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Angel Annette

Angel Bennet

Joshi Vinod

Jindal Manisha

Rastogi Pooja

See next page for additional authors

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Authors

Angel Annette, Angel Bennet, Joshi Vinod, Jindal Manisha, Rastogi Pooja, Peer Nuzhat, Shareef BM, Poorna Khaneja, Ambreen Shafaat Khan, Shilpa Barthwal, Bhawna Sharma, Neha Singh, and Satendra Pal Singh

ORIGINAL STUDY

Correlation Between Hematological Parameters, Blood Urea Level and The Mortality of COVID-19 Patients

Annette Angel ^a, Bennet Angel ^a, Vinod Joshi ^{a,*}, Manisha Jindal ^b, Pooja Rastogi ^b, Nuzhat Peer ^a, BM Shareef ^a, Poorna Khaneja ^a, Ambreen S Khan ^a, Shilpa Barthwal ^a, Bhawna Sharma ^a, Neha Singh ^a, Satendra P Singh ^c

^a Department of Life Sciences, School of Basic Sciences & Research, Sharda University, Greater Noida, Uttar Pradesh, 201310, India

^b School of Medical Sciences & Research, Sharda Hospital, Sharda University Campus, Greater Noida, Uttar Pradesh, 201310, India

^c Central Research Laboratory, School of Medical Science & Research, Sharda University, Greater Noida, Uttar Pradesh, 201310, India

Abstract

Aim: Present study was aimed to analyze difference of hematological parameters and blood urea level between Recovered and Dead cases of COVID-19.

Material & methods: A hospital based study was undertaken wherein hematological parameters and blood urea level of 65 cases were analyzed.

Results: Recovered patients, 16 (42.1%) showed higher levels of neutrophils with corresponding 22 (57.9%) patients showing normal level of lymphocytes, 25 (65.7%) with normal hemoglobin and 35 (92%) with normal blood urea. On other hand, among 27 Died cases, 26 (96.2%) showed higher counts of neutrophils, 1 patient showed normal lymphocytes (3.8%) and 26 (96.2%) with low count of lymphocytes.

Conclusion: In majority of cases, recovered patients showed normal range of lymphocytes (20–45%), hemoglobin and blood urea levels, whereas mortality was observed associated with deficiency of lymphocytes (except one patient all below <20%), low Hemoglobin and high blood urea level. An infusion of fresh blood which will contain live leucocytes may add to the immunogenic competence of the serious patients.

Keywords: COVID-19, Hemoglobin, Urea, Mortality, Fresh blood, Coronavirus

1. Introduction

Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-COV2) is the ongoing challenge for the health and ultimate survival of human population. India has faced the second wave of pandemic starting since 11th February 2021 [1] embracing 177,108,695 total cases and 3,840,223 total deaths till June, 2021 [2].

To reduce case fatality, we need to study carefully as to how the Recovered and Dead cases differ from each other with regards to their vital body function parameters. Although hospital

admitted cases of COVID-19 are examined for their essential functional parameters yet observations of vital functionalities do not seem to guide the course of hospital management in majority of COVID-19 cases. Present study was aimed to correlate the hematological and blood urea levels of the COVID-19 patients with survived and succumbed patients, to reveal the important observations which can guide better management of severe cases. Present paper reports the comparative account of hematological parameters and blood urea level among Recovered and Dead Cases of COVID-19.

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* Corresponding author.
E-mail address: vinodjoshidmrc@gmail.com (V. Joshi).

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2. Materials and methods

A study of association between blood urea levels hematological parameters and survival/mortality of COVID-19 patients was undertaken among patients reporting in Noida and Greater Noida, UP, India. Surviving and Dead cases were chosen at random for the study. Few investigations were done in the residential society as per the information of COVID-19 patients obtained from the society notifications/news board. Few samples were also studied among students, staff and faculties in Sharda University, Greater Noida, U.P., India. who had either been patients of COVID-19 or had any family members infected with SARS-CoV-2 in the past. Some information was collected from the patients records of Sharda hospital, Greater Noida, UP, India after obtaining appropriate permission from the Hospital administration. The contact details of the COVID-19 patients obtained from the above survey was tabulated and patients were contacted telephonically. The aims and objectives of this study were telephonically conveyed to the patients or their family members (who so ever were available on phone for the conversation). After taking their verbal consent for participation in the study, their Kidney function tests and other clinical parameters were studied.

Exclusion criteria: All the patients who had history of chronic kidney disease were excluded, in the study.

Inclusion criteria: Patients without any chronic disorders of respiratory or kidney diseases and who were tested positive for SARS-COV2, were included in the study.

3. Results

Correlation between hematological parameters, Blood Urea level and Recovery of patients of COVID-19. The observations on hematological parameters in association with kidney function parameter, blood urea level were analysed with respect to 38 COVID-19 cases who Recovered from the disease and 27 succumbed cases. In total 65 cases were studied. The age composition of the total 38 patients who were in the category of Recovered, ranged from children to old age people. 5.2% were of the age 0–20 (1 female & 1 male), 34.21% were of the age 21–40 years (7female & 6 Male), 26.31% were of the age 41–60 years (5 Females & 5 Males) and 31.57% were above 61 years of age (2 Females & 10 males). The duration of treatment and recovery was observed to be two days' minimum period to a maximum period of 18 days.

It was observed that 16 (42.1%) patients who recovered, showed higher levels of neutrophils whereas, 16

patients also showed low levels of lymphocytes indicating possibility of weak immune response.

Out of 38 Recovered patients, 25 (65.7%) had normal values of hemoglobin and only 13 Recovered cases (34.21%) were on margin of being anemic. Blood Urea level among 35 Recovered cases (92%) were in normal range indicating that majority of Recovered patients had normal hemoglobin and blood urea levels (Table 1, Figs. 1 & 2).

Correlation between hematological parameters, Blood Urea level and Mortality of patients of COVID-19. We studied total 27 patients who died of COVID-19. It was observed that except 1, all the 26 patients (96.2%) who died showed higher levels of neutrophils revealing the possibility of mixed infections. It was interesting to further observe that only one of the patients studied showed normal counts of Lymphocytes.

Out of 27 Dead cases we studied, as many as 17 (62.9%) showed low levels of hemoglobin, and among 9 patients (33.3%) 12–13 gm/dl was observed. Only one of the dead patients showed hemoglobin level as 15.3 gm/dl of blood. Among patients who showed low hemoglobin, 22 (81.4%) of them had higher levels of blood urea.

It was interesting to observe that among 38 patients who recovered of COVID-19, the recovery was correlated with high counts of immunity imparting cells lymphocytes, normal hemoglobin and blood urea levels whereas mortality was associated with deficiency of lymphocytes, low hemoglobin levels and corresponding high blood urea levels (Table 2, Figs. 1 & 2).

4. Discussion

The objective of the present study was to analyze how with respect to hematological parameters and blood urea level, the two categories of patients, one who Recovered and other who succumbed, differ from each other? In present investigations which were based on the analysis of 65 patients (38 Recovered; 27 Died), we observed that both Recovered as well as succumbed patients showed hematological evidences of mixed infections, yet among patients who died, Lymphocytes were below normal level of counts. Under the circumstances when mix of bacterial, fungal and viral infections is infesting, a strong titre of lymphocytes is required to impart innate immune response by the patients. Among succumbed patients the cell counts of immune system that is lymphocytes were too low as compared to those who survived. Lack of immunological competence, both innate as well as adaptive immunity, could be further studied as

Table 1. Correlation of hematological parameters and Blood urea levels with Recovery of patients from COVID-19.

S.No	Patient code	Age	Sex	Day of discharge after hospitalization	Neutrophils (%) Reference level: 40–70%	Lymphocytes (%) Reference level: 20–45%	Haemoglobin (g/dl) Reference level: 12–15.00 gm/dl	Blood Urea (g/dl) Reference level: 20–43.0 mg/dl
1.	SCR 5	41	M	8 th	64	25	14.5	38.5
2.	SCR 7	56	F	9 th	58	30	11.5	99.7
3.	SCR 9	35	M	10 th	50	43	13.7	19.2
4.	SCR 13	62	M	10 th	57	33	11.5	30.90
5.	SCR 15	23	F	11 th	60	30	10.8	19.20
6.	SCR 16	31	F	10 th	60	30	12.0	16.2
7.	SCR 17	25	F	11 th	64	27	9.7	14.8
8.	SCR 18	35	F	9 th	60	32	13.2	22.0
9.	SCR 19	5	F	6 th	30	62	11.2	20.5
10.	SCR 20	65	M	8 th	58	30	13.2	20.8
11.	SCR 22	37	M	3 rd	70	20	14.8	23.1
12.	SCR 25	46	M	8 th	67	23	13.0	24.7
13.	SCR 26	48	F	5 th	83	13	13.6	29.7
14.	SCR 27	65	M	14 th	90	6	10.3	125.3
15.	SCR90	35	F	7 th	40	48	12.6	ND
16.	SCR 28	51	M	7 th	71	21	14.5	23.4
17.	SCR 31	78	M	13 th	89	6	13.1	61.4
18.	SCR 32	58	F	11 th	72	19	12.1	30.4
19.	SCR 35	62	M	8 th	57	32	15.5	25.6
20.	SCR 37	65	M	11 th	79	13	10.0	26.5
21.	SCR 38	30	F	7 th	81	16	10.5	ND
22.	SCR 41	23	M	7 th	46	42	17.7	20.9
23.	SCR 44	23	F	13 th	40	50	12.0	17.5
24.	SCR 45	21	M	13 th	43	45	17.1	17.9
25.	SCR 53	59	F	18 th	86	8	10.9	35.3
26.	SCR 54	62	M	3 rd	59	30	14.3	24.4
27.	SCR 55	74	M	9 th	—	30	10.8	40.0
28.	SCR 56	75	F	8 th	86	11	10.2	41.4
29.	SCR 60	52	M	7 th	95	3	16.1	82.8
30.	SCR 61	—	F	2 nd	60	27	15.9	21.3
31.	SCR 62	41	F	9 th	92	6	13.7	40.1
32.	SCR 64	35	M	30 th	74	15	13.9	53.1
33.	SCR 65	62	M	4 th	85	10	16.0	34.2
34.	SCR 67	72	F	2 nd	78	18	11.5	24.5
35.	SCR 70	68	M	10 th	79	11	12.6	ND
36.	SCR 72	14	M	10 th	88	10	13.4	25.9
37.	SCR 73	40	M	8 th	38	48	14.2	22.9
38.	SCR 74	49	M	12 th	94	3	10.1	59.4

Comparison of Hemoglobin levels in Recovered and Dead cases

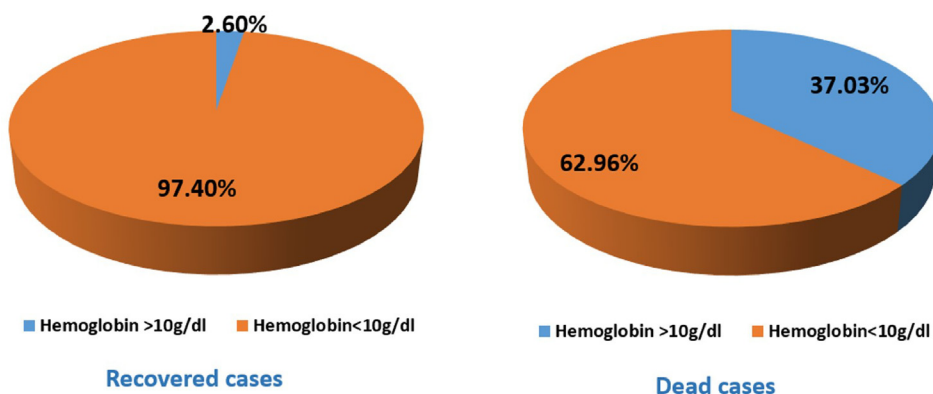


Fig. 1. Comparison of Hemoglobin among Recovered and dead cases.

Comparison of Blood Urea levels among Recovered and Dead cases

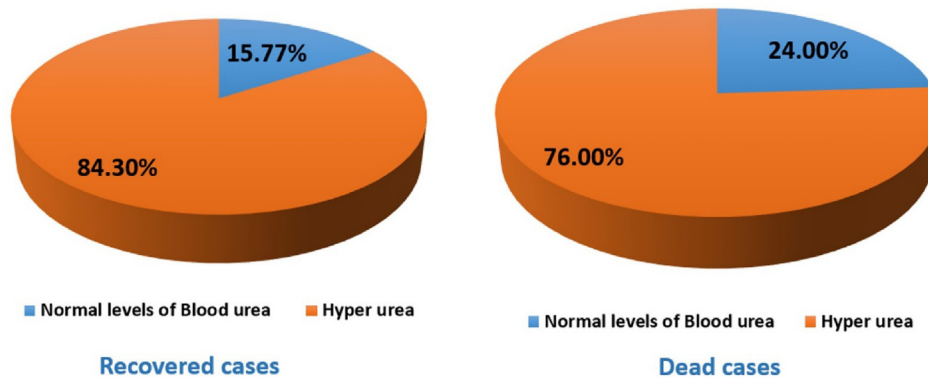


Fig. 2. Comparison of Blood Urea among Recovered and dead cases.

Table 2. Correlation of hematological parameters and Blood urea levels with Mortality of patients from COVID-19.

S.No	Patient code	Age	Sex	Day of discharge after hospitalization	Neutrophils (%) Reference level: 40–70%	Lymphocytes (%) Reference level: 20–45%	Haemoglobin (g/dl) Reference level: 12–15.00 gm/dl	Blood Urea (g/dl) Reference level: 20–43.0 mg/dl
1.	SCD 1	60	M	5 th	78	13	9.4	234.9
2.	SCD 2	63	F	6 th	92	4	9.4	52.6
3.	SCD 3	80	M	5 th	88	5	9.9	86.6
4.	SCD 4	70	M	4 th	91	3	7.6	221.8
5.	SCD 5	51	F	3 rd	90	7	11.2	39
6.	SCD 7	52	F	8 th	93	4	9.2	114.8
7.	SCD 8	24	F	4 th	93	6	7.9	63.5
8.	SCD 9	80	F	4 th	90	5	12.2	52.4
9.	SCD 10	46	M	6 th	89	4	10.5	123.4
10.	SCD 11	63	M	5 th	83	8	15.3	116.3
11.	SCD 19	—	M	9 th	96	3	12.4	36.1
12.	SCD 21	56	M	2 nd	67	31	9.5	ND
13.	SCD 22	67	M	9 th	89	7	8.7	29.7
14.	SCD 23	57	F	7 th	86	10	10.2	36.3
15.	SCD 24	68	F	2 nd	80	15	12.0	47.8
16.	SCD 28	67	M	5 th	90	7	9.6	87.0
17.	SCD 32	58	M	3 rd	90	6	8.7	85.1
18.	SCD 35	71	M	2 nd	90	7	11.8	ND
19.	SCD 38	57	M	1 st	80	16	12.2	43.2
20.	SCD 42	60	F	2 nd	90	6	13.2	67.0
21.	SCD 52	66	F	7 th	93	4	10.3	45.2
22.	SCD 53	66	M	2 nd	90	6	13.0	75.7
23.	SCD 55	40	M	5 th	90	5	12.6	42.3
24.	SCD 61	80	M	4 th	87	8	11.5	47.7
25.	SCD 62	—	M	8 th	88	6	12.6	44.8
26.	SCD 68	—	M	3 rd	83	10	12.6	54.3
27.	SCD 69	82	M	3 rd	93	3	11.7	133.9

possible cause of death and immunotherapy could be considered for possible inclusion in treatment protocol of patients. In present study we also observed that majority of the patients who Died did not have normal level of hemoglobin and this deficiency could have induced kidney disease [3] as we observed higher level of blood urea in majority of the fatal cases. In such patients the body tissue

blood, being aggressively treated by anti-viral and anti-bacterial drugs but not having enough of hemoglobin may produce poor clinical results in terms of their survival [4,5]. Similar observations have been reported [12] in some previous studies [6–8]. Another important understanding to be added to this COVID-19 triggered uremic manifestation, is the relapse of aHUS (Atypical

Hemolytic Uremic Syndrome) which may lead to activation of Complement system and thereby may damage the endothelial membrane [6].

Many viruses Like Epstein Barr Virus, Cytomegalovirus, Human Immunodeficiency Virus, Parvovirus, Hepatitis A, C etc. have been known to be associated with anemia [9]. Just as there is an association observed between prevalence of anemia in Community Associated Pneumonia (CAP) [11] similarly in COVID-19 also, occurrence of anemia has been observed whose exact pathogenesis is to be revealed [12]. Anaemia is known to arise early in the start of kidney disease leading to worsening of the kidney parameters due to reduction/deficiency of erythropoietin production (which is required for production of RBCs) [3, 10–13]. Based on our preliminary observations of correlations we also report that low hemoglobin levels being caused by SARS-CoV-2 infection are affecting kidney functions which could pose serious challenge for the survival of post covid patients.

It appears more than necessary that we consider few additions to the ongoing treatment protocol of COVID-19 patients to reduce mortality. Currently the supplemental oxygen therapy like Low and High Flow Nasal Cannula (LFNC & HFNC), Non-invasive ventilation etc. are being used for reverting the hypoxia occurring at lung tissue level. Through this paper, we wish to propose inclusion of fresh blood infusion (blood taken from healthy donors) which will contain both, live leucocytes to generate innate and specific immune response as well as will improve hemoglobin levels.

5. Conclusion

To reduce the mortality among COVID-19 patients, leucocyte supplementation could be immunotherapeutic measure to enhance adaptive immune response and reduce anemia checking subsequent hyper urea condition.

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Conflict of interest

NIL.

Source of funding

NIL.

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