Colonization with Extended-Spectrum Beta-Lactamase–Producing Enterobacteriaceae and the incidence of Subsequent Bacteraemia

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Introduction and Purpose

Prevalence of colonization with extended spectrum beta-lactamase (ESBL) producing enterobacteria is increasing worldwide. There are very few data on how many patients colonized with ESBL-producing *Escherichia coli* (EC-ESBL) or *Klebsiella pneumoniae* ESBL (KPN-ESBL) develop infection caused by the colonizing bacterium, especially bloodstream infections (BSI) which have a high morbidity and mortality. EC-ESBL is mainly community-acquired while KPN-ESBL is primarily nosocomial pathogen. Our aim was to assess the incidence of KPN- or EC-ESBL BSI in patients with EC-ESBL or KPN-ESBL colonization and compare characteristics of ESBL colonized patients with or without subsequent BSI.

Methods

We retrospectively analyzed hospital and laboratory records of patients who were hospitalized at the Department of Infectious Diseases, University Medical Centre Ljubljana between 2010 and 2014. We analyzed data from patients aged 18 years or older who were colonized with EC-ESBL or KPN-ESBL during the study period. Colonization was detected by a rectal swab. BSI group consisted of patients who were colonized within one year preceding a positive blood culture result (366 days prior and 2 days post admission) In the control group we included patients who were colonized, but did not have a positive blood culture. BSI was defined as positive blood cultures for the same species as surveillance isolate. Data on comorbidities and length of hospital stay were collected. Characteristics of ESBL colonized patients with or without subsequent BSI were compared using chi square or t-test, depending on the variable type. Alpha was set at 0,05. Ethics committee approval was obtained prior to the study.

	EC-ESBL			KPN-ESBL		
	BSI (21)	Colonized (284)	p-value	BSI (15)	Colonized (209)	p-value
Age (years)	77 (54 do 88)	80 (23 - 97)	0,48	76 (43 - 84)	71 (19 - 100)	0,57
Female (%)	33	50	0,14	40	41	0,93
Hospitalisation duration (days)	12 (3 - 48)	8 (1 - 53)	0,96	28 (5 - 95)	22 (1 - 165)	0,13
ICU admission(%)	4,7	12	0,31	27	27	0,81
LTFR (%)	52	44	0,49	6,7	17	0,37
McCabe > 1 (%)	19	3	<0,001	23	7,9	0,03
Dementia (%)	14	23	0,35	0	3,8	0,46
Heart disease (%)	52	32	0,07	20	25	0,83
PAOD (%)	4,7	26	0,49	13	5,7	0,18
Lung disease (%)	9,5	9	0,91	13	5,3	0,15
Kidney disease (%)	28	12	0,03	20	12	0,30
Liver disease (%)	0	2,1	0,50	13	5,7	0,18
Diabetes mellitus (%)	52	28	0,02	20	23	0,96
Neurological illness (%)	43	23	0,04	20	19	0,77
Connective tissue disease (%)	4,7	2,5	0,53	6,7	7,1	0,97
Cancer (%)	24	12	0,11	13	11	0,71
Immunosuppression (%)	9,5	5,3	0,42	0	6,7	0,33
In-hospital mortality (%)	14	18	0,70	27	12	0,07

Table 1. Clinical characteristics of the patient population. Shown are data for patients with a bloodstream infection (BSI) and ESBL colonized patients without infection. P-values < 0,05 were deemed significant. ESBL, extended spectrum beta-lactamase; KPN, *Klebsiella pneumoniae*; EC, *Escherichia coli*; ICU, intensive care unit; PAOD, peripheral arterial occlusive disease; LTFR, long-term facility resident.

Results

We included 305 patients with EC-ESBL and 224 with KPN-ESBL colonization. Hospital records were available for 96% of patients. The data for patients with a bloodstream infection (BSI) and ESBL colonized patients without infection are shown in Table 1. The percentage of patients who developed BSI did not differ significantly between the groups (5,2% in EC-ESBL vs. 4,3% in KPN-ESBL). In general, patients with EC-ESBL BSI had a higher McCabe index (index >1 19% vs. 3%, p <0,001), higher incidence of kidney disease (29% vs. 12%, p = 0,02), diabetes mellitus (52% vs. 28%, p = 0,01) and neurological illness (43% vs. 23%, p = 0,04) than those only colonized with EC-ESBL. Likewise, patients with a KPN-ESBL BSI had a higher McCabe index (index >1 23% vs. 8%, p = 0,02), but did not differ in specific comorbidities. Patients with KPN-ESBL BSI had a longer hospital stay than those with EC-ESBL BSI (12 days vs. 28 days, p = 0,003). The time from first positive rectal swab for ESBL to positive blood culture was longer in KPN-ESBL colonized patients compared to EC-ESBL colonized patients, but the difference was not significant (EC: median 0 days, range of -2 to182 days vs. median of 10 days, range of -1 to 221 days for KPN, p = 0,67).

Conclusions

Colonized patients who developed subsequent BSI had more comorbidities in both groups which may explain the spread of the colonizing bacteria into the bloodstream. Despite different epidemiology the percentages of subsequent EC-ESBL and KPN-ESBL BSI are similar. Therefore, colonization with ESBL has to be considered when choosing empirical therapy in a colonized patient with many comorbidities.

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