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# The influence of Ringer's lactate or HES 130/0.4 administration on the integrity of the small intestinal mucosa in a pig hemorrhagic shock model under general anesthesia.

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## Abstract

**OBJECTIVE:** To determine the effect of fluid resuscitation with 2 different physiological solutions, Ringer's lactate (RL) and hydroxyethyl starch (HES) 130/0.4, on histological lesions of the small intestinal mucosa in anesthetized pigs subjected to severe acute bleeding.

**DESIGN:** Prospective experimental study.

**SETTING:** University teaching hospital.

**ANIMALS:** Twenty-eight healthy Large White pigs, 3 months of age.

**INTERVENTIONS:** Pigs were subjected to severe acute bleeding (30 mL/kg) under total intravenous anesthesia with propofol and remifentanil. Pigs were randomly allocated to 3 groups: Group 1 (n = 11) received RL solution (25 mL/kg) after bleeding; Group 2 (n = 11) received HES 130/0.4 solution (20 mL/kg) after bleeding; and Group 3 (n = 6) volume replacement nor induced bleeding. Pigs were euthanized and the small intestine was harvested for histopathological analysis.

**MEASUREMENTS AND MAIN RESULTS:** The small intestine was histologically evaluated and the presence of the following lesions were characterized: edema, congestion, hyperemia, hemorrhage, inflammatory infiltration, cellular degeneration, necrosis, and epithelial detachment. Mucosal loss percentage (%ML) and crypt:interstitium ratio (C:I) were also assessed. In the duodenum, jejunum, and ileum, and the entire small intestine, the %ML was significantly higher in Group 1, than in Groups 2 and 3. Hyperemia in the small intestine was significantly higher in pigs resuscitated with HES 130/0.4 compared to pigs resuscitated with RL.

**CONCLUSIONS AND CLINICAL RELEVANCE:** In a setting of controlled hemorrhage, resuscitation with HES 130/0.4 was associated with a lower percentage of mucosal loss on the small intestine, compared with resuscitation with RL solution. Our study also suggests that the duodenum may be more sensitive to hypovolemia induced by severe hemorrhage.



**KEYWORDS:** hypovolemia; intestinal mucosa injury; morphological assessment

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