

Rapid Versus Slow Advancement of Feeds in Preterm Babies Less than 34 Weeks in Incidence of NEC and Feed Intolerance

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Abstract

Objective: To evaluate whether preterm neonates less than 34 weeks at birth receiving rapid enteral feeding advancement at 25-30 ml/kg/day and those receiving slow enteral feeding advancement at 15-20 mL/kg/day to attain full feeding (180 ml/kg/day) are at increase in the incidence of necrotizing enterocolitis or feed intolerance.

Study design: Retrospective cohort study. Setting: Level III Neonatal Unit in Southern India

Subjects: Neonates born at <34 weeks of gestational age and admitted to the NICU during study period were enrolled.

Outcome: Mortality and major morbidity - NEC as per Bell staging, incidence of feed intolerance.

Results: Both groups had similar baseline characteristics. The average gain in weight, length and head circumference were significantly lower in the slow feeding group as compared rapid feeding group. The mean days to reach birth weight was less in rapid feeding group; 12.43 vs. 15.46 in slow feeding group ($p=0.04$). It was inferred that duration of hospital stay (22.58 vs. 31.34 days) and parenteral nutrition (8.69 vs. 11.18 days) was less in rapid feeding group as compared to slow feeding group ($p=0.04$). Powered by Editorial Manager® and Prodxion Manager® from Aries Systems Corporation Rapid feeding group does not have increased episodes of feed intolerance or NEC (5 vs. 6 cases) compared to slow feeding group.

Conclusions: Our study support enteral nutrition by rapid enteral feeding regimen (increments of 25-30 ml/kg/day) in stable preterm neonates less than 34 weeks of gestation.

Keywords: Preterm neonate; Slow feeding regimen; Rapid feeding regimen; Necrotising enterocolitis; Feed intolerance

Background

The delivery of a preterm baby is a nutritional emergency. After stabilization of initial problems including respiratory status, nutrition is the major challenge in front of the treating neonatologist. In spite of extensive research in nutrition of very low birth weight preterm infants, still there are lot of controversies as to what is the nutritional goal, what should be the composition of postnatal feeds to match the intrauterine growth and methods to provide optimal nutrition to improve both short term and long term outcomes in very low birth weight infants. The landmark epidemiologic studies by Barker et al have shown that in utero growth retardation predisposes to cardiovascular diseases, hyperlipidemia, hypertension and type 2 diabetes mellitus [1]. The appropriate goals of low birth weight feed includes ensuring adequate short term growth, preventing feeding related morbidities, optimizing long term outcomes including its impact on adult onset diseases (e.g. coronary artery disease, diabetes mellitus, etc.). Over last 2 decades the concept of minimal enteral nutrition has evolved which is defined as starting small amount of enteral feeding (exact volume not defined) usually 5-25 ml/kg as soon as possible after birth. This has numerous positive impacts on

development and maturation of gut function, hormonal and digestive enzyme surge [2,3]. There are numerous studies, which have shown the beneficial effects of MEN however none of these studies have demonstrated any increase in the incidence of NEC however larger trials are required regarding safety in very immature and critically sick babies [4,5].

The rapidity of feed volume increments has been beset with controversies. A more rapid increase should result in faster weight gain and a shorter hospital stay. The proponents of slow feed advancements have cited risk of necrotising enterocolitis in their defence, while those in favour of rapid advancements have cited better growth in their defence. Controlled trials prior to the 1990s had observed an association between rapid feed advancement and increased risk of NEC. However recent randomized controlled trials have not demonstrated any increased risk of NEC. The lack of effect on NEC could be a result of differences in study design, improved neonatal care resulting in decrease in NEC risk factors and shift in feeding protocols from formula to human milk.

Moreover, most of these trials were conducted in developed nations. The only trial from a developing country precluded any firm conclusion on the risk of NEC and rapid enteral feeding, owing to small sample size.

The aim of this study was to assess the incidence of NEC and feed intolerance in our NICU with two different feeding protocols (slow feeding regimen versus rapid feeding regimen).

Methodology

This retrospective cohort study was conducted in a level III neonatal unit of a teaching hospital in Southern India between June 2013 and June 2014. Data was collected for preterm infants with gestational age of less than 34 weeks at birth after obtaining informed consent from parents. Gestational age was assessed by last menstrual period and supported by modified Ballard score. Exclusion criteria included babies with major congenital anomalies, delayed initiation of feeds for more than 5 days, severe birth asphyxia, infants not fit for enteral nutrition (abdominal distension, vomiting, gastro intestinal bleeding Neonates with congenital malformations of gastrointestinal tract or oral cavity), preterm admitted to NICU in whom feeds were already established elsewhere (>20 ml/kg /day) and babies critically ill requiring respiratory support after day 7 of life. All data was recorded in predesigned structured proforma. The study was approved by Institutional Ethics Committee.

Data was collected for 40 babies in each group; Infants who received slow feeding and rapid feeding were studied. Expressed human milk, when available, was the nutrition of choice. When human milk was not available, preterm formula was used. Human milk fortifier (Lactodex-HMF) per 50 ml breast milk was added in infants of both groups when they reached feed volume of 120 ml/kg/day. All infants were weighed each morning, naked, before feeding and bathing, on one same electronic weighing scale with one-gram accuracy. Side effects were recorded for any feed intolerance (defined as vomiting, diarrhoea, abdominal distention defined as >2 cm from baseline with or without visible bowel loops, increased aspirates >50% or change in nature of aspirates), Necrotizing enterocolitis (NEC) any stage (modified Bells staging).

Slow feeding regimen group

In this group feeds were initiated on day one of life at volume of 15-20 ml/ kg/day of expressed breast milk (EBM). Standard preterm formula of 20 kcal/30 ml was used when EBM was not available. Feeds were advanced by volume of 20 ml/kg/day until maximum enteral feeds of 180 ml/kg/day were reached.

Rapid feeding regimen group

In this group feeds were initiated on day one of life at volume of 20 ml/kg/day of expressed breast milk (EBM). Standard preterm formula of 20 kcal/30 ml was used when EBM was not available. Feeds were advanced by volume 25-30 ml/kg/day until maximum enteral feeds of 180 ml/kg/day were reached.

Method of feeding

Feeds were given by trained staff as bolus feeds via orogastric tube at the interval of two hours. Abdominal girth was checked prior to every feed. If the abdominal girth increased by more than 2 cm between the feeds, gastric aspiration was performed. If the gastric aspirate was 50% of the pre-feed volume, no further increment in feed was made for the next 24 hours. Preterm babies less than 34 weeks of gestation received appropriate parenteral nutrition till enteral feed volumes of 100

ml/kg/day were reached, after which parenteral nutrition was discontinued.

Temporary discontinuation of feeds

Feeds were withheld temporarily if any of the following conditions were present:

Feed intolerance (which was defined as one or more of the following: residual gastric volume of more than 50% of pre-feed volume, more than three episodes of vomiting in any 24 hours period, bilious or blood stained vomiting, abdominal tenderness, abdominal wall erythema, sluggish bowel sounds, increase in abdominal girth by more than 2 centimetres between feeds)

Recurrent Apneic episodes (more than three apnoeas/ hour after 1 hour of age)

Neonatal seizures

Requirement of inotropic agents.

Discharge from NICU

The neonates were discharged from the hospital if they met all of the following criteria: (a) A sustained pattern of weight gain at the rate of 10 g/kg/day for at least 3 days. (b) Maintenance of normal body temperature when fully clothed. (c) Competent cup feeding/breast feeding. (d) Review of hospital course was completed; underlying medical problems had been treated. After discharge from the hospital, the patient had a follow-up visit 1 week and 2 weeks later in the outpatient department during which the weight was recorded. Days taken to regain birth weight were recorded.

Outcome

Our primary outcome measures were NEC as per BELL staging, Incidence of feed intolerance and Mortality. Our secondary outcome measures were time required to reach full enteral feeds i.e. 180ml/kg/day, duration of parenteral nutrition, duration required to regain birth weight, duration of hospital stay, episodes of feed interruptions and sepsis.

Statistical Analysis

The data was collected using MS excel sheet and analyzed using SPSS version 16 for Microsoft windows. Summarization of the data was presented using basic tables and graphs. Level of significance was tested using T test. Chi square analysis was performed wherever applicable. Test was considered significant where p value was <0.05.

Results

Total number of babies included in the study was 80; 40 babies were in each group that is rapid feeding and slow feeding group.

Baseline characteristics of both the groups were similar (Table 1). Outcome measures in both groups are summarised in Table 2. The lowest gestational age was 27 weeks in slow feeding group.

It was inferred that days to reach birth weight was less in rapid feeding group compared to slow feeding group. T test for equality of means has been applied and p value was 0.04 which is statistically significant.

It was inferred that average weight and length gain was more in rapid feeding group compared to slow feeding group. The difference between the two groups was statistically significant as shown in Table 2.

It was inferred that duration of IV/PPN in rapid feeding group was less compared to slow feeding group. There was significant statistical difference between the two groups. T test for equality of means has been applied and p value was 0.04 which is significant

It was inferred that duration of hospital stay in rapid feeding group was less compared to slow feeding group. There was significant statistical difference between the two groups. T test for equality of means has been applied and p value was 0.04 which is significant.

Amongst other outcome measures present study demonstrated that days to reach full feeds was less in rapid feeding group compared to slow feeding group; average head circumference gain was more in rapid feeding group compared to slow feeding group. However the differences were not statistically significant.

It was inferred that rapid feeding group has increased episodes of feed interruptions compared to slow feeding group, however rapid feeding group does not have increased episodes of feed intolerance or NEC compared to slow feeding group. However there was no significant statistical difference between the two groups.

	Slow feeding group	Rapid feeding group
Sample size (n)	40	40
Gender		
Male	18 (45%)	15 (37.5%)
Female	22 (55%)	25 (62.5%)
Gestational age (weeks)		
28 or less	8 (20%)	9 (22.5%)
28-30	9 (22.5%)	7 (17.5%)
30-32	7 (17.5%)	8 (20%)
32-34	16 (40%)	16 (40%)
Mean(SD)	31.37 (2.38)	31.21 (2.32)
Mode of delivery		
Vaginal delivery	21 (52.5%)	21(52.5%)
C- SECTION	19 (47.5%)	19 (47.5%)
Mean Weight at admission in grams (SD)	1380.2 (324.8)	1236.6 (264.2)
Mean Head circumference at admission in cms (SD)	28.77 (2.4)	28.51 (2.8)
Mean length at admission in cms (SD)	37.55 (3.9)	37.28 (3.9)
Mean age at which feeds were started in days (SD)	1.70 (0.75)	1.62 (0.78)

Table 1: Baseline characteristics of both groups.

Outcome measure	Slow feeding group	Rapid feeding group	p Value
Mean age to reach full feeds in days (SD)	11.81(4.07)	10.21 (3.04)	0.128
Mean age to reach birth weight in days (SD)	15.46 (4.9)	12.43 (5.3)	0.04
Average weight gain in gram/kg/day (SD)	10.7 (1.9)	13.17 (4.2)	0.02
Average head circumference gain in cms/week (SD)	0.6 (0.13)	0.84 (1.08)	0.13
Average length gain in cm/week (SD)	0.79 (0.14)	0.89 (0.302)	0.02
Average duration of IV/PPN in days (SD)	11.18 (5.1)	8.69 (3.8)	0.04
Average duration of hospital stay in days (SD)	31.34 (17.1)	22.58 (14.1)	0.04
Episodes of feed intolerance	9	9	1
Number of feed interruptions	11	13	0.76
Number of NEC episodes (%)	6 (17%)	5 (14%)	0.49
Number of sepsis cases (%)	11 (32%)	9 (25%)	0.33
Number of deaths	6 (17%)	5 (14%)	

Table 2: Outcome measures in both groups.

Discussion

Despite decades of research, necrotizing enterocolitis has been one of the most difficult disorders to eradicate and its pathogenesis remains elusive [6]. The data from various RCTs indicate that certain factors such as breast milk, use of antenatal steroids, probiotics may positively influence the incidence of NEC [7,8]. There is still an ongoing controversy with regard to enteral feeding practices [9-15]. The most recent guidelines published by the American Society of Parenteral and Enteral Nutrition (A.S.P.E.N) suggest increment in enteral feeds by 30 ml/kg/day, but the evidence for this approach is weak [1]. Though feeding strategies vary substantially between countries and institutions[16]; surveys indicate that most neonatologists tend to increase daily enteral feeds by smaller amounts (10-20 ml/kg/ day) [16].

Possible benefits of rapid increments in enteral feeding include lesser duration of parenteral nutrition, earlier regain of birth weight, improved early postnatal growth, a lower rate of catheter-related infections, a shorter duration of hospital stay, and reduced cost of neonatal care. Conversely, assessment of preterm nutrition with the use of growth as the principal outcome measure is flawed as we still do not know what exactly represents the optimal growth [2].

Given the contradictory data published in the literature with regard to potential association between aggressive enteral feeding regimens in VLBW infants and the incidence of NEC [3], the aim of this study was to assess our own feeding policy (slow feeding regimen versus rapid feeding regimen) and relate it to the incidence of NEC and feed intolerance in our NICU.

We found that rapid feeding group does not have increased episodes of feed intolerance or NEC compared to slow feeding group.

We also found that infants in rapid feeding group reached birth weight earlier than slow feeding group and were found to have better postnatal growth. There was reduction in duration of hospital stay as well as less duration of parenteral nutrition in rapid feeding group. In current study full feeds were reached at an earlier age in both slow and rapid feeding groups as compared to study by Vasu et al., and Krishnamurthy et al. [17,18].

We also found that rapid feeding group does not have increased incidence of mortality or sepsis compared to slow feeding group. In current study there were 6 deaths in slow feeding group and 5 deaths in rapid feeding group while in study by Mukhopadhyay et al., there were 5 deaths and all were in slow feeding group.

Our study's results were comparable with other studies worldwide – Karagol et al. [19], Krishnamurthy et al. [18] and Caple et al. [20].

Strength of our study was sufficient sample size with adequate power to detect a difference.

Limitation of our study was retrospective nature of the study and short term assessment of postnatal growth.

To conclude, our study support enteral nutrition by rapid enteral feeding regimen (increments of 25-30 ml/kg/day) in stable preterm neonates less than 34 weeks of gestation.

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