International Journal of Medical and Health Research
www.medicalsciencejournal.com
ISSN: 2454-9142
Received: 26-04-2024, Accepted: 18-05-2024, Published: 12-06-2024
Volume 10, Issue 3, 2024, Page No. 45-48

Effect of early nutritional support on neonates that were admitted to neonatal intensive care unit (NICU) in Baghdad

Besmah Mohammed Ali Ibrahim[1*], Maysaa Basim Abbood[1], Murtadha Hussein Ali[2]
[1] Department of Clinical Nutrition, Ghazi Al-Hariri Teaching Hospital, Medical City, Baghdad, Iraq
[2] Department of Neonatology, Child's Central Teaching Hospital, Baghdad, Iraq

Abstract
Background: Nutritional support is critical for preterm infants in the neonatal intensive care unit (NICU). A nutritional support team (NST) that focuses on providing optimal nutrition care could be helpful**.** We conducted an evaluation about clinical and nutritional outcomes in a tertiary NICU following the intervention of an NST.
Patient and method: This study used prospective approach, Preterm neonates' ≤32 weeks gestational age or weighing ≤1500 g were enrolled. Clinical and nutritional outcomes were compared between two groups that were used different practice in nutrition. Medical records were reviewed, and clinical and nutritional outcomes were compared between the two groups.
Results: In total, 50 patients from the group with NST and 50 patients from the group without NST were enrolled. The cumulative energy delivery during the first week of life increased from 256.6 kcal / kg in the group without NST to 657.7 kcal /kg in the group with NST. The cumulative protein, lipid and carbohydrate deliveries also significantly increased. The time required to reach full enteral feedings decreased in group with NST (14.4±4.1 vs. 19.6±10.9 days, $p = 0.007$). Changes of Z-score in weight from admission to discharge exhibited more favorable results in group with NST (-1.30±0.69 vs. -1.71±0.97, $p = 0.047$), and the length of NICU stay significantly decreased in the group with NST (25.1±15.8 vs. 34.3±6.2, P= 0.001).
Conclusion: NST intervention in the NICU resulted in significant improvements in the provision of nutrition to preterm infants in the first week of life. There were also favorable clinical outcomes, such as increased weight gain and reduced length of NICU stay.

Keywords: Neonatal intensive care unit, nutritional support team, parenteral nutrition, premature infants

Introduction

Preterm neonates, mostly <1500 g birthweight and/or <32 weeks gestation; are liable to subsequent growth failure. Growth failure in premature neonates is associated with long term malnutrition and poor neurodevelopmental outcome [1, 2]. This can be ameliorated by balancing nutritional needs with optimal total parenteral nutrition (TPN) and aggressive enteral feeding [3]. Enteral feedings with human milk should be initiated as soon as clinically possible; ideally within 24 to 48 hours. Early enteral feedings are associated with better endocrine adaptation, enhanced immune function and gut maturation, decreased time to reach full feeds, and earlier discharge without increase in risk of NEC [4].

Minimal enteral or trophic feeds are sub nutritional quantities of milk feeds given during the first few days of life to stimulate the development of the immature gastrointestinal tract of the preterm infant; This practice, also called hypocaloric, trophic feedings, is characterized by a small volume feeding to supplement parenteral nutrition. Trophic feeds are usually given for 3 to 7 days prior to advancing feeding volume; PN is used as a supplement to enteral feedings or as a complete substitution (TPN) when adequate nourishment cannot be achieved by the enteral route [4]. The nutritional needs of VLBWIs are usually dependent on parenteral nutrition during early postnatal life [5]. Early PN minimizes weight loss, positively affects post-natal growth [6], and improves neurodevelopmental outcome [7]; However, TPN is also associated with complications of sepsis, and electrolyte disturbances [8]. PN should be started on the first day of life and as soon as possible in preterm or sick infants to decrease catabolism and to optimize postnatal growth [4].

TPN is challenging in developing countries because of the limited availability of components, shortage of qualified health care professionals, and difficulties in preparation and administration [9].

This prospective study aimed to investigate the nutrition support of preterm neonate and VLBWts to evaluate current practice and identify areas of improvement and evaluate the effect of introduction of early nutritional support on neonatal growth and health.

Patient and method

This was a prospective study conducted on preterm infants who were admitted to the NICU of Baghdad teaching hospital and those who were admitted to NICU of AL-Elwea maternity hospital in Baghdad during period between first of April 2023 to first of December 2023. The inclusion criteria included inborn neonates who were equal or less than 32 week gestational age at birth or who had birth weights equal or less than 1500 g. patients diagnosed with a major congenital anomaly or inborn error of metabolism or who died within one week of life were excluded. We divided the patients into two groups: group with NST who were admitted to NICU of Baghdad teaching hospital and group without NST who were admitted to NICU of AL-Elwea maternity hospital. The two groups were used different practice in nutrition. Clinical and nutritional outcomes were compared between them. In the group with NST, there were nutritional support team composed of neonatologist pharmacists, and nurses, coordinate together.

Enteral feeding was started as clinically possible, ideally within 24-48 hours, with trophic feeds which are usually given for 3 to 7 days prior to advancing feeding volume. Parenteral nutrition (PN) was used as a supplement to enteral feedings or as a complete substitution (TPN all nutrients: fats, carbohydrates, proteins), when adequate nourishment cannot be achieved by the enteral route. Tasks were based on NICE guidelines [10]. These guidelines have recommendations on whom and when to start TPN, constituents, monitoring, and stopping TPN. In the group without NST, enteral feeding was started as clinically possible usually at day (6-8) and according to judgment of the attending pediatrician. Enteral feeding was supplemented with intravenous dextrose, dextrose saline, and no total parenteral nutrition was given in this group. Nutritional and clinical data were collected via reviews of the patients' medical records. The clinical data for the preterm infants included gestational age, birth weight, mode of delivery, length of NICU stay, and other comorbidities. The infants' weights at admission and discharge were adjusted for gestational age with reference to the Fenton 2013 preterm growth chart [11]. The nutritional data included the daily intake of energy, protein, lipids and glucose during the first 7 days of life, the number of days to the initiation of enteral feeding, the number of days to reach full enteral feeding (>120 ml/kg/day) and the number of days on PN. The amount of energy intake was calculated by adding both non-protein and protein calories. The parenteral intake and the enteral intake were added to determine the total intake per day.

Statistical analysis

The significance of difference of different means (quantitative data) was tested using Students-t-test for difference between two independent means or Paired-t-test for difference of paired observations (or two dependent means). The significance of difference of different percentages (qualitative data) was tested using Pearson Chi-square test (χ^2-test) with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

Results

Fifty patients from the group with NST and fifty patients from the group without NST were included in the study; there were no differences in gestational age at birth (30.6±1.6 vs. 30.2±1.9 weeks, respectively), birth weight (1370±163 vs. 1381±179 g, respectively), maternal history of chorioamnionitis, or respiratory distress syndrome of newborn between the two groups (Table 1).

Table 1: Demographics of the study population

	With- NST (n= 50)	Without- NST(n= 50)	P-value
GA (week)	30.6±1.6	30.2±1.9	0.278
Birth weight (g)	1370±163	1381±179	0.777
CS	44 (88%)	23 (46%)	0.0001
PROM	8 (16%)	22 (44%)	0.002
CAM	4 (8%)	4 (8%)	_
PIH	9 (18%)	_	0.002
Maternal DM	12 (24%)	4 (8%)	0.029
AS 1 min	4.07±2.03	3.65±1.9	0.12
AS 5 min	6.3±1.7	6.05±1.6	0.28
RDS	50 (100%)	50 (100%)	_

Abbreviations: *GA* gestational age, *CS* caesarian section, *PROM* premature rupture of membrane, *CAM* chorioamnionitis, *PIH* pregnancy induced hypertension, *DM* diabetes mellitus, *AS* Apgar score, *RDS* respiratory distress syndrome. Values are presented as means ± SDs or numbers (%)

The daily energy intake during the first week of life was more and significantly different in the group with NST than the group without NST (days 1–7); as did the protein, lipid, and glucose intake per day (days 1–7), (Table 2). The cumulative energy delivery during first week of life increased from 256.6 kcal / kg in the group without NST to 657.7 kcal /kg in the group with NST (Table 2). All of the patients that enrolled in the study received glucose within 24 hrs. of admission according to the basic institutional protocol, however; the time of protein and lipid initiation differed on a case-by-case. Where in the group with NST, lipids and proteins were initiated earlier (1.8±0.8 vs. 7.8±4.7 days, $p = 0.0001$). Also the initiation of enteral feeding was earlier in the group with NST compared with the group without NST (2.2±1.0 vs. 7.8±4.7 days, $p = 0.0001$).

Table 2: Nutrition delivered during the first week of life

	PND	With- NST	Without -NST	p-value
Energy (kcal/kg)	1	54.34±14.11	32.98±5.59	0.0001
	2	70.92±15.03	39.37±6.98	0.0001
	3	82.48±22.15	25.25±6.92	0.0001
	4	96.12±27.78	31.82±10.04	0.0001
	5	109.46±32.57	38.68±11.58	0.0001
	6	116.52±29.96	42.42±13.64	0.0001
	7	127.84±33.41	46.09±16.05	0.0001
	Total	655.5±147	256.6±61.8	0.0001
Protein (g/kg)	1	0.91±1.14	0±	0.0001
	2	1.76±1.27	0±	0.0001
	3	2.27±1.3	0.03±0.10	0.0001

	4	2.75±1.41	0.10±0.21	0.0001
	5	3.03±1.49	0.20±0.31	0.0001
	6	3.29±1.44	0.28±0.39	0.0001
	7	3.56±1.43	0.38±0.49	0.0001
	Total	17.57±8.6	0.99±1.4	0.0001
Lipid (g/kg)	1	0.47±0.56	0±	0.0001
	2	1.42±0.90	0±	0.0001
	3	2.01±1.07	0.05±0.16	0.0001
	4	2.82±1.27	0.17±0.36	0.0001
	5	3.42±1.42	0.33±0.52	0.0001
	6	3.82±1.43	0.47±0.66	0.0001
	7	4.39±1.48	0.64±0.83	0.0001
	Total	18.35±6.7	1.67±2.37	0.0001
Glucose (g/kg)	1	13.63±2.58	9.70±1.65	0.0001
	2	14.80±2.95	11.5±1.99	0.0001
	3	15.91±3.51	7.25±1.89	0.0001
	4	17.01±4.09	8.71±2.34	0.0001
	5	18.82±4.64	10.13±2.31	0.0001
	6	19.25±4.20	10.70±2.39	0.0001
	7	20.74±4.83	11.15±2.44	0.0001
	Total	120.33±19.36	69.13±13.55	0.0001

Values are expressed as means ± SDs. *Abbreviations: PND* postnatal day

The time to reach full enteral feeding was significantly decreased in the group with NST (14.4±4.1 vs. 19.6±10.9 days, $p = 0.007$), (Table 3).

Although there were no significant difference in the admission *Z*-scores and discharge *Z*-scores between the two groups; there was a significant decrease in the downward change of *Z*-scores between discharge and admission in the group with NST (-1.30±0.69 vs.− -1.71±0.97, $p = 0.047$) by paired *t*-test. There were no significant differences in the necrotizing enterocolitis rate or mortality rate between the two groups (Table 3).

Table 3: Results of nutritional intervention

	Group A	Group B	p-value
Lipid initiation (d)	1.8±0.8	7.8±4.7	0.0001
Time to initiation of enteral feedings (d)	2.2±1.0	7.8±4.7	0.0001
Time to reach full enteral feedings* (d)	14.4±4.1	19.6±10.9	0.007
Weight Z-score at admission	-0.40±0.72	-0.36±0.98	0.855
Weight Z-score at discharge	-1.70±0.94	-2.07±0.91	0.090
Weight Δ Z-score during hospital stay	-1.30±0.69	-1.71±0.97	0.047
Weight at discharge (grams)	1776.9±101.6	1413.5±138.3	0.0001
Length of NICU stay (days)	25.1±15.8	34.3±6.2	0.001
NEC	10 (20%)	11 (22%)	0.806
Mortality (n)	10 (20%)	13 (26%)	0.476

Values are expressed as numbers (%) or means ± SDs. *Full enteral feeding: ≥ 120 ml/kg/day *NEC*: necrotizing enterocolitis

Discussion

Nutritional support practice varies according to the hospital settings, resources available and the patient characteristics. It is widely accepted that nutritional support team (NST) involvement associated with many benefits; however; previous studies in this topic are confined to adult population. Thus, evaluation the effect of NST in a NICU setting must include outcomes appropriate to the neonatal populations. However, existing data are limited to fully describe the advantage of functioning NST in a NICU [12].

Premature neonate exhibit physiology differs from that of adult or pediatrics population, Consequently; they are require sufficient energy to survive, but this energy should be provided through stepwise approach to minimize the metabolic disorders that may be occur [13, 14]. In general; it is assumed that poor growth in premature infants primarily reflect inadequate nutrients intake [15].

Premature infant may requires 120 to 140 kcal/kg/ d for optimal weight gain [4]. This was more achieved at day 7 in group with NST implementation in our study.

In the present study NST interventions reduced the lag time for lipid administration; that enabled more calories provision and prevented the deficiency of essential fatty acids. A study conducted in Seoul National University Children's Hospital by Eurim Jeong *et al* [16]. showed comparable results. Previously; the practice was to withhold lipid in cases of sepsis, hyperbilirubinemia or respiratory insufficiency [13]. Studies regarding lipids administration have demonstrated conflicting results; however; current recommendations state that sepsis and hyperbilirubinemia are not absolute contraindications; and at the present time most authors recommend early administration of lipid and advancement to sufficient amount as tolerated [14, 17,18]. Critical illnesses induce increased demand for lipid because of increased rate of lipid oxidation, because neonates have limited fat stores; thus they are liable to fatty acids deficiency if they are given fat-free diets [19, 20].

The main function of NICU NST that differs from adult NST is promotion of appropriate growth [12]; A study evaluated the effect of NST on growth rates of neonatal populations [12] indicated that greater weight gain from birth to discharge was achieved after NST interventions. The advantage of our study is that weight was modified by age using *Z*-score, which provide better assessment of weight changes.

In the present study, the time to reach full enteral feeding was decreased in group with NST interventions; this in agreement with a study done by Eurim Jeong *et al* 2016 [16], where found comparable result.

Our study, showed that there is reducing mean length of NICU stay by about 9 days. This is in agreement with a study on adult population done by Naylor CJ *et al*, where found that**,** the implementation of early; and high quality nutritional therapy will reduce the length of hospital stay [21].

Conclusions

NST interventions in the NICU resulted in significant improvements in the provision of nutrition to preterm infants in the first week of life. There were also favorable clinical outcomes, such as increased weight gain and reduced length of NICU stay.

References

1. Mukhopadhyay K, Mahajan R, Louis D, Narang A. Longitudinal growth of very low birth weight neonates during first year of life and risk factors for malnutrition in a developing country. Acta Paediatr,2013:102:278-81.
2. Chien HC, Chen CH, Wang TM, Hsu YC, Lin MC. Neurodevelopmental outcomes of infants with very low birth weights are associated with the severity of their extrauterine growth retardation. Pediatr Neonatol,2018:59:168-75.
3. Patel P, Bhatia J. Total parenteral nutrition for the very low birth weight infant. Semin Fetal Neonatal Med,2017:22:2-7.
4. Gomella TL, Eyal FG, Mohammed FB. Nutritional Management. In: *Gomella's Neonatology.* Eighth edition. New York: McGraw-Hill Education, 2020, 130-131.
5. Parish A, Bhatia J. Early aggressive nutrition for the prematur infant. Neonatology,2008;94(3):211–214. doi: 10.1159/000143724.
6. Meyers JM, Greecher CP, Shaffer ML, Shenberger JS. Potential influence of total parenteral nutrition on body composition at discharge in preterm infants. *J Matern Fetal Neonatal Med*,2013:26(15):1548–1553.
7. De Curtis M, Dito L, Lucchini R, Terrin G. Nutrition of very low birth-weight infants. Ital J Pediatr,2014:40(Suppl 1):A39:S1–A39.
8. Zingg W, Tomaske M, Martin M. Risk of parenteral nutrition in neonates - an overview. *Nutrients*,2012:4(10):1490–1503. doi: 10.3390/nu4101490.
9. Murguia Peniche T, Kirsten GF. Meeting the challenge of providing neonatal nutritional care to very or extremely low birth weight infants in low-resource settings. *World Rev Nutr Diet*,2014:110:278–296. doi: 10.1159/000358476.
10. National Institute for Health and Care Excellence. Neonatal parenteral nutrition [Internet]. NICE, 2020. [updated Feb2020]. (NICE guideline [NG 154]). Available from: *https://www.nice.org.uk/guidance/ng154*
11. Fenton TR, Kim JH. A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants. *BMC Pediatr*,2013:13:59. doi: 10.1186/1471-2431-13-59.
12. Sneve J, Kattelmann K, Ren C, Stevens DC. Implementation of a multidisciplinary team that includes a registered dietitian in a neonatal intensive care unit improved nutrition outcomes. *Nutr Clin Pract*,2008:23:630–634. doi: 10.1177/0884533608326140.
13. Cloherty JP, Eichenwald EC, Stark AR. Manual of nutrition care, 5th ed. Lippincott Williams and Wilkins, 2004.
14. Russell EM. A.S.P.E.N. Nutrition Support Practice Manual, 2nd ed. American Society for Parenteral and Enteral Nutrition, 2005.
15. Embleton NE, Pang N, Cooke RJ. Postnatal malnutrition and growth retardation: an inevitable consequence of current recommendations in preterm infants? *Pediatrics*,2001:107(2):270–273. doi: 10.1542/peds.107.2.270.
16. Eurim J, Jung YH, Shin SH. The successful accomplishment of nutritional and clinical outcomes via the implementation of a multidisciplinary nutrition support team in the neonatal intensive care unit. *National Libraey Of Medicine*,2016:16:113. Available from: doi: 10.1186/s12887-016-0648-0.
17. Putet G. Lipid metabolism of the micropremie. *Clin Perinatol*,2000:27(1):57–69. doi: 10.1016/S0095-5108(05)70006-3.
18. Van Aerde JE, Sauer PJ, Pencharz PB, Smith JM, Heim T, Swyer PR. Metabolic consequences of increasing energy intake by adding lipid to parenteral nutrition in full-term infants. *Am J Clin Nutr*,1994:59(3):659–662.
19. Coss Bu JA, Klish WJ, Walding D, Stein F, Smith EO, Jefferson LS. Energy metabolism, nitrogen balance, and substrate utilization in critically ill children. *Am J Clin Nutr*,2001:74(5):664–669.
20. Friedman Z, Danon A, Stahlman MT, Oates JA. Rapid onset of essential fatty acid deficiency in the newborn. *Pediatrics*,1976:58(5):640–649.
21. Naylor CJ, Griffiths RD, Fernandez RS. Does a multidisciplinary total parenteral nutrition team improve patient outcomes? a systematic review. *JPEN J Parenter Enteral Nutr*,2004:28:251–258. doi: 10.1177/0148607104028004251.