Suspected Bacterial Respiratory Coinfection in COVID-19 Pneumonia at admission

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Background/Aims: Rapid characterization of bacterial co-infection is essential in the management of the COVID-19. This study was undertaken to show the impact of bacterial co-infection in mild COVID-19 pneumonia at admission on the overall clinical courses.

Methods: This 3-month retrospective cohort study included COVID-19 pneumonia patients in a single public hospital. All of the patient's clinical features and parameters were collected and analyzed over the whole period of hospitalization. The severity and extent of pneumonia from the initial chest CT were calculated using AI and measured visually by radiologist. Bacterial Co-infection group(BC-G) was defined as considering antibiotics for suspecting bacterial infection at admission by clinician's decision or radiologic interpretation, comparing to Viral infection only group(V-G) without such concern.

Results: A total of 139 had pneumonic infiltration in the initial chest CT including 9 with BC-G and 130 with V-G (Table 1). BC-G had more elderly, asymptomatic patients, dementia, CVA and nursing home residents than V-G. Among BC-G, SpO2 (95.1% vs. 97.5%, p=0.003) at admission tended to be lower, but initial vital signs and MEWS scores had statistically no difference. BC-G had higher PSI and MULBSTA score, high level of CRP, PCT, ferritin, and LDH, and low albumin. The pneumonia volume and the extent of opacities quantified using the AI were significantly larger in the BC-G as well as visual severity scores of the CT. 88.9% of BC-G(vs. 13.1%, p <0.001) suffered desaturation(SpO2 ≤93%) and 77.8%(vs. 4.6%, p<0.001) needed oxygenation that applied oxygen within one day (vs 5 days, p=0.037). BC-G took less time for first negative conversion of the coronavirus PCR (16±12 vs. 24±12days, p=0.014), but no difference in hospital days (37±31 vs. 32±13days), and mortality (0% vs. 0.8%). A total of 7/9(77.8%) in the BC-G and 6/130(6.2%) of V-G were prescribed antibiotics at admission day.

Conclusions: BC-G had more elderly, comorbidities, and showed higher pneumonia severity scores and inflammatory markers, and more severe radiologic involvement at admission, and suffered oxygen desaturation earlier and more frequently without differences in mortality.

Table 1. Baseline characteristics of the hospitalized COVID-19 Pneumonia patients according to the Bacterial Co-infection at admission

Variables	Total (n=139)	Bacterial Co-infection Group (n=9)	Viral infection only Group (n=130)	p-value†
Age(years), mean	45.3 ± 17.9	66.6± 20.6	43.8± 16.8	0.003
Male, n (%)	56(40.3)	4(44.4)	52(40.0)	0.527
Comorbidities, n (%)				
Hypertension	31(22.3)	4(44.4)	27(20.8)	0.112
Diabetes mellitus	12(8.6)	2(22.2)	10(7.7)	0.175
Dementia	8(5.8)	5(55.6)	3(2.3)	<0.001
Cerebrovascular accident	3(2.2)	2(22.2)	1(0.8)	0.011
Obstructive airway disease	3(2.2)	1(11.1)	2(1.5)	0.183
Immunosuppressive agents	2(1.4)	0	2(1.5)	0.874
Chronic renal disease	1(0.7)	0	1(0.8)	0.935
Residents in a nursing home or long-term facility, n(%)	8(5.8)	6(66.7)	2(1.5)	<0.001
BMI (kg/m2) , mean	23.7 ± 4.0	25.5 ±3.0	23.6 ± 4.0	0.089
Initial symptoms, n (%)				
Asymptomatic	20(14.4)	4(44.4)	16(12.3)	0.025
Lower respiratory (cough, sputum, dyspnea)	54(38.8)	3(33.3)	51(39.2)	0.511
First recorded vital sign				
Heart Rate (beats/min)	86.8 ± 14.2	82.6 ± 13.9	87.1 ± 14.3	0.401
Systolic blood pressure (mmHg)	128.3 ± 15.0	131.3 ± 15.5	128.1 ± 15.0	0.411
Respiratory rate (breaths/min)	19.0 ± 2.7	22.3 ± 7.4	18.7 ± 1.9	0.493
Body temperature (ºC)	36.9 ± 0.6	36.9 ± 0.8	36.9 ± 0.5	0.653
Oxygen saturation, SpO2 (%)	97.3 ± 1.6	95.1 ± 2.8	97.5 ± 1.3	0.003
Severity scorings on presentation				
MEWS	1.3 ± 0.7	1.8 ± 1.1	1.3 ± 0.6	0.069
PSI	42.7 ± 23.2	83.6 ± 30.7	40.0 ± 19.8	<0.001
MuLBSTA score	4.7 ± 3.7	10.8 ± 3.7	4.3 ± 3.3	<0.001
Initial laboratory findings				
White blood cells (10⁹/L)	5.7 ± 2.3	7.7± 5.1	5.6 ± 2.0	0.288
Neutrophil (%)	58.1±12.4	62.5±18.8	57.6±11.8	0.271
Lymphocyte (%)	30.4±11.0	25.8 ± 14.4	30.7 ± 10.7	0.404
Platelet (10⁹/L)	222.6 ± 67.6	186.7 ± 58.5	225.1 ± 67.7	0.144
CRP (mg/dL), median (IQR)	0.4(0.1-1.4)	3.8 (2.1-8.9)	0.3(0.1-1.1)	<0.001
Procalcitonin (ng/ml), median (IQR)	0.04(0.03-0.06)	0.17(0.04-0.32)	0.04(0.03-0.06)	0.033
Ferritin (µg/L), median (IQR)	149(86-331)	502(290-2534)..	147(85-296)	0.007
LDH (U/L), median (IQR)	246(214-314)	418(320-505)	342(213-306)	<0.001
Quantitative CT analysis by AI				
Pneumonia volume (cm³), median (IQR)	14.3(3.9-47.5)	108.3(49.6-294.8)	12.1(3.5-42.0)	<0.001
Extent of Opacities (%), median (IQR)	0.7(0.2-2.4)	7.8(5.1-19.2)	0.6(0.2-2.0)	<0.001
Visually Estimated CT Scoring by the radiologist	5.4±3.9	10.4 ± 3.1	5.1 ±3.7	<0.001

Data are presented as mean ± standard deviation, unless otherwise stated.

Abbreviations: BMI, body mass index; MEWS, modified early warning score; PSI, pneumonia severity index; MuLBSTA score, multilobular infiltration, hypo-lymphocytosis, bacterial coinfection, smoking history, hypertension and age; CRP, C-reactive protein; LDH, lactate dehydrogenase