Lesion mapping in acute stroke aphasia and its implications for recovery

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Abstract
Patients with stroke lesions offer a unique window into understanding human brain function. Studying stroke lesions poses several challenges due to the complexity of the lesion anatomy and the mechanisms causing local and remote disruptions on brain networks. In this prospective longitudinal study, we compare standard and advanced approaches to white matter lesion mapping applied to acute stroke patients with aphasia. Eighteen patients with acute left hemisphere stroke were recruited and scanned within two weeks from symptom onset. Aphasia assessment was performed at baseline and six-month follow-up. Structural and diffusion MRI contrasts indicated an area of maximum overlap in the anterior external/extreme capsule with diffusion images showing a larger overlap extending into posterior perisylvian regions. Predictors of recovery included damage to ipsilesional tracts (as shown by both structural and diffusion images) and contralateral tracts (as shown by diffusion images only). These findings indicate converging results from structural and diffusion lesions mapping analysis but clear differences between the two approaches in their ability to identify predictors of recovery.

1. Introduction
Stroke imaging has greatly contributed to our current understanding of the anatomy of higher cognitive functions, including language. Most stroke studies are conducted in the chronic stage for practical reasons, but also to reduce the effect of clinical fluctuations, anatomical and metabolic changes, and possible functional reorganisation which has been described between the acute and subacute phases (Bald et al., 2015; Drongers, 2000; Fridriksson et al., 2010; Price, 2012; 2000; Price and Friston, 2002; Turken and Drongers, 2011a, Hillis et al., 2000). In recent times, the increased availability of magnetic resonance imaging (MRI) scanners with clinically feasible acquisition sequences has led to an increasing number of studies focusing on acute stroke (Forkel et al., 2014; Hillis and Heidler, 2002; Hillis et al., 2001; Saur et al., 2006). Compared to chronic stroke, acute stroke imaging offers several advantages (Karnath and Rorden, 2012). For example, inter-individual differences in structural anatomy and cognitive functioning can be best studied in the acute stage, as the lesion has not yet caused full degeneration of anatomical structures and patients have yet to develop their own cognitive strategies to overcome their deficits. Additionally, some conditions such as anosognisa for hemiplegia, visuospatial neglect and anosognosia are more prominent in the acute stages and their clinical progression can be better studied in early post-stroke days (Besharati et al.,
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