Editorial

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Correlating stroke lesion location with clinical outcomes – an example from deglutition research

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See article pg xxx-xxx: Neuroanatomical correlates of tube-dependency and impaired oral intake after hemispheric stroke. Galovic et al., 2016

Not being able to swallow has far-reaching consequences: no meals with family and friends, struggling to keep up sufficient nutrition and hydration, and being at significant risk of aspiration pneumonia or choking.

Orchestrated by an intricate network of sensory and motor circuits in the brainstem and supratentorial areas, swallowing is a complex sensorimotor task that propels a bolus of food or liquid from the oral cavity via the pharynx and esophagus to the stomach, while maintaining airway protection and preventing aspiration. Yet, this complex myriad of biomechanical and neurophysiological events occurs largely unnoticed, unless it breaks down. Disordered swallowing, or dysphagia, is a common consequence of damage to the nervous system caused by a range of conditions, including neurodevelopmental disorders, traumatic brain injury, stroke or neurodegenerative conditions. Dysphagia is associated with serious complications such as poor nutrition and hydration, choking or aspiration pneumonia. Length of stay in hospital more than doubles for patients presenting with stroke who also have dysphagia (Altman et al., 2010).

In light of the significant impact of disordered swallowing, the last few decades have seen a rapid expansion of our understanding of normal and impaired swallowing processes. Much of this research was driven by the advent of neuro-imaging and neuro-stimulation techniques which have identified a number of intricate neural networks that are involved in swallowing sensorimotor control.

It is generally accepted that the sequential, precisely timed sequence of pharyngeal muscle contractions during the pharyngeal phase of swallowing is orchestrated by a network of central pattern generators in the medulla, in particular consisting of bilateral dorsal and ventral swallowing groups (Jean, 2006). These pattern generators receive trigeminal and vagal inputs from the periphery and produce a tailored swallowing response that is responsive to bolus qualities, e.g. taste, texture, size and temperature. There is also significant evidence demonstrating the influence of interconnected cortical motor networks on swallowing motor control. Imaging studies using functional magnetic resonance imaging have identified a number of supratentorial regions that appear to be involved in volitionally initiated swallowing, including but not limited to the lateral pre- and post-central gyri and insula, frontal operculum (Hamdy et al., 1999; Martin et al., 2001) and anterior cingulate cortex (Martin et al. 2001). Cortical control of swallowing in humans appears to be bilaterally, but asymmetrically organised. Clinically, unilateral damage to either the left or right hemisphere can result in impaired swallowing (Daniels et al., 1996) and spontaneous recovery of swallowing function following stroke is associated with expansion of the pharyngeal motor representation on the contralesional primary motor cortex (Hamdy et al., 1998).

A clear understanding of the links between central nervous system damage and its effects on swallowing function are a critical prerequisite for optimising rehabilitation outcomes. This is of particular importance in the current global climate of health care reform, where treatment efficacy and allocation of health care funds are increasingly scrutinised, and length of hospital stay is minimised. Identifying factors that are able to predict the potential for functional recovery, or the risk of serious side effects that may arise as a result of a given neuropathological presentation, are critical for optimising clinical treatment pathways and ultimately treatment success.

Galovic and colleagues (pg xxx in this edition) make an important contribution to this body of the literature by identifying neuroanatomical correlates of acute feeding tube-dependency in the early days following stroke. Clinically, provision of adequate nutrition and hydration is critical for the physiological and neurological recovery from neurological insult, and thus early identification of those at potential risk for severe swallowing impairment and tube-dependency is important. The authors identified that lesions of the anterior insular cortex were highly predictive of tube-dependency. This finding is in keeping with previous research demonstrating the pivotal role of this region in a wider sensorimotor integration network involved in swallowing (Lowell et al., 2012). Interestingly, and in contrast to some previous research, this study did not identify a significant influence of laterality on the incidence of dysphagia. Together with research reporting significant inter-individual variability of this asymmetry (Hamdy et al., 1996), this finding underscores the importance of further research into the lateral asymmetry of swallowing sensorimotor control, as well as correlations between lesion location and long-term tube-dependency and associated health-economic factors. Another important further step will be to directly correlate brain lesion subtypes with precise assessments of swallowing biomechanics. In addition to radiographic swallowing studies, there are now equally accurate biomechanically based assessments of swallowing function that can be easily performed at the bedside using a fine bore catheter-based instrument allowing quantification of swallowing features that predispose to aspiration risk and poor oral intake (Omari et al., Gastroenterology 2011). There is every indication that these methods can be highly sensitive for detecting the consequences of impaired sensorimotor integration and timing of consecutive stages of components of deglutition (Ferris et al., 2015) as well as global measures that can track swallowing efficiency longitudinally (Kritas et al., 2016) which is important, for example in the context of functional recovery following stroke.

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