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Auditory symptoms in primary progressive aphasia: a commentary on Utianski et al (2019)

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## **Auditory symptoms in primary progressive aphasia: a commentary on Utianski et al (2019)**

In their recent article in *Cortex*, Utianski and colleagues described a patient who presented with a prominent auditory deficit in the context of primary progressive aphasia (PPA). We wish to emphasise that auditory dysfunction is an important emerging theme in the ‘language-led’ dementias. A spectrum of complex auditory deficits has been demonstrated in PPA, and cases with prominent nonverbal auditory symptoms may signify a more widespread phenomenon.

The patient reported by Utianski and colleagues did not meet current consensus criteria (Gorno-Tempini et al., 2011) for a single canonical PPA subtype at initial presentation, with symptoms fitting both the logopenic variant (lvPPA) and nonfluent/agrammatic variant (nfvPPA), though she did eventually develop features most consistent with nfvPPA. While her selective auditory agnosia for speech, or ‘word deafness’ was unusually salient, auditory symptoms are commonly experienced by patients with all major forms of PPA (Hardy et al., 2016) and cases with prominent auditory agnosia have been well attested from the earliest reports (Mesulam, 1982; Sérioux, 1893).

Indeed, speech perception may be critically vulnerable in nfvPPA. Accurate speech perception depends on precise temporal feature decoding, and early analysis of speech and non-linguistic auditory signals is affected in nfvPPA (Goll et al., 2010; Grube et al., 2016; Hardy, Augustus, Marshall, Clark, Russell, Bond, et al., 2017; Hardy, Augustus, Marshall, Clark, Russell, Brotherhood, et al., 2017; Rohrer, Sauter, Scott, Rossor, & Warren, 2012). For uncertain reasons, word deafness (and environmental sound agnosia) may be a more frequent presentation in Japanese patients (Otsuki, Soma, Sato, Homma, & Tsuji, 1998). Patients with nfvPPA also have significant auditory apperceptive dysfunction, manifesting in disproportionate difficulty identifying or understanding sounds in difficult listening conditions (Fletcher et al., 2013; Hailstone et al., 2012; Hardy et al., 2018). These symptoms may have a neuroanatomical substrate in posterior peri-Sylvian cortices, consistent with the involvement of posterior superior temporal cortices in the patient described by Utianski and colleagues. Interestingly, the authors additionally found left inferior frontal lobe hypometabolism on FDG-PET. Targeting of this region in nfvPPA may impair predictive decoding of incoming speech signals, (Cope et al., 2017), perhaps providing an alternative (or complementary) explanation for the patient’s difficulties.

It is also worth noting that auditory symptoms are likely to be under-recognised in lvPPA and semantic variant PPA (svPPA). lvPPA is associated with temporo-parietal junction atrophy, and auditory verbal short term memory is blighted as a result (Gorno-Tempini et al., 2011; Marshall et al., 2018). These patients also have problems with speech perception under degraded listening conditions (Hardy et al., 2018), which may reflect a more general problem with auditory scene analysis, also significantly affected in other variants of Alzheimer’s disease (Golden, Augustus, et al., 2015; Golden, Nicholas, et al., 2015; Goll et al., 2012). Patients with svPPA, by contrast, develop auditory associative agnosias as part of a more general erosion of semantic memory affecting all modalities, linked with anterior temporal lobe dysfunction (Bozeat, Lambon Ralph, Patterson, Garrard, & Hodges, 2000; Golden, Downey, et al., 2015; Goll et al., 2010). Interestingly, however, patients with svPPA also commonly experience tinnitus and hyperacusis, linked to involvement of central auditory pathways (Mahoney et al., 2011).

We agree with Utianski and colleagues that measuring sensory hearing function via pure tone audiometry is important in establishing whether the origin of a patient’s auditory symptoms is peripheral (i.e. at the level of the cochlea) or central (i.e. at the level of the brain). In fact, recent work suggests that patients with nfvPPA have elevated pure tone audiometric hearing thresholds relative to age-matched healthy control participants and patients with Alzheimer’s disease (Hardy et al., 2019), though the precise mechanism responsible for these findings remains to be elucidated.

We welcome carefully characterised cases such as this in drawing attention to an important and potentially fundamental pathophysiological principle of PPA. We would argue that these syndromes should be reappraised as pervasive disorders of communication and the investigation of hearing symptoms in PPA should encompass ears, brain and their potentially complex interaction. Longitudinal studies that prospectively track auditory processing across the major PPA syndromes will be vital to answer some of the key questions raised by this interesting report.

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