Residual Gastric Stomach Volume via Dye Dilution

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OBJECTIVE

- To evaluate the validity and feasibility of a dye dilution method for determining the remaining stomach volume (RSV) in clinical settings using George’s dye dilution method.
- To evaluate a commercially available colorimeter for measuring the dye concentration in a feeding tube.

BACKGROUND

- Nasogastric feeding tubes are commonly used for providing nutrition and medication to patients who are unable to eat or drink by directly delivering nutritional liquid from the nose directly to the stomach.
- Statistics from the Journal of Parenteral and Enteral Nutrition have shown that up to 60% of critically ill patients in the ICU may require enteral feeding.
- Currently, there is a lack of proper measurement of how much nutritional fluids can be fed before a patient reaches their upper limit of their residual gastric volume.
- By implementing dye within the nasogastric feeding process, we could apply a combination of Beer-Lambert’s law and dye dilution equations to accurately measure the residual volume in a patient’s stomach.

RESULTS

- Results show successful application of Beer’s Law and Dye Dilution equations to calculate the residual stomach volume.
- Graphs show both the calculated volume and true stomach volume in relation to the concentration C₃ of the mixture as seen in equation 3. As the concentration increases, the resultant volume V₁ decreases.
- % Error for the spectrophotometer was less than 3% while the % error for the colorimeter was less than 8%.

CONCLUSION

- Our apparatus design and protocol has shown the feasibility of applying a dye dilution method along with the principles of Beer-Lambert’s law to evaluate the volume present in the stomach.
- Further improvements can be made with application of a more thorough tubing system and a more compact colorimeter design. Additionally, feasibility could be further tested using less transparent solutions to mimic feeding tube liquids more accurately.