Immune characteristics of critically-ill patients with COVID-19 pneumonia developing secondary bacterial infections

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Background & Objectives

Since the beginning of the SARS-CoV-2 pandemic, it has been clear that the host immune response plays a central role in determining the manifestations and severity of this disease. Secondary bacterial infections are observed very frequently in critically ill patients affected by COVID-19. This manifestations reflect the derangements of immune function and, as demonstrated by several studies, appears to be an important determinant of patients' outcome. The purpose of this study is to observe which characteristics and immunological structure correlate with the development of secondary bacterial infections in critically ill patients suffering from COVID-19 pneumonia.

Methods

We analysed data from a database specially conceived to record immune-laboratory parameters of patients admitted with COVID-19 pneumonia at the intensive care of the University Hospital of Modena from February 2020 to June 2020. The patients were classified according to the development or not of a secondary bacterial infection during their hospital stay, during or after admission to intensive care, the characteristics, therapies and immune and laboratory parameters of these two groups were compared by means of single-variant analysis.

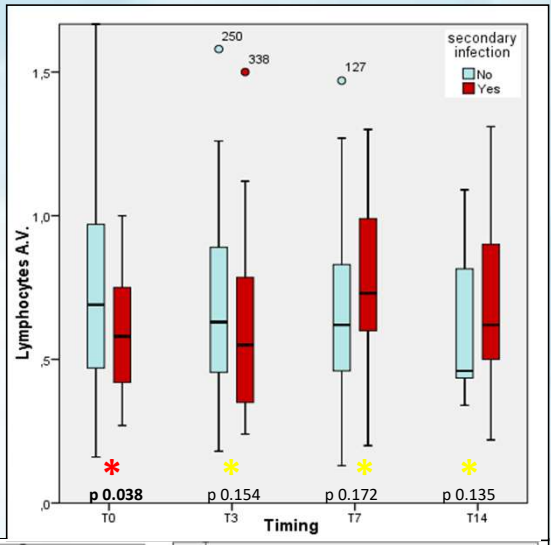
A multiple-variant COX regression analysis was performed to assess the weight of clinically relevant parameters with statistical significance at univariate analysis in determining the occurrence of a secondary bacterial infection.

Results & Conclusions

Although patients of the two groups were both lymphocytopenic at admission, lymphocytes were lower in patient who developed secondary infection (median 0.58 vs. 0.69). Lymphocytes mean value prior to secondary infection development and treatment with steroids appeared to affect the risk of secondary infection development also at multivariate analysis.

In conclusion, patients with higher risk of developing secondary bacterial infections seem to have more pronounced lymphocytopenia. Further studies could help clarify if these patients could benefit from a personalised clinical approach.

SECONDARY INFECTIONS CARACHTERISTICS		N =33/98
Secondary infection (S.I.) occurrence (n.%)		33 (33.7)
Days from admission to S.I. (median . IQR)		7 (4-12)
Severity of S.I.	Infection without sepsis	4 (12.1)
	Sepsis	16 (48.5)
	Septic shock	13 (39.4)
BSI		9 (27.3)
pneumonia		28 (84.8)
IVU		1 (3.0)
other		2 (6.1)
MDR	no	10 (30.3)
	yes	21 (63.6)
	unidentified m.o.	2 (6.1)



	ALL PATIENTS (n=98)	SECONDARY INFECTION (n=33)	NO SECONDARY INFECTION (n=65)	P value
Age (median. IQR)	63 (56-70)	67 (62-72)	61 (54-67)	* 0.004
Sex. male (n. %)	78 (76.6)	27 (81.8)	51 (78.5)	0.697
Comorbidities (n.%)	70 (71.4)	27 (81.8)	43 (66.2)	* 0.105
SOFA (median. IQR)	4 (3-5)	4 (4-4)	4 (3-5)	0.827
SAPS II (median. IQR)	32 (26-37)	34 (30-39)	29 (25-35)	* 0.035
Treatment with steroids (n.%)				
no	38 (38.8)	3 (9.1)	35 (53.8)	* 0.000
Low-dose (ARDS)	29 (29.6)	13 (39.4)	16 (24.6)	
High-dose (immune-suppression)	31 (31.6)	17 (51.5)	14 (21.5)	
Immune-modulating therapies (n.%)				
None	28 (28.6)	8 (24.2)	20 (30.8)	0.565
Tocilizumab	52 (53.1)	20 (60.0)	32 (49.6)	
Anakinra	18 (18.4)	5 (15.2)	13 (20.0)	
Neuro-muscolar block (n; %)	70 (71.4)	31 (93.9)	39 (60.0)	* 0.000
Pronarion-supination cycles (n; %)	55 (56.1)	27 (81.8)	28 (43.1)	* 0.000
Alive at day 30 (n.%)	68 (69.4)	19 (57.6)	49 (75.4)	* 0.071
Alive at ICU discharge (n.%)	70 (71.4)	20 (60.6)	50 (76.9)	* 0.091

MULTIVARIATE COX ANALYSIS	* Sig. = 0.002
SAPSII score	* 0.170
comorbidities	0.455
Lymphocytes mean	* 0.032
Steroid regimen	* 0.011