Candida bloodstream infection during extracorporeal membrane oxygenation: Comparison with bacteremia

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Background/Aims: There is a paucity of specific report on candida bloodstream infection (BSI) in extracorporeal membrane oxygenation (ECMO) patients. This study aimed to evaluate the clinical characteristics and outcomes of candidemia in ECMO patients, and whether they differ from those of bacteremia.

Methods: We retrospectively reviewed medical records for patients between January 2015 and June 2020 who required ECMO for more than 48 hours and had BSIs while receiving ECMO. Cases were excluded if a blood culture was positive within 24 hours of ECMO implantation. Our surveillance protocol included daily blood culture since ECMO implantation until withdrawal.

Results: There were 251 eligible patients, including 195 patients of veno-arterial (VA) ECMO and 56 patients of veno-venous (VV) ECMO. We identified 132 BSI cases in 81 patients after exclusion of contaminants, and gram negative pathogens (74 cases, 56.1%) were the most common BSI isolates. There were 20 cases (15.2%) of candidemia, and the incidence of candidemia was 22.9 cases/1,000 days of ECMO support. Compared with gram negative bacteremia, the timing of candidemia was late (19 [11−38] vs. 13 [8−31] days from ECMO implantation; P = 0.023), even though 40% (8 out of 20 cases) of candidemia occurred within the first 2 weeks after ECMO implantation. Despite the lack of statistical significance, candidemia showed tendency toward an increased rate of prior exposure to carbapenem (P = 0.12), and lower level of procalcitonin (P = 0.07) and simplifid acute physiology score (SAPS) II (P = 0.07) at the time of BSI. In terms of clinical characteristics and outcomes, there were no significant differences between candidemia and gram positive bacteremia.

Conclusions: Our results suggest that candida BSI occurs relatively late during ECMO course compared with gram negative bacteremia, even though it may occur within the first 2 weeks of ECMO, especially in patients with exposure to carbapenem. Conseqeuntly, empirical antifungal therapy should be considered in such ECMO patients, regardless of levels of inflammatory markers and severity scoring system of patients.

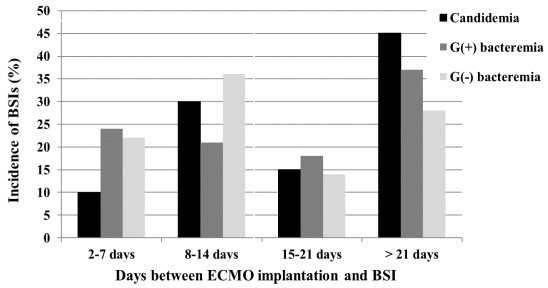

Fig. 1 Incidence of each bloodstream infections (BSIs) among extracorporeal membrane oxygenation (ECMO) patients that were stratified by days between ECMO implantation and BSI.

Table 1. Clinical characteristics and outcomes of the 20 cases of candidemia and 112 cases of bacteremia during extracorporeal membrane oxygenation (ECMO)

Variables	candidemia (n = 20)	Bacteremia gram negative bacteremia (n = 74)	Bacteremia gram positive bacteremia (n = 38)	*P* value (candidemia vs. gram negative bacteremia	*P* value (candidemia vs. gram positive bacteremia
Age, median years (IQR)	58 (51–67)	56 (45–68)	58 (48–66)	0.85	0.90
Male	11 (55)	55 (74)	29 (76)	0.06	0.13
ICU days before ECMO implantation, median (IQR)	2 (1–4)	1 (0–3)	1 (0–3)	0.10	0.11
Days between ECMO implantation and BSI, median (IQR)	19 (11–38)	13 (8–31)	8 (16–27)	0.023	0.25
Venoarterial mode of ECMO	11 (55)	58 (78)	25 (66)	0.036	0.42
Duration of ECMO, median days (IQR)	31 (18–57)	17 (13–31)	26 (17–50)	0.012	0.65
Immunocompromised state	11 (55)	44 (60)	30 (79)	0.72	0.06
Hematological malignancy	0	1 (1)	1 (3)	>0.99	>0.99
Active solid tumor[a]	1 (5)	1 (1)	0	0.38	0.35
Solid-organ transplant	3 (15)	6 (8)	7 (18)	0.40	>0.99
Long-term corticosteroid use[b]	1 (5)	37 (50)	1 (3)	0.69	>0.99
High-dose corticosteroid use[c]	9 (45)	1 (1)	27 (71)	0.38	0.052
SAPS III score at ICU admission	56 (41–64)	49 (36–62)	48 (41–61)	0.34	0.58
SOFA score at the time of BSI	11 (8–15)	13 (10–14)	11 (9–12)	0.29	0.69
SAPS II score at the time of BSI	52 (46–59)	62 (49–77)	54 (42–69)	0.07	0.65
Inflammatory markers at the time of BSI					
Lactate, mmol/L	3.2 (2.6–4.2)	4.7 (2.8–8.8)	3.7 (2.3–4.6)	0.12	0.76
CRP, mg/dL	12.2 (7.0–21.5)	14.9 (5.8–29.1)	17.4 (9.7–24.5)	0.41	0.31
Procalcitonin, ng/mL	2.2 (1.0–6.6)	4.0 (1.3–16.2)	4.3 (1.2–15.3)	0.07	0.22
CRRT prior to BSI[d]	16 (80)	57 (77)	29 (76)	>0.99	>0.99
TPN prior to BSI[d]	15 (75)	40 (54)	26 (68)	0.09	0.60
Antibiotic exposure prior to BSI[d]					
Glycopeptide	16 (80)	48 (65)	23 (61)	0.28	0.16
Carbapenem	12 (60)	30 (41)	15 (40)	0.12	0.14
Piperacillin/tazobactam	8 (40)	40 (54)	18 (47)	0.27	0.59
Amikacin	3 (15)	6 (8)	7 (18)	0.40	>0.99
Fluoroquinolones	9 (45)	21 (28)	10 (26)	0.16	0.15
Colistin	12 (60)	31 (42)	21 (55)	0.15	0.73
Metronidazole	2 (10)	11 (15)	2 (5)	0.73	0.60
Antifungal agent	3 (15)	13 (18)	8 (21)	>0.99	0.73
Outcomes					
ECMO weaning	5 (25)	23 (31)	9 (24)	0.28	0.91
Survival to discharge	4 (20)	10 (14)	6 (16)	0.49	0.72

BSI, bloodstream infection; CRRT, continuous renal replacement therapy; ICU, intensive care unit; IQR, interquartile range; SAPS, simplified acute physiology score; SOFA, sequential organ failure assessment; TPN, total parenteral nutrition.

Data are presented as No. (%) unless indicated otherwise.

[a] Antitumor treatment within the previous year

[b] >7.5 mg of prednisolone or equivalent per day for more than 3 months

[c] > 1 mg/kg of prednisolone or equivalent per day for more than 1 week within the last 3 months

[d] > 48 hours of therapy within the 14 days prior to the BSI