Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

Increased number of positive coagulase-negative staphylococci in blood cultures is partly explained by increased use of intra-arterial catheters in patients with COVID-19

Sir,

Approximately one-third of patients in intensive care units (ICUs) have indwelling arterial catheters (IACs), mainly used for continuous blood pressure monitoring, blood sampling for laboratory analysis, and arterial blood gas monitoring [1]. The use of IACs increased during the coronavirus disease 2019 (COVID-19) pandemic due to increased need for arterial blood gas measurement in monitoring respiratory status. During the pandemic, we observed a substantially higher rate of coagulase-negative staphylococci (CoNS)-positive blood cultures in patients in the ICU. CoNS are skin microbiota, and blood cultures growing CoNS are often used as the benchmark for quality of blood culture sampling [2]. To investigate this clinical observation, we performed a case–control study. We compared patients admitted to the ICU due to COVID-19 during the first (April 2020) and second (October 2020) waves of COVID-19 in the Netherlands {N=118 patients, median age 64 [interquartile range (IQR) 54–72] years, 30.5% female} with control groups {i.e. patients admitted to the same ICU in the same months 1 year earlier [N=120, median age 62 (IQR 50–69) years, 40.8% female]} (Table I).

Blood cultures were obtained at the physician's request when there was a clinical suspicion of infection, or to follow-up a culture of proven infection. Peripheral and blood cultures from IACs or central venous catheters (CVCs) were collected using aseptic technique. The hospital protocol prescribes disinfection of the catheter hub using chlorhexidine 0.25% before IAC/CVC sampling and for skin antisepsis. Prior to inoculation of blood into blood culture bottles, bottle stoppers are disinfected using 70% alcohol.

In total, 585 total blood culture sets (one set consists of one aerobic and one anaerobic bottle) were taken in patients with COVID-19, and 541 sets were taken in non-COVID-19 patients (median of two blood culture sets per patient in both groups). In 2019 (before the pandemic), 16.1% of all blood cultures were positive and 11.6% of these grew CoNS. During the COVID-19 months of the study, the proportion of positive blood cultures increased to 30.1% (absolute increase of 14%, relative increase of 88%), and 27.2% (15.6% increase) of these grew CoNS. Limiting the analysis to blood cultures taken from IACs, a comparable absolute increase (14.9%) (relative increase of 104%) was observed, from 14.3% (11.5% CoNS) in 2019 to 29.2% (26.7% CoNS) during the COVID-19 months.

Using logistic regression analysis, we calculated that the odds ratio (OR) of patients with COVID-19 having any positive blood cultures with CoNS relative to non-COVID-19 patients was 2.9 [95% confidence interval (CI) 1.7–5.1, P<0.0001] and 2.8 (95% CI 1.6–5.0, P<0.0001) after adjusting for age and sex. Each time an IAC was used, it was associated with a 2.0% increase in the risk of a CoNS-positive blood culture (OR 1.02, 95% CI 1.02–1.03, P<0.0001). When the frequency of IAC use was included in the analysis, the association between CoNS-positive blood culture and COVID-19 patients compared with non-COVID-19 patients decreased (OR 2.4, 95% CI 1.2–4.6, P=0.009).

We thus found an increased risk of CoNS in blood cultures from patients with COVID-19. CoNS bacteraemia could be related to the high incidence of microthrombus formation in patients with COVID-19 [3], but as many patients in the study setting did not have follow-up blood cultures, true CoNS infection was unlikely. A more likely explanation is contamination upon drawing of the blood samples or inoculation of the blood culture bottles. Due to increased workload and the need to employ less-experienced nursing staff to facilitate the increase in ICU capacity during the pandemic, adherence to the blood culture sampling protocol may have been lower than usual. Another contributory factor may have been that insertion of IACs/CVCs was performed by medical staff with less experience in these aseptic procedures. The increased number of CoNs-positive blood culture sets was also observed in blood cultures obtained from IVCs and venepunctures, but the numbers of isolates from these sites were lower, precluding statistical analysis. It is notable that the risk of CoNS-positive blood cultures decreased when the frequency of IAC use was taken into account, suggesting that infection was not introduced as a result of increased frequency of accessing IACs.

This observation provides indirect evidence that blood culture sampling via IACs should not be performed. This results in false-positive CoNS results that may lead to additional tests, unnecessary use of antibiotics, and prolonged length of stay. Instead, sampling should be performed by peripheral venepuncture, which is associated with lower contamination rates

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Table I
Patients and blood culture characteristics

Characteristics	First COVID-19 wave		Second COVID-19 wave		Total	
	First COVID-19 wave (April 2020)	April 2019	Second COVID-19 wave (October 2020)	October 2019	COVID-19	Non-COVID-19
At patient level						
Number of patients	59	57	59	63	118	120
Median age (IQR)	64 (55–72)	60 (51–68)	64 (51–70)	63 (49–69)	64 (54–72)	62 (50–69)
% female	23.7	42.1	37.3	39.7	30.5	40.8
Median number of blood culture sets obtained per patient (IQR)	3 (1–10)	2 (1–5)	2 (1–4)	2 (1–5)	2 (1–6)	2 (1–5)
Number of blood culture sets	370	260	215	281	585	541
Obtained from IACs, *N* (%)	306 (82.7)	216 (83.1)	177 (82.3)	219 (77.9)	483 (82.6)	435 (80.4)
CoNS, %	26.8	13.0	26.6	10.5	26.7	11.5
Positive significant culture, %	3.3	2.8	2.3	1.1	2.5	2.8
Negative culture, %	69.9	84.2	72.3	87.2	70.8	85.7
Obtained from CVCs, *N* (%)	54 (14.6)	32 (12.3)	25 (11.6)	40 (14.2)	79 (13.5)	72 (13.3)
CoNS, %	31.5	15.6	28.0	10.0	30.4	12.5
Positive significant culture, %	7.4	6.2	4.0	10.0	6.3	8.3
Negative culture, %	61.1	78.2	68.0	80.0	63.3	79.2
Obtained from venepuncture, *N* (%)	10 (2.7)	12 (4.6)	13 (6.0)	23 (7.8)	23 (3.9)	34 (6.3)
CoNS, %	10.0	0	38.5	18.2	26.1	11.8
Positive culture, %	0	16.7	0	18.2	0	17.6
Negative culture, %	90.0	83.3	61.5	63.6	73.9	70.6

CoNS, coagulase-negative staphylococci; IAC, intra-arterial catheters; CVC, central venous catheters; IQR, interquartile range; SD, standard deviation.

than sampling from IACs/CVCs [4]. This message may need to be strengthened during the pandemic.

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