Pain stimulation by using Synchronised Somatosensory Evoked Potentials (SSEPs) and Contact Heat Evoked Potentials (CHEPs)

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Introduction/Objective

SSEPs evaluate conduction of non-painful stimuli over large A-beta fibers. Nociceptive stimuli generate action potentials conducted in thinner A-delta and C fibers. These fibers are characterized by slower conduction velocities and can be evaluated by CHEPs. We verified the feasibility of synchronized SSEPs and CHEPs in normal subjects, in order to create a new electrophysiological tool for clinical use.

Methods

- 20 healthy normal subjects were investigated (10 females/10 males, age 25 ± 7 and height 176 ± 7 cm). SSEPs were triggered at the right posterior tibial nerve (8 ± 3 mA). Synchronised CHEPs were induced at the right S1 dermatome with a thermocouple at 52° C (250 msec stimulus duration, 15 sec inter stimulus interval, total number of stimuli: 90). Visual Analogue Scale (VAS) was obtained at the first stimulus and every 3 min thereafter. Acquisition of evoked potentials were acquired on Fz (A1-A2) and CPz (A1-A2) derivations.

Results

- SSEPs induced a P45 (48.1 ± 4.1)/N60 (56.5 ± 5.1) potential and CHEPs induced a N550 (564 ± 105 ms) and a P650 (670 ± 121 ms) potential with a topography on Cz-Pz location (Figure 1 and 3).
- Correlation analysis:
  1. N1 and P1 amplitudes were correlated (p<0.01).
  2. N1-P1 amplitudes did not change over time.
  3. VAS scores decreased from 33.2 ± 20.9 mm to 19.5 ± 12.9 mm (p<0.01) (Figure 2).
  4. The VAS scores were not correlated with N1-P1 amplitudes.
  5. There was no correlation between P45 and N1-P1 amplitudes.

Discussion/Conclusions

This study confirms the feasibility of recording SSEPs and CHEPs using concomitant stimulation. CHEPs induces a late N1-P1 component at 550 and 650 ms in Fz and CPz that may reflect A-delta fibres activation. While VAS decreases with time, CHEPs and SSEPs amplitudes remain constant. These results suggest that pain perception is a “cognitive process” that is not solely dependent on pain evoked potential amplitude.