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Increased ileal-mucosal-arterial PCO2 gap is associated with impaired villus microcirculation in endotoxic pigs.

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OBJECTIVE: To investigate whether an increased ileal-mucosal-arterial PCO2 gap (delta PCO2) during hyperdynamic porcine endotoxemia is associated with impaired villus microcirculation. DESIGN: Prospective, randomized, controlled, experimental study. SETTING: Animal research laboratory. ANIMALS: Twenty-two domestic pigs. INTERVENTIONS: After baseline measurements, anesthetized and ventilated pigs received continuous i.v. endotoxin (ETX, n = 12) for 24 h or placebo (SHAM, n = 10). MEASUREMENTS AND RESULTS: Before, as well as 12 and 24 h after, the start of endotoxin or saline portal venous blood flow (QPV, ultrasound flow probe) and lactate/pyruvate ratios (L/P), the ileal-mucosal-arterial delta PCO2 (fiberoptic sensor) and bowel-wall capillary hemoglobin O2 saturation (%Hb-O2-cap, remission spectrophotometry) were assessed together with intravital video records of the ileal-mucosal microcirculation (number of perfused/heterogeneously perfused/unperfused villi) using orthogonal polarization spectral imaging (CYTOSCAN A/R) via an ileostomy. At 12 and 24 h endotoxin infusion, about half of the evaluated villi were heterogeneously or unperfused which was paralleled by a progressive significant increase of the ileal-mucosal-arterial delta PCO2 and portal venous L/P ratios, whereas QPV as well as both the mean %Hb-O2-cap and the %Hb-O2-cap frequency distributions remained unchanged. By contrast, in the SHAM-group, mucosal microcirculation was well-preserved, and none of the other parameters were influenced. CONCLUSIONS: We conclude that an increased ileal-mucosal-arterial delta PCO2 during porcine endotoxemia is related to impaired villus microcirculation. A putative contribution of disturbed cellular oxygen utilization resulting from "cytopathic hypoxia" may also assume importance.

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