

Abstracts

Scientific Program

C. Philip Larson, Jr., M.D., Editor

Effects of Sodium Thiopental and Catecholamines on Sodium Transport in Toad Bladder *in Vitro*. N. B. ANDERSEN, M.D., *Department of Anesthesiology, College of Medicine, University of Florida, Gainesville, Florida.* **Methods:** The effect of sodium thiopental on Na⁺ transport was studied in the short-circuited toad bladder. Changes in short-circuit current (SCC) were assumed to parallel changes in active Na⁺ transport (J. Gen. Physiol. 41: 657, 1958). Simultaneous studies of the flux of Na²² from the mucosal to the serosal side of the bladder were made. **Results:** When both sides of the bladder were treated with thiopental, concentrations below 15 mg/100 ml increased SCC while concentrations above 15 mg/100 ml decreased SCC. Phenoxybenzamine, 50 µg/ml, prevented stimulation. Epinephrine, 10⁻⁴ to 10⁻³, nor-epinephrine, and isoproterenol, 10⁻⁶ to 10⁻⁴ µg/ml, increased SCC and showed positive interaction with thiopental at concentrations from 0.2 to 5 mg/100 ml. Epinephrine, 10⁻³ µg/ml, increased SCC when applied only to the serosal side, but had no effect when applied only to the mucosal side of the bladder. Thiopental, 50 mg/100 ml, increased SCC on the serosal side, but decreased SCC on the mucosal side. Positive interaction was found on the serosal and not on the mucosal side. The sodium pump is located in the serosa of the bladder. In the untreated bladder, Na²² flux results from transport (3/4) and exchange diffusion (1/4). Thiopental, 5 mg/100 ml or 25 mg/100 ml, decreased exchange diffusion. **Summary:** The stimulating effect of thiopental

resulted from interaction with epinephrine on receptors in the serosa, while the inhibiting effect was mediated through different receptors in the mucosa. (Supported by NIH Grant GM13029.)

Anesthesia for Patients with Chronic Renal Failure for Renal Homotransplantation. R. D. BASTRON, M.D., G. BAILEY, M.D., S. DEUTSCH, M.D., and L. D. VANDAM, M.D., *Departments of Anesthesia and Medicine, Harvard Medical School and Peter Bent Brigham Hospital, Boston, Mass.* A review of the medical histories, clinical courses and anesthetic management of 144 patients with chronic renal failure for homotransplantation (including the first successful renal homotransplants in man), performed in the Peter Bent Brigham Hospital between 1951 and 1967, is presented. **Results:** Routine hemodialysis within 24 hours prior to operation was instituted in 1966, with resultant marked improvement in chemical and physical condition. Prior to this, average BUN was 99 mg/100 ml, with a range of 12 to 240 mg/100 ml. With routine hemodialysis the average was 52 mg/100 ml, with a range of 13 to 99 mg/100 ml. With routine hemodialysis the percentage of patients with serum potassium levels of 6 mEq/l or higher was reduced from 23 to 6 per cent; ECG evidence of hypocalcemia was reduced from 11 to 3 per cent; metabolic acidosis was reduced from 45 to 17 per cent. The need for control of congestive heart failure with digitalis, hazardous in these patients, was reduced from 36 to 6 per cent. There were no cases of pericarditis, pericardial effusion or pulmonary vascular congestion, which had previously appeared in 7, 5, and 17 per cent of the cases, respectively. The improvement in physical condition resulted in evolution of

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anesthetic management from regional (continuous spinal) anesthesia, previously administered in 88 per cent of the cases, to general anesthesia. Serious cardiac arrhythmias (bradycardia, frequent premature ventricular contractions, ventricular tachycardia or fibrillation) were observed in five patients during general anesthesia—three of the five episodes were associated with tracheal intubation. *Summary:* The hazards of general anesthesia in anephric patients are minimized by preoperative preparation.

Tracheostomy Cuffs: Physical Characteristics and Physiologic Sequelae. R. CARROLL, M.D., M. HEDDEN, F.E.A.R.C.S., and P. SAFAR, M.D., *Department of Anesthesiology, University of Pittsburgh School of Medicine, Pittsburgh, Penna.* Recent reports have implicated tracheostomy cuffs as the primary etiologic factor in the production of subglottic stricture and tracheoesophageal fistula. Departmental experience suggested that the potentials of the cuffs to cause injury varied with residual volume. *Methods:* To test this hypothesis, cuffs were evaluated with a special strain gauge directly implanted in the anterior wall of tracheas. *In vivo* measurements during intermittent positive-pressure ventilation (IPPV) were conducted, monitoring cuff sealing area, intracuff pressure, airway pressure, and lateral tracheal wall pressure. Pressures were measured dynamically *in vivo* in the intact dog, as well as in excised canine and human tracheas. All measurements were made after the cuff had been expanded just to the point of abolishing leak, and again after overinflation by one ml. *Results:* Cuffs could be grouped into four categories, depending on residual cuff volume and sealing surface area. Group A cuffs had high residual volumes so that only a small amount of air was necessary to nudge the cuff walls against the tracheal mucosa. The large Sanders and Auchincloss cuffs are seal-inflating, in that airway pressure equilibrates across the soft cuff wall, thereby cyclically raising the intracuff and tracheal-wall pressures to equal airway pressure. Group B₁ included orotracheal tubes with built-in rubber cuffs. Tracheal wall pressures averaged 37.5 mm Hg. Group B₂ cuffs were

built into plastic tracheostomy tubes and had tracheal pressures ranging from 55 to 160 mm Hg. Group C included narrow, very-high-pressure, unevenly-inflating, slip-on tracheostomy cuffs. Tracheal wall pressures always exceeded arterial pressure. *Summary:* Large residual-volume cuffs allow IPPV at tracheal wall pressures never exceeding airway pressure, *i.e.*, usually of the order of capillary blood pressure. Small-residual-volume cuffs commonly produce tracheal-wall pressures in excess of arterial pressure. Double-cuff tubes offer no advantage, because they simply incorporate two narrow, low-volume, high-pressure cuffs.

Influence of Methoxyflurane on Myocardial Mechanics of the Digitalized Heart. P.-Y. CHEN, M.D., C. SHANKS, B.A., C. GAMBLE, B.S., and S. SHIMOSATO, M.D., *Department of Anesthesiology, Tufts University School of Medicine and New England Medical Center Hospitals, Boston, Mass.* Recently, we reported that methoxyflurane exerts a negative inotropic effect upon the contractile state of the intact canine left ventricle, as determined by the force-velocity relations (*ANESTHESIOLOGY* 29: 538, 1968). It has been shown that digitalis exerts positive inotropism in normal and diseased hearts, and that it may be used as a prophylactic measure to combat hypotension during anesthesia and surgery (*J. Clin. Invest.* 40: 52, 1961). This study was undertaken to ascertain whether the positive inotropic effects of digitalis counteract the negative inotropic effect of methoxyflurane on the performance of the intact left ventricle. *Methods:* Studies were performed in dogs anesthetized with chloralose-urethane given intravenously. Measurements of force-velocity relations were made before and following the administration of ouabain (0.05 mg/kg) and during methoxyflurane anesthesia at a mean arterial concentration of 17 mg/100 ml. *Results:* Methoxyflurane caused significantly less decreases in peak force in seven predigitalized dogs (-28 ± 4 per cent) than in eight nondigitalized dogs (-45 ± 4 per cent). Average changes in mean aortic pressure in predigitalized and nondigitalized dogs during anesthesia were -22 ± 3 per cent and -19 ± 2