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Time span of a total parenteral nutrition bag: From consultation to the end of administration

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ABSTRACT

Objective: A multidisciplinary nutrition support team (NST) aims to improve a patient's nutritional status. Nutritional support should be initiated promptly in patients who need it. Parenteral nutrition (PN) solutions have a risk of being unstable until 24 hours after preparation. The aim of this study was to determine the time span of the PN process, which starts from a consultation with an NST until the end of the administration of the solution, to demonstrate the appropriateness of the practice.

Methods: In this study, the timing of each process including NST consultation, evaluation of the patient by NST, delivery of the order label to the pharmacy, compounding process, delivery of the bags to the services/units, storage in the services/units, and duration of administration were prospectively followed and recorded by three pharmacists in a university hospital for two weeks in January 2017.

Results: A total of 12 patients' PN processes were followed and the duration of each stage was recorded by pharmacists. The mean duration of compounding PN±standard deviation (SD) was 5.18±0.87 minutes. The average (±SD) volume of PN was 1557±205.2 mL. The mean (±SD) duration of administration was recorded as 24 hours and 14 minutes±37.5 minutes. The mean (±SD) volume of residual PN solution was 106.9±30.3 mL and 41.6% of the waste was discarded as household waste rather than medical waste. The mean (±SD) room temperature during the administration of PN was 25.01±1.6°C.

Conclusion: With regard to stability problems of PN solutions, awareness among healthcare professionals should be raised in order to reduce the waiting period till administration. Minimizing waste-cost and the residual volume of PN is important to maintain the patients' nutritional requirements.

Keywords: Compounding, nutritional support team, parenteral nutrition

Introduction

Parenteral nutrition (PN) is preferred when a patient cannot be fed orally or enterally. The safe practices for PN therapy are comprehensive due to its multicomponent nature (1).

In a Task Force survey, most participants declared that they needed up to 20 adult PN bag per day in their institutions. Hospitals should have standard operating procedures for the ordering, compounding, appropriate usage, complication prevention, and management of PN to ensure patient safety and cost reduction (2).

There are two types of all-in-one systems: compounded bags (COBs) and commercial multi-chamber bags (MCBs). MCBs require less workload as compared to COBs. Special equipment, infrastructure, and trained staff are needed to administer COBs. On the other hand, for MCBs, the chamber seal is broken prior to the administration which allows mixing of the chambers and only requires the addition of trace elements and vitamins. Stability of non-activated MCBs varies with different manufacturers but usually has 12 to 24 months shelf-life at room temperature (3).

A nutrition support team (NST) consists of a clinician, dietitian, nurse, and pharmacist, however, the composition is variable in different hospitals. While providing nutrition assessment and determining nutritional needs, the NST aims to ensure appropriate and safe nutritional support to

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a patient. An NST improves the quality of patient care with improvements in patient nutrition status and clinical outcomes as well as reductions in cost. After hospitalization, routine screening of patients for malnutrition should be implemented and those at risk must be advised to consult the NST for further assessment of their malnourished status. In institutions using COB for PN therapy, physicians or dietitians under the supervision of physicians are responsible for prescribing PN orders, pharmacists or technicians under the supervision of pharmacists are responsible for receiving the orders and compounding PN, and nurses are responsible for the administration of PN and monitorization and destruction of PN bags (4).

In the proper practices of PN, the compounding, hang time, storage time, and maximal infusion rate of total nutrient admixture (TNA) are important. According to the literature, the maximum hang time for a TNA was 24 hours (3). Both for COBs and activated MCBs, the new beyond-use date is important and it is specified that infusion should not exceed 24 hours. Because of the concern for microbial contamination, the United States Pharmacopoeia (USP) recommends that intravenous fat emulsion (IVFE) products must be used within 12 hours of opening the original container if they are administered as a separate infusion. If the IVFE is admixed directly to the PN, the final PN formulation can be infused over a 24-hour period since it provides a safe vehicle with less infectious risks (2).

According to the USP 797 for medium-risk preparation, in the absence of passing a sterility test, the storage periods cannot exceed the following time periods: before administration, in proper storage conditions PN bags cannot be stored for more than 30 hours at controlled room temperature and no more than 9 days at a cold temperature (+4°C) (5).

Limited literature is available to demonstrate the PN preparation time while comparing MCBs and COBs (6-8). However, according to published literature, the timing of each process (time periods between consultation and evaluation of patient by NST, between evaluation of patient and label printing, between label printing and the end of compounding, between the end of compounding and delivery, and between delivery of bags and administration) and storage conditions in the services/units during administration has not been demonstrated together in one study. The aim of this study was to determine the time span of the PN process, which starts from a consultation with an NST until the end of the administration of the solution, to demonstrate the appropriateness of the practice.

Methods

This cross-sectional and observational study was conducted in a university hospital between 2 January 2013 to 13 January 2017. The patients who received a consultation with the NST for PN therapy for the first time were included in the study, while those who were already under nutritional therapy were excluded.

In this study, the timing of each process including NST consultation, evaluation of the patient by NST, delivery of the order label to the pharmacy, compounding process, delivery of the bags to the services/units, storage in the services/units, and duration of administration were prospectively followed and recorded by three pharmacists. Furthermore, the room temperature during PN storage and the temperature of the patient's room, sunlight exposure, decomposition conditions of unused quantities, and the number of wasted bags were also evaluated.

Statistical analysis

The values were given as a number (percentage) for categorical variables and as mean±standard deviation (SD) for continuous variables.

Results

During the study, a total of 12 NST consultations for new PN assessment were observed. Four of these consultations happened in surgical units, 6 in non-surgical units, and 2 in oncological units. Although the PN varies according to the bag volume (mean±standard deviation [SD] 1557±205.2 mL) the filling process takes place on an average of (±SD) 5.18±0.87 minutes (min). The average (±SD) duration of administration of PN bags time was 24 hours 14 minutes±37.5 minutes. The timing of each process from the consultation until the destruction of PN bags is given in Table 1.

The mean (±SD) temperature of the patients' room was 25.01±1.6°C (range: 21–26.5°C). It was determined that there was sunlight exposure during the daytime administration of 6 PN solutions. No medication was administered from the same catheter as PN in 6 patients, medications were given from the same catheter as PN in 2 patients, and PN infusion was stopped while the medication was administered in 3 patients.

An average of 106.9 mL of leftover PN solution was detected at the end of the infusion period and 41.6% of this waste was separated as household waste instead of medical waste.

Table 1. The time span of TPN processes			
Stages of process	**Median (minutes)**	**Minimum (minutes)**	**Maximum (minutes)**
The time between consultation and evaluation of the patient by NST	57.5	1	342
The time between the evaluation of patient and label printing	44	7	256
The time between label printing and the end of compounding	87	25	309
The time between the end of compounding and delivery	32	10	207
The time between delivery of bags and administration	56.5	5	90
The time between receiving a consultation and the beginning of TPN infusion	428.5	187	651
NST: Nutrition Support Team; TPN: total parenteral nutrition			

Discussion

The aim of this study was to determine the time span of the PN process, which starts from a consultation with an NST until the end of the administration of the solution, to demonstrate the appropriateness of the practice.

A multidisciplinary NST aims to improve a patient's nutritional status. According to a survey conducted by the American Society for Parenteral and Enteral Nutrition (ASPEN) in 2008 to evaluate the utility of NSTs in clinical practice, the average consult response time ranged from 10 minutes to 72 hours and a majority of participants (52.2%) declared that consultations were generally responded to within 24 hours. Only one-third of the respondents stated that their consult was addressed in less than 8 hours (9). Since the NST does not provide care for 24 hours in our institution, one of the consultations was responded to in 342 minutes because of a late-night consultation. However, in this study, it was determined that the consultations were responded to and patients were evaluated mostly within 1 hour (median 57.5 min) by NST. Compared to the ASPEN survey results, the consult response time was much faster in our institution.

Even though COBs are more time consuming than MCBs, the compounding time of PN reported by Pichard et al. (6) was 15 minutes. In a prospective, multi-center, randomized, comparative, single-blind study conducted by Yu et al. (7), the preparation times for 1886.5 mL COBs were evaluated in 115 patients on day 1 and day 5 postoperatively (12.13±5.62 minutes and 11.77±4.79 minutes, respectively). A study by Berlana et al. (8) reported that the mean time taken to prepare 82 PN solutions (1500±250 ml) was 14.09 minutes. Unlike other studies, COB preparation time was found to be shorter (5.18±0.87 minutes) in our study even though the PN volumes (mean 1557±205.2 ml) were similar. The usage of different compounder devices might be the explanation for this variation in preparation time, however, they could not be compared because the manufacturers of the devices were not mentioned in any of these studies.

According to the study by Didier et al. (10), bacterial growth in PN solutions occurred at 25°C only after 24–48 hours. In our study, the mean duration of administration was determined as 14±37.5 minutes and the mean room temperature during the administration of TPN was 25.01±1.6°C. At this temperature, the time period between the end of compounding and delivery (32 minutes, range: 10–207 minutes) and between delivery of bags and administration (56.5 minutes, range: 5–90 minutes) compared with the mean duration of administration (24 hours 14 minutes±37.5 minutes) showed that some PN solutions were at high risk for bacterial growth and instability. In this study, the maximum time between the end of compounding and delivery mostly depended on the lack or workload of staff in charge of the delivery and maximum time between delivery of bags and administration period depended on the lack of available nurses. By providing an adequate number of clinicians and staff, optimal time periods between the transition points can be achieved.

An average of 106.9 mL of leftover PN solution out of the mean PN volume of 1557±205.2 mL was detected at the end of infusion period, which means that almost 7% of the targeted volume and calorie intake could not be provided. Further, none of the clinicians or NST members were aware of that situation. Nurses should record waste amounts of PN nutrition and inform the NST, or they should readjust the PN infusion rate to minimize waste amounts.

Another important finding of this study was to detect differences in the practices of PN waste management since 41.6% of these wastes were separated as household

waste instead of medical waste. Waste management of these solutions should be standardized and all clinicians should perform the same practice.

Parenteral nutrition solutions are not drug delivery systems and the risk of incompatibility is high while administering PN solutions and drugs through the same catheter (11). In this study, 2 patients' medications were given from the same catheter with PN and in 3 patients the PN infusion was stopped while the medication was administered. Due to the involvement of a clinical pharmacist in our NST, all patients' medication was managed to ensure the prevention of drug incompatibility.

As no previous study in the literature has reported all these findings together, some findings could not be compared and discussed. Also, due to the limited number of observed PN bags, a statistical analysis was not performed in this study. Further studies are needed with more PN bag follow-ups to report statistical data and to compare the practices in different units and the timing periods of each process.

In conclusion, with regards to the stability problems of TPN solutions, awareness among healthcare professionals should be raised in order to reduce the unnecessary waiting period. Minimizing waste-cost and the residual volume of TPN is important to maintain the patients' nutritional requirements.

Ethics Committee Approval: Authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

Informed Consent: Due to the design of the study, informed consent was not taken.

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