Title: THE AROUSAL STATE AND INCIDENCE OF ABNORMAL NEUROLOGICAL SIGNS DURING RECOVERY FROM BALANCED ANESTHESIA, ENFLURANE, AND ISOFLURANE

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Introduction: The Arousal State and the incidence of abnormal neurological signs during recovery from balanced anesthesia, halothane, and enflurane have been reported recently (1). There has been no similar report on isoflurane anesthesia as yet. This study compares the Arousal State and the incidence of abnormal neurological signs during recovery from balanced anesthesia, enflurane, and isoflurane in ambulatory surgical patients.

Method: Informed consent was obtained from 60 ASA class I patients scheduled for surgery. Each received diazepam 5 mg iv for premedication 15 minutes before induction of anesthesia and sodium pentothal 4 mg/Kg iv for induction. The patients were then assigned randomly to Balanced, Enflurane, or Isoflurane Group. In the Balanced Group patients received fentanyl 0.1 mg prior to induction; anesthesia was maintained with nitrous oxide 70% in oxygen. In the Enflurane and Isoflurane Groups the patients initially received two MAC (3.4% and 2.6%, respectively) inspiratory concentration of the volatile agent in nitrous oxide 50%. The end-tidal concentration of the volatile agent was monitored continuously by an EMMA quartz crystal transducer; when it reached 1 MAC (1.7% enflurane and 1.3% isoflurane) the inspiratory concentration was reduced and maintained at one MAC until the surgical procedure was over. An individual other than the attending anesthesiologist, ignorant to the identity of the anesthetic technique, determined the patient's Time-to-First Response and assessed the Arousal State and neurological signs at 20 and at 40 minutes after the discontinuation of anesthesia. The Arousal State was rated 0 to 3, as described by Rosenberg et al (1). The neurological examination included the following: pupils, quadriceps and Achilles tendon reflexes, Babinski reflex, and shivering. The quadriceps tendon reflex was graded 0 to 4 according to the standard scale. When stretching of the Achilles tendon produced clonus it was considered "sustained" if it lasted 5 seconds or more. The results were analyzed by the unpaired Student's t-test, and p values less than 0.05 were considered significant.

Results: The results are shown in tables 1 and 2. The Isoflurane Group had a longer Time-to-First Response than both the Balanced and Enflurane Groups and the same Arousal State as the Enflurane Group at 20 and at 40 minutes after discontinuation of anesthesia. There were abnormal neurological signs in all 3 groups.

Conclusions: The results of this study suggest that isoflurane offers no advantage over enflurane or balanced anesthesia in ambulatory surgery.

Agent	n	TFR, min	AS 20 min	AS 40 min
I	20	9.3±5.2	1.75±1.0	2.73±0.5
E	20	6.2±2.4	1.75±0.7	2.43±0.5
B	20	4.7±2.4*	2.50±0.5**	2.90±0.3

Table 1: Time-to-First Response (TFR) and Arousal State scores (AS) at 20 and at 40 minutes after discontinuation of isoflurane (I), enflurane (E), or balanced (B) anesthesia (mean+SD). n - the number of patients in each group. *p<0.025 when compared to the Isoflurane Group. **p<0.025 when compared to the Isoflurane and the Enflurane Groups

Agent	n	PP	QR+4	SC	BR+	SH
I	20	5	7	4	1	4
E	20	4	8	4	-	4
B	20	7	5	1	-	-

Table 2: The number of observations of pin-point pupils (PP), quadriceps reflex +4 (QR+4), sustained clonus of the Achilles' tendon (SC), positive Babinski reflex (BR+), and shivering (SH) in the Isoflurane (I), Enflurane (E), and Balanced (B) Groups.

Reference:
1. Rosenberg H, Clofin R, Bialik O: Neurological changes during awakening from anesthesia. Anesthesiology 54:125-130, 1981