Impact of a New Guideline for Central Venous Catheter Care on Sepsis in Total Parenteral Nutrition: Experience in Ramathibodi Hospital

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Background: *Total parenteral nutrition (TPN) is the essential treatment for hospitalized patients in whom normal enteral nutrition is inadequate or not feasible. However, TPN-related sepsis is the most serious and fatal complication of the treatment and the catheter is the most common cause of infection. Therefore, the Nutrition Support team in Ramathibodi Hospital has developed a new guideline for central venous catheter care for TPN patients and has used it for at least a year.*
Objective: *Survey the current incidence of TPN-related sepsis in the hospital, the predisposing factors of the TPN-related sepsis, and the pathogenic organisms of the sepsis.*
Material and Method: *Between July 1999 and February 2000, 52 TPN treatments (catheter count) in 40 surgical and medical patients were prospectively recruited. Microbiological studies were done in all cases of TPN-related sepsis.*
Results: *The incidence of TPN-related sepsis was 15% per catheter or 12.64/1000 catheter-days. Although no statistically significant predisposing factors were found for the sepsis, some factors such as postoperative TPN and short interval ($\leq$ 2 days) for TPN line change (OR = 3.33, 95% CI = 0.33-30.34) showed a higher risk for TPN-related sepsis. The most common pathogenic organisms were Coagulase-negative staphylococci, Candida albicans, and gram-negative bacteria. The organisms were found from hemoculture in septic patients and were well correlated with those found in the catheter line. Thus, the significant pathogenic role of Coagulase-negative staphylococci emphasizes the importance of aseptic technique during catheterization.*
Conclusion: *The Ramathibodi guideline rendered support for a good policy to improve and standardize the TPN treatment. Along with a practical guideline, the well-trained and highly responsible personnel would also be crucial to avoid the infectious complications.*

Keywords: *Guideline, TPN-related, Catheter*

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Malnutrition is a common problem for the patients in the hospital. The incidence of malnutrition in hospitalized patients is about 19-80%[1]. Proper nutrition support can improve patient's malnutrition either by enteral or parenteral route. Therefore, in whom normal enteral nutrition is inadequate or not feasible, central vein feeding should be an ideal treatment and could provide high-energy intake with limited fluid. However, the most important problem of the central vein feeding is the catheter-related sepsis, which occurs commonly if the catheter is not well cared for and happens more than infusion fluid contamination. The incidence of sepsis in total parenteral nutrition (TPN) treatment patients during 1969-1973 was about 3.5-27%[2-4]. In Thailand, the demand for TPN treatment

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is increasing and therefore, the Faculty of Medicine, Ramathibodi Hospital has introduced a new guideline for central venous catheter care for the practitioners (1998)[5]. The guideline has been in practice in the hospital since 1998. The present project was aimed to study the effect of the guideline on the incidence of the TPN-related sepsis, its predisposing factors and the relationship between the pathogenic organisms of the TPN-related sepsis and the organism found on the catheter tip or hub of the infusion line.

Material and Method

Definition

TPN-related sepsis would be diagnosed if the patient had a fever more than 38.5 degree and had positive blood culture with the same organisms from the catheters, from peripheral blood culture and from the tip of the catheter. At the same time, no other sources of infection were identified.

Patients aged between 18-70 years who were on TPN, during July 1999 - February 2000, in the Surgery and Medicine were recruited. The general demographic data, underlying disease, TPN solutions, insertion site, type of catheter, date of the first and the last day of TPN treatment, duration of TPN dressing change, duration of TPN line and fat-TPN line change, and other complications or problems were recorded. The criteria for diagnosis of infectious complications were either i. the body temperature at 38-38.4 C for 3 times in 24 hours or ii. the body temperature higher than 38.4 C after receiving TPN. Then, the patient's blood (5 mL) was drawn via catheter for hemoculture and via the peripheral vein. The TPN fluid (2 mL) was collected from central TPN-line in a sterile bottle. If there is an inflammation around the catheter insertion, swab the skin around the wound for culture. Apply heparin-lock to the TPN-line for 24 hours and then, if there is no spike of fever again, infuse NSS 1,000 ml via TPN-line for the next 24 hours. After that, if there is still no fever or the hemoculture result turns out negative, the TPN treatment will be continued. If the patient has fever, TPN-line will be taken off, the catheter tip for 4-5 cm long collected and the hub or the last joint close to the patient placed in a sterile bottle for culture.

Statistical analysis

The data were collected and analyzed with computer program Microsoft Access 97, SPSS version 9.05, and Stata version 6.0. The data were analyzed by descriptive statistics (mean, standard deviation (SD), Chi-square test, and odds ratio calculated with 95% confidence interval. In case of less than 5 subjects, the data were analyzed with Fisher's exact test. The patients' age (years) and duration of TPN treatment (days) were analyzed with Student's *t*-test after determining the data for normality and equal variances. A p-value of less than 0.05 was considered statistically significant. The incidence of TPN related sepsis was calculated as:

$$\% \text{ of TPN-related sepsis} = \frac{\text{Number of TPN-related sepsis cases} \times 100}{\text{Total number of cases}}$$

$$\text{and TPN-related sepsis per 1000 catheter-days} = \frac{\text{Number of TPN-related sepsis cases} \times 1000}{\text{Total catheter-days of risk}}$$

Results

Table 1 shows the basic information of the 52 TPN treatments including the patients' characteristics, summary of diagnosis, indication for TPN treatment, and Table 2. There were 40 patients, 27 males and 13 females, the mean age and mean duration of treatment was 53 years and 12 days, respectively. Most of them had malignant diseases and gastrointestinal (GI) problems, which impeded adequate enteral feeding. Postoperative complications were the most indications of TPN treatment. Table 2 shows details of laboratory data of all cases in which, there were no abnormal liver and renal function tests. All TPN treatment courses were conducted by the clinicians and resulted in 13 complete treatments with no complication, eight treatments ended up with mechanical problems of catheter, i.e. clot or leakage, 31 treatments were complicated with fever (59.6%) whereas 23 treatments were complicated with fever from other causes and eight treatments with TPN-related sepsis. The incidence of TPN-related sepsis was 15.4% per catheter or 12.64/1,000 catheter-day. Table 3 describes febrile cases with proven TPN-related sepsis. As for the indications for TPN, the post-operative support group had more TPN-related septic cases (8 of 21, 38.1%) than other groups ($p = 0.0003$, Fisher exact test). The mean age (years) and mean duration of TPN (days) were not significantly different between the TPN-related septic cases and the other (51.9 vs. 53.5 years and 14 vs. 12 days, respectively).

The predisposing factors of the TPN-related sepsis are shown in Table 4. Three types of catheters were used in the present study, Hickman, Cavafix and cut-down. The catheters had various numbers of lumens (one to three). Most cases used the single lumen catheter. Although the single lumen group had more cases with TPN-related sepsis than the double

Table 1. Patients' characteristics and indications for TPN

Characteristics	Total
Number of patients n (Male:Female)	40 (27:13)
Number of treatments catheter (Male:Female)	52 (35:17)
Age year; mean [± SD]	53.1 (± 19.8)
Duration of TPN treatment day; mean [± SD]	12.2 (± 12.5)
Summary of diagnosis by No of catheterization (n)	
Malignancy	24
Gastrointestinal (GI) disorders	22
Others	6
Indications for TPN by No of catheterization n (%)	
Postoperative nutritional support	21 (40.4)
Preoperative nutritional support	2 (3.8)
Gastrointestinal fistula	12 (23.1)
Inflammatory bowel diseases	17 (32.7)

Table 2. Initial laboratory data of the patients

Parameter	($\bar{x}$ ± SD)
Total protein (g/L)	64.1 ± 2.2
Albumin (g/L)	34.0 ± 4.9
Triglyceride (mmol/L)	1.3 ± 1.0
Cholesterol (mmol/L)	3.9 ± 1.9
Glucose (mmol/L)	7.6 ± 2.1
Uric acid (□mol/L)	242.0 ± 109.1
Calcium (mmol/L)	2.3 ± 1.0
Phosphorus (mmol/L)	1.2 ± 0.8
Hemoglobin (g%)	11.5 ± 1.7

lumen group (6 vs. 2), no definite conclusion could be made from the statistical test. Place of catheterization is considered another important factor for TPN-related sepsis. The patients who had venous access done in wards had more TPN-related sepsis than the patients who were done in the operate room (20% vs. 9.1%). However, the above differences could not reach statistical significance. Nearly all cases were catheterized by a resident and only two cases were done by fellow or staff. However, one of the two latter cases was complicated by TPN-related sepsis. Most cases were successfully performed with only one venupuncture. A similar number of TPN-related septic cases were found in both the 1-time and 2-time group (14.7% and 12.5%, respectively). There were two cases that needed three venupunctures and one of them was infected.

The nursing care for the catheters and TPN lines were observed as the interval of wound dressing (day), the interval of TPN-line and fat TPN-line change (day). The shorter is the interval of wound dressing (≤ 3 days), the more are TPN-related septic cases (interval ≤ 3 days vs. ≥ 7 days, 18.2% vs. 10.5%) and also the same as the TPN line change and fat-line change, the shorter interval group (≤ 2 days), the more septic cases (≤ 2 days vs. ≥ 3 days, 33.3% vs. 13% and 16.7% vs. 15%, respectively).

The etiological organisms of TPN-related sepsis are shown in Table 5. Most of the TPN-related septic cases showed positive blood culture and positive tip and hub culture with the same organisms. All of the catheter tips and hubs had colonization with the same organisms found in the blood culture, whereas the TPN mixtures gave all negative, except for one case. There was positive culture of C. albicans because a nurse made a mistake by collecting the TPN mixture culture via the TPN line instead of aspirating directly from the bottle. The most common pathogen was Coagulase-negative staphylococci. Two cases had signs of wound inflammation and positive swab cultures. However, only one of them showed the same organism with all tests. The most common organisms were Coagulase-negative staphylococci, Candida albicans, and gram-negative bacteria, respectively, which were similar to other reports.

Discussion

A study in the Gold Coast Hospital, Queensland revealed that the TPN-related sepsis rate was improved after the presence of TPN clinical nurses (16% vs. 37%)[6]. The Children's Hospital of Philadelphia also showed an improved infection rate after a standardized

Table 3. Patients' risk factors to TPN sepsis by number of catheterization

Factors	TPN-related sepsis (n = 8)	No TPN-related sepsis (n = 44)	p-value
Gender (Male : Female) ± SD	4:4	31:13	OR (95%CI) 2.38 (0.41-13.96)
Mean age (year) ± SD	51.9 ± 22.8	53.5 ± 19.0	0.481
Weight (kg) ± SD	47.9 ± 4.2	48.1 ± 5.1	0.211
Body mass index (kg/m^2) ± SD	17.9 ± 2.1	16.2 ± 1.8	0.200
Duration of TPN (days) ± SD	14.0 ± 18.0	12.0 ± 10.2	0.097
Diagnosis			
Malignancy	1	23	
Gastrointestinal (GI) disorders	7	15	
Others	0	6	
Indications for TPN			
Postoperative support	8	13	0.0003
Preoperative support	-	2	
Gastrointestinal fistula	-	12	
Inflammatory bowel diseases	-	17	

Table 4. Risk factors in catheterization and TPN sepsis

Factors	TPN-related sepsis (n = 8)	No TPN-related sepsis (n = 44)	Relative risk (95% CI)
Duration TPN (day)	14.0 ± 18.6	12.0 ± 10.2	0.097
Catheterization			
1. Type			
Hickman	4 (25.0%)	12 (75.0%)	2.67 (0.46-15.79)
Cavafix	4 (12.9%)	27 (87.1%)	0.63 (0.11-3.56)
Cut-down	-	5	
2. Lumen			
Single	6 (18.7%)	26 (81.3%)	2.08 (0.32-16.93)
Double	2 (12.5%)	14 (87.5%)	0.71 (0.09-4.78)
Triple	-	4	
Place of catheterization			
Operative room	2 (9.1%)	20 (90.9%)	2.50 (0.38-20.33)
Ward	6 (20.0%)	24 (80.0%)	
Operator			
Resident	7 (14.3%)	42 (85.7%)	3.00 (0-53.6)
Fellow or staff	1 (33.3%)	2 (66.7%)	
Number of venupuncture			0.86 (0.15-5.37)
1 time	5 (14.7%)	29 (85.3%)	0.71 (0.09-4.78)
2 times	2 (12.5%)	14 (87.5%)	6.14 (0-262.58)
3 times	1 (50%)	1 (50%)	
Interval of wound dressing			
≤ 3 days	6 (18.2%)	27 (81.8%)	1.89 (0.29-15.43)
≥ 7 days or none	2 (10.5%)	17 (89.5%)	
Interval of TPN line change			
≤ 2 days	2 (33.3%)	4 (66.7%)	3.33 (0.33-30.34)
3 days	6 (13.0%)	40 (87.0%)	
Inteval of fat line change			
≤ 2 days	2 (16.7%)	10 (83.3%)	1.13 (0.13-7.97)
≥ 3 days	6 (15%)	34 (85%)	

Table 5. Culture results in TPN-related septic patients

	Peripheral blood	Central blood	Catheter tips	Hub	TPN wound*	TPN mixture
I	Acinetobacter Calcoaceticus anitratus	Acinetobacter Calcoaceticus anitratus	Acinetobacter Calcoaceticus anitratus	No growth	Not done	No growth
II	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Not done	No growth
III	C. albicans	C. albicans	C. albicans	C. albicans	Not done	No growth
IV	C. albicans and Pseudo. aeruginosa	C. albicans	C. albicans	C. albicans	Not done	C. albicans
V	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Not done	No growth
VI	P. aeruginosa	P. aeruginosa	P. aeruginosa	P. aeruginosa	Not done	No growth
VII	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Bacillus cereus	No growth
VIII	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	Coagulase-negative Staphylococci	No growth

* Done when inflamed
Neg. = negative, Pos. = positive

TPN care program (4.58/1,000 to 3.83/1,000 catheter-day)[7]. Furthermore, Ryan et al[4] could reduce the TPN-related sepsis with an intensive TPN care program (20% to 3%). They suggested that the sepsis rate could be decreased with a good TPN care protocol. The good TPN care protocol means standardized care of the whole TPN treatment process including TPN fluid preparation, catheterization process, TPN and catheter line care, and complication monitoring. Ramathibodi Hospital has developed a standard guideline for central venous catheter care, which had been used for more than 1 year before the present study. The survey of current situation of TPN treatment in Ramathibodi Hospital was to evaluate the role of the guideline. The main outcomes observed were the incidence of TPN-related sepsis and its predisposing factors. Thirty-one of fifty-two TPN treatments were complicated with fever (59.6%), but only eight of them were diagnosed with TPN-related sepsis. There were four mortalities and all expired from their underlying diseases and no case was related to the TPN-related sepsis. The incidence of TPN-related sepsis was 15.4% per catheter or 12.64/1,000 catheter-days. This was not different from the results of earlier reports of TPN-related sepsis. Maki et al[2] found that the incidence of TPN sepsis was about 0-27%, whereas that of Ryan et al[4] was 20%.

The patients with and without sepsis had similar profiles regarding age, duration of TPN, catheters and TPN-line care pattern, types of catheter, operator and places of catheterization. With regard to the predisposing factors, a significant factor for TPN-related sepsis was the indication for postoperative TPN support (Table 3). The indication for TPN might not be a significant factor for TPN-related sepsis from a previous report[8]. However, postoperative patients might need more nursing care and more manipulation with their catheters and tubes than other kinds of patients. TPN-related sepsis associate with suboptimal care during the catherterization and the TPN nursing[9]. Age and gender are not risk factors for TPN-related sepsis[10]. Although the duration of TPN is a significant factor for TPN-related sepsis, the duration of TPN in the present study might not be long enough when compared to the other report in which the duration of TPN was continued for months[11]. Therefore, duration of TPN in the present series did not influence the septic risk and was not significantly different between septic and non-septic groups.

The catheter is the main cause of TPN-related sepsis. Type of catheter is a factor for infection. Cut-

down is a plain catheter placed at the antecubital fossa, moves more frequently, and causes less colonized, less oily, and less moisture in the chest and the neck[12]. It is placed far away from the nasal and the endotracheal secretion. Therefore, it is associated with a low rate of infection. The cut-down costs less and has fewer mechanical complications, such as thrombosis or hemothorax[13]. The reason for the unpopularity of cutdown is patient's discomfort and that it could not be maintained for a long period of time. Therefore, cut-down was used in only a few cases in the present study and did not seem to be a significant factor for TPN-related sepsis (Table 3). The Cavafix is another type of catheter placed percutaneously into the subclavian vein. It is convenient and easy with an experienced hand. The Hickman is a permanent, tunneled central venous catheter designed for inhibiting migration of organisms into the catheter. The Cavafix was used in most cases in the present study. However, no specific type of the catheter was significantly related to TPN- risk sepsis.

Three types of catheter lumen were used: single, double, and triple lumens. Multilumen catheter is designed for easy manipulation with many kinds of parenteral nutrients. Using only single lumen catheter may need more than one catheter sites. However, the bigger wounds due to more lumen, the larger the catheter thus, the higher are the risks of infection. Pemberton and McCarthy[14,15] showed a higher septic rate of the triple lumen catheter than the single lumen catheter: 19% vs. 13% and 12.8% vs. 0%, respectively. They have suggested that single lumen catheter should be used for TPN treatment[15,16]. However, Gil and Powell[7,18] reported a prospective study which showed that there was no difference in the rate of catheter colonization or catheter-related sepsis between single lumen and triple or double lumen catheter. The present study revealed that the single lumen and double lumens showed a higher incidence of TPN-related sepsis than the triple lumen (25%, 12.9% vs. 0%), but without any statistical difference.

The process of central venous catheterization is crucial for either the success or complications of TPN. Proper and sterile procedure can prolong the use of TPN line and prevent TPN-related sepsis. Sitges-Serra et al[19] found that catheter-related infections occurred on day 20 in cases who were catheterized in the operate room (OR), whereas those catheterized in the ward treatment room developed TPN-related sepsis on day-16. Six of eight TPN-septic cases in the present study were catheterized in ward treatment room, whereas only two were catheterized in the OR. The number may not be large enough to confirm the statistical significance, but it could show the same trend with a prior report[19]. However, the results might reflect the aseptic technique rather than the place of catheterization. The procedure in the OR was performed by personnel well dressed with mask, cap, gown, drape, and with better antiseptic technique than in the ward treatment room. Most guidelines recommend the cleanliness of the procedure itself rather than the place to perform the operation[9]. The experience of the operator for central venous access is very important as well. An inexperienced operator may break aseptic technique during the procedure or may perform multiple attempts to get a successful central venous access. Bernard et al[19] studied the contamination rate of the catheter tips from the TPN cases, which were operated by a non-expert (less than 50 collective cases) vs. the expert (more than 50 collective cases) as 56% vs. 25% of colonization rate on the catheter tips. Most of the cases in the present study were catheterized by residents and had 14.3% of the TPN-related septic cases, whereas those of the staff had 33%. However, this contradictory finding may need further studies before it can be concluded.

Improper TPN wound care is considered a risk factor for infection as well. Semi permeable, transparent dressing may be safe and cost-effective and is considered superior to gauze and tape[20]. If the central venous catheter placement is performed with full aseptic technique and proper dressing, the TPN should not need frequent dressing change. Many studies recommend a 7-day interval period for dressing change[17]. The present study reveals the TPN-related septic group had more earlier frequent wound dressing ($\leq$ 3 vs. $\geq$ 7-day interval).

The TPN-line and fat-line change interval is another risk factor for contamination even though the infusate is well-prepared and sterile. The more frequent the line change and manipulation, the higher is the risk of TPN related sepsis. The present study showed trend of infection in $\leq$ 2 days vs. $\geq$ 3 days change interval of TPN-line and fat-line as 33.3% vs. 13.0% and 16.7% vs. 15%, respectively, but without statistically significant difference.

The common organisms found in the TPN-related septic group were coagulase-negative staphylococci, Candida albicans, and gram-negative species, respectively (Table 5). These organisms are common as in many reports of TPN-related sepsis. There has been a marked change in the causative organisms of

TPN-related sepsis over the past two decades[21].The coagulase-negative staphylococci (CNS), replace the gram-negative species and accounts for 28% of all nosocomial TPN-related sepsis[21]. The presence of CNS infection implies a significant role of skin flora of both patient and operator or other health care workers in the pathogenesis of TPN sepsis. Therefore, catheterization and TPN care are very crucial and the TPN team must adhere to standardized protocol and quality control measures for TPN service. Staphylococcus aureus accounts for 16% of reported nosocomial TPN sepsis[22]. It used to be more common for TPN sepsis in the past and it has potency to spread and cause metastatic infection foci.

Candida species are the most common fungal infection and may account for 6-10% of TPN-related sepsis[23]. Recent epidemiologic studies have suggested that Candida infection is related with contaminated devices or TPN infusate[24]. Careful procedure for infusate preparation is needed to avoid this fatal infection. Fungal infection may result from prolonged use of broad spectrum antibiotics. The gram negative is another causative agent for TPN sepsis, but less common than CNS and fungus[10]. It could result from prolonged admission and use of broad spectrum antibiotics as well. Contaminated medical device should also be suspected when gram-negative TPN sepsis occurs[25].

The frequency of causative organisms for TPN sepsis in the present study was in accordance with previous studies. Coagulase-negative staphylococci accounted for 4 of 8 TPN-related sepsis. Gram-negative bacteria and Candida albicans accounted for 2 and 2 of 8 TPN septic cases, respectively. Coagulase-negative staphylococci is the major organism colonizing on skin. The culture results imply the significant role of those microorganisms on the patient and health care worker integument. The catheter wound is most likely the entry site of those pathogens. The source of infection is better explained by the inoculation and contamination during catheterization process and, from the present study, catheterization might be the most significant predisposing factor for TPN-related sepsis. Beside the catheterization procedure, TPN-line care might be another important factor as well. The supporting evidence is the results of interval of TPN-line change and TPN-related sepsis. The TPN mixture tests in the present study showed negative results, except in one case with positive Candida that was collected as a mistaken specimen. Most reports showed a very low rate of TPN fluid contamination (0.5-1%)[26]. Maki[27] has estimated the incidence of TPN sepsis from contaminated TPN fluid to be less than one per 1,000 infusions. This means that TPN fluid is usually well prepared, even made in-house, and should not be the suspicious item for a cause of infection unless there is more suggestive evidence. The diagnosis of TPN-related sepsis may need only three culture specimens from central blood, peripheral blood, and catheter tips. The hub culture usually reveals the same organism with the others and the TPN infusate culture rarely shows positive result. This policy can reduce the cost and time for clinicians and the patients.

It can be concluded that special care is needed for successful TPN treatment. Many studies have confirmed the advantage of the special well-trained TPN team that could reduce the TPN-related sepsis rate dramatically. Along with the well-experienced personnel, an effective standardized protocol for TPN care is also crucial for the treatment. Ramathibodi Hospital has used its own protocol for central venous catheter care for more than 1 year. The protocol has been assigned and expected to be followed by the health personnel in all wards that have TPN treatment. From the observation, all ward personnel followed the protocol very well and the protocol seemed to be effective to control the incidence of TPN-related sepsis in Ramathibodi Hospital. There might be some small differences in TPN care among them. The differences were the interval of the TPN wound care and dressing, interval of TPN line change, interval of fat line change, the management when TPN patient got febrile, etc. The presented TPN care protocol is a good policy to standardize the TPN program. Nevertheless, catheterization procedure may be a weak part of this TPN program. The pathogenic organisms might get access into the TPN wound during the procedure. The place for catheterization and the operator should be seriously controlled for a good start of TPN. Operating room may not be the essential part of the catheterization procedure and not available for all cases, but a clean room with fully aseptic technique and a sterile drape must be utilized. The operator should have some experience and/or be supervised closely by an expert. A good start for catheterization, followed by a good TPN care protocol, can guarantee the success of the presented TPN program. Nevertheless, applying the catheter properly in a clean room and well sterile preparation with experienced hands may be an effective way to prevent TPN-related sepsis with less cost.

Conclusion

The incidence of TPN-related sepsis was 15%

per catheter or 12.64 / 1,000 catheter-days. The incidence rate was similar to the rates from other reports. The statistical analysis could not reveal any significant factors predisposing to TPN-related sepsis, although the results might suggest some role of catheterization procedure and TPN line care.

References

1. Roongpisuthipong C. Clinical nutrition. Bangkok: Imageserplas; 1999.
2. Maki DG, Goldman DA, Rhame FS. Infection control in intravenous therapy. Ann Intern Med 1973; 79: 867-87.
3. Bernard RW, Stahl WM, Chase RM Jr. Subclavian vein catheterizations: a prospective study. II. Infection complications. Ann Surg 1971; 173: 191-200.
4. Ryan JA Jr, Abel RM, Abbott WM, Hopkins CC, Chesney TM, Coller R, et al. Catheter complications in total parenteral nutrition. A prospective study of 200 consecutive patients. N Engl J Med 1974; 290: 757-61.
5. Roongpisuthipong C, Suthatvoravut U, Sathpatyavong B, Komindr S, Churdavijug B, Junyongvorakul Y, et al. Guideline for central venous catheter care Faculty of Medicine, Ramathibodi Hospital, Mahidol Universiry 1998. Thai J Parenter Enteral Nutr 1998; 3: 98-103.
6. Jansen D. The impact of a clinical nurse's role on CVC infections and bacteremia: a two-year comparative, retrospective study. Aust Nurs J 1994; 1: 22-5.
7. Lange BJ, Weiman M, Feuer EJ, Jakobowski D, Bilodeau J, Stallings VA, et al. Impact of changes in catheter management on infectious complications among children with central venous catheters. Infect Control Hosp Epidemiol 1997; 18: 326-32.
8. Hickey MM, Munyer TO, Salem RB, Yost RL. Parenteral nutrition utilization: evaluation of an educational protocol and consult service. JPEN J Parenter Enteral Nutr 1979; 3: 433-7.
9. Pearson ML. Guideline for prevention of intravascular device-related infections. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1996; 17: 438-73.
10. Miller SJ. Peripheral parenteral nutrition: theory and practice. Hosp Pharm 1991; 26: 796-801.
11. Ziegenbein RC. Focused review criteria for central parenteral nutrition. Nutr Clin Pract 1989; 4: 24-30.
12. Roth RR, James WD. Microbial ecology of the skin. Annu Rev Microbiol 1988; 42: 441-64.
13. Ryder MA. Peripheral access options. Surg Oncol Clin North Am 1995; 4: 395-427.
14. Pemberton LB, Lyman B, Lander V, Covinsky J. Sepsis from triple- vs single-lumen catheters during total parenteral nutrition in surgical or critically ill patients. Arch Surg 1986; 121: 591-4.
15. McCarthy MC, Shives JK, Robison RJ, Broadie TA. Prospective evaluation of single and triple lumen catheters in total parenteral nutrition. JPEN J Parenter Enteral Nutr 1987; 11: 259-62.
16. Clark-Christoff N, Watters VA, Sparks W, Snyder P, Grant JP. Use of triple-lumen subclavian catheters for administration of total parenteral nutrition. JPEN J Parenter Enteral Nutr 1992; 16: 403-7.
17. Gil RT, Kruse JA, Thill-Baharozian MC, Carlson RW. Triple- vs single lumen central venous catheters. A prospective study in a critically ill population. Arch Intern Med 1989; 149: 1139-43.
18. Powell C, Fabri PJ, Kudsk KA. Risk of infection accompanying the use of single-lumen vs double-lumen subclavian catheters: a prospective randomized study. JPEN J Parenter Enteral Nutr 1988; 12: 127-9.
19. Sitges-Serra A, Puig P, Jaurrieta E, Garau J, Alastrue A, Sitges-Creus A. Catheter sepsis due to Staphylococcus epidermidis during parenteral nutrition. Surg Gynecol Obstet 1980; 151: 481-3.
20. Young GP, Alexeyeff M, Russell DM, Thomas RJ. Catheter sepsis during parenteral nutrition: the safety of long-term opsite dressings. JPEN J Parenter Enteral Nutr 1988; 12: 365-70.
21. Banerjee SN, Emori TG, Culver DH, Gaynes RP, Jarvis WR, Horan T, et al. Secular trends in nosocomial primary bloodstream infections in the United States, 1980-1989. National Nosocomial Infections Surveillance System. Am J Med 1991; 91(Suppl 3B): 86S-9S.
22. Jarvis WR, Martone WJ. Predominant pathogens in hospital infections. J Antimicrob Chemother 1992; 29(Suppl A): 19-24.
23. Beck-Sague C, Jarvis WR. Secular trends in the epidemiology of nosocomial fungal infections in the United States, 1980-1990. National Nosocomial Infections Surveillance System. J Infect Dis 1993; 167: 1247-51.
24. Sherertz RJ, Gledhill KS, Hampton KD, Pfaller MA, Givner LB, Abramson JS, et al. Outbreak of Candida bloodstream infections associated with retrograde medication administration in a neonatal intensive care unit. J Pediatr 1992; 120: 455-61.
25. Beck-Sague CM, Jarvis WR. Epidemia blood-

stream infections associated with pressure transducers: a persistent problem. Infect Control Hosp Epidemiol 1989; 10: 54-9.
26. Josephson A, Gombert ME, Sierra MF, Karanfil LV, Tansino GF. The relationship between intravenous fluid contamination and the frequency of tubing replacement. Infect Control 1985; 6: 367-70.
27. Maki DG. Sepsis arising from extrinsic contamination of the infusion and measures for control. In: Phillips I, Meers PD, D'Arcy PF, editors. Microbiological hazards of infusion therapy. Lancaster: MTP Press; 1976: 99-143.

ผลการใช้แนวทางการดูแลสายสวนหลอดเลือดดำส่วนกลางสำหรับการให้สารอาหารทางหลอดเลือดดำแบบครบถ้วนต่อภาวะติดเชื้อแทรกซ้อนในโรงพยาบาลรามาธิบดี

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การให้สารอาหารทางหลอดเลือดดำแบบครบถ้วน (TPN) เป็นการรักษาที่สำคัญสำหรับผู้ป่วยที่มีปัญหาในการให้อาหารผ่านระบบทางเดินอาหารไม่ได้ แต่ TPN ก็มีภาวะแทรกซ้อนที่สำคัญคือการติดเชื้อที่เกี่ยวข้องกับสายสวน เพื่อเป็นการป้องกันปัญหาดังกล่าว โรงพยาบาลรามาธิบดีได้พัฒนาแนวทางการดูแลสายสวนหลอดเลือดดำส่วนกลาง ซึ่งได้ใช้มาเป็นเวลา 1 ปี การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาอุบัติการณ์ของการติดเชื้อแทรกซ้อนอันเนื่องจาก TPN ปัจจัยเสี่ยงต่อการติดเชื้อ และเชื้อที่เป็นสาเหตุ โดยได้ทำการศึกษาแบบไปข้างหน้าในผู้ป่วยอายุรกรรมและศัลยกรรมของโรงพยาบาลรามาธิบดี จำนวน 40 คน ในช่วง กรกฎาคม พ.ศ. 2542 ถึง กุมภาพันธ์ พ.ศ. 2543 ซึ่งมีจำนวนการใช้ TPN รักษา 52 ครั้ง (catheter count) ผู้ป่วยจะได้รับการตรวจทางจุลชีววิทยาเพื่อหาความสัมพันธ์ของเชื้อที่เป็นสาเหตุกับเชื้อที่พบที่สายสวนหลอดเลือดดำ ผลการศึกษาพบว่า อุบัติการณ์ของภาวะติดเชื้อแทรกซ้อนที่เกี่ยวข้องกับ TPN เท่ากับร้อยละ 15 ต่อ catheter หรือ 12.64 ต่อ 1,000 catheter-days ปัจจัยเสี่ยงต่อภาวะติดเชื้อที่พบในการศึกษานี้ได้แก่ การให้ TPN สำหรับผู้ป่วยหลังผ่าตัด และการเปลี่ยนสาย TPN สำหรับสารอาหารบ่อยกว่าทุก 2 วัน (OR = 3.33, 95%CI = 0.33-30.34) อย่างไรก็ตาม ปัจจัยเสี่ยงที่พบยังไม่แสดงนัยสำคัญทางสถิติ เชื้อที่เป็นสาเหตุของภาวะติดเชื้อแทรกซ้อนที่เกี่ยวข้องกับ TPN ได้แก่ โคแอกูเลส เนกาตีฟ สแตฟฟิโลคอคคัส แคนดิดา อัลบิแคนส์ และเชื้อแบคทีเรียแกรมลบ ตามลำดับ เชื้อที่พบในเลือดของผู้ป่วยจะสอดคล้องกับเชื้อที่พบในสายสวนหลอดเลือดดำ ทั้งนี้การที่เชื้อ โคแอกูเลส เนกาตีฟ สแตฟฟิโลคอคคัส เป็นสาเหตุหลักของการติดเชื้อแทรกซ้อนแสดงให้เห็นถึงความสำคัญ และความจำเป็นที่ต้องระมัดระวังในการใช้เทคนิคปราศจากเชื้อในการแทงสายสวนหลอดเลือดดำ

***สรุป**: ข้อปฏิบัติของโรงพยาบาลรามาธิบดีช่วยให้เกิดนโยบายที่ดี ในการปรับปรุงวิธีการให้อาหารทางหลอดเลือดดำให้ได้มาตรฐาน ร่วมกับการปฏิบัติตามคำแนะนำ ควรมีบุคลากรที่ฝึกฝนมาแล้ว และมีความรับผิดชอบสูงซึ่งเป็นสิ่งสำคัญยิ่ง ในการหลีกเลี่ยงโรคแทรกซ้อนจากการติดเชื้อ*