

BRIEF COMMUNICATION

Modified minimal-contact COVID-19 workflow allows for safe, remote parenteral nutrition prescribing in non-critically ill patients

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Abstract

Background: In line with recent guidance from the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN) to minimize healthcare team exposure by clustering care and relying on other providers or telehealth to collect relevant nutrition assessments, our nutrition support team has adopted a modified workflow using information technology to provide parenteral nutrition (PN) remotely in a safe and timely manner. We aim to compare our prescribing adequacy and PN-related complications before and during the coronavirus disease 2019 (COVID-19) outbreak using the modified workflow in non-critically ill patients.

Methods: This study reviewed a prospectively recruited cohort of adults receiving PN in the general wards or high-dependency units from December 5, 2019, to April 15, 2020. Demographic data, nutrition assessment, PN prescriptions, blood results, electronic notes, capillary blood glucose monitoring, and catheter-related bloodstream infection rates were reviewed for patients who received PN.

Results: We found that patients who started PN during COVID-19 were more malnourished with lower body mass index and higher proportion of Subjective Global Assessment B/C scores (52 [92.9%] vs 36 [73.5%], $P < .005$). The proportion of patients who achieved target energy amounts within 5 days was similar in both groups. Protein prescription was >1 g/kg/day in both groups, though there was a trend of higher protein prescription during COVID-19. Complications were similar in both groups.

Conclusion: Our study demonstrates that minimal contact with effective multidisciplinary communication using the modified workflow can allow for safe and timely PN administration.

KEYWORDS

COVID-19, nutrition support teams, parenteral nutrition

CLINICAL RELEVANCY STATEMENT

Cluster care using a modified minimal-contact workflow that uses information technology and effective communication is possible during the coronavirus disease 2019 (COVID-19) pandemic. It allows safe, timely, and appropriate parenteral nutrition prescription to be done remotely, thus minimizing healthcare team exposure to COVID-19.

INTRODUCTION

The global coronavirus disease 2019 (COVID-19) pandemic has had a lasting impact on healthcare delivery. Healthcare workers worldwide have adopted vigilant precautions with regard to hand hygiene and using personal protective equipment (PPE) while attending to hospitalized patients.¹ Parenteral nutrition (PN) is an integral supportive therapy in managing patients with intestinal failure in the acute hospital setting.²

In line with recent guidance from both the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN) to minimize healthcare team exposure by clustering care and relying on other providers or telehealth to collect relevant nutrition assessment to prescribe PN,^{3,4} our nutrition support team (NST) has adopted a modified workflow that uses information technology to minimize patient contact while providing PN in a safe and timely manner.

The study aims to evaluate PN care in an acute care setting during the COVID-19 pandemic by reviewing the effect of a modified minimal-contact workflow on PN prescription adequacy and PN-related complications compared with our previous daily, physical review model.

Primary outcomes include the proportion of patients reaching their energy target within 5 days of PN commencement. Secondary outcomes include rates of hypoglycemia, hyperglycemia, and catheter-related bloodstream infection (CRBSI).

METHODS

This study reviewed a prospectively recruited cohort of adults (>18 years old) receiving PN in the general wards or high-dependency units of Singapore General Hospital, Singapore. Patients who were in the intensive care unit were excluded from the study analysis. The study was approved by the Institution Review Board (Ref: 2020/2585). Demographic data, nutrition assessment, PN prescriptions, blood results, electronic notes, capillary blood glucose (CBG) monitoring, and CRBSI rates were reviewed for patients who received PN from December 5, 2019, to April 15, 2020.

Hypoglycemia was defined as CBG levels <4 mmol/L and hyperglycemia as CBG levels >10 mmol/L. An event was recorded once regardless of the frequency of hypoglycemia or hyperglycemia. Other clinical outcomes, including fluid overload and inpatient mortality were recorded. Fluid overload was recorded based on the manag-

ing team's clinical impression. CRBSI was recorded based on clinical impression with positive blood cultures. Total energy requirements were calculated using the Harrison-Benedict equation (stress factor 1.3).

Prior to the COVID-19 outbreak, the NST conducted daily physical reviews of all patients receiving PN. Use of the modified workflow (Figure 1) commenced on February 6, 2020 (during COVID-19). The aforementioned parameters were compared with data from December 5, 2019, to February 5, 2020 (before COVID-19).

As part of the modified workflow, gastroenterology fellows assigned to a geographical coverage for referrals would attend to new consults under the supervision of an NST consultant. The fellow would review admission history and perform a physical examination pertinent to the Subjective Global Assessment (SGA) while wearing appropriate PPE. Thereafter, PN and/or enteral nutrition would be discussed with and prescribed electronically by NST pharmacists and dietitians via a Computerized Provider Order Entry system (Sunrise Clinical Manager, Allscripts). The PN prescription was then transcribed into the PN compounding system (CLINUS TPN management system, B. Braun).

Daily physical review was replaced by NST pharmacists, dietitians, and physicians meeting in a nonclinical area, practicing social distancing, reviewing patient electronic charts, and prescribing PN remotely. Robust electronic documentation allowed the NST to review patient fluid balance, enteral intake, central-line access, blood investigations, and CBG levels in order to adjust the PN prescription and create electronic notes for nutrition management remotely. Clarifications regarding the prescribed nutrition therapy were discussed between the NST and the managing team via telephone or secure messaging. Only in cases when a clinical decision was not reached via nonphysical communication would the NST physician assess the patient in person.

Statistical analysis

The Mann-Whitney *U* test was used for continuous variables. The Fisher exact test was used for categorical variables. SPSS (Version 25.0, IBM Corp, Armonk, NY, USA) was used for statistical processing. A *P* <.05 was considered statistically significant.

RESULTS

A total of 105 patients received PN during the study period: 49 patients before COVID-19 and 56 patients during COVID-19. None of the patients were diagnosed with COVID-19. Baseline characteristics between both groups were similar (Table 1).

The proportion of patients in ileus/obstruction was higher during COVID-19. Patients who received PN during COVID-19 were more malnourished with a lower body mass index and a greater proportion of SGA B/C scores. A majority of patients achieved target energy within 5 days, and all received an average energy rate of at least 20 kcal/kg/day (Table 1, Figure 2). Protein prescription was >1 g/kg/day in both groups, with a trend of higher protein prescription during COVID-19.

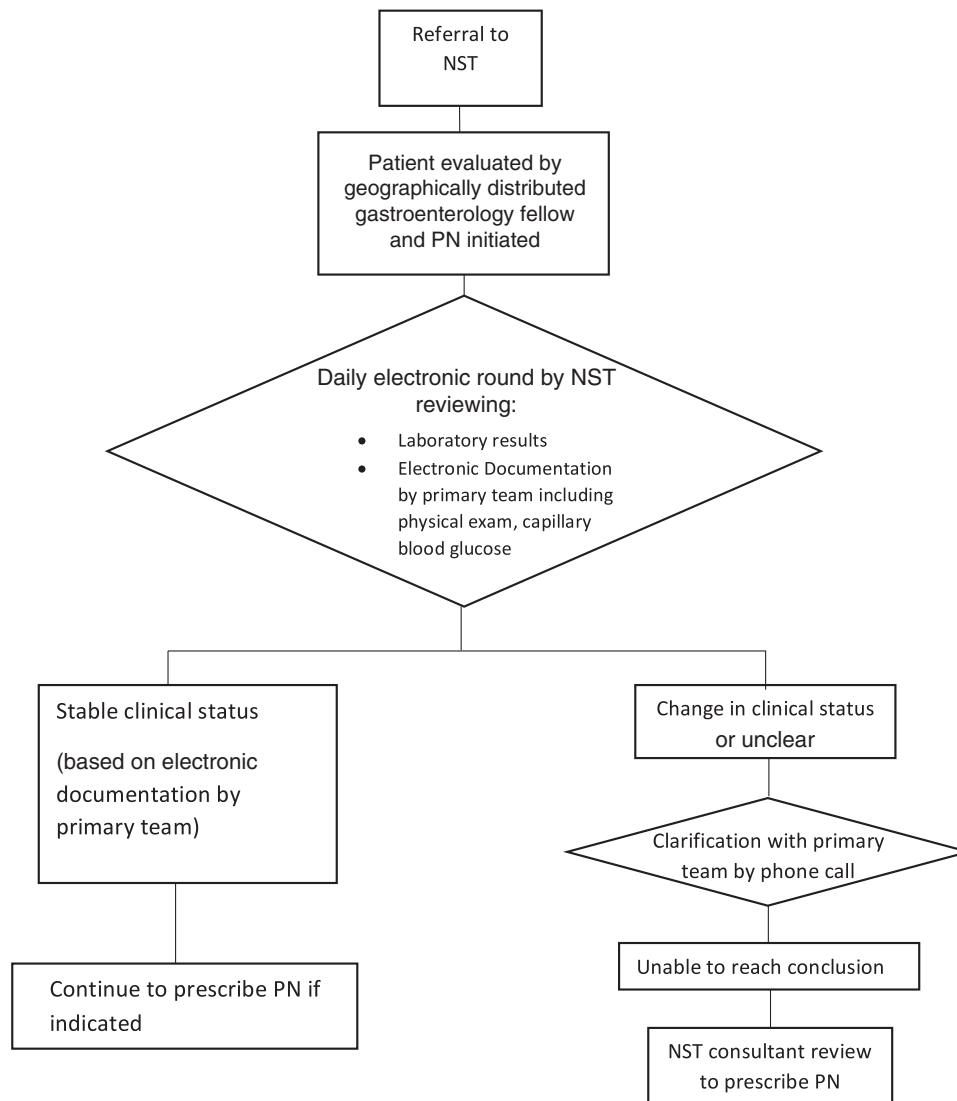


FIGURE 1 Modified workflow during coronavirus disease 2019. NST, nutrition support team; PN, parenteral nutrition

Complications (CRBSI, fluid overload, hypoglycemia, and hyperglycemia) were similar in both groups.

DISCUSSION

This modified workflow is in line with guidance issued by both ESPEN and ASPEN, and demonstrates that safe PN prescribing during the COVID-19 pandemic is feasible with a minimal-contact workflow.

Our institution had shifted to full electronic documentation for all inpatient clinical notes and charts in 2016. Clinical data such as blood results, fluid balance, enteral intake, CBG levels, and line-access information are captured in an integrated electronic suite fully assessable by members of the NST. Shifting to a minimal-contact workflow would not be possible without such thorough electronic documentation.

The managing team, with geographically allocated gastroenterology fellows and dietitians, were able to function as effective physi-

cal proxies, providing pertinent and current clinical information to the NST. Our experience was that there was increased communication via phone call and secure messaging between the NST and the managing team to clarify findings and treatment intent. Physical reviews by NST consultants only occurred on 4 occasions during COVID-19. All 4 occasions occurred as a result of concerns raised regarding the fluid status assessment as documented in the electronic medical record against the primary team's intention to continue PN. Only in 2 occasions was PN continued, as it was believed that the increased oxygen requirements were due to pneumonia rather than a fluid overload state. There was 1 incident in which PN was infused over the wrong duration (before COVID-19) and another in which PN was delivered to the wrong patient (during COVID-19). Both were considered non-prescribing errors. The limitations of this study include that we did not evaluate the risk of refeeding syndrome in our cohort. Nevertheless, approximately 93% (52 of 56) of our patients had SGA B and C scores, which put the majority of our patients at risk of refeeding syndrome, and a slow increment of energy to target was provided by a well-trained

TABLE 1 Baseline patient characteristics and results

Characteristics	Before COVID-19 (n = 49)	During COVID-19 (n = 56)	P-value
Median age, y (\pm SD)	63 (\pm 15.1)	66 (\pm 12.4)	-
Males, n (%)	31 (63.3)	28 (50)	NS
Indication, n (%)			
Ileus or obstruction	18 (36.7)	32 (57.1)	.05
ECF	4 (8.2)	-	-
Anastomotic leak	2 (4.1)	5 (8.9)	NS
GI hemorrhage	1 (2.0)	1 (1.8)	NS
Supplemental PN	17 (34.7)	16 (28.6)	NS
GVHD	2 (4.1)	-	-
Others ^b	5 (10.2)	2 (3.6)	NS
Underlying malignancy, n (%)	33 (67.3)	44 (78.6)	NS
Days receiving PN, median (\pm SD)	14.6 (\pm 12.8)	11 (\pm 10.1)	NS
Transition to oral/enteral feeding, n (%)	44 (89.8)	48 (85.7)	NS
BMI, median (\pm SD)	24.5 (\pm 4.3)	21.2 (\pm 4.1)	<.005
SGA score, n (%)			
A	13 (26.5)	4 (7.1)	<.005
B	29 (59.2)	41 (73.3)	NS
C	7 (14.3)	11 (19.6)	NS
SGA B/C ^a	36 (73.5)	52 (92.9)	<.005
Nutrition delivery			
Achieved target energy, n (%)	35.0 (64.8)	47.0 (83.9)	.095
Energy, median (\pm SD), kcal/kg/day	20.2 (\pm 5.14)	20.9 (\pm 5.14)	NS
Dextrose, median (\pm SD), g/kg/day	2.92 (\pm 1.09)	2.69 (\pm 1.00)	NS
Protein, median (\pm SD), g/kg/day	1.09 (\pm 0.32)	1.38 (\pm 0.25)	NS
Lipid, median (\pm SD), g/kg/day	0.56 (\pm 0.26)	0.62 (\pm 0.16)	NS
Complication, n (%)			
CRBSI	2 (4.1)	-	-
Hypoglycemia	6 (12.2)	3 (5.4)	NS
Hyperglycemia	23 (46.9)	20 (35.7)	NS
Fluid overload	4 (8.2)	3 (5.4)	NS
Mortality	4 (8.2)	4 (7.1)	NS

Abbreviations: BMI, body mass index; COVID-19, coronavirus disease 2019; CRBSI, catheter-related bloodstream infection; ECF, enterocutaneous fistula; GI, gastrointestinal; GVHD, graft-vs-host disease; NS, not significant; PN, parenteral nutrition; SGA, Subjective Global Assessment.

^aSGA B/C were collated together to represent the proportion of more malnourished patients.

^bOther causes include ischemic bowel and chemotherapy-related mucositis.

NST (84% (47 of 56) achieved target energy within 5 days) with an intention to safely provide PN to our patients.

Our study also highlights that patients who required PN during COVID-19 were more malnourished than those receiving PN before COVID-19. This likely represents the prioritization of essential and emergent cases and perhaps a self-selection of sicker and frailer patients, who are arguably at higher risk of PN-related complications.

Despite this, we demonstrated a similar rate of PN-related complications. Further, during COVID-19, >80% of patients achieved target energy within 5 days with a higher protein prescription per kilogram.

In conclusion, the current study demonstrates that a minimal-contact workflow can allow for the safe and timely administration of PN, but this is dependent on effective electronic documentation and multidisciplinary communication.

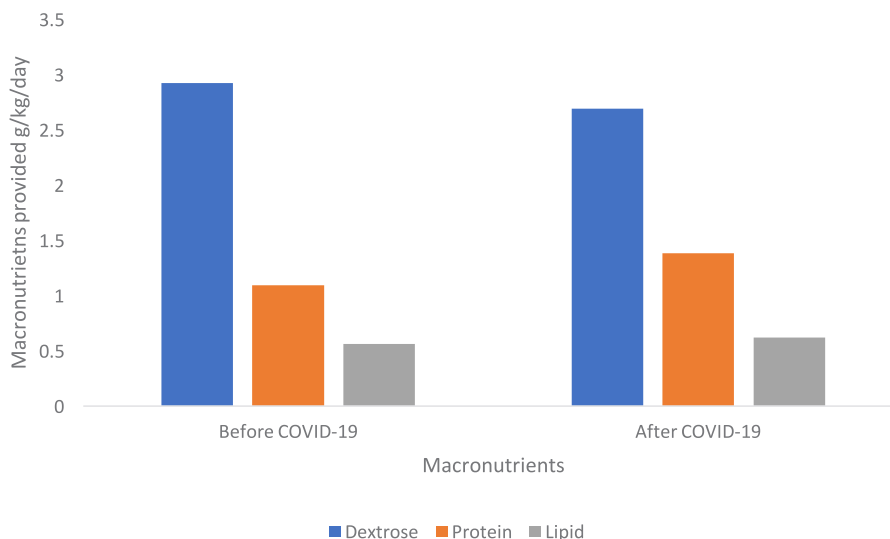


FIGURE 2 Nutrition delivery for macronutrients in patients before and after COVID-19. Dextrose: before COVID-19, 2.92 (\pm 1.09) vs during COVID-19, 2.69 (\pm 1.00) g/kg/day (NS). Protein: before COVID, 1.09 (\pm 0.32) vs during COVID, 1.38 (\pm 0.25) g/kg/day (NS). Lipid: Before COVID, 0.56 (\pm 0.26) vs during COVID, 0.62 (\pm 0.16) (NS) g/kg/day. COVID-19, coronavirus disease 2019; NS, not significant

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None declared.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

Ennaliza Salazar and Mark Cheah Chang Chuen equally contributed to the conception and design of the research, Poh Bee Yen and Cheang Lai Ye contributed to the acquisition and analysis of the data, Tan Lee Boo and Yong Pay Wen contributed to the interpretation of the data, and Ennaliza Salazar and Mark Cheah Chang Chuen drafted the manuscript. All authors critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript.

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