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Inotropic treatment and intestinal mucosal tissue oxygenation in a model of porcine endotoxemia.

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OBJECTIVE: To evaluate the dose-related effects of dopamine, dopexamine, and dobutamine on intestinal mucosal tissue oxygenation following short-time infusion of Escherichia coli lipopolysaccharide, which has previously been shown to decrease mucosal tissue oxygenation by 60% of control values. DESIGN: Prospective, randomized, unblinded study. SETTING: Animal research laboratory. SUBJECTS: Anesthetized, mechanically ventilated domestic pigs. INTERVENTIONS: Pigs were infused with 2 microg/kg of E. coli lipopolysaccharide over 20 mins via the superior mesenteric artery. Pulmonary artery occlusion pressure was maintained near 15 mm Hg, using a mixed infusion regimen of Ringer's lactate solution and hydroxyethyl starch. Following endotoxemia, a small segment of the jejunal mucosa was exposed by midline laparotomy and antimesenteric incision. The control group (n = 7) received no further interventions. Pigs in the dopamine (n = 7), dopexamine (n = 7), and dobutamine (n = 7) groups were infused with 2.5, 5, 10, and 20 microg/kg/min of the respective drug via a central venous catheter. MEASUREMENTS AND MAIN RESULTS: Systemic hemodynamics as well as systemic, mesenteric, and femoral blood gas variables were measured using an arterial, a thermodilution pulmonary artery, a superior mesenteric venous, and a femoral venous catheter. Jejunal mucosal tissue PO2 was measured by means of two Clark-type surface oxygen electrodes. Oxygen saturation of jejunal mucosal microvascular hemoglobin was determined by tissue reflectance spectrophotometry. Infusion of endotoxin resulted in pulmonary hypertension. Systemic hemodynamics remained unchanged except for brief decreases in cardiac output and arterial blood pressure. Dopamine, dopexamine, and dobutamine increased systemic oxygen delivery in a dose-related manner by 80% ($p < .01$), 96% ($p = .00$), and 129% ($p = .00$) of values before inotropic treatment. Dopamine increased mucosal tissue PO2 by 109% (10-microg dose, $p < .01$) and 164% (20-microg dose, $p = .00$), and mucosal hemoglobin oxygen saturation by 61% (5-microg dose, $p < .05$), 102% (10-microg dose, $p < 01$) and 121% (20-microg dose, $p = .00$). Dopexamine increased mucosal tissue PO2 by 89% (20-microg dose, $p < .01$) and mucosal hemoglobin oxygen saturation by 26% (2.5-microg dose, $p < .05$) and 35% (5-, 10-, and 20-microg dose, $p < .05$). In the dobutamine and control groups, no significant effect on either mucosal tissue PO2 or hemoglobin oxygen saturation was observed. CONCLUSIONS: In this model of porcine endotoxemia, dopamine and, to a lesser extent, dopexamine increase intestinal mucosal tissue oxygenation. Of all three inotropes used, dobutamine has the most pronounced effect on systemic oxygen delivery, but it does not improve mucosal tissue oxygenation. Selective vasodilation within the intestinal mucosa, mediated mainly by dopamine-1 receptors, seems to explain the observed intestinal mucosal effect of dopamine and dopexamine.

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