Progress of Pinprick Sensation Examination in Patients with Spinal Cord Injury

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Editorial

In 2019, we reported two novel approaches for pinprick sensation examination in patients with Spinal Cord Injury (SCI). One is to use a set of cone tools with different tapers (22.5°, 45°, 67.5° and 90°) and divides the pinprick sensation into five grades [1], another is a 0-10 Numerical Rating Scale which makes a distinction between eleven grades [2]. They both can produce reliable semi-quantitative pinprick test results and are useful for clinical sensory evaluation in patients with SCI. It is a great pleasure to share the experience of our research. As we all know, the International Standards for the Neurological Classification of SCI (ISNCSCI) is used in the diagnosis of SCI by examining the pinprick sensation and light touch sensation of key sensory points in combination with the strength of key muscles. To perform a pinprick sensation, a safety pin is used to prick the skin while observing the function of sharp/dull sensation (pain). The present classification uses a 0-2 scale for pinprick sensation examination of SCI: 0 (no pinprick sensation), 1 (impaired pinprick sensation), and 2 (normal pinprick sensation). During the pinprick sensation examination, the forehead of the patient is first tested with the pin for normal reference, then the examiner would ask the patient whether the perceived sharp/dull sensation in the tested sensory area is same or not compare to the reference [3,4]. Usually, the patient would answer “yes” which means normal pinprick sensation, or “no” which means impaired pinprick sensation. However, sometimes the patient would answer “almost” which neither means “yes” nor “no”. To make clear the exact meaning of the word “almost” in this situation, the 0-10 Numerical Rating Scale (NRS) is proposed. We would ask the patient, suppose the sharp/dull sensation in your forehead is 10 points, how much you would give for the tested area? The answer would be very interesting. Occasionally, the answer was 10 points which meant impaired pinprick sensation, and the majority answers were 8 points or 7 points which meant impaired pinprick sensation, but we never got an answer with 9 points, which would be very difficult to differentiate between normal and impairment. It is a mystery why we never got an answer with 9 points. From October, 2016 to December, 2018, sixty-nine patients with SCI from Department of Spinal Cord Injury Rehabilitation, China Rehabilitation Research Center were measured with NRS. The results showed the NRS has high test-retest reliability (ICC = 0.88) and inter-rater reliability (ICC = 0.93) for the assessment at abnormal pinprick sensation points in patients with SCI [2]. The NRS was originally used in neuropathic pain in individuals with chronic spinal cord injury, the larger the number, the worse the pain [5]. It is an innovative work to use the NRS in pinprick sensation and light touch sensation examination in patients with SCI. The NRS is easy to learn and use, and helpful to determine the sensory level in the SCI diagnosis of complicated cases. A shortcoming of the scale, however, is that it can only provide information about the subjective pinprick sensation of patients with SCI, it is not an objective method. And the ISNCSCI-0.2 scale can just tell us about the presence or complete loss of sensory function, making it difficult to quantify the results of conditions falling between the two extremes. It is limited in its ability to evaluate the extent of pinprick sensory dysfunction and the response to treatments [6]. Any tiny recovery of the sensory or motor function is a great encouragement for the patients with SCI and their families [6-8]. To explore an objective and quantitative method for the pinprick sensation evaluation is the reason and aspiration we try to design a set of cone tools with different tapers for pinprick sensation examination. How to choose different sharpness of cone tools to represent the different pinprick sensation is the first step. Less taper difference between the cone tools means more quantity of the cone tools needed and more accurate of the examination results, yet, much more time spent during the pinprick sensation examination. Several taper protocols were proposed in the preliminary test including: 15°, 30°, 45°; …; 18°, 36°, 54°; …; 20°, 40°, 60°; …; 22.5°, 45°, 67.5°; …; 90°. As efficiency is always important in clinical practice, and the sharpness of cone tool with 22.5° is very similar to that of the tip end of the safety pin, the last protocol (22.5°, 45°, 67.5° and 90°) is chosen for further study. Since a pinprick sensation is closely related not only the sharpness of cone tool but also the pressure on it when pricking to the skin, therefore, the next step is to decide the pressure on the cone tool to prick to the skin. We discovered in the pretest that it would feel pain or uncomfortable when the pressure is more than 30 g on the skin of the able-bodied individual. According


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to this pressure threshold, during each formal test, the cone tool was attached to a dynamometer to exert a force equivalent to 20g on the skin, for the sake of compliance and safety in the study. The cone tool was validated first in 91 able-bodied individuals and then in 30 patients with SCI. The discriminant validity was adequate for the examining results of pinprick sensation with the different cone tools \((p = 0.000)\). Using four tapers \((22.5^\circ, 45^\circ, 67.5^\circ \text{ and } 90^\circ)\), the pinprick sensation in patients with SCI can be graded into five levels: normal, slight impairment, moderate impairment, severe impairment, and complete loss of sensation.

Objective and quantitative measures of sensory and motor function with high validity, reliability, and sensitivity are promising tools to inform and improve future SCI trials [9]. Comparing the two approaches for pinprick sensation examination, Numerical Rating Scale has more discriminant grade, and the cone tool is more objective. Therefore, a combination of these methods is recommended to improve the physical examination results of SCI in the future. We hope they will be applied more and more widely, and any suggestions and criticism are welcome.

References


