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Haematological Features of COVID -19 Infection During Admission: Single Center Experience

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Abstract:- The COVID-19 pandemic is a worldwide pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus was confirmed to have spread to Bangladesh in March 2020. The first three known cases were reported on 8 March 2020. COVID-19 is a systemic infection with a significant impact on the hematopoietic system and hemostasis. In this study, we retrospectively analyzed 92 adult patients, confirmed as case of COVID- 19 infection by RT- PCR from April, 2020 to June, 2020. We divided the patients into two groups; ICU and Non – ICU groups. We analyzed haematological indices including haemoglobin, total white cell count, absolute neutrophil count , absolute lymphocyte count, platelet count, D-Dimer, ferritin, LDH in patients of both groups during admission. Our study showed that on admission, neutrophilic leukocytosis, lymphopenia, hyperferritinemia and very high D-DIMER were usually associated with ICU admission.

Keywords:- *COVID-19, White cell count (WBC), Absolute neutrophil count (ANC), Absolute lymphocyte count (ALC), Hyperferritinemia, D-Dimer.*

I. INTRODUCTION

Coronavirus disease 2019, COVID -19 is a pandemic, since December, 2019, had its first outbreak in Wuhan, China. COVID -19 disease is caused by severe acute respiratory syndrome virus (SARS-CoV-2). It usually presents with severe lung damage and acute respiratory distress syndrome (ARDS) and has high mortality [1]. It has diverse presentation from milder form of disease to severe ARDS. Identification of severity of disease is very important to provide support to patients in limited health care facilities. COVID-19 may produce various haematological changes in patients and some haematological parameters can guide the disease severity [2]. Several studies examined haematological changes in COVID -19 [2-9]. This study showed changes in haematological parameters in COVID -19 patients including both ICU and non ICU cases during admission to assess severity of the disease.

II. PATIENTS AND METHODS

This is a retrospective study. We have analyzed 92 adult patients admitted in our hospital on basis of following inclusion criteria. Patients were included if 1) they were 16 years or more of age; 2) diagnosed as COVID -19 Infection by real time reverse transcriptase (Real time RT- PCR) of nasal swab specimens between April, 2020 and June, 2020. The clinical data and laboratory results on admission or during hospitalization were extracted from the electronic medical records by June, 2020. We collected complete hematological results including haemoglobin, white blood cell count, absolute neutrophil count, absolute lymphocyte count, platelet count, Ferritin, D-Dimer on day of admission.

- *Laboratory Measurement and Confirmation of COVID-19*

Complete blood count was completed using SYSMEX XN -2000. Real-time RT-PCR assays for the enrolled patients were performed in accordance with the technical guidance established by the WHO. Ferritin was done Dimension ExL-200 and D-DIMER was done by using SYSMEX CS -1600.

- *Statistical analysis*

All statistical analyses were performed using SPSS software (Version 23.0, SPSS Inc.). A p-value (two-sided) less than 0.05 was considered statistically significant. P value was obtained using paired - samples t test.

III. RESULTS

In this study, we analyzed 92 COVID -19 cases confirmed by RT-PCR. Among them, 14(15.2%) cases were in ICU and 78(84.8%) patients were non ICU cases. The median age of the patients is 50 years (range is 19 to 81 years). **Table 1** showed patient characteristics in two groups. There is no statistically significant differences in age and sex in ICU vs non ICU cases.

Our analysis showed statistically significant difference in some haematological parameters in two groups. **Table 2, 3 and 4** showed haematological parameters in both ICU and non ICU patients.

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This study revealed that ICU cases presented with lower haemoglobin level (Hb<12gm/dl, 64.3% vs 33.7% in ICU and non ICU cases respectively, p value=.028). Leukocytosis is prominent in ICU cases (42.9% and 16.7% in ICU and non ICU cases respectively, p value=.019). There is no case with ANC less than 1x10^9/L.

Lymphopenia is a strong marker for disease severity. Total 18 patients (19.6%) presented with lymphopenia (n=92). In ICU cases lymphopenia was marked (42.8%) than non ICU cases (15.4%) with p-value=.025 which is statistically significant.

In this study, 5 cases (5.4%) presented with mild thrombocytopenia without statistically significant difference between ICU and non ICU cases (p value = .335)

In other haematological laboratory parameters, we included ferritin and D-DIMER. There are missing data both these two parameters.

Hyperferritinemia (Normal Range: 0-400) is marked in ICU patients and found statistically significant difference in ICU and non ICU cases (85.8% and 33.3% respectively, p value= .001).

D- DIMER is very high in 71.4% ICU cases and 26.3% non ICU cases with significant statistical difference, p value = .002.

IV. DISCUSSION

COVID -19 disease can present with mild symptoms to severe illness. Older adults are usually more prone to severe form of illness and need ICU admission [9]. In our study, there is no statistically significant age difference in ICU and non ICU groups. In ICU cases, male: female ratio is 1:1.

Haematological indices are common laboratory investigations performed on patients admitted to hospitals. If we can identify any parameters indicating severe form of disease and ICU admission it will be helpful to isolate the patient and also monitor the patient properly. Blood counts often provide useful clues regarding the diagnosis and complications of infectious disease.

The SARS-CoV-2 virus has greater influence on red blood cells in comparison to other viruses. It has been suggested that increase of inflammatory factors can lead to a reduced erythropoiesis and increased damage of red blood cells, resulting in anemia [3][5]. In our study, there is statistically significance in haemoglobin concentration in both groups. ICU patients have lower haemoglobin concentration.

Total white blood cell count and neutrophil count were significantly higher in the ICU groups indicating that a higher degree of inflammation is occurred in severe patients than mildly ones [3]. There may be secondary bacterial infections which also can cause neutrophilic leukocytosis [10]. Our study also showed higher neutrophilic leukocytosis in ICU groups which is statistically significant.

Several studies have shown lymphopenia in COVID-19 patients [3–5, 8, 9, and 11]. Lymphocyte count is usually significantly lower in the ICU group. This is a very important finding to take into account. In this study, overall 19.6% patients presented with lymphopenia which is comparatively smaller than 63% of patients in Wuhan, China, and 42% of patients outside of Wuhan who presented with lymphopenia [12, 13]. We found that lymphopenia is more marked in ICU group (42.8%) than non ICU group (15.4%) which is statistically significant.

Several studies showed association between COVID-19 infection and thrombocytopenia [2-4, 14]. Our study showed mild thrombocytopenia in 5.4% patients. But there is no statistically significant difference of thrombocytopenia in ICU and non ICU groups.

Ferritin is a key mediator of immune deregulation, especially under extreme hyperferritinemia, via direct immune-suppressive and pro-inflammatory effects, contributing to the cytokine storm. Fatal outcomes by COVID-19 are accompanied by cytokine storm syndrome, thereby it has been suggested that disease severity is dependent of the cytokine storm syndrome. One study showed laboratory findings in patients with severe COVID-19 related with cytokine storm resulting in elevated inflammatory markers e.g. ferritin and has been associated with critical and life-threatening illness [15]. Our study also presented statistically significant high ferritin level in ICU group.

Association between COVID-19 and venous thromboembolism is not rare. Several studies have described an association between the severity of the disease and high D-dimer [4–6]. Patients with severe COVID-19 disease with high D-DIMER level have an increased risk of developing pulmonary embolism [17]. In our study, there is significant association of high D-DIMER level in ICU group.

The limitation of our study is missing data as some laboratory investigations e.g. ferritin, D-DIMER were not performed routinely in mildly symptomatic non ICU group on admission. However, this study is a reflection of real-life clinical setting showing that patients of non ICU group usually presents with normal haematological parameters whereas lymphopenia , high ferritin, high D-DIMER were more marked in patients of ICU group.

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V. CONCLUSION

To conclude, in this study we presented hematological parameters of ICU and non ICU patients on admission. Usually routine hematological parameters were significantly different in two groups of COVID-19 patients. As several studies showed, we also confirmed in our study that low hemoglobin, neutrophilic leukocytosis, lymphopenia, hyperferritinemia and high D-DIMER were more present in the ICU groups of patients. In contrast, we could not confirm leucopenia, significant thrombocytopenia in COVID-19 patients. We can use these parameter to detect the patient who will require ICU support during their course of disease and to predict prognosis of COVID-19 patients. Further studies need to compare haematological parameters during admission and disease progression.

REFERENCES

[1]. Chen N, Zhou M, Xuan D, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020; 395:507–513.

[2]. Luipi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: a meta-analysis. Clin Chim Acta. 2020; 506:145–148.

[3]. Henry BM, Santos de Oliveira MH, Benoit S, et al. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): a meta-analysis. Clin Chem Lab Med. 2020; 58 (7):1021–1028.

[4]. Terpos E, Ntanasis-Stathopoulos I, Elalamy I, et al. Hematological findings and complications of COVID-19. Am J Hematol. 2020; 95(7):834–847.

[5]. Sun S, Cia X, Wang H, et al. Abnormalities of peripheral blood system in patients with COVID-19 in Wenzhou, China. Clin Chim Acta. 2020; 507:174–180.

[6]. Yun H, Sun Z, Wu J, et al. Laboratory data analysis of novel coronavirus (COVID-19) screening in 2510 patients. Clin Chim Acta. 2020; 507:94–97.

[7]. Tan L, Wang Q, Zhang D, et al. Lymphopenia predicts disease severity of COVID-19: a descriptive and predictive study. Signal Transduct Target Ther. 2020; 5:33–35.

[8]. Gao Y, Li T, Han M, et al. Diagnostic utility of clinical laboratory data determinations for patients with severe COVID-19. J Med Virol. 2020; 92(7):791–796.

[9]. Fan BE, Chong VCL, Chan SSW, et al. Hematologic parameters in patients with COVID-19 infection. Am J Hematol. 2020;95(6):E131–E134

[10]. Li X, Wang L, Yan S, et al. Clinical characteristics of 25 death cases with COVID-19: a retrospective review of medical records in a single medical center, Wuhan, China. Int J Infect Dis. 2020; 94: 128–132.

[11]. Ciceria F, Castagna A, Rovere-Querini P, et al. Early predictors of clinical outcomes of COVID-19 outbreak in Milan, Italy. Clin Immunol. 2020; 217:108509.

[12]. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020; 395(10223): 497- 506.

[13]. Xu XW, Wu XX, Jiang XG, et al. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. *BMJ*. 2020; 368:m606.

[14]. Yang X, Yang Q, Wang Y, et al. Thrombocytopenia and its association with mortality in patients with COVID-19. J Thromb Haemost. 2020; 00:1–4.

[15]. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, and Manson J. COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet. 2020. [Accessed on May 22, 2020].

[16]. F. Zhou, T. Yu, R. Du, et al., Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study, Lancet 395 (10229) (2020 Mar 28) 1054–1062, https://doi.org/10.1016/S0140-6736(20) 30566-3.

[17]. Garcia-Oliv, H. Sintes, J. Radua, J Abad Capa, A. Rosell. D-dimer in patients infected with COVID-19 and suspected pulmonary embolism. Respiratory Medicine 169 (2020) 106023

	Total (n=92)	ICU cases (n=14)	Non ICU cases (n=78)	P -value
Age	19-81	24-66	19-81	0.079
Sex 1. Male 2. Female	 65 27	 7 7	 58 20	 0.067

Table 1:- Patient characteristics

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	Total (n=92)	ICU cases (n=14)	Non ICU cases (n=78)	P -value
Haemoglobin(Hb) (gm./dl)				
<12	35(38%)	9(64.3%)	26(33.7%)	.028
>12	57(62%)	5(35.7%)	52(66.7%)	
WBC(White blood cell count)(x10^9/L)				
<2	0	0	0	
2-4	7(7.6%)	0	7(9%)	.019
>4	66(71.7%)	8(57.1%)	58(74.4%)	
>11	19(20.7%)	6(42.9%)	13(16.7%)	
ANC (X10^9/L)				
<0.5	0	0	0	
0.5-1	0	0	0	.123
>1	68(73.9%)	8(57.1%)	60(76.9%)	
>7	24(26.1%)	6(42.9%)	18(23.1%)	
ALC (X10^9/L)				
<0.5	3(3.3%)	1(7.1%)	2(2.6%)	.025
0.5-1	15(16.3%)	5(35.7%)	10(12.8%)	
>1	74(80.4%)	8(57.1%)	66(84.6%)	
Platelet count (X10^9/L)				
<100	0(0)	0	0	
100-150	5(5.4)	0	5(6.4%)	.335
>150	87(94.6)	14(100%)	73(93.6%)	

Table 2:- Laboratory profiles including CBC and other parameters

Ferritin(X microgram/L)	Total (n=44)	ICU Cases (n=14)	Non ICU cases (n=30)	P - value
>1000	7(15.9%)	6(42.9%)	1(3.3%)	
400 -1000	15(34.1%)	6(42.9%)	9(30%)	.001
<400	22(50%)	2(14.3%)	20(66.7%)	

Table 3:- Laboratory profiles including Ferritin

D-DIMER	Total (n=52)	ICU Cases (n=14)	Non ICU Cases (n=38)	P- value
High	20(38.5%)	10(71.4%)	10(26.3%)	
Normal	32(61.5%)	4(28.6%)	28(73.7%)	.002

Table 4:- Laboratory profiles including D-DIMER