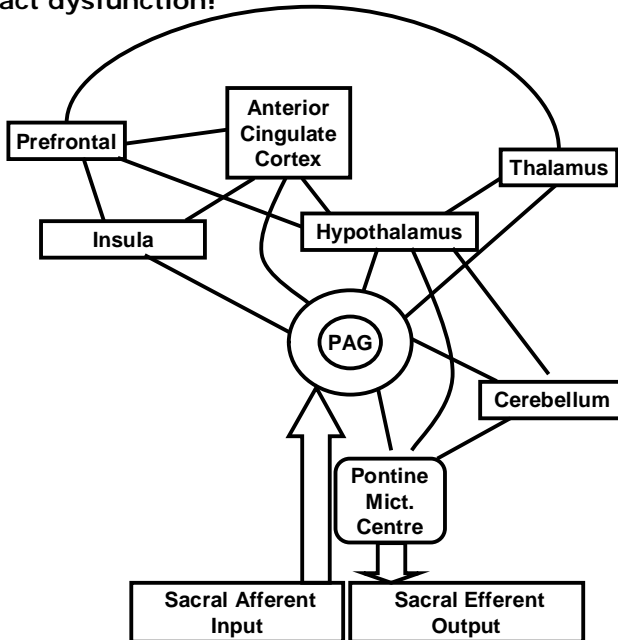
What is LUT neural control?



What is LUT neural control?



Nervous system lesions lead to lower urinary tract dysfunction!




A practical neurological classification of lower urinary tract dysfunction?


Suprapontine lesion

Pontine-suprasacral (spinal)

Sacral lesion (peripheral)



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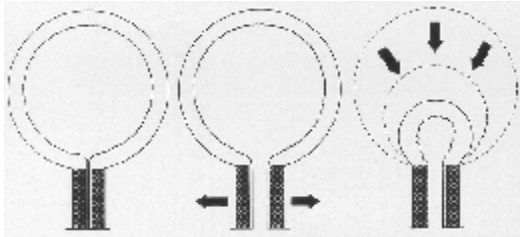
Pons (brainstem) is the most important structure for coordinated voiding.

On the left: Proposed simple neuroanatomical classification of lesions leading to LUT dysfunction.

“Neurological classification” of LUT dysfunction (ie. based on neurological lesions) has little relevance in everyday care of patients, because similar neuroanatomical lesions may lead to different types of LUT dysfunction!

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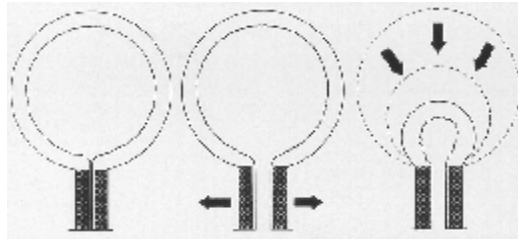




It is the classification based on bladder/sphincter (dys)function which is relevant for clinical practice!

ICS classification of lower urinary tract dysfunction (based on function)

(Abrams et al 1988)



Bladder

- Normal
- Overactive
- Underactive

Urethra

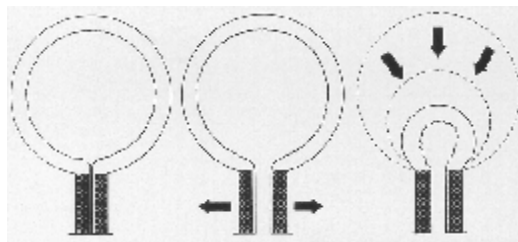
- Normal
- Overactive
- Incompetent

Sensation

- Normal
- Hypersensitive
- Hyposensitive

ICS classification of lower urinary tract dysfunction (based on function)

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Bladder

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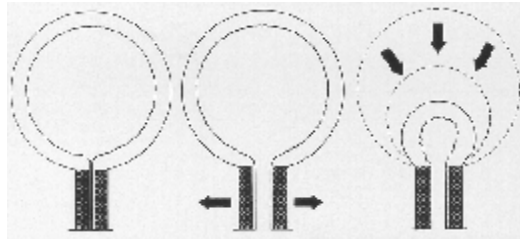
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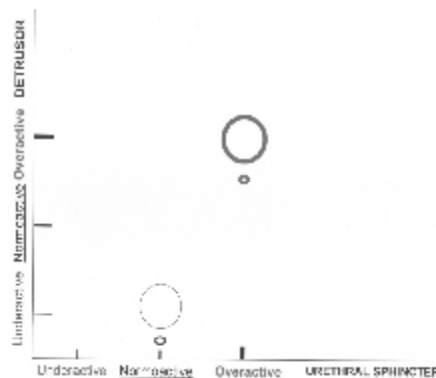
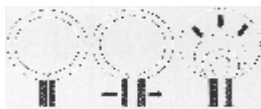
Normal

Hypersensitive

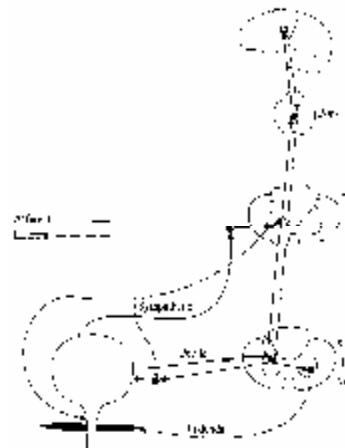
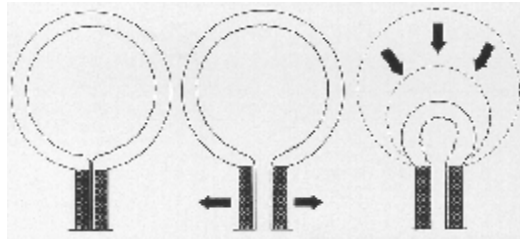
Hyposensitive

Conceptualisation of lower urinary tract dysfunction (based on function)

(Madersbacher 1986)



The synthesis: *The neuroanatomic syndrome associates with a LUT dysfunctional syndrome (but exceptions from the rule are frequent!):*



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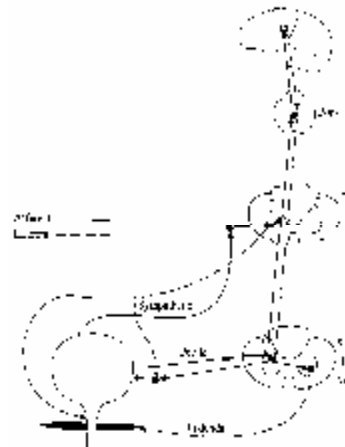
Suprapontine lesion

(overactive bladder with synergic voiding)

Pontine-suprasacral ("spinal") lesion

(overactive bladder with dyssynergic voiding)

Sacral lesion (hypoactive bladder with poor emptying, overflow incontinence and stress incontinence)





The synthesis: *The neuroanatomic syndrome associates with a LUT dysfunctional syndrome (but exceptions from the rule are frequent!):*

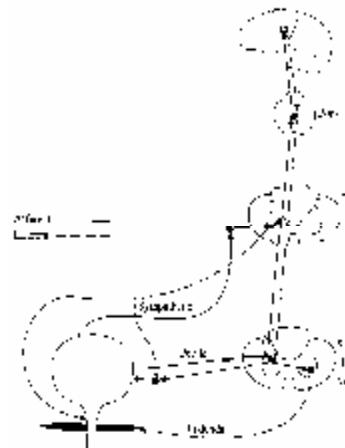
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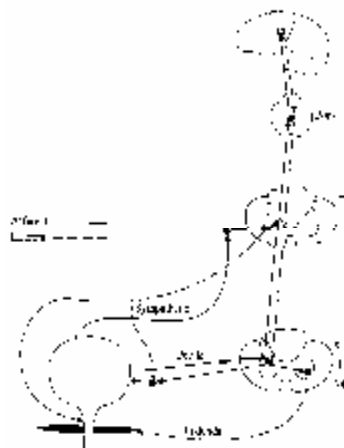
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Diagnostics in a patient with LUT dysfunction and a (suspected) neurological disorder

Assessment may be viewed as three-pronged:

I) Assessing LUT dysfunction

Assessment of LUT dysfunction relies on concepts derived from the functionally based classification!

II) Assessing the neural lesion

Specific assessment of the neural lesion is performed in patients without a neurological diagnosis.

III) Defining the cause (of the neural lesion)

The cause of neurogenic LUT dysfunction is as a rule implicit.



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Assessment may be viewed as three-pronged:

35 years old typist, mother of two, with a history of retrobulbar neuritis, develops bothersome urgency & frequency, and urge incontinence.

Definition of the LUT dysfunctional syndrome —→ ?

Definition of the neural lesion —→ ?

Diagnosis of condition / disease —→ ?



The diagnostic process

I) Assessing LUT dysfunction

- a) The first step in evaluation of LUT dysfunction is taking the history.
- b) Physical examination adds little to understanding of LUT function.
- c) *Therefore, measurements are the only means to definitely define and document LUT (dys)function.*



Question set for evaluating lower urinary tract dysfunction

- Frequency
- Urgency
- Nocturia/enuresis
- Incontinence – stress/urge
- Hesitancy
- Postvoid dribbling

- History of urological/obstetrical injury or surgery
- Drugs

Urinary diary!
(intake; frequency – volumes)



Interpretation of urinary symptoms –

- urge or stress incontinence
- enuresis
- frequency
- nocturia

-

abnormal storage

Symptoms derived from history may tentatively be interpreted to signify a particular LUT dysfunction.

Urinary infection has always to be ruled out!



Interpretation of urinary symptoms –

- straining
- hesitancy
- poor stream
- incomplete emptying
- postmicturition dribble

-

abnormal voiding

Symptoms derived from history may tentatively be interpreted to signify a particular LUT dysfunction.

Urinary infection has always to be ruled out!



- **Urinary diary** (intake; frequency – volumes) is especially helpful to guide diagnosis and management.
- **Questionnaires** have been formulated to assess LUT dysfunction, particularly incontinence in women and poor voiding in men.

For instance: ICIQ – short version (generally applicable).

Rotar et al 2009



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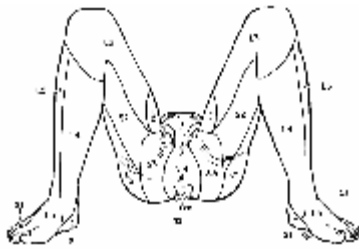
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Rotar et al 2009

**International Consultation on Continence Modular Questionnaire*

The diagnostic process

II) Defining the neurological lesion



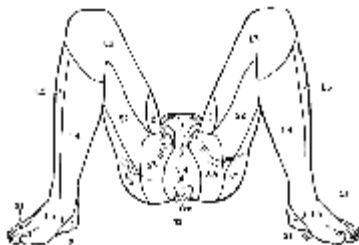
a) The first step is **taking the history.**

b) **Physical examination** helps defining the neurological lesion.

c) *Neurophysiological testing; imaging.*

The diagnostic process

II) Defining the neurological lesion



• **History**

• **Testing motor function**

• **Testing sensation**

• **Testing reflexes**

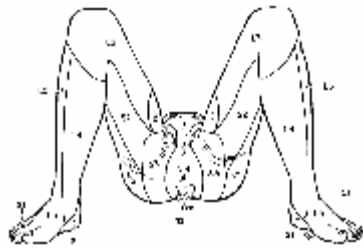
Cremaster

Bulbocavernosus

Anal

The diagnostic process

Defining the neurogenic LUT dysfunction



Interpretation of urinary symptoms
&
Interpretation neurological symptoms + findings

-Making a working diagnosis

Proceeding to tests?

Proceeding to tests?

I) Defining the LUT dysfunction → Functional diagnostics (urodynamics)



The diagnostic process

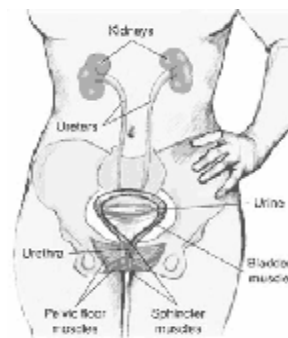
I) Defining the LUT dysfunction

Functional diagnostics (urodynamics)

Incontinence is obvious.

*But the extent of
incomplete bladder emptying
cannot be reliably ascertained from
patient history.*

(Fowler and O'Malley 2003)

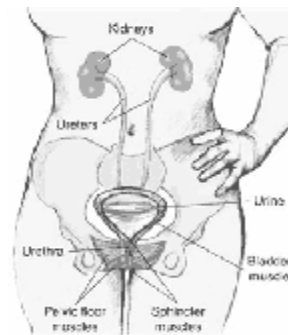


The diagnostic process

I) Defining the LUT dysfunction

Functional diagnostics (urodynamics)

In neurological patients with urinary symptoms
the first and most important
diagnostic test is
the measurement of the
postvoid residual urine.



The diagnostic process

I) Defining the LUT dysfunction

Functional diagnostics (urodynamics)

Postvoid residual urine is measured after voiding:

a) by an "in-out" catheterisation

a) by ultrasound



Critical value > 100 ccm!

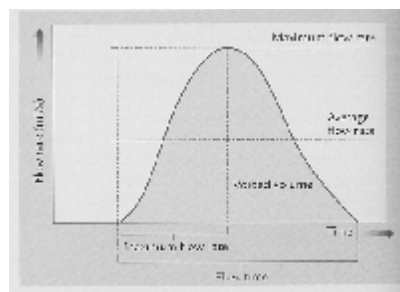
Functional diagnostics

I) Defining the LUT dysfunction

Uroflowmetry (measuring urinary flow) is indicated in the assessment of **voiding disorders**.

Uroflowmetry combined with ultrasound measurement of post-void residual urine is a **screening test** to exclude serious bladder outflow obstruction.

(Fowler et al. 2001)



Urodynamics

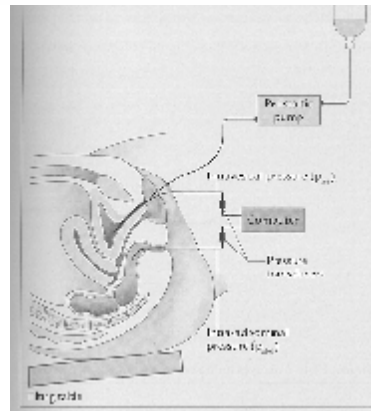
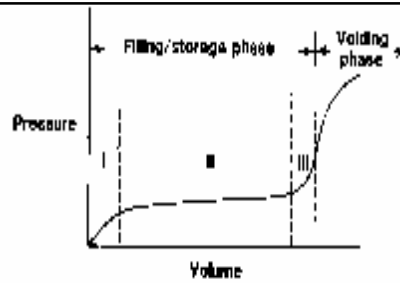
I) Defining the LUT dysfunction

Cystometry is the recording of the pressure/volume relation of the bladder.

It provides data on bladder motor and sensory function.

(It assesses both bladder storage and voiding).

(Fowler et al. 2001)

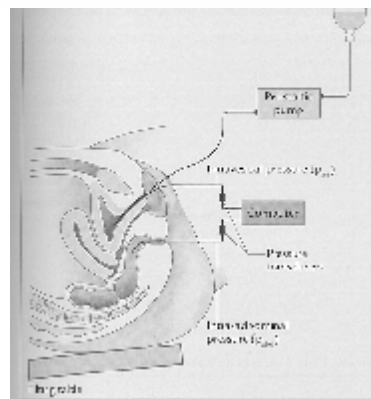
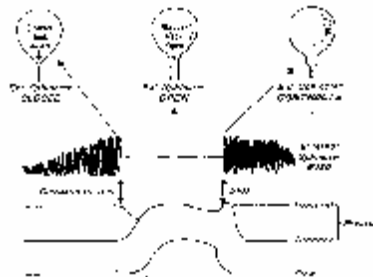


Urodynamics

I) Defining the LUT dysfunction

Cystometry – the pressure – flow study demonstrates the relationship between detrusor and striated sphincter activity.

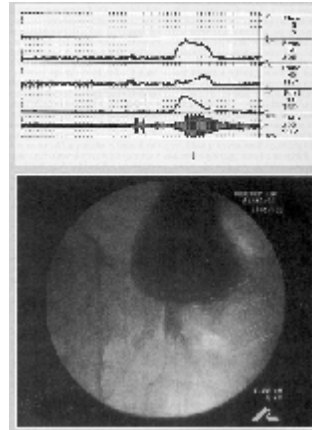
(Fowler et al. 2001)



Urodynamics

I) Defining the LUT dysfunction

Video urodynamics visualises uretheric reflux and the site of bladder outlet obstruction.



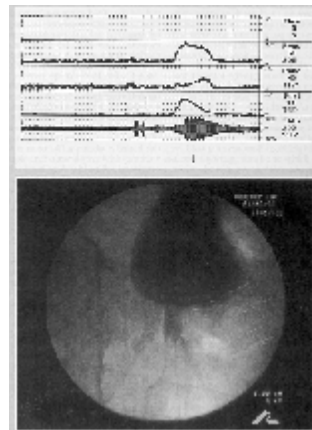
Neurourologists recommend urodynamics in neurological patients with urinary symptoms because such investigation clarifies the often complex dysfunction, and reveals abnormalities compromising the upper urinary tract.

(Stohrer et al 2007)

Proceeding to tests?

A detailed urodynamic investigation is necessary in patients with traumatic spinal cord injury and dysraphism.

- *High resting intra-vesical pressures are often present in these patients, and should be revealed at an early stage.*



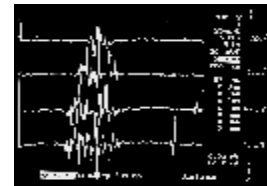
The need of urodynamics in every single neurological patient with urinary symptoms has been questioned.

(Fowler et al 2009)

Proceeding to tests?

Clinical neurophysiological testing is optional in selected patients with lower urinary tract dysfunction with (suspected) involvement within the peripheral sacral reflex arc.

(Tubaro et al. 2013)

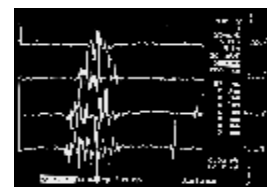


Clinical neurophysiological testing

Optional clinical neurophysiological tests in patients with suspected (peripheral) neurogenic involvement are:

- **concentric needle EMG**
- **testing the bulbocavernosus reflex**

(Tubaro et al. 2013)





The diagnostic process I

35 years old typist, mother of two, with a history of retrobulbar neuritis, develops bothersome urgency & frequency, and urge incontinence.

Definition of the LUT dysfunctional syndrome →

*History;
Urine lab tests;
US measurement of residual urine*

Definition of the neuromuscular lesion →

History, Neurological examination

Diagnosis of condition / disease →

Tests as dictated by the diagnostic hypothesis



The diagnostic process I

35 years old typist, mother of two, with a history of retrobulbar neuritis, develops bothersome urgency & frequency, and urge incontinence.

Definition of the LUT dysfunctional syndrome →

*Hyperactive bladder?;
Infection;
150 ml residual urine*

Definition of the neuromuscular lesion →

Positive Babinski sign bilaterally

Diagnosis of condition / disease



The diagnostic process I

35 years old typist, mother of two, with a history of retrobulbar neuritis, develops bothersome urgency & frequency, and urge incontinence.

Definition of the LUT dysfunctional syndrome

*Hyperactive bladder?;
Infection;
150 ml residual urine*

Definition of the neuromuscular lesion

Positive Babinski sign bilaterally

Diagnosis of condition / disease →

*↓
VEP, MRI of head, spinal cord, CSF*



The diagnostic process I

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Definition of the LUT dysfunctional syndrome →

*Hyperactive bladder?;
Infection;
150 ml residual urine*

Definition of the neuromuscular lesion →

Positive Babinski sign bilaterally

Diagnosis of condition / disease →

Multiple sclerosis

The diagnostic process II

18 years old athlete sustained a traumatic L2 fracture a year ago. Surgical stabilisation; indwelling catheter for 4 weeks. Claimed to be without neurological deficits.

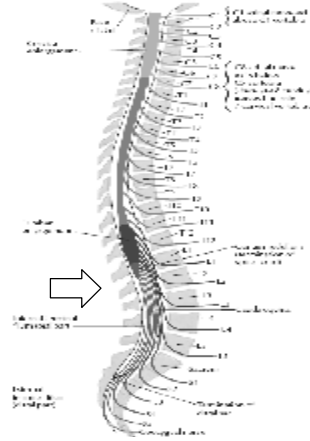
Complains of occasional tingling in the perianal region and poor urinary stream since trauma.

-
- Definition of the LUT dysfunctional syndrome →
 - Definition of the neuromuscular lesion →
 - Diagnosis of condition / disease →

Urine lab tests;
Cystometry

Neurological examination,
Clinical neurophysiological testing

Tests as dictated by the
diagnostic hypothesis



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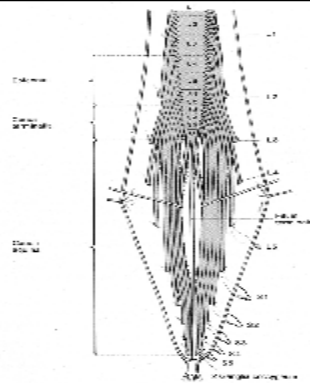
Complains of occasional tingling in the perianal region and poor urinary stream since trauma.

-
- Definition of the LUT dysfunctional syndrome →
 - Definition of the neuromuscular lesion →
 - Diagnosis of condition / disease →

Poor sensation of bladder fullness,
poor detrusor contraction; 90 ml
residual urine

Perianal partial sensory loss,
absent anal reflex; abnormal ext.
anal sphincter EMG,
bulbocavernosus reflex detected
electrophysiologically

(Mild) conus/cauda equina
lesion due to original trauma!

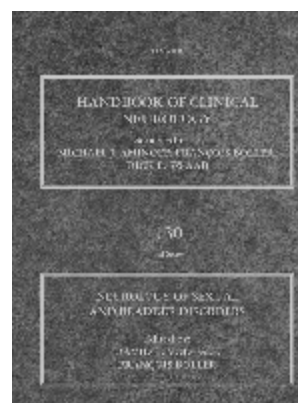




Conclusions

Diagnostics in neurological patients with urinary symptoms should be driven by the need for **symptom management** & **prevention of chronic disease.**

Diagnostic procedures should be co-ordinated by the patient's main treating physician.



Suggestions for further reading

Tubaro A, Vodušek, D B, Amarenco G, Doumouchsis S K, DeLancey J O L, Fernando R et al. Imaging, Neurophysiological Testing and Other Tests. In: Abrams P, Cardozo L, Wein A (Eds). Incontinence, 5th Ed. ICUD – EAU 2013; 507-622.

Wyndaele JJ, Vodušek DB. Approach to the male patient with lower urinary tract dysfunction. In: DB Vodušek und Boller F. NEUROLOGY OF SEXUAL AND BLADDER DISORDERS, Elsevier, Amsterdam 2015; 143-163.

And other Chapters from the book:
Vodušek DB und Boller F. Neurology of Sexual and Bladder Disorders, Elsevier, Amsterdam 2015

