

Incidence of Central Line Related/Associated Bloodstream Infections in an Acute Hospital

Abstract:

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Abstract

Bloodstream infection related to a central venous catheter in the intensive care unit is a substantial clinical and economic problem. The aim of the study was to examine the incidence of central line related bloodstream infections and central line associated bloodstream infections in Our Lady of Lourdes Hospital, Drogheda, during a six month period, using an active patient based prospective surveillance method. CLRBSI rate in ICU/HDU was 0.93/1000 central line days. There was no CLABSI identified in the studied time period. However, further interventions are needed, particularly with CVC care bundle. Also, the implementation of 2% chlorhexidin in 70% isopropylalcohol use for skin asepsis, which is recommended by the Irish national guidelines, would be beneficial.

Introduction

Bloodstream infection related to a central venous catheter (CVC) in the intensive care unit (ICU) is a substantial clinical and economic problem. Attributable mortality is estimated between 2% and 35%, and length of stay in the ICU is thought to increase by 9.5 to 11.9 days, causing substantial economic cost and excess morbidity.^{2,3} Preventative strategies to reduce the prevalence of catheter related blood-stream infections (CRBSI) have been effective in other countries. These include education of health-care workers (HCWs) about correct catheter insertion and maintenance, routine monitoring of CRBSI rates, adherence to hand hygiene, the use of a dedicated infusion therapy team, use of sterile semi permeable dressings and removing the intravascular catheter as soon as possible.^{4,5} The aim of this study was to examine the incidence of central line related bloodstream infections (CLRBSI) and central line associated bloodstream infections (CLABSI) in Our Lady of Lourdes Hospital (OLOLH), Drogheda, during a six month period. There is no national healthcare associated infection surveillance programme established in Ireland. National data on CLRBSI/CLABSI incidence in Ireland is currently unavailable. However, following implementation of the planned national critical care audit programme in Ireland, it is anticipated that a national report will be available in the near future.

Methods

The study was conducted in ICU and High Dependency Unit (HDU) in Our Lady of Lourdes Hospital (OLOLH) in Drogheda from 1st January 2013 to 30 Jun 2013. OLOLH is a 339 bed acute general hospital providing acute medical, surgical and maternity services to a catchment area of 307 032 people in counties Louth, Meath, and North County Dublin. Trauma services are provided for patients in above mentioned area as well as for those in county Cavan and Monaghan. ICU/HDU accommodates medical, surgical and trauma patients and provides five level 3 and three level 2 beds. An active patient based prospective surveillance method was used in the study. Data was stored in an Excel spreadsheet on a password protected secure drive which only the hospital's Infection Prevention and Control Team had access to and was backed up by hospital server. The duration of central line insertion was recorded by the nursing staff in the ICU/HDU. Positive blood cultures were recorded daily by a surveillance scientist and reviewed daily by a Consultant Microbiologist and a Consultant Anaesthetist. A multi disciplinary committee was formed in July 2012 and the committee reviewed all methods to conduct this surveillance e.g. the Hospital in Europe Link for Infection Control through Surveillance (HELICS), CDC. However due a lack of resources, namely a critical care audit nurse, it was decided the most suitable guidelines to conduct this surveillance in this hospital was the CDC definitions for CLRBSI and CLABSI.

CLRBSI occurs, when patient has at least one of the following signs or symptoms: fever (>38oC), chills, or hypotension and positive laboratory results are not related to an infection at another site. CLABSI, a term used by the CDC's National Healthcare Safety Network (NHSN), is a primary bloodstream infection (BSI) in a patient that had a central line within the 48-hour period before the development of the BSI and is not related to an infection at another site.⁶ Most of the catheters used in ICU/HDU were four-lumen CVCs. The usual insertion site was internal jugular vein as well as subclavian vein. None of the catheters were coated. The blood cultures were processed in the Microbiology Department OLOLH on analyzer Bact Alert 3D (Biomerieux, Marcy L'Étoile, France). ICU/HDU was routinely audited by Infection prevention and control team. Hand hygiene audits showed 63% compliance in January and 95% in May 2013. Environmental audit score was 88% in the studied time period. CVC care bundle was not in place at that time.

Results

234 patients were included in the study. Only 1 CLRBSI was identified in the time period January to June 2013. CLRBSI rate was calculated as follows:

Total number of CLRBSI = 1 x 1000 = rate per 1000 central line days

Total number of Central Line days=1070.

CLRBSI rate in ICU/HDU was 0.93/1000 central line days. There was no CLABSI identified in the studied time period. The patient with CLRBSI had a CVC inserted in internal jugular vein for 9 days and an arterial line was 10 days in situ. He was ventilated and naso-gastric (NG) tube fed. Antimicrobial treatment with meropenem and vancomycin lasted for 14 days prior to developing CLRBSI and the main indication was a severe community acquired pneumonia of an unknown origin. Underlying conditions were myocarditis and IgG immunodeficiency. The causative organism of CLRBSI was Staphylococcus haemolyticus, isolated from two sets of positive blood cultures and the line tip. Our data suggests a very low incidence of CLRBSI/CLABSI in ICU/HDU in our hospital setting. Further interventions are needed, particularly with CVC care bundle. Also, the implementation of 2% chlorhexidin in 70% isopropylalcohol use for skin asepsis, which is recommended by the Irish national guidelines, would be beneficial.

Discussion

Our study showed CLRBSI rate as low as 0.93 per 1 000 central line days. CLABSI rate was 0 per 1 000 central line days. The incidence rate was below expected level of 1.1, found in comparable critical care units in US hospitals.⁹ This data was published in Device-associated Module of National Healthcare Safety Network (NHSN) Report in 2010. A study in an 18-bed medical ICU of a large teaching healthcare facility in Geneva reported an incidence rate of 5.8/1000 central-line days for microbiologically documented BSIs, with dramatic decreases occurring following implementation of a programme targeted at vascular access care. A Belgian retrospective study of CRBSI in three ICUs of Brugmann University Hospital, published in 2013, showed CRBSI rates as high as 2.95, 1.13 and 1.26 per 1 000 estimated catheter days. The authors identified Staphylococcus epidermidis to be the most frequent causative organism.⁹ A UK study conducted in an acute general hospital, in the adult medical and surgical nine bedded ICU for 4 years, monitored CRBSI before and after interventions were introduced. Following interventions, the annual CRBSI rate fell from 3.4 to 0/1000 patient days with zero episodes during the final 19 months of the study. The authors describe a significant reduction in CRBSI for the first time in a UK ICU.¹⁰ A Swiss prospective interventional study on 2009 similarly showed, that the incidence of CRBSI decreased from 3.9 per 1000 catheter days in the preintervention phase to 1.0 per 1000 catheter days in the intervention phase (p < 0.001).¹¹ Other studies have also reported a high rate of CRBSI.¹²⁻¹⁶

In 2010 a three months pilot study was conducted in 11 critical care units of nine Irish hospitals where 17 CRI were diagnosed. In 2012, a national point prevalence study of hospital acquired infections and antimicrobial use was conducted in 50 Irish hospitals. BSI defined by HELICS criteria showed prevalence of 5.1%. Of the 11 BSI reported from patients admitted to critical care units, five were secondary to an infected indwelling vascular catheter.¹⁷

Concordance was found between US and European definitions of BSI.¹⁸ Very interesting results were presented by authors of an Irish multi-centre surveillance study, published in 2013. It involved 614 patients from 8 major teaching hospitals across the Republic of Ireland. Catheter related infections (CRI) rate was 2.2 per 1000 CVC days (95% confidence interval). Pathogens causing the 17 CRI episodes were: coagulase-negative staphylococci (n=6), *Candida albicans* (n=4), *Klebsiella* species (n=2), vancomycin-resistant enterococci (n=2), vancomycin-susceptible enterococci (n=1), methicillin resistant *Staphylococcus aureus* (n=1) and methicillin sensitive *Staphylococcus aureus* (n=1).¹⁹

A threshold of CLRBSI rate in ICU in OLOL hospital was found as low as 0.93/1000 central line days and CLABSI rate was 0 per 1 000 central line days. The results are consistent with background of enthusiastic IPCT and the ICU teams in OLOL Hospital. ICU environment was supportive to infection prevention and control interventions and audits. However, there are further interventions needed in the field of insertion bundles, maintenance and removal bundles as well as implementation of 2% chlorhexidin in 70% isopropylalcohol use for skin asepsis, as advised by the Irish national guidelines. In the future HELICS programme will facilitate use of standard surveillance methodologies and analysis.

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