Title: HALOTHANE, ISOFLURANE, ENFLURANE AND A-V CONDUCTION: AWAKE VS. ANESTHESIA

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Introduction: The effects of halothane (HAL), isoflurane (ISO) and enflurane (ENF) on specialized A-V conduction have been evaluated in dogs utilizing catheter His bundle electrocardiography (HBE) [1-3]. HBE requires an immobilized, anesthetized subject [1]. Consequently, the "control" for HBE has been a light level of the agent studied [1-3]. This casts uncertainty as to the meaning of results; particularly, as such apply to man. HBE is often performed in humans; but only for the study of abnormal conduction (not anesthetics). The desire to make anesthetic conduction studies more clinically relevant prompted the preparation of a dog model suitable for awake testing [4]. We now compare the effects of HAL, ISO and ENF on A-V conduction in six dogs.

Methods: Our method for the preparation of dogs for awake cardiac electrophysiologic testing has been described [4]. Dogs recovered for four weeks prior to study. Each dog was tested awake prior to HAL, ISO or ENF on separate occasions (randomized, 3-7 days apart): 1) HAL (1.0,1.5,2.0% end-tidal, ET), 2) ISO(1.73,2.58,3.45% ET) and 3) ENF (2.53,3.78,5.06% ET). ET levels for ISO and ENF are comparable (MAC multiples) to the ET levels of HAL. Ventilation was controlled (CO_2 ET, 35-40 torr) and rectal temperatures ranged from 37.0-38.5°C.

Results: The effects of anesthetics on spontaneous cycle length (SCL), A-V nodal (AVN), His-Purkinje (HP) and ventricular (VENT) specialized conduction are compared to awake (A) values in Table 1. "A" values for SCL, AVN, HP and VENT were not different for each anesthetic. In Table 2, results (HAL) are combined with those previously obtained [4]. Note (Table 1) that only ISO and ENF prolong AVN, and only HAL and ENF prolong HP. HAL results (11 dogs, Table 2) are similar to those previously reported [4].

Discussion: HAL (Table 1) had no effect on SCL, AVN on VENT, in contrast to previously tested dogs [4]. But as noted, combined results with HAL (11 dogs, Table 2) are similar to previous results [4]; except, that SCL was not prolonged by increasing level of HAL, and AVN was prolonged by similar amounts at each HAL level (Table 2). "A" values for SCL and AVN were longer in this compared to our earlier series [4]. This may be due to a longer conditioning period (four vs. two weeks)[4]. We suspect present "A" dogs had a lower resting level of "sympathetic tone", accounting for the longer SCL (slower heart rate), and prolonged AVN. ISO prolonged AVN at 3.45% ET (2.3 MAC). This conflicts with previous results (2.5 MAC)[2]. ENF prolonged AVN and HP (5.06% ET), but had no other effects on conduction, as previously shown [3]. Present results for anesthetic testing with "A" as control indicate that HAL most and ISO least depresses AVN. Additionally, HAL depresses HP and VENT.

References:

1. Atlee JL, et al: Halothane effects on conductivity of the AV node and His-Purkinje system in the dog. Anesth Analg 56:378-386, 1977

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3. Atlee JL, et al: Atrioventricular conduction times and atrioventricular nodal conductivity during enflurane anesthesia in dogs. Anesthesiology 47:498, 1977.

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TABLE 1: ANESTHETIC COMPARISONS ($\bar{X}$±SE)

ANESTHETIC (A or % ET)	SCL (msec)	AVN (msec)	HP (msec)	VENT (msec)
HAL (A)	547±65	81±7	26±2	77±4
ISO (A)	518±59	78±6	27±2	81±4
ENF (A)	464±35	77±7	29±3	77±4
HAL (1.0)	551±66	88±8	28±2*	80±4
ISO (1.73)	446±19	73±5	28±2	82±5
ENF (2.53)	462±15	79±5†	30±2	80±5
HAL (1.5)	544±78	88±7	28±2*	80±4
ISO (2.58)	457±16	83±8	28±2	81±5
ENF (3.78)	446±18	87±7*	31±2	82±4
HAL (2.0)	550±81	89±5	29±2*	81±4
ISO (3.45)	480±38	93±6*	29±2	83±5
ENF (5.06)	432±14	91±7*	31±2*	82±5

* P≤0.05 (AWAKE vs. ANESTHESIA, same agent)
† P≤0.05 (HAL vs. ENF, same % ET level)

TABLE 2: HAL-AWAKE vs. ANESTHESIA ($\bar{X}$±SE)

HALOTHANE (A or % ET)	SCL (msec)	AVN (msec)	HP (msec)	VENT (msec)
A	522±37	76±5	29±2	80±3
1.0	627±51	94±7*	31±2*	83±3*
1.5	590±50	93±6*	31±2*	83±3*
2.0	554±44	89±5*	32±2*	85±5*

* P≤0.05 (AWAKE vs. ANESTHESIA)