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The Impact of Routine Evaluation of Gastric Residual Volumes on the Time to Achieve Full Enteral Feeding in Preterm Infants

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Objective To evaluate the time to full enteral feedings in preterm infants after a practice change from routine evaluation of gastric residual volume before each feeding to selective evaluation of gastric residual volume , and to evaluate the impact of this change on the incidence of necrotizing enterocolitis (NEC).

Study design Data were collected on all gavage-fed infants born at ≤34 weeks gestational age (GA) for 2 years before (n = 239) and 2 years after the change (n = 233).

Results The median GA was 32.0 (IQR: 29.7-33.0) weeks before and 32.4 (30.4-33.4) weeks after the change ($P = .02$). Compared with historic controls, infants with selective evaluations of gastric residual volumes weaned from parenteral nutrition 1 day earlier ($P < .001$) and achieved full enteral feedings (150 cc/kg/day) 1 day earlier ($P = .002$). The time to full oral feedings and lengths of stay were similar. The rate of NEC (stage ≥ 2) was 1.7% in the selective gastric residual volume evaluation group compared with 3.3% in the historic control group ($P = .4$). Multiple regression analyses showed that the strongest predictor of time to full enteral feedings was GA. Routine evaluation of gastric residual volume and increasing time on noninvasive ventilation both prolonged the attainment of full enteral feedings. Findings were consistent in the subgroup with birth weights of <1500 g. Increased weight at discharge was most strongly associated with advancing postmenstrual, age but avoidance of routine evaluations of gastric residual volume also was a significant factor.

Conclusions Avoiding routine evaluation of gastric residual volume before every feeding was associated with earlier attainment of full enteral feedings without increasing risk for NEC. *(J Pediatr 2017;■■:■■-■■).*

See editorial, p ••• and related article, p •••

In most neonatal intensive care units (NICUs), the routine standard care of preterm infants includes assessment of the volume and color of gastric residuals before each enteral gavage feeding.[1,2] Preterm, especially very low birth weight (VLBW) (<1500 g), infants frequently experience signs and symptoms, such as gastric residuals, that are related to gastrointestinal (GI) immaturity and reduced gut motility. These are usually interpreted as feeding intolerance, although these findings may be physiological.[3] Although still not strongly substantiated in the literature,[4] the early initiation and advancement of enteral feeding has been associated with more rapid maturation of the GI system, less feeding intolerance, and better neurodevelopmental outcomes[5,6] in preterm infants, including VLBW infants. These findings as well as a decreased incidence of necrotizing enterocolitis (NEC)[7] have led to the widely accepted recommendation for each NICU to institute and optimize local guidelines for early initiation and advancement of enteral nutrition[8] Recent studies question the reliability of gastric residual volumes as markers of feeding intolerance or NEC[1,9-14] in the absence of other suspicious clinical signs, and suggest abandoning routine gastric residual volume evaluation, although this practice is still widespread.[13]

We reviewed the outcomes of preterm infants in our NICU after discontinuation of routine evaluation of gastric residual volumes before every feeding compared with a historic control group. When routine evaluation of gastric residual volumes was discontinued, we concomitantly implemented guidelines for the early detection of morbidity and NEC based on high clinical

GA	Gestational age
GI	Gastrointestinal
LOS	Length of stay
NEC	Necrotizing enterocolitis
NICUs	Neonatal intensive care units
NIMV	Noninvasive mechanical ventilation
NPO	Nothing per os (no enteral feeding)
PN	Parenteral nutrition
PO	Per os (orally)
VLBW	Very low birth weight

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alertness to other suspicious signs and symptoms. Our hypothesis was that this change in practice was safe and could decrease time to full enteral feeding.

Methods

This was a single center retrospective study conducted in the neonatology department of Bnai Zion Medical Center. Infants were included if they were born at ≤34 weeks of gestation and initially were fed by orogastric tube. Data were collected from the medical records for 2 years before and after a practice change in July 2011: routine evaluations of gastric residual volumes before every feeding were discontinued and infants were selectively evaluated for gastric residual volumes only if there were abdominal symptoms suggestive of NEC or feeding intolerance. If any of the following conditions occurred, the guidelines stated that gastric residual volume should be checked and immediately reported to the physician in charge: abdominal distention, vomiting or large regurgitation, green or bilious regurgitation or vomiting of any quantity, restlessness, somnolence or apathy, increased number of apneas and bradycardias, or other changes in vital signs.

Included infants were born at ≤34 weeks of gestation and divided into 2 groups based on the date of admission to our NICU: The historic control group consisted of infants born between July 1, 2009 and June 30, 2011 who had routine evaluation of gastric residual volume before each feeding. The study group consisted of infants admitted between July 1, 2011 and June 30, 2013 who had selective evaluation of gastric residual volumes based on the NICU guidelines. Infants were excluded if they were critically ill and died before any gavage feedings were given, or if they had congenital anomalies (especially in the GI tract) that could be associated with delayed enteral feedings. The study was approved by the hospital's ethics committee. All infants were identified using the hospital's medical records manager system (v 5.66.4; Max Software Ltd, Haifa, Israel), and their full medical records were retrieved from archives. Data collected included gestational age (GA), birth weight, sex, Apgar scores, and morbidities during the NICU course, including late onset infections and number of days on antibiotics. Data on GI and enteral feeding maturation included parenteral nutrition (PN) days, age at initiation of enteral gavage feedings, the total number of no enteral feeding (NPO) days, the number of NPO episodes (ie, the number of times enteral feeds were discontinued), the time to full enteral feeds (the number of days needed to attain enteral feedings of 150 mL/kg/d, counted from the first day feedings were introduced), the time to full nipple (per os or orally, [PO]) feeds, the length of stay (LOS), and GI morbidities, specifically NEC graded following Bell criteria[15,16] and the treatment given.

The primary outcome measure was time to full enteral feeds. Secondary outcome measures included incidence of NEC, number of NPO and PN days, age at full PO feeds, LOS, and weight at discharge.

Data were statistically analyzed using SigmaPlot v 11.0 (Systat Software Inc, San Jose, California) and Minitab v 16.2.2 (Minitab Inc, State College, Pennsylvania and Coventry, United Kingdom). Statistical analysis included descriptive statistics, Mann-Whitney rank sum test for comparison of groups with nonparametric distributions, and χ^2 test for comparisons of categorical variables. Data was presented as median (IQR), and P values of <.05 were considered statistically significant. Significantly different variables between the 2 study groups were entered into multiple forward stepwise regression models. These multivariable models were also tested on the subgroup of VLBW infants.

Results

The study group (selective evaluations of gastric residual volume) included 233 infants compared with 239 infants in the historic (routine evaluations of gastric residual volume) control group. The mean GA in the study group (selective evaluations of gastric residual volume) was slightly but significantly older than that of the historic control group (**Table I**). There were no significant differences in birth weight, demographic data, or morbidities between the groups (**Table I**). Infants in the control group with routinely evaluated gastric residual volumes were supported longer by noninvasive mechanical ventilation (NIMV). The age at the introduction of the first feeding was younger in the selective gastric residual volume evaluation group (**Table I**). Infants in the selective gastric residual volume evaluation group reached full (150 mL/kg/day) enteral nutrition at younger ages (**Table II**). The time to full enteral feeds was significantly shorter in the selective gastric residual volume evaluation group (**Table II**). Time to full PO feeding and LOS were not different. The rates of NEC and Bell stage ≥ 2 NEC were lower in the second period, but the differences were not statistically significant (**Table II**). Subgroup analysis of VLBW infants showed that the findings were consistent in this group of more premature infants. Median time to full enteral feeds (IQR) was 12 (9.0-16.0) days in VLBW infants with selective gastric residual volume evaluations, significantly shorter than the 13 (10.5-19.0) days needed for the VLBW infants with routine gastric residual volume evaluations ($P = .037$).

Multiple stepwise forward linear regression models showed that although GA was the most significant predictor of the age at which full enteral feeding was attained, avoiding routine gastric residual volume evaluations also contributed to earlier attainment of full enteral gavage feeding (**Tables III** and **IV**). Longer time on NIMV also prolonged time to full enteral feeds (**Tables III** and **IV**). To evaluate whether the differences in weight at discharge could be attributed to the effects of selective vs routine gastric residual volume evaluations or if they were related primarily to differences in postmenstrual age at discharge (**Table II**), a multiple regression model included all the significant variables outlined above as well as neonatal morbidities that may affect weight gain at discharge. The model explained 64% of the variance in weight at discharge ($P < .001$). The most significant variable contributing to weight gain was older postmenstrual age at discharge (delta R-square 56.4%, $P < .001$), but avoiding routine gastric residual volume evaluation also contributed to weight gain at discharge (delta

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Table I. Comparison of the 2 study groups before and after the change

	Selective gastric residual volume evaluations n = 233	Routine gastric residual volume evaluations n = 239	*P* value
GA (wk)	32.4 (30.4-33.4)	32.0 (29.7-33.0)	.02
Birth weight (g)	1645 (1297-1954)	1625 (1207-1934)	.30
Birth weight <10th percentile for GA (%)	22 (9.4%)	28 (11.7%)	.51
1-min Apgar score	8.0 (7.0-9.0)	9.0 (7.0-9.0)	.19
5-min Apgar score	9.0 (9.0-10.0)	9.0 (8.0-10.0)	.78
Male:female	117:116	137:102	.14
Age at first enteral feeds (d)	1.0 (1.0-2.0)	2.0 (2.0-2.0)	<.001
Type of enteral feeds (%)			
Mother's milk	21.9%	42.0%	
Formula only	7.3%	9.3%	<.001
Mixed (mother's milk and formula)	70.8%	48.7%	
Invasive mechanical ventilation (d)	0.0 (0.0-0.0)	0.0 (0.0-0.0)	.44
NIMV (d)	0.0 (0.0-4.0)	1.0 (0.0-5.0)	.002
Oxygen (d)	0.0 (0.0-4.0)	1.0 (0.0-5.0)	.08
Bronchopulmonary dysplasia (%)	20 (8.6%)	18 (7.5%)	.81
Grades III-IV intraventricular hemorrhage or periventricular leukomalacia (%)	8 (3.4%)	12 (5.0%)	.53
Patent ductus arteriosus (%)	45 (19.3%)	48 (20.1%)	.92
Surgical ligation of ductus arteriosus (% of infants with patent ductus arteriosus)	[7 (15.6%)]	[7 (14.6%)]	

All the results are presented as median (IQR) unless indicated otherwise.

R-square 2.6%, $P < .001$). Other significant factors were fewer PN days, younger age at attainment of full PO feeds, feeding type (enrichment of mother's milk with supplemental formula feedings), and longer LOS (delta R-square and *P* values: 2.8% < .001, 0.7% < .001, 0.7% 0.008, 0.5% < .001, respectively).

Discussion

Although there is relatively little evidence to support the practice of routine evaluation of gastric residual volumes in preterm infants,[1] this practice has been traditional because gastric residual volumes have been interpreted as markers of feeding intolerance or as an early sign of NEC.[2] Appropriate management of gastric residual volumes is difficult because of a lack of standards and wide variability in practice regarding the assessment of gastric tube position, the volume or color of GRV that should be interpreted as pathologic, the optimal frequency for evaluation of gastric residual volumes, and whether the gastric residual volume should be returned or discarded.[17-21] This uncertainty leads to frequent decisions to hold feedings with subsequent delays in advancement of enteral nutrition, which in turn may prolong the use of PN and increase the risk for PN-related consequences (eg, late-onset sepsis, extra-uterine growth restriction, and PN-associated liver disease).[22-24] In 2002 Mihatsch et al[2] tried to define a critical gastric residual volume that might be associated with feeding intolerance and questioned whether large gastric residual volume were associated with NEC.[25] They also found that green gastric residual volumes were not indicative of feeding intolerance and suggested that these should not slow feeding advancement.[2] Recent studies question the reliability of gastric residual volumes as markers of feeding intolerance or NEC[1,9-14] in the absence of other suspicious clinical signs, although the practice of routine evaluation of gastric residual volume before every feeding is

Table II. Outcome measures in the 2 groups

	Selective gastric residual volume evaluations n = 233	Routine gastric residual volume evaluations n = 239	*P* value
NPO (d)	0.0 (0.0-1.0)	1.0 (1.0-2.0)	<.001
Number of NPO episodes	0.0 (0.0-0.0)	0.0 (0.0-1.0)	.17
PN (d)	5.0 (2.0-8.2)	6.0 (4.0-11.0)	<.001
Age at full enteral feeds (d)	9.0 (8.0-12.2)	12.0 (9.0-16.0)	<.001
Time to full enteral feeds (d)	8.0 (6.0-11.0)	9.0 (7.0-13.0)	.002
Age at full PO feeds (d)	26.0 (16.0-41.7)	27.0 (15.0-44.7)	.74
LOS (d)	39.0 (24.0-56.2)	36.0 (24.0-55.0)	.45
Weight at discharge (g)	2600 (2329-3019)	2385 (2182-2630)	<.001
Weight gain from birth to discharge (g)	940 (486-1569)	790 (367-1256)	.02
Percent weight gain (%)	56.2 (25.0-111.7)%	52.9 (19.4-109.3)%	.27
Postmenstrual age at discharge (wk)	37.3 (36.3-38.9)	36.9 (35.9-37.9)	<.001
NEC (%)	7 (3.0%)	15 (6.3%)	.14
Infants with NEC Bell stage ≥ 2 (%)	4 (1.7%)	8 (3.3%)	.40
Days of antibiotic treatment (d)	3.0 (3.0-7.0)	3.0 (2.0-6.0)	.22
Number of infections	0.0 (0.0-0.0)	0.0 (0.0-0.0)	.13

All the results are presented as median (IQR) unless indicated otherwise.

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Table III. Multiple stepwise forward linear regressions for the effects of multiple factors on the outcomes in all infants

NPO (d)	DF	F	*P*	R	Rsqr	Adj rsqr
Regression	3	89.239	<.001	0.604	0.365	0.361

Variables	Coefficient	SE	F	*P*	R	Rsqr	Delta rsqr
Constant	13.344	2.907					
GA	−0.422	0.0874	79.212	<.001	0.542	0.293	29.3%
Day at first feed	0.850	0.145	32.626	<.001	0.583	0.340	4.69%
NIMV (d)	0.0773	0.0182	5.172	<.001	0.604	0.365	2.46%
Routine gastric residual volume evaluation			0.198	.657			
Feed type			0.0770	.781			

PN (d)	DF	F	*P*	R	Rsqr	Adj Rsqr
Regression	4	190.876	<.001	0.788	0.621	0.618

Variables	Coefficient	SE	F	*P*	R	Rsqr	Delta Rsqr
Constant	54.676	4.676					
GA	−1.591	0.141	127.925	<.001	0.751	0.563	56.3%
NIMV (d)	0.204	0.0293	48.406	<.001	0.776	0.602	3.85%
Day at first feed	0.863	0.243	12.604	<.001	0.786	0.617	1.54%
Routine gastric residual volume evaluation	1.045	0.458	5.199	.023	0.788	0.621	0.42%
Feed type			1.464	.227			

Age at full enteral feeds (150 cc/kg/d) (d)*	DF	F	*P*	R	Rsqr	Adj rsqr
Regression	5	103.848	<.001	0.727	0.529	0.524

Variables	Coefficient	SE	F	*P*	R	Rsqr	Delta rsqr
Constant	53.304	4.943					
GA	−1.346	0.151	79.212	<.001	0.689	0.474	47.4%
NIMV (d)	0.178	0.0312	32.626	<.001	0.710	0.504	2.95%
Routine gastric residual volume evaluation	1.124	0.494	5.172	.023	0.719	0.517	1.35%
Day at first feed	0.685	0.256	7.150	.008	0.724	0.524	0.73%
Feed type	−0.541	0.265	4.173	.042	0.727	0.529	0.42%

Adj, adjusted; *DF*, degrees of freedom; *Rsqr*, R-squared.
*In the multivariate models, we have used the age at which full enteral feeds were attained instead of time to full enteral feeds because we also wanted to study the effect of age at first enteral feeding, which is part of the definition of time to full enteral feeds (time to full enteral feeds =[age at full enteral feeds]-[age at first enteral feeding]).

still widespread.[13] Kaur et al[26] compared 2 methods for assessing feeding intolerance in VLBW infants by measuring either gastric residual volume or prefeeding abdominal circumference. They found that measuring prefeeding abdominal circumference was associated with shorter time to achieve full enteral feeding with fewer feeding interruptions and a shorter duration of PN.[26]

In this study, we have shown that avoiding routine gastric residual volume evaluation before each gavage feeding was associated with earlier achievement of full enteral feeding in preterm infants born ≤34 weeks of gestation without increasing the risk for NEC (**Table II**).

The study (selective) and the historic control (routine) groups were quite similar, except for a few differences (**Table I**) that were addressed in the multivariable model (**Tables III** and **IV**). Control infants were of younger GA and required NIMV for longer periods, and study group infants were started on enteral gavage feeding earlier (**Table I**), reflecting the current practice in neonatology. Groups also differed in the type of enteral feeds and the use of human milk (**Table I**). We suspect that the latter difference is not related to a change in practice, but rather reflects reporting differences because recently, we have adopted a stricter registry to better identify those infants fed solely mother's milk). The multivariable models (**Tables III** and **IV**) showed that although the most significant predictor of time to full enteral feeds was GA (the younger the infant the longer it takes), avoiding routine gastric residual volume evaluation before every feeding also contributed to earlier attainment of full enteral gavage feeding. A longer time on NIMV also prolonged time to full enteral feeds, probably because of its distending effects on the stomach. In our NICU, infants on NIMV have an open gastric tube after feedings and air is evacuated at least 6 times per day from the stomach. This practice may have contributed to prolonging the time to full enteral feeds, but NIMV is not associated with NEC.[27] GA, routine gastric residual volume evaluation, and time on NIMV as predictors of time to full enteral feeds remained significant when subgroup analysis of VLBW infants was performed (**Table IV**).

As expected, earlier attainment of full enteral gavage feeding was associated with fewer NPO and intravenous PN days. The criteria for discontinuing PN did not change between the 2 periods (ie, amount of enteral feeds to stop PN). However, the decrease in intravenous days in the more recent study period (selective evaluation of gastric residual volume) did not lead to a significant decrease in the number of infections, as would have been desired, and the decrease in the number of antibiotic days was not statistically significant (**Table II**). The incidence of NEC did not increase as a result of discontinuing

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Table IV. Multiple stepwise forward linear regressions for the effects of multiple factors on the outcomes in VLBW infants (<1500 g)

NPO (d)	DF	F	*P*	R	Rsqr	Adj Rsqr	
Regression	3	26.478	<.001	0.558	0.311	0.299	
Variables	**Coefficient**	**SE**	**F**	***P***	**R**	**Rsqr**	**Delta rsqr**
Constant	20.486	5.734					
GA	–0.661	0.183	13.002	<.001	0.498	0.248	24.8%
Day at first feed	0.841	0.249	11.381	<.001	0.542	0.293	4.59%
NIMV days	0.0597	0.0282	4.486	.036	0.558	0.311	1.76%
Routine gastric residual volume evaluation			0.00442	.947			
Feed type			0.000785	.978			
PN days	**DF**	**F**	***P***	**R**	**Rsqr**	**Adj rsqr**	
Regression	3	57.684	<.001	0.704	0.496	0.487	
Variables	**Coefficient**	**SE**	**F**	***P***	**R**	**Rsqr**	**Delta rsqr**
Constant	58.596	8.505					
GA	–1.671	0.277	36.373	<.001	0.651	0.424	42.4%
NIMV days	0.199	0.0437	20.673	<.001	0.693	0.480	5.64%
Routine gastric residual volume evaluation	2.285	0.974	5.498	.020	0.704	0.496	1.58%
Day at first feed			2.632	.106			
Feed type			0.0127	.910			
Age at full enteral feeds (150 cc/kg/d) (d)*	**DF**	**F**	***P***	**R**	**Rsqr**	**Adj rsqr**	
Regression	3	32.181	<.001	0.595	0.354	0.343	
Variables	**Coefficient**	**SE**	**F**	***P***	**R**	**Rsqr**	**Delta rsqr**
Constant	50.335	9.284					
GA	–1.240	0.302	16.818	<.001	0.535	0.286	28.6%
NIMV (d)	0.178	0.0478	13.838	<.001	0.578	0.334	4.78%
Routine gastric residual volume evaluation	2.480	1.064	5.437	.021	0.595	0.354	1.99%
Day at first feed			0.832	.363			
Feed type			0.341	.560			

*In the multivariate models, we have used the age at which full enteral feeds were attained instead of time to full enteral feeds because we also wanted to study the effect of age at first enteral feeding, which is part of the definition of time to full enteral feeds (time to full enteral feeds =[age at full enteral feeds]-[age at first enteral feeding]).

routine gastric residual volume evaluation. In fact, there was a nonsignificant decrease in the incidence of NEC and Bell stage ≥ 2 NEC after the practice change. Our hospital has a relatively low incidence of NEC,[28] and a post-hoc power analysis showed that almost 700 infants (using power of 80% with alpha of 0.05) would have been needed in each group to show differences in the rates of NEC between the 2 study periods in our population. Therefore, our study was underpowered to detect differences in this outcome. The low incidence of NEC in our study cohort also might be attributed to implementing specific guidelines concerning the early recognition of NEC in the selective gastric residual volume evaluation period.[7]

Although our study was retrospective and observational, our findings are in agreement with the small randomized controlled study recently conducted by Torrazza et al.[14] Sixty-one premature infants were randomized to either routine evaluations of gastric residual volume (control) or no gastric residual volume evaluations (study group). Although the study did not find statistically significant differences between the groups (probably because of the small sample size), the infants who had no routine gastric residual volume evaluations on the average reached full enteral feeding 6 days earlier, and had 6 fewer days of central venous lines, as a result of weaning-off PN earlier.[14]

A concerning finding in our study was that shortening the time to full enteral feeds did not also decrease the time needed to reach full PO feedings or the LOS, and in fact, the opposite occurred. Infants were discharged at a later postmenstrual age, and, accordingly, their weight at discharge was heavier (Table II). Previous studies have shown that earlier achievement of full PO feedings is mostly related to GA and maturation, and it is not necessarily related to the earlier attainment of full enteral feedings.[29,30] However, we noted prolonged hospitalization in the study cohort compared with the historic controls. Recently in our population, there has been a trend toward delaying discharge home related to parental preferences. This is supported by our national healthcare system that provides global payment for an admission of a preterm infant (<1750 g at birth), regardless of how long or complicated the hospitalization may be. This eliminates any pressure for earlier discharge of preterm infants. Encouragingly, despite a prolonged LOS and discharge at significantly older postmenstrual age (Table II), the multiple regression models showed that some of the significantly better weight gain at discharge could be explained by avoiding routine gastric residual volume evaluation. Although avoiding routine evaluation of gastric residual volume accounted for a small percentage of improved weight gain at discharge, this may be important because better extra-uterine growth has been associated with better neurodevelopmental outcomes.[8,23]

The main limitation of our study is that it was a retrospective single center study based on a "before and after" study design using historic controls. We changed our protocol for all babies in our NICU in 2011 but did not change any other clinical practices between the 2 periods. Furthermore, most of our professional team was unchanged, and infants during the 2 time periods would have received comparable care with the exception of the practice change. However, the effect of any intervention or change in practice is typically unidirectional (ie, toward improvement). With advances in science and technology, it is unlikely that neonatal outcomes will be worse over time and it is harder to show that a new practice is worse than an old practice in any study using historic controls. Indeed, the early initiation of enteral feeding, and possibly also the use of less NIMV, could reflect such evolution in neonatology practice and, thus, could contribute to the difference in time to full enteral feeds especially when the effect of size (delta R-squared) for our new practice of selective gastric residual volume evaluation was small in the multiple regression analysis (**Tables III** and **IV**). Thus, our results should be interpreted with caution addressing the positive finding of shorter time to full enteral feeds in terms of possible benefit with no evidence of harm, as we cannot fully assure that it might not be confounded by other factors.

Another limitation of our study was the relatively loose and subjective criteria (eg, abdominal distention or restlessness) for checking gastric residual volume in the second period. This must be understood in light of the new (and relatively revolutionary to NICU nursing) practice we introduced and implemented and our desire to ensure that no sick infant might be missed. There is also a possibility that dividing the 2 groups based on the date of birth before and after a single date might have created some overlap in the 1-2 months before and after the change in practice. It is possible that there were some delays for the new practice to become consistent or some trickling in of the practice change during the education and training phases before the official implantation. However, because this possible overlap was in both directions and involved only a small percentage of time during the 4-year total study period, the effect of the overlap should be negligible. It could also be argued that the study should have included only very preterm VLBW infants (ie, 28-32 weeks or <1500g) because the inclusion of more mature preterm infants might have diluted the effects of change in practice. To try to compensate for this, we conducted a subgroup analysis on VLBW infants (81 infants in the selective vs 100 in the routine gastric residual volume evaluation group) and found similar results, especially regarding shorter time to full enteral feeds.

In summary, our study supports the safety of discontinuing the practice of routine evaluation of gastric residual volume before every feeding in preterm infants with the concurrent implementation of protocols to evaluate infants with other signs of feeding intolerance or early signs of NEC. Avoiding routine evaluation of gastric residual volume also contributed to earlier attainment of full enteral gavage feeding, thus, decreasing the number of NPO and intravenous PN days, without increasing the risk for NEC. Our study supports other research showing that routine evaluation of gastric residual volumes does not provide any advantage in monitoring enteral gavage feedings[14,26] and that this practice actually may be a hindrance to the progression of feedings.[1] ■

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