CLINICAL NOTE

Positive blood cultures in a pediatric emergency department: a descriptive analysis

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None

We describe the infections and microorganisms causing bacteremia in an emergency department and to analyze the influence of a positive blood culture on subsequent management. It is a retrospective study of positive blood cultures ordered in the emergency department in 2008 and 2009. A change in therapeutic approach was defined as the initiation or modification of antibiotic therapy and/or hospital admission. A total of 7582 blood cultures were ordered. Bacteria grew in 382 (5.0%); 88 (23.0%) were true positives. Pneumonia and urinary tract infection were the main diagnoses associated with bacteremia. The pathogens implicated most often were *Streptococcus pneumoniae* and *Escherichia coli.* A positive blood culture led to a change in therapeutic approach in a third of the cases, mainly in patients with fever of unknown origin. We conclude that the management changed on the basis of blood culture findings in a significant number of cases although given the low prevalence of bacteremia, the overall impact was low. [Emergencias 2012;24:386-388]

Key words: Blood cultures. Bacteremia. Emergency health services. Pediatrics.

Introduction

In pediatric emergency departments (PEDs), ordering blood cultures (BC) is a common practice when dealing with patients at risk of bacteremia[1]. Positivity is not usually confirmed before 24-36 hours, and it is necessary to identify which patients require empirical antibiotic therapy. In recent years, ordering BC in adult EDs has been questioned, especially in immunocompetent individuals with common infections or those that may be confirmed by other culture methods, after observing that BC had very limited usefulness in these cases[2-4].

In pediatric studies, only a few have analyzed the prevalence and characteristics of children with positive BC and its impact on subsequent management[5-7]. The objectives of the present study were: 1) to determine the diseases and microorganisms responsible for bacteremia in PED patients and 2) analyze the impact of positive BC.

Clinical cases

We performed a retrospective review of medical records of patients aged ≤ 18 years with positive BC performed in the PED during the years 2008 and 2009. The indication for blood sampling was according to existing PED protocols[8]. The blood samples for BC were taken by PED nurses and processed immediately in the microbiology department using standard techniques. Bacteremia was defined as the isolation of one or more microorganisms in one or several cultures whenever the BC was compatible with clinical and laboratory findings. Probable contamination was considered as isolation of coagulase negative *Staphylococcus, S. viridans,* diphtheroids, *Propionibacterium* and *Bacillus* spp, unless one was isolated in two BC and the clinician considered it relevant. We calculated incidence rates of BC and bacteremia per 1,000 patients seen in the PED and overall diagnostic yield (number of bacteremias/number of BC) and the rate of contamination (number contaminated/number of BC). A change in therapeutic approach was considered as initiation or modification of antibiotic prescribed (due to resistance to the prescribed antibiotic or due to indication for one of reduced spectrum) and/or hospitalization in patients initial-

ly sent home if this was indicated by persistent fever.

During the study period 172,990 visits were received, and BC was requested BC for 7582 (4.3%) (44 BC per 1,000 visits). In 382 (5.0%) there was bacterial growth: 294 (77.0%) were considered contaminated and 88 (23.0%) true positives. The diagnostic yield of BC was 1.2% and contamination rate was 3.9%. The 88 episodes of bacteremia corresponded to 86 patients, with an incidence rate of 0.5 episodes per 1,000 visits attended. The median age was 20.6 months (p25-75: 2.2 months – 4.5 years) and 53 (61.6%) were male. Twenty-one children (24.4%) had risk factors, 14 of them (66.6%) having hemato-oncologic processes.

The reasons for requesting BC were: suspected invasive bacterial disease before receiving systemic antibiotic therapy (46 episodes; 52.3%), fever of unknown origin (FUO) (33 episodes; 37.5%) and fever in immunocompromised patients (9 episodes; 10.2%).

At least one dose of heptavalent pneumococcal conjugate vaccine (PCV-7) was received by 37 children (42.4%), and 3 patients had FUO (3/33; 9.1%). Fever at home was reported in 78 children (88.6%) and 2 (2.2%) had received antibiotics. BC was performed in a feverish peak in 52 cases (59.1%). After the initial visit, empirical antibiotic was prescribed for 78 (88.6%) patients (60 with specific diagnosis and 18 with FUO) and 78 (88.6%) were hospitalized. The 10 children discharged comprised 7 cases with FUO, two with pneumonia and one with urinary tract infection, the latter three were prescribed empirical antibiotic.

Infection was mono-microbial in all cases, and *S. pneumoniae* was the most frequently isolated agent (Table 1). All *S. epidermidis* bacteremias corresponded to immunocompromised patients bearing intravascular devices. The main entities associated with bacteremia were pneumonia and urinary tract infection (Table 2). After evaluation of the antibiogram, the empiric antibiotic was adequate in 73 cases (93.6%). A positive BC result conditioned a change in therapeutic approach in 27 episodes (30.7%) (0.3% of all BC performed): antibiotic therapy was initiated in the 10 children with FUO who had not received it and the 7 children initially discharged home were hospitalized, and the antibiotic changed in the remaining 17 cases: 5 due to antibiotic resistance and in 12 cases it was changed to one of reduced spectrum (9 of these patients had hemato-oncologic disease).

Table 1. Etiology of the episodes of bacteremia (n = 88)

Etiology	N (%)
S. pneumoniae	32 (36.4)
E. coli	16 (18.2)
S. epidermidis	9 (10.2)
S. agalactiae	9 (10.2)
N. meningitidis	5 (5.7)
S. pyogenes	4 (4.5)
P. stutzeri	2 (2.3)
Others*	11 (12.5)

*One case each of the following micro-organisms: *S. dysgalactiae, E. faecalis, A. lwoffs, B. cepacia, S. maltophila, S. enterica, S. mitis, P. mirabilis, H. influenzae, K. pneumoniae, P. aeuriginosa.*

Table 2. Pathologies associated with episodes of bacteremia (n = 88)

Etiology	N (%)
Pneumonia	19 (21.6)
Urinary infection	14 (15.9)
Occult bacteremia	13 (14.8)
Sepsis	11 (12.5)
Oncological bacteremia	9 (10.3)
Meningitis	7 (8.0)
vascular catheter infection	7 (8.0)
Otitis	3 (3.4)
Others*	5 (5.7)

*One case each of the following disorders: arthritis, cutaneous cellulitis, mastoiditis, endocarditis and peritonitis.

Discussion

Forty four BC were performed per 1,000 visits to the PED. This figure is similar to that described by Waltzam et al. (47 BC/1.000 children attended)[9], but significantly below the 73/1.000 or 445/1.000 children described by other authors[5,6]. While these differences are partly attributable to the particular profile of patients seen in PED, they also reflect the variability in BC indication, given the lack of international consensus.

In the literature, BC contamination rates range from 1% to 7%[1,5,9,10], and in our study this was 3.9%. Numerous studies reflect the consequences of false positive BC in the ED[10,11]. Several factors have been proposed as early predictors to distinguish contaminated BC from true positives (BC positivity time, initial Gram test result)[1,12]. We believe that the predominance of contaminated BC over true positives is largely due to the decrease of occult bacteremia (OB) following the introduction of PCV-71. Further studies are required in this regard.

The overall diagnostic yield of BC was 1.2%. Other studies show somewhat higher yields (between 1.5% and 3%), although most BC only involved children with FUO and high risk of OB and were performed in the pre-PCV-7 era[5,6,9,10]. Given the characteristics of the present study it was not

possible to determine the diagnostic yield for various diseases, since that would require inclusion of all the BC performed. Also, the various factors influencing outcome would have to be analyzed[13].

As in other pediatric studies[5,10,14], the main organism isolated was *S. pneumoniae,* unlike in adult populations where *E. coli* is the predominant microorganism[15]. In our series the presence of *S. epidermidis* was striking; the increasing number of cases of greater complexity in clinical practice requires that we consider the potential involvement of microorganisms classically considered as contaminants.

We found that the impact of positive BC on therapeutic approach was very limited in patients with specific initial diagnosis, since most had received suitable empirical antibiotic therapy. Furthermore it should be noted that most FUO patients who required a change were immunocompromised patients who were prescribed a lower spectrum antibiotic, despite being sensitive to the antibiotic originally prescribed.

Our study has several limitations: it was retrospective and descriptive, so it was not possible to analyze whether BC positivity influenced the duration of treatment, which could modify the results. Furthermore, including only positive BC episodes meant it was not possible to analyze the diagnostic yield of BC for various diseases in the PED.

For these reasons, although BC in the PED is useful, we believe the low prevalence of bacteremia means it must be monitored and analyzed to detect areas for improvement, both in the indication and the quality of BC.

References

1 Sard B, Bailey MC, Vinci R. An analysis of pediatric blood cultures in the postpneumococcal conjugate vaccine era in a community hospital emergency department. Pediatr Emerg Care. 2006;22:295-300.
2 Kelly AM. Clinical impact of blood cultures taken in the emergency department. J Accid Emerg Med. 1998;15:254-6.
3 Howie N, Gerstenmaier JF, Munro PT. Do pheripheral blood cultures taken in the emergency department influence clinical management?. Emerg Med J. 2007;24:213-4.
4 Cisneros JM, Sánchez M, Prados MT, Llanos C, Vigil E, Soto B, Pachón J. Hemocultivos en el servicio de urgencias. Enferm Infecc Microbiol Clin. 2005;23:135-9.
5 Epstein D, Raveh D, Schlesinger Y, Rudensky B, Gottehrer N, Yinnon A. Adult patients with occult bacteremia discharged from the emergency department: epidemiological and clinical characteristics. Clin Infect Dis. 2001;32:559-65.
6 Leonard P, Beattie TF. How do blood cultures sent from a paediatric accident and emergency department influence subsequent clinical management? Emerg Med J. 2003;20:347-8.
7 Pitetti RD, Choi S. Utility of blood cultures in febrile children with UTI. Am J Emerg Med. 2002;20:271-4.
8 Jordi Pou i Fernández. Urgencias en Pediatría. Protocolos diagnóstico-terapéuticos. Unidad Integrada Hospital Clínic-Sant Joan de Déu. 4ª edición. Madrid: Ediciones Ergon; 2005.
9 Waltzman ML, Harper M. Financial and clinical impact of false-positive blood culture results. Clin Infect Dis. 2001;33:296-9.
10 Segal G, Chamberlain J. Resource utilization and contaminated blood cultures in children at risk for occult bacteremia. Arch Pediatr Adolesc Med. 2000;154:469-73.
11 Bates DW, Goldman L, Lee TH. Contaminant blood cultures and resource utilization. The true consequences of false-positive results. JAMA. 1991;265:365-9.
12 Kornberg AE, Jain N, Dannenhoffer R. Evaluation of false positive blood cultures: guidelines for early detection of contaminated cultures in febrile children. Pediatr Emerg Care. 1994;10:20-2.
13 Connell T, Rele M, Cowley D, Buttery J, Curtis N. How reliable is a negative blood culture result? Volume of blood submitted for culture in routine practice in a children's hospital. Pediatrics. 2007;119;891-6.
14 Laupland KB, Gregson DB, Vanderkooi OG, Ross T, Kellner JD. The changing burden of pediatric bloodstream infections in Calgary, Canada, 2000-2006. Pediatr Infect Dis J. 2009;28:114-22.
15 Matas L, Martí C, Morera MA, Sierra M, Vilamala A, Corcoy F y grupo de mircrobiólogos de hospitales cormarcales de catalunya. Bacteriemia en 13 hospitales generales de la provincia de Barcelona. Estudio prospectivo de 1674 episodios. Enferm Infecc Microbiol Clin. 1995;13:345-55.

Estudio descriptivo de los hemocultivos positivos en un servicio de urgencias pediátrico

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Se describe las patologías y los microorganismos que causan bacteriemia y la influencia del hemocultivo (HC) positivo en urgencias en el manejo posterior. Se trata de un estudio retrospectivo de los HC positivos realizados en urgencias durante 2008 y 2009. Se consideró el cambio de la actitud terapéutica, el inicio o modificación del antibiótico y/o el ingreso hospitalario. Se realizaron 7.582 HC. En 382 (5,0%) hubo crecimiento bacteriano, 88 (23,0%) fueron verdaderos positivos. La neumonía y la infección urinaria fueron las principales patologías asociadas a bacteriemia y *S. pneumoniae* y *E. coli* los microorganismos más frecuentes. El HC positivo condicionó cambio de actitud terapéutica en un tercio de los episodios, principalmente en pacientes con fiebre sin foco. Se concluye que la positividad del HC condicionó un cambio de actitud terapéutica en un número significativo de pacientes, aunque dada la baja prevalencia de bacteriemia el impacto global fue bajo. [Emergencias 2012;24:386-388]

Palabras clave: Hemocultivos. Bacteriemia. Servicio de urgencias. Pediatría.