Original Article

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Pre Feed Aspirates vs Abdominal Girth Monitoring for Detection of Feed Intolerance in VLBW Babies

Paediatrics Section

SHIV PRASAD DUBEY, ASHISH JAIN, NISHA KUMARI, ANJOO BHATNAGAR, VEENA DEVGAN

ABSTRACT

Introduction: Feed intolerance is well known in NICU and is linked to morbidity and mortality in Very Low Birth Weight (VLBW) babies. Most definitions of feed intolerance include 1 or more of clinical criteria's viz. pre feed Gastric Residual Volumes (GRVs), colour of gastric aspirates, abdominal distention, emesis, bloody stools and clinical deterioration (increase in apnoea and/or bradycardia) resulting in discontinuation of feeding. But clinical significance of each of these criteria has not been studied systematically.

Aim: To compare the role of abdominal girth monitoring vs pre feed residuals in prediction of feed intolerance, fasting hours, time to reach full feeds, incidence of Necrotizing Enterocolitis (NEC) II, and weight gain in VLBW babies.

Materials and Methods: This prospective, 2 centre trial was conducted in the NICUs of 2 Tertiary Care Hospitals. Total 60 VLBW babies (30 from each hospital) on gavage feeding were enrolled. VLBW babies on gavage feeds at Faridabad Escort Hospital (FEH)-Pre feed Aspiration group (PA) and Hindu Rao Hospital (HRH)-Abdominal Girth monitoring group (AG) were studied. The outcome variables were vomiting, apnoea, bradycardia, fasting hours, days to reach full feeds, NEC-II and weight gain.

Results: Lesser feed were found in AG group and fasting hours (p=0.015), days to reach full feeds (p=0.001) were significantly less and weight gain (p=0.02) was significantly more in AG group as compared to PA group.

Conclusion: Monitoring feed intolerance by pre feed abdominal girth had advantage of better weight gain and fewer fasting hours and days to reach full feeds compared to pre feed aspiration in VLBW babies. Abdominal girth monitoring is a less invasive and equally effective as pre feed aspiration.

Keywords: Abdominal distension, Feed intolerance, Necrotizing enterocolitis

INTRODUCTION

Feed intolerance is very well known in NICU and up to two-third of VLBW infants have been reported to experience feed intolerance. Moreover, it is linked to increased morbidity and mortality in VLBW babies. Most definitions of feed intolerance include one or more of clinical criteria's viz. pre feed GRVs, colour of gastric aspirates, abdominal distention, emesis, bloody stools and clinical deterioration (increase in apnoea and/or bradycardia) resulting in discontinuation of feeding. But clinical significance of each of these criteria has not been studied systematically [1,2].

In most of the NICUs, pre feed aspirate has been given significant emphasis in monitoring and detecting feed intolerance and risk of NEC while augmenting feeds in VLBW babies [1]. These repeated aspirations may injure vulnerable gastric mucosa and subject VLBW baby to complications like increased sepsis, intolerance, ulcers, stress, desaturations etc. The delay in gastric emptying may be a normal manifestation of immature gastrointestinal motility. Withholding feeds because of high gastric residuals (in absence of other symptoms) can result in marked delays in reaching the goals of nutritional needs and contribute to poor weight gain and delayed growth. Hence, there is a need of a non invasive and less harmful method which can be routinely used to monitor feeding in these babies.

Other authors have used other objective parameters like abdominal circumference, colour of aspirate to guide feeding therapy [3]. They have suggested that instead of routine GRV aspirate prior to each feed, an increase in abdominal girth of 2 cm should be taken as sign for withholding feed. Abdominal girth measurements have been used to identify infants with NEC or other gastrointestinal problems. Abdominal girth monitoring is a non invasive method where gastric mucosa is not disturbed. Some of the studies have reported abdominal distention to be a better predictor of NEC than increased pre

feed gastric residual volume. There are very limited numbers of trials which have used abdominal girth measurement to guide enteral therapy.

MATERIALS AND METHODS

This prospective, 2 centre study was conducted between the period of May 2011 to November 2012 in the NICUs of 2 Tertiary Care Hospitals. Total 60 VLBW babies (30 from each hospital) on gavage feeding were included in the study. Babies with major congenital anomalies like anencecephaly, encephalocoele, meningomyelocoele, ectopia vesicae, complex congenital heart disease, congenital anomalies of gastrointestinal tract, umbilical sepsis/abdominal skin infection, babies on aminophylline therapy, ventilator support (MAP>9 mmHg) or high frequency ventilation, augmenting inotropes, metabolic abdomen (hypokalaemia), severe birth asphyxia and abnormal umbilical arterial flow in antenatal Doppler were excluded. Consent was taken from parents before enrolling neonate in the study. Study was approved by ethical committee of the institutions.

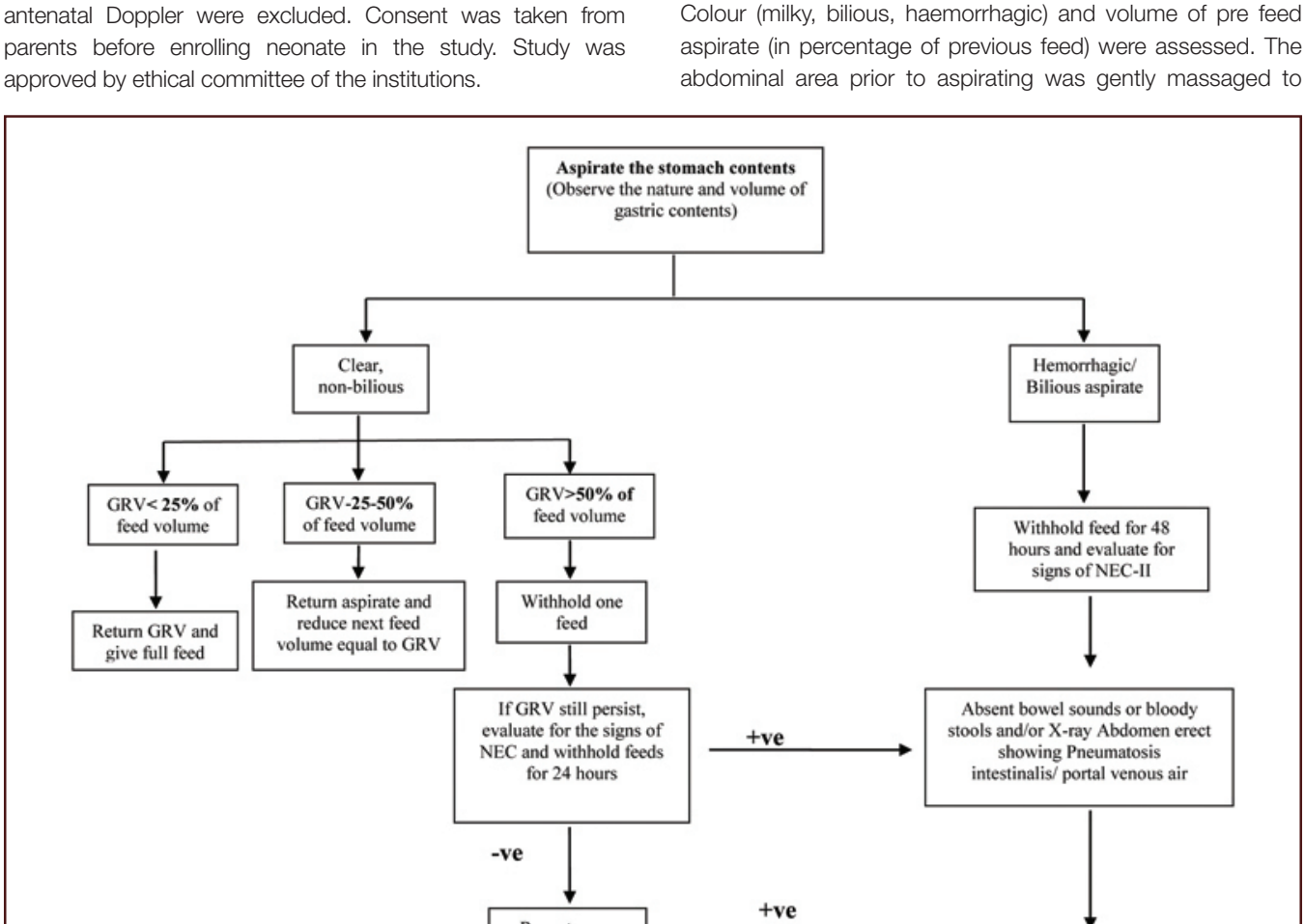
Groups: Babies meeting inclusion criteria were enrolled at 2 sites viz Faridabad Escorts Hospital (FEH) and Hindu Rao Hospital (HRH) to PA Group and the AG Group respectively.

Sample Size Estimate: To observe a difference of 3 days in time taken to achieve full feeds between two groups with a power of 80% and a significance level of 0.05, it was estimated that study would require a sample size of 30 subjects in each group.

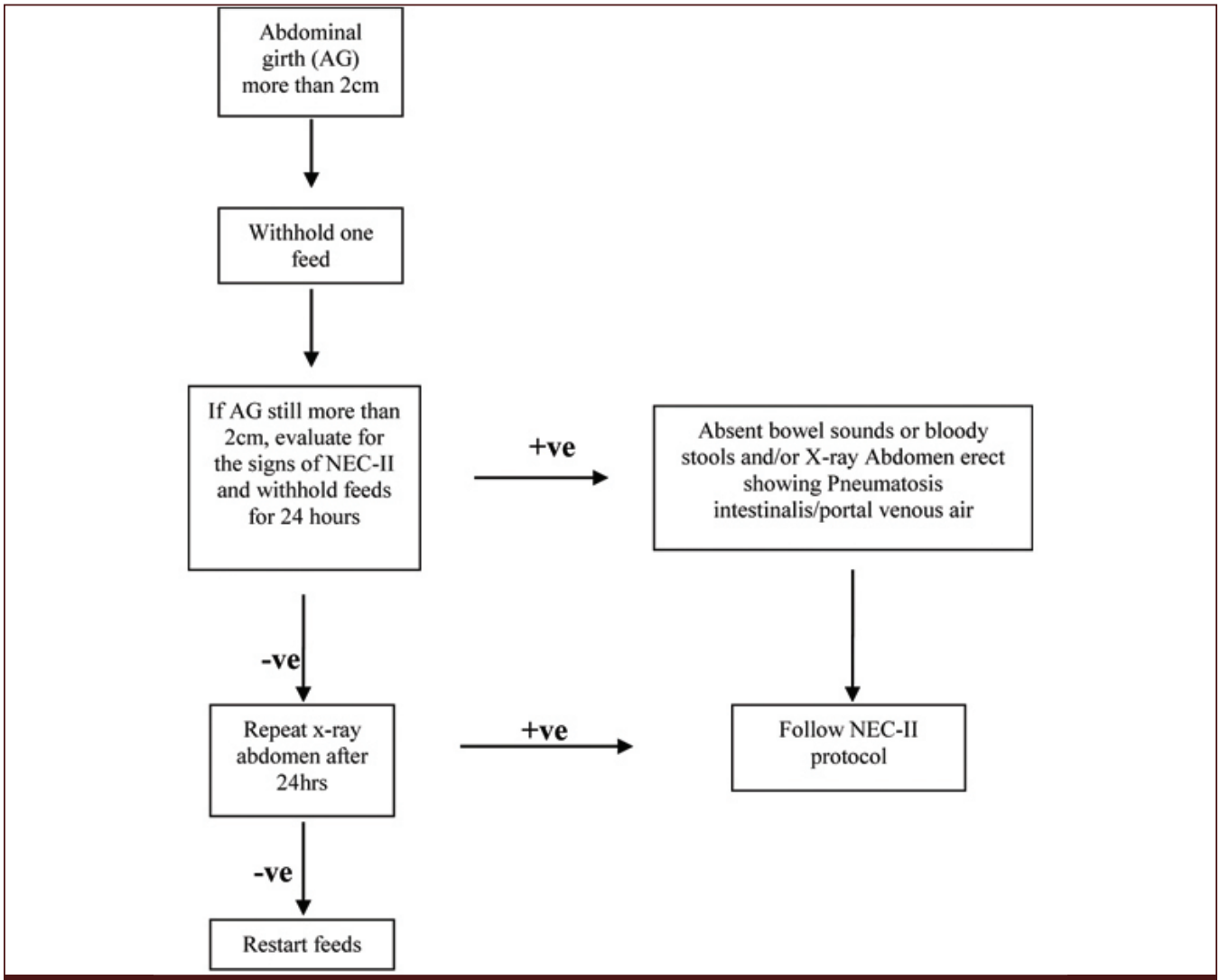
Feeding Protocols

The feeding was done every two hourly by 5 cc/10 cc syringe by gravity method. Initial volume was 2 cc/kg/feeding with a minimal absolute volume of 2 cc and was increased not more than 20 cc/Kg/day. All attempts were made to provide Expressed Breast Milk (EBM) from biological mother but if inadequate then were supplemented with LBW infant formula milk.

PA Group: Pre feed aspiration was done with 2 cc syringe. Colour (milky, bilious, haemorrhagic) and volume of pre feed aspirate (in percentage of previous feed) were assessed. The abdominal area prior to aspirating was gently massaged to



[Table/Fig-1]: Feeding flow chart: Pre feed aspirate group.



[Table/Fig-2]: Feeding flow chart: Abdominal girth group.

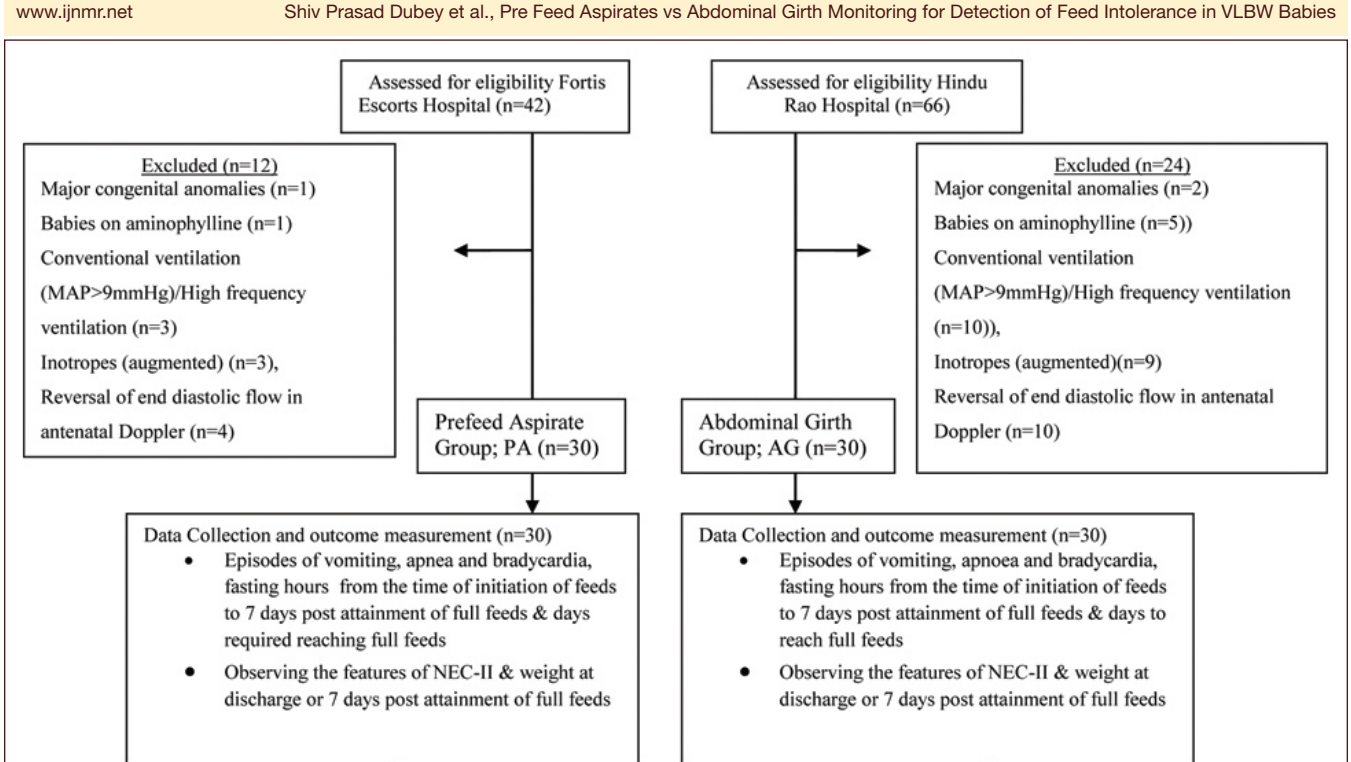
ensure that feeding tube was not adhering to wall of stomach and were aspirated with infants resting in supine position. A pre feed gastric residual volume >50% of previous feed was considered as sign of feed intolerance. GRV was assessed and decision about next feed was taken [Table/Fig-1].

AG Group: Abdominal girth monitoring was done before each feed. The abdominal girth was measured with standard non stretchable measuring tape (with markings up to 1 mm) at level of umbilicus or just above it in case of umbilical clamp with babies lying in supine position. Three measurements were taken each time and mean of measurements was recorded. Increase in the pre feed abdominal circumference > 2 cm was considered as sign of feed intolerance and feed was stopped and decision was taken [Table/Fig-2].

The feeding amount was not increased for next 24 hours when ever feeding was stopped. Whenever feed was restarted after 24 hours or more of stopping feed, it was started with previous day volume. In case of single episode of vomiting, one feed was withhold and if vomiting occurred more than once then feeding was stopped for 24 hours and baby was evaluated for NEC.

Patients developing Stage II or greater NEC requiring gavage feed discontinuation were managed based on clinical protocols.

Pulse oximetry was applied to any of the limb to measure heart rate and oxygen saturation. Apnoea was assessed by clinical observation. RBS, serum electrolytes, serum calcium, temperature, sepsis screening, ABG, chest X-ray, cranial USG were done to evaluate cause of apnoea. If no other cause of apnoea was apparent then apnoea was considered due to feed intolerance. In case of apnoea/bradycardia feed was stopped for 24 hours.



[Table/Fig-3]: Description of trial flow.

STATISTICAL ANALYSIS

All of the statistical computations were performed by using SPSS for Windows, version 17.0 (SPSS, Chicago, IL). Continuous variables were compared using student's 't' test. All means were expressed as mean±standard deviation. All medians were expressed as median (inter quartile range). For comparison of categorical data Chi-square test was used as applicable. Mann Whitney-U test was also used wherever applicable. Multivariate regression analysis was also performed and adjusted outcomes were computed accordingly wherever required. The p-value <0.05 was used to define statistical significance.

RESULT

Total 108 VLBW babies were assessed for eligibility (FEH; n=42 and HRH; n=66) and after exclusion 30 babies were enrolled in each Group (PA and AG). Flow trial is shown [Table/Fig-3].

The two groups were comparable in all the baseline characteristics except, mode of delivery, pattern of growth and use of antenatal steroids [Table/Fig-4]. Feeding characteristics like day of starting feeds and use of expressed breast milk (EBM) only or mixed feed (EBM+formula) were also comparable in the two groups.

The median days to reach the full feed in AG Group were 3.5 days lesser than PA Group (p-value=0.001). Two babies in each group developed NEC [Table/Fig-5]. Incidence of feed intolerance in PA Group was 60% and that in AG group was 30%, p-value <0.001.

As some of the baseline characteristics, therapies were significantly different in both the groups, their confounding effects on outcomes were analysed by multivariate regression analysis and the outcomes, which were significantly affected (days to reach full feeds and fasting hours), were adjusted for the variables which affected them significantly. Adjusted outcomes viz. fasting hours and the days to reach full feeds still differed significantly with a p-value of less than 0.001 [Table/Fig-6,7].

DISCUSSION

The strategies used to monitor feeding practices are generally based on the evidence of feed intolerance, it is a common physiology in preterm VLBW infants, reported in 2-67% of infants weighing <1500 gm [4,5]. The accurate definition of feed intolerance and appropriate therapeutic response once it is identified is not yet scientifically established and this has lead to varying incidence of feed intolerance and feed interruptions in different trials [1]. The dilemma is in understanding the significance of signs of feed intolerance and differentiating ileus of prematurity from early NEC. Some of the authors have used excessive gastric residual volume, determined by percentage of previous feeding or an absolute volume as a surrogate for early

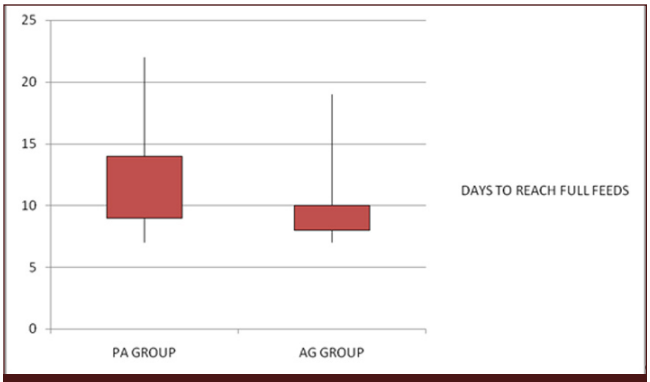
Baseline Characteristics/ Therapies/Morbidities	PA Group (FEH)	AG group (HRH)	p-value
Gestational Age $	31 (29,32)	31 (30,32)	0.708
Birth Weight #	1.23 (0.18)	1.28 (0.15)	0.288
Antenatal Steroids †	14 (46.7)	4 (13.3)	0.005*
Resuscitation Required †	10 (33.3)	6 (20.0)	0.243
Mode of Delivery †			
Normal Vaginal Delivery	7 (23.30)	26 (86.70)	<0.001*
Lower Segment Cesarian Section	23 (76.70)	4 (13.30)	
Sex †			
Male	16 (53.3)	16 (53.3%)	1
Female	14 (46.7)	14 (46.7)	
Pattern of Growth †			
AGA	21 (7)	30 (All)	0.002*
SGA	9 (30)	None	
APGAR Score $			
1minute	7 (6,8)	7 (7,8)	0.41
5minute	8 (8,9)	8 (8,9)	0.53
CPAP †	20 (66.7)	16 (53.3)	0.292
Surfactant †	15 (50.0)	7 (23.3)	0.032*
Antibiotics †	26 (86.7)	19 (63.30)	0.037*
Phototherapy †	24 (80.0)	15 (50.0)	0.015*
Use of caffeine †	8 (26.7)	3 (10.0)	0.095
Parenteral Nutrition †	20 (66.7)	5 (16.7)	<0.001*
Sepsis †	7 (23.3)	8 (26.7)	0.766
Hypoglycaemia †	5 (16.7)	5 (16.7)	1
Hypocalcaemia †	2 (6.7)	Nil	0.15
Polycythaemia †	Nil	Nil	-
IVH †	Nil	Nil	-
ROP †	4 (13.3)	2 (6.7)	0.389

[Table/Fig-4]: Characteristics, therapies and morbidites.
†Number (%), #Mean (±SD), $Median (IQ), *p-value-significant

NEC/feed intolerance. However, Bertino E et al., in a retrospective study comparing proven NEC cases with gestational age and weight matched controls found that gastric residuals upto 42% may be normal in preterm neonates [6]. A similar study by Cobb BA et al., comparing residuals only for 6 days preceding NEC onset found wide variability of gastric residual volume before onset of NEC which suggests that residual volume may not reliably predict development of NEC [7]. In our study feeds were given safely with no increase in the morbidity even in patients with upto 50% pre feed aspirate. Moreover, gastric residual volume measurement differs in varying body positions and the technique of extracting the gastric residual might be too variable to reliably use it as a significant predictor of early NEC

Outcome	PA Group	AG Group	p-value
Primary Outcome			
Number with Vomiting †	7 (23.33)	7 (23.33)	1
Number with Apnoea †	1(3.33)	1 (3.33)	1
Number with Bradycardia †	1 (3.33)	1 (3.33)	1
Fasting hours #	40.80 (58.01)	22.93 (53.62)	0.015
Days to reach full feed $	12 (9,14)	8.5 (8,10)	0.001
Secondary Outcome			
NEC-II *	2 (6.70)	2 (6.70)	1
Weight Gain (g/kg/day) #	4.03 (3.23)	6.71 (3.06)	0.002

[Table/Fig-5]: Primary and secondary outcome
mean (±std deviation), † number (%), $ median (IQ)



[Table/Fig-6]: Days to reach full feeds

Outcome	PA Group	AG Group	p-Value
Fasting hours #	48.20 (36.87)	15.52 (29.62)	<0.001
Days to reach full feeds $	10.5 (9.43,11.42)	8.8 (8.16,9.4)	<0.001

[Table/Fig-7]: Adjusted outcomes after regression analysis
#mean (±std deviation), $ median (IQ)

[8]. In our study bilious aspirates were considered as a sign for withholding feeds but Mihatsch WA et al., found that green residuals by themselves did not impact feeding volume and therefore suggested that a certain amount of duodeno-gastral reflux seems to be normal [9]. The volume of gastric residues has also been reported to vary with the position of the baby, location of orogastric tube, and the technique of extraction [10]. Bertino E et al., also found that the bilious residuals did not seem to be associated with NEC onset [6].

Bhatia P et al., reported variability of abdominal circumference with feeds in premature infants (n=27) and found that 95% of these values are within 1.8 cm of baseline values [11]. Abdominal circumference was positively correlating with birth weight (p=0.001) and time from last defecation (p=0.001) and negatively correlated with time from last feeding (p=0.04). Based on such reports some of the authors have measured serial abdominal circumference in neonates receiving enteral feeds as

a surrogate for early NEC/feed intolerance [3,11,12]. Malhotra AK et al., reported that whenever abdominal girth increased by two cm or more, aspirate was more than 23% [3] and hence recommended that instead of routine gastric aspirate prior to each feed and increase in abdominal girth of atleast two cm may be taken as warning to withhold or to reduce volume of oral feeds and we used the same in our study.

As the study was carried out in two different centres some of the baseline characteristics of the two groups differed significantly which may be partially explained by the fact that one of the centres catered for most of the antenatally followed high socioeconomic booked cases and the other had predominantly low socioeconomic unbooked cases.

Our study shows fasting hours and days to reach the full feeds were significantly less when abdominal girth is used to guide enteral feeds [Table/Fig-5]. The fasting hours due to feed intolerance (p=0.015) and days to reach the full feeds (p=0.001) were significantly more in PA Group. The weight gain at discharge or 7 days after attainment of full feed was also significantly more in AG Group as compared to PA Group (p=0.002).

Dhingra A et al., reported 19% incidence of feed intolerance with a 2 hourly feeding schedule while using both abdominal circumference and gastric residual to monitor feeds [13]. The high intolerance in the pre feed aspirate group, may be due to the very nature of the intervention, where the possibility of having increased aspirates as a physiology is possible. The incidence of feed intolerance in our study was 30% in AG Group and 60% in PA group. Our incidence of feed intolerance in PA Group was similar to that reported by Boo NY et al., who used gastric residual volume alone to define feed intolerance (64.4%) [14]. Salhotra A et al., reported 51.8% incidence of feed intolerance with rapid advancement of feeds (30 mL/Kg/day) while using abdominal circumference and gastric residuals to monitor feeds [12]. This was significantly more compared to the abdominal girth group in our study.

Our study shows that increase in pre feed abdominal girth more than 2 cm can be used as a marker to identify feed intolerance and leads to more rapid advancement of enteral feeding. Our study however did not have enough power to draw conclusion on risk of NEC. There are very few trials which have directly compared abdominal circumference with gastric residual as a method for defining feed intolerance.

Malhotra AK et al., showed that the problem of gastric residuals decreased as postnatal age increased and feeds were advanced (20.7% on day 4 vs 8.6% on day 7 p<0.001) [3]. Similar results were also reported in another study which showed that kinetics of gastric emptying is affected by postnatal age and gestational maturity [15]. They suggested that if gastric residual is used as a sole criterion, it would lead to frequent interruptions in early neonatal period. Early feeding and fewer interruptions by using abdominal girth to define feed intolerance can lead to better post natal intestinal adaptation through release of gut hormones. Malhotra AK et al., also recorded pre and post feed abdominal girth but found no correlation with amount of gastric residual aspirated [3].

LIMITATION

In this study no randomization was done. There would be heterogeneity in the resources and care of the babies which is not adjusted to modality of feeding as this may also be perceived as feed intolerance. Also there was no neurodevelopment follow-up done and sample size is not adequate to look at outcomes like NEC I and II.

CONCLUSION

For decades in most of the NICUs the pre feed aspirate has been given significant emphasis in monitoring and detecting the feed intolerance and the risk of NEC while augmenting feeds in VLBW babies. Feed intolerance is a common occurrence in VLBW infants and monitoring it by pre feed abdominal girth had advantage of better weight gain and fewer fasting hours and days to reach full feeds compared to pre feed aspiration in VLBW babies. Abdominal girth monitoring is a less invasive and equally effective as pre feed aspiration.

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AUTHOR(S):
1. Dr. Shiv Prasad Dubey
2. Dr. Ashish Jain
3. Dr. Nisha Kumari
4. Dr. Anjoo Bhatnagar
5. Dr.Veena Devgan

PARTICULARS OF CONTRIBUTORS:
1. Consultant, Department of Paediatrics and Neonatology, Fortis Escorts Hospital, Faridabad, Haryana, India.
2. Assistant Professor, Department of Neonatology, Maulana Azad Medical College, New Delhi, India.
3. Senior Resident, Department of Paediatrics, Deen Dayal Upadhyay Hospital, New Delhi, India.
4. Consultant, Department of Paediatrics, Fortis Escorts Hospital, Faridabad, Haryana, India.
5. Senior Specialist, Department of Paediatrics HIndu Rao Hospital, New Delhi, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Ashish Jain,
601A, Sukhsagar Apartments, Plot No. 12, Sector 9,
Dwarka, New Delhi-110077, India.
E-mail: ashish.jain.mamc@gmail.com

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