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A re-audit of compliance with national guidelines for blood culture processing

The College's Clinical Effectiveness Department wishes to encourage high-quality clinical audit. We therefore periodically publish interesting examples of audits that have been successfully evaluated through our clinical audit certification scheme. In this issue we feature a re-audit of compliance with national guidelines for blood culture processing: is loading 100% of blood cultures onto the blood culture analyser possible within 4 hours of collection?

Background

Blood cultures provide information essential to patient management. Positive cultures allow correction of inadequate initial antibiotic therapy and more targeted treatment, permitting stepping down from broad spectrum agents thereby improving antibiotic stewardship. They also provide clues to the site of infection as well having implications for infection control and public health. A negative 36-hour blood culture in neonatal medicine allows early cessation of antibiotics.[1]

Significant delays may occur between collection and placement on the blood culture analyser. This may have a detrimental effect on patient care. A national survey in 2013 revealed no laboratory loaded the blood culture analyser outside of routine working hours, leaving blood cultures in the main specimen reception either at room temperature or in an incubator overnight thus being incapable of meeting the standard.[2]

The PHE SMI B37 *Investigation of Blood Cultures* recommends that blood cultures should be loaded on to the analyser within 4 hours of collection.[3]

To meet the standard a multi-disciplinary group consisting of blood science staff, clinicians and microbiologists was established. A series of interventions were introduced sequentially.

1. **Move blood culture analyser from microbiology into main reception in blood sciences.**
   As blood sciences staff work a 24-hour shift system, this enabled loading the analyser 24 hours a day. For a three-week period, all blood cultures received in blood science reception were date stamped on arrival, allowing us to monitor the length of time between receipt and placement on the analyser. 100% were loaded within 15 minutes of arrival, showing the delay to be minimal.

2. **Switch from glass to plastic blood culture bottles.**
   Unlike glass bottles, which required portering to the laboratory, plastic bottles could be placed in the air tube system.

3. **Education of clinical staff.**
   A questionnaire showed a significant percentage of clinical staff (nursing and medical) were unaware of the need to send blood cultures without delay, resulting in an education programme.

Audit cycles 1–5 (described below) had been completed previously following each intervention, to gauge the effect on meeting the standard.

This latest re-audit, cycle 6, was to check standards had been maintained.

Aims and objectives

To audit the time between collection and placement of blood cultures on the analyser against national standards (time from collection to placement on analyser < 4 hours).

To meet NICE guidance on 36-hour reporting of negative neonatal blood cultures.

If the standard was not met, to draw up an action plan.

Standards and criteria

Criteria range: 100% of blood cultures to be loaded on the analyser within 4 hours of collection.

100% of 36-hour negative neonatal blood cultures to be reported within 40 hours of collection (36 hours plus maximal load delay of 4 hours).

Blood cultures: All blood cultures with a time and date of collection either printed or handwritten to be included in the study.

Method

Sample selection:

- All blood cultures on the blood culture analyser (holds 5 days' worth of blood cultures) on a Tuesday were included. (A Tuesday was chosen to include weekends, as this might be the time of poorest performance.)

Figure 1: poster produced for the audit

- Blood culture request forms were obtained and specimen number, date and time of collection obtained.
- The blood culture analyser database was interrogated for time of loading for the corresponding specimen numbers.
- Using the two data points, the time between specimen collection and loading was acquired.

Result

This audit (September 2016, 101 blood culture sets) shows that 89% of blood cultures were loaded in ≤1 hour, 96% in ≤2 hour, 97% in ≤3 hour, 100% in ≤4 hours and 0% in >4 hours, with 100% of neonatal negative blood culture reports being issued within 38 hours of collection compared to previous audit results, shown in tables 1 and 2.

Audit 1

Results following transfer of blood culture analyser into centralised reception in blood sciences.

Audit 2/3

Results following switching to plastic blood culture bottles.

Audit 4/5

Results following education to staff.

Conclusion

A series of interventions both within and outside of the laboratory was required to meet the standard. Prior to movement of the blood culture machine, at least 40% of blood cultures would not have met the standard (being left overnight in an incubator). Transfer of the blood culture analyser into blood sciences, followed by introduction of plastic bottles (audits 1–3), produced a significant improvement but one in 20 bottles still took more than 4 hours.

From discussions with blood science staff, it became apparent that ward staff frequently appeared early morning carrying several blood cultures sets along with their routine bloods (inferring the blood culture sets had been stored and not sent immediately to pathology on collection). The matter was raised at the multi-disciplinary group. Whilst in microbiology it was assumed everyone would be aware a blood culture should be sent immediately, the clinical team's experience was that this was far from common knowledge.

A questionnaire was developed to ascertain the knowledge of (medical and nursing) staff involved in blood culture collection. Results revealed that 91% of staff thought a CSF sample should be sent to the laboratory immediately, compared to 68% for a blood culture. Out of hours, only 52 % of staff thought a blood culture should be sent to the laboratory immediately.

From discussions with staff, several factors accounted for blood cultures not being sent immediately, including:

- microbiology laboratory not being open 24 hours a day
- experience of working in hospitals where it was common place for blood cultures to remain at ward level for prolonged periods
- perversely, sending out negative 48-hour blood culture reports lead some to believe that it took 48 hours to process a blood culture (hence no urgency).

A poster was produced (see Figure 1) as part of a package to bridge the knowledge gap. It was distributed by two of the team, who also educated their peers. Following this, audits 4 and 5 were performed, showing the standard had been met.

This re-audit (audit 6) took place 6 months later, after a major change of junior doctors in the hospital. Additionally, two of the authors who had helped implement change through education within the organisation had left. Thus, one of the main reasons for re-auditing was to see whether the improvement was sustained, which it was.

Table 1: Percentage of blood cultures loaded within specified number of hours of collection

	≤1 hour	≤2 hours	≤3 hours	≤4 hours	>4 hours	Number of sets
Audit 1: April 2015	46%	69%	77%	82%	18%	84
Audit 2: Sept 2015	71%	83%	91%	95%	5%	65
Audit 3: Aug 2015	79%	88%	94%	95%	5%	82
Audit 4: Jan 2016	82%	94%	100%	100%	0%	79
Audit 5: Feb 2016	88%	96%	99%	100%	0%	71

Table 2: Reporting 0f 36-hour negative neonatal blood cultures

Neonatal blood culture audit: 42 blood cultures	
Time from collection to placement on blood culture machine	**Cumulative percentage of blood cultures**
0–30 minutes	43
0–1 hour	81
0–2 hours	100

These audit cycles demonstrate it is possible to meet the national standard of 4 hours and produce real time 36-hour negative neonatal reports. In fact, 96% of blood cultures are now loaded within 90 minutes of collection. Clinicians are used to sending bloods for haematology/biochemistry without delay, expecting a turnaround within the hour. Such tests are usually collected simultaneously to a blood culture being drawn. Prior to the above interventions, blood cultures were not treated with equal urgency. Once the importance of sending blood cultures without delay was appreciated, the target was easily met. It might be argued that the standard could be made more stringent, for example >90% of samples to be loaded within 2 hours, 100% within 4 hours.

Action plan

Action plan
Recommendations
Audit load delays every 6 months
Lead responsible for action
M J Weinbren
Implementation date
Next audit March 2017

Prior to the process, more than 40% of blood cultures were taking more than 4 hours to be loaded, some in excess of 18 hours. In an optimised blood culture pathway, haemolytic streptococci flag positive from 6 hours onwards after collection, E coli 7 hours with a mean of just over 11 hours. Load delays in comparison to time to positivity can be substantial, easily doubling or trebling the time to detect a pathogen.

Audit is key to establishing the effectiveness of the blood culture pathway. Without audit, no one – be they clinician or microbiologist – can gauge performance. This ultimately stems from the innate biological variability between samples producing a wide range in times to positivity. Thus, there is no one time permitting performance to be judged, inadvertently providing a shroud to hide poor practice. In Eire, in response to a high-profile death from sepsis, the coroner found turnaround times to be unacceptable. This resulted in the Irish national Accreditation Body enforcing the PHE blood culture standard. In the UK the standard is not obligatory.

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References

1. NICE CG149 *Neonatal infection: antibiotics for prevention and treatment.* Section 1.7.2 (36-hour neonatal blood cultures), 2012.
2. Lewis T, Sturgess A, Kavi J, Weinbren M. The result of three surveys (local, regional and national) of blood culture practice. *The Bulletin of the Royal College of Pathologists* 2015;171:192–194.
3. Public Health England. SMI B37 Investigation of Blood Cultures (for Organisms other than *Mycobacterium* species), 2014.

Audit evaluators wanted

We are looking for audit evaluators in all pathology specialties to be responsible for evaluating whether the criteria and standards of audits for certification are met appropriately.

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