

Research Article

Optimal Timing for the Initiation of Supplemental Parenteral Nutrition in Critical Conditions- A Mini Review

Dan Wang MM

School of Medical Management and Health Management, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China

Xiaoquan Lai MD

Tongji Hospital, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China

Chenxi Liu MM

School of Medical Management and Health Management, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China

Yuqi Xiong MM

School of Medical Management and Health Management, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China

Xinping Zhang MD

School of Medical Management and Health Management, Tongji Medical College of Huazhong University of Science and Technology, Wuhan, China

ABSTRACT

The controversial issues from guidelines and their support exist on optimal timing for the initiation of supplemental parenteral nutrition in critical conditions. The reason of the controversial such as different study population, caloric quantity, study

designs and etc is complex which needed further research.

Keywords: Supplemental parenteral nutrition; Timing; Critically ill patients.

Introduction

Nutritional support for patients in the intensive-care unit (ICU) is part of standard care.¹⁻² Both enteral nutrition (EN) and parenteral nutrition (PN) route have restrictions. The previous studies have shown that EN alone often cannot achieve caloric targets while PN alone results in increased infectious complications.³⁻⁴ Such challenge prompts the exploring about supplemental PN approach (SPN) (EN combined with PN when EN alone is insufficient) which had validated SPN as one effective way to reduce nosocomial infection when initiated at 4 days after admission in critically ill adults.⁵ The delivering timing for SPN has become one big concern for nutrition research field. This article encompasses the main findings concerning timing of SPN in critically ill patients.

The Controversial Issues From Guidelines

Based on current clinical guidelines and substantial evidence, the consensus that early EN should be initiated within 48 hours of admission when the gastro-intestinal tract is functioning has been reached.⁶⁻⁹ However, optimal timing for the initiation of PN still remains controversial.¹⁰ The European (ESPEN) and American (A.S.P.E.N.) guidelines have put forth conflicting recommendations about the timing of PN initiation.¹¹⁻¹² ESPEN recommended patients who are not expected to be on normal nutrition within 2-3 d should receive PN within 24 to 48 h if EN is contraindicated, while A.S.P.E.N. supported no SPN should be provided if early EN is not feasible or is unavailable during the first 7d.

The Controversial Issues From Research

Supporting the guidelines for ESPN, a meta analysis of Simpson F showed that the early initiation of PN increased the survival of critically ill patients compared with patients who received EN late.⁹ Also, the researches of Dvir D and Villet S showed that early SPN with quicker restoration process was associated with lower percentage of nosocomial infection. In our study conducted in pediatric patients in PICU of Emergency Department, the timing of SPN was showed as one independent predictor for nosocomial infection as late SPN group (48th after PICU admission) is associated with higher incidence of nosocomial infection. Similar to the guidelines of A.S.P.E.N., a multi-center randomized trial conducted later supported the initiation of SPN after 8th day of admission (EPaNIC).¹³ Similarly, the study conducted in critically ill trauma patients showed SPN initiated in within 7 days after injury was associated with increased infectious complications.¹⁴ Thus the timing of SPN is still under debate demanding for further studies. (Table 1)

Why the controversial issues exist?

The disagreement between researches was likely due to the following factors as discussed in detail. Firstly, study population is likely one important factor. Study population supporting different positions were different, such as the pediatric or adult patients, medical or surgical conditions. The difference between groups for nutritional delivery and energy requirements cannot be ignored as one possible factor for nosocomial infection. For

Table 1: List of cited papers by insight of controversial issues.

Position	Citation	Type of research	Point of view
Supporting the ESPN guidelines	Simpson F(2005)	A meta-analysis	Reduced mortality was associated with parenteral nutrition use. (grade B+ evidence-based recommendation for parenteral nutrition use in patients in whom enteral nutrition cannot be initiated within 24 h of ICU admission or injury) (level II trials, no heterogeneity)
	Dvir D(2006)	An observational study	egative energy balance may be correlated with the occurrence of complications in the ICU.
	Villet S(2005)	Prospective observational study	Negative energy balances were correlated with increasing number of complications, particularly infections.
	Dan Wang(2015)	A retrospective study	The timing of SPN was one independent predictor for nosocomial infection as late SPN group is associated with higher incidence of nosocomial infection in critically ill pediatric patients of Emergency Department.
Supporting the A.S.P.E.N guidelines	Casaer MP(2011)	Multi-center random trail (EPaNIC)	The timing of SPN was showed as one independent predictor for nosocomial infection as early SPN group (within 8 th of ICU admission) is associated with higher incidence of nosocomial infection
	Sena MJ(2008)	Retrospective cohort study	In critically ill trauma patients who are able to tolerate at least some EN, early PN administration can contribute to increased infectious morbidity and worse clinical outcomes

example, In the EPaNIC study, the specific amount of nutrition was designed and delivered in early-initiation and late -initiation group following the study protocol, as the nutrition amount delivered in this study was followed by the Chinese guidelines for all pediatric patients¹⁵. As for the nutrition requirement for both studies, calculations regarding the caloric goal included protein energy and were based on corrected ideal body weight, age, and sex in the multi-center study, while the WHO equation¹⁶ was applied for pediatric patients. Further study controlling the effect of nutrition delivery and requirement need be done for exploring the response of different study population to nosocomial infection. Another factor for our observation includes difference in caloric quantity. Due to the discrepancy of study designs, the feeding strategy was designed with the dose targeted to a certain value in random controlled studies while patients in retrospective study groups received varied nutrition amounts prescription as the nutritional practice demanded. It is not certain exactly how an increased number of calories might influence nosocomial infection, regardless of the composition of nutrition support.

Conclusion

The issues on optimal timing for the initiation of parenteral nutrition in critical conditions existed universal controversial from guidelines to research evidence. The reason of the controversial is complex which needed further research.

Future directions for investigations

Further studies can be conducted exploring the optimal

timing for SPN approach after controlling the aforementioned confounding factors. Initially, the issues raised by heterogeneous study population need to be controlled, such as the nutrition demand. Also, prospective studies need to be designed with exact feeding strategy for nutrition delivery amounts. Thus prospective comparative study would be become one direction for further research.

REFERENCES

1. Federico Bozzetti, Luca Gianotti, Mario Braga, et al. Postoperative complications in gastrointestinal cancer patients: The joint role of the nutritional status and the nutritional support. *Clin Nutr* 2007; 26: 698–709.
2. Stanislaw Klek, Marek Sierzega, Piotr Szybinski, et al. Perioperative nutrition in malnourished surgical cancer patients-A prospective, randomized, controlled clinical trial. *Clin Nutr* 2011 ;30 :708-713.2.
3. C.T.I. de Betue, W.N. van Steenselen, J.M. Hulst, et al. Achieving energy goals at day 4 after admission in critically ill children; predictive for outcome? *Clin Nutr* 2015; 34:115-22.
4. Mehta NM, Bechard LJ, Cahill N, et al. Nutritional practices and their relationship to clinical outcomes in critically ill children—an international multicenter cohort study. *Crit Care Med* 2012; 40:2204-11.
5. Claudia Paula Heidegger, Mette M Berger, Séverine Graf, et al. "Optimisation of energy provision with supplemental

- parenteral nutrition in critically ill patients: a randomised controlled clinical trial." *The Lancet* 2013; 381: 385-93.
6. Martindale RG, McClave SA, Vanek VW, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition: Executive Summary. *Crit Care Med* 2009; 37: 1757-61.
 7. Gramlich L, Kichian K, Pinilla J, et al. Does enteral nutrition compared to parenteral nutrition result in better outcomes in critically ill adult patients? A systematic review of the literature. *Nutrition* 2004; 20: 843-8.
 8. Heyland DK, Schroter-Noppe D, Drover JW, et al. Nutrition support in the critical care setting: current practice in Canadian ICUs- opportunities for improvement? *J Parenter Enteral Nutr* 2003; 27:74-83.
 9. Simpson F, Doig GS. Parenteral vs. enteral nutrition in the critically ill patient: a meta-analysis of trials using the intention to treat principle. *Intensive Care Med* 2005; 31: 12-23.
 10. José E. de Aguilar-Nascimento, Alberto Bicudo-Salomao, Pedro E. Portari-Filho. Optimal timing for the initiation of enteral and parenteral nutrition in critical medical and surgical conditions. *Nutrition* 2012; 28: 840-43.
 11. Singer P, Berger MM, Van den Berghe G, et al. ESPEN Guidelines on Parenteral Nutrition: intensive care. *Clin Nutr* 2009; 28: 387-400.
 12. American Society for Parenteral and Enteral Nutrition (ASPEN) Board of Directors. Clinical guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. *JPEN J Parenter Enteral Nutr* 2009; 33: 255-259.
 13. Casaer MP, Mesotten D, Hermans G, et al. Early versus late parenteral nutrition in critically ill adults. *N Engl J Med* 2011; 365: 506-517.
 14. Sena MJ, Utter GH, Cuschieri J, et al. Early supplemental parenteral nutrition is associated with increased infectious complications in critically ill trauma patients. *J Am Coll Surg* 2008;207:459-467
 15. Pediatric Collaborative Group, Society of Parenteral and Enteral Nutrition, Chinese Medical Association. Clinical guidelines for the provision of enteral nutrition and parenteral nutrition for children patients (in Chinese). *Chinese Journal of Pediatrics* 2010; 48:436-41.
 16. World Health Organization. Energy and protein requirements. Report of a joint FAO/WHO/UNU expert consultation. WHO technical report series 724. Geneva: World Health Organization; 1985.

ADDRESS FOR CORRESPONDENCE

Xinping Zhang, School of Medical Management and Health Management, Tongji Medical College of Huazhong University of Science and Technology, Hangkong Road No. 13, Wuhan, China, Tel: +86-18071509979; Fax: +86-027-83692796; E-mail: xpzhang602@163.com