Journal of Microbiology, Immunology and Infection (2017) xx, 1–6

Available online at www.sciencedirect.com

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journal homepage: www.e-jmii.com

Original Article

Implementation of a national bundle care program to reduce central line-associated bloodstream infections in intensive care units in Taiwan

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Received 9 October 2017; received in revised form 10 October 2017; accepted 10 October 2017
Available online ■ ■ ■

KEYWORDS
Central line-associated

Abstract *Background/purpose:* This study assessed the effect of the central line bundle on the rate of central line-associated bloodstream infections (CLABSI) in intensive care units (ICUs) in Taiwan.

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https://doi.org/10.1016/j.jmii.2017.10.001

bloodstream infections;
Bundle care;
Intensive care units;
Taiwan

Methods: This national study was conducted in 27 ICUs with 404 beds total, including 15 medical ICUs, 11 surgical ICUs, and one mixed ICU. The study period was divided into two phases: a pre-intervention (between June 1, 2011 and October 31, 2011) and intervention phase (between December 1, 2011 and October 31, 2012). Outcome variables, including CLABSI rates (per 1000 catheter-days) and catheter utilization rates, were measured.
Results: The overall rate of CLABSI significantly decreased by 12.2% ($p < 0.001$) from 5.74 per 1000 catheter-days in the pre-intervention phase to 5.04 per 1000 catheter-days in the intervention phase. The catheter utilization rate decreased by 1.1% from 55.3% in the pre-intervention phase to 54.2% in the intervention phase. The decline in CLABSI varied significantly among hospital and ICU levels, except surgical ICUs ($p = 0.59$).
Conclusions: Implementing a multidimensional central-line bundle significantly reduced the rates of CLABSI by 12.2% in nearly all participating ICUs, except surgical ICUs.

Introduction

Central venous catheters (CVC) are indicated to monitor hemodynamic status and administer drugs with a low risk of phlebitis, as well as for hemodialysis and intravenous access; thus, it is a common device in hospitals. However, CVC insertion can cause complications including pneumothorax, bleeding problems, air embolism, arrhythmias and even death. Additionally, the delayed complication, known as central line-associated bloodstream infection (CLABSI), can occur and have negative impacts such as increasing mortality, morbidity, hospital stay, and overall medical costs.[1–4] In Taiwan, a previous study evaluating the comparative impact of hospital-acquired infections on medical costs, length of hospital stay, and outcomes clearly demonstrated that patients with hospital-acquired BSI were associated with prolonged hospital stay (mean, 15.5 days in one medical center and 16.6 days in two regional hospitals) and extra hospital costs (mean, US$4872 and US$4643 in the medical center and regional hospitals, respectively).[5] CLABSI is a major life-threatening disease in intensive care units (ICUs) worldwide,[6] with Taiwan being no exception.[7–10]

Fortunately, CLABSI is preventable with appropriate care.[11] Several evidence-based interventions, such as chlorhexidine gluconate (CHG) use to prepare the insertion site, maximal sterile barriers when inserting the CVC, use of the subclavian or internal jugular vein as the insertion site, hand hygiene, and early removal of the CVC if not needed, were developed to prevent CLABSI.[12–15] The Institute for Healthcare Improvement (IHI) incorporated these interventions into a care bundle known as the central line bundle. A recent meta-analysis including 79 studies reported after implementation of insertion or maintenance or both central-line bundles CLABSI in ICUs can decrease by 60%, from 6.4 per 1000 catheter-days to 2.5 per 1000 catheter-days.[11] Moreover, in a meta-analysis of nine studies, the estimated cost savings for every prevented episode of CLABSI can be as high as US$42,609.[11]

In Taiwan, the CLABSI rates among ICUs in medical centers and regional hospitals were 5.5 and 3.5 per 1000 catheter-days, respectively, in 2012.[10] Thus, a government-led force combined with a professional organization to promote vascular and urinary catheter care quality is imperative, and the Centers for Disease Control in Taiwan (Taiwan CDC) implemented a national action plan to reduce CLABSI in Taiwan in 2013. In this project, the CLABSI bundle care was implemented and the effect of the bundle care was assessed in 27 ICUs in medical centers and regional and district hospitals.

Methods

Setting and participating hospitals

This study was conducted in nine medical centers, three regional hospitals, and one district hospital. After obtaining the approval of the Institutional Review Board at each investigation site, this national study was conducted in 27 ICUs, with a total of 404 beds, including 15 medical ICUs, 11 surgical ICUs, and 1 mixed ICU (Table 1). Among the 27 ICUs, 21 were located in 20 medical centers, five in five regional hospitals and one in a district hospital. The number of participating ICUs (number of beds) was eight (107) in northern Taiwan, four (76) in middle Taiwan, 13 (186) in southern Taiwan, and two (35) in eastern Taiwan. This study period was divided into the pre-intervention (between June 1, 2011 and October 31, 2011) and intervention phase (between December 1, 2011 and October 31, 2012).

Study interventions

After expert meetings, a national evidence-based guideline of the CLABSI bundle was developed. The CVC bundle in this project included the insertion and maintenance bundles. The insertion bundle included hand hygiene, maximal sterile barriers upon insertion, use of CHG for preparing skin, and avoidance of femoral veins as the access site. The maintenance bundle included hand hygiene, proper dressing changes, aseptic technique for accessing and changing needleless connectors, and a daily review of catheter necessity.[16,17]

Please cite this article in press as: Lai C-C, et al., Implementation of a national bundle care program to reduce central line-associated bloodstream infections in intensive care units in Taiwan, Journal of Microbiology, Immunology and Infection (2017), https://doi.org/10.1016/j.jmii.2017.10.001