Are patients on PN adequately fed?

Manchester University
NHS Foundation Trust

Marie Labaquere
Senior Specialist HPB Dietitian
Supplementary prescriber, Oxford road site

Methods

Specialist Dietitians from 4 different specialties compared Parenteral Nutrition (PN) requirements with PN prescriptions issued for each patient:

- for 9 components - fluid, calories (Kcal), nitrogen (N), fat, sodium (Na), potassium (K), magnesium (Mg), calcium (Ca) and phosphorus (PO4)
- for each day - bags were made up Bespoke or to a certain volume of Standard bags (N4 peripheral or N7/N9 central access bags).

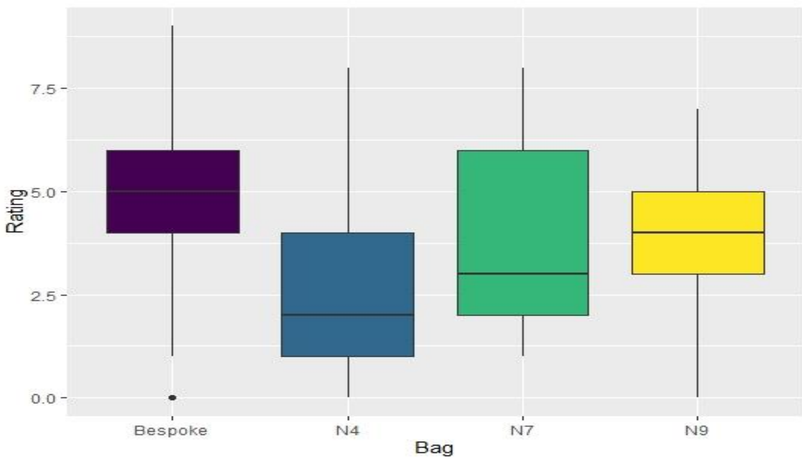
The data was gathered prospectively by Dietitians during their assessment, between June and July 2021.
53 patients required PN, 6 were excluded because the data was incomplete. 636 days (bags) prescribed to 47 patients were analysed.

Results

Bag ratings

Bags were rated on their nutritional provision against estimated requirements by summing the number of components that were within the clinically acceptable range (score 9 for the best bag and 0 when none of the components were in range).

A Kruskal wallis test was applied, which confirmed that the bags performed differently, and this was significant ($p<0.001$) with Bespoke performing the best (score 5 (4, 5.75)) and N4 preforming the worst (score 1 (1, 3)).



Average success rate

Success rate of prescriptions meeting nutritional requirements for all 9 nutritional components was poor:

- Critical Care: 53%
- Gastro/ Colorectal: 46%
- HPB medical/ Surgical: 43%
- Haematology: 40.8%

Breakdown of bags used by each team and prescriptions adequacy

Patients' needs and dietetic practice vary greatly between specialist teams, depending on line access, clinical team practices and clinical factors such as fluid restrictions.

Critical care's ratings were the best because of the predominant use of central lines for administering PN, which allows for more flexibility in selecting PN bags.

In Gastro/ Colorectal and HPB, N4 bags are used peripherally, short term (<2 weeks), often pre/ post surgery, when there is suspicion of gastric outlet obstruction or ileus. These prescriptions often provided less than the clinically acceptable range.

Haematology's prescriptions performed the worst, despite a higher percentage of Bespoke prescriptions. This is likely related to fluid restrictions and negatively skewed the average Bespoke bags' performance results (score 5/9).

Critical care

Bag prescribed	n=105
N4 1.5L	0 (0%)
N4 2.5L	0 (0%)
N7	0 (0%)
N9	83 (79.0%)
Bespoke	22 (21.0%)

38.1% of prescriptions provided lower amounts of N than the clinically acceptable range, increasing the risk of further muscle loss. 78% of prescriptions were too low in K and 52.4% too low in Mg.

35.2% provided excessive amounts of kcal, purposefully to account for interruptions to feeding and meet N requirements. But 30% provided excessive fat, increasing the risk of metabolic complications such as hyperglycaemia and hyperlipidaemia.

Gastro/ Colorectal

Bag prescribed	n=100
N4 1.5L	23 (23%)
N4 2.5L	19 (19%)
N7	0 (0%)
N9	28 (28%)
Bespoke	30 (30%)

28% of prescriptions were too low in N and 16% too low in Kcal, increasing the risk of deconditioning.

A large proportion of prescriptions were also too low in electrolytes:

86% (Ca), 77% (PO4), 64% (Na), 63% (K), 51% (Mg), increasing the need for additional lines and electrolyte replacement on the ward.

HPB medical/ surgical

Bag prescribed	n=188
N4 1.5L	51 (27.1%)
N4 2.5L	50 (26.6%)
N7	56 (29.8%)
N9	31 (16.5%)
Bespoke	0 (0%)

80.9% of prescriptions exceeded the acceptable range for fat, increasing the risk of metabolic and hepatobiliary complications.

But in 41.5% and 25.5%, kcal and N content was too low, increasing the risk of physical deconditioning.

Many prescriptions were also too low in electrolytes: 63.3% (K), 56.4% (PO4), Ca (53.7%) and 53.2% (Na).

Haematology

Bag prescribed	n=243
N4 1.5L	4 (1.6%)
N4 2.5L	12 (4.9%)
N7	124 (51.0%)
N9	2 (0.8%)
Bespoke	101 (41.6%)

35.2% of prescriptions were too low in kcal.

Prescriptions were also often too low in electrolytes: 78.1% (K), 67.6% (Ca), 61% (Na), 52.4% (Mg).

In this patient group, there is a heavy reliance on PN (vs EN) which is reflected in the higher number of PN prescriptions compared to other teams. Heavy IV burden (blood products, medications) due to severe mucositis has a negative impact on fluid allowance, which limits PN volume and content.

Discussion

These results contradict popular belief that patients who receive PN are adequately fed. The practical limitations and risk of underfeeding should be considered when making a clinical decision to use the parenteral feeding route.

Nationwide, standard bags are predominantly used due to reduced costs, better safety profile and same day availability. Across our teams, PN prescriptions adequacy was limited by lack of access to central line placement and fluid restrictions. Limited access to the full range of commercial standard PN bags (higher N, fat free, SMOF lipids) and the lack of Aseptics' capacity for on-site electrolytes additions also impacted on PN prescriptions' adequacy, leading to significant underfeeding.

Future studies should look at actual nutritional deficit by comparing patients' needs and PN administered.