Introduction:
Several preclinical studies demonstrated beneficial effects for methane (CH$_4$) administration in various inflammatory conditions. Our aim was to investigate the consequences of post-treatment with inhaled CH$_4$ in a clinically relevant intra-abdominal sepsis model.

Methods:
Anesthetized minipigs were subjected to fecal peritonitis (0.6 g/kg, 5-9x10$^6$ CFU i.p.; n=22) or sham-operation (sterile saline i.p; n=5). Invasive hemodynamic monitoring with blood gas analyses was started between 16-24 hours, organ dysfunction parameters (PaO$_2$/FiO$_2$ ratio; mean arterial pressure; lactate, bilirubin, creatinine; urine output and platelet counts) were determined according to a modified porcine-specific Sequential Organ Failure Assessment (ps-SOFA) score system, the perfusion rate (PR) of sublingual microcirculation was measured by incident dark field illumination imaging. The animals were divided into non-treated septic or septic shock groups (n=6-6) and CH$_4$-treated septic or septic shock (n=5-5) subgroups, CH$_4$ inhalation started from the 18th hr (2.2% CH$_4$ in normoxic air; 500 mL/min).

Results:
Despite the standardized induction, heterogeneous severity of organ damage was evolved. In septic and septic shock groups the median values of ps-SOFA score reached 5 (4.75-5.65) and 13 (11.75-14), respectively. Septic shock was characterized by significant elevations of creatinine and bilirubin levels, while the platelet count decreased (from 332 to 76 *10$^9$/L). Inhalation of CH$_4$ increased the sublingual PR by 22% in the septic group, the creatinine and bilirubin levels were decreased by 28% and 80%, respectively. CH$_4$ post-treatment significantly decreased the ps-SOFA score (to 1; 0.5-2.75) and resulted in lower values in septic shock group (to 10; 9.5-12.4).

Conclusion:
Methane post-treatment effectively influences sepsis-related end organ dysfunction. Up to a severity threshold it may be a promising additional organ protective tool.

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