Mismatch negativity impairment associated with alcohol consumption in chronic alcoholics: A scalp current density study

J. Marco-Pallarés a,b,c, G. Ruffinib, M.D. Polo d, A. Gual e, C. Escera f, C. Graua,⁎

a Neurodynamics Laboratory, Department of Psychiatry and Clinical Psychobiology, University of Barcelona, Passeig de la Vall d’Hebron 171, 08035 Barcelona, Catalonia, Spain.
b Starlab Barcelona SL, Edif. Observatori Fabra, Barcelona, Spain
c Department of Neuropsychology, Otto von Guericke University, Magdeburg, Germany
d The Burden Neurological Institute, Bristol, UK
e Unidad de Alcohologia, Institut Clinic de Psiquiatria i Psicologia, Hospital Clinic de Barcelona, Barcelona, Spain
f Cognitive Neuroscience Research Group, Department of Psychiatry and Clinical Psychobiology, University of Barcelona, Barcelona, Spain

Received 7 November 2006; received in revised form 31 January 2007; accepted 1 March 2007
Available online 12 March 2007

Abstract

Previous studies, based on amplitude and latency measurements of auditory event-related brain potentials, yielded inconclusive results about the status of mismatch negativity (MMN) in chronic alcoholics. The present study explores scalp current density (SCD) dynamics during MMN latency range in alcoholics, and correlates electrical SCD results with clinical data of the patients. SCD was computed from 30 electrodes in 16 abstinent chronic alcoholics and 16 healthy control volunteers in a paradigm on MMN elicited by duration changes. Reduced activity was observed in left frontal and right anterior and posterior temporal areas during MMN in alcoholics. Alcohol consumption correlated negatively with SCD intensity in these regions. Delayed activation was observed in the left posterior temporal area in the patients. Alcohol abstinence duration correlated positively with SCD intensity in this region. These results point to an impairment of automatic brain processing mechanisms associated with auditory change detection in chronic alcoholism. The present results suggest a reorganization of the computational neurodynamics of automatic auditory change detection linked to the amount of alcohol consumed in abstinent chronic alcoholics.

© 2007 Elsevier B.V. All rights reserved.

Keywords: Chronic alcoholism; Mismatch negativity; Scalp current density

1. Introduction

Chronic alcohol consumption, the metabolites involved and other conditions associated with it (e.g., nutritional deficits) have been shown as adversely affecting the brain of chronic alcoholics. In particular, considerable efforts have been put into the study of event-related brain potentials (ERPs) in alcoholic patients. This technique provides a non-invasive way to study brain computing at the sub-second temporal level, and has uncovered many brain processing abnormalities in chronic alcoholics.

There is evidence that abstinent alcoholic patients, compared to control subjects, have delayed brain-stem auditory evoked potentials (BAEPs) (Begleiter et al., 1981), enhancement of peak-to-peak amplitude of the N1–P2 (Cadaveira et al., 1991), and reduced P300 amplitude (Porjesz et al., 1987, 1998). Other ERP abnormalities in chronic alcoholics include enhanced P3a elicited by novel sounds (Polo et al., 2003), reduced P3a in visual paradigms (Rodriguez-Artalejo et al., 1999) and a reduction in the amplitude of N400 (Nixon et al., 2002) and contingent negative variation (CNV) (Chao et al., 2003).

A component of the auditory ERPs that has received recent attention in the alcoholism literature is the mismatch negativity (MMN). The MMN appears circa 100–200 ms after the occurrence of a deviant auditory event in a repetitive pattern of sounds (Näätänen et al., 1978). The main generators of MMN are located in the supratemporal cortex (see review in Escera et al., 2000). In addition, studies using scalp source current density analysis (SCD) have shown that MMN also has sources located
(1935–2006), distinguished Professor of Psychiatry and Neuroscience in the SUNY Downstate Medical Center at Brooklyn, dear professor and friend who inspired this work.

References


