Editorials

Controversy: Is there a "renal dose" dopamine?

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Dopamine is used ubiquitously as a vasoconstrictor in hemodynamics for many aspects of critical care medicine (1-4). Its main pharmacologic effect is on the β-adrenergic vascular receptors in moderate doses (5). It is also known to clinicians that at lower doses, so-called "renal doses," dopamine appears to augment diuresis. Earlier studies in animals have shown the natruretic and diuretic effects of dopamine. Whether or not this effect is a direct effect of dopamine on the kidneys or secondary to changes in hemodynamics has been debated for many years (2, 6, 7).

In an article published in this issue of *Critical Care Medicine*, Dr. Ichai and colleagues (8) investigate this controversy in critical care medicine. The authors address whether or not there is such a thing as "renal dose" dopamine. This study reports the results of a single blinded, prospective, randomized trial comparing the renal effects of two catecholamines, dopamine and dobutamine, in "equipotent" doses. The study attempts to answer questions concerning the effects of these drugs on the renal system. The authors choose the outcome effects of diuresis, natruresis, and creatinine clearance to compare the two drugs.

The main conclusion of the trial states that the effects of dopamine on the kidneys were not apparently related to the hemodynamic augmentation of cardiac output. Rather, the authors argue that in this study, whereas both dopamine and dobutamine raised the cardiac index, the effect on the kidneys (increases in diuresis, creatinine clearance, and fractional excretion of sodium) was only seen with dopamine infusion. It is not clear that the data fully support this assertion. Sample size was very small, raising questions of reproducibility and generalization of the data.

Although there is an overall group trend in the rate of diuresis and creatinine clearance, there are a few assumptions in the design of the study that could be questioned. First, "equipotent" dosing for dopamine is a difficult concept and an important aspect of study design that is not clarified in the manuscript. One could argue that there should be similar effects on hemodynamics. As evidenced by the data, mean arterial pressure (MAP) went up with increasing dopamine infusion and, as expected, the systemic vascular resistance index went down with higher doses of dobutamine. Increasing MAP was correlated to the increase in diuresis. How the effects of systolic pressure rather than forward cardiac output influence renal function potentially limits the conclusions of this study and illustrates the need for further investigation

and discussion. The investigators present graphs of linear correlation between creatinine clearance and cardiac index with these interventions. It may be more relevant to focus on the change in creatinine clearance vs. the change in cardiac index. Similarly, the authors present a correlation between creatinine clearance and MAP. Again, the major issues concerning "response to treatment" may be the change in creatinine clearance vs. the change in the MAP during the investigative stages of the study. Thus, their assertion that there are "no hemodynamic effects" of these infusions on kidney function may be suspect.

Although the effect as a group is statistically significant, one can also question whether or not this effect is real. On grossly inspecting the data, there seems to be a trend, but it is obvious that one patient (one data point) was an outlier. Although this is a well thought out and well-designed study, inclusion of more patients may further clarify this controversy.

Overall, there are a number of very important issues raised in the article by Dr. Ichai and colleagues (8). This is a carefully designed study, and the investigators should be commended for attempting to answer such a difficult question. The conclusion should be questioned because of the small sample size, the comparability of the intervention, and the methods with which the outcome variables (diuresis, creatinine clearance) were analyzed. Understandably, it is not possible to identically match all hemodynamic variables with the different agents; however, the assertion that hemodynamics do not play a role in renal function with low dose dopamine is not proven from this data. The information obtained will be of interest and should spark future studies to help clarify the potential discrepancies between the findings of these investigators and previous reports.

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