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Renal Functions During Positive Pressure Respiration. (20137)

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Although the circulatory changes during respiration at pressures above atmospheric have been extensively studied, the effect of such a procedure on renal functions has not been investigated, except by Drury, Henry, and Goodman(1), who showed that marked reduction in urine volume and urea clearance resulted.

Methods. Eight experiments have been done on dogs in barbiturate anesthesia, in which respiration at pressures from 9 to 31 mm Hg above atmospheric was brought about by connecting the trachea with a large chamber through which air was passed at a rapid rate. Measurement of intratracheal pressure with a Hamilton manometer showed it to be close to the chamber pressure and essentially constant throughout the respiratory cycle. In 7 of the experiments, 1 kidney was denervated by stripping all visible nerves from artery, vein, and ureter. In 3 experiments, the vagus nerves were cut, to avoid respiratory inhibitory reflexes which limited the height to which the pressure could be raised. This did not appear to alter the type of response. In 5 of the experiments, pressure pulses in the aorta were recorded and cardiac outputs calculated from them(2). In all experiments, priming doses and continuous infusions of creatinine, p-aminohippurate, and glucose were given. Blood plasma and urine were analyzed for these substances, and clearances and maximum tubular transfer calculated. In most experiments, plasma and urine samples were analyzed for sodium and potassium by flame photometry, in some, urine chloride only was determined. Venous pressure was measured in some experiments.

Results. The experiments may be divided into 2 groups, one in which the TMg fell, one in which it rose. For the first group, the values, in the innervated kidneys, at maximal change were, in % of control (average, with range) C_{cr} *62* (33-85), C_{pah} *73* (43-100), TMg *70* (50-94). In the second group, these were C_{cr} *88* (63-115), C_{pah} *91* (76-103), TMg *187* (111-193). As an example of group 1, it can be seen in Fig. 1 that on the application of the pressure, the fall in cardiac output is associated with a fall in arterial pressure, but this returns to normal with an increase in total peripheral resistance. While the kidney appears to take part in this reflex vasoconstriction, with parallel decreases in clearances and TM, its response does not develop maximally until the third ten-minute period, by which time cardiac output and total peripheral resistance have returned essentially to normal. When respiration is returned to atmospheric pressure, there is a rise in cardiac output and a fall in total peripheral resistance, and renal functions return to normal, but as can be seen in the values for RF, that fraction which renal blood flow is of total blood flow, the kidney again only slowly takes part in the total change. This lag in response of the kidney was seen in the experiments cited above(1), and may resemble that seen in hemorrhage(3).

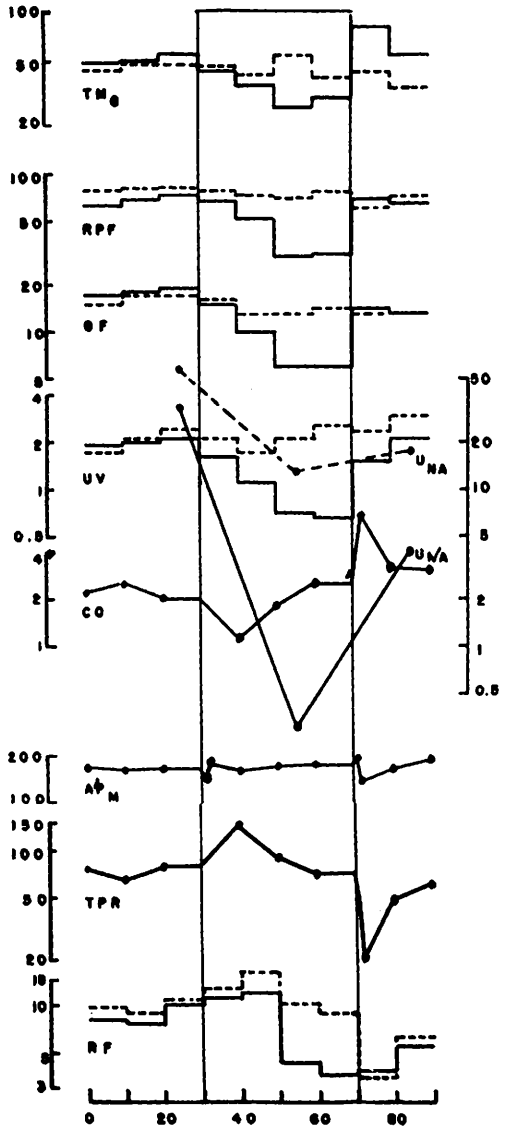

FIG. 1. Male dog, 10.9 kg barbital sodium, 250 mg/kg. TM_g, glucose tubular maximum, mg/min. RPF, renal plasma flow from p-aminohippurate clearance, ml/min. GF, glomerular filtration rate from creatinine clearance, ml/min. UV, urine volume, ml/min. UNa, urine sodium excretion, microequivalents/min. CO, cardiac output, liters/m^2/min. AP_m, mean arterial pressure from planimetry of pulse curve. TPR, total peripheral resistance, AP_m divided by CO, arbitrary units. RF, renal blood flow in % of CO. Solid lines are innervated kidney, dashed lines are denervated kidney. Time in min. Respiration of positive pressure during periods 4-7, tracheal pressure 14 mm Hg.

Drury, *et al.*, took into account a possible humoral mechanism for reducing urine volume, but this can scarcely be the case here. The fact that the denervated kidney does not take part in the phenomena just described indicates that they are nervous rather than humoral in origin.

The marked reduction in sodium excretion, to 1% of the control rate, should be noted. The much smaller change in the denervated kidney may result from the increased venous pressure, as has been shown to occur without change in filtration rate(4). Potassium excretion showed a fall also, but to 5% in the innervated, 60% in the denervated kidney.

In the other type of response, as seen in Table I, the general circulatory changes were similar, but falls in glomerular filtration, renal blood flow, and urine formation were small or absent, and TM values rose. In this experiment, at the end of the last clearance period Janus green was injected into the left ventricle and the kidneys removed ½ minute later, with following estimation of the number of active glomeruli(5). The proportion between the 2 kidneys in glomerular count supports the TM as a measurement of number of nephrons.

It may be that in this type of experimental result, not all nephrons were active in the control state, but tended to become so during pressure respiration, thus preventing a reduction in filtration and blood flow in the kidney as a whole, although these values were reduced in the individual nephron. Since these changes occurred in both kidneys, they seem to be independent of the nerves, and may represent some intrinsic mechanism of control.

Summary. Dogs under barbiturate anesthesia with one kidney acutely denervated and respiring air at greater than atmospheric pressure show two types of renal functional changes. In half the animals studied, a reduction in glomerular filtration rate, renal plasma flow, maximal tubular transport of glucose, urine volume, and sodium excretion occurred in the intact kidney. No change in these functions occurred in the denervated kidney. In the rest of the animals, changes in glomerular filtration, renal plasma flow, and urine formation were smaller, while the TmG increased. The renal functions of these animals appear to have been depressed during control observations, perhaps due to trauma or deep anes-

TABLE I.

Female dog, 19.5 kg pentobarbital Na 30 mg/kg. Right kidney denervated; vagi cut. No. of glomeruli, left 231600, right 177900. UV urine volume, UCl urine chloride, C_{cr} creatinine clearance, C_{pah} p-aminohippurate clearance, TM_g glucose tubular maximum, RR renal resistance, AP_m divided by renal blood flow, AP_m, mean arterial pressure from planimetry of Hg manometer tracing.

UV, ml/min.		UCl, μEq/min.		C_{cr}, ml/min.		C_{pah}, ml/min.		TM_g, mg/min.		RR		AP_m, MM Hg	Procedure
Inn.	Den.	Inn.	Den.	Inn.	Den.	Inn.	Den.	Inn.	Den.	Inn.	Den.		
2.9	1.6	60	43	27.9	14.2	182	129	48	40	34	48	154	c*
3.1	1.5	50	25	26.9	12.4	204	124	45	35	31	51	156	c
3.5	1.5	59	15	24.9	10.6	198	122	39	32	37	59	171	c
4.0	1.3	67	16	25.8	10.6	188	120	50	39	35	55	158	25 mm Hg†
4.7	1.3	87	12	30.7	12.1	199	116	85	54	31	53	160	31

* c = control. † Pressure resp.

thesia, but positive pressure respiration caused partial restoration. Since both kidneys participated, the mechanism must be independent of the renal nerves.

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Prophylactic Penicillin in Anterior Ocular Transplantation Technic in Mice.*† (20138)

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The animal anterior ocular chamber offers an unusual opportunity to study the behavior of transplanted tissue in that the progress of the graft may be easily observed, and several animals may be used in the same case, with sacrifice at different ages, microscopic studies, and retransfer. A vast field for clinical application of this technic was opened by Greene(1) when he grew human sarcomas and carcinomas in the anterior ocular chambers of foreign species. So as to obviate the ever present risk of extraneous infection, there is need to improve technics in dealing with such implanted tissue. Investigators rarely report one hundred percent incidence of tissue revascularization in anterior chamber transplants. Although it is true that many problems are involved, a major factor preventing successful transfer is infection, arising either from originally contaminated tissue or from contamination of the operative site at the time of transfer. Penetration of penicillin into the eyes of dogs(2) and rabbits(3) has been measured by several investigators. Prophylactic penicillin was used systemically (4) in the anterior chamber transplantation of ovarian tissue in rabbits, however, controls were not used.

The purpose of this investigation is to evaluate the effectiveness of systemic penicillin in lowering the infection incidence in the anterior chamber technic of tissue grafting, utilizing the mouse eye.

Materials and methods. Three hundred and eighty-five, white Swiss, C3H and hybrid

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