EFFECT OF VOLUME EXPANSION ON
RENAL BLOOD FLOW AND ITS AUTOREGULATION IN THE RAT

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ABSTRACT

Renal blood flow (RBF), RBF autoregulation, and kidney functions of rats were studied before, during, and after acute loading with 4% body weight of isotonic Ringer's solution, isoncotic donor-rat plasma or 6 g% albumin in Ringer's solution. In all rats, the arterial blood pressure (ABP) was increased slightly during the loading period. The urine flow rate (V) and the sodium excretion rate (UNaV) were increased several-fold in all rats following volume expansion; these values tended to decline back to the control values during postloading. Glomerular filtration rate (GFR) was increased nearly two-fold during the loading period irrespective of the type of expanding solution. In isotonic volume expanded rats, the RBF was increased slightly but significantly during the loading period, but was restored to the control value at 1½ hours postloading. However, there was a sustained increase in GFR by about 15% of the control value during the postloading period. This may be a result of the decrease in plasma protein concentration. Expansion with the isoncotic solution, but not with the isotonic solution, resulted in a marked increase in intravascular volume. Concomitantly, the RBF was increased to almost twice the control value during the postloading period as
the renal vascular resistance was decreased by about 40% of the control value. However, the elevated GFR was restored to the control value during this time. These results imply that the GFR of these rats is not readily dependent on the renal plasma flow (RPF). It is, therefore, suggested that during the loading period the glomerular capillary pressure may be transiently elevated and responsible for the increase in GFR. Of interest is the finding that RBF autoregulation was impaired during the loading period in isoncotic volume expanded rats. However, during the postloading period the kidney regained its ability to autoregulate its blood flow; this indicates a resetting of the autoregulation to a higher RBF. The results lend support to the suggestion that the impairment of RBF autoregulation may be responsible for the increased RBF. Thus, isoncotic volume expansion resulted in a substantial elevation of the RBF with a transient loss of its autoregulatory capacity. The possible mechanisms responsible for the RBF autoregulation are briefly discussed. In general, the measured parameters reveal no difference in the renal responses to volume expansion either by donor-rat plasma or 6 g% albumin in Ringer's solution.