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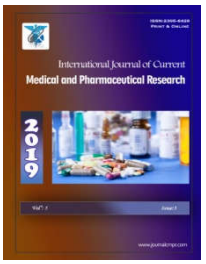

THE INCIDENCE OF CANDIDEMIA AMONG PATIENTS RECEIVING TOTAL PARENTERAL NUTRITION (TPN): A SINGLE-CENTER STUDY

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ABSTRACT

Objective: Hospitalized patients receiving Total Parenteral Nutrition (TPN) are at risk of developing several nosocomial infections, and namely candidemia. This study aimed to estimate this incidence in single center in Saudi Arabia, and to explore potential risk factors.
Methods: A retrospective reviewincluding all patients admitted to King Abdulaziz University Hospital in Jeddah, Saudi Arabia, between 2014 and 2015, and who were on TPN.
Results: One hundred and sixteen patients were included in this study. Male patients constituted (62.1%), and with a mean age of (55.6 ± 18.4) years. The incidence of candidemia was (11.2%). TPN duration was significantly longer in patients who tested positive for candidemia (26.1±21.2 days), whencompared to those who tested negative (14.2±11.7 days; P = 0.002). Regarding risk factors; a history of solid organ malignancy, or being on corticosteroids prior to TPN wereboth significantly associated with being positive for candidemia (P=0.004 & P=0.019, respectively).
Conclusion: Hospitalized patients receiving TPN are at risk of candidemia, especially those on prolonged TPN or those on corticosteroids. Patients on TPN should be managed by a specialized and dedicated nutritional support team.

INTRODUCTION

Candidemia is one of the most common nosocomial infections worldwide [1–5]and is considered a major cause of morbidity and mortality [5–7]. In Saudi Arabia, a recent increase in the incidence of candidemia among hospitalized patients was significantly associated with malignancy, admissions to the intensive care unit, the use of broad-spectrum antibiotics or corticosteroid therapy, and receipt of total parenteral nutrition (TPN).[8–10]

TPN refers to the nutrition provided exclusively via an intravenous route, when other means of feeding are not suitable for the patient's condition, or when other means are not providing optimal nutritional requirements [11]. Despite the many benefits of TPN, it has also been reported to carry a considerable risk of mechanical, metabolic, and infectious complications [11,12]; in addition, while TPN is recognized as an important risk factor of nosocomial candidemia, it is still widely used among hospitalized patients [13–16]. Thus, prior to considering TPN, it is crucial to thoroughly assess the patient's needs and the suitability of TPN according to guidelines for the use of parenteral nutrition [11,12].

Limited literature supports the use of prophylactic antifungal medications in critically ill patients, namely those receiving TPN; in particular, there is no clear definition for high-risk patients in need of antifungal prophylaxis, and there is the possibility of organism-resistance to these agents [17]. Therefore, to improve patient care and minimize the risks of hospital-acquired candidemia, it is imperative to understand the infectious risks of TPN [18]. The purpose of this retrospective study was to 1) estimate the rate of candidemia among critically adult patients receiving TPN admitted to the intensive care unit (ICU) at the university hospital and 2) identify potential TPN-associated risk factors for candidemia.

MATERIALS AND METHODS

This was a retrospective review involving all hospitalized patients at the hospital in Saudi Arabia who were receiving TPN during their hospital stay during the years 2014 and 2015.

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Pediatric patients, adult patients who received TPN for less than 72 hours, those who received anti-fungal therapy prior to TPN initiation, and patients with pre-existing candidemia within 6 weeks prior to TPN initiation were excluded. The study was approved by the ethical and technical committee at King Abdulaziz University, and all other administrative authorizations were obtained before the start of data collection.

At King Abdulaziz University Hospital, parenteral nutrition (PN) prescriptions are requested using an electronic order form, completed by members of the attending medical team, who are of variable experience and competency in nutritional assessment and appropriate use of TPN. The hospital's pharmacy compounds the prescribed solution under strict aseptic technique, in accordance with international standards. Typically, PN is administered as a 2-in-1 dextrose-amino acid solution, with or without an intravenous soybean-based fat emulsion infused separately. Since peripheral PN is usually avoided, patients typically receive the prescribed solutions through a centrally or peripherally inserted central catheter (PICC) line.

A data collection sheet was developed to collect relevant patient information including the following: A) demographic data such as age, sex, weight, and body mass index (BMI); B) clinical profile including serum albumin level at admission, length of hospital stay, history of ICU admission, and incidence of 28-day mortality. We also collected data on significant medical conditions such as diabetes mellitus, dialysis, abdominal surgeries (all during the same admission), immunosuppression (defined as an absolute neutrophil count < 2000/mm^3 of blood), hematological malignancies, solid malignancies, liver disease, and the usage of steroids and antibiotics prior to TPN initiation; C) history of TPN including date and site of TPN initiation (i.e., in ICU or hospital ward), TPN duration in days, vascular access for TPN administration (a PICC line or a central line); and D)history of *Candida* infection, i.e., evidence of candidemia, source of blood isolation (central vs. peripheral), isolation of *Candida* in other cultures (e.g., urine, respiratory droplets), and the isolated subtypes of *Candida*.

To collect the above information, a list of all TPN prescriptions dispensed during the years 2014 and 2015 was retrieved from the pharmacy department, with patients' medical record numbers. Regarding candidemia information, a corresponding patient list was prepared, in collaboration with the clinical microbiology laboratory using the above medical record number, to compare data on *Candida* isolation. The identification of candidemia followed the standard protocol used at KAUH, as follows. Blood cultures were performed using an automated blood culture system (BacT/Alert, Organon, Teknika, USA). Five milliliters of blood was inoculated into a single pediatric bottle and loaded into the blood culture system, and it remained there until either designated positive or for a maximum of 5 days of incubation. Samples from all bottles designated positive were Gram stained, and those found positive for yeast cells were subcultured on Sabouraud dextrose agar. The yeasts were identified using VITEK MS (bioMerieux, Inc., France) on the same day of sufficient growth on Sabouraud dextrose agar; the identification was confirmed using the VITEK ® 2 system, and the yeasts then underwent antifungal-susceptibility testing.

Descriptive statistical analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA), version 22. Categorical data were presented as counts and frequencies, while continuous data were presented as means and standard deviations. The chi-squared and independent t-tests were used to test for differences between groups. A p-value < 0.05 was set as statistically significant.

RESULTS

One hundred and sixteen patients were included in this study (male, n = 72 [62.1%]; female, n = 44 [37.9%]; mean age, 55.6 ± 18.4 years; mean body weight, 64.1 ± 18.1 kg; BMI, 24.9 ± 6.1 kg/m^2; mean serum albumin, 25.6 ± 7.9 g/dL). Additional characteristics of the study population are provided in Table 1. Of the 116 TPN cases, 13 patients (11.2%) were positive for candidemia. Those with candidemia experienced non-significantly longer hospital stays than those without candidemia (74.5 ± 85.2 vs. 51.3 ± 73.1, respectively, P = 0.159). Of those with candidemia, 61.5% were admitted to the ICU, while only 43.7% of patients without candidemia had a history of ICU admission (P = 0.223). Moreover, more than half (53.8%) of the patients receiving TPN with candidemia started TPN in the ICU, whereas less than one-third (30.1%) of those without candidemia started TPN in the ICU. Neither ICU admission nor the start of TPN in the ICU was associated with increasing rates of candidemia. TPN duration was significantly longer in patients with candidemia (26.1± 21.2 days) than in those without candidemia (14.2 ± 11.7 days; P = 0.002). On the other hand, the candidemia incidence in relation to TPN site showed no difference between patients with and without candidemia (P = 0.695). The 28-day mortality rate for the total included sample was 17.2% (N = 20). Of these, three patients tested positive for candidemia, whereas the remaining 17 patients tested negative (P = 0.554) **(**Table 2).

For patients with candidemia, the organism was isolated from different TPN sites as follows: PICC line (53.8%), central line (38.5%), and both lines (7.7%). Of those testing positive, *Candida* was isolated in cultures other than blood for eight patients (Figure 1A); of these eight patients, six (46.1 %) were negative in other tissues, one (7.7%) was positive in urine, and one (7.7%) was positive in other tissues. The distribution of *Candida* subtypes isolated is shown in Figure 1B.

Regarding the possible risk factors for candidemia, having a medical history of solid organ malignancy and being on corticosteroids prior to TPN were significantly associated with candidemia (P = 0.004 and P = 0.019, respectively). On the contrary, diabetes, dialysis, immunosuppression, history of hematological malignancy or liver disease, and antibiotic usage prior to TPN were not associated with candidemia.

Table 1 Patient characteristics and medical history

Characteristics	Total	(+ ve) Candidemia N = 13 (11.2%)	(- ve) Candidemia N = 103 (88.8%)	P-value
		Mean ± SD	Mean ± SD	
Age *(y)*	55.6 ± 18.4	54.5 ± 16.0	55.7 ± 18.6	0.559
Weight *(kg)*	64.1 ± 18.1	66.5 ± 17.3	65.2 ± 18.2	0.896
BMI *(kg/m^2)*	24.9 ± 6.1	23.8 ± 6.3	25.0 ± 6.1	0.697
Serum albumin *(g/dL)*	25.6 ± 7.9	20.1 ± 6.9	26.3 ± 7.8	0.045
Characteristics	Total	N (%)	N (%)	P-value
		Sex		
Male	72 (62.1%)	7 (53.8%)	65 (63.1%)	0.517
Female	44 (37.9%)	6 (46.2%)	38 (36.9%)	
		Diabetes		
Yes	35 (30.2%)	3 (23.1%)	32 (31.1%)	0.554
No	81(69.8%)	10 (76.9%)	71 (68.9%)	

	On dialysis			
Yes	4 (3.4%)	1 (7.7%)	3 (2.9%)	0.373
No	112 (96.6%)	12 (92.3%)	100 (97.1%)	
	Immunosuppressed/neutropenia			
Yes	13 (11.2%)	1 (7.7%)	12 (11.7%)	0.670
No	103 (88.8%)	12 (92.3%)	91(88.3%)	
	PMH-abdominal surgery			
Yes	78 (67.2%)	6 (46.2%)	72 (69.9%)	0.086
No	38 (32.8%)	7 (53.8%)	31(30.1%)	
	PMH-hematological malignancy			
Yes	0 (0%)	0 (0%)	0 (0%)	-----
No	116 (100%)	13 (100%)	103 (100%)	
	PMH-solid organ malignancy			
Yes	62 (53.4%)	2 (15.4%)	60 (58.3%)	0.004
No	54 (46.6%)	11 (84.6%)	43 (41.7%)	
	PMH-liver disease			
Yes	8 (6.9%)	1 (7.7%)	7 (6.8%)	0.904
No	108 (93.1%)	12 (92.3%)	96 (93.2%)	
	Corticosteroid use prior to TPN			
Yes	31 (26.7%)	7 (53.8%)	24 (23.3%)	0.019
No	85 (73.3%)	6 (46.2%)	79 (76.7%)	
	Antibiotics use prior to TPN			
Yes	102 (87.9%)	12 (92.3%)	90 (87.4%)	0.607
No	14 (12.1%)	1 (7.7%)	13 (12.6%)	

PMH, Past Medical History; TPN, total parenteral nutrition

Table 2 Association of total parenteral nutrition with admission to the intensive care unit

Characteristics	Total	(+ ve) Candidemia N = 13 (11.2%)	(- ve) Candidemia N = 103 (88.8%)	P-value
		Mean ± SD	Mean ± SD	
Length of hospital stay *(d)*	53.9 ± 75.2	74.5 ± 85.2	51.3 ± 73.1	0.159
TPN duration *(d)*	15.6 ± 13.6	26.1 ± 21.2	14.2 ± 11.7	0.002
Characteristics	Total	N (%)	N (%)	P-value
	ICU Admission			
Yes	53 (45.7%)	8 (61.5%)	45 (43.7%)	0.223
No	63 (54.3%)	5 (38.5%)	58 (56.3%)	
	TPN started in ICU			
Yes	38 (32.8%)	7 (53.8%)	31 (30.1%)	0.086
No	78 (76.2%)	6 (46.2%)	72 (69.9%)	
	TPN site			
PICC	39 (33.6%)	5 (38.5%)	34 (33.1%)	0.695
Central	77 (66.4%)	8 (61.5%)	69 (66.9%)	
	28-day mortality			
Yes	20 (17.2%)	3 (23.1%)	17 (16.5%)	0.554
No	96 (82.8%)	10 (76.9%)	86 (83.5%)	

SD, standard deviation; TPN, total parenteral nutrition; ICU, intensive care unit; PICC, peripherally inserted central catheter

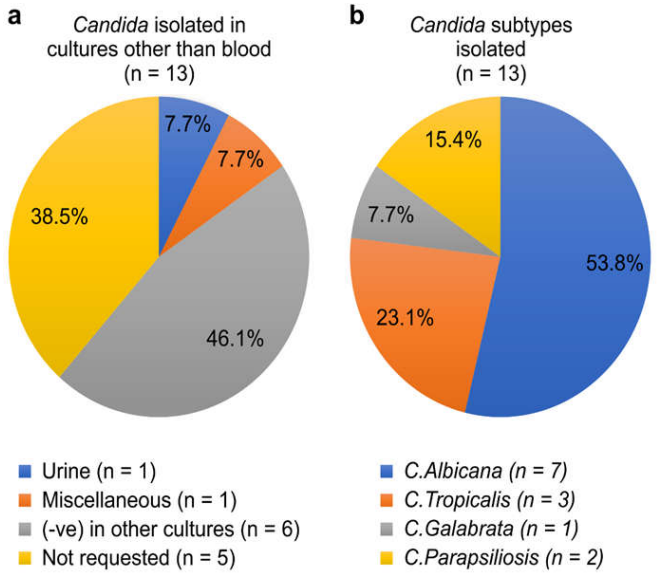

Figure 1 Candida subtypes isolated

DISCUSSION

PN can be appropriately utilized for hospitalized patients who are malnourished or at risk of malnutrition, namely when oral or enteral nutrition is not feasible or may not be tolerated. However, this method of nutritional support is commonly associated with bloodstream infections (BSIs), primarily those related to use of a central venous catheter. In fact, PN therapy has been shown to be an independent risk factor for central venous catheter-related infections [19]. A retrospective study from a single center in Australia reported a BSI incidence of 10.0/1000 PN days [20]. Candidemia is of a special concern because of its high morbidity and mortality risks, especially if diagnosis and administration of appropriate anti-fungal therapy is delayed. For the above Australian cohort, *Candida* was the most frequently identified organism, and excessive delays in administration of antifungal therapy were revealed [20].

Another observational retrospective study assessed the incidence of and risk factors for candidemia in 286 recipients of PN in a tertiary medical center. In that study, 4.9% of these patients suffered from new-onset candidemia, an incidence rate of 1.6 episodes per 1000 hospital-days [17]. It was suggested that a guideline-directed PN may have tended to select more severely ill patients, who were already at high risk of candidemia. The setting of this prior study was similar to that of the current study, where the decision regarding PN provision is based on guidelines, is made by any member of the interdisciplinary attending team, and is not necessarily under the supervision of a dedicated nutritional support team. The latter may explain the relatively higher rate of candidemia (11.2%) detected among the current cohort of patients.

In general, predisposing factors for BSIs while receiving PN can be classified into the following categories: patient-related (e.g., current clinical status or co-morbidities), catheter-related, or PN composition-related. For the first group of factors, an increased disease severity was associated with increased candidemia risk. In a study by Stratman *et al*., 83% of PN recipients with candidemia were categorized as "of a major or an extreme illness severity" [17]. Although our study did not record disease severity scores, a significant increase in the incidence of candidemia was noted among patients with lower serum albumin and those on corticosteroid therapy, both of which may reflect a more acute and severe disease status. Regardless, admission to the ICU, another possible predictive sign of condition severity, was not associated with a higher risk of candidemia. On the contrary, malnutrition is considered a risk factor for central venous catheter-related infections, as noted with the lower serum albumin for candidemia-positive patients; nevertheless, serum albumin is not a reliable indicator of patient nutritional status in acute settings [21].

Duration of PN infusion is an important risk and possibly an independent risk factor for catheter-related BSIs, including candidemia[14,17,22–24]. This may be partially due to the increased colonization risk associated with prolonged catheterization, especially when multi-lumen catheters are inserted in urgent situations, without being replaced in a timely manner [23].On the contrary, rates of colonization are usually lower when single-lumen catheters are solely used for PN [25]. Another prospective study among non-critical patients showed that being on PN for more than 14 days was the only independent risk factor for developing BSIs [26]. Moreover, a case control study focusing on nosocomial candidemia in elderly patients found a strong association between receiving PN for more than 7 days with a

higher candidemia risk [22].Consistent with this previous study, candidemia in the present study was associated with longer PN duration. Thus, reducing the duration of PN should be considered as soon as resuming oral and/or enteral feeding is feasible.

Hyperglycemia is associated with several adverse outcomes in patients receiving PN, including severe sepsis [27]. In a study by Townell *et al*. [20], *Candida* was the most common pathogen isolated from patients receiving PN, and insulin infusion (a marker of sustained hyperglycemia) was identified as a risk factor for developing PN-associated BSIs [20]. For our patients, diabetes was not associated with higher risks of candidemia; however, although blood glucose levels were not recorded, patients who were on corticosteroids (a risk factor for hyperglycemia) prior to receiving PN experienced a higher incidence of candidemia. Interestingly, the most common cause of hyperglycemia is excess dextrose infusion and overfeeding, which is more likely to occur when PN is not supervised and is managed by a dedicated nutritional support team. Current guidelines recommend a target blood glucose range of 140 or 150–180 mg/dL for the general ICU population [28]. The latter can be achieved by limiting dextrose infusion rates in patients at risk, proper monitoring, and the appropriate use of insulin.

We acknowledge the limitations of this study, which are mainly due to its retrospective design at a single center. The number of patients included did not allow for detecting differences in important risk factors such as diabetes, neutropenia, and type of venous access, nor did it allow examination of important outcomes such as length of ICU admission and hospital stay. Future prospective studies are needed to better identify risk factors for candidemia in TPN recipients and to understand the role of prophylactic therapy in high-risk patients.

CONCLUSIONS

The risk of candidemia in hospitalized patients receiving TPN is significant, especially for critically ill patients, those receiving corticosteroids, or those on prolonged TPN. Appropriate use of PN for the shortest necessary duration must be supervised by a professional nutrition team, with strict adherence to guidelines.

References

1. Horn DL, Fishman JA, Steinbach WJ, Anaissie EJ, Marr KA, Olyaei AJ, *et al*. Presentation of the PATH Alliance registry for prospective data collection and analysis of the epidemiology, therapy, and outcomes of invasive fungal infections. DiagnMicrobiol Infect Dis 2007;59:40714.doi.org/10.1016/j.diagmicrobio.2007.06.008
2. Pappas PG. Invasive candidiasis. Infect Dis Clin 2006;20:485–506.
3. Sievert DM, Ricks P, Edwards JR, Schneider A, Patel J, Srinivasan A, *et al*. Antimicrobial-resistant pathogens associated with healthcare-associated infections summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2009–2010. Infect Control HospEpidemiol 2013;34:1–4.doi.org/10.1086/668770
4. Yapar N. Epidemiology and risk factors for invasive candidiasis. TherClin Risk Manag 2014;10:95–105.
5. Wisplinghoff H, Bischoff T, Tallent SM, Seifert H, Wenzel RP, Edmond MB. Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. Clin Infect Dis 2004;39:309–17.doi.org/10.1086/421946
6. Pfaller MA, Diekema DJ. Epidemiology of invasive candidiasis: a persistent public health problem. ClinMicrobiol Rev 2007;20:133–63.
7. Bassetti M, Trecarichi EM, Righi E, Sanguinetti M, Bisio F, Posteraro B, *et al*. Incidence, risk factors, and predictors of outcome of candidemia. Survey in 2 Italian university hospitals. DiagnMicrobiol Infect Dis 2007;58:32531.doi.org/10.1016/j.diagmicrobio.2007.01.005
8. Jiman-Fatani A, Meawed TE, El-Hossary D. Antifungal susceptibility, risk factors and treatment outcomes of patients with candidemia at a university hospital in Saudi Arabia. Int Arabic J Antimicrob Agent 2015;5:1–10.doi.org/10.3823/770
9. Al-Tawfiq JA. Distribution and epidemiology of Candida species causing fungemia at a Saudi Arabian hospital, 1996–2004. Int J Infect Dis 2007;11:239–44.doi.org/10.1016/j.ijid.2006.03.003
10. Al Thaqafi AH, Farahat FM, Al Harbi MI, Al Amri AF, Perfect JR. Predictors and outcomes of Candida bloodstream infection: eight-year surveillance, western Saudi Arabia. Int J Infect Dis 2014; 21:5–9.doi.org/10.1016/j.ijid.2013.12.012
11. Board AS. Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. J Parenteral Enteral Nutr 1993;17:1SA–52SA.doi.org/10.1177/014860719301700401
12. Pomposelli JJ, Bistrian BR. Is total parenteral nutrition immunosuppressive? New Horiz 1994;2:224–9.
13. Blumberg HM, Jarvis WR, Soucie JM, Edwards JE, Patterson JE, Pfaller MA, *et al*. Risk factors for candidal bloodstream infections in surgical intensive care unit patients: the NEMIS prospective multicenter study. Clin Infect Dis 2001;33:177–86.doi.org/10.1086/321811
14. Chow JK, Golan Y, Ruthazer R, Karchmer AW, Carmeli Y, Lichtenberg DA, *et al*. Risk factors for albicans and non-albicanscandidemia in the intensive care unit. Crit Care Med 2008;36:1993–8.doi.org/10.1097/ccm.0b013e31816fc4cd
15. Dimopoulos G, Karabinis A, Samonis G, Falagas ME. Candidemia in immunocompromised and immunocompetent critically ill patients: a prospective comparative study. Eur J ClinMicrobiol Infect Dis 2007;26:377–84.doi.org/10.1007/s10096-007-0316-2
16. Jordà-Marcos R, Álvarez-Lerma F, Jurado M, Palomar M, Nolla-Salas J, Leon MA, *et al*. Risk factors for candidaemia in critically ill patients: a prospective surveillance study. Mycoses 2007;50:302–10.doi.org/10.1111/j.1439-0507.2007.01366.x
17. Stratman RC, Martin CA, Rapp RP, Berger R, Magnuson B. Candidemia incidence in recipients of parenteral nutrition. NutrClinPract 2010;25:282–9.doi.org/10.1177/0884533610368704
18. Taylor BE, McClave SA, Martindale RG, Warren MM, Johnson DR, Braunschweig C, *et al*. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral

and Enteral Nutrition (ASPEN). Crit Care Med 2016;44:390–438.doi.org/10.1177/0148607115621863
19. Beghetto MG, Victorino J, Teixeira L, de Azevedo MJ. Parenteral nutrition as a risk factor for central venous catheter–related infection. J Parenteral Enteral Nutr 2005;29:367–73.doi.org/10.1177/0148607105029005367
20. Townell N, McDougall D, Playford EG. Parenteral nutrition-associated bloodstream infection in an Australian teaching hospital—An 8-year retrospective study of over 11,000 PN-days. Scand J Infect Dis 2014;46:361–7.doi.org/10.3109/00365548.2014.880185
21. Fuhrmann K, Panamonta N, Roaten S. Malnutrition in the ICU: Current recommendations for the assessment of nutritional status and a review of the use of albumin as an indicator of malnutrition. Southwest Respirat Crit Care Chron 2013;1:8–14.doi.org/10.12746/swrccc.v1i4.89
22. Luzzati R, Cavinato S, Giangreco M, Grana G, Centonze S, Deiana ML, *et al*. Peripheral and total parenteral nutrition as the strongest risk factors for nosocomial candidemia in elderly patients: a matched case–control study. Mycoses 2013;56:664–71.doi.org/10.1111/myc.12090
23. Yilmaz G, Koksal I, Aydin K, Caylan R, Sucu N, Aksoy F. Risk factors of catheter-related bloodstream infections in parenteral nutrition catheterization. J Parenteral Enteral Nutr 2007;31:284–7.doi.org/10.1177/0148607107031004284
24. Shah A, Madhavan T, Mihalko B, Bortell B. Duration of parenteral hyperalimentation and candidemia in severely ill hospitalized patients. J Chemother 1989;1:926–7.
25. Dimick JB, Swoboda S, Talamini MA, Pelz RK, Hendrix CW, Lipsett PA. Risk of colonization of central venous catheters: catheters for total parenteral nutrition vs other catheters. Am J Crit Care 2003;12:328–35.
26. Ocón BM, Mañas MA, Medrano NA, García GB, Gimeno OJ. Risk factors for catheter-related bloodstream infection in non-critical patients with total parenteral nutrition. NutrHosp 2012;28:878–83.
27. Cheung NW, Napier B, Zaccaria C, Fletcher JP. Hyperglycemia is associated with adverse outcomes in patients receiving total parenteral nutrition. Diabetes Care2005;28:236771.doi.org/10.2337/diacare.28.10.2367
28. McMahon MM, Nystrom E, Braunschweig C, Miles J, Compher C, the American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) Board of Directors, *et al*. "A.S.P.E.N. clinical guidelines: nutrition support of adult patients with hyperglycemia." JPEN J Parenter Enteral Nutr 2013;37:23–36.doi.org/10.1177/0148607112452001

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