Title: CUTANEOUS RHYTHMIC OSCILLATORY VASOMOTION AND ANESTHESIA

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Introduction. The smooth muscle in the microcirculation exhibits slow wave potentials and spontaneous generation of action potentials. Such slow wave activity of vascular smooth muscle may drive spontaneous rhythmic arteriolar vasomotion. The adaptive value of such spontaneous rhythmic arteriolar vasomotion is implicit in Poiseuille's law, viz., the resistance of a vessel with a constant diameter is notably greater than that of a vessel with the same average diameter whose diameter changes sinusoidally (1). The significance of these rhythmical patterns may also lie in the spatial and temporal synchronization of the cells, metabolic energy saving, and the steady preparedness of the vessels to adapt to changing circulatory requirements. Since a variety of anesthetics appear to be able to inhibit, directly, the normal calcium-dependent vasomotion in vitro (2), we undertook the present study to examine whether anesthetic levels achieved clinically could modify cutaneous rhythmic oscillatory vasomotion.

Methods. Six patients, ASA physical status I-II, participated in this study approved by the local institutional review board of the Medical College of Virginia and the research committee of the Veterans Administration Medical Center, Richmond. Cutaneous rhythmic oscillatory vasomotion was provoked by topical application of 2.2 X 10^{-2}M glyceryl trinitrate to the volar forearm skin. Cutaneous erythrocyte flux was monitored continuously by laser Doppler velocimetry (LD 5000 MedPacific, Seattle, WA). Topical challenge was performed at 5 times for each patient: A, 24 to 12 hours before surgery; B, 2 to 1 hour before surgery (after "premedication"); C, during induction and first half of surgery; D, during final stages of surgery; and E, 2 to 6 hours postoperatively in the recovery room. For each sample the period (sec), mean erythrocyte flux (mV), wave height (mV), and wave height expressed as a percentage of mean erythrocyte flux (%) were analyzed (see Table).

Results. In all 6 patients rhythmic oscillatory changes in cutaneous erythrocyte flux disappeared completely during induction (Stage C). The amplitude of the oscillations, analyzed as either wave height (mV) or wave height (%), was higher on the day before surgery (Stage A) than during any of the subsequent stages. The mean erythrocyte flux was quite similar in stages A, B, D, and E. The mean erythrocyte flux was considerably greater during stage C, and the increase in cutaneous erythrocyte flux was shown to be contemporaneous with administration of systemic anesthetic agents. The period of the oscillatory vasomotion was similar during stages A and B and was also similar in stages D and E. However, the period for stages A and B was considerably longer than for stages D and E.

Discussion. Although premedication had an effect on the amplitude of the rhythmic oscillatory changes in cutaneous erythrocyte flux, the most profound changes in cutaneous rhythmic oscillatory vasomotion occurred during administration of the systemic anesthetic agents. Although some rhythmic oscillatory vasomotion returned in half of the patients at the end of surgery, the frequency was considerably greater. This decrease in period duration persisted through stage E in four of the patients, and rhythmic oscillatory vasomotion still could not be provoked in the other two patients. These results are compatible with the view that general anesthetics influence the microcirculation, and that these effects may persist well beyond the return of consciousness. These results are also compatible with previous studies which suggest an origin of the oscillations in the slow wave activity of vascular smooth muscle (3,4), and imply a direct inhibitory effect of the anesthetic agents on the cutaneous vascular smooth muscle.

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References.

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Table. Summary of Data (Medians)

	Perioperative Stages				
	A	B	C	D	E
Period, sec	10.9	10.7	-	7.5	8.1
Wave Height, mV	20	14	-	16	18
Wave Height, %	52.0	26.5	-	11.0	26.0
Mean Erythrocyte Flux, mV	50	64	110	59	64
Subjects with periodic vasmotion	6	6	0	3	4