Journal of Critical Care 33 (2016) 137–144

Contents lists available at ScienceDirect

Journal of Critical Care

journal homepage: www.jccjournal.org

Evaluation of the effect on patient parameters of not monitoring gastric residual volume in intensive care patients on a mechanical ventilator receiving enteral feeding: A randomized clinical trial

Nurten Ozen, RN, PhD [a,*], Nuran Tosun, RN, PhD [b,1], Levent Yamanel, MD [c,2], Neriman Defne Altintas, MD [d,3], Guldem Kilciler, MD [e,4], Volkan Ozen, MD [f,5]

[a] Kasimpasa Military Hospital, Istanbul, Turkey
[b] Gulhane Military Medical Academy, School of Nursing, Ankara, Turkey
[c] Gulhane Military Academy of Medicine, Department of Critical Care, Ankara, Turkey
[d] Ankara Ataturk Training and Research Hospital, Intensive Care Unit, Ankara, Turkey
[e] Gulhane Military Academy of Medicine, Department of Gastroenterology, Ankara, Turkey
[f] Kasımpasa Military Hospital, Department of Anestesiology and Reanimation, Istanbul, Turkey

ARTICLE INFO

Keywords:
Evidence-based practice
Gastric residual volume
Gastroesophageal reflux
Intolerance
Nutritional adequacy
pH monitoring

ABSTRACT

Purpose: This study aimed to evaluate the effects of not measuring gastric residual volume (GRV) in intensive care patients on a mechanical ventilator and receiving enteral feeding on the feeding intolerance, gastroesophageal reflux (GER) risk, and nutritional adequacy.
Methods: This randomized clinical study was performed in 2 medical intensive care units of 2 university hospitals in Ankara, Turkey. The patients were randomized into 2 groups. In the group with GRV monitoring, GRV was measured 3 times a day, and the GRV threshold was accepted as 250 mL. In addition, 24-hour pH monitoring was used in this group to assess the risk of GER. In the group without GRV monitoring, GRV was not measured. The patients were followed-up for 5 days.
Results: The feeding targets were reached more quickly in the group without GRV monitoring ($n = 26$) with no increase in the complication rate ($P < .05$). No significant relationship was found between GRV and GER in the group with GRV monitoring ($n = 25$) ($P > .05$).
Conclusion: The discrepancies in GRV measurement make it unreliable for monitoring feeding intolerance and GER. The use of GRV measurements may therefore be discontinued as part of the standard care protocol in medical intensive care units.

1. Introduction

Gastric residual volume (GRV) measurements are routinely used to evaluate the feeding tolerance in patients receiving enteral feeding (EF) therapy in the intensive care unit (ICU). This measurement is thought to directly indicate the amount of feeding product left in the stomach, with increasing gastroesophageal reflux (GER) and aspiration risk with increasing amounts [1–4]. However, there is little supportive evidence in the literature [5,6]. The use of GRV measurements in patients receiving EF therapy in the ICU is controversial [2,7–9].

1.1. Background

The volume of the fluid obtained by aspirating the gastric content through an enteral tube using a syringe is called GRV [10]. However, the GRV result can be influenced by some factors such as patient position, feeding tube location, syringe size, and measurement method [11,12]. A study has revealed that the GRV is 2 times higher on average in patients with a wide feeding tube compared with those with a narrow feeding tube [13].

Increased GRV interrupts the use of EF because it is assumed that the gastric emptying is delayed, the GER risk is increased, and the patient cannot tolerate feeding [4]. However there is little evidence in the

* Corresponding author at: Kasımpaşa Askeri Hastanesi, Eğitim Koordinatörlüğü, 34440, Beyoğlu, İstanbul, Türkiye. Tel.: +90 212 238 79 00 (Work); fax: +90 212 238 79 02.
E-mail addresses: ozenurten@yahoo.com.tr (N. Ozen), ntosun@gata.edu.tr (N. Tosun), lyamanel@gata.edu.tr (L. Yamanel), defne98hac@yahoo.com (N.D. Altintas), guldemd@yahoo.com (G. Kilciler), vozen81@gmail.com (V. Ozen).
[1] Postal Address: GATA Hemşirelik Yüksekokulu, 06010, Etlik, Ankara, Türkiye. Tel.: +90 312 304 39 02 (Work); fax: +90 312 304 39 00.
[2] Postal Addresses: GATA Yoğun Bakım BD, 06010, Etlik, Ankara, Türkiye. Tel.: +90 312 304 30 32(Work); fax: +90 312 304 39 00.
[3] Postal Addresses: Ankara Üniversitesi Tıp Fakültesi, İbni Sina Hastanesi, Yoğun Bakım BD, 06230, Ankara, Türkiye. Tel.: +90 312 508 32 38 (Work); fax: +90 312 310 63 71.
[4] Postal Addresses: GATA Gastroenteroloji BD, 06010, Etlik, Ankara, Türkiye. Tel.: +90 312 304 40 45 (Work); fax: +90 312 304 39 00.
[5] Postal Addresses: Kasımpaşa Askeri Hastanesi, Anesteziyoloji ve Reanimasyon AD, 34440, Beyoğlu, İstanbul, Türkiye. Tel.: +90 212 238 79 00/5355; fax: +90 212 238 79 02.

http://dx.doi.org/10.1016/j.jcrc.2016.01.028
0883-9441/

literature on this subject [5], and the matter is controversial [14–16]. A study has revealed that GER can be seen in patients despite low GRV values [14]. There are also no commonly accepted GRV and high GRV values in the guidelines. The acceptable GRV value has been determined as 500 mL by the American Society for Parenteral and Enteral Nutrition (ASPEN) [17] and 250 to 500 mL by the Canadian Clinical Practice Guidelines [18]. Clinical procedures related to high GRV values also differ. A study on 2298 intensive care nurses has revealed that a high GRV amount requiring EF interruption was accepted as 200 mL by 36.5% of the nurses, 250 mL by 25%, and 500 mL by 12.6% [19].

The current guides for GRV measurement in ICU patients differ, and there is no consensus recommendation for the issue [1]. (1) ASPEN has recommended avoiding EF interruption when the GRV amount is less than 500 mL and if other signs of intolerance are absent, and performing the measurement every 4 hours [17]; (2) the German Society for Nutritional Medicine indicates that GRV measurement is not a reliable concept especially for internal medicine patients, and the nurses' workload can be decreased by not performing these measurements while stating that GRV measurements should be performed in the presence of vomiting [20]; (3) the Canadian Clinical Practice Guidelines reports that there is no adequate information to be able to recommend an acceptable GRV amount, but levels 1 and 2 studies suggest a GRV amount of 250 to 500 mL as acceptable [21], (4) and the European Society for Clinical Nutrition and Metabolism (provides no specific information on GRV measurement [22].

Gastric residual volume measurement is the most commonly used method to evaluate feeding tolerance in intensive care patients [19] and is therefore one of the main factors among the reasons for interrupting EF [23–25]. However, the guidelines, clinical procedures, and studies differ on how frequently the measurement should be performed and how long EF should be interrupted before the measurement [1,26,27].

Although it is not known when GRV first entered nursing procedures, measurements were being performed in the 1980s [24]. Nursing investigators have emphasized the importance of clarifying the matter and that there are very few guidelines that can guide nurses regarding GRV measurement [10]. They state that a nurse spends 5.25 minutes on average for a GRV measurement and the measurement both causes loss of time and increased cost. It has been reported that the time spent on the measurement could be used for nursing activities such as providing a proper position and oral care for the patient [24].

Gastric residual volume measurements are not standardized [10,28], and it has been reported that these measurements are unnecessary because there is little supportive evidence [3,10,23,26,28] and that they do not have any positive effect on patient parameters [18,24]. Gastric residual volume monitoring is now more traditional than based on evidence in intensive care patients [23].

We designed a randomized trial to test the hypothesis that absence of GRV monitoring was not associated with an increased incidence of feeding intolerance such as vomiting, diarrhea, abdominal distention compared with GRV monitoring in patients receiving invasive mechanical ventilation (MV), and EF. We also assumed that GRV measurement can be inadequate in estimating the GER risk and can unnecessarily cause feeding to be inadequate in cases with a high GRV.

The secondary objective of our trial was evaluating whether the absence of GRV monitoring affected EF adequacy.

2. Methods

2.1. Design

This prospective, randomized, controlled clinical study was planned to determine the effect of not monitoring GRV on the nutritional adequacy, feeding intolerance, and GER risk of ICU patients on invasive MV and who are receiving EF treatment.

2.2. Participants

This study was conducted in the adult medical ICU of 2 university hospitals in Ankara, Turkey, between March 2014 and April 2015. Ethical approval was obtained from the Clinical Trials Ethics Committee of Kecioren Training and Research Hospital (approval no. B.10.4.İSM.4.06.68.49/486). The investigator explained the study to the relatives of all the eligible patients before the study. If the relative decided for the patient to participate, he or she completed the informed consent form before the patient was enrolled in the study.

The sample size of the study was calculated using the power and sample size package program (http://biostat.mc.vanderbilt.edu/wiki/Main/PowerSampleSize, Vanderbilt University). It is reported that the differences between the complication rates in the groups where GRV is measured and not measured vary between 20% and 30% [3,26]. We planned a sample size of 50, with 25 patients in each group for this study, assuming a difference of 30%, α error value of 5%, and power of 80%.

The patients were divided into 2 groups: M_0, without GRV monitoring; M_1, with GRV monitoring with the block randomization method according to the order of hospital admission. Randomization was computer derived, with blocking into 2 groups to allow for orderly distribution to the groups and to reduce the risk of irregular distribution of both groups. The study was not blinded. Patients included in the study were monitored for 5 days (Fig. 1).

2.3. Eligibility criteria

Patients who were planned to receive more than 5 days of invasive MV treatment, those more than 18 years of age, patients where EF treatment would be started with a nasogastric (NG) tube, and patients whose relative provided written consent were included in the study. All patients were unconscious and unable to communicate. We excluded patients with paralytic ileus, acute pancreatitis, pregnancy, inflammatory bowel disease, short bowel syndrome, Crohn disease, gastrointestinal bleeding, esophageal and fundic varices, morbid obesity (body mass index >40 kg/m^2), or gastrostomy/jejunostomy; those receiving thoracic or abdominal radiotherapy; those less than 18 years of age; and patients whose relatives did not accept the patient's study participation.

2.4. Intervention and measurements

2.4.1. Interventions and measurements in both groups

Educational material was prepared, and nurses were trained regarding nursing procedures in EF treatment so that a standard approach could be ensured. The educational content included the patient position, preventing contamination of the EF product and the sets, the storage duration of the EF products, endotracheal tube cuff pressure, oral care, what to do to prevent NG tube occlusion, drug administration, when and how EF should be interrupted, and evaluation of feeding intolerance.

The data collection form was created by the investigators after a literature review [3,5,8,17,18,23,26]. The data collection form consisted of 2 sections. The first section included questions on the descriptive characteristics of the patients, such as age, sex, and beginning date of MV. The second section consisted of questions related to EF traits including the type and administration rate of feeding solution, the amount of GRV, intolerance symptoms (abdominal distention, vomiting, diarrhea, high GRV value), time to reach target volume, the medication used, and the reasons for feeding interruption.

A NG tube was placed after the start of invasive MV treatment in both groups, and EF was started once the tube location was confirmed with x-ray. The level of the sedation affects the patient's compliance with MV treatment and the gastric motility [17]. We therefore used the Acute Physiology and Chronic Health Evaluation II (APACHE II)