Conclusive Properties of Ethrane, Fluroxene, Halothane and Chloroform Anesthesia. T. A. JOAS, M.D. and W. C. STEVENS, M.D., *Department of Anesthesia, University of California, San Francisco Medical Center, San Francisco, Calif.* During evaluation of Ethrane (compound 347; 2-chloro-1,1,2-trifluorethyl difluoromethyl ether) in dogs, twitching movements of the limbs and body were observed. The electroencephalogram (EEG) showed high-voltage spikes during this increased neuromuscular activity and in response to hand-clapping at the dog's ear. A survey of EEG activity during Ethrane, fluroxene, diethyl ether, divinyl ether, halothane and chloroform was undertaken to determine the seizure potential of these drugs and to form a baseline against which other yet-to-be-developed anesthetics might be compared. *Methods:* Unpremedicated dogs were anesthetized with the agent being evaluated and oxygen only. EEG tracings were obtained at the minimum alveolar anesthetic concentration (MAC) and at multiples of MAC for each agent before and during hand-clapping. Pa_{CO_2} was maintained at 20 torr. *Results:* Seizure patterns occurred in those animals anesthetized with the ethers but did not occur in animals anesthetized with halothane or chloroform. The seizure patterns seen with Ethrane could be induced at will at almost any depth by an auditory stimulus. All of these animals survived. The seizure paterns seen with divinyl ether occurred only at very deep levels, were spontaneous in onset and were often accompanied by overt neuromuscular activity. All of these animals died. The changes seen in the animals anesthetized with fluroxene resembled those seen in animals anesthetized with Ethrane. In contrast, the results observed with diethyl ether were similar to the results observed with divinyl ether. With fluroxene two of four animals survived, whereas with diethyl ether three of four died and the one survival was ataxic. *Summary:* The exact significance of the seizure patterns is difficult to interpret. The EEG activity which we have seen with diethyl and divinyl ether, although not always accompanied by gross neuromuscular activity, may be indicative of serious central nervous system damage, because of the small number of animals that survived exposure to these agents.

Indirect Methods for Monitoring the Performance of the Heart During Anesthesia: The Time Interval of Electrical and Mechanical Systole. L. B. KADIS, M.D., N. T. SMITH, M.D., E. I. EGER, II, M.D., C. WITCHER, M.D., and D. CULLEN, M.D., *Departments of Anesthesia, Stanford University School of Medicine, Stanford, Calif., and University of California San Francisco Medical Center, San Francisco, Calif.* Nondestructive recording techniques (electrocardiogram, phonocardiogram and carotid artery waveform) and analog/hybrid computer methods permit on-line computation of the time duration of the phases of ventricular systole on a beat-by-beat basis. *Methods:* Left ventricular ejection time and pre-ejection period were measured in human volunteers who received either halothane anesthesia, methoxamine, or mephentermine. *Results:* Changes in the pre-ejection period and left ventricular ejection time correlated with the changes in stroke volume (dye dilution) following administration of cardioactive drugs. Both methoxamine and halothane had negative inotropic actions, while positive inotropy was seen following mephentermine. *Summary:* Left ventricular ejection time and the pre-ejection period can be recorded by nondestructive techniques and provide useful information about the performance of the heart during anesthesia.

Naloxone–Oxymorphone Interaction in Man. T. KALLOS, M.D., and T. C. SMITH, M.D., *University of Pennsylvania School of Medicine, Philadelphia, Penna.* Naloxone (Narcan,® Endo Laboratories) is a potent opioid antagonist without agonistic effects. We expected it to reverse mild degrees of depression, in contrast to nalorphine and levallorphan, which may add to mild narcotic depression. *Methods:* Five intramuscular injections, 2.5, 5, and 10 μg/kg naloxone with 14 μg/kg oxymorphone, and 7 and 28 μg/kg oxymorphone

with 5 μg/kg of naloxone, were given to each of ten healthy volunteers in a randomized, double-blind, complete crossover design. Gas exchange, lung volumes and ventilatory response to rebreathing CO_2 were determined. *Results:* Naloxone antagonism of depression was clearly evidenced by the CO_2 response curves. The larger the dose of naloxone (in the presence of a constant dose of oxymorphone) the less the respiratory depression. Complete reversal was not attained. Further studies suggest 14 μg/kg of naloxone are required to reverse 14 μg/kg of oxymorphone. Naloxone produced a dose-related decrease in subjective sedation after narcotics, contrasting with the sedative effects of increasing doses of levallorphan with opiates. No significant dose-related changes were observed in O_2 consumption, CO_2 excretion, R.Q., vital capacity and its components, respiratory rate, tidal volume, anatomic deadspace, minute ventilation, or end-tidal CO_2 tension. *Summary:* Since naloxone reverses even mild respiratory depression and does not itself cause depression, it should be preferable in cases of undiagnosed narcosis, postoperative depression after narcotic-supplemented anesthesia, the depressed newborn, and other clinical circumstances where the agonistic properties of nalorphine and levallorphan might be hazardous.

Thiobarbiturate–Succinylcholine–Oxygen for Uncomplicated Cesarean Section. Y. Kosaka, M.D., L. C. Mark, M.D., and R. Rakahashi, M.D., *Departments of Anesthesiology, Hiroshima Prefectural Hospital and Sapporo Medical College, Japan, and Columbia University, New York, N. Y.* The apparent paradox of the wakeful baby newly delivered from a mother anesthetized with thiopental 400 mg and nitrous oxide 50 per cent was previously verified in vaginal deliveries but not in cesarean sections, in which five of six infants were depressed at birth, (Amer. J. Obstet. Gynec. 95: 621, 1966). In an ongoing study of cesarean sections in Japan, however, using thiamylal at a dose of 4 mg/kg, depression of the newborn was uncommon (Kosaka *et al.*, Hiroshima Igaku 19: 848, 1966). *Methods:* Thiopental or thiamylal, 8 mg/kg, was administered intravenously in 45 seconds to each of 35 patients undergoing elective cesarean section. All received succinylcholine 1 mg/kg, for tracheal intubation, followed by hyperventilation with oxygen 100 per cent until ligation of the umbilical cord, 45 seconds to 13 minutes later. Time from uterine section to delivery was 20 to 68 seconds in 33 cases and 2½ and 2¾ minutes in the others. (Because of the short time requirements in some of the studies planned, 15 patients received nitrous oxide and halothane for less than four minutes, followed by three minutes of lung washout with oxygen 100 per cent, prior to thiopental.) Subsequent uterine and wound closures were accomplished with inhalation anesthesia. Blood samples for thiopental measurement were obtained at birth from the maternal antecubital vein and the umbilical artery and vein. Apgar scores were determined one minute after birth. *Results:* Apgar scores of 7 or less were obtained in 16 of the 35 cases in which the mother received 8 mg/kg; 13 of these 16 were delivered within three to seven minutes after thiobarbiturate injection. These results compare unfavorably with those after the lower dosage of 4 mg/kg, when only four of 36 babies scored 7 or less. Finster and Poppers recently reported relative safety of thiopental, 250 mg, for the induction of general anesthesia for cesarean section, using nitrous oxide 70 per cent and succinylcholine 0.2 per cent intravenously (Anesthesiology 29: 190, 1968). They related Apgar scores of 6 or less to prolonged anesthesia (mean: 22.7 minutes) and surgery, with increased fetal acidosis. In the corresponding (4 mg/kg) series of Kosaka *et al.*, with a shorter duration of anesthesia and operation (maximum: seven minutes), poor results were attributed to asphyxia from surgical difficulty or aspiration of amniotic fluid. Noteworthy in both of these series was the stringent limitation of total dosage of thiopental (4 mg/kg would seem adequate in most instances). *Summary:* A strictly controlled thiobarbiturate–succinylcholine–oxygen sequence seems safe for cesarean section in the absence of complications such as eclampsia, polyhydramnios and hemorrhage. Essential to success are an expert anesthesiologist and an