

Bacterial aetiology of bloodstream infections and antimicrobial susceptibility among paediatric oncohaematologic patients

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Background and aims

Sepsis is the leading cause of morbidity and treatment-related mortality in patients with haematologic malignancies and solid tumours undergoing intensive cytotoxic chemotherapy (1). The emergence of carbapenem resistant Gram-negative and vancomycin resistant Gram-positive bacteria is occurring worldwide (2). Our aim was to analyse local species distribution causing bacteremia and their antibiotic resistance patterns in our oncohaematology centre in order to review the evidence based strategy for empirical antimicrobial therapy.

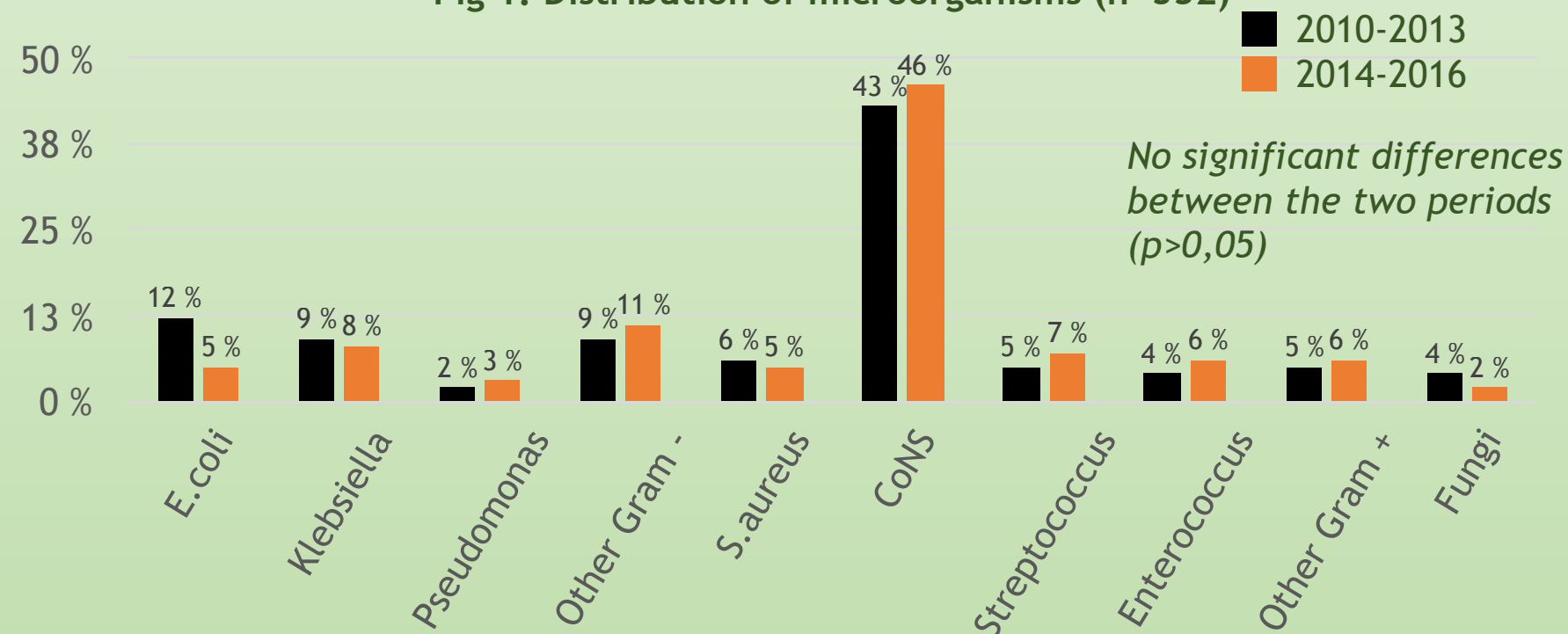
Material and methods

All positive blood cultures (n=460) of paediatric cancer patients treated at the Centre for Paediatric Oncology/Haematology, Children's Hospital, Affiliate of Vilnius University Hospital Santaros Klinikos during the recent 7 years (2010-2016) were retrospectively analysed. The data were compared between two periods: 2010-2013 and 2014-2016.

Results

A total of 532 microorganisms were cultured (67.7% gram-positive bacteria, 29.5% gram-negative bacteria and 2.8% fungi). Monospecies comprised majority (85.4%) of blood cultures. Two species grew in 62 cultures (13.5%) and three species - in five cultures (1,1%).

Fig 1. Distribution of microorganisms (n=532)



Other Gram-negative bacteria: *Acinetobacter baumannii*, *A. lwoffii*, *Aeromonas hydrophila*, *A. sobria*, *Agrobacterium radiobacter*, *Alcaligenes spp.*, *Altenaria spp.*, *Bacteroides ureolyticus*, *B. vulgatus*, *Enterobacter aerogenes*, *E. cloacae*, *Haemophilus parainfluenzae*, *Moraxella catarrhalis*, *Pantoea spp.*, *Salmonella enteritidis*, *Stenotrophomonas maltophilia*, *Veilonella spp.*

Other Gram-positive bacteria: *Actinomyces viscosus*, *Aerococcus viridans*, *Bacillus spp.*, *Bifidobacterium spp.*, *Clostridium tyrobutyricum*, *Corynebacterium spp.*, *Micrococcus luteus*, *M. lylae*

CoNS - coagulase negative Staphylococci

Table 1. Gram-positive bacteria antimicrobial susceptibility.

Bacteria	CoNS (n=238)			S. aureus (n=30)			Streptococci (n=33)			Enterococci (n=28)		
	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total
Erythromycin	37%	29%	33%	77%	100%	87%	46%	54%	50%	-	-	-
Gentamicin	50%	49%	50%	94%	100%	97%	-	-	-	50%	50%	50%
Linezolid	97%	95%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Oxacillin	19%	28%	23%	100%	100%	100%	-	-	-	-	-	-
Penicillin	5%	7%	6%	29%	42%	35%	79%	61%	69%	-	-	-
Teicoplanin	54%	55%	54%	100%	100%	100%	-	-	-	100%	100%	100%
Vancomycin	95%	94%	95%	90%	100%	93%	93%	100%	97%	80%	100%	92%

The most important and the most commonly used antimicrobials among childhood cancer patients are highlighted. ■ Sensitivity ≥ 80% ■ Sensitivity <80%

Table 2. Gram-negative bacteria antimicrobial susceptibility.

Bacteria	Klebsiella (n=45)			Pseudomonas (n=14)			E.coli (n=46)			Other gram negative bacteria (n=52)		
	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total	2010-2013	2014-2016	Total
Amikacin	91%*	65%*	79%	86%	100%	93%	100%	100%	100%	90%	95%	93%
Amoxiclav	35%	25%	30%	-	-	-	64%	80%	67%	57%*	17%*	42%
Ceftazidime	33%	32%	33%	100%	100%	100%	91%	100%	93%	63%	50%	57%
Ciprofloxacin	41%	35%	38%	100%	86%	93%	88%*	55%*	79%	79%	76%	78%
Gentamicin	48%	55%	51%	100%	100%	100%	85%*	55%*	77%	81%	62%	71%
Imipenem	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	100%	95%
Meropenem	100%	100%	100%	80%	100%	92%	100%	100%	100%	91%	100%	95%
Piperacillin/Tazobactam	57%	30%	44%	71%	57%	64%	91%	82%	89%	71%	50%	63%
Tobramycin	35%	17%	28%	83%	100%	92%	83%	60%	79%	78%	67%	73%
Co-trimoxazole	27%	20%	24%	-	-	-	19%	9%	17%	52%	70%	61%

The most important and the most commonly used antimicrobials among childhood cancer patients are highlighted. ■ Sensitivity ≥ 80% ■ Sensitivity <80%

* Significant changes during the time periods (p<0.05)

Conclusions

Gram-positive bacteria were the most frequent cause of bloodstream infection, with a predominance of coagulase-negative staphylococci.

Resistance to ciprofloxacin was high and increasing which resulted in abolishing of ciprofloxacin prophylaxis for stem cell transplanted patients.

Due to a high resistance pattern among Gram-negative bacteria, carbapenems are the first-line choice in febrile neutropenia for the highest risk patients, however, susceptibility pattern has to be closely monitored.

There was no emergence of vancomycin resistant Gram-positive bacteria, however appropriate use of glycopeptides is essential.

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2. Ventola CL. The Antibiotic Resistance Crisis: Part 1: Causes and Threats. *Pharmacy and Therapeutics*. 2015;40(4):277-283.