

Epidemiology of fungaemia and fungal meningitis in Sweden: a nationwide retrospective observational survey

Lena Klingspor¹, M. Ullberg^{1,2}, J. Rydberg³, Nahid Kondori⁴, L. Serrander⁵, J.Swanberg⁶, K.Nilsson⁷, C. Jendle Bengtén⁸, M. Johansson⁹, M. Granlund¹⁰, E. Törnqvist¹¹, A. Nyberg¹², K. Kindlund¹³, M. Ygge¹⁴, D. Kartout-Boukdir¹⁵, M. Toepfer¹⁶, E. Hålldin¹⁷, G. Kahlmeter¹⁸, V.Özenci^{1,2}

¹Div. of Clin. Microbiology, Dep. of Laboratory Medicine, Karolinska Institutet, Stockholm. ²Dep. of Clin. Microbiology, Karolinska University Hospital, Stockholm. ³Div. of Laboratory Medicine, Dep. of Clin. Microbiology, Lund. ⁴Dep. of Infectious Diseases, Sahlgrenska Academy, University of Gothenburg, Gothenburg. ⁵Dep. Clin. and Experimental Medicine, Linköping University, Linköping. ⁶Dep. of Clin. Microbiology, Ryhov Hospital, Jönköping. ⁷Dep. of Medical Sciences, Section of Clin. Microbiology and Infectious Diseases, Uppsala University, Uppsala. ⁸Dep. of Clin. Microbiology, Karlstad Central Hospital, Karlstad. ⁹Dep. of Clin. Microbiology, Kalmar County Hospital, Kalmar. ¹⁰ Dep. of Clin. Microbiology, Umeå University, Umeå. ¹¹Dep. of Laboratory Medicine/ Clin. Microbiology, Örebro University Hospital, Örebro. ¹²Laboratory Medicine/Clin. Microbiology, County Hospital Sundsvall-Härnösand, Sundsvall-Härnösand. ¹³Dep. of Clin. Microbiology, Hallands Hospital, Halmstad. ¹⁴Sunderby Hospital, Luleå. ¹⁵Unilabs AB, Clin. Microbiology, Mälarsjukhuset Hospital, Eskilstuna. ¹⁶Unilabs AB, Clin. Microbiology, Skaraborg Hospital, Skövde. ¹⁷Clin. Microbiology, Västerås Hospital, Västerås. ¹⁸Dep. of Clin. Microbiology, Central Hospital, Växjö, Sweden

Objectives: To identify the epidemiology and antifungal susceptibilities of *Candida* spp. among blood culture isolates and to describe the epidemiology of fungal meningitis in Sweden.

Methods: The study was a retrospective, observational nationwide laboratory-based surveillance for fungaemia and fungal meningitis and was conducted from September 2015 to August 2016.

Isolate identification was mostly done by Maldi- Tof MS. Antifungal susceptibility testing was performed using Sensititre YeastOne™ or Etest.

Susceptibility to the antifungal drugs was determined with clinical breakpoints from the European Committee on Antimicrobial Susceptibility Testing (EUCAST).

Results: In total, 488 *Candida* blood culture isolates were obtained from 471 patients (58% males). Compared to our previous study (1), the incidence of candidaemia has increased from 4.2/100,000 (2005-2006) to 4.7/100,000 population/year (2015-2016)

Of the 471 patients, 291 (61.8%) were >60 years old, whereas 19 (4%) were children (< 18y). Only one child was a neonate, yielding an incident of 0.09 per 100.000 babies born.

The three most common *Candida* spp. isolated from blood cultures were *C. albicans* (54.7%), *C. glabrata* (19.7%) and species in the *C. parapsilosis* complex (9.4%).

C. glabrata was predominant in patients >60 years of age (73%). In children non-*albicans* species dominated (52.6%).

In 15 (3.2%) patients more than one yeast were isolated.

Cryptococcus neoformans caused seven (58.3%) and *Candida* species five (41.7%) of the 12 meningitis cases, yielding an incidence of 0.12/100,000 population/year.

Candida resistance to fluconazole was 2% in *C. albicans* and between 0-100%, in non-*albicans* species other than *C. glabrata* and *C. krusei*. Resistance to voriconazole was rare, except for *C. glabrata*, *C. krusei* and *C. tropicalis*. Resistance to anidulafungin was 3.8% while no *Candida* isolate was resistant to amphotericin B.

Conclusions: We report an overall increase in candidaemia but a decrease of *C. albicans* while *C. glabrata* and *C. parapsilosis* remain constant over this 10-year period. Fungal meningitis is rare and acquired antifungal resistance is unusual, but reduced susceptibility/or resistance to anidulafungin was seen in 3.5% of the isolates

Table 1. The number of yeast isolates from blood in different age groups (years).

Species	Number	%	<1	.1-10	.11-20	.21-40	.41-60	.61-80	>81
<i>Candida albicans</i>	266	54.7	3	6	2	18	63	137	37
<i>Candida glabrata</i>	96	19.7				13	13	53	17
<i>Candida parapsilosis</i>	44	9.0	1	5	1	7	13	14	3
<i>Candida dubliniensis</i>	18	3.7				3	8	7	
<i>Candida tropicalis</i>	18	3.7		2	1	6	2	6	1
<i>Candida krusei</i>	14	2.9		1	1	2	6	3	1
<i>C. lusitaniae</i>	10	2.1			1		4	4	1
<i>C. kefyr</i>	5	1.0				1		3	1
<i>C. pelliculosa</i>	4	0.8				1	2	1	
<i>C. magnoliae</i>	3	0.6				2	1		
<i>C. ortopsilosis</i>	2	0.4				1	1		
<i>C. lipolytica</i>	1	0.2					1		
<i>C. famata</i>	1	0.2					1		
<i>Candida sake</i>	1	0.2							1
<i>Candida species</i>	1	0.2				1			
<i>Sacharomyces cerevisiae</i>	1	0.2							1
<i>Fusarium oxysporon</i>	1	0.2				1			
<i>Cryptococcus neoformans</i>	1	0.2				1			
Total	487		4	14	6	57	115	230	61

Demographic data are missing for one *C. albicans* isolate.