

Retrospective Analysis of Haematological Abnormalities in Older Diabetic Patients with COVID-19

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Background: Understanding the severity of Coronavirus Disease 2019 (COVID-19) in elderly diabetic patients is crucial, considering the impact of age, comorbidities, and clinical biomarkers. However, the assessment of common haematological markers in this specific population remains limited.

Methods: We conducted a retrospective cohort study involving 27 elderly patients (mean age: 61.81±7.14 years) with COVID-19 infection. We analysed the medical e-records of COVID-19 positive patients who presented to a COVID-19 centre in Qatar in July 2020. Real-Time Polymerase Chain Reaction was used to confirm COVID-19 infection using throat-swab upper respiratory samples. Clinical haematological parameters were analysed and compared with normal ranges.

Results: Among the 27 patients investigated, 51.85% were male. A low viral load (cycle threshold (Ct) ≥ 30) was observed in 7.4% of patients, while 92.59% had a high viral load (Ct < 30). At presentation, 59.25% of patients were symptomatic. The observed haematological abnormalities ranked in descending order of frequency were as follows: high red blood cell counts, and high mean platelet volume (52% each), high platelet distribution width (48%), low haemoglobin values, and low haematocrit values (22% each), leukopenia, neutropenia, and lymphopenia (15% each), thrombocytosis, thrombocytopenia, leucocytosis, and neutrophilia (7% each), and lymphocytosis (4%).

Conclusion: Our study highlights the common occurrence of haematological abnormalities in older diabetic patients with COVID-19 infection. Monitoring haematological parameters may be valuable in managing these patients, especially in severe cases, and could facilitate early identification of individuals requiring intensive care, potentially reducing mortality.

Keywords: Geriatric Medicine; Public Health; Real-Time Polymerase Chain Reaction; Risk Factor; SARS-CoV-2; Symptomatic Infection; Thrombocytopenia; Viral Load

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INTRODUCTION,

The ongoing coronavirus disease 2019 (COVID-19) pandemic, caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), has sparked extensive interdisciplinary research efforts aimed at comprehending its systemic implications (1-7). While initially recognized as a respiratory infection, emerging evidence suggests the involvement of multiple organ systems, including significant haematological abnormalities (1-7). Increasing clinical observations and studies have underscored the prognostic value of haematological parameters in COVID-19 patients. Several deviations in white blood cell count (WBC), lymphocyte count, neutrophil count, and inflammatory markers such as C-reactive protein (CRP), D-dimer, and ferritin have been found to correlate with disease severity and outcomes (1-6). Notably, parameters such as leucocytosis, neutrophilia, lymphopenia, and an elevated

neutrophil to lymphocyte ratio (NLR) have been consistently documented in COVID-19 patients (4, 5). Furthermore, alterations in other indices, including haemoglobin, red blood cell count (RBC), and platelet count, have been observed in individuals with COVID-19, potentially serving as markers of disease extent and progression (3, 5, 6). Understanding these haematological responses in the context of disease severity and progression is vital for effective patient management and informed clinical decision-making (1-3, 5).

Elderly patients and those with underlying health conditions such as type 2 diabetes mellitus (T2DM) have been identified as particularly vulnerable to severe COVID-19 outcomes (1, 2, 4, 5). The increased risk associated with T2DM is attributed to factors such as altered immune response and the pro-coagulant state

often observed in diabetic individuals, leading to an exaggerated inflammatory response and heightened disease severity (2-4). Given the intricate interplay between age, T2DM, and haematological changes in COVID-19 patients, gaining a deeper understanding of their combined effect on disease progression and outcomes is crucial. However, the impact of COVID-19 on haematological parameters in this population remains unclear. Therefore, a better understanding of the haematological abnormalities associated with COVID-19 infection in older diabetic patients is crucial for effective management and treatment of these patients.

This retrospective cohort study aimed to investigate haematological abnormalities in older diabetic patients with COVID-19 infection. The study focused on analysing the levels of different haematological parameters in older diabetic patients with COVID-19 infection.

METHODS

Data Collection and Participants

This retrospective cohort study utilized medical e-records to analyse data from patients aged ≥ 55 years who sought COVID-19 testing at Rawdat Al Khail Health Site (RAK-HC), a designated testing center in Doha, Qatar. The study was conducted in July 2020, and demographic and laboratory information were extracted from anonymized patient records provided by the Primary Health Care Corporation research department. Ethical approval for the study was obtained from the PHCC ethics committee (reference number PHCC/DCR/2020/08/091).

Among the 1,054 COVID-19 positive patients seen at RAK-HC, a subgroup of 58 patients underwent additional investigations, including blood tests, electrocardiograms, chest X-rays, and comprehensive clinical assessments to evaluate the severity of their COVID-19 infection. From this subgroup, only 27 patients had a prior diagnosis of T2DM and were included in the present study. Real-Time Polymerase Chain Reaction was used to confirm COVID-19 infection using throat-swab upper respiratory samples.

The following data were collected: age, sex, cycle threshold (Ct), haematological data [basophiles; eosinophils; haemoglobin; haematocrit; lymphocytes; mean corpuscular haemoglobin; mean corpuscular haemoglobin concentration (MCHC); mean corpuscular volume (MCV); mean platelet volume (MPV); neutrophils; platelet distribution width (PDW); platelet count; RBC; RBC distribution width; and WBC]. Low viral load was defined by a Ct ≥ 30 . Normal ranges of haematological parameters are exposed in tables, and the following haematological abnormalities were identified: high RBC, high MPV, high PDW, anaemia (ie; low haemoglobin values), low haematocrit values, leukopenia, neutropenia, lymphopenia, thrombocytosis, thrombocytopenia, leucocytosis, neutrophilia, and lymphocytosis.

RESULTS

The sex distribution of the 27 patients was nearly equal, with 51.85% being males. The majority of patients (92.6%) exhibited a high CT. At the time of presentation to the health center, most patients (59.25%) were symptomatic, highlighting the clinical manifestation of the disease.

Table 1. Haematological parameters in older diabetic COVID-19 patients (n = 27).

Parameters	Unit	Mean \pm SD	Normal range	Abnormal high, %	Abnormal low, %	Normal, %
WBC	$10^9/L$	5.98 \pm 2.38	(4.0 - 10.0)	7.41	14.81	77.78
RBC	$10^6/mm^3$	5.04 \pm 0.75	(3.8 - 4.8)	51.85	0.00	48.15
Haemoglobin	g/dl	13.57 \pm 1.97	(12.0 - 15.0)	22.22	22.22	55.56
Haematocrit	%	41.47 \pm 5.55	(36.0 - 46.0)	18.52	22.22	59.26
MCV	fL/cell	83.03 \pm 5.21	(83.0 - 101.0)	0.00	37.04	62.96
MCH	pg/cell	27.16 \pm 2.34	(27.0 - 32.0)	51.85	0.00	48.15
MCHC	gm/dL	32.70 \pm 1.54	(31.5 - 34.5)	7.41	22.22	70.37
RDW-CV	%	13.91 \pm 1.64	(11.6 - 14.5)	29.63	0.00	70.37
Platelet	/mcL	231.11 \pm 75.91	(150 - 400)	7.41	7.41	85.19
MPV	fL/cell	10.24 \pm 1.37	(7.4 - 10.4)	51.85	0.00	48.15
PDW	fL/cell	12.89 \pm 3.05	(9.4 - 10.6)	48.15	3.70	48.15
Neutrophil	$10^9/L$	3.57 \pm 2.36	(2.00 - 7.00)	7.41	14.81	77.78
Lymphocyte	$10^9/L$	1.59 \pm 0.70	(1.00 - 3.00)	3.70	14.81	81.48
Monocytes	$10^9/L$	0.53 \pm 0.37	(0.20 - 1.00)	7.41	0.00	92.59
Eosinophils	$10^9/L$	0.13 \pm 0.18	(0.0 - 0.5)	7.41	0.00	92.59
Basophiles	$10^9/L$	0.06 \pm 0.15	(0.02 - 0.10)	0.00	22.22	77.78

MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; MCV: Mean Corpuscular Volume; MPV: Mean Platelet Volume; PDW: Platelet Distribution Width; RBC: Red Blood Cells; RDW: Red Blood Cell Distribution Width; WBC: White Blood Cell Count.

Our analysis revealed the presence of haematological abnormalities in the patient cohort. Specifically, 51.85% of the patients had high RBC, while 22% exhibited anaemia, and 22% had low haematocrit values. Thrombocytosis was observed in 7.41% of patients, whereas 7.41% had thrombocytopenia. Furthermore, elevated MPV was observed in 51.85% of patients, along with increased PDW in 48.15% of patients (Table 1).

Alterations in leucocyte counts were also noted in our study. Leucocytosis affected 7.41% of the patients, while 14.81% exhibited leukopenia. Neutrophilia was observed in 7.41% of the patients, while 14.81% presented with neutropenia. Additionally, 3.70% of the patients demonstrated lymphocytosis, whereas 14.81% exhibited lymphopenia.

DISCUSSION

Our analysis focused on a cohort of 27 older diabetic patients with COVID-19, aiming to investigate haematological abnormalities and their potential association with disease severity and outcomes. The presence of T2DM as a known risk factor for severe COVID-19 added an interesting perspective, considering the overlay of age-related vulnerability and chronic disease (7, 8). Among the 27 patients, a high prevalence of haematological abnormalities was observed. Approximately half of them exhibited high RBC count, while a smaller number showed low haemoglobin and haematocrit, indicating potential impacts on erythropoiesis. Similar findings have been reported in previous studies linking alterations in RBC parameters to COVID-19 infection and severity (9). These changes in RBC parameters may be associated with systemic inflammation and hypoxia, which are common manifestations of severe COVID-19 and warrant further investigation (10).

The study also identified a subset of patients with thrombocytosis and thrombocytopenia, along with variations in MPV and PDW. Existing research has suggested that platelets and related parameters can provide valuable insights into the inflammatory status and prognosis of COVID-19 patients (11). Increased MPV and PDW, observed in half of the patients, are often associated with active platelets production and turnover, indicative of ongoing systemic inflammation (11). These parameters could potentially serve as markers for monitoring disease progression.

Leukocyte abnormalities were another notable finding in our cohort. Some patients exhibited leucocytosis and

leukopenia, as well as neutrophilia, neutropenia, lymphocytosis, and lymphopenia. Similar trends have been reported in a study by Taj et al., indicating significant changes in leucocyte counts based on disease severity and lung involvement (12). An imbalance in neutrophil and lymphocyte counts, often resulting in an elevated NLR, is associated with severe inflammatory response and poorer outcomes in COVID-19 patients (13, 14). However, these trends were not universally applicable in our cohort, emphasizing the need for individual patient analysis rather than broad categorization based solely on these parameters.

In terms of lymphocyte and neutrophil counts, as well as the neutrophil-lymphocyte ratio, our study revealed significant alterations in patients with severe COVID-19, suggesting their potential as prognostic markers (10). However, these correlations were less pronounced in our patient group, possibly due to the influence of concurrent T2DM, which is known to disrupt normal immune responses (1).

Regarding platelets parameters, our findings support previous studies suggesting a link between COVID-19 severity and higher MPV and PDW (2). Platelets play a critical role in host defence, inflammation, and tissue repair processes. Changes in platelets and morphology have been proposed as markers of systemic inflammation and disease severity (3). It is noteworthy that our study observed both thrombocytosis and thrombocytopenia, suggesting that the platelets response to COVID-19 may vary significantly among individuals, influenced by factors such as age, disease severity, and underlying comorbidities (4, 7).

The role of haematological parameters, including leucocyte count, neutrophil, and lymphocyte, has been extensively studied in the context of COVID-19 (5, 12, 13). Our study identified leucocytosis, leukopenia, neutrophilia, and neutropenia in a small fraction of patients. The variation in leucocyte response may reflect individual immune responses modulated by factors such as age and comorbidities (6). However, it is important to note that the clinical relevance of these parameters, particularly in elderly patients with comorbid diabetes, requires further exploration.

The presence of haematological abnormalities in COVID-19 patients is not uncommon (9-12). These alterations have the potential to serve as biomarkers for assessing disease severity and prognosis. However, further studies are needed to enhance our understanding of the complex interplay between COVID-19 infection,

haematological parameters, and patient-specific factors such as age and comorbidities (11).

In summary, our study highlights the significant haematological abnormalities that may impact clinical outcomes in older diabetic patients with COVID-19 infection. Further research is warranted to validate these observations and establish standardized haematological markers for disease monitoring and prognosis.

Limitations

Our study has several limitations that should be acknowledged. First, the relatively small sample size and single-center design may limit the generalizability of our findings to a broader population. Larger multi-center studies are needed to validate our results and establish more robust conclusions. Second, the lack of longitudinal data and follow-up information restricted our ability to assess the long-term implications of haematological abnormalities on patient outcomes. Future studies with longer follow-up periods are warranted to evaluate the prognostic significance of these haematological parameters in older diabetic patients with COVID-19. Third, our study focused specifically on elderly patients with comorbid diabetes, and caution should be exercised when extrapolating these findings to other patient populations. Fourth, the retrospective nature of our study limited our ability to establish causal relationships between haematological abnormalities and disease severity. Prospective studies with comprehensive data collection are needed to better understand the underlying mechanisms and temporal associations. Fifth, the absence of certain haematological parameters, such as coagulation profiles and specific immune cell subsets, may have limited our ability to comprehensively assess the haematological status of the patients.

Despite these limitations, our study contributes to the growing body of literature on the haematological manifestations of COVID-19 in older diabetic patients. The findings highlight the importance of considering haematological parameters in the management of these individuals, providing valuable insights for clinical decision-making and improving patient care.

Practical Implications

The findings of our study have practical implications for the management of older diabetic patients with COVID-19 infection. The identification of haematological abnormalities in this patient population can aid healthcare professionals in early detection, risk stratification, and appropriate intervention. Regular monitoring of haematological parameters, including RBC count, haemoglobin, haematocrit, platelets, and

WBC, may provide valuable insights into the progression and severity of COVID-19 in these individuals. This information can guide clinical decision-making, treatment strategies, and resource allocation, ultimately improving patient outcomes.

CONCLUSION

Our retrospective cohort study highlights the importance of monitoring haematological abnormalities in older diabetic patients with COVID-19 infection. The observed dysregulation of immune and hematopoietic systems, as indicated by significant alterations in various haematological parameters, can aid in the early identification of severe cases and guide appropriate management strategies. By incorporating these parameters into clinical decision-making, healthcare providers can improve patient management, enhance treatment efficacy, and reduce fatality. However, further research on a larger scale is needed to validate these findings and provide a more comprehensive understanding of the haematological changes associated with COVID-19 in this vulnerable population.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval for the study was obtained from the PHCC ethics committee (reference number PHCC/DCR/2020/08/091).

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are openly available upon request from the corresponding author.

COMPETING INTERESTS

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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AUTHORS' CONTRIBUTIONS

Conception and design –O.R; Analysis and interpretation of the data – O.R, M.Z, A.A.A; Drafting of the paper – O.R, M.Z; Revising it critically for intellectual content- O.R, M.Z, A.A.A; The final approval of the version to be published – O.R, M.Z; All authors agree to be accountable for all aspects of the work.

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DECLARATION

The authors declare no relevant affiliations or financial involvement with any organization or entity that could influence or be perceived to have a financial interest or conflict of interest regarding the subject matter or materials discussed in this manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties. Additionally, in accordance with the guidelines of the New Asian Journal of Medicine (15), we disclose the use of AI assistance during the writing process of this manuscript. ChatGPT, an AI language model developed by OpenAI, was employed to enhance the academic English and improve the clarity and coherence of certain sentences in the text (16). The primary objective of utilizing AI assistance was to ensure a high standard of language proficiency in the

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