Infection control for the Reduction of Catheter Related Blood Stream Infection (CRBSI)

OBJECTIVE. The purpose of this research was to reduce rate of CRBSI at Bangkok Hospital by using 2002 CDC evidence-based guidelines as a preventive of CRBSI.¹

MATERIALS AND METHODS. A target surveillance on CRBSI was conducted in all 4 adult intensive care units at the Bangkok Hospital. The findings were compared with the CDC recommendations. Then we set up a multidisciplinary patient-care project team who applied the CDC guidelines in order to work towards the reduction and eventual prevention of CRBSI’s in our hospital.

RESULTS. The reduction of CRBSI incidence was observed to be sustainable after the new guidelines were implemented in October 2004. The rate of CRBSI incidence reduced gradually especially in the year of 2010. It approached to zero per 1000 catheter-day.

CONCLUSION. Nowadays, all healthcare personnel must take responsibility for preventing nosocomial infection. We has demonstrated that our multidisciplinary team can reduce the infection rates sharply.

Catheter Related Blood Stream Infection (CRBSI) is the third most common nosocomial infection. The infection results in higher antibiotic costs, prolonged hospitalization days and is even related to high morbidity and death.²⁻⁴

The Centers for Disease Control and Prevention (CDC) of the United States of America has provided evidence-based guidelines for catheter care to reduce Blood Stream Infections (BSI). They refer to recommendations for hand hygiene,⁵ maximal sterile personnel protection equipment (PPE),⁶⁻⁷ preferred antisepsics for skin preparation,⁴⁻⁹ catheter site dressing regimens,¹⁰ the site chosen for catheter placement,¹¹⁻¹² etc. In 2004, our Infection Control Committee set up a project aimed at reducing CRBSI at Bangkok Hospital by using the aforementioned 2002 CDC evidence-based guidelines as a preventive of CRBSI.¹

Materials and Methods

Case Definitions for CRBSI including

1. Bacteremia/fungemia in a patient with an intravascular catheter, with at least one positive blood culture obtained from a peripheral vein and clinical manifestation of infections (such as fever, chills, and/or hypotension) but no apparent source for the BSI except for the catheter.

2. One of the following should be present:
The CRBSI rate is best determined by analyzing rate of infection by BSIs per 1000 catheter-day. These rates can be used as benchmarks by individual hospitals to estimate how their rates compare with other institutions.

During January to August 2004, the incidence of CRBSI at the Bangkok Hospital was an average 12 per 1000 catheter-day.

Before the implementation of the new guidelines for prevention of CRBSI, more than 90% of physicians did not use all appropriate personnel protective equipment during central line catheter insertion, for example, only 20% of them used sterile gowns, usually because equipment was not readily available (Table 1). The drapes provided in the central line insertion kit were too small. The disinfectant commonly used was 10% providone-iodine solution and there was no specific system set up to remind nurses when to change dressings or intravenous solution on a timely basis.

After making new central line kits available (Figure 1) and educating physicians on the new protocol, giving nurses the new instructions for aseptic techniques for looking after CVCs and demonstrating how to use a 7 day-color-coded-color sticker (Figure 2) to ensure timely changes of specific intravenous sets and dressings, the incidence rate of CRBSI had reduced to an average 5.9 per 1000 catheter-days during September to December 2004 (Figure 3). Figure 4 shows surveillance compliance for the CVCs project. The performance improved year by year.

The reduction of CRBSI incidence was observed to be sustainable after the new guidelines were implemented in October 2004. Figure 5 shows the surveillance rate of CRBSI from 2004-2010. The rate of CRBSI incidence reduced gradually especially in 2010. It approached to zero per 1000 catheter-day.

| Table 1: Summarized physician’s performance during central venous catheter (CVC) insertion compared to the CDC new guidelines for CRBSI prevention. |
|-----------------|-----------------|-----------------|
| Prevention      | Amount of CVC insertion | (%)         |
| Maximal PPE*    | 3               | 7.9            |
| Partial PPE*    | 35              | 92.1           |
| sterile gown    | 7               |                |
| mask            | 12              |                |
| cap             | 1               |                |
|oggle            | 7               |                |
| **Total**       | **38**          | **100**       |

PPE* = Personnel Protection Equipment
Figure 1: Guideline of the new standard of central venous insertion kit

Figure 2: 7-day-colour-coded sticker for timely changes of intravenous catheter and dressing
Figure 3: Graph shows Catheter Related Blood Stream Infection Rate of Bangkok Hospital in the year of 2004.

Figure 4: Graph shows surveillance compliance for caring central venous catheter project. The performance improved yearly as can be seen.
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Discussion

Nosocomial infection associated with CRBSI is now a major concern in Modern Medicine. Due to the wide use of invasive medical devices, particularly central venous catheters, complications occurring because of infection have resulted in high mortality rates.1-3

In the USA, there are an estimated 250,000 cases of CRBSI annually; attributed mortality is estimated to be 12-15% for each infection, with a cost to the health-care system $25,000 cases per episode.1

Danchaivijitr et al13 showed that in Thailand, about 10% of primary blood stream infections were found to be nosocomial. The CRBSI percentage was shown to be higher in university hospitals (4%) as opposed to general hospitals (0.8%) However, that study didn’t analyze BSIs per 1000 catheter-day, (as per official formula for CRBSI rate) so we could not directly compare the prevalence at our medical center to other institutions in Thailand.

The key issues which are so different from previous practices of CVCs insertion and post insertion care include more stringent hand hygiene and aseptic technique during CVCs insertion, with maximal personal protective equipment (PEE), using a larger drape and skin antiseptic with 2% chlorhexidine gluconate in 70% alcohol.

Using maximal PEE and 2% chlorhexidine gluconate for skin preparation prior to CVCs insertion lowered BSI rate when compared with previous standard precautions.7-9

The benefit of using 2% chlorhexidine gluconate in 70% Alcohol instead of providone-iodine in preventing catheter-related infections is its superior and rapid skin decontamination.8,9

Since our project to apply these recommendations from the CDC to reduce CRBSI reduction began in 2004, due to good cooperation from our multidisciplinary team, by 2010 we had succeeded in controlling CRBSI rate to zero rate per 1000 catheter-day.

CDC revised their guidelines yet again in 2011.14 The major differences from their 2004 guideline are;

1) Using antiseptic/antibiotic impregnated short-term central venous catheters and chlorhexidine impregnated sponge dressing.
2) An emphasis on performance improvement by implementing bundled strategies.
3) Definition of CRBSI that requires specific laboratory testing.

Since it is often problematic to establish a diagnosis, a simple definition used for surveillance purposes is
CLABSI (Central Line Associated Blood Stream Infection). A CLABSI is a primary BSI in a patient that had a central line within a 48-hour period and is not blood stream related to an infection at another site.

This year, 2012, our Infection Control Committee will revise the case definition of CRBSI to CLABSI to be in line with CDC’s latest guidelines.

Conclusion

Nowadays, all healthcare personnel must take responsibility for preventing nosocomial infections. Our Team has demonstrated that a multidisciplinary team following the CDC guidelines could indeed reduce the infection. In the near future CRBSI may be the first nosocomial infection that can be eliminated from all patient-care areas.

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References