Journal of Infection and Public Health (2017) 10, 211—218

http://www.elsevier.com/locate/jiph

Clinical and microbiological features of resistant gram-negative bloodstream infections in children

Türkan Aydın Teke[a,*], Gönül Tanır[a], Gülsüm İclal Bayhan[a], Fatma Nur Öz[a], Özge Metin[a], Şengül Özkan[b]

[a] *Dr. Sami Ulus Maternity and Children's Training and Research Hospital, Pediatric Infectious Diseases, Turkey*
[b] *Dr. Sami Ulus Maternity and Children's Training and Research Hospital, Microbiology, Turkey*

Received 18 November 2015; received in revised form 18 March 2016; accepted 3 April 2016

KEYWORDS
Bloodstream infection;
Gram-negative;
Resistance;
Children

Summary
Background: Bloodstream infections (BSIs) caused by Gram-negative (GN) bacteria cause significant morbidity and mortality. There is a worldwide increase in the reported incidence of resistant microorganisms; therefore, surveillance programs are important to define resistance patterns of GN microorganisms causing BSIs. The objective of this study was to describe the clinical and microbiological features of resistant GN BSIs in a tertiary pediatric hospital in Turkey.
Methods: Patients between 1 month and 18 years of age hospitalized between January 2005 and December 2012 were included in this study. The presence of ESBL and AmpC type beta-lactamase activity were evaluated using the Clinical and Laboratory Standards Institute (CLSI) disk diffusion and double-disk synergy tests.
Results: A total of 209 resistant GN bacterial BSI episodes were identified in 192 patients. Of 192 children, 133 (69.2%) were aged ≤48 months of age. Sixty-six (31.6%) of the BSIs were considered community-acquired and 143 (68.4%) were hospital-acquired infections. The most common isolates were non-fermenting GN bacteria ($n = 117$, 55.9%). The major causative pathogens were *Pseudomonas* spp. in non-fermenting GN bacteria. The resistance rates to imipenem for *Pseudomonas* spp. and *Acinetobacter* spp. were 40.5% and 41.6%, respectively. The most common isolates in fatal patients were *Pseudomonas* spp. followed by *Escherichia coli*. The overall 28-day mortality rate was 16.3%.

* Corresponding author at: Dr. Sami Ulus Çocuk Hastanesi, Babür Caddesi No: 44, 06080 Altındağ, Ankara, Turkey. Tel.: +90 3123056545; fax: +90 3123170353.
E-mail address: turkanteke@gmail.com (T. Aydın Teke).

http://dx.doi.org/10.1016/j.jiph.2016.04.011

Conclusions: Although our study was performed at a single center and represents a local population, based on this study, it is concluded that surveillance programs and studies of novel antibiotics for resistant GN bacteria focusing on pediatric patients are required.

Introduction

Bloodstream infection (BSI) is a clinical syndrome defined as the presence of bacteria in the blood, and it is associated with high morbidity and mortality. The epidemiology of microbial pathogens causing BSI has changed over the years, with an increase in the incidence of Gram-negative (GN) organisms [1,2]. Prompt and appropriate empirical treatment plays a critical role in GN BSIs. However, the increasing prevalence of resistant GN bacteria makes the empirical treatment of BSIs more difficult [3,4]. Although the use of antibiotics and, therefore, infections due to resistant organisms are highly common in hospital settings, and antibiotic resistance has recently emerged as an important cause of community-acquired BSIs [5,6]. This increase has also reduced the number of appropriate antibiotics available for the treatment of serious life-threatening GN BSIs. By contrast, it is worrisome that this increase has progressed much faster than the development of new antibiotics. Moreover, antibiotics that were developed and those currently under development are generally focused on adults. Studies investigating the clinical and epidemiological features of pediatric BSIs are lacking, and most of these studies are focused on specific age groups, particular microorganisms, or underlying diseases [7—9]. The objective of this study is to describe the clinical and microbiological features of community- and hospital-acquired BSIs and to investigate their causative pathogens and antibiotic resistance profiles, as well as mortality caused by BSIs, in a tertiary pediatric hospital in Turkey.

Methods

This retrospective study included clinical records of hospitalized patients aged between 1 month and 18 years who had blood culture positivity for resistant GN bacteria at Dr. Sami Ulus Maternity and Children's Training and Research Hospital between January 2005 and December 2012. Neonatal patients, outpatients, patients with a hospital stay shorter than 24 h and patients who were referred to our hospital from other health-care facilities were excluded from the study. Age, gender, department of hospitalization, underlying diseases, history of hospitalization within the last 3 or 6 months, history of parenteral or oral antibiotic use, and 30-day history of corticosteroid or other immunosuppressive or anticarcinogenic drug use, surgical operations, administration of hemodialysis, peritoneal dialysis, or plasmapheresis, and use of a mechanic ventilator and central venous catheter were recorded. In addition, the peripheral leukocyte count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) levels that were assessed on the day when the positive blood culture was obtained were recorded. BSI was defined as the isolation of a pathogen microorganism from >1 blood culture bottle. BSIs were classified as community- and hospital-acquired infections and were compared accordingly. Pathogens were defined as community-acquired BSIs if detected within the first 48 h of hospitalization, and they were defined as hospital-acquired BSIs if detected after 48 h of hospitalization. The recovery of different species 72 h after the previous positive blood culture in a single patient was considered to be a distinct episode. Isolation of the same microorganism from a single patient was considered to be a single episode even if the culture was obtained after 72 h.

The blood cultures were incubated in a BacT/Alert automated culture system at 37 °C for 24—48 h (bioMérieux®, France) and then Gram-stained and subcultured onto plates containing 5% sheep blood agar, eosin methylene blue agar, and chocolate agar. A control passage was performed for cultures that did not grow for 10 days. Confirmation of bacterial identification was achieved using conventional methods, such as a Gram stain test, oxidase test, lactose fermentation, urea test, indole test, and motility test, with an API 20E (bioMérieux®, France) in fermenting GN bacteria