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Electrical Activity Recorded from Within the Anterolateral Funiculus During Percutaneous Cordotomy in Man

J. A. Campbell and D. Bowsher

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16. Electrical activity recorded from within the anterolateral funiculus during percutaneous cordotomy in man

By J. A. Campbell and D. Bowsher

Pain Relief Foundation, Walton Hospital, Liverpool L9 1AE, U.K.

Percutaneous cervical cordotomy involves placing an electrode in the anterolateral quadrant (a.l.q.) of the spinal cord to produce the radio-frequency lesion. This offers a unique opportunity for neurophysiological recording.

An electrode, insulated to within 2 mm of its tip, was introduced into the a.l.q. down the centre of a spinal needle, whose tip remained within the cerebrospinal fluid. The position of the electrode was assessed anatomically using X-rays with contrast medium and physiologically by electrically stimulating through the electrode at 100 pulses s^{-1} and noting the position at which the patient reported sensation. The cordotomy electrode was then used to record averaged potentials evoked by electrical stimulation of peripheral nerves. The spinal needle was used as the reference electrode for these recordings.

The early response after stimulation of the ipsilateral median nerve at the wrist was typified by a large well-defined positive deflection with a mean peak latency of 15.7 ± 1.7 ms (P16) and an onset latency of 12.7 ± 1.9 ms. After contralateral median nerve stimulation, a small biphasic potential (P12/N13) was seen, followed in approximately half of the subjects by a P16, although this was of only half the amplitude of that seen ipsilaterally.

The ipsilateral P16 potential was first detected at stimulus intensities of half the threshold for thumb twitch (T_m). Increasing the stimulating current produced a linear increase in P16 amplitude until the maximum amplitude was reached at $1.4\,T_m$.

Potentials evoked by stimulation of the ipsilateral median nerve at the wrist, and tibial nerve at the knee, showed similar morphology but a latency difference of 6.5 ms, indicating that the P16 is not a segmental response.

When evoked responses were recorded at three depths as the electrode was inserted and advanced into the cord, the early biphasic potential seen after contralateral stimulation did not change its amplitude or morphology, suggesting that it may be a far-field potential. The P16 increased in amplitude with depth, and changes in morphology were also seen, indicating that it is a near-field potential with intra-spinal generators.

The peak latency of the P16 was apparently later at more anterior sites within the a.l.q. than at positions nearer to the dentate ligament. The P16 is probably a complex potential arising from several generators including activity within the dorsal column system.

Where the stimulus intensity was increased, a later positive peak appeared on the contralateral recording at a latency of 24 ms. The threshold for this response was more than twice that for the P16 and it is likely that this is a true crossed pathway response originating within the a.l.q. and mediated by peripheral Aδ fibres.