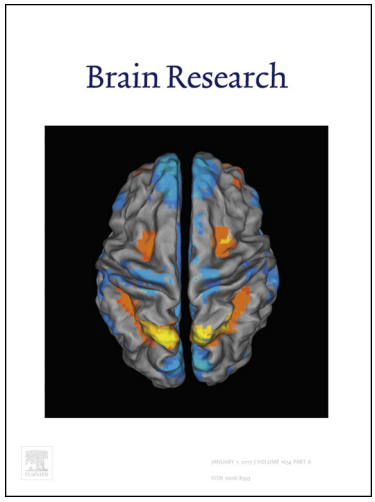

Research report

Gap-induced reductions of evoked potentials in the auditory cortex: a possible objective marker for the presence of tinnitus

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Gap-induced reductions of evoked potentials in the auditory cortex: a possible objective marker for the presence of tinnitus

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Abstract

Animal models of tinnitus are essential for determining the underlying mechanisms and testing pharmacotherapies. However, there is doubt over the validity of current behavioural methods for detecting tinnitus. Here, we applied a stimulus paradigm widely used in a behavioural test (gap-induced inhibition of the acoustic startle reflex GPIAS) while recording from the auditory cortex, and showed neural response changes that mirror those found in the behavioural tests. We implanted guinea pigs (GPs) with electrocorticographic (ECoG) arrays and recorded baseline auditory cortical responses to a startling stimulus. When a gap was inserted in otherwise continuous background noise prior to the startling stimulus, there was a clear reduction in the subsequent evoked response (termed gap-induced reductions in evoked potentials; GIREP), suggestive of a neural analogue of the GPIAS test. We then unilaterally exposed guinea pigs to narrowband noise (left ear; 8-10 kHz; 1 hour) at one of two different sound levels - either 105 dB SPL or 120 dB SPL – and recorded the same responses seven-to-ten weeks following the noise exposure. Significant deficits in GIREP were observed for all areas of the auditory cortex (AC) in the 120 dB-exposed GPs, but not in the 105 dB-exposed GPs. These deficits could not simply be accounted for by changes in response amplitudes. Furthermore, in the contralateral (right) caudal AC we observed a significant increase in evoked potential amplitudes across narrowband background frequencies in both 105 dB and 120 dB-exposed GPs. Taken in the context of the large body of literature that has used the behavioural test as a demonstration of the presence of tinnitus, these results are suggestive of objective neural correlates of the presence of noise-induced tinnitus and hyperacusis.

Keywords

Tinnitus; auditory cortex; noise exposure; chronic recording

Introduction

Tinnitus, the perception of sound in the absence of an external acoustic stimulus, is a widespread health concern, affecting between 8-15% of the population and is debilitating in ~1% (Shargorodsky et al., 2010). Animal models of the condition are essential for examining the underlying causes and developing potential treatments, and objective assessment of tinnitus is an essential prerequisite