to 24 hours. Resuscitation could be successfully completed even if undertaken 65 minutes after onset of apnea and 45 minutes after cardiac arrest. *Conclusion:* Tentatively, it is concluded that, if cold exposure has not progressed to the point of circulatory failure, conservative measures are effective for resuscitation. However, if the syndrome has progressed to the stage of circulatory failure, external measures are expected to fail; while some hope of success might be expected from mechanical assistance of the circulation and respiration and highly efficient means for heat transfer. [Supported by a grant from the Research Council of the American Medical Association.]

Halothane Versus Cyclopropane in Shock. P. P. Bosomworth, M.D., Z. Nikolowski, M.D., J. E. Tetirick, M.D., C. B. Edwards, Ph.D., and W. Hamelberg, M.D., *University of Kentucky Medical Center, Lexington, Kentucky, and Ohio State University Hospital, Columbus, Ohio.* General anesthesia during progressive degrees of hypovolemia is usually associated with varying changes in metabolism, cardiovascular compensation, and organ function. These changes are dependent on many factors including the anesthetic agent itself. This study investigated responses of 16 conditioned mongrel dogs to two anesthetic agents, halothane and cyclopropane, in terms of renal blood flow and resistance and femoral blood flow and resistance during progressive hemorrhage through time. The controversy between using cyclopropane and halothane anesthesia for hypovolemic states continues. Fabian (Fabian, L. W., and others: Anesth. Analg. *41:* 272, 962) reported the comparable effects of halothane and cyclopropane on renal blood flow at a 30 per cent reduction in blood volume, concluding that no significant difference in flow existed despite a difference in mean arterial pressure. *Method:* In this study anesthesia was maintained and stabilized for one hour with 0.6 per cent halothane or 10 per cent cyclopropane during exposure of the right renal and left femoral arteries. Square-wave flowmeter probes were placed around the arteries and systemic and central venous pressures were recorded. Arterial blood, 30 ml. per kilogram body weight, was withdrawn in one minute and four minutes allowed for stabilization. Arterial P_{CO_2} values were determined frequently to insure no change during measurement of flow. *Results:* With 100 per cent of the blood volume remaining, during halothane anesthesia the mean renal flow was 150.5 ml. per minute with a mean arterial pressure of 105 mm. of mercury; during cyclopropane anesthesia the mean flow was 91.7 ml. per minute with a mean arterial pressure of 125 mm. of mercury. A significant difference existed in renal flow, resistance, and arterial pressure for the two anesthetic agents ($P > 0.05$). With 70 per cent of the blood volume remaining, there was no significant difference in the renal flow and resistance or in the femoral flow and resistance under halothane or cyclopropane anesthesia. There was no significant difference in the percentage blood volume remaining at the termination of renal flow under halothane (54.7 per cent) or cyclopropane (58.0 per cent) anesthesia or of femoral flow for halothane (60.1 per cent) or cyclopropane (56.1 per cent) anesthesia. When dogs were bled (510 ml.) to termination of renal or femoral flow and administered 250, 500, and finally 1000 gamma of metaraminol, blood pressure was restored, to 125 mm. of mercury, but not renal or femoral blood flow. A reinfusion of 180 ml. of whole blood, after femoral and renal flow ceased, restored both renal (65 ml./minute) and femoral (25 ml./minute) flow to approximately one-half of the control values. *Conclusions:* There is a significant difference in the blood flow of the renal artery as influenced by cyclopropane and halothane anesthesia with normal blood volume. There is not a significant difference in the renal or femoral flow as influenced by either agent when the blood volume is reduced by 30 per cent. There is no difference in the percentage blood volume remaining when renal flow shuts off with either agent. A small volume of blood re-infused after cessation of renal and femoral flow is more effective in the restoration of flow than is the administration of metaraminol.

Potassium Superoxide as an Oxygen Source During Resuscitation. Verne L. Brechner, M.D., and Robert F. Wolff, M.D., *Division of Anesthesia, University of Cal-*

ifornia Medical Center at Los Angeles. Potassium superoxide is employed as a chemical source of oxygen in self-contained rescue apparatuses. It has a theoretical yield of 236 ml. O_2/g. dry weight ($4\ KO_2 + H_2O + CO_2 \rightarrow 3_{O_2} + K_2CO_3 + 2\ KOH$). The purpose of this investigation was to devise means of adapting potassium superoxide as an oxygen source for resuscitative purposes. *Method:* Initial studies indicated that the simplest design would be an adaptation of the potassium superoxide canister to mouth-to-mouth resuscitation. A 350-ml. Foregger to-and-fro canister was packed with 400 g. of KO_2 granules. The breathe-through cells of two Liston-Becker 16 CO_2 analyzers were attached to each end of the canister. The open end of each cell was fitted with an endotracheal tube adapter supplied with a side port to which a deflated clamped balloon was attached. A BOC ventimeter was inserted in the line. Two dogs were anesthetized with pentobarbital and their tracheas intubated with cuffed tubes. Each tube was fitted to the open end of a CO_2 analyzer. The continuity of the system was as follows: Dog *A* OT tube → side arm O_2 sample balloon *A* → CO_2 analyzer *A* → BOC ventimeter → KO_2 canister → CO_2 analyzer *B* → side arm O_2 sample balloon *B* → dog *B* OT tube. Thus, each dog was attached to a closed to-and-fro system employing the other dog's lungs as a rebreathing bag. CO_2 concentration delivered to each animal as well as alveolar CO_2 was recorded. Samples for oxygen analysis were obtained by clamping one endotracheal tube and releasing the sampling balloon clamp as gas was delivered from the other dog's lungs through the canister. The samples were analyzed with a Beckman D_2 analyzer. A femoral artery of each dog was cannulated. Blood samples were analyzed with a Waters Connel Oximeter. An initial sample was taken with the dogs breathing air. The thorax of dog *A* was manually compressed at a rate of 20/minute. Shortly thereafter, both dogs became apneic and inflation of dog *B*'s lungs occurred with each compression of dog *A*'s chest. Artificial respiration was continued for 40 minutes. A tidal volume of 150–350 ml. was delivered with each thoracic compression. Mechanical dead space for each animal was 100 ml. *Results:* The inspired O_2 concentration of dog *A* rose to 28 per cent within 10 minutes and 31 per cent in 40 minutes. Inspired O_2 concentrations of dog *B* were 24 per cent in 10 minutes and 29 per cent in 40 minutes. Inspired CO_2 concentration was 1.9 per cent throughout most of the experiment for dog *A* and alveolar CO_2 was 8.3 per cent. Inspired CO_2 concentration of dog *B* varied betwen 0.8 and 1.8 per cent. Alveolar CO_2 concentration varied from 3.2 to 5.8 per cent. Control arterial oxygen saturations were 81 volumes per cent (V/V) for dog *A* and 84 volumes per cent for dog *B*. After 40 minutes resuscitation through the KO_2 canister, saturation of dog *A* was 92 volumes per cent (11 volumes per cent higher than control). *Conclusion:* The data indicate that a relatively high concentration of oxygen may be delivered from a KO_2 canister during conditions of the experiment. We believe the results justify further investigation with more refined techniques.

Ventilation of the Emphysematous Patient During Anesthesia. ELWYN S. BROWN, M.D., and JAMES O. ELAM, M.D., *Department of Anesthesiology, Roswell Park Memorial Institute, Buffalo, New York.* *Method:* Nitrogen washout of the lungs was performed just prior to operation in anesthetized emphysematous patients, and in a control group of similar age with normal lungs. Following intravenous meperidine and scopolamine and topical anesthesia, the trachea was intubated. Respiratory flow rate, CO_2 and N_2 concentrations and airway pressure were recorded. Blood samples were taken from the femoral artery late in each washout-period, and CO_2 tension was measured. The first nitrogen washout was recorded while the patient breathed spontaneously. After thiopental was given and a succinylcholine drip started, tidal volume and respiratory rate were preset on the ventilator. Tidal volumes up to two liters at frequencies of 10–15 breaths per minute were employed in a series of N_2 washouts. A long expiratory period was employed to permit more complete exhalation by the emphysematous patients. *Results:* Functional residual volumes ranged from 1000 to 2000 ml. in normal men and 2500 to 5000 ml. in emphysematous men. In both the normal and the emphysematous men, 20–30 per cent of the alveolar ventilation