Implementing Standard Parenteral Nutrition in the PICU

A quality improvement approach

Shannon Hartell
Senior Specialist Paediatric Critical Care Dietitian,
Evelina London Children's Hospital, United Kingdom (UK)

Optimal nutrition is essential for improving patient outcomes in the PICU, as discussed in earlier parts of this series.[1] Barriers to nutrition provision, such as feed intolerance, feeding interruptions, clinical instability and contraindications to enteral feeding, can significantly hinder the ability to meet nutritional goals through enteral feeding alone. In these circumstances, parenteral nutrition (PN) may be indicated.[2-4]

PN is a potentially lifesaving therapy, used either exclusively or as a supplementary form of nutrition, and can help patients meet their nutritional requirements while supporting improved clinical outcomes.[1, 5] Both standard formulations and individualised PN prescriptions may be appropriate. Standard PN should be considered first line unless contraindicated, as it can reduce prescribing and ordering errors and support timely initiation of PN.[5-7]

Identifying the need for standard PN

In 2023, we conducted a clinical audit evaluating the appropriateness of PN prescribing practices in the PICU at Evelina Children's Hospital. At the time, the unit relied solely on individualised bespoke PN, compounded externally and prescribed according to standardised regimens used across the trust. The audit reviewed PN indications, timing of initiation – particularly in relation to the Early Versus Late Parenteral Nutrition in the Pediatric Intensive Care Unit (PEPaNIC) randomised controlled trial – duration of PN and macronutrient content, benchmarking these against the 2018 European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) paediatric parenteral nutrition guidelines.[4-8]

The audit revealed that PN prescribing practices did not align with international guidance. Issues included inappropriate macronutrient prescriptions and early initiation of PN within the first seven days of admission.[9] These findings prompted a comprehensive review of prescribing practices, with an emphasis on delaying PN initiation where clinically appropriate and moving away from the trust's standard macronutrient regimens.

"Standard PN should be considered first line unless contraindicated, as it can reduce prescribing and ordering errors and support timely initiation of PN.[5-7]"

Individualised PN prescribing carries several challenges, including increased complexity and risk, potential delays in commencing PN if ordering deadlines are missed, and additional pressure on pharmacy services.[6, 7] In our unit, this was compounded by high levels of waste due to the need for advance ordering ahead of weekends and bank holidays.

Given the audit findings, the subsequent changes to prescribing practices, and the operational challenges identified, the need for standardised PN became increasingly clear. We anticipated that introducing standard PN would improve access, reduce wastage associated with advance ordering, and enhance patient safety by minimising prescribing and ordering errors.

Selecting the appropriate standard PN formulation

Once the need for standardised PN was established, the next step was to determine the most appropriate product. This process involved multidisciplinary collaboration between pharmacists, dietitians and intensivists. Key considerations included:

- Whether to develop a bespoke standard formulation or adopt an existing commercial product
- Age-based indications
- Nutritional composition and volume
- Suitability for central versus peripheral administration.

Given the needs of our unit, we chose to explore existing standard PN products rather than develop a unique formulation. After reviewing the available options on the market, we identified two products that met both patient and service requirements. These were shelf-stable, three chamber bags designed for two age groups (0-2 years and 2-18 years), with macronutrient and electrolyte compositions aligned with the 2018 ESPGHAN PN guidelines.

Both products were concentrated and intended for central administration only, making them suitable for our frequently fluid-restricted patient cohort. The proposed products were presented to the senior PICU team for final consultation and were subsequently approved for implementation.

Implementation

Implementation of the products followed a multi-stage process over approximately three months. The key stages included:

- Development of prescribing guidance
- Education and training of staff
- Scoping phase
- Go-live
- Service evaluation and audit.

Development of prescribing guideline

The first stage involved developing a prescribing guideline to accompany the existing trust wide PN policy. This guideline was designed specifically for PICU and included product information, prescribing considerations, storage requirements, activation and administration instructions, and build up regimens. It also supported prescribing in the absence of the nutrition team, such as during weekends or bank holidays.

The guideline specified that standard PN could be used as the sole source of nutrition for up to 7 days, after which a switch to individualised PN was recommended. This limitation reflects the unit's lack of facilities to add micronutrients or electrolytes to the standard bags.

Once completed, the guideline was submitted to the clinical guidelines committee and approved for use. It was updated during the early go-live period and has since been revised again to include guidance on administering the product as a two chamber infusion (without lipid activation).

Education and training of staff

Staff involved in prescribing, dispensing and administering the products received training prior to the go-live date. The pharmaceutical company delivered training on product handling, activation and quality control, while the dietetic and pharmacy teams provided additional teaching on prescribing and administration. This training continued into stage one of go-live to ensure broad staff coverage.

Education on PN prescribing, administration and the use of standard bags has now been incorporated into the induction programme for all new PICU starters.

The scoping phase

In the month preceding go-live, the nutrition team (pharmacist and dietitian) collected data on all PICU patients commencing PN. Each patient was assessed to determine whether they would have been suitable for standard PN. These data informed ordering requirements and ensured adequate stock levels for launch.

Go-live

Go-live was conducted in two stages, with data collection beginning on day one.

Stage one restricted prescribing of standard PN to the nutrition team, making it available Monday to Friday only. This allowed the team to identify, document and resolve any issues before expanding access to weekend ordering. After six weeks, the guideline was updated and weekend PN ordering was introduced.

Stage two began with the introduction of weekend ordering and continued until the end of the year, four months after implementation. This phase focused on ongoing data collection and on shifting perceptions around the use of standard PN through continued education and feedback based on clinical experience.

Stage two concluded with a review of staff experiences, after which the team moved into the final phase: analysing the data and presenting the findings

Service evaluation and audit

Following completion of the go-live period, a service evaluation was undertaken. This included analysis of the four months of collected data and review of staff feedback regarding their experience with the product.

The primary aim was to assess the safety and effectiveness of standard PN on PICU. Findings aligned with existing literature, demonstrating that standard PN was safe and effective for this patient group. The main reasons for transitioning to individualised PN were lipid unsuitability – likely related to frequent Intralipid use for propofol infusion – and the need for PN beyond seven days. These findings highlighted the value of introducing two chamber bags, which will form the next stage of the project. Staff feedback was positive; all respondents felt the product was beneficial for the patient group, and more than half reported that prescribing, dispensing or administering standard PN was easier than with individualised PN.

The evaluation also demonstrated a potential cost-saving benefit, attributed both to the lower cost of the product and reduced wastage.

An abstract based on this service evaluation was later submitted to the 2025 ESPGHAN Congress and the 2025 Paediatric Critical Care Society Conference, with both submissions accepted.

Conclusion

The implementation of standard PN in the PICU has demonstrated that a structured, evidence-aligned approach can meaningfully improve the safety, timeliness and consistency of PN delivery. By addressing the operational challenges associated with individualised PN and ensuring access outside core nutrition team hours, the project has enhanced our ability to provide reliable nutritional support to critically ill children.

While the transition required cultural and practical adjustments, the benefits have been clear: reduced prescribing complexity, improved workflow efficiency, and strengthened multidisciplinary engagement with nutrition care. Staff feedback and early outcome data reinforce that standard PN is a safe and effective option for the majority of patients requiring short term parenteral support.

Looking ahead, the introduction of two-chamber formulations and exploration of intravenous micronutrient provision will further refine our service and reduce the need for bespoke PN. Importantly, the cost savings and operational efficiencies achieved have supported the development of a dedicated nutrition team, laying the groundwork for wider adoption of standard PN across paediatric services. This work represents a significant step toward delivering consistent, high quality nutritional care for all children requiring PN within our organisation.

"Looking ahead, the introduction of two-chamber formulations and exploration of intravenous micronutrient provision will further refine our service and reduce the need for bespoke PN"

References: **1.** Abad-Jorge A (2013). Nutrition management of the critically ill pediatric patient. ICAN: Infant Child Adolesc Nutri.; 5(4): 221–230. **2.** Tume LN, *et al.* (2021). Practical strategies to implement the ESPNIC nutrition clinical recommendations into PICU practice. Clin Nutr ESPEN.; 42: 410–414. **3.** Tume LN, *et al.* (2020). Nutritional support for children during critical illness: European Society of Pediatric and Neonatal Intensive Care (ESPNIC) metabolism, endocrine and nutrition section position statement and clinical recommendations. Intensive Care Med.; 46(3): 411–425. **4.** Jacobs A, *et al.* (2019). Early supplemental parenteral nutrition in critically ill children: An update. J Clin Med.; 8(6): 830. **5.** Arnell H, *et al.* (2019). Safety of a triple-chamber Bag Parenteral Nutrition in children ages up to 24 months. J Pediatr Gastroenterol Nutr.; 69(6): e151–e157. **6.** Puntis, JWL, *et al.* (2018) ESPGHAN/ESPEN/ESPR/CSPEN guidelines on Pediatric Parenteral Nutrition: Organisational Aspects. Clin Nutr.; 37(6): 2392–2400. **7.** Riskin A, *et al.* (2018). ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Standard versus Individualized Parenteral Nutrition. Clin Nutr.; 37(6): 2409–2417. **8.** Fivez T, *et al.* (2015a). Impact of withholding early parenteral nutrition completing enteral nutrition in pediatric critically ill patients (PEPaNIC trial): Study protocol for a randomized controlled trial. Trials.; 16(1): 202. **9.** Payne J, *et al.* (2024) P40 appropriateness of parenteral nutrition prescribing in Paediatric Intensive Care Patients. BMJ Paediar Open.; https://doi.org/10.1136/bmjpo-2024-NPPG.50.