Original Article

Appropriateness of the Use of Parenteral Nutrition in a Local Tertiary-Care Hospital

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Abstract

Introduction: Parenteral nutrition (PN) is an important supportive therapy for critically ill patients who have non-functioning gut. However, it is an expensive therapy and carries significant complications. The objective of our audit was to determine the appropriateness of prescription of PN in our hospital, based on the American Society for Parenteral and Enteral Nutrition (ASPEN) 2002 guidelines. In our hospital, the prescription of PN is managed by the Nutrition Support Team. Materials and Methods: A retrospective review of adult patients prescribed with PN in 2001 was undertaken. Data on patient demographics, underlying diagnoses, indications, duration and routes administration were collected. The use of PN was classified as "appropriate", "inappropriate" or "indeterminate" by the authors based on the above guidelines. Results: 145 patients were prescribed PN in 2002. We were able to review the case notes for 137 patients. One patient received PN on 2 separate admissions. Of the 138 courses of PN (in 137 patients) reviewed, there were 88 males with the median age of 61 years (range, 16 to 91 years). 81.2% were surgical patients and of the remaining patients, 10.1% had haematological malignancies. The 2 most common indications were postoperative ileus (37.0%) and post-surgical complications (14.5%). The median duration of PN prescription was 9 days (range, 1 to 175 days). 109 (78.3%) courses of PN were classified as "appropriate", 22 (15.9%) courses as "inappropriate" and 7 (5.8%) courses as "indeterminate". Patients from the postoperative ileus group contributed to 10 (45.5%) patients with "inappropriate" indications; the main reason was premature initiation of PN. Of the patients considered to show "inappropriate" indications, 15 courses (68.1%) were prescribed for less than 7 days. PN was discontinued in 78% of courses due to satisfactory resumption of oral or enteral intake. The mean duration of PN use for patients with "inappropriate" indication was significantly shorter than for patients with "appropriate" indication (7.7 ± 5.3 days versus 15.8 ± 20.0 days, $P = 0.002$). 99.3% of PN courses were given via the central routes (with central vein cannulation or PICC). These lines were specifically inserted for PN in 60.14% of the cases. Conclusion: Our audit showed that 15.9% of PN prescriptions were inappropriate according to the ASPEN guidelines. This was largely attributed to premature initiation of PN for postoperative ileus. We believe that these PN courses could have been avoided if these patients had been tried on naso-jejunal tube feeding, or oral nutrition with the use of prokinetics during the postoperative period.

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Key words: Indications for parenteral nutrition, Nutritional support, Postoperative ileus

Introduction

Parenteral nutrition (PN) is an important supportive and often life-saving therapy for patients with gut failure.[1] However, it is expensive and carries significant complications such as electrolyte disturbances, hyperglycaemia, hypertriglyceridaemia, hepatobiliary complications and line-related complications.[2,3]

Much research has been done in attempting to identify patients who are most likely to benefit from PN, but characteristics of these patients remain poorly defined and controversial.[4] Though enteral nutrition (EN) cannot be definitively proven to be superior to parenteral nutrition (PN) in many disease states, there is still a general preference to use EN whenever possible. Perceived advantages of EN

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include maintenance of gut integrity, reduced infections, decreased cost and length of hospital stay.[5] The American Society of Parenteral and Enteral Nutrition (ASPEN) guidelines for the use of parenteral and enteral nutrition in adult and paediatric patients[5] provide a general clinical direction for selecting suitable PN candidates.

Previous audits have reported fairly variable rates of inappropriate PN use of between 0% and 38%.[2,6-9] These audits, however, had varying definitions of appropriate use. So far, only 1 institution has evaluated their practices against the previous ASPEN guidelines.[2] The objective of our audit was to determine the indication and appropriateness of PN prescription at the Singapore General Hospital, an acute tertiary-care hospital, as based on the 2002 ASPEN guidelines. Prescription of PN in our hospital is managed by a multi-disciplinary Nutrition Support Team consisting of physicians, pharmacists, dietitians and nurses.

Materials and Methods

Medical records and PN order forms of patients who were prescribed PN in the year 2001 were reviewed. Neonatal and paediatric patients were excluded. Data collected from the records included patients' demographics, underlying diagnoses, indication for PN, duration of PN and route of administration. For patients who were started on PN due to ileus, the maximum daily volume of gastric residue, number of days in ileus and trial of any feeding and/or prokinetics were recorded. If patients were on PN for less than 7 days, the reason was also recorded.

For each patient reviewed, the prescription of PN was classified as "appropriate", "inappropriate" or "indeterminate", as based on the 2002 ASPEN guidelines. If patients were unable to use the gastrointestinal (GI) tract due to diffuse peritonitis, intestinal obstruction, intractable vomiting, paralytic ileus, intractable diarrhoea or GI ischaemia, or were expected not to be able to eat adequately for more than 7 days, PN prescription was considered "appropriate".[5]

For patients put on perioperative PN, they were considered "appropriate" regardless of when PN was started relative to the operation, as long as they were malnourished. Though there is no consensus on the definition of malnutrition,[10] some important and common markers include body mass index (BMI), serum albumin and severity of weight loss.[10] We considered those with a BMI of less than 18.5 or unintentional weight loss of more than 10% over the previous 3 months as malnourished.

For patients with postoperative ileus, indication for PN was considered as "appropriate" if patients had been unable to tolerate enteral intake for at least 7 days postoperatively. We did not take into consideration the site of surgery, surgical team's concern of prolonged ileus or fear of anastomotic leak, or nutritional state of the patients.

For patients with intestinal obstruction due to advanced cancer, PN prescription was considered "appropriate" if active treatment was planned for the patients. Active treatment could be in the form of surgical treatment such as defunctioning colostomy or ileostomy, or chemotherapy. However, the indication was considered "inappropriate" if the patient was for conservative management, and "indeterminate" if the treatment plan was unknown. As EN has been shown to be safe in patients with mild to moderate pancreatitis, those started for pancreatitis were considered "appropriate" if their pancreatitis was severe or was complicated by pseudocysts, intestinal or pancreatic fistulae, pancreatic abscesses or pancreatic ascites.[5]

The data were coded and entered into MINITAB Version 10 (Minitab Inc, State College, USA) for analysis. Descriptive data on the patient demographics, details pertaining to PN utilisation, appropriateness of PN prescription and patient outcome were generated.

Results

A total of 145 adult patients were started on PN in 2001. One patient was started on PN on 2 separate admissions for different indications and this was considered as 2 courses. The medical records of 8 patients were unobtainable and they were excluded from further analyses. This audit was based on the data of 137 patients and their 138 courses of PN. The demographic data and patient outcome are shown in Table 1. PN was most commonly used for surgical patients (112 courses, 81.2%). Of the 26 medical patients, the majority had haematological malignancies (50%). Ninety-seven patients had underlying malignancies, with colorectal cancer being the most common.

Details on PN utilisation are shown in Table 2. More than a third of patients were started on PN for postoperative ileus. For patients with ileus, the median duration of ileus was 7 days (range, 2 to 21 days). Nasogastric and nasoenteric tube feeding was attempted in 28 patients. Twenty-four of these patients also had prokinetics, most commonly intravenous metoclopramide. The mean daily gastric residue was 1172 mL (SD, ± 749 mL)/day.

Other common indications for PN were for perioperative nutritional support (12 patients), postoperative complications such as anastomotic leaks or fistula (20 patients), chemotherapy-associated mucositis in patients undergoing bone marrow transplantation (12 patients) and intestinal obstruction due to intestinal obstruction from malignancies and carcinomatosis peritonei (16 patients). Two patients had gastrointestinal fistula; 1 from Crohn's disease and the other from post-radiation enteritis.

In the miscellaneous group, there were 3 patients with chylous leak, 1 patient with bleeding duodenal ulcer after

Table 1. Patients' Baseline Demographics Data

Baseline demographics	
Male:Female, No.	88:49
Age, median (range), y	61 (16-91)
Referring department, No. (%)	
Surgical	112 (81.2)
General surgery	41 (29.7)
Colorectal surgery	59 (42.8)
Cardiothoracic surgery	12 (8.7)
Medical, No. (%)	26 (18.8)
Oncology	6 (4.3)
Haematology	13 (9.4)
Gastroenterology	2 (1.5)
Others	5 (3.6)
Underlying malignancies, No. (%)	
No malignancies	41 (29.7)
Laryngeal	2 (1.5)
Oesophagus	4 (2.9)
Stomach	10 (7.2)
Colorectal	50 (36.2)
Gynaecological	4 (2.9)
Haematological	14 (10.1)
Others	13 (9.5)

Table 2. Indications for Parenteral Nutrition

Indication	No.	%
Perioperative nutritional support for malnutrition	12	8.7
Postoperative ileus	52	37.0
Postoperative complications (e.g. leaks, fistulas)	20	14.5
Short bowel syndrome	3	2.2
Pancreatitis	5	3.6
Gastrointestinal fistula	2	1.5
Advanced cancer with GI obstruction (peritoneal metastases)	16	11.6
Mucositis	12	8.7
Miscellaneous	16	12.4

GI: gastrointestinal

hepatectomy, 1 patient with infected percutaneous endoscopic gastrostomy, 8 critically ill patients, 2 patients undergoing radiotherapy (1 for bladder carcinoma and another for cricoid carcinoma), and 1 patient with recurrent intestinal obstruction from adhesion.

The median duration of PN was 9 days (range, 1 to 175 days). Forty-four patients (31.9%) were treated with PN for <7 days. The main reason for termination of PN was that patients were able to tolerate enteral or oral nutrition (35 patients). Other reasons for termination were line infection and death. Only 1 patient in this cohort received peripheral PN; all the remaining patients received their PN through the central route with central vein cannulation (112) or percutaneously inserted central catheter (PICC) (25). These central vein cannulations were carried out specifically for the delivery of PN in 83 patients (60.1%). The other patients already had an existing central line.

Of the 138 PN courses reviewed, 108 PN starts (78.3%) were considered to be of "appropriate" indication, 22 (15.9%) "inappropriate" and 8 (5.8%) "indeterminate". The distribution of appropriateness of prescription according to indication, duration of PN and intention of line insertion is shown in Table 3.

In the perioperative PN group, 1 patient was considered to have received PN inappropriately as he was not malnourished. Patients from the postoperative ileus group contributed the most number of cases of inappropriate PN use (45.5%). In this category, PN was considered appropriate if patients had been in postoperative ileus for longer than 7 days. Ten patients were considered to have been started on PN inappropriately. Nine patients had been in ileus for less than 7 days. One patient was classified as "inappropriate" even though she had been in ileus for 12 days because she was able to tolerate enteral feeds by the time PN was started and received PN for 1 day only.

None of the patients with the indications of postoperative complications such as fistula/anastomotic leaks, short bowel syndrome, pancreatitis and gastrointestinal fistula was classified as "inappropriate" use of PN. We considered most of the cases with chemotherapy-associated mucositis as "appropriate" apart from 2 cases; these cases were considered as "inappropriate" and "indeterminate" because of improving mucositis and the ability to tolerate small amounts of oral nutrition. Seven patients were classified as either "inappropriate" or "indeterminate" from the group of patients with gastrointestinal obstruction from advanced malignancies. The reasons were the lack of active treatment plan or patients' poor functional and physical state.

In the miscellaneous group, 3 patients were put on PN due to postoperative chylous leak with chylothorax; these 3 cases were classified as "indeterminate". In this group, 6 patients were considered as having received PN inappropriately. One patient had intestinal obstruction but he was not malnourished and had only been in obstruction for 4 days. One patient was started on PN to allow recovery of an infected PEG site. This was not considered as a valid indication for PN as it was possible to use the gastrointestinal tract via nasojejunal tube feeding. The others were critically ill patients who should have been put on nasojejunal or nasogastric tube feeding.

The mean duration of PN use for patients with "inappropriate" indication was significantly shorter than for patients with "appropriate" indication: 7.7 ± 5.3 days versus 15.8 ± 20.0 days, $P = 0.002$ (paired Student's *t*-test). Twenty-three out of 51 (45.1%) in the postoperative ileus group received PN for less than 7 days and the main reason for termination of PN was the ability to tolerate enteral or

Table 3. Distribution of Appropriateness of Use According to Indication, PN Duration and Intention of Line Insertion

	Number	"Appropriate" No. (%)	"Inappropriate" No. (%)	"Indeterminate" No. (%)
Indications				
Perioperative	12	11 (10.2)	1 (4.5)	0
Postoperative ileus	51	41 (37)	10 (45.5)	0
Postoperative complications	20	20 (18.5)	0	0
Short bowel syndrome	3	3 (2.7)	0	0
Pancreatitis	5	5 (4.6)	0	0
GI fistula	2	2 (1.9)	0	0
GI obstruction	16	9 (8.3)	4 (18.2)	3 (42.8)
Mucositis	12	10 (9.3)	1 (4.5)	1 (14.4)
Miscellaneous	17	8 (7.5)	6 (27.3)	3 (42.8)
Total	138	109 (100)	22 (100)	7 (100)
Duration of PN				
<7 days	44	26 (23.1)	15 (68.1)	3 (50)
7-14 days	55	44 (40.7)	7 (31.9)	4 (50)
15-21 days	18	18 (16.7)	0	0
>21 days	21	21 (19.5)	0	0
Total	138	109 (100)	22 (100)	7 (100)
Line insertion				
Specifically inserted for PN	83	67 (67)	11 (50)	5 (62.5)
Not specifically inserted for PN	55	41 (40)	11 (50)	3 (37.5)

GI: gastrointestinal; PN: parenteral nutrition

oral feeds. Out of these 23 patients, 9 patients were classified as "inappropriate" as they had ileus for less than 7 days before initiation of PN.

Fifty per cent of patients considered to have received their PN "inappropriately" had central line insertion carried out specifically for the delivery of their PN.

Discussion

The degree of inappropriate TPN use from our audit, 15.9%, is comparable to that of a similar audit by Trujillo et al,[2] which used the 1993 ASPEN guidelines as their standard. Fifteen per cent of their 209 PN prescriptions were considered as "not indicated".[2]

More than a third of our patients were started on PN for postoperative ileus. We decided not to take the nutritional state of the patients into consideration when deciding the appropriateness of PN use due to the controversial benefits of postoperative PN.[5] Postoperative PN has been shown to result in an absolute increase in the rate of complications by approximately 10%.[5] While the appropriateness of starting PN in patients who have been in ileus for at least 7 days is undisputed, it is not as clearly defined for those who have been in ileus for less than 7 days. While it is difficult to predict when a patient may be able to tolerate enteral or oral feeds, PN in some of these patients could have been avoided if more patients had been tried on nasogastric/nasojejunal feeding with prokinetics during the postoperative period.[10,11] Studies have shown that early enteral nutrition is feasible and safe, and may well decrease morbidity in surgical patients.[2] Recent recommendations suggest that surgeons' reluctance to use the gastrointestinal tract may not always be warranted. In our series, PN courses had been initiated in many of these patients due to surgeons' expectations of prolonged ileus. We believe that PN could have been started prematurely during the postoperative period. This hypothesis is supported by our observation that a substantial proportion of patients (15 out of 23) required PN for <7 days due to resumption of satisfactory oral/enteral nutrition. This finding suggests that more aggressive enteral or oral feeding could have reduced the unnecessary use of PN. This could also have reduced the number of central lines inserted and the possible complications from these line insertions.

Preoperative PN was shown to decrease postoperative complications by about 10%,[5] with the benefits especially seen in the severely malnourished patients. Ideally, patients who need nutritional build-up should receive PN for 5 to 7 days before the operation.[5] Due to lack of complete information on the urgency of the operation and current climate of cost control, prescription of PN was considered "appropriate" as long as the patients were malnourished, even if PN was given for <5 days preoperatively. One randomised clinical trial by Bozzetti et al[12] showed that 10 days of preoperative PN continued for 9 days postoperatively could reduce complication rates by about one-third in severely malnourished patients with gastrointestinal cancers.

It is not clear, however, whether a shorter period of preoperative PN would be of benefit, which is the case in most of our patients.

Patients undergoing bone marrow transplant (BMT) have been shown to benefit from PN.[10] The optimal duration of PN and time of initiation are still unclear due to the limited data on PN use in BMT patients. Intuitively, the ASPEN guidelines advise discontinuation of PN after mucositis has resolved.[5] As such, we considered most of the PN prescription for mucositis to be "appropriate". An audit at the Mayo Clinic concluded that for haemopoietic stem cell transplant patients, PN should not be started until oral caloric intake is less than 50% of estimated needs.[13] However, more studies are needed to determine if this is indeed the correct guideline for the prescription of PN in haematological patients.

One of the most controversial areas in PN is its use in cancer patients. The only possible benefit of PN in cancer is when it is given preoperatively to moderate to severely malnourished patients for 7 to 14 days. It has no benefit when given as an adjunct to chemotherapy, and may even lead to adverse outcomes.[5] The Working Group of the European Association for Palliative Care recommends that PN should be considered only for patients who may die of starvation rather than from tumour spread.[14,15] However, it is often difficult to make this distinction, even in patients with metastatic cancer who generally have a poor prognosis. The ASPEN guideline recommends that nutritional support with PN or EN is reasonable in patients for whom some active treatment is planned.[5] This is especially so for patients who still have a good functional status, where PN may improve their quality of life.

Though conservative management and PN have been used to treat chylothorax,[16] there are also many reports of successful management of chyle leak using medium chain triglycerides. As there is currently no consensus on the optimal management of these patients, these 3 cases were classified as "indeterminate".

The level of inappropriate PN prescription reported in our audit, although not alarmingly high, is sufficient to necessitate action to minimise deviation from the guidelines in the future. The main finding of our audit was that the majority of patients given PN inappropriately were in postoperative ileus. We believe that PN was commonly started too early during the postoperative period. The use of PN in these patients could have been avoided, with more enteral or oral nutrition. This approach could have reduced the number of PN prescriptions and central line insertions, resulting in potential cost savings and reducing the incidence of metabolic and line complications associated with PN.

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