Post-stroke spasticity as a condition: a new perspective on patient evaluation

Dear Sir,

Stroke is a major cause of long-term disability. Post-stroke spasticity (PSS) has been described as a velocity-dependent increase in muscle tone with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex and presenting as intermittent/sustained involuntary muscle activation (Pandyan et al., 2005). In clinical practice, accurate quantitative measures of spasticity can be difficult to obtain in a single examination: indeed, PSS can be modified in different conditions, e.g. static conditions as opposed to dynamic situations, such as walking. In addition, the impact of PSS on subjective sensations and activities of daily living (ADL) can be hard to describe. Furthermore, in order to optimize treatment procedures in patients with PSS, assessment of patient-reported outcomes and perceptions should be reported, given that sensorimotor alterations due to PSS may influence “interoception”, i.e. the sense of the physiological condition of the entire body (Craig, 2002; Franceschini et al., 2014).

In order to improve understanding of these components of PSS, we studied 116 adults affected by first-ever unilateral stroke (more than 3 months from onset) with spasticity (less than 3 months from the last botulinum toxin treatment) in the affected arm (41 right hemiparesis and 75 left hemiparesis), graded ≥1 on the Modified Ashworth Scale (MAS). Spasticity was measured with the MAS in the affected shoulder, elbow, wrist and fingers, and associated reactions of the affected arm were recorded during the sit-to-stand movement and during walking. Also the following variables were evaluated in the affected arm: Motricity Index (MI) sub-items for the upper limb; active range of motion of the shoulder, elbow, wrist and finger (percentage differences from normal values); self-assessment of functioning of the arm during ADL, as rated on a visual analog scale (0 no use; 100 normal use); Disability Assessment Scale; and self-estimation of pain, heaviness and rigidity in the shoulder, elbow, wrist and finger joints according to the Numerical Rating Scale (NRS) (0 no symptom; 100 worst symptom). Afterwards, we performed a principal component analysis (PCA), which is a variable reduction procedure, in order to obtain a smaller number of principal components (artificial variables), and also because the PCA would account for the variance in the observed data, while retaining most of the information from the sample.

On the basis of the PCA results, we defined three classes based on the main unpleasant sensations reported by each patient (heaviness, rigidity and pain) as follows: Class I (29 patients; 12 right hemiparesis and 17 left hemiparesis; mean age 63.4 years; mean time from stroke onset 58.2 months) corresponded to a higher level of proximal (shoulder) heaviness and a low level of pain (NRS 23.3 and 12.7, respectively); Class II (29 patients; 11 right hemiparesis and 18 left hemiparesis; mean age 60.7 years; mean time from stroke onset 74.1 months) corresponded to the highest level of rigidity (NRS 59.5, 70.7, 77.8 and 76.4 at the shoulder, elbow, wrist and fingers, respectively) and pain (NRS 17.1, 7.9, 11.7 and 13.1 at the shoulder, elbow, wrist and fingers, respectively); Class III (58 patients; 18 right hemiparesis and 40 left hemiparesis; mean age 63.2 years; mean time from stroke onset 70.9 months) corresponded to a lower level of heaviness (NRS 12.8, 2.7, 1.3 and 1.1 at the shoulder, elbow, wrist and fingers, respectively), the intermediate level of rigidity (NRS 21.5, 27.8, 21 and 18.1 at the shoulder, elbow, wrist and fingers, respectively), a greater level of functional ability and a low level of proximal (shoulder) pain (NRS 13.3).

According to the non-parametric Kruskal-Wallis test (alpha level for significance p<0.05), no significant differences were found between Classes I, II and III in the MAS (shoulder adductors, elbow flexors, wrist and finger flexors) and MI (shoulder, elbow and pinch grip) scores.

On the basis of this finding, we suggest that unpleasant sensations of pain, heaviness and rigidity may relate not only to muscle tone (as measured by the MAS), but also to altered proprioceptive and body ownership information, as well as to the individual’s self-estimated ability to achieve functional goals. This is in keeping with previous findings about the impact of PSS on limitations in ADL, wellbeing and life satisfaction, which may not be indicated by quantitative scores but are demonstrated by patient-reported outcome measures (Sunnerhagen and Francisco, 2013). Indeed, PSS also has an afferent, sensory component, which might be related to some differences in the sensations described by patients (Craig, 2002; Franceschini et al., 2014). It is well known that proprioceptive afferent information coming from mechanoreceptors in joints, muscles, tendons and stretch-sensitive receptors in the skin, together with efferent motor signals, can play a key role in postural schema understood as dynamic representations of body posture. Moreover, the sense of body ownership, too, is presumably developed using sensory information, as recently described by Walsh and colleagues (2011), who demonstrated that non-tactile proprioceptive cues might contribute to this sense.
Another possible explanation for the current observations could be related to problems occurring in patient-provider communication and the role that this communication plays in PSS rehabilitation within the context of patient-centered health care, which addresses illness from a holistic perspective (Sunnerhagen and Francisco, 2013). Furthermore, treatment goals should be patient-centered and the rehabilitation program should be tailored to the needs of each patient, identifying what they describe as limitations and trying to focus on possible correlations between these and PSS.

In conclusion, our patients with PSS described different patterns of sensations even without showing significant differences in their MAS and MI scores. We suggest that PSS might be considered not only as a modification of muscle tone, but also as a clinical condition that is specific to the single patient, and has a significant impact on his/her sensations and self-estimated autonomy in ADL. Future studies are needed to further investigate these issues.

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