Volume Receptors and the Mechanism of Postprandial Diuresis in the Harbor Seal (Phoca Vitulina L.)

H. V. Murdaugh, Jr., William Mitchell, J. C. Seabury, and H. O. Sieker
University of Alabama and Duke University

Seals have pronounced postprandial diuresis without dilute urine but with 2-5 fold increase in glomerular filtration rate (GFR) (Hiatt, 1942). This change in GFR is not reproduced by water, salt, mannitol or uprea diuresis. Studies were done on 6 female seals to evaluate this diuresis and the existence of volume receptors in the seal. There was no change in urine flow with 20 cm water continuous positive or negative pressure breathing. This implies no atrial stretch receptors or demonstrates the effectiveness of the seal's inferior vena caval valve in control of pulmonary blood volume, important since the seal breathes relative negative pressure when swimming. Dextran was filtered so freely by the glomeruli of the seal kidney that it could not be used in the study. Intravenous infusion of 500 ml 1% gelatin in saline or 500 ml fresh seal plasma caused up to 40 fold increase in urine flow, without proteinuria or dilute urine, but with a 2 fold increase in GFR. Control infusions of 500 ml 5% dextrose in water or normal saline did not cause a change in GFR or as marked a diuresis. It is concluded that the dramatic postprandial diuresis in the seal is due to increased blood volume and is mediated via volume receptors. Preliminary studies in the seal with I^{131} albumen support this. It is suggested that the inferior vena caval valve protects the seal from pulmonary congestion while swimming with head above water.

Renal Function During Diving in the Seal (Phoca Vitulina)

H. V. Murdaugh, Jr., Bodil Schmidt-Nielsen, William L. Mitchell, and James W. Wood
Univ. of Alabama School of Medicine and Duke University

Renal clearances were performed on young female harbor seals trained with a teeter board to allow the cephalad portion of their body to be submerged without struggling for 10 minutes. Exogenous creatinine clearance was used as a measure of glomerular filtration rate and para-aminohippurate clearance was used as an index of renl plasma flow. Urine flow stopped during this type of diving. Following the dive, glomerular filtration rate and renal plasma flow returned to normal in a step wise fashion over a period of 4 to 6 minutes. Urine concentration and urine sodium concentration decreased progressively during the first few minutes after the dive with the occurance of a brief diuresis. The data was consistant with cessation of glomerular filtration rate and renal blood flow during normal diving. Unlike the changes in renal clearance when respiration was interrupted by an occlusive nose cone, (Bradley, et al, J. Cell. and