"Effect of Care bundles on Central Line Associated blood stream infections rate in ICU at a teritiary care centre in Kanpur"

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Abstract

Introduction: Central line-associated bloodstream infection (CLABSI) is one of serious healthcare-associated infections which can be controlled by well-coordinated use of care bundles and peer educational training also gear up in its reduction. **Aim:** To study the effect of care bundles on rate of CLA-BSI in ICU at a teritiary care centre in Kanpur. **Material and Methods:** There were two phase: Phase I (2017-2018); Retrospective preintervention phase where data were recorded from medical record unit. Phase II (2019-2020); Prospective Intervention phase where care bundles were implemented and samples were also collected from CLA-BSI suspected patients. Collected samples Blood and central line were processed according to standard protocols. **Results:** The rate of CLA-BSI was 3.6 and 1.8 per 1000 central line days in 2017 and 2018 respectively in phase I. In 2019 rate were increased to 2.5 per 1000 central line days and then reduces to 0.7 per 1000 central line days in 2020 (Phase II). Klesiella pneumoniae was found common isolates in preintervention phase while Staphylococcus aureus was mostly recover during intervention phase. E.coli, Acinetobacter sp and Pseudomonas aeruginosa were also CLA-BSI associated pathogen in the study. **Conclusion:** :CLA-BSI preventing Care bundle Implementation as well as continuous sensitization regarding infection control to health care personnel in ICU setting was useful and effectively reduced CLABSIs.

Key words:- Care bundle, CLABSIs,ICU

Introduction:-

The use of central venous catheters (CVCs) is widely used in health care throughout the world, for the administration of intravenous fluids, blood products, medications, and parenteral nutrition, as well as providing access for hemodialysis and hemodynamic monitoring[1]. However, their use is associated with the risk of bloodstream infection caused by microorganisms that colonize the external surface of the device or the fluid pathway when the device is inserted or manipulated after insertion. Central line-associated

bloodstream infection (CLABSI) is a laboratory confirmed bloodstream infection occurring in a patient with a CVC in place for >48 hours that is not related to an infection at any other site. [2]

Care bundles aims to ensure that all patients consistently receive the best care or treatment, all the time. This approach has been successfully applied to the management of device-associated infections (DAIs) in the critical care setting.Several guidelines for the prevention of CLABSIs are available, but the core contents of the evidence-based recommendations are shared in common [3,4]

Although the objectives of the CLABSI prevention guidelines are evident and simple, the implementation of these guidelines in clinical practices requires many factors to be well-coordinated. Heterogeneity in compliance or performance with the guidelines exists worldwide, and interventions have not always been successful [5]The aim of our study was to evaluate the impact of the bundle care approach on reducing CLA-BSI.

Materials and Methods:-

This study was conducted in the Department of Microbiology.The primary aim of the intervention was to reduce CLABSIs. This study was designed in two phases: Phase I Retrospective assessment of CLABSI rates during January 2017 to December 2018 as preintervention phase and Phase II January 2019 to December 2020 as the intervention phase.

Phase I- Data from 2017 to 2020 were collected from microbiology service laboratory and medical record department and analyzed.

In phase II 2019 and 2020, intervention phase weekly educational training programs were conducted on Hospital infection control and prevention. This training programs are especially for all the nursing staffs as well as all junior doctors posted in ICU. Maximum training sessions are bases on 'Central line Insertion care bundle', 'Catheter maintenance bundle'and what are the medical ethics to work in the ICU. The insertion bundle included (1)hand hygiene, (2)skin antisepsis, (3)catheter site selection and (4)maximal barrier precautions. The maintenance bundle included (1)hand hygiene, (2)catheter site dressing, hub care, and (3)daily review of central line necessity.

In 2020 there was a 'Hand washing bell' which rang every 2hrs and each staff in ICU including housekeeping have to wash or sanitizethe hand.

Hand hygiene performance in the ICU was monitored by an infection control nurse using the World Health Organization hand hygiene guide.[6] During monitoring INS measure the performance weekly as well as train the healthcare workers on the spot. One check list was prepared for Care bundle which was maintained by ICU incharge nurse.

Specimen Collection processing- Blood samples and tips of central lines were collected aseptically from the patients. For blood culture, from adult 5-10 ml and children 2-3 ml of blood was collected by aseptic procedures and inoculated into blood culture bottle for adult and paediatrics respectively. All blood cultures were processed in laboratory using standard procedure by conventional method. For central line tip culture, tip processing was done by Maki's Roll over plate method.[7] Briefly, before removing tip the catheter skin was cleaned with 70% alcohol. The proximal end of tip or catheter was held and carefully removed from the

patient with a sterile instrument, taking care to avoid contact with the skin and cut approx 2-4 cm segment from tip and placed in sterile container. Semi quantitative culture method was used by rolling the tip across an agar plate; the presence of >15 colonies along with the same organism isolated from peripheral blood with clinical signs and symptoms. 9 Isolated colonies were identified

Patients details included clinical characteristics, details of bloodstream infection, central line days, and bed days were recorded. The central line days were calculated as the total number of days a central line was in place for each patient in the ICU. CLA-BSI rates were calculated as the number of CLA-BSI x1000/central line days.

Results

In the present study 1742 cases were included from four consecutive years 2017, 2018. 2019 and 2020. Among these 1030 cases were included in phase I as preintervention phase and all the data were collected from Laboratory and medical record department. While 702 cases found in phase II as prospective intervention phase of study. Number of CLA-BSI suspected and confirmed cases in 2017 to 2020 has mentioned in **Table 1**. Total 23 bacteria were responsible for the CLA-BSIs during study period. In the pre-intervention phase, the predominant causative agent was Klebsialla pneumoniae while in intervention phase Staphylococcus aureus was the common isolates. **[Fig 1**]The rate of CLA-BSI per 1000 central line days in Phase I was 3.6 and 1.8 in 2017 and 2018 respectively. In Phase II 2019 it was increased to 2.5 and then decreased to 0.75. [**Fig 2**]Month wise rate of CLA-BSI in different phases is mentioned in [**Fig 3] .**

Table 1 : No. of CLA-BSI suspected and confirmed cases in 2017 to 2020

S.N.	Year	Suspected cases	Confirmed cases
1	2017	584	11
2	2018	446	5
3	2019	351	5
4	2020	351	2

Fig 1: Bacteria Associated with CLA-BSI in phase 1 (Pre-intervention) and Phase II (Intervention phase)

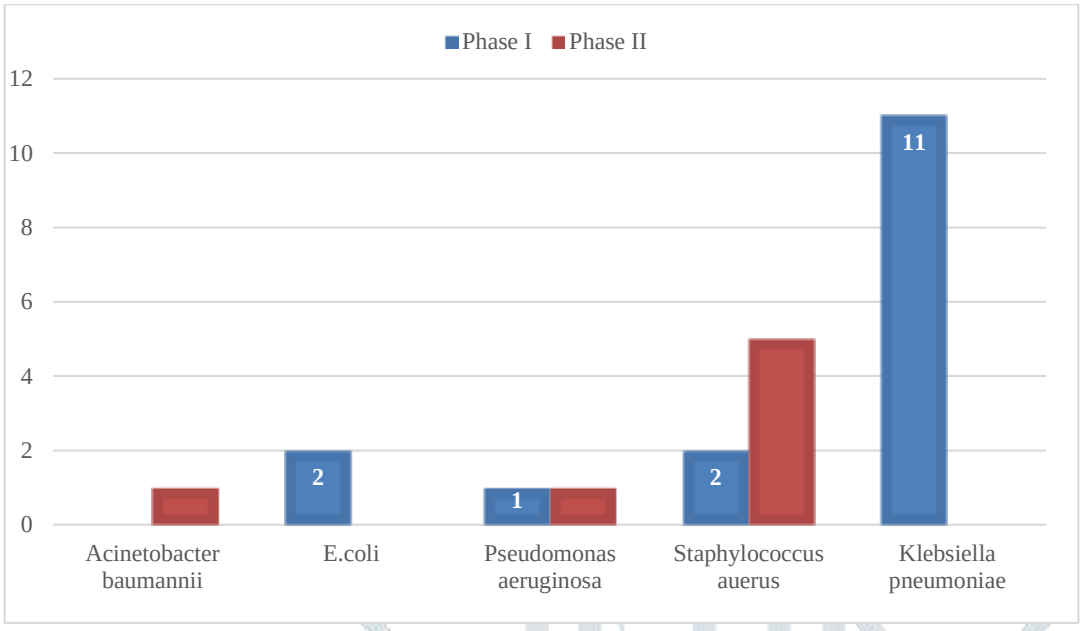


Fig 2: The trend of the central line associated bloodstream infection rate during study period.

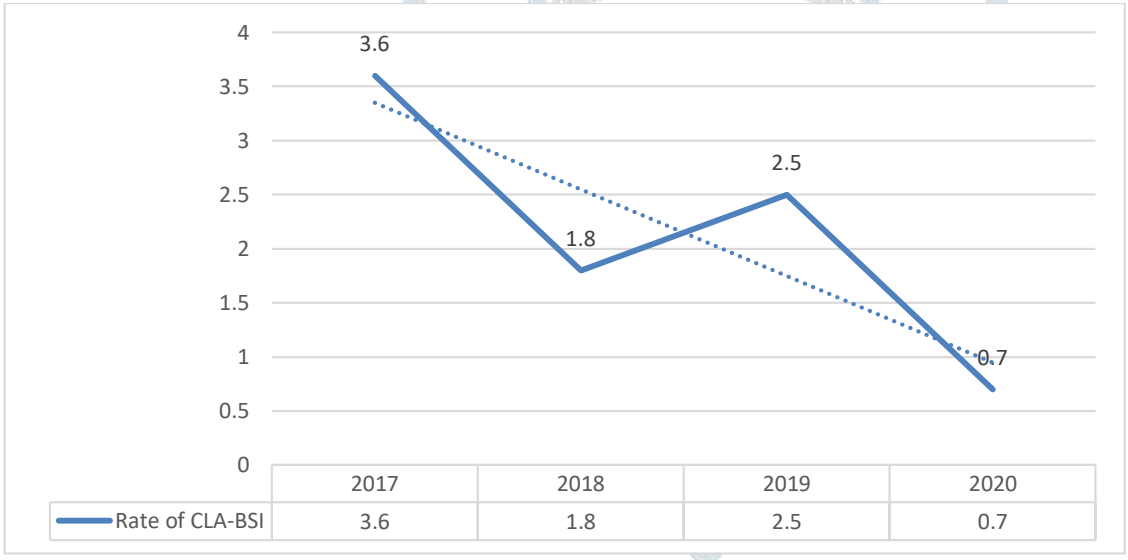
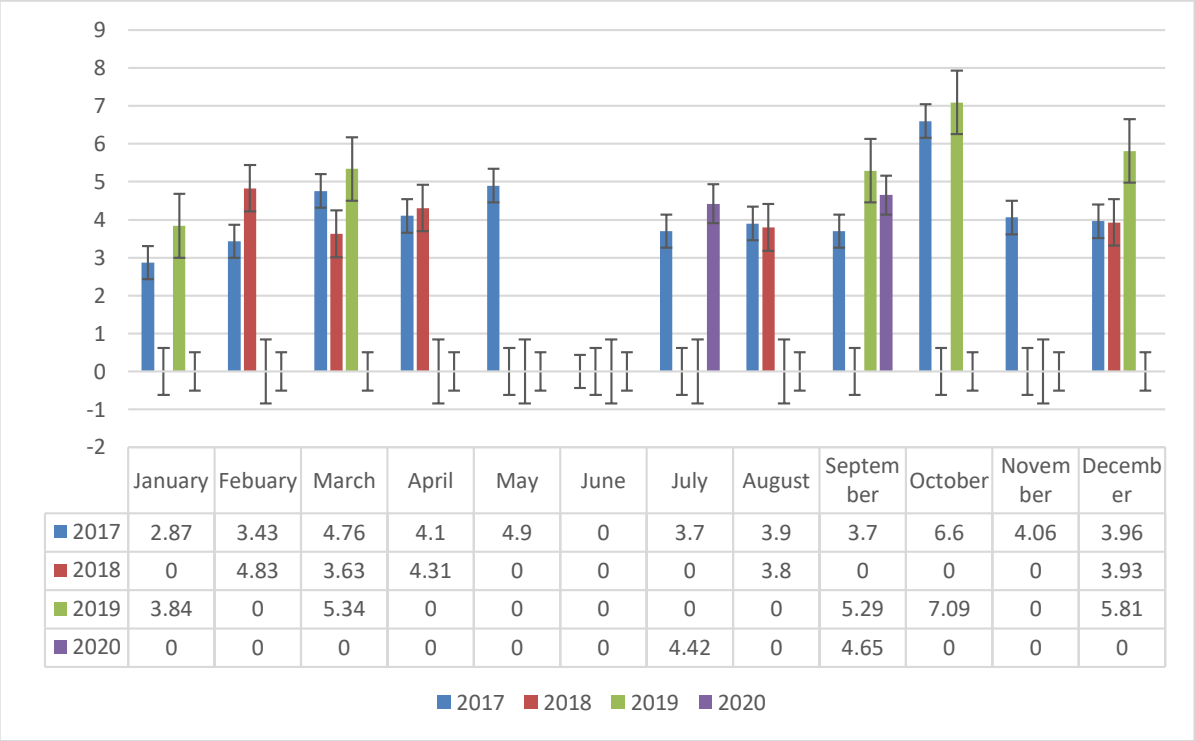


Fig 3: Month wide rate of CLA-BSI in Phase I(2017-2018) and Phase II (2019-2020)



	January	Febuary	March	April	May	June	July	August	September	October	November	December
2017	2.87	3.43	4.76	4.1	4.9	0	3.7	3.9	3.7	6.6	4.06	3.96
2018	0	4.83	3.63	4.31	0	0	0	3.8	0	0	0	3.93
2019	3.84	0	5.34	0	0	0	0	0	5.29	7.09	0	5.81
2020	0	0	0	0	0	0	4.42	0	4.65	0	0	0

Discussion:-

The implementation of care bundles can help to enhance compliance to evidence-based quality process measures to improve patient care. Care bundles include a set of evidence-based measures that when implemented together have shown to produce better outcomes and also help to create reliable and consistent care systems in hospital settings.

In the study 1742 cases were included who were suspected for CLA-BSI. Out of these, 1030 cases were lie in preintervention phase where we found rate of infection were 3.6 per 1000 central line days in 2017 and in 2018 it reduces to 1.8. After 2017 statistics, hospital infection control committee started paying attention towards infection control that cause reduction of CLA-BSI infection rate in 2018.

In Prospective intervention phase, 702 suspected CLA-BSI cases recorded (2019 and 2020). Here rate of infection were further increased to 2.5 per 1000 central line days, then there werestrict compliances to follow the central line care bundles. In 2020 CLABSIs rate reduce to 0.7 per 1000 central line days by implementing CLABSI prevention bundles and regular educational training. Hand hygiene before central line insertion or maintenance, or before any examination, provides protection against infection which most convenient and cost effective to follow. [2]To promote hand hygiene, in 2020 there was a 'Hand washing bell' which rang every 2hrs and each staff in ICU including housekeeping have to wash or sanitize the hand. Our educational training was organized to sensitize health care worker about care bundles. The duration of training was not for many hours, its only for few minutes but every alternate day. Because without continuous active interactions and dominating internal governance, the reduction of CLABSIs was not sustained, which we have observed in 2017 and 2018 statics in the study.

One study revealed that the incidence of catheter related BSI for cases in which all elements of the care bundles were not perfectly performed was twice as high that for cases in which all elements of the care bundles were perfectly performed[8].Studies conducted by Menegueti et al., Warren et al. and Longmate et al. revealed decreasing CLABSI rate after or during care bundle implementation9.3–5.1 per 1000 central line days, 9.4–5.5 per 1000 central line daysand 3.9–0 per 1000 central line days respectively.[9,10,11]

Similar to our results, a study conducted by Yilmaz et al. reported that the CLABSI rate decreased in the first 3 months after the post-implementation of bundle but up surged thereafter, emphasizing on the fact that a continuous regular educational program is needed to achieve a sustained impact of bundle.[12]

Educational training was based on 'Central line Insertion care bundle' and 'Catheter maintenance bundle'. The insertion bundle included hand hygiene, skin antisepsis, catheter site selection and maximal barrier precautions.The maintenance bundle included hand hygiene, catheter site dressing, hub care, and daily review of central line necessity.[13,14,15]

The previous studies have revealed that femoral vein catheterization is associated with a higher risk of CRBSI than is subclavian or internal jugular vein catheterization.[16,17]

Before accessing2% chlorhexidine tincture and 70% alcohol was used as disinfectant to reduce contamination. For site dressing either sterile gauze or transparent semipermeable dressing was used and replaced every 2 days and 1 week respectively if not otherwise indicated. Encouraging nursing staff to enforce the checklist and stop procedure if sterility was breached. During procedure, movement around the bed was prohibited.

Common CLABSI pathogens in the pre-interventional phase was gram negative bacilli(GNB). The distribution of CLABSI pathogens were Klebsiella pneumonia followed by Staphylococcus aureus, E.coli and Pseudomonas aeruginosa. While during intervention phase Gram positive cocci(GPC)Staphylococcus aureuswere most isolated pathogen followed by Non-fermenting gram negative bacilli(NFGNB) i.e. Pseudomonas aeruginosa and Acinetobacter sp. Hence care bundle implemented in our settings can prevent GNB but not enough to protect from GPC and NFGNB. Healthcare personnel should follow each bundle element for every patient, always. Continuous sensitization of care bundles will develop and promote a positive habitforming behaviour among Healthcare staff and ultimately a reliable care processes.

Conclusion

Bundled interventions are an effective completely when they implemented all together and improve the "culture" of patient safety by promoting teamwork, measuring compliance.Therefore, physicians and nurses should implement all elements of the care bundles completely and without exception.

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