Infection control: 1044–1057

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A RANDOMIZED CONTROLLED CROSSOVER STUDY TO COMPARE FILTRATION FACTOR OF A NOVEL NON FIT TESTED HEPA FILTERING FACEMASK WITH A FIT-TESTED N95 MASK

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AIMS. To compare the filtration factor of a novel non fit tested HEPA filtering (Totobobo) facemask with a fit-tested N95 facemask

METHODS. Randomized unblinded crossover study involving 22 healthy volunteers who had previously passed a fit test with a 1860, 1860S or 1862 N95 filtering facemask. Prior to testing the N95 mask, the subject adjusted the mask and performed a user seal test. Prior to testing the Totobobo mask the investigator trimmed the mask according to the manufacturer's instructions and following training by the inventor. The investigator also visually checked the fit of both types of mask. Volunteers then underwent a standard quantitative mask fit testing protocol involving measurement of particles 0.02–1 μm diameter inside and outside the mask. Filtration factor was defined as the ratio of particles outside to particles inside the mask. If the ratio exceeded 100 the subject was considered to have passed the fit test. A PortaCount Plus (TSI Incorporated, St Paul, Minnesota) connected to a computer running FitPlus for Windows software (TSI Incorporated, St Paul, Minnesota) was used to count particles and calculate the filtration factor. Median filtration factors were compared using the Wilcoxon signed ranks test. The proportion of subjects passing the test was compared using the chi square test.

RESULTS. The median (interquartile range) filtration factor was significantly higher (193 (145–200)) for N95 masks compared to Totobobo masks (135 (83–184)) ($p < 0.05$). However there was no statistically significant difference between the proportion of subjects achieving a ratio of $\geq$100 between N95 (19/22) and Totobobo (16/22) masks.

CONCLUSIONS. The significantly lower performance of non fit tested Totobobo masks indicates that they are not an adequate replacement for fit tested N95 masks. Although there was no significant difference in the proportion of subjects passing the fit test with each mask, the study was not powered to show a difference in this outcome. However the absolute level of performance of this mask suggests that it is worthy of further investigation.

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PULSE-OXIMETRY IN INTENSIVE CARE: HAZARD WARNING OR POTENTIAL HAZARD?

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INTRODUCTION. In the UK, nosocomial infections affect 1 in 10 patients admitted to hospital, resulting in 5,000 deaths annually[1], and are an important cause of patient morbidity and mortality on ICU. Any personnel or equipment encountered by a patient during treatment is a potential vector for infection transmission.

This audit was conducted on the 16 bedded mixed general/neuroscience ICU at Salford Royal NHS Foundation Trust, between May and July 2008. It aimed to assess the adequacy of the current method of cleaning pulse oximeter probes, and to determine if alternative methods could improve the effectiveness of the cleaning process.

METHODS. Pulse oximeter probes on the ICU were examined to assess cleanliness and the effectiveness of current cleaning practices. Microbiology samples were taken from all probes and the specimens cultured. Initial results demonstrated ineffective cleaning techniques. Augmented cleaning techniques (where a toothbrush was used), and an alternative cleansing agent (Chloroprep) were then tested, to see if the use of such techniques reduced the potential for the probes to act as vectors for infection transmission.

RESULTS. Initial swabbing was carried out on all the pulse oximeters on the ICU. Mixed coagulase negative staphylococcus was isolated from > 80% of all probes after standard cleaning techniques were used, staphylococcus aureus from 3 probes and MRSA from isolated in one probe.

After cleaning using augmented cleaning techniques, only 12.5% of the probes cleaned showed no growth on culture: there was still significant growth of MCNS on most swabs. This is a similar incidence of growth to that found after cleaning using established techniques.

When ChlorPrep was used to clean the pulse oximeter probes, samples taken from 66% of the oximeter probes resulted in no bacterial growth; significant growth still occurred in swabs taken from 33% of pulse oximeters.

DISCUSSION. Established cleaning techniques are not providing adequate disinfection of the pulse oximeter probes. The augmented cleaning techniques using established cleaning agents (ChlorClean) did not improve the results. However, using a different cleaning agent (ChlorPrep) resulted in more effective cleaning. The clinical implications of the findings are relevant to patient care.

The design of pulse oximeter probes makes effective cleaning very difficult. Despite the use of enhanced cleaning techniques, we found that one third of all the pulse oximeter probes within the ICU were colonised with bacteria. The presence of colonisation after 'effective' cleaning clearly demonstrates the potential for probes to act as vectors of infection transmission.

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MORTALITY ATTRIBUTABLE TO PRIMARY AND CATHETER-RELATED NOSOCOMIAL BACTEREMIA. A CASE CONTROL STUDY

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OBJECTIVE. Evaluate the impact of primary (PB) and catheter-related bacteremia (CRB) on mortality in critically ill patients and study factors influencing outcome.

METHODS. Dealing with data base from the "Estudio Nacional de Vigilancia de Infección Nosocomial en UCI" (ENVIN-UCI) during the 1997–2007 period (120 Spanish ICU involved), a case control study (1:4) evaluating patients with their first episode of monomicrobial PCRB compared with patients without bacteremia has been carried out. The variables included in the matching process are: age (±10 years), gender, year of admission in ICU, type of the disease (coronary, medical, trauma or elective surgery), APACHE II score at admission (±5 points) or SAPS score (±10 points). Bacteria have been grouped according to gram stain and theoretical risk of death (high for Pseudomonas, Acinetobacter, MRSA and fungi, and low for the rest). A matched conditional logistic regression analysis was performed in order to determine the risk of mortality in the whole population.

RESULTS. 2,116 patients suffering at least one episode of PCRB. 1,879 were adequately matched and compared with 7,516 controls.

TABLE 1

Factor (cases/controls)	Mortality cases (%)	Mortality controls (%)	OR	CI 95%	*p*
PCRB (1,879/7,516)	28.1	18.7	1.14	1.05–1.25	0.002
PB only (862/3,472)	30.7	18.3	1.20	1.06–1.36	0.005
CRB only (1,011/4,044)	25.9	19.1	1.10	0.98–1.24	0.10
Gram-negative (499/1,996)	30.1	18.0	1.19	1.01–1.46	0.040
Gram-positives (1,280/5,120)	26.2	18.8	1.11	1.00–1.23	0.045
Fungi only (88/352)	46.6	19.1	3.01	1.85–4.89	<0.001
High-risk (638/2,552)	32.5	18.6	1.22	1.05–1.41	0.008
Low-risk (1,229/4,916)	25.9	18.8	1.11	0.99–1.23	0.057

CONCLUSIONS. In our study the PCRB attributable mortality was 9.4%. This impact on mortality has been higher in BP than CRB, and otherwise greater in episodes caused by gram-negative bacteria and fungi than those coming from gram-positive pathogens.

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THE ELIMINITION OF CENTRAL LINE RELEATED BLOOD STREAM INFECTION (CRBSI) ON THE INTENSIVE CARE UNIT

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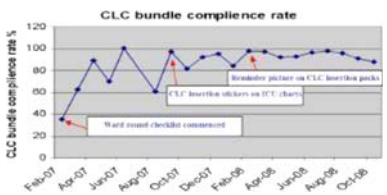
INTRODUCTION. The work was done in the Intensive Care Unit (24 beds) at the Royal Free Hospital in London. This is a major London teaching hospital. Primarily, doctors and nurses in the ITU were involved. The work spread to involve a culture change across all visitors to the ITU, both medical and non-medical.

OBJECTIVES. We set out to address the problem of central line related blood stream infection (CRBSI). It is one of the most frequent, lethal and costly complications of central venous catheterization. Together with the microbiology department we used an agreed definition for CRSBI, following root cause analysis. We measured the rate of CRBSI in the Intensive Care Unit. We assessed the cause as multifactorial. Using PDSA methodology we introduced a series of changes.

METHODS.

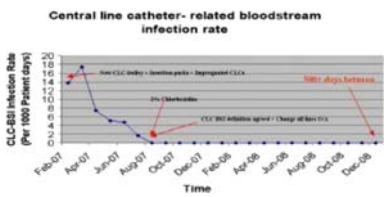
clc



A series of small step changes were introduced. These involved application of the central line care bundle, introduction of catheter packs and the use of 2% chlorhexidine. We also introduced strict policies for visiting teams and hand washing. All medical and nursing staff were involved with nomination of "champions" for each group.

RESULTS.

CRBSI



To date there have been no CRBSI's for more than 560 days. There have been no MRSA bacteraemia for more than a year. Constant attention to detail, dissemination of information and embedding a culture of ownership all proved challenging.

CONCLUSIONS. A target that initially seemed improbably achievable was in fact possible. This is a multifactorial problem that is not solved by a "quick fix". A combination of methodologies is the best way forward. Listening to all suggestions by any member of staff prove very useful and time saving.

It is imperative to involve all members of the team and to disseminate information, changes and results in a prominent and timely fashion. There must be a universal sense of ownership and responsibility for the problem. Ultimately it is necessary to change culture both within the individual unit and the wider organisation.