Knowledge of Good Blood Culture Sampling Practice among Healthcare Staffs in An Emergency Department - Are We Getting It Right?

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SUMMARY

Background: Although a vital test, blood culture is often plagued with the problem of contamination and false results, especially in a chaotic emergency department setting. The objectives of this pilot study is to find out the level of understanding among healthcare staffs in emergency department, Hospital Universiti Sains Malaysia (HUSM) regarding good blood culture sampling practice.

Methods: All healthcare staffs in emergency department, HUSM who consented to this study were given a set of self-administered anonymous questionnaire to fill.

Results: More than half (53.1%) of the 64 participants are emergency medicine residents. Majority of them (75%) have been working in the emergency medicine, HUSM for more than 2 years. More than half of them were able to answer correctly the amount of blood volume needed for culture in adult and pediatric patients. When asked what are the factors required to improve the true yield as well as to reduce the risk of culture contamination, the four commonest answers given were observing proper aseptic technique during blood sampling, donning sterile glove, proper hand scrubbing as well as ensuring the sterility of the equipments.

Discussion and conclusion: This study suggests that there is a lack of proper knowledge of good blood culture sampling practice among our healthcare staffs in emergency department.

INTRODUCTION

According to the Clinical and Laboratory Standard Institutes (CLSI), blood culture is defined as a blood specimen that is submitted for bacterial or fungal culture irrespective of the number of bottles or tubes into which the specimen is divided or distributed[1]. It is a vital investigation with major implication in the diagnosis of serious infection and selection of appropriate anti-microbial therapy. Unfortunately, false positive blood culture results can occur due to contamination. Microorganisms like coagulase negative staphylococci, Corynebacterium species, Propionibacterium species, and alpha-hemolytic Streptococci are established organisms commonly resulted from contamination while performing blood taking. Misinterpretation of these organisms can have serious consequences to both hospital and patient care. For the patient the consequences may include misdiagnoses, unnecessary or prolonged antibiotic administration as well as increased length of hospital stays. On the other hand, the hospital budget may increase because of possibility of the need for additional blood culture and other diagnostic test. It also increases the workload of the laboratory technologist.

Therefore, there is a need to improve the standard of blood-culture-taking technique, and in turn, improves both the quality of patient care as well as judicious resources utilization[2]. The onus is on the nursing and medical staffs to be responsible for safe and effective blood sampling, especially in an emergency department setting. While the targeted rate for contamination is set to less than 2 - 3%[3], in reality, the rate of blood culture contamination varies between departments and hospitals. In the emergency department of Hospital Universiti Sains Malaysia (HUSM), the annual positive blood culture rates fluctuate between 9.5-40.8%. Out of these positive results, contaminated samples account for 2.7-14.3% of all positive cultures[4]. Most of these false positive results are caused by endogenous human microbial flora. Of importance is the fact that emergency department can be an extremely chaotic place when the patient load unpredictably surges. During these busy periods, healthcare professionals can be especially slack in observing aseptic technique. As such, strict skin preparation and good venipuncture technique are extremely important in reducing the rate of contamination[5].

Certain practices have been shown to improve the chance of obtaining the true yield as well as to reduce the risk of obtaining inadvertent false results from blood culture. These include proper training of staffs in aseptic technique when taking blood sampling, the optimal number of blood culture sampling sets that should be used, volume of blood in each culture bottle as well a the proper use of selective antiseptic agents for skin preparation. This paper is the results of a pilot project that we conducted in developing our structured learning package for good blood culture sampling practice for healthcare staffs in emergency department. The objective of this survey is to find out the knowledge level among healthcare staffs in emergency department, HUSM regarding these good practices in blood culture sampling.

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Table I: Responses to questions on good blood culture sampling practice

	Total number (%) or participants that responded (N = 64)
Occupation	
Paramedics	19 (29.7%)
House officers	5 (7.8%)
Medical officers	6 (9.4%)
Emergency medicine residents	34 (53.1%)
Have you been previously trained in proper blood culture sampling technique?	
Yes	30 (46.9%)
No	34 (53.1%)
Have you been previously trained in blood culture sampling?	
Yes	30 (46.9%)
No	34 (53.1%)
Blood volume needed for blood culture	
Answered correctly volume of blood culture in adult is 10 ml	44 (68.8%)
Answered correctly volume of blood culture in adult is 3 – 5 ml	48 (75.0%)
Contact time (CT) of different antiseptics	
Answered correctly that the contact time for povidone iodine is 1.5 – 2 min	14 (22.0%)
Answered correctly that the contact time for tincture iodine is 30 seconds	7 (11.0%)
Answered correctly that the contact time for chlorhexidine is 30 seconds	8 (12.5%)
Top four answers given by our participants on factors that can improve the chance of a true yield as well as to reduce the risk of culture contamination	
Observing proper aseptic technique during blood sampling	53 (82.8%)
Donning sterile glove	25 (39.1%)
Proper hand scrubbing	22 (34.4%)
Ensuring the sterility of the equipments	16 (25.0%)

MATERIALS & METHODS

All healthcare staffs in emergency department, HUSM who gave verbal consent to this survey were given a set of self-administered questionnaire to fill. The questionnaire was developed together with the trainers from BMS Diagnostics (M) Sdn Bhd. This questionnaire is not a validated questionnaire but is simply a pre-test handed out prior to a training session by BMS Diagnostic (M) Sdn Bhd to gauge the level of prior knowledge among participants.

To find out the knowledge level of blood culture sampling practice we asked our participants the amount of blood needed for culture sampling in adults and children, the skin contact time for different common antiseptic agents used, viz., providone iodine, tincture iodine and chlorhexidine as well as an open question on factors that may improve the chance of a true yield as well as to reduce the risk of culture contamination.

The participants were reminded that they were to fill the questionnaire anonymously without disclosing their names and identities. After completing the questionnaire, the forms were then handed back to the researchers. This was followed by a talk on good blood sampling practice by a trainer from BMS Diagnostics (M) Sdn Bhd. The variables that we asked in the questionnaire were elucidated in Table 1. The data was analyzed using IBM® Statistical Package for the Social Sciences (SPSS®) software version 20.

RESULTS

A total of 64 participants volunteered for this survey. Out of these, 53.1% are emergency medicine residents – trainees in emergency medicine specialty. Majority of them (75%) have been working in the emergency medicine, HUSM for more than 2 years. More than half of them were able to answer correctly the amount of blood volume needed for culture in adult patients as well as in pediatric patients excluding neonates and infants.

However, only 14 (22.0%) of participants answered correctly that the contact time for povidone iodine is 1.5 to 2 minutes, 7 (11.0%) of participants answered correctly that the contact time for tincture iodine is 30 seconds and 8 (12.5%) of participants answered correctly that the contact time for chlorhexidine is 30 seconds.

Using categorical analysis, we also found that there is no statistical significance between previous training in blood culture sampling practice and the ability to give a correct answer for the contact time for povidone iodine ($p=0.73$; CI 0.68 – 0.78), but there is significant statistical significance between previous training in blood culture sampling practice and the ability to give a correct answer for the contact time for tincture iodine and chlorhexidine (both with $p<0.001$ and CI 0.0008 – 0.0012). When asked what are the factors that improve the true yield as well as reduce the risk of culture contamination, the four commonest answers are observing proper aseptic technique during blood sampling, donning sterile glove, proper hand scrubbing as well as ensuring the sterility of the equipments.

DISCUSSION

Through this pilot study, we found that majority of the participants do not know that the proper duration for skin contact time when applying antiseptic agent. Skin contact time required for the antiseptic to exert its maximal effect is an important factor to reduce the risk of contamination[6]. Unfortunately, as demonstrated in this study, often the individual who is performing the blood culture procedure does not have the knowledge of the minimum contact time required for their chosen antiseptic agent, or the circumstances may not allow for a sufficient drying time, especially in an emergency department setting. For example, in this study, only 14 participants (22%) were able to answer correctly that the skin contact time when using povidone iodine is at least 1.5 – 2 minutes although povidone iodine is the most commonly used antiseptic in many Malaysian hospitals[7]. Perhaps, we should use chlorhexidine more often. Chlorhexidine is an antiseptic agent with broad-spectrum activities. A study has found that chlorhexidine plus alcohol results significantly lower contamination rate as compared to povidone iodine[8]. Despite the advantages of chlorhexidine however, its activity is pH dependent[9] and is not recommended to be used for infants and children less than 2 months of age[1]. Nonetheless, it should also be stressed that skin antisepsis cannot totally prevent contamination from skin flora as up to 20% of these bacteria have been found to be able to survive disinfectants particularly those that are located in the deep layers of the skins or sites where the antiseptics cannot penetrate easily[6].

Although 44 out of 64 (68.8%) of participants and 48 participants (75.0%) were able to answer correctly the volume of blood needed for adult and pediatric culture respectively, these figures are still relatively low when we should be expecting almost 100% of all healthcare staffs involved in obtaining the blood culture to know the amount of blood needed. This ignorance may not only contribute to wastage of resources but also lead to a delay in initiating antimicrobial therapy when the results are shown to be falsely negative. In fact, the volume of blood is the most important variable in determining the success to detect bacteremia or fungemia[1]. In numerous studies[10,11], a direct relationship between the diagnostic yield of blood cultures and the volume of blood cultured has been demonstrated. On the basis of this information, the recommended volume of blood per culture set for an adult is 10-30 mL,[12] However, blood volumes of more than 30 ml do not enhance the diagnostic yield and may contribute to nosocomial anemia especially among those of the extreme of age. In fact, as a practical matter, blood at these volumes may clot in the syringe, thereby making it impossible to inoculate the blood culture bottles. The optimal volume of blood that should be obtained from children has not been defined with certainty[13]. However, for infants and small children, Szymczak *et al.* (1979) concluded that the chance of failing to detect bacteremia was greater with blood volumes of less than 1 ml per culture than with blood volumes of more than 1 ml[14]. Therefore, on the basis of the available data, Paisley and Lauer (1994) have recommended 1-2 ml of blood per culture for neonates, 2- 3 ml for infants aged one month to 2 years, 3-5 ml for older children, and 10-20 ml for adolescents[13].

CONCLUSION

In conclusion, this study suggests that there is a lack of proper knowledge of good blood culture sampling practice among healthcare staffs in our emergency department. As such, there is a great need to educate our healthcare staffs in emergency department for good blood sampling practice in order to enhance efficiency, reduce contamination and improve our quality of patient care.

REFERENCES

1. Clinical and Laboratory Standard Institutes (CLSI). Principles and Procedures for Blood Cultures; Approved Guideline. Wayne, PA. 2007 Document Number M47-A
2. Alahmadi HA. Assessment of patient safety culture in Saudi Arabian hospitals. Qual Saf Health Care. 2010 Oct; 19(5): e17.
3. Chandrasekar PH, Brown WJ. Clinical issues of blood cultures. Arch Intern Med. 1994 Apr 25; 154(8): 841-9.
4. Hashairi F, Hasan H, Azlan K, Deris ZZ. An eight-year review of blood culture and susceptibility among sepsis cases in an emergency department in Northeastern Malaysia. Trop Biomed. Dec; 28(3): 599-605.
5. Weinstein MP. Current blood culture methods and systems: clinical concepts, technology, and interpretation of results. Clin Infect Dis. 1996 Jul; 23(1): 40-6.
6. Hall KK, Lyman JA. Updated review of blood culture contamination. Clin Microbiol Rev. 2006 Oct; 19(4): 788-802.
7. Darus N, M. Antiseptics for skin preparations prior to procedures. In: Health Technology Assessment Malaysian Ministry of Health; 2006. Available at URL: http://tinyurl.com/6pehup5 Accessed 7 April 2012
8. Mimoz O, Karim A, Mercat A, Cosseron M, Falissard B, Parker F, Richard C, Samii K, Nordmann P. Chlorhexidine compared with povidone-iodine as skin preparation before blood culture. A randomized, controlled trial. Ann Intern Med. 1999 Dec 7; 131(11): 834-7.
9. Rosenberg A, Alatary SD, Peterson AF. Safety and efficacy of the antiseptic chlorhexidine gluconate. Surg Gynecol Obstet. 1976 Nov; 143(5): 789-92.
10. Tenney JH, Reller LB, Mirrett S, Wang WL, Weinstein MP. Controlled evaluation of the volume of blood cultured in detection of bacteremia and fungemia. J Clin Microbiol. 1982 Apr; 15(4): 558-61.
11. Ilstrup DM, Washington JA, 2nd. The importance of volume of blood cultured in the detection of bacteremia and fungemia. Diagn Microbiol Infect Dis. 1983 Jun; 1(2): 107-10.
12. Ntusi N, Aubin L, Oliver S, Whitelaw A, Mendelson M. Guideline for the optimal use of blood cultures. S Afr Med J. Dec; 100(12): 839-43.
13. Paisley JW, Lauer BA. Pediatric blood cultures. Clin Lab Med. 1994 Mar; 14(1): 17-30.
14. Szymczak EG, Barr JT, Durbin WA, Goldmann DA. Evaluation of blood culture procedures in a pediatric hospital. J Clin Microbiol. 1979 Jan; 9(1): 88-92.