Gastric Residual Volumes in Critical Illness: What Do They Really Mean?

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• Gastric residual volumes • Enteral nutrition
• Intensive care unit • Patient outcome

The use of gastric residual volumes (GRVs) for monitoring enteral nutrition (EN) in the intensive care unit (ICU) setting is highly controversial. Despite the fact that use of GRVs is one of the most common practices in nutrition therapy, few data in the literature supports its efficacy. Although the origins of GRVs are difficult to determine, references to the practice began to appear in the nursing literature in the 1980s.[1] At the time, no data substantiated its use. No subsequent prospective randomized controlled trials suggest that their use improves patient outcomes in the ICU.[1–4] The practice of GRV monitoring was originally designed to help prevent aspiration pneumonia, yet their use serves as a major barrier to the delivery of EN in the ICU.[5] As a consequence, ironically, the use of GRVs may actually increase risk for pneumonia because of reduced delivery of EN.[6,7] Thus, although GRVs were designed to be a safeguard when delivering EN, their use may inadvertently increase risk for the patient.

Obtaining and interpreting GRVs are predicated on several assumptions. Performing GRVs assumes that the practice is well standardized, that GRVs reliably and accurately measure gastric contents, and that the practice distinguishes between normal and abnormal gastric emptying. By performing GRVs, clinicians have assumed that they are easy to interpret, that a tight correlation exists between GRVs and aspiration, and that continuing to provide EN once a high GRV above some designated level has

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been reached will inadvertently lead to pneumonia and adverse outcome. And the test is assumed to be inexpensive with little or no impact on allocation of health care resources. Surprisingly, very little evidence supports any one of these assumptions. Through examining what few data support or refute each of these assumptions, clinicians should hope to reduce reliance on the practice of GRVs and alter interpretation of elevated values. This article not only reviews these assumptions but also makes recommendations for the use and interpretation of GRVs to better promote delivery of EN in patients in the ICU.

ASSUMPTION #1: THE PRACTICE OF GASTRIC RESIDUAL VOLUMES IS WELL STANDARDIZED

The practice of GRVs has numerous technical aspects, and virtually none has been well standardized in the literature. Institutions vary regarding the way in which GRVs are used clinically. Some centers use GRVs as a designated cutoff value above which cessation of tube feeds is mandated, whereas other centers use them as an initiation value below which it is appropriate to advance the rate of feeds. The absolute value for the designated cutoff value varies widely in the literature, from as little as little as 50 mL to as high as 500 mL.[7,8] Often the designated GRV may vary from one unit to the next within the same institution.[7] Still other institutions may prohibit the use of GRVs altogether. No clear consensus exists on what the appropriate GRV cutoff level should be nor how they should be used as a monitor for patients in the ICU.[5,8]

Despite whether the GRV should be discarded or reinfused back into the patient is controversial.[9,10] Simply discarding the GRV contributes to a reduced delivery of EN. In a small study from the nursing literature in which patients were randomized to have the GRV returned (n = 8) or discarded (n = 10),[10] no significant differences were seen in the rate of aspiration pneumonia, electrolyte abnormalities, need for tube replacement, or delays in feeding between the groups. In a subsequent larger single-center study of 125 patients, again randomized to have the GRV returned (n = 63) or discarded (n = 62), the severity and incidence of delayed gastric emptying was significantly lower in the group for which the GRV was returned and reinfused.[9] Intolerance measures, including diarrhea, nausea, vomiting, and abdominal distention, were no different between the groups. These two trials provide evidence supporting that GRVs below 500 mL should be routinely reinfused into the patient.[9,10]

Specific aspects of technique may alter the GRV obtained from an individual patient.[11] The size of the syringe and the material of the tubing affects the ability to obtain GRVs and the accuracy with which it measures gastric contents.[11–14] Silicone has less tensile strength than polyurethane, and therefore tubes made of silicone are more likely to collapse on aspiration. Manual aspiration with a syringe is more likely to collapse a tube than hooking the feeding tube to wall suction over several minutes. Larger-bore tubes have been shown to generate higher GRVs than smaller-bore tubes. In a study of three different sizes of tubes, Metheny and colleagues[12] showed that the mean GRV from 10-French tubes was significantly lower that the mean GRV obtained from either 14- or 18-French tubes (20.1 vs 45.8 mL, respectively; $P<.05$).

The location of the tip of the feeding tube within the gastrointestinal tract affects the GRV obtained.[15,16] Percutaneous endoscopic gastrostomy (PEG) tubes are situated on the anterior wall of the stomach. Gastric contents tend to pool in the posterior fundus when patients lies on their back, and in the antrum when they are positioned in the right lateral decubitus position. Only if the patient were in the prone position would a PEG tube be in a dependent position with regard to the gastric pool. Not surprisingly, a study comparing GRVs between PEG tubes and nasogastric tubes