Effects of hypochlorous acid and ascorbic acid on conductance, permeability, and structure of equine colonic mucosa in vitro.

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Abstract

OBJECTIVES:

To study effects of hypochlorous acid (HOCl) on equine colonic mucosa in vitro, and determine whether addition of ascorbic acid protects against the effects.

ANIMALS:

6 healthy horses and ponies.

PROCEDURE:

Short-circuit current was measured in mucosa mounted in Ussing chambers. Incubation conditions were: control (no additions); 5 mM HOCl; 1 mM HOCl; same and 5 mM ascorbic acid; 3 mM HOCl; 3 mM HOCl and 5 mM ascorbic acid; 7 mM HOCl; and 7 mM HOCl plus 5 mM ascorbic acid. Permeability was measured with [3H]mannitol and, at the conclusion of each experiment, tissues were examined microscopically to assess the effects of HOCl and ascorbic acid, alone or in combination.

RESULTS:

Short-circuit current and conductance increased transiently in response to 1 mM HOCl. Tissues had mild surface epithelial damage, as evident by swelling and separation of isolated cells. These changes were abolished when tissues were coincubated with 5 mM ascorbic acid and 1 mM HOCl. At 3 and 7 mM concentrations, HOCl caused marked increase in tissue conductance, short-circuit current, and permeability to mannitol; these changes were associated with histologic damage. Again, coincubation with 5 mM ascorbic acid protected against these changes. Additional studies indicated that the effects of HOCl and the protective effects of ascorbic acid were not mediated through changes in pH.

CONCLUSIONS:

HOCl in low concentrations is capable of increasing the short-circuit current in equine colon, possibly by increasing secretions; however, higher concentrations can cause tissue damage. The addition of 5 mM ascorbic acid blocks these changes.

CLINICAL RELEVANCE:

The concentration of HOCl produced by activated neutrophils could damage equine colonic mucosa and potentially contribute to or cause reperfusion injury. The ability of ascorbic acid to ameliorate this injury in an in vitro setting offers a potential method for pharmacologic evaluation of this injury and for treatment.