Challenges in the management of neonatal surgical conditions under the absence of total parenteral nutrition

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The presence of surgical pathology, and the stress of surgery increases metabolic rate with resultant breakdown of body protein in adults as well as neonates.[1] This demands adequate intake of protein, fat, carbohydrate, minerals, trace elements, and multivitamins, preferably via the enteral route, to maintain positive nitrogen balance. Post operatively in surgical neonates, nutritional support is important for survival because the glucoronyl transferase enzyme that is required for gluconeogenesis is poorly developed and hepatic glycogen store may be exhausted within approximately 4 hours after birth.[1] Extraneous nutritional support is usually commenced within the first 6 hours of birth, but neonates who cannot feed enterally, as is the case in many surgical neonates, are often given supplementary or total parenteral nutrition (TPN). The importance of TPN cannot be overemphasized, as it has increased the survival of surgical neonates.[1] In many developing countries, absence of TPN is a major challenge when managing surgical neonates.[2] In view of this, a 2-year prospective study was undertaken at the University of Benin Teaching Hospital, and Leadeks Medical Center between January 2007 and December 2008, to managed surgical neonates in the absence of TPN. This paper reports the challenges and outcomes of managing surgical neonates under the absence of TPN.

After approval was obtained from the local Ethics Committee Board of the Leadeks Medical Center, consecutive cases of neonates who were assessed to require TPN were recruited for the study. The available alternatives in the absence of TPN were explained to parents, and caregivers, following which their consents were obtained. Only the neonates whose parents, or caregivers gave consent were included, while the child who was discharged against medical advice on financial grounds was excluded from the study. All the neonates were resuscitated, and fluid or electrolytes were adequately corrected. In the absence of TPN, management was dependent on the type and location of surgical pathology. These include, resection of entire dilated proximal bowel segment, avoidance of stoma formation, bowel resection with primary anastomosis, primary closure of perforation, enteroplasty, feeding (gastrostomy or enterostomy), transnastomotic feeding tube placement, warm saline (gastric or colonic) irrigation, and early commencement of oral feeds. The age at presentation, gender, surgical pathology, clinical conditions on arrival, morbidity, survival, and follow up were documented on preformed structured forms. The data obtained were analyzed using SPSS version 11 software package (SPSS, Chicago, IL, and USA) and presented in counts, frequency, and percentage. Continuous data were expressed in mean/SD.

A total of 106 neonates who weighed from 1.4-5.9 kg (mean 2.8 ± 1.7 kg), aged between one and 30 days (mean 8.3 ± 2.7 days), comprising of 64 males, and 42 females, with a male:female ratio of 1.5:1, including 84 (79.2%) who had surgical lesions involving the esophagus, and gastrointestinal tract were managed. Of these 84 neonates, 71 (84.5%) required total parenteral nutrition support. As shown in **Table 1**, these were neonates with intestinal atresia, gastroschisis, ruptured omphalocele, malrotation complicated by volvulus, and bowel gangrene, necrotizing enterocolitis with surgical complications, tracheoesophageal fistula, and bowel perforation. The neonates could not be fed per oral for more than 2-3 weeks after surgery due to loss of adequate bowel functions, or to protect distal anastomosis that made the use of TPN mandatory. Therefore, alternative means were employed to manage these neonates. All the neonates had strict fluid, and electrolytes maintenance as well as dextrose, and multivitamins infusions. Other management regimes are shown in **Table 1.**

The creation of stoma was avoided in babies with malrotation complicated by (volvulus or necrosis), with necrotizing enterocolitis, and those with bowel perforation. Resection, and primary anastomosis, or primary closure of perforations, were carried out that allowed early commencement of oral feds. Survival rates are shown in **Table 1**. Overall, alternatives to a total parenteral nutrition increased survivors to 38 (53.5%) from a near zero percent recorded with these lesions in previous years. Clinical conditions of the 33 (46.5%) neonates who eventually died continued to deteriorate on the above regimen. The presence of fluid, or electrolytes derangement recorded in 25 (75.8%) neonates, sepsis in 21 (63.3%) and respiratory compromise in 11 (33.3%) before presentation resulted in a rapid deterioration especially after 10 days of treatment without TPN. They subsequently developed progressive weight loss, hypotonia, lethargy, weak respiratory efforts, delayed wound healing, oral thrush, and nosocomia infections. Laboratory investigations revealed recurrent hypoglycemia, hypoproteinemia, and anemia. These continued until between the thirteenth and sixteenth day on admission when they died of inanition.

Many surgical neonates, especially those with gastrointestinal lesions, required nutritional support in

Table 1 - Indications for total parenteral nutrition, alternative measured taken, and outcomes.

Indications	n	(%)	Alternatives to total parenteral nutrition	Survivors n	(%)
Intestinal atresia	28	(39.4)	Resection of entire dilated proximal segment, enteroplasty, early commencement of oral feeds.	22	(78.5)
Gastroschisis	11	(15.6)	Resection of necrosed bowels, fluid or electrolytes maintenance, dextrose or multivitamins, oral glucose.	2	(18.2)
Ruptued omphalocele	8	(11.3)	Fluid and electrolytes, dextrose, multivitamins, maintenance, oral glucose.	3	(37.5)
Malrotation/volvulus	7	(9.9)	Resection of necrosed bowels with primary anastomosis, early commencement of oral feeds.	5	(71.4)
Necrotizing enterocolitis	7	(9.9)	Avoidance of stomas, resection with primary anastomosis, early commencement of oral feeds.	2	(28.6)
Tracheoesophageal fistula	6	(8.5)	Gastrostomy or enterostomy feeding.	2	(33.3)
Bowel perforation	4	(5.6)	Primary closure, avoidance of stomas, early commencement of oral feeds.	2	(50.0)
Total	**71**	**(100)**		**38**	**(53.5)**

this study, but unavailable TPN was a major challenge that resulted in many deaths, unlike what is obtained in centers with TPN.[1] Carbohydrates provide a major source of nutrition through parenteral, and enteral routes and the addition of even small amount of glucose to the nutrition was reported to prevent breakdown of somatic protein source and thus, acts as protein-sparing substrate.[1] In the presence of none or low amounts of glucose, neonates rapidly develop hypoglycemia resulting from inadequate hepatic production of glucose. When neglected, it can progress to death or irreversible brain damage. Also, the continued mobilization, and utilization of body fat and protein results in wasting that can progress to death if extraneous nutrition is not provided.[1] Methods adopted in managing surgical neonates in the absence of TPN succeeded in increasing survival to 53.5%. This is, however, poor when compared to a near 100% survival among similar surgical neonates where TPN is available.[1]

The decision to institute TPN to reduce mortality and morbidity must be weighed against the risk of serious complications of the technique, especially sepsis.[1] Although, older children and adults generally do not require TPN unless the period of starvation exceeds 7-10 days, TPN is mandatory in neonates if starvation exceeds 3 days. Intravenous fluid, or electrolytes maintenance, glucose, and multivitamin infusions alone sustained these neonates for up to 10 days in this study. Beyond 10 days, however, features of starvation supervened, which progressed rapidly to irreversible damage and deaths, especially among neonates with gastrointestinal lesions. The progression of weight loss, hypotonia, lethargy, weak respiratory efforts, delayed wound healing, occurrence of oral thrush and nosocomia infections, as well as laboratory confirmation of hypoglycemia, hypoproteinemia, and anemia, confirmed malnutrition in these neonates. Careful clinical examination is as accurate as more complex and expensive laboratory and anthropometric measurement in identifying malnutrition in stressed neonates.[1] Consequently, the features of malnutrition, which were supported by laboratory evidence, were easy to identify in the neonates during this study.

Of the 106 neonates managed during the period, a total of 67% required total parenteral nutrition support, which showed its importance in managing surgical neonates. Neonates with intestinal atresia, gastroschisis, ruptured omphalocele, malrotation complicated by volvulus, and bowel gangrene, necrotizing enterocolitis with surgical complications, tracheoesophageal fistula and bowel perforation who could not receive enteral feeds for more than 2 weeks, were the main group of neonates affected by lack of TPN.[3] Therefore, resection of entire dilated proximal segment, enteroplasty, and early commencement of oral feeds gave good results in babies with intestinal atresia.[1,3] Similarly, the use of improvised silo closure, warm saline (gastric, or colonic) irrigation, and resection of redundant, and obviously necrosed bowels segment increased the chance of survival of neonates with gastroschisis, and ruptured omphalocele. The associated massive loss of fluid, electrolytes, and nutrients in neonates with high intestinal stomas may result in death. In this study, therefore, the creation of stoma was avoided. Resection and primary anastomosis, or primary closure of perforations with early commencement of oral feds increased survival in neonates with (malrotation or volvulus), necrotizing enterocolitis, and bowel perforation who, required stoma formation. Gastrostomy, enterostomy, and transanastomotic tube inserted for feeding of babies with tracheoesophageal fistula, which are no longer in

use in centers with TPN, were tried without success in this study.[4] The presence of compromised clinical conditions such as (fluid or electrolytes) derangement, established sepsis and aspiration, which resulted in respiratory impairment before presentation increased muscle breakdown that necessitated the use of TPN. This corresponds with the studies on older children and adults, but is contrary to the experiences of other authors who did not record any significant difference in metabolic rates between compromised and stable neonates.[5]

In conclusion, the importance of TPN was obvious in this study, as many babies who required it did not survive. The resection of entire dilated proximal bowel segment, avoidance of stoma formation, bowel resection with primary anastomosis, primary closure of perforation, enteroplasty, feeding (gastrostomy or enterostomy), transnastomotic feeding, warm saline (gastric or colonic) irrigation, and early commencement of oral feeds increased survival rate. The importance of TPN cannot be overemphasized, but where it is unavailable, the use of these alternatives may salvage some surgical neonates.

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