Risk Markers for Alcoholism: Brain Potentials Distinguish Amphetamine Responders and Nonresponders

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METHODS

Phase 1
- Healthy young men and women each received 10 mg d-amphetamine
- Biphasic Alcoholic Effects Scale (BAES) used to assess stimulant response
- BAES administered before and 30, 90, 150, and 210 min after capsule
- Participants relaxed and performed quiet activities
- Change scores on BAES Stimulant subscale (90 min – baseline) calculated
- Two groups identified (see Figure 1):
  - Responders (change in Stim > 0; n = 26 women; 32 men)
  - Nonresponders (change in Stim ≤ 0; n = 26 women; 25 men)

Phase 2
- Responders and Nonresponders participated in second phase
  - In separate sessions, each administered placebo or 10 mg d-amphetamine
  - ERPs recorded during auditory novelty oddball task (see Table 1)
  - Task initiated 70 min after capsule and lasted 8 min

RESULTS

P3a: Responders (R; n = 58) > Nonresponders (NR; n = 55)

Figure 1a. Grand-Mean ERPs Elicited by Novelts

Figure 1b. P3a Amplitude (Novelties)

Table 1. Novelty Oddball Task

<table>
<thead>
<tr>
<th>Trial categories</th>
<th>Standards (p = .76)</th>
<th>Targets (p = .12)</th>
<th>Rare Nontargets (p = .12)</th>
<th>Instructions</th>
<th>Sequence</th>
<th>Stimulus onset asynchrony</th>
<th>Task duration</th>
<th>Recording epoch and bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000-Hz tones, 100-ms duration</td>
<td>1500-Hz tones, 100-ms duration</td>
<td>Novel sounds, variable: M = 336 ms</td>
<td>Press button to targets (high tone)</td>
<td>Pseudorandom</td>
<td>1000 ms, fixed</td>
<td>480 trials (8 m)</td>
<td>990 ms (100 ms prestimulus)</td>
<td>0.1 – 100 Hz (-3 dB)</td>
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<td>52 scalp sites referred to nose and HEOG, VEOG</td>
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SUMMARY AND INTERPRETATION

- FINDING—P3a AMPLITUDE: Responders > Nonresponders.
- INTERPRETATION: Attention shift to novel stimuli greater in Responders than in Nonresponders, independent of amphetamine.
- SUGGESTS: There is overlap between neural structures supporting stimulant and novelty response.
- FINDING—P300 AMPLITUDE: In Responders, Amphetamine > Placebo but in Nonresponders, Amphetamine = Placebo.
- INTERPRETATION: In responders but not Nonresponders, amphetamine facilitates allocation of resources to processing targets.
- SUGGESTS: P300 reflects a process integral to subjective energizing effect of amphetamine.

OVERALL CONCLUSIONS

Enhanced subjective stimulant response associated with enhanced:

1. Neurocognitive response to novelty
2. Effect of amphetamine on effortful attention

As both responses are thought to depend in part on dopamine function, these associations may reflect variability in that system.

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