Neonatal blood cultures: survey of neonatologists' practices

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Brief report

Background: **There are currently no standard recommendations regarding the optimal method to obtain a blood culture in neonates.**

Methods: **We performed an online survey of the membership of the Section on Perinatal Pediatrics of the American Academy of Pediatrics regarding their practices when drawing blood cultures. The survey included questions regarding the type of antisepsis used in preparing the site for sampling, the amount of blood drawn and preferred site for obtaining the culture.**

Results: **Overall 715 of 2955 (24%) members responded to the survey. There was wide variability in responses to all of the questions. However, virtually all providers washed their hands and wore gloves while performing the procedure, and virtually all providers obtained ≥0.5 mL of blood for the sample.**

Conclusions: **Given the wide variability of practices among the members of the Section, evidence-based standards are needed to guide clinical practice for this procedure.**

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Key words: **blood culture; infection; neonate**

Introduction

Blood culture remains the gold standard for diagnosing sepsis in newborns. Factors such as the type of antisepsis method used, the preparation of the skin, the source of the culture, the volume of blood, and the type of culture media may all impact the result of the blood culture. Guidelines for obtaining blood cultures in newborns are not well defined and this may result in variability in standard practices. Little is known regarding actual practices for obtaining blood cultures in newborns. The objective of this study was to ascertain blood culture practices among neonatologists in the United States.

Methods

In 2010, we surveyed the 2955 members of the American Academy of Pediatrics (AAP) Section on Perinatal Pediatrics.

In 2010, we invited the members of the AAP Section on Perinatal Pediatrics to complete an online anonymous survey. A second wave survey was conducted eight weeks after the first to catch those who had not responded. The survey asked about work setting and self reported actual practices for obtaining blood cultures. Variables surveyed included choice of culture site in newborns (with and without central lines), volume of blood sampled, provider antisepsis method, infant skin preparation method, and type of blood culture bottle used. The Institutional Review Board at the Albert Einstein Medical Center, Philadelphia, PA, approved the study protocol.

Descriptive statistical analysis was performed with SPSS.

Results

A fourth of the AAP Section membership (715/2955, 24%) participated in the survey. The response rate from each district ranged from 18% to 33%.The highest response rate (33%) was from AAP district 3 (DC, DE, MD, NJ, WA), the lowest (18%) from AAP district 7 (AR, MS, OK, LA, TX). Most of the survey participants worked in NICUs in teaching hospitals.

Table 1 shows the actual practices for obtaining the blood cultures. In newborns with central lines, most respondents (70%) obtained both central and peripheral cultures, 25% only peripheral. In newborns without

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central lines, over half (60%) obtained venous blood cultures while 40% obtained arterial blood cultures. Almost all respondents (99%) sampled an amount of blood equal or greater than 0.5 mL. Nearly half (46%) routinely sent both aerobic and anaerobic cultures, while 42% sent only anaerobic cultures when indicated. Common reasons for sending anaerobic cultures were clinical concerns with necrotizing enterocolitis (NEC), intraperitoneal infection, bowel rupture, recent surgery, or a history of wound infection.

Table 2 lists the antiseptic methods used by the providers in preparation for drawing the culture and also for preparing the infants' skin. Most providers (95%) washed hands and wore gloves (45% unsterile, 41% sterile). The most common type of infant skin preparation method used was iodophor followed by alcohol (43%); the next most common was chlorhexidine (27%).

Table 1. Blood culture data

Source of culture (n=707)*	
In infants with central lines	
Central line only	5.0%
Peripheral only	25.0%
Central and peripheral	70.0%
In infants without central lines	
Venous	60.0%
Arterial	39.7%
Capillary	0.3%
Amount of blood drawn (n=715)*	
<0.5 cc	1.0%
0.5-1cc	82.0%
>1 cc	17.0%
Blood culture bottles (n=715)*	
Aerobic only	50.0%
Aerobic and anaerobic	46.0%
Don't know	4.0%
Reasons for anaerobic culture (n=667)*	
Routine	44.0%
Clinically indicated	42.0%
Don't know	14.0%

*: Number of respondents.

Table 2. Methods of antisepsis

Provider antisepsis methods (n=715)*	
Hand wash/rub	95.0%
Unsterile gloves	45.0%
Sterile gloves	41.0%
Face mask	6.0%
Unsterile gown	2.8%
Sterile gown	1.8%
Skin preparation methods (n=715)*	
Iodophor then alcohol	43.0%
Chlorhexidine preps	27.0%
Iodophor only	16.0%
Alcohol then iodophor	10.0%
Alcohol only	2.5%
Other	2.5%

*: Number of respondents.

Discussion

This nationwide survey of neonatologists showed a wide variation in the actual practice of obtaining blood cultures in newborns. Key findings were the preferential use of central lines (70%) when available, the frequent (39.7%) use of arterial sampling when a central line was not available, and the wide range of antisepsis and skin preparation methods utilized.

The use of central lines as a source of blood cultures was commonly reported. Indwelling vascular catheters may be colonized with organisms leading to false positive results.[1] Over two thirds of respondents reported obtaining peripheral blood cultures in addition to the central line cultures. Current evidence suggests that there is no difference between the qualities of samples from arterial or venous sites for blood cultures.[1] Regarding the use of venous versus arterial sampling for blood cultures, some experts have suggested venipuncture as the preferred method of blood sampling for term neonates because it is associated with fewer complications and is less painful.[2,3]

An important area of variability was that related to antisepsis and skin preparation. Nearly half of respondents used sterile gloves, half did not.

Appropriate aseptic technique does not necessarily require sterile gloves. A new pair of disposable nonsterile gloves can be used in conjunction with a "no-touch" technique for phlebotomy.[4] However, a recent study[5] showed that routine sterile gloving before venipuncture may reduce blood culture contamination. The most common antisepsis used to prepare the skin for the blood culture was iodophor with alcohol followed by chlorhexidine preps. A large randomized trial comparing four skin antiseptics, 10% povidone iodine, 70% isopropyl alcohol, tincture of iodine, or povidone-iodine plus 70% ethyl alcohol, found a blood culture contamination rate ranging from 2.5% to 3.0%, with no significant differences among the groups.[6] Regarding the use of chlorhexidine in newborns, a common practice in our survey, infection prevention guidelines do not endorse chlorhexidine gluconate use in neonates who are less than 2 months old because of incomplete safety data in this population.[7]

The amount of blood sampled was generally appropriate. Buttery et al[2] reported the minimal amount of blood necessary for a newborn blood culture to be 0.5 mL. In a study of the effect of small blood culture

volumes for a variety of common neonatal pathogens, blood volumes of 0.5 mL or less had significantly less chance of detecting bacteremia in their *in vitro* study model.[8]

Our survey also found a low use of anaerobic culture bottles. The CDC recommends obtaining a set of blood cultures (aerobic and anaerobic) percutaneously from two different sites.[9] However, this practice might be difficult in newborns. Anaerobic sepsis in newborns is exceedingly rare, with many centers preferring to use all the blood for aerobic cultures unless specific clinical indications exist.[2,10]

To our knowledge, this is the first national survey of blood culture practices in neonates that focused exclusively on techniques of collecting blood cultures. Rubin et al[11] surveyed 278 neonatologists and neonatal fellows from 35 children's hospitals regarding their management of late onset sepsis. A small part of their survey dealt with the specific techniques of collecting blood cultures. Their results were similar to ours. They found that 80% of respondents would draw two cultures if a central catheter was in place, while we found 70% would perform two cultures under those circumstances; 52% of their respondents as opposed to 50% of our respondents drew only an aerobic culture. Lastly, a greater percentage of our respondents used chlorhexidine (27% *vs*. 12%) with a corresponding drop in the use of povidone-iodine and alcohol among our respondents (53% *vs*. 79%). Strengths of the study include its large sample size, two and one-half times larger than the Rubin study,[11] and nationwide representation. The major limitations include the relatively low response rate and possible self reporting bias. This survey provides self reporting data, and these data have not been validated by observation.

The variability in actual practices used to obtain blood cultures in newborns indicates a need for evidence-based studies that define optimal methods. Defining the best practices for provider antisepsis, patient access decontamination, minimum volume of blood sample and aerobic and anaerobic incubation media need further studies. Although the nature of neonatal blood sampling is difficult at best, striving for more standardized practices, with less contamination, may allow for better comparisons of data, cost containment by reducing antibiotic use, and even decreased length of stay.

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Ethical approval: This study was approved by the Institutional Review Board of the Albert Einstein Healthcare Network.

Competing interest: None declared.

Contributors: Kerur B proposed the study, wrote the first draft and analyzed the data. All authors contributed to the design and interpretation of the study and to further drafts. Schutzman DL is the guarantor.

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