Assessment of gas and liquid bolus movement using impedance manometry in rabbit colon

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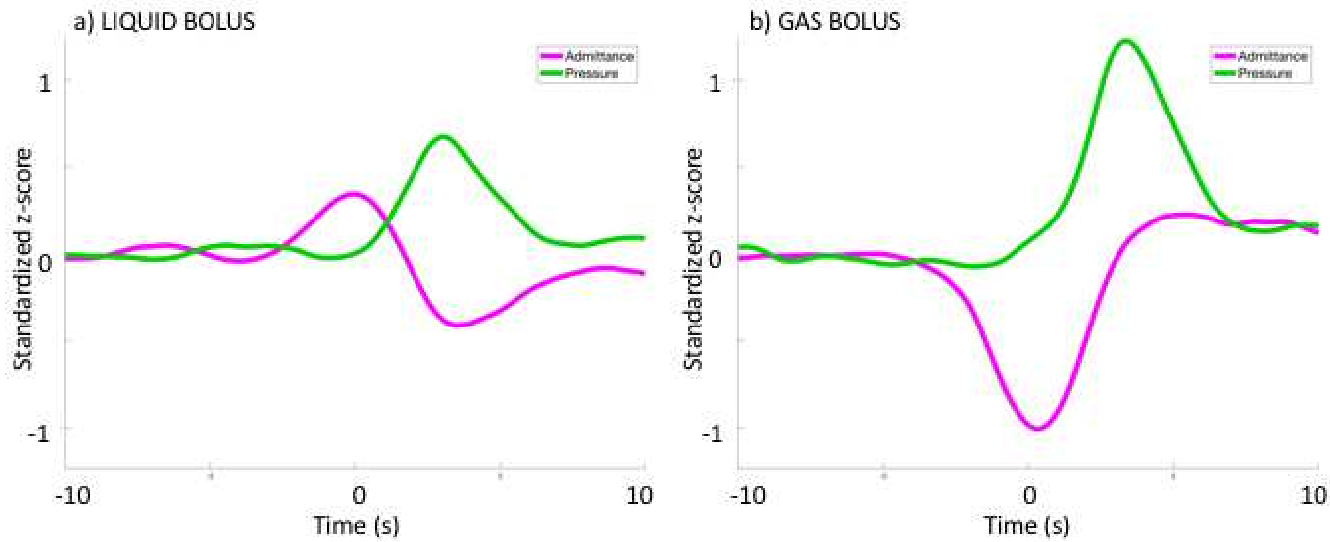
Background: Impedance manometry catheters are diagnostic tools used in oesophageal motility studies by detecting intraluminal pressure changes in relation to the movement of liquid, gas or solid content. Analysis of impedance/manometry data in the oesophagus is now based upon well validated and recognised impedance/pressure "signatures" associated with the voluntarily controlled swallow. Application of impedance manometry has not been developed in the colon due in part to the lack of voluntary control on colonic motor patterns, and its content contains a mixture of liquid, gas and solid. The aim of this study was to apply impedance manometry to the large intestine. Our intention was to detect and quantify the passage of liquid and gas bolus movement in the isolated colon and determine the relationship that exists between these movements as detected by impedance and the dynamic local changes in intraluminal pressure.

Methodology: A multichannel intraluminal impedance manometry catheter (32 pressure channels at 1cm spacing and 16 impedance channels at 2cm spacing) was inserted into excised and emptied proximal colon from humanely killed rabbits (n=9), according to the university's animal welfare committee permit. The isolated colon was mounted in an organ bath with oxygenated Krebs solution warmed at 36°C, along with inflow and outflow connectors at the oral and anal ends respectively. A video camera positioned above the colon captured all contractile activity. Liquid (Krebs solution) followed by gas (room air) were infused into the oral end using a peristaltic pump at 10 min intervals. Spatiotemporal maps of changes in gut diameter (DMaps) were constructed from the video recordings and used as the gold standard in identifying bolus movement. These DMaps were aligned in space and time with intraluminal admittance (inverse impedance) and pressure. A total of 240 minutes of liquid and 90 minutes of gas infusion were recorded. The admittance and pressure data associated with bolus propulsion were standardised to z-scores. The changes in admittance in relation to pressure with propagation of gas and liquid boluses were determined.

Results: For recordings made with liquid bolus, 1834 admittance/pressure recordings from all channels were identified as bolus propulsion, and 772 for gas. A liquid bolus caused an increase in admittance (magenta line) from baseline, before decreasing with increasing intraluminal pressure (green line) as shown in Fig. a. In comparison, a gas bolus caused a decrease in admittance from baseline, returning to baseline with increasing pressure (Fig. b). The peak pressure occurred approximately 3s after maximal admittance deflection in both bolus media.



Conclusion: Liquid and gas boluses in the rabbit colon have specific admittance signals in relation to pressure. The findings of this study can facilitate interpretation of impedance manometric recordings in the human colon. This can occur by determining flow of intraluminal content as well as content medium, which are difficult to directly visualise.