Establishing Best Clinical Practice in Blood Culture Collection

Successful Implementation of a Multimodal Quality Improvement Strategy in a Public Hospital in Auckland

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Background
Blood culture is an essential test in diagnosis of blood stream infections in patients presenting with suspected serious infections. Performing blood cultures appropriately (i.e. correct timing, adequate volume and number of sets), and using aseptic techniques can greatly influence the diagnostic yield and interpretation (clinical significance as a pathogen versus contaminant) respectively. Blood culture draws contaminated with skin bacteria leading to positive results prior to final identification (usually 24 hrs after positive growth detected) can potentially lead to unnecessary antimicrobial usage, readmission after discharge from ED, additional investigations and misdiagnosis as infection.

We describe the impact of a multi-faceted quality improvement program to improve the utilisation of blood cultures and reduction in contamination rates in our institution.

The Problem- contamination rate and lack of standard practice (January- June 2013)
North Shore Hospital microbiology laboratory performs about 12,000 blood cultures per annum for patients seen at Waitemata District Health Board acute care facilities, including North Shore Hospital. A 550 inpatient bed public hospital. About 1000-1200 of these are positive. Laboratory data from Jan 2013 till Sept 2013 indicated that:
1. Total blood culture contamination rate (defined as growth of microorganisms- usually common skin bacteria, which were clinically considered insignificant or non-pathogenic) was 2.6% (226/8866).
2. Majority of patients (78%) had only 1 set of blood cultures performed.
3. The most prevalent microorganisms isolated from positive cultures in Jan- June 2013 were Coagulase negative Staph (CoNS) 29%, followed by E.coli 27% as shown in Figure 1 below.

![Figure 1: Positive blood cultures at Waitemata DHB Distribution of 574 isolates (number, percent) from blood cultures WDNB Jan-Jun’13](image)

The Quality improvement program – Intervention (September 2013 to July 2014)
Quality improvement program was launched after establishing baseline using the FAST methodology: Find, Analyse, Solve and Track, with the following essential elements:
1. Development and promotion of blood culture policy for best practice.
2. Introduction of aseptic non-touch technique (ANTT) in ED/ADU.
4. Clinician awareness about indications and minimum of 2 sets of blood culture draws.
5. Development of blood culture drawing kits or packs with easy accessibility to standardise equipment for blood culture drawing and for cost effectiveness.

Policy
The development of a hospital policy was the initial priority. This was based upon the internationally recognised Aseptic Non Touch Technique (ANTT) guidelines for the best practice in blood culture drawing.

Healthcare professionals have become proficient in accessing the hospital’s intranet for policies and procedures. This provided educators and trainers with the main resource they needed to introduce a change in clinical practice.

New technique
A majority of practitioners used the needle and syringe method for collecting blood cultures. With the new policy advocating a butterfly and tube holder approach, teaching the new technique was fundamental in achieving a change in practice. High user areas were targeted as a priority for education and those being formally trained in aseptic technique.

E-Learning
With the DHB spanning two main inpatient sites and over thirty inpatient areas, providing training and education without a designated workforce was a challenge. An e-learning module based upon best practice guidelines was developed to address this. All existing and new blood culture practitioners were asked to complete it. In its first eight months, over 1,000 practitioners had enrolled onto the course.

Resources
Very few clinical areas were adequately equipped to comply with the new policy. Ward managers were given information on what to order and how to create designated areas where practitioners could efficiently gather all the equipment they required to comply with the policy. Posters detailing the ANTT step-by-step process were placed in high visibility areas promoting best practice.

Developing awareness
Every opportunity to raise the profile of the new policy, technique and elearning module with all healthcare practitioners was taken. This was significantly bolstered when data was available about the reduction in contamination rates and the positive effect the change in practice was having. Staff were encouraged to challenge poor practice and direct clinicians to the hospital policy and associated resources.

Assessing Impact- Post intervention analysis (July-December 2014)
The following results illustrate the impact of our Quality improvement program
1. Improved awareness of blood culture policy and best practice was noted in the repeat survey after the intervention and launch of e-learning program. Figure 2 shows the attitudes and knowledge of 123 staff who completed the survey in both periods.
2. A significant reduction in blood culture contamination rate was noted in the post intervention period 1.8% (146/8123) compared to baseline 2.6% (226/8686), p=0.001. As a result the proportion of contaminants also decreased including Coagulase negative Staph. (21% vs 29%) as shown in Figures 3 and 4.
3. Improvement was seen in number of patients where more than 1 set of blood cultures was obtained. 60% of single set blood cultures were positive in post intervention period compared to 78% at baseline. Overall increase of 3.5% in yield of E. coli, S. aureus and Klebsiella was noted (Figure 4). Detection of clinically significant bacteria was higher with multiple sets of blood cultures (Figure 5).
4. An estimated cost saving of 143,520 NZD was noted based on comparison of 8000 blood cultures sets each in the baseline and post intervention periods. This cost was primarily driven by savings from providing blood culture collection kits and the reduced cost of blood culture bottles. This was noted despite an increase in the total number of blood cultures performed by the laboratory (8123 in 6 months vs 8686 in 9 months). Other cost variables including reduction in length of stay, readmission after ED discharge due to positive culture result, antimicrobial stewardship and impact of workload in Microbiology lab were not measured.

Conclusion:
A significant reduction in blood culture contamination rate was achieved through a multimodal program, associated with improved clinical practice, awareness and cost savings.