Blood culture volume and detection of coagulase negative staphylococcal septicaemia in neonates

G Jawaheer, T J Neal, N J Shaw

Abstract
A prospective, blind study was carried out to determine: the amount of blood submitted for culture from neonates; whether small blood volumes resulted in false negative results; and whether there was a temporal relation between volume of blood cultured and time to positivity.

Seventy three bottles were evaluated. They contained a median of 0.63 ml of blood. Twenty nine bottles (39.7%) contained less than 0.5 ml of blood; 21 bottles (28.8%) were positive. There were three false negative cultures, only one of which contained a blood volume below 0.5 ml. The median time to positivity was 22.4 hours. There was no correlation between blood volume cultured and time to positivity.

Neonatal cultures frequently contain less than 0.5 ml of blood. False negative cultures are rare. Neonatal blood culture bottles need to be validated for blood volumes below 0.5 ml.

Keywords: blood cultures; septicaemia; coagulase negative staphylococci

Blood cultures have an important role in the diagnosis of coagulase negative staphylococcal septicaemia in neonates. The bottles are validated only for a specific range of blood volumes. During the past two decades, coagulase negative staphylococci (CNS) have emerged as the principal pathogen associated with late onset disease in preterm infants. As infection with this organism gives rise to a varied clinical picture, the results of blood cultures form the basis of accurate diagnosis and effective treatment. According to the data sheet, our blood culture bottles (Pedi-BacT, Organon Teknika) were validated using blood volumes ranging from 0.5 ml to 4.0 ml. At least 1.0 ml of blood has been recommended for neonatal blood cultures. However, it is often difficult to take a peripheral blood culture in a neonate. The occasions when the smallest quantity of blood is obtained are often those where there are the greatest difficulties obtaining the sample and where the risk of contamination is highest. Samples smaller than 0.5 ml may be submitted for culture. For such low blood volumes, the sensitivity of the bottles is unknown and, therefore, the reliability of the cultures is questionable. This problem has not received much attention and is not widely recognised by clinicians.

The aims of this study were first, to determine the volume of blood submitted for culture in neonates, second, to assess the reliability of such cultures, and third, to examine the relation between volume of blood cultured and time to positivity.

Methods
All the blood culture bottles on our neonatal intensive care unit were replaced by bottles which had been numbered and weighed on an electronic scale (Denver Instruments, UK) by one investigator (TJN). Blood cultures were drawn by physicians who were blind to the purpose of the study and unaware that the bottles were being weighed. In all cases blood was obtained by peripheral venepuncture after cleansing the skin with 70% isopropyl alcohol. After inoculation the bottles were reweighed in the public health laboratory. The difference between weight (g) before and after inoculation was considered to be equivalent to the volume of blood inoculated in millilitres. The bottles were incubated at 37°C and monitored using the BacT/Alert continuous monitoring blood culture system (Organon, Teknika Corporation, Durham, North Carolina, USA). The time taken for the bottles to signal positive was determined by the computer software in the blood culture machine. The cultures were kept for seven days. Empirical broad spectrum antibiotics, consisting of co-amoxiclav and netilmicin, were started after cultures were taken. If the cultures remained negative after an incubation period of 48 hours, antibiotics were stopped. When the cultures were positive with a pure growth of coagulase negative staphylococci, antibiotic treatment was adjusted according to the results of sensitivity tests and administered for five days. A blood culture result was considered to be false negative when clinical symptoms persisted and a subsequent blood culture drawn within 72 hours of the original was positive for the organism.

Data are expressed as median and range. The positive and the negative groups were compared using the Mann-Whitney U test. The correlation between the volume of blood cultured and time to positivity was evaluated using the Pearson product moment correlation coefficient. Differences were considered significant at P < 0.05.

Results
Eighty blood culture bottles were submitted for culture over a period of five months. Seven were rejected: organisms other than coagulase negative staphylococci were cultured in three
and the time of blood collection was not recorded in four. The 73 bottles evaluated were from 43 neonates. The weight (kg) of the neonates was 2.07 (0.7-4.24) and their gestational age (weeks) was 32 (24-41). The volume of blood inoculated in the 73 bottles was 0.63 ml (0.05 - 2.57). Twenty one bottles (28.8%) were positive, yielding a pure growth of coagulase negative staphylococci. The positive bottles contained significantly smaller volumes of blood than the negative bottles: 0.41 ml (0.13-1.81) and 0.67 ml (0.05-2.57), respectively (P= 0.03). Twenty nine bottles (39.7%) contained less than 0.5 ml of blood; 14 were positive for coagulase negative staphylococci and 15 were negative. The median time to positivity was 22.4 hours (13.2-40.6). There was no significant correlation between the volume of blood cultured and time to positivity (r = -0.13; P = 0.56). Three cultures (4.1%) were considered false negative because subsequent positive cultures, with a pure growth of coagulase negative staphylococci, were obtained within 72 hours of the original blood culture. Only one of the three original cultures contained a blood volume below 0.5 ml.

**Discussion**

The management of neonates with suspected infection hinges on the results of blood cultures. In clinical practice a negative blood culture signifies the absence of bacteraemia and antibiotics are subsequently stopped. The reliability of the results is therefore of crucial importance. The single most important factor governing the sensitivity of blood cultures is the amount of blood inoculated in the bottles which in turn, does not affect the time taken for blood cultures to become positive. Paediatric blood culture bottles therefore need to be evaluated for blood volumes of less than 0.5 ml.


Blood culture volume and detection of coagulase negative staphylococcal septicaemia in neonates

G Jawaheer, T J Neal and N J Shaw

Arch Dis Child Fetal Neonatal Ed 1997 76: F57-F58
doi: 10.1136/fn.76.1.F57

Updated information and services can be found at:
http://fn.bmj.com/content/76/1/F57

These include:

References
This article cites 9 articles, 6 of which you can access for free at:
http://fn.bmj.com/content/76/1/F57#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/