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Levosimendan is superior to milrinone and dobutamine in selectively increasing microvascular gastric mucosal oxygenation in dogs.

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OBJECTIVE: The effect of levosimendan, a novel inotropic vasodilator (inodilator), on the microvascular gastric mucosal hemoglobin oxygenation (muHbo(2)) is unknown. A possible effect could thereby be selective for the splanchnic region or could primarily reflect changes in systemic oxygen transport (Do(2)) and/or oxygen consumption (Vo(2). We compared systemic and regional effects of levosimendan with those of established inotropes, milrinone and dobutamine. DESIGN: Laboratory experiment. SETTING: University animal research laboratory of experimental anesthesiology. SUBJECTS: Chronically instrumented dogs with flow probes for cardiac output measurement. INTERVENTIONS: Anesthetized, mechanically ventilated dogs (each group n = 6) on different days randomly received levosimendan (10 microg.kg, followed by four infusion steps: 0.125-1.0 microg.kg.min), milrinone (5.0 microg.kg, followed by 1.25-10 microg.kg.min), or dobutamine (2.5-10.0 microg.kg.min). Since these drugs may modify regional or systemic responses to fluid load, an additional predefined volume challenge was subsequently performed with hydroxyethyl starch 6% (10 mL.kg). MEASUREMENTS AND MAIN RESULTS: We measured muHbo(2) (reflectance spectrophotometry), Do(2), Vo(2), and systemic hemodynamics. Levosimendan significantly increased muHbo(2) from baseline (approximately 55% for all groups) to 64 +/- 4% and further to 69 +/- 2% with volume challenge (mean +/- sem). At the systemic level, levosimendan alone only slightly increased Do(2) at a Vo(2). Milrinone elicited similar systemic effects (Do(2), Vo(2), hemodynamics) but failed to increase muHbo(2). Dobutamine, conversely, increased muHbo(2) to a similar extent as levosimendan; however, this was accompanied by marked increases in Do(2) and Vo(2). The gastric mucosa selectivity of these interventions, expressed as slope of the muHbo(2)/Do2 relation, was highest for levosimendan (+1.89 and +1.14, without and with volume challenge), compared with milrinone (+0.45 and + 0.47) and dobutamine (+0.48 and + 0.33). CONCLUSIONS: Levosimendan is superior to milrinone (no significant regional effects) and dobutamine (marked systemic effects) in increasing gastric mucosal oxygenation selectively (i.e., at only moderately increased Do(2) and stable Vo(2). If our experimental data apply to the clinical setting, levosimendan may serve as an option to selectively increase gastrointestinal mucosa oxygenation in patients at risk to develop splanchnic ischemia.

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