

Title: THE EFFECT OF INTRATHECAL MORPHINE ON LOWER EXTREMITY SOMATOSENSORY EVOKED POTENTIALS IN MAN

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**Introduction:** It has been suggested that sensory evoked potentials (SEPs) may be useful in assessing anesthetic blockade of sensory and pain pathways(1). Epidural local anesthetics affect dermatomal SEPs to a lesser degree than subarachnoid local anesthetics(2). If a similar relationship existed for peridural narcotics, intrathecal administration might be expected to have more profound effects on SEPs than the minimal influence previously reported for epidural morphine. To investigate this possibility, the authors studied the effect of preoperative intrathecal morphine on lower extremity somatosensory cortical evoked potentials (SCEPs) in awake patients.

**Methods:** With institutional approval and informed consent, we enrolled 22 unpremedicated neurologically normal ASA I and II patients (ages 20-48 years) undergoing elective pelvic and abdominal procedures. Patients were randomly assigned to receive either intrathecal preservative free morphine sulfate (Group A) or placebo (Group B). Group A (11 patients) received intrathecal morphine (ITM) 15 µg/kg via subarachnoid puncture at L4/5 (after skin infiltration with 1% lidocaine) in the right lateral decubitus position at least two hours prior to surgery. Subarachnoid puncture was confirmed by aspiration of CSF prior to and after injection. With the exception of subarachnoid puncture, group B (11 patients) underwent an identical procedure, including skin preparation, infiltration with local anesthetic and placement of an introducer needle. Patients were not aware of the type of injection performed. SCEPs were obtained immediately prior to the administration of either ITM or placebo (PRE). Thereafter, recordings were repeated at 5, 10, 20, 30, 60, 90 and 120 (T5-T120). With each SCEP recording, mean systemic blood pressure (MBP), heart rate (HR), and level of cutaneous analgesia to pinprick were recorded.

Each set of evoked potentials consisted of a right (R) and a left (L) lower extremity SCEP waveform, elicited by sequential stimulation of either posterior tibial nerve at the ankles using adhesive electrodes. Recordings were taken from scalp surface electrodes (Cz' and FPz, International 10-20 system). The stimuli consisted of 400 constant current impulses, each of 200 µsec duration (Intensity 2 mA over motor threshold), delivered at a rate of 3.1 Hz. Bandpass filters were set at 30 and 500 Hz and a timebase of 140 msec following stimulus delivery was analyzed. Data were evaluated using a repeated measures analysis of variance, the Newman-Keuls procedure and the Bonferroni T-test where appropriate. Statistical significance was assumed at the p<0.05 level.

**Results:** Groups A and B were equivalent with respect to age, weight, height and sex. MBP and HR did not vary significantly during the study period. Four patients in group A developed cutaneous analgesia beginning at T60. Levels ranged from L4 to C2 and did not always develop to an equal extent bilaterally. SCEPs were recorded without difficulty throughout the study period. Mean R and L SCEP

latencies appear in tables 1 and 2, respectively. When compared to PRE, there were no consistent changes in SCEP latency or amplitude during the study period in either group. However, in group A, R posterior tibial nerve stimulation resulted in significantly prolonged N1 latencies at T5, T10, T20 and T90, when compared to the corresponding waveforms in group B (see Table). In contrast, no prolongation was observed with L posterior tibial nerve stimulation.

**Discussion:** Our results indicate that intrathecal morphine does not adversely affect the recordability lower extremity SCEPs nor does it influence waveform component amplitude and latency sufficiently to interfere with interpretation. It would appear, then, that intrathecal administration of morphine affects neural afferent transmission, as assessed by SCEPs, to the same minimal extent as does epidural administration. The observation that RSCEPs, but not LSCEPs, behaved differently following ITM than in the placebo group may be related to the fact that subarachnoid puncture was performed in the right lateral decubitus position. Taking into account also the heterogeneity among the observed levels of cutaneous analgesia, one could speculate that subarachnoid puncture alone or in conjunction with ITM in the lateral decubitus position could have a subtle lateralizing influence on impulse conduction in the neuraxis.

#### References:

1. Saugbjerg P, Asoh T, Lund C, Kuhl V, Kehlet H: Effects of epidural analgesia on scalp-recorded somatosensory evoked potentials to posterior tibial nerve stimulation. Acta Anaesthesiol Scand 30:400-403, 1986
2. Lund C, Selmar P, Hansen OB, Hjortso NC, Kehlet H: Effects of epidural/intrathecal bupivacaine and morphine on somatosensory evoked potentials to dermatomal stimulation. Anesthesiology 65:A177, 1986

Table 1 : RSCEP LATENCY (ms) AFTER ITM & PLACEBO (mean±SD)

	Grp	PRE	T5	T10	T20	T30	T60	T90	T120
P1	B	37.2±4.2	37.3±2.2	36.9±3.1	37.1±3.8	37.4±4.7	38.4±3.1	37.1±2.3	37.0±2.9
	A	39.1±3.3	40.8±2.9	39.9±2.5	40.2±3.3	38.9±4.0	39.8±3.9	40.3±4.2	39.0±4.1
N1	B	45.1±3.0	45.7±2.9	45.3±2.6	44.9±1.9	45.3±2.0	45.8±2.8	45.0±1.8	44.3±2.0
	A	47.6±3.9	49.5±2.5*	48.5±3.7*	48.9±3.7*	48.3±3.7	49.2±3.0	49.0±3.6*	49.6±6.4
P2	B	56.2±3.8	56.3±3.6	56.7±3.2	57.0±2.3	54.3±5.0	58.1±2.6	56.2±3.4	55.3±2.7
	A	58.9±3.2	50.8±3.0*	59.9±2.8	59.1±2.9	59.0±3.4	59.3±2.4	59.6±2.7*	60.4±5.5
N2	B	68.4±2.4	68.0±2.7	67.9±2.7	69.0±1.6	68.9±2.6	69.1±3.0	67.8±2.8	67.6±2.9
	A	70.4±3.7	70.7±2.7	71.9±3.2*	71.9±3.3	72.4±3.4	71.9±2.7	72.4±3.7*	70.3±4.6
P3	B	82.2±3.5	83.2±4.0	84.9±5.8	85.6±4.1	85.9±5.7	84.8±6.0	82.2±6.6	82.1±7.4
	A	84.1±5.5	84.8±5.0	85.0±5.1	84.9±4.4	85.7±5.6	83.7±5.0	84.9±6.1	83.8±4.8

\*p<0.05 vs. B

Table 2 : LSCEP LATENCY (ms) AFTER ITM & PLACEBO (mean±SD)

	Grp	PRE	T5	T10	T20	T30	T60	T90	T120
P1	B	37.1±3.9	37.2±3.6	37.0±2.6	37.3±2.5	36.5±3.8	36.9±3.0	37.1±3.3	36.6±2.9
	A	39.0±3.1	39.0±3.2	39.5±3.3	39.7±3.6	39.2±3.2	38.4±4.2	39.4±3.5	39.7±3.3
N1	B	43.9±2.7	44.4±1.8	44.9±3.3	44.9±2.4	44.6±2.8	45.2±2.6	44.8±3.1	44.3±2.9
	A	45.9±3.4	46.3±3.8	46.2±3.6	47.8±4.1	46.8±3.5	46.9±4.4	46.9±3.1	47.4±3.9
P2	B	55.7±2.9	54.3±4.5	56.8±2.1	56.6±3.0	54.4±5.9	57.2±3.8	57.1±2.2	55.7±2.9
	A	56.9±3.9	58.5±4.5	57.6±4.3	58.6±4.7	58.4±4.5	58.4±3.3	59.2±4.5	58.2±3.8
N2	B	68.5±1.8	69.5±3.7	69.4±3.2	68.1±2.6	68.8±2.3	68.2±2.5	68.1±3.2	67.2±3.3
	A	70.0±3.8	70.0±5.5	69.5±5.2	69.5±3.9	69.4±5.1	69.1±4.3	70.3±5.5	69.9±4.6
P3	B	82.8±4.4	81.6±4.4	83.0±5.8	82.3±5.5	83.5±6.9	83.0±4.3	83.4±6.2	82.6±6.7
	A	84.6±5.3	84.1±5.1	83.9±5.4	85.2±5.4	84.2±4.8	87.3±22.7	83.8±5.1	84.4±4.7