

The Effect of Antibiotic Use on Blood Cultures: Implications for Future Policy

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Abstract : Blood cultures (BCs) are an important aspect of management of the septic patient, identifying the underlying pathogen and its antibiotic sensitivities. However, while the current literature outlines indications for initial BCs to be taken, there is little guidance for repeat sampling in the following 5-day period and little information on how antibiotic use can affect the usefulness of this investigation. A retrospective cohort study was conducted using inpatients who had undergone 2 or more BCs within 5 days between April 2016 and April 2017 at a 400-bed hospital in the west of Scotland and received antibiotic therapy between the first and second BCs. The data for BC sampling was collected from the electronic microbiology database, and cross-referenced with data from the hospital electronic prescribing system. Overall, 283 BCs were included in the study, taken from 92 patients (mean 3.08 cultures per patient, range 2-10). All 92 patients had initial BCs, of which 83 were positive (90%). 65 had a further sample within 24 hours of commencement of antibiotics, with 35 positive (54%). 23 had samples within 24-48 hours, with 4 (17%) positive; 12 patients had sampling at 48-72 hours, 12 at 72-96 hours, and 10 at 96-120 hours, with none positive. McNemar's Exact Test was used to calculate statistical significance for patients who received blood cultures in multiple time blocks (Initial, < 24h, 24-120h, > 120h). For initial vs. < 24h-post BCs (53 patients tested), the proportion of positives fell from 46/53 to 29/53 (one-tailed $P=0.002$, OR 3.43, 95% CI 1.48-7.96). For initial vs 24-120h ($n=42$), the proportions were 38/42 and 4/42 respectively ($P < 0.001$, OR 35.0, 95% CI 4.79-255.48). For initial vs > 120h ($n=36$), these were 33/36 and 2/36 ($P < 0.001$, OR ∞). These were also calculated for a positive in initial or < 24h vs. 24-120h ($n=42$), with proportions of 41/42 and 4/42 ($P < 0.001$, OR 38.0, 95% CI 5.22-276.78); and for initial or < 24h vs > 120h ($n=36$), with proportions of 35/36 and 2/36 respectively ($P < 0.001$, OR ∞). This data appears to show that taking an initial BC followed by a BC within 24 hours of antibiotic commencement would maximise blood culture yield while minimising the risk of false negative results. This could potentially remove the need for as many as 46% of BC samples without adversely affecting patient care. BC yield decreases sharply after 48 hours of antibiotic use, and may not provide any clinically useful information after this time. Further multi-centre studies would validate these findings, and provide a foundation for future health policy generation.

Keywords : antibiotics, blood culture, efficacy, inpatient

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