Effects of Intraluminal Vancomycin in Decreasing Central Venous Catheter Infection

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Abstract

Background: Central venous catheters (CVC) are important intravenous routes, that nowadays they can be used for various reasons including resuscitation management, intravenous feeding, chemotherapy drugs, and blood transfusions. Due to the special importance and increasing usage of these catheters lengthening the duration of these catheters are very important. Infections are the most common cause of removal of this catheter.

Methods: In this prospective study (cohort), 80 patients with central venous catheter were divided into two groups. In the first group Vancomycin once per day injected inside catheter equal to their intraluminal volume and remained for 2 h, then catheter was aspirated and washed. But in control group catheter was washed only with normal saline. Finally, catheter infection rates in the two groups were compared.

Results: In the group that used intraluminal Vancomycin, catheter infection was observed in 3 cases and was confirmed by blood culture, but in none of them catheter infection agent was not Gram-positive cocci. In control group, 18 cases of catheter infection were confirmed by culture that in 16 cases were caused by Gram-positive cocci that in 14 cases catheter was removed, and in 2 cases of catheter infection, infectious agent was Staphylococcus epidermidis which catheter maintained with appropriate antibiotics.

Conclusions: Use of the intraluminal Vancomycin significantly reduces the rate of infection and thus increase the survival rate of CVC.

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Introduction

Central venous catheters (CVC) are inserted through an internal jugular vein or subclavian vein and tip of them is placed in the right atrium entrance (1-3). CVC are used for various purposes, including the resuscitation management and fluid therapy, especially in cases where other measures, such as urine or vital signs are not reliable or for injecting solutions with a high concentration such as glucose higher than 10% which injection of these solutions through peripheral veins cause phlebitis and venous damage (4,5). Furthermore, in patients who require long-term use of reliable intravenous lines, CVC can be used.

Embedding CVC accompanied with important complications, among them include pneumothorax, cardiac arrhythmias, air embolism, and damage to adjacent artery (6-9). With regard to matters mentioned maintenance of central venous catheter is very important and should not be routinely replaced or removed. The most common cause for removal of this catheter is infections; these infections are an important factor in the morbidity and mortality of patients (10-13). Gram-positive organisms are responsible for most of central venous catheter-related infections, such that in 40-80% of cases is factor for Staphylococcus and other factors such as Enterococcus and Gram-negative bacilli were seen in patients with weakened immune systems. Less cases are included (14-16).

In similar studies about dialysis temporary catheters or dialysis catheter with cuff, considerably have been saved (17-19). According to the wider use of CVC Compared with dialysis catheters, we decided to investigate the effect of intraluminal antibiotics to increase survival and reduce morbidity and mortality in patients.

Materials and Methods

A prospective cohort study conducted during March-September 2012. In this study, 80 inpatients that were

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received central venous catheter were selected from two hospitals (Shariati and Sina Hospitals) in Tehran, Iran. All catheters have a lumen and have been made by ARROW and all of them embedded through right subclavian because infection in internal jugular and subclavian venous catheter is different. All the patients had a catheter inserted for total parenteral nutrition (TPN).

Patients by computer randomly divided into two groups of 40 patients each. In control group, patients without any intervention were observed, but in second group once daily equal volume of intraluminal catheter received intraluminal vancomycin and 2 hours after injection, CVC has not been used.

During the study period, if patients experienced symptoms of sepsis syndrome, first probable infection sites such as urinary tract infection, pneumonia, surgical wound infections, and area of environmental catheter investigated and then after rejecting the other infection sites and doing the peripheral blood culture using content of sent catheter, catheter infection could be considered if microbial growth was similar.

Since during the initial investigation for possible infection source blood culture has been sent. Therefore, if that growth staphylococcus epidermidis, without removing the catheter implanted catheter infection treated with antibiotics. Finally, the incidence of infection in the two groups was compared. Data and statistical analysis was performed using SPSS software (version 21.0, IBM Corporation, Armonk, NY, USA) and t-test was used for comparison of two groups.

Results

During the study, in group that received intraluminal vancomycin three cases of catheter infection proven by culture was observed. In all three cases, Gram-negative bacteria had grown, and the catheter was removed.

In the control group, 18 cases of infection were observed (confirmed by blood cultures) that 16 of them, (8.88%) grown factor was Gram-positive cocci. In 14 cases, the catheter was removed and sent for cultivation, and the tip of the catheter infection was confirmed. In 2 other cases, since grown factor was Staphylococcus epidermidis addition to maintaining the catheter infection was cured by treatment AB. The average time to maintain the catheter in patients treated with intraluminal vancomycin was 28.7 days and in the second group was 13.1 days.

Discussion

In the present study which designed as a cohort study, 80 patients were selected. To avoid the confounding effect of how to use of the catheters, in all cases, the purpose of Embedding central venous catheter was TPN. Considering that location of catheter effects on infection rate, and subclavian catheters have the lowest rates of infection, all patients had right subclavian catheter to remove the confounding variable. Due to the patients with immune deficiency system are more at risk of infection compared to normal patients. Selected patients, neither of them did not suffering from immune deficiency diseases and chronic diseases. CVC are made of different types and by different companies. In this study, to avoid confounding the catheters that coated with antibiotic were not used. Meanwhile, in all patients single lumen central venous catheter sets (14 Ga and length 20 cm) were used, that produced by Arrow Company, diameter of catheters are 0.032 inch which is roughly equivalent 0.81 mm. Stick and length of used catheter were 18 Ga and 6.35 cm, respectively. Laboratory flow velocity of this catheter is 6900 cc/hour, and their intraluminal volume is 0.35 cc.

Size of injected Vancomycin in catheter without any connections such as road and Etc. was 4 cc that this injection conducted by insulin syringe and intravenous vancomycin (Vancomycin 500 mg) made by Jaber Hayan Pharmaceutical Company was used which is the equivalent 40 mg of intraluminal volume. Of the study and after all these measures do significantly with $P < 0.05$ the rate of infection was lower in patients treated with intraluminal AB, and therefore the longevity of the catheters was also significantly higher, and also longevity of catheters significantly increased.

As mentioned CVC are important, but because of its dangerous potential effects use of them is specific, and is exclusive to this catheter. Therefore, we would increase the duration of their consumption to fewer complications imposed on patients. Central venous catheter infections are the most common cause leading to the removal of central venous catheter. However, central venous catheter infections have dangerous complications and potentially fatal such as septic shock or sever sepsis, using a strategy that can reduce the rate of infection can be very beneficial in reducing morbidity and mortality (20).

Use of intraluminal vancomycin as a strategy that was used in CVCs in this study showed that use of them can be helpful in reduce the infection rate and increase the longevity of CVC.

As a conclusion, vancomycin can reduce central venous catheter infection. Furthermore, use of intraluminal Vancomycin can increase the duration of use CVC.

Conflict of Interests

Authors have no conflict of interests.

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References

1. Montreuil B. Vascular and peritoneal access. In: Souba WW, Fink MP, Jurkovic GJ, Editors. ACS Surgery: Principles and Practice. 6th ed. Toronto, ON: B C Decker; 2007.
2. Miller RD. Cardiovascular monitoring. In: Mark BJ, Slaughter TS, Editors. Anesthesia. 5th ed. London, UK: Cherchil-Livingstone; 2000.
3. Mansfield PF, Hohn DC, Fornage BD, Gregurich MA, Ota DM. Complications and failures of subclavian-vein catheterization. N Engl J Med 1994; 331(26): 1735-8.
4. Sharifi A, Shojaeifard A, Soroush A, Jafari M, Abdehgah AG, Mahmoudzade H. Predictors of regional lymph node recurrence after initial thyroidectomy in patients with thyroid cancer. J Thyroid Res 2016; 2016: 4127278.
5. Kashefi Marandi A, Shojaiefard A, Soroush A, Ghorbani AA, Jafari M, Khodadost M, et al. Evaluation of response to preoperative chemotherapy versus surgery alone in gastroesophageal cancer: tumor resectability, pathologic results and post-operative complications. Asian Pac J Cancer Prev 2016; 17 Spec No.: 231-7.
6. Moradi Y, Jafari M, Chaichian S, Khateri S, Akbarian A, Moazzami B. Trends in ovarian cancer incidence in Iran. Iran J Cancer Prev 2016; 9(6): e5452.
7. Sadat-Safavi SA, Nasiri S, Shojaiefard A, Jafari M, Abdehgah AG, Notash AY Jr, et al. Comparison the effect of stump closure by endoclips versus endoloop on the duration of surgery and complications in patients under laparoscopic appendectomy: A randomized clinical trial. J Res Med Sci 2016; 21: 87.
8. Jafari M, Ahmadzade F. Investigation of the association between the components of emotional intelligence and academic achievement in students. Razi J Med Sci 2014; 21(125): 85-93. [In Persian].
9. Dabbagh N, Soroosh A, Khorgami Z, Shojaeifard A, Jafari M, Abdehgah AG, et al. Single-incision laparoscopic cholecystectomy versus mini-laparoscopic cholecystectomy: A randomized clinical trial study. J Res Med Sci 2015; 20(12): 1153-9.
10. Kazemeyni SM, Otroj E, Mehraban D, Naderi GH, Ghadiri A, Jafari M. The role of noninvasive penile cuff test in patients with bladder outlet obstruction. Korean J Urol 2015; 56(10): 722-8.
11. Jafari M, Moradi Y, Khodadost M, Sekhavati E, Amini Anabad H, Moradpour F, et al. The trend of esophageal cancer incidence in Iran. Int J Travel Med Glob Health 2015; 3(3): 127-31.
12. Molavi B, Shojaiefard A, Jafari M, Ghorbani-Abdehgah A, Yaghoobi-Notash A, Mir A, et al. The effect of ticlopidine on early arteriovenous fistula Thrombosis: A randomized clinical trial. Iran J Surg 2017; 4(1): 9-12.
13. Conces DJ Jr, Holden RW. Aberrant locations and complications in initial placement of subclavian vein catheters. Arch Surg 1984; 119(3): 293-5.
14. McGee DC, Gould MK. Preventing complications of central venous catheterization. N Engl J Med 2003; 348(12): 1123-33.
15. Scott WL. Complications associated with central venous catheters. A Survey. Chest 1988; 94(6): 1221-4.
16. Sznajder JI, Zveibil FR, Bitterman H, Weiner P, Bursztein S. Central vein catheterization. Failure and complication rates by three percutaneous approaches. Arch Intern Med 1986; 146(2): 259-61.
17. Rippe JM, Irwin RS, Fink MP. Procedures and techniques-Central venous catheters. In: Rippe JM, Irwin RS, Fink MP, Cera FB, Editors. Intensive care medicine. Boston, MA: Little, Brown; 1996. p. 15-36.
18. Taylor RW, Palagiri AV. Central venous catheterization. Crit Care Med 2007; 35(5): 1390-6.
19. Almirall J, Gonzalez J, Rello J, Campistol JM, Montoliu J, Puig de la B, et al. Infection of hemodialysis catheters: Incidence and mechanisms. Am J Nephrol 1989; 9(6): 454-9.
20. Snell RS. The upper limb. In: Snell RS, Editor. Clinical anatomy: An illustrated review with questions and explanations. Philadelphia, PA: Lippincott Williams & Wilkins; 2004. p. 113-56.