



The importance of the bulbocavernosus reflex

Jean Gabriel Previnaire¹

Received: 14 September 2017 / Accepted: 25 September 2017
© International Spinal Cord Society 2018

Abstract

The BCR consists of the contraction of the bulbocavernosus muscle in response to squeezing the glans penis or clitoris, and is mediated through the pudendal nerve. In case of a complete lesion, the presence of BCR is indicative of intact S2–S4 spinal reflex arcs and loss of supraspinal inhibition, determining an upper motor neuron (UMN) lesion, its absence a lower motor neuron (LMN) lesion. The BCR further helps distinguish conus medullaris from cauda equina syndromes. Sensory or motor function in the most caudal sacral segments, not BCR, defines the sacral sparing as part of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI). Sphincter dysfunctions are addressed in the International Standards for the Assessment of Autonomic Function after SCI (ISAFSCI). However, the ISAFSCI does not include the BCR, and is not part of the ISNCSCI. Yet, determination of the type of lesion, UMN or LMN, is very useful for the clinicians, and has important prognostic and therapeutic implications for bowel, bladder, and sexual function: UMN lesions are associated with detrusor and rectum hyperactivity, reflex erection and ejaculation, while the opposite is seen in patients with LMN lesions. BCR is complementary to the voluntary contraction of the external anal sphincter and should be added to ISNCSCI and ISAFSCI classifications, which should ultimately benefit patient care and research activities.

The bulbocavernosus reflex (BCR) is a well-known somatic reflex that is useful for gaining information about the state of the sacral spinal cord segments. When present, it is indicative of intact spinal reflex arcs (S2–S4 spinal segments) with afferent and efferent nerves through the pudendal nerve. Contractions of bulbocavernosus muscles and/or external anal sphincter (anal wink) are readily monitored in response to squeezing the glans penis or clitoris [1].

In this paper, we try to demonstrate the value of the BCR assessment in the management of persons with spinal cord injury (SCI) and in the classification of SCI.

In case of a thoraco-lumbar bony injury, presence of BCR helps distinguish conus medullaris from cauda equina syndromes. These syndromes are described in the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) [2]. On physical examination, other signs such as the Babinski, ankle clonus, and increased deep

tendon reflexes further support the differentiation of these syndromes but the BCR is an integral part.

BCR helps determine whether the sacral lesion is upper or lower motor neuron (UMN / LMN) and helps predict the type of sphincter dysfunction, especially in those patients with a complete SCI.

In bladder dysfunction, the BCR presence is significantly correlated with detrusor overactivity and related detrusor sphincter dyssynergia, while LMN lesions cause detrusor areflexia, flaccid paralysis of the striated sphincter, and urinary stress incontinence. In bowel dysfunction, rectal distension will provoke rectal contraction and stool leakage in patients with UMN lesions, but not in those with LMN lesions, in whom passive leakage is expected. For sexual life, men with UMN lesion are more likely to have reflex erection and projectile ejaculation than those with LMN lesion, who further suffer from more severely impaired fertility potential [3]. In women with UMN lesions, reflex lubrication is thought to be more likely. Men and women with all degrees and types of spinal cord lesions are significantly more likely to experience orgasm than those with complete LMN lesions [4]. All of these issues are addressed in the International Standards for the Assessment of Autonomic Function after SCI (ISAFSCI), yet the BCR is not even mandated here and the ISAFSCI is not part of the ISNCSCI [5, 6].

✉ Jean Gabriel Previnaire
previnlg@hopale.com

¹ Spinal Unit, Centre Calve, Fondation Hopale, Berck-sur-Mer, France

Therapeutic interventions vary depending on the type of lesion. Spontaneous voiding is only found in patients with UMN lesions and treatment of bladder sphincter dyssynergia is sometimes necessary. When intermittent catheterisation is performed, treatment of detrusor overactivity is often necessary with UMN lesions. Bowel management for persons with UMN lesions includes stimulation of the gastrocolic reflex and digital rectal stimulation to produce reflex stool evacuation. In contrast, digital removal of stool is appropriate for those with LMN lesions when straining is ineffective. Men with LMN lesions are poor responders to penile vibratory stimulation for ejaculation and phosphodiesterase inhibitors for erectile dysfunction and intracavernosus injections are often necessary for erectile dysfunction [3].

These examples clearly demonstrate determination of type of lesion has important prognostic and therapeutic implications for bowel, bladder, and sexual function. Still, sacral sparing, not BCR, is part of the ISNCSCI. The ISNCSCI was developed in 1982 by the American Spinal Injury Association to provide precision in the definition of neurological levels and extent of SCI, and to achieve consistent and reliable data for patient care and research [2]. In 1992, a complete injury was redefined as the absence of sacral sparing (sensory or motor function in the most caudal sacral segments), whereas an incomplete injury is defined as the presence of sacral sparing [2]. Determination of complete and incomplete SCI in the acute phase or at discharge from rehabilitation centres is routinely applied for predicting neurologic and functional recovery of patients; however, the absence of the BCR and related research regarding recovery of bladder, bowel and sexual function are significant omissions [7–10].

Sacral sparing is thus an important part of the ISNCSCI, but many physicians do not perform sacral reflexes. Yet the BCR is easy to perform, does not need any additional tools, and is obtainable in all men and women without concomitant peripheral neuropathy. Together with the voluntary anal contraction, both should be systematically tested in the person with SCI.

In conclusion, the BCR is easy to perform and useful in testing the integrity of the sacral reflex arc. The BCR helps distinguish UMN lesions from LMN lesions, which has important prognostic and therapeutic implications for bowel, bladder, and sexual function. It is complementary to the voluntary contraction of the external anal which gives information on the sacral motor sparing. The ISNCSCI

gives an accurate neurological level of injury and is useful to prognosticate motor recovery; in contrast, the ISAFSCI assesses autonomic function and is necessary to determine potential for sacral autonomic recovery. Both are useful for classification; however, the addition of BCR to ISNCSCI and ISAFSCI is necessary to determine the exact type of lesion and ultimately benefit patient care and research activities.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Blaivas JG, Zayed AA, Labib KB. The bulbocavernosus reflex in urology: a prospective study of 299 patients. *J Urol.* 1981;126:197–9.
2. Kirshblum SC, Burns SP, Biering-Sorensen F, Donovan W, Graves DE, Jha A, et al. International standards for neurological classification of spinal cord injury (revised 2011). *J Spinal Cord Med.* 2011;34:535–46.
3. Previnaire JG, Soler JM, Alexander MS, Courtois F, Elliott S, McLain A. Prediction of sexual function following spinal cord. *Spinal Cord Ser Cases.* 2017;3:17096.
4. Alexander MS, Marson L. The neurologic control of arousal and orgasm with specific attention to spinal cord lesions: integrating preclinical and clinical sciences. *Auton Neurosci.* 2017.
5. Alexander MS, Biering-Sorensen F, Bodner D, Brackett NL, Cardenas D, Charlifue S, et al. International standards to document remaining autonomic function after spinal cord injury. *Spinal Cord.* 2009;47:36–43.
6. Krassioukov A, Biering-Sorensen F, Donovan W, Kennelly M, Kirshblum S, Krogh K, et al. International standards to document remaining autonomic function after spinal cord injury. *J Spinal Cord Med.* 2012;35:201–10.
7. Kirshblum SC, Botticello AL, Dyson-Hudson TA, Byrne R, Marino RJ, Lammertse DP. Patterns of sacral sparing components on neurologic recovery in newly injured persons with traumatic spinal cord injury. *Arch Phys Med Rehabil.* 2016;97:1647–55.
8. Marino RJ, Ditunno JF Jr, Donovan WH, Maynard F Jr. Neurologic recovery after traumatic spinal cord injury: data from the model spinal cord injury systems. *Arch Phys Med Rehabil.* 1999;80:1391–6.
9. van Middendorp JJ, Hosman AJ, Pouw MH, Group E-SS, Van de Meent H. Is determination between complete and incomplete traumatic spinal cord injury clinically relevant? Validation of the ASIA sacral sparing criteria in a prospective cohort of 432 patients. *Spinal Cord.* 2009;47:809–16.
10. Alexander MS, Carr C, Chen Y, McLain A. The use of the neurologic exam to predict awareness and control of lower urinary tract function post SCI. *Spinal Cord.* 2017;55:840–3.