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Case report

Pure apraxia of speech due to infarct in premotor cortex

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ABSTRACT

Apraxia of speech (AOS) is now recognized as an articulation disorder distinct from dysarthria and aphasia. Various lesions have been associated with AOS in studies that are limited in precise localization due to variability in size and type of pathology. We present a case of pure AOS in setting of an acute stroke to localize more precisely than ever before the brain area responsible for AOS, dorsal premotor cortex (dPMC). The dPMC is in unique position to plan and coordinate speech production by virtue of its connection with nearby motor cortex harboring corticobulbar tract, supplementary motor area, inferior frontal operculum, and temporo-parietal area via the dorsal stream of dual-stream model of speech processing. The role of dPMC is further supported as part of dorsal stream in the dual-stream model of speech processing as well as controller in the hierarchical state feedback control model.

1. Introduction

Apraxia of speech is a disorder of motor speech planning characterized by slow speech rate, segmentation of syllables, sound distortions, distorted substitutions, trial-and-error articulatory movements, and increased difficulty with increased length and complexity of utterances. It is termed Aphemia in its most severe form. It is distinct from Broca's aphasia given intact repetition, grammar, syntax and writing. It is also distinct from transcortical motor aphasia (TCMA) since articulation is normal on repetition in TCMA. Aphasia may co-occur with aphasia so AOS has been divided into two types – pure AOS or AOS with aphasia. The earlier neuroanatomic correlations in patients with AOS had an infarction in multiple structures around the left inferior frontal gyrus including the adjacent motor cortex, deep white matter, and insula; however these studies had a limited sample size and imaging resolution on CT scans [1]. Further studies on AOS

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involving a large number of patients and improved imaging technique like MRI, emphasized the role of the insular region [2]. However, this "lesion overlap" approach was criticized and failed to explain the absence of AOS in all insular strokes. Attempts to explore such neuroanatomical correlation between insula and AOS found no significant association, instead demonstrated either structural damage or hypoperfusion in left posterior inferior frontal gyrus on functional imaging; and few cases had lesions only in precentral and postcentral gyrus [3]. A larger study involving stroke patients with pure AOS demonstrated isolated infarcts in the premotor cortex (PMC) and adjacent motor cortex [4]. This line of evidence reconciled with studies of neurodegenerative AOS where PMC and supplementary motor area (SMA) have been implicated [5]. We present a case of pure AOS with a lesion in dorsal premotor cortex (dPMC) and adjacent motor cortex; and discuss lesion evidence in support of dPMC in speech planning and coordination.

2. Case presentation

A 60-year-old right-handed man with past medical history of ischemic cardiomyopathy with systolic heart failure, hypertension, hyperlipidemia, and gout presented with sudden onset of slurred speech and right arm weakness. Exam showed left upper motor neuron facial palsy and left arm weakness mainly in forearm extensors and wrist extensors. MRI of brain showed an acute infarct in left dorsal premotor cortex and left motor cortex. The infarcts in other areas included the left prefrontal cortex (Fig. 1) and left cerebellum (not shown) were chronic with no restricted diffusion. The etiology of infarct was

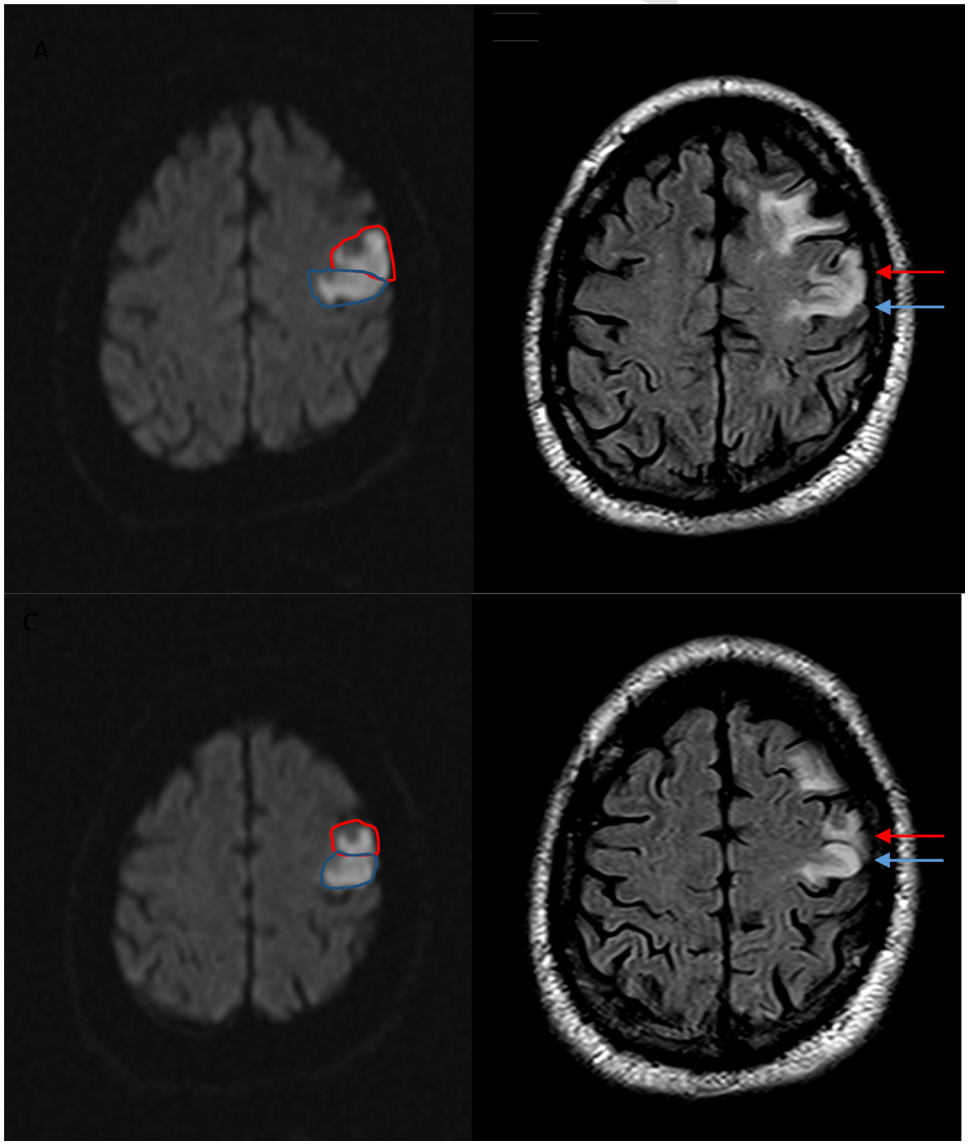

Fig. 1 – MRI Brain. (a) and (c) DWI sequence showing restricted diffusion in left dorsal premotor cortex (outlined in red) and left cortical motor cortex (outlined in blue). (b) and (d) FLAIR sequence showing infarcts in left prefrontal cortex (arrow head), left dorsal premotor (red arrow) and left motor cortex (blue arrow). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

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