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Educational intervention as an effective step for reducing blood culture contamination: a prospective cohort study

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SUMMARY

Background: Contaminated blood cultures lead to diagnostic challenges and place a burden on healthcare services.

Aim: To determine the impact of introducing a clinical skills test (CST) as part of the medical licensing examination and an institutional education programme on the contamination rates of blood cultures.

Methods: A prospective cohort study was conducted from 2009 through 2013 in all wards of a tertiary-care teaching hospital. We evaluated the effects of the CST, which was added to the National Medical Licensing Examination in Korea (KMLE) in 2010 and our institutional education programme, which began in 2013. The medical interns in charge of collection of blood for culture were divided in three groups with presence or absence of CST and the institutional education programme. The primary outcome was the percentage of blood cultures contaminated in each group, which were compared using the Poisson regression model. Participants' self-rated scores for the blood draw procedure were also analysed.

Findings: Although introduction of the CST in the KMLE failed to reduce blood culture contamination rate (1.36% vs 1.35%; $P = 0.734$), the institutional education programme significantly reduced the contamination rate (1.35% vs 1.00%; $P < 0.0001$). Most participants answered that they always followed each step correctly except for waiting the recommended contact time after applying the antiseptic.

Conclusion: The educational intervention, not the introduction of CST in the KMLE, was effective in reducing overall contamination rates.

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Introduction

Taking a blood culture is a widely performed task in clinical practice and can provide essential information on various infectious diseases, including septicaemia or sepsis. A positive blood culture can indicate an infectious cause of the disease and evaluate a microbiological response to antibiotic therapy.[1] Unfortunately, false-positive blood culture results are often encountered due to specimen contamination.[2–4] These contaminated blood cultures have significant negative consequences for individual patients and the overall healthcare system. Treatment decisions based on a contaminated blood culture may lead to prescribing unneeded antibiotics, the unnecessary removal of central intravenous lines, extra hospital days, associated stress for the patient, and additional laboratory testing.[5–7] The financial impact of blood culture contamination has been described in a number of studies[8–11] and the cost burden for a contaminated blood culture and related therapies has been estimated at US$2,889 to $8,720 per episode.[12] Whereas the Clinical and Laboratory Standards Institute recommends a national benchmark for each healthcare institution to maintain a contamination rate <3%, reported contamination rates in hospitals vary widely and range from 0.6% to >6%.[5,13–17]

Although it is not possible to achieve contamination rates of zero or even close to zero, there have been significant efforts to reduce contamination, including those aimed at the collection methods — for example, obtaining blood via venepuncture rather than from an intravascular catheter and using a two-needle rather than a single-needle technique.[14] There is also evidence that some antiseptic preparations may be more efficacious than others in reducing contamination rates. An alcoholic solution of 0.5% chlorhexidine gluconate used as an antiseptic prior to a blood draw for culture was associated with significantly lower contamination rates compared with a standard povidone-iodine preparation.[18] We showed the efficacy of routinely wearing sterile gloves in reducing blood culture contamination rates in a previous randomized controlled trial.[19] Several published studies have shown that training phlebotomists or blood culture teams can reduce contamination rates in individual institutions.[20–23]

Although improving guidelines is important and an essential part of proper clinical procedures, it does not matter how perfect the guidelines are if physicians are not following them correctly. In 2010, the clinical skills test (CST) was introduced in Korea for the first time in Asia. The CST is an independent test performed from September to November before graduation as part of the National Medical Licensing Examination in Korea (KMLE). The CST was added, in part, to focus attention on clinical skills training as well as the acquisition of clinical knowledge; therefore, we expected that the clinical skills of physicians would improve.[24,25] In addition to the CST, our hospital started an institutional education programme for blood culture in 2013, as a part of the hospital infection control programme. Therefore, we hypothesized that the introduction of a CST in KMLE and educating medical interns on drawing blood for cultures would influence the blood culture contamination rates. In this study, we tried to determine the impact of introducing a CST in the medical licensing examination and of an institutional education programme on drawing blood samples.

Methods

Study design

This was a prospective, cohort study. We evaluated the impact of introducing CST in the KMLE as well as an institutional education programme on obtaining blood samples on blood culture contamination rates. For this purpose, the cohort was divided into three groups (Figure 1). Group 1 included interns in 2009, a period when there was no CST in the KMLE and no institutional education programme for blood draws. Group 2 included interns from 2010 to 2012, when the CST had been introduced, but not the institutional education programme. Group 3 includes interns in 2013, when both the CST and institutional education programme were introduced. We included all blood culture data from 2009 to 2013 in all 57 wards, including the emergency and paediatric departments, of the Seoul National University Hospital (SNUH), a 1600-bed, university-affiliated tertiary-care teaching hospital in Seoul, Korea. Blood culture contamination rates were compared between groups. At this hospital, medical interns rather than dedicated phlebotomists are in charge of drawing blood for cultures. The medical interns in the hospital were rotated through different departments each month. The institutional review board (IRB) at Seoul National University Hospital had approved the study protocol and approved the investigator's request to waive the requirement to obtain informed consent.

Education programme

Before 2013, there was just a brief, annual lecture regarding the blood draw for culture process in our hospital given just before starting the medical internships. In February 2013, we initiated an education programme on drawing blood for culture for all medical interns before starting internship training in March as a part of the hospital infection control programme. The education programme was composed of self-learning the blood drawing using video clips and guidelines, simulation practice using a manikin on a one-to-one basis, tutor's evaluation, and giving feedback for the procedure. Twelve professors instructed the simulation practice and ensured the proper technique of each participant. All 187 medical interns participated in the programme. Any medical intern who failed to show proper technique participated in a remedial course and

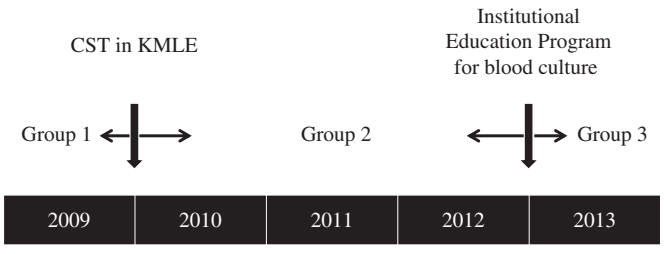

Figure 1. Cohort study group and flow diagram. The cohort was divided into three groups. Group 1 did not experience the clinical skills examination in the National Medical Licensing Examination in Korea (KMLE) or the educational intervention. Group 2 had the clinical skills test (CST), but not the educational intervention. Group 3 had the CST and the educational intervention.