Case Report

The importance of the clinical examination of the lower sacral segments: Four case reports

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Context: In our practice, in a spinal cord injury unit, clinical examinations include anal sensation and voluntary anal contraction, which are essential for neurological classification of spinal cord injury according to international standards (ISNCSCI), but we also always examine the integrity of the sacral segments, testing anal tone and anal and bulbocavernosus reflexes (S2-S4 segments) and the dartos reflex to evaluate the thoracolumbar sympathetic pathway.

Findings: In this paper, we describe four case reports of bladder dysfunction in which a clinical examination of the lower sacral segments was decisive to identify the neurological etiology.

Conclusion/Clinical Relevance: These cases, in patients with unexplained bladder dysfunction, highlight the importance of clinical testing the sacral segments, as part of the neurological examination, otherwise sacral lesions may remain undetected.

Keywords: Neurogenic bladder, Sacral neurotomes, Urinary retention, Incontinence

Introduction

Bladder dysfunction symptoms are usually of nonspecific aetiology. The remainder of a neurological examination may present as normal for a patient with neurogenic bladder if the lesion is restricted to the lower sacral segments S2 to S4. For this reason, screening for bladder dysfunction requires a careful clinical examination of the segments involved in neurophysiologic control of the bladder, namely by testing the lower sacral segments (S2, S3, S4)^{1,2} responsible for somatic and parasympathetic control of the bladder and thoracolumbar segments (T10-L2) responsible for sympathetic control,³ aspects that are frequently neglected. This involves testing sensation in the sacral dermatomes, a rectal examination to assess anal resting tone and voluntary anal contraction, anal and bulbocavernosus reflexes (S2-S4 segments)^{2,4} and the dartos reflex (T12-L2 spinal level).^{5,6} In this paper, while exploring four case reports, we underline the importance of these examinations, mandatory for a person with unexplained bladder dysfunction, since they may be the key for a correct diagnosis.

Case 1

A 21-year-old female student complained about urgency for a month, accompanied by sporadic incontinence and difficulty in stopping the urinary stream. She denied any pain or urinary tract infection (UTI). She also mentioned constipation.

Her personal and family history was unremarkable.

She was initially evaluated by a neurologist, which did not find anything relevant in the neurological examination and asked for our observations. Despite a normal neurological examination of the lower limbs, she had slightly reduced anal sphincter tone and voluntary anal contraction, absent anal reflex and abnormal pin prick S4-S5 on the left, which pointed to a sacral lesion S2-S5.

The diagnostic workup consisted of lumbosacral MRI, urodynamic study, bladder and kidney ultrasound and laboratory tests.

The MRI revealed Tarlov cysts in the sacral canal and S1, S2, S3 left nerve roots in the foramina (Fig. 1).

The cystometry revealed impaired bladder sensation (normal desire to void at 400 ml and strong desire to void at 680 ml), the profilometry parameters were normal and the uroflowmetry showed a terminal dribble.

Tarlov cysts are usually incidental findings in imaging studies, although they can be associated with bowel and

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Figure 1 Lumbosacral MRI axial view demonstrating Tarlov cysts (arrows).

bladder dysfunction.⁷ In this case, data pointed to a sacral lesion caused by the Tarlov cysts. The urinary urgency was caused by impaired bladder sensation.

The therapeutic plan, which resolved the symptoms, was a voiding schedule with 4-6 hour intervals, depending on fluid ingestion.

Case 2

88-year-old male with history of ischaemic stroke (with no known sequela), idiopathic thrombocytopenic purpura, hypertension, cardiac failure, atrial fibrillation under oral anticoagulation and pacemaker.

The patient fell at home and suffered a left trochanteric fracture. At the hospital, he was treated with closed reduction and internal fixation under general anaesthesia and an ultrasound-guided left femoral block. On the second postoperative day, he suffered from acute confusional syndrome, attributed to the opioid drugs, which resolved gradually over the next few days after pharmacological adjustments. On the sixth postoperative day, he developed an acute urinary retention and had an indwelling catheter inserted. Several attempts were made to remove the catheter, without success. There were no signs of UTI and the prostate ultrasound revealed a slightly enlarged gland volume (32 g) without other changes.

Initially, the inability to void was attributed to the exaggerated bladder distension that was seen on the sixth postoperative day. When we examined the patient, he complained of pain in his left hip and lumbosacral region, with bilateral radiation. The physical examination revealed proximal muscle atrophy and pain during range of motion testing of the left hip, according to the postoperative status. He also had pain on lumbosacral palpation. The muscle examination not only demonstrated diminished strength in the

proximal muscles of the left lower limb, including L2, not testable (NT) because of the pain, but also in the ipsilateral plantar flexors (grade 4 Medical Research Council Scale [MRC]). Tendon reflexes were present and symmetrical in the upper limbs but absent in the lower limbs. The sensory examination was normal. In the sacral segmental examination, he had a weak voluntary anal contraction and absent anal reflex, despite normal anal sensation and tone, and the presence of the bulbocavernosus reflex. This S1-S4 lesion raised the suspicion of a lumbosacral lesion, of probable traumatic origin given his fall history. Owing to the pacemaker's incompatibility with the MRI machine, a CT was performed and revealed osteoporotic vertebral fractures in L1, L2 and L3 vertebrae, a narrow spinal canal between L3-L5 and narrowing of the intervertebral foramina bilaterally L3-L4, L4-L5, L5-S1, in addition to generalised degenerative changes. The patient thus had a previously undiagnosed spinal cord injury, of neurological level of injury (NLI): unable to determine (UTD), AIS D.

The urodynamic study revealed a hyposensitive bladder (first sensation at 450 ml), normal compliance (35 mL/cm H₂O) and absent voluntary detrusor contraction.

The remainder of the workup was unremarkable.

He started an alpha blocker (tamsulosin) and intermittent catheterisation, every 4 hours, preceded by a voiding attempt. After a few weeks he was able to void by schedule with negligible residual volumes.

Case 3

A 22-year-old patient was involved in a traffic accident in September 2014 which resulted in severe polytrauma with cranial fractures, clavicle middle third, scapular and rib fractures and complex sacral, ilio- and ischiopubic fractures, left femoral dislocation, retroperitoneal hematoma and hematic content in the pyelocaliceal system, bladder and ureter. The patient was admitted to the Intensive Care Unit for the first month and then transferred to the Orthopaedic ward. During October 2014, there was difficulty in changing the bladder catheter, which was interpreted as a probable urethral lesion and the patient was maintained with an indwelling catheter until November. At that time, a trial without catheter was attempted, but was not successful due to urinary retention and the catheter was maintained. He was transferred to our Rehabilitation Department in mid-November. A neurologic examination revealed reduced strength in right/left MRC S L2 (5/5), L3 (4/4), L4 (2/5), L5 (2/4) and S1(4/5) key muscles, right L5 territory hyperesthesia and absent right Achilles reflex. This clinical picture could be explained by the traumatic brain injury, pelvis fractures,

peripheral nerve lesions or immobility, but does not explain the urinary retention. A clinical examination of the lower sacral segments revealed diminished anal tone and voluntary contraction, and absent anal and bulbocavernosus reflex, which pointed to a sacral lesion. Besides the EMG, which revealed a right L5-S1 peripheral lesion, a lumbosacral MRI was performed. It revealed an S1-S2 meningocele in communication with the thecal sac and enlarged dural sheath of the S2, S3 and S4 roots, which suggested post-traumatic meningoceles (Fig. 2) and no lumbar lesion. In this case, a clinical examination of the sacral segments was fundamental to detect the sacral lesion and to explain to the patient and his family the possible consequences on bladder, bowel and sexual functions, as well as the need to maintain the intermittent bladder catheterisation programme. The other levels of reduced strength were due to immobility and peripheral lesion.

Case 4

A 47-year-old female with a history of mild stress urinary incontinence, repeated UTI and difficulty in starting micturition was observed. The symptoms had been present for three years, since a car accident that resulted in traumatic, left above-knee amputation, right tibia and fibula shaft fractures and an associated right common peroneal nerve lesion. The patient had been seen by insurance company physicians, namely three or four urologists, but the problem remained. The family history was irrelevant. The obstetric history revealed two pregnancies with two natural deliveries. She was without medication at the time of our medical appointment.

Figure 2 Lumbosacral MRI demonstrating post-traumatic meningocele in sagittal view.

The physical examination found a left residual limb without significant ROM or muscle strength changes. The right lower limb had a marked dorsiflexion and eversion deficit (grade 0 and 1 MRC scale, respectively). There was also hypoesthesia below T11 and the right plantar skin reflex was indifferent. An examination of the sacral segments revealed patulous anus and diminished voluntary anal contraction, absent right perianal sensation (S4-S5), absent bilateral anal reflex and a markedly diminished clitoro-anal reflex (S2-S4). The pelvic floor was significantly flaccid and hypermobile and there was urine leakage during cough.

She had previously had numerous diagnostic examinations. Her renal and bladder ultrasound was normal and a spine MRI did not show any signal changes in the medulla and conus medullaris. However, lower extremity somatosensory-evoked potentials were compatible with compromised medullary cone pathways. Anal manometry revealed normal sphincter rest pressure and normal anal sensation, but a markedly diminished voluntary anal contraction. A urodynamic study revealed normal bladder sensation, cough-induced detrusor hyperactivity with associated leakage, low bladder compliance, non-relaxing urethral sphincter during voiding, sphincter insufficiency and urethral hypermobility. During cough, there was significant protrusion of the pelvic floor with associated jet-leakage.

For this reason, the clinical picture and diagnostic tests were compatible with spinal cord injury, T11 neurological level, AIS unable to determine, probably located in the medullary cone (stretch lesion?), despite having a normal medulla and conus medullaris MRI.

We initiated intermittent catheterisation and anticholinergic. Since the patient also presented with a flaccid and hypermobile pelvic floor with sphincter insufficiency, she also participated in a pelvic re-education programme, which, in addition to the previously mentioned intervention, contributed to symptomatic improvement (reduced incontinence and frequency of UTI).

Discussion

Neuro-urological dysfunction can be originated by multiple conditions that affect the neural structures responsible for vesicosphincteric control. A neurological examination is the key to locating the site of the lesion: cerebral, cerebellum, basal ganglia, pontine micturition center, spinal cord, cauda equine, peripheral neuropathy (which is associated with autonomic involvement) or pudendal nerve lesion. Among those structures, somatic and parasympathetic innervations, originating in segments S2-S4, are only accessible to

physical examination through a lower sacral examination, which includes anal sensation, anal tone, voluntary anal contraction, anal reflex and bulbocavernosus or clitoro-anal reflex (whether man or woman).^{6,8} In a patient with a known neurological problem, the diagnosis of a neuro-urological dysfunction is easier.

The problem lies in patients with urological symptoms that may have a neurological cause. So, for a person with unexplained bladder dysfunction, we must perform a neuro-urological examination, testing the integrity of the sacral segments and, in male, testing the dartos reflex (T12-L2 spinal level).^{5,6} The dartos muscle is a sympathetically innervated dermal muscle layer within the scrotum, distinct from the somatically innervated cremaster muscle. We elicit the dartos reflex by cutaneous stimulation of the thigh, which produces a slow, writhing, vermicular contraction of the scrotal skin. This reflex can be used to evaluate the thoracolumbar sympathetic and genitofemoral nerve pathway. If it is abnormal, this points to a sympathetic lesion. In men and women, a patulous anus suggests a loss of both striated and smooth sphincter tone.³ Dartos and anal reflexes must be tested bilaterally.⁶ In women, the muscular strength of the pelvic floor muscles should also be assessed.^{8,9}

In the first case, in the neurological examination, only the lower sacral examination revealed abnormalities, which explained the clinical and urodynamic findings and was compatible with the imaging. Tarlov cysts are normally incidental findings, although they can be associated with bladder symptoms, as in this case. Explaining this was sufficient to make the patient understand the need to perform regular scheduled voiding, depending on fluid ingestion, and this solved the problem.

In case 2, the patient was admitted for rehabilitation after hip fracture surgery. There was an episode of post-operative urinary retention and the inability to void afterwards was thought to be consequence of bladder hyperdistention, but what could explain the urinary retention? The patient did not have prostatic hypertrophy and the retention only occurred a few days after surgery. The neurological examination found diminished left S1 muscle strength, unlikely to be caused by the trochanteric fracture, and a clinical examination of the lower sacral segments revealed abnormalities that prompted further study with lumbosacral CT, showing previously unidentified lumbar fractures.

In case 3, examination of the lower sacral segments clarified the origin of the vesicosphincteric dysfunction, ensuring accurate therapeutic orientation and prognosis.

In case 4 there was a history of severe trauma and urinary complaints which had been identified and studied previously, but not integrated into a diagnosis of a neuro-urological disorder and a therapeutic strategy. The examination according to ISNCSCI was decisive, since the distal lower limb deficit could be explained by the common peroneal nerve injury and the sensory level could have remained undetected. The lower sacral segment abnormalities and urodynamic results pointed to a mixed, central and peripheral lesion, compatible with a medullary cone lesion. This had previously been reported in somatosensory-evoked potentials, but had not been properly valued because of the absence of changes in the MRI. In this case, the patulous anus points to a loss of somatic (sacral) and sympathetic (thoracolumbar) innervation, which corroborates the T11 lesion. This was important not only for the therapeutic plan, but also for calculation of the incapacity insurance later received.

These case reports demonstrate the importance of complete neurological examinations, without missing the lower sacral segments, particularly if we are dealing with an unexplained bladder dysfunction. For clinicians who work with spinal cord injury, the ISNCSCI implies testing sacral sensation and voluntary anal contraction, so it is impossible to forget the sacral segments. We believe that it is very useful to perform a complete neuro-urological examination to collect information about the three sets of nerves that innervate the lower urinary tract. The dartos reflex (T12-L2 spinal level)⁶ tests the thoracolumbar sympathetic innervation, the anal tone reflex receives information from the striated sphincter (sacral somatic innervation) and smooth sphincter (thoracolumbar sympathetic innervation) and the anal reflex (S2-S5), bulbocavernosus or clitoroanal reflex (S2-S4),⁶ deep anal sensation and voluntary anal contraction (S4-S5) test the integrity of the sacral segments responsible for somatic and parasympathetic innervations. This can be decisive for a proper diagnosis and treatment plan and can modify a patient's prognosis. In these case reports, the results had major repercussions for patients' quality of life.

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