Journal of Infection (2008) **56**, 354–359

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A randomized trial of 2% chlorhexidine tincture compared with 10% aqueous povidone–iodine for venipuncture site disinfection: Effects on blood culture contamination rates☆

Gompol Suwanpimolkul, Montri Pongkumpai, Chusana Suankratay*

Division of Infectious Diseases, Department of Medicine, Faculty of Medicine, Chulalongkorn University, PhraramIV Road, Pathumwan, Bangkok 10330, Thailand

Accepted 6 March 2008
Available online 14 April 2008

KEYWORDS
Chlorhexidine;
Povidone–iodine;
Alcohol;
Blood cultures;
Disinfection;
Antiseptics;
Contamination rate

Summary *Background:* Contaminated blood cultures have been recognized as a bothersome issue, and continue to cause frustration for clinicians. Skin antiseptics can prevent blood culture contamination. To our knowledge, there have been no randomized studies to compare 2% alcoholic chlorhexidine and 10% aqueous povidone–iodine for venipuncture site disinfection.
Objective: This study aimed to evaluate the efficacy of venipuncture site disinfection with 2% chlorhexidine in 70% alcohol and 10% aqueous povidone–iodine in preventing blood culture contamination.
Patients and methods: A prospectively randomized investigator-blinded trial was conducted in all patients in the medical wards and emergency room (ER) at King Chulalongkorn Memorial Hospital, Bangkok, Thailand, from August to October, 2006. Venipuncture sites were disinfected with 2% chlorhexidine in 70% alcohol or 10% aqueous povidone–iodine, and blood cultures were taken by students, residents, or nurses.
Results: Of 2146 blood cultures, 108 (5.03%) were contaminated with skin flora. The blood culture contamination rate with 2% alcoholic chlorhexidine was 3.2% (34 of 1068), compared with a rate of 6.9% (74 of 1078) ($P < 0.001$) with 10% aqueous povidone–iodine. In medical wards, the contamination rates were 2.6% and 3.9% with 2% alcoholic chlorhexidine and 10% aqueous povidone–iodine ($P = 0.2$). In ER, the contamination rates were 4.3% and 12.5% with 2% alcoholic chlorhexidine and 10% aqueous povidone–iodine ($P < 0.001$). The most common

☆ This study was presented in part at the 17th European Congress of Clinical Microbiology and Infectious Diseases, Munich, Germany, 31 March to April 3, 2007 [Abstract O18].

* Corresponding author. Tel./fax: +66 2 256 4578.
E-mail address: chusana.s@chula.ac.th (C. Suankratay).

doi:10.1016/j.jinf.2008.03.001

contaminant was coagulase-negative *Staphylococcus* (80.6%), followed by *Corynebacterium* (7.4%), *Micrococcus* (6.5%), and *Bacillus* (5.5%).
Conclusion: Two percent alcoholic chlorhexidine is superior to 10% aqueous povidone—iodine for venipuncture site disinfection before obtaining blood cultures.

Introduction

Blood cultures are among the most important laboratory tests performed in the diagnosis of infectious diseases. It has recently become apparent that contaminated blood cultures are common, enormously costly and frequently cause confusion for clinicians. Institution-specific contamination rates vary from 2% to more than 6%.[1] Coagulase-negative *Staphylococcus* (CoNS), aerobic and anaerobic diphtheroids, *Micrococcus* spp., *Bacillus* spp., and viridans *Streptococcus* are considered contaminants, if two or more blood cultures are obtained and only one is positive.[2] False-positive blood cultures may result in errors in clinical interpretation, inappropriate antibiotic use, additional laboratory investigations, longer length of hospital stays, and extra hospital costs.[3,4] Povidone—iodine is used as a skin antiseptic agent before taking blood cultures in many medical centers and also at our institution, King Chulalongkorn Memorial Hospital. A recent meta-analysis of eight randomized, controlled studies found that the incidence of intravenous catheter-related bloodstream infection was significantly lower among patients whose catheter sites were disinfected with chlorhexidine gluconate than among those for whom povidone—iodine was used.[5–12] Chlorhexidine and iodine tincture (maximum antiseptic effect of 30 s) have a more rapid bactericidal effect than povidone—iodine (maximum antiseptic effect of 1.5—2 min).[2] Chlorhexidine is a cationic bisbiguanide that reverses the surface charge of the bacterial cells, resulting in leakage of cytoplasmic contents and cell death.[13] Alcohol may speed the drying time, and alcohol itself is an effective antiseptic agent. However, to our knowledge, there have been no randomized studies to compare the blood culture contamination associated with the use of 2% alcoholic chlorhexidine gluconate and 10% aqueous povidone—iodine. In this study, we aimed to evaluate the efficacy of venipuncture site disinfection with 2% chlorhexidine in 70% alcohol and 10% aqueous povidone—iodine in preventing blood culture contamination at King Chulalongkorn Memorial Hospital, Bangkok, Thailand.

Methods

Patients

This study was conducted on all patients who needed to have two or more blood cultures drawn through peripheral veins at 12 medical wards, two intensive care units (ICUs), and one emergency room (ER) at King Chulalongkorn Memorial Hospital, a tertiary-care teaching hospital, from August 15 to October 15, 2006. The study included patients of 16 years of age or older, who had symptoms or signs of bacteremia requiring blood cultures taken from the peripheral veins. We excluded patients with apparent skin infection or dermatitis at the venipuncture site of blood cultures. Written consent was obtained from all patients, and the institutional review board approved the protocol.

Design

A prospectively randomized investigator-blinded study was carried out. Each patient received the intervention including 2% chlorhexidine in 70% alcohol (Medichem, Poligono Industrial, Girona, Spain) or 10% aqueous povidone—iodine (Mundipharma BV, the Netherlands) as a skin antiseptic agent before obtaining blood cultures. Computerized randomization lists were generated in blocks of four and were stratified by unit of hospitalization (12 medical wards and two ICUs), except at ER where the alternate 1-week duration of each antiseptic agent was assigned during the whole study period (Fig. 1).

Routine skin antiseptic technique as recommended by an institutional protocol was done by vigorously applying the assigned antiseptic solution twice. Approximately 1 min after the application, a blood sample was obtained by medical students or residents in medical wards and ICUs, and by nurses in ER. Culture bottles were prepared, while the venipuncture site was drying. The tops were wiped with a 10% povidone—iodine pad that was then placed over the septum until the time of inoculation. Needle change methodology was employed. The 5-ml sample was inoculated into an aerobic bottle of blood culture broth (TREK Diagnostic Systems, Cleveland, OH, USA), and then was incubated at

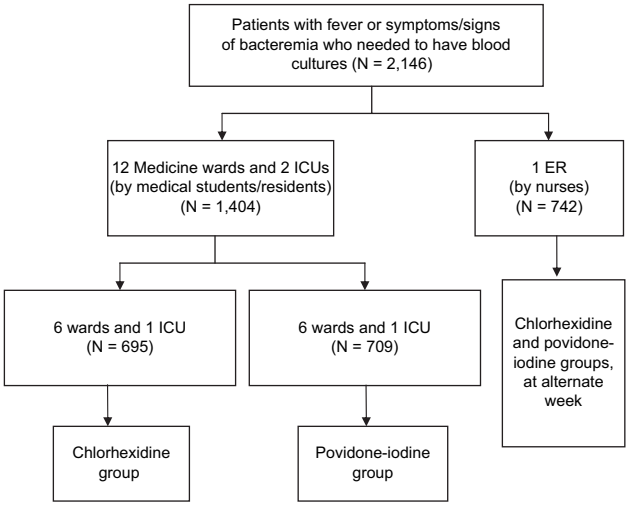

Figure 1 Trial design for 12 medical wards and two intensive care units (ICUs) as well as one emergency room (ER) selected for using 2% chlorhexidine in 70% alcohol and 10% aqueous povidone—iodine antiseptics.