Article title: COVID-19 And Erythrocyte Aggregates: An Intensivists Experience When Being Affected

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COVID-19 AND ERYTHROCYTE AGGREGATES: AN INTENSIVIST'S EXPERIENCE WHEN BEING AFFECTED

ABSTRACT

COVID-19 pandemic has killed over 310,000 individuals as of 17 May 2020. Healthcare providers are profoundly vulnerable to be contaminated instead of taking every single careful step. Although the respiratory tract and the lungs are the target organs some complications may develop even at the introductory phase of this sickness course. Hemoconcentration with raised serum ferritin levels is one of the dangerous conditions that may occur from chronic hypoxia and severe dehydration because of increased insensible loss due to continuous excessive perspirations. Recent posthumous pulmonary tissue studies revealed that the viral infective mechanism, as well as the miniaturized erythrocyte aggregates, are additionally a significant contributing phenomenon to create acute respiratory distress syndrome (ARDS). Hematological issues require to deal proactively alongside other vital organ protection protocols for better outcomes. This article will depict the disease sequence of an intensivist working in a corona unit after being infected by COVID-19.

Keywords: COVID-19; ARDS; Hemoconcentration; Erythrocyte aggregates; Thromboembolism

INTRODUCTION

A 35-year-old male intensivist, youthful and lively, having no comorbidity, no absence of confidence and inspiration. He was at the frontline of the fight against the deadly COVID-19 not long after the discovery and authority revelation of the primary case in Bangladesh on 8 March 2020.¹ He was dynamic, light-footed and vigor in the Critical Care Centre of a Level IV tertiary military hospital where a corona unit has recently been established. A proportion of the staff of this unit is additionally associated with the Emergency and Casualty division. They carefully followed the prudent orders and utilized individual protective measures while on their

obligations. This case report will portray the ailment course of a fully complied intensivist working in a corona unit after being tainted by COVID-19 out of a propelled medical focal setting of Bangladesh.

THE CASE

Despite his adherence to the principles and conventions of contamination control in the hospital, he had a gentle dry hack and runny nose on 3 April 2020. There was tiredness that was somewhat uncommon in his everyday life. He additionally felt light myalgia and bone torments for days. However, he thought those might be because of ongoing additional overwhelming obligations and physical depletion. He took simple analgesics (paracetamol) and antihistamine orally. It diminished muscle torment and rhinorrhea as well. However, he felt abnormal tiredness and light cough by even nominal physical activities like attending the patients. On that night, in the wake of coming back from the hospital to his dormitory, he felt hot and he noted his body temperature at 102 degrees Fahrenheit estimated by a clinical thermometer. He became very disappointed and informed his senior in-control. His in-charge exhorted him to report to the fever clinic of the emergency division for affirmation. He got conceded in the segregation unit at that night on 6 April 2020 and was given the following introductory treatment:

- Tab. Paracetamol 500 mg for fever
- Tab. Fexofenadine 120 mg 1+0+1 is an antihistamine
- Tab. Montelukast 10 mg 0+0+1
- Oral rehydration saline (ORS) and water as much as he drinks to keep up hematocrit level typical
- Tab. Vitamin C 1+1+1 to increase immunity
- Tab. Zinc 1+0+1 to increase immunity

Relevant investigations were in progress. His nasopharyngeal sample was sent sharp for real-time polymerase chain reaction (RT-PCR). Colleagues were guaranteeing him that it will be negative, nothing to be stressed and it's a simple viral fever. In any case, following a couple of hours, he turned out to be seriously stunned after realizing that his sample was positive for SARS-CoV-2 RNA. He got a condition of thought block assuming the upcoming consequences of this novel coronavirus disease. He was moved to a cubicle of the corona unit and following administration was included:

- Tab. Hydroxychloroquine 200 mg 2+0+2 on the first day and then 1+1+1 for subsequent 10 days
- Tab. Favipiravir 200 mg 8+0+8 on the first day then 3+3+3 on subsequent days
- Cap. Doxycycline 100 mg 1+0+1 for forestalling atypical pneumonia

A high-resolution computed tomographic (HRCT) scan of his chest was done on the next morning and the report was: acute respiratory distress syndrome (ARDS) with bilateral ground-glass opacity with pneumonia. Then, the accompanying parenteral drugs were added:

- Inj. Meropenem 1 gm 1+1+1 IV
- Inj. Moxifloxacin 400 mg 0+1+0 IV

Instead of the above-mentioned management along with the highest dose of intravenous paracetamol his body temperature never touched the benchmark for seven days. Therefore, he turned out to be increasingly feeble and delicate. His liver proteins, hemoglobin, and serum ferritin levels were found to increase continuously. The vital laboratory findings were:

- Hb%: 19 mg/dL
- Haematocrit: 49%
- WBC count: 18,000/ μ l
- Neutrophil: 90%

- Serum Ferritin: more than 9,000 ng/mL
- ALT and LDH: were elevating bit by bit
- D-dimer: Negative
- S. Creatinine: 0.9 mg/dL
- CRP: Negative
- S. Procalcitonin: Normal

At that point, the following medication was included:

- L-Ornithine+L-Aspartate (converts toxic ammonia to non-toxic urea)
- Ursodeoxycholic acid (suppresses synthesis and secretion of cholesterol from the liver and reduces cholesterol absorption from intestines)
- Prednisolone 40 mg 1+0+1 (for ARDS)
- Target-controlled hydration

His weakness increased on the next day and he began to feel initial breathlessness on mild activities, then even on rest. His oxygen saturation was estimated at 83-84% by pulse oximetry. At that point, he was given high stream humidified oxygen by vent mask at a rate of 6-8 L/min. It increased his saturation a little (92-93%). He developed bilateral crepitation in all lung fields that gave him feelings of suffocations and chest tightness. At that moment, he was about to be intubated and went on mechanical ventilation. That made the intensivist exceptionally tense and anguished, indeed.

However, the invasive episodes of interventions could be avoided as the condition did not deteriorate further. At that point, he adopted a periodical change of his posture at his own to take advantage of ventilation in prone and lateral positions. Then, he got the management of negative fluid balance just to maintain a normal or near-normal range of hematocrit value. He was given the following to prevent the thromboembolic complications:

- Deferoxamine (an iron-chelating agent) 1 gm slow IV infusion BD for 3 days
- Prophylactic enoxaparin (low molecular weight heparin) 40 mg SC for 5 days

Three to four days later, his clinical conditions began to improve and the changes in the lungs began to resolve as seen on the chest Computed Tomographic films. At that point, he rehearsed chest physiotherapy at his own and he found the breath-holding exercise the most productive. His oxygen saturation raised to 95-96% with oxygen at a rate of 2 L/min. He was feeling better step by step and announced relieved after discovering two consecutive RT-PCR negatives on 22nd day (29 April 2020) and was discharged from the hospital.

DISCUSSION

This novel disease course points to some important issues. A study of 7,015 confirmed cases demonstrated that it is rapidly transmitting and has a short and widely variable incubation period (5-14 days). The onset chiefly occurs among young to middle-aged adults (average age of all cases was 44.24 years old).² Healthcare personnel are the most vulnerable group of people to be infected by SARS-CoV-2.³ The inadequacy of proper testing facilities at the mass level is predominant as like as many developed countries. Standard personal protective equipment (PPE) supply and competent compliance to the protocols are also lacking.⁴ Working in the emergency and outpatient department is the most likely area of contamination.⁵ Sadly, it is reported that some patients are carriers without any symptoms, while many of them ignore or deliberately hide their complaints mimicking the initial signs and recent exposure of COVID patients to their primary physicians.⁶ Then again, doctors and paramedics working in the emergency department must be wary and should attempt to maintain a strategic distance from aerosol-generating procedures (AGP) as much as possible.⁷

Hyperpyrexia does not relief for about a week in spite of the highest dose of analgesics. This causes excessive perspiration and insensible loss of volume which may contribute to

developing severe dehydration.⁸ Dry cough, throat, and chest pain produces irritability and discomfort which instigate to spit more. On top of these, hypoxia initiates excessive red blood cell production and an increased level of serum ferritin.⁹ In this way, hypoxia and increased hematocrit are a vicious cycle. These entire phenomena may ignite the risk of thromboembolism because of hemoconcentration. It is also detailed that, among subjects not treated with heparin, mortality raised according to increasing D-dimer levels.¹⁰ The physicians may focus on dealing with the hyposaturation and the chest films while this aspect of complication may be unintentionally ignored while treating the COVID-19 patients. Rather, microthrombus, stroke, and pulmonary embolism are the potential reasons for the sudden death of these patients. It warrants early detection and appropriate management for better results. Recent studies indicated that erythrocyte aggregates may be one of the potential causes of ARDS (Figure 1)¹¹ and acute tubular necrosis (ATN)¹².

Although the lung is the target organ of COVID-19 however other vital organs' functions are to be monitored proactively. Liver enzymes and serum creatinine are to be checked routinely.¹³ Respiratory invasive interventions are tried the most to be avoided. Self-adopted chest physiotherapy, incentive spirometer, and lateral and/or prone decubitus have proven effective.¹⁴ Patients must be consoled to forestall psychological injury as it is an obscure and unique disease process.¹⁵ They might be encouraged by an audio-visual display to perform these useful exercises in the wards and at home.

CONCLUSION

Intelligent suspicion, inquisitiveness; caregivers safety; early detection, isolation and proactive concise management are the key instruments to win the battle against COVID-19. The issue of erythrocyte aggregates should not be missed anyway. Take hold of the ailment before it assumes control over you. The final victory could be accomplished only after the innovation of an effective vaccine against this lethal virus which is in the pipeline.

REFERENCES

1. Hossain I, Khan MH, Ahmad SA, Rahman S. Epidemiology distribution of 48 diagnosed COVID-19 cases in Bangladesh: A descriptive study. *Texila International Journal of Academic research* 2020;7(1) doi:10.21522/TIJAR.2014.07.01.Art020
2. Nie X, Fan L, Mu G. et al. Epidemiological characteristics and incubation period of 7,015 confirmed cases with Coronavirus Disease 2019 outside Hubei Province in China. *The Journal of Infectious Diseases* 2020. doi:10.1093/infdis/jiaa211
3. Zhang Z, Liu S, Xiang M. et al. Protecting healthcare personnel from 2019-nCoV infection risks: lessons and suggestions. *Front Med* 2020. doi:10.1007/s11684-020-0765-x
4. Anwar S, Nasrullah M, Hosen MJ. COVID-19 and Bangladesh: Challenges and how to address them. *Front Public Health* 2020;8:154. doi:10.3389/fpubh.2020.00154
5. Siegler EL. Challenges and responsibilities in caring for the most vulnerable during the COVID-19 Pandemic. *J Am Geriatr Soc* 2020. doi:10.1111/jgs.16497
6. Lu S, Lin J, Zhang Z. et al. Alert for non-respiratory symptoms of coronavirus disease 2019 (COVID-19) patients in epidemic period: A case report of familial cluster with three asymptomatic COVID-19 patients. *J Med Virol* 2020. doi:10.1002/jmv.25776
7. Wilson N, Norton A, Young F. et al. Airborne transmission of severe acute respiratory syndrome coronavirus-2 to healthcare workers: a narrative review. *Anaesthesia* 2020. doi:10.1111/anae.15093
8. Peng F, Tu L, Yang Y, et al. Management and treatment of COVID-19: The Chinese experience. *Can J Cardiol* 2020 doi:10.1016/j.cjca.2020.04.010
9. Haase VH. Hypoxic regulation of erythropoiesis and iron metabolism. *Am J Physiol Renal Physiol* 2010;299(1):F1-F13. doi:10.1152/ajprenal.00174.2010

10. Porfidia A, Pola R. Venous thromboembolism in COVID-19 patients. *J Thromb Haemost* 2020;10.1111/jth.14842. doi:10.1111/jth.14842
11. Rotzinger DC, Beigelman-Aubry C, von Garnier C, Qanadli SD. Pulmonary embolism in patients with COVID-19: Time to change the paradigm of computed tomography. *Thromb Res* 2020;190:58-59. doi:10.1016/j.thromres.2020.04.011
12. Su H, Yang M, Wan C, et al. Renal histopathological analysis of 26 post-mortem findings of patients with COVID-19 in China. *Kidney International* 2020. doi.org/10.1016/j.kint.2020.04.003
13. Fan Z, Chen L, Li J, et al. Clinical features of COVID-19-related liver damage. *Clin Gastroenterol Hepatol* 2020;S1542-3565(20)30482-1. doi:10.1016/j.cgh.2020.04.002
14. Lazzeri M, Lanza A, Bellini R, et al. Respiratory physiotherapy in patients with COVID-19 infection in acute setting: a Position Paper of the Italian Association of Respiratory Physiotherapists (ARIR). *Monaldi Arch Chest Dis* 2020;90(1). doi:10.4081/monaldi.2020.1285
15. Brugliera L, Spina A, Castellazzi P, et al. Rehabilitation of COVID-19 patients. *J Rehabil Med* 2020;52(4):jrm00046. doi:10.2340/16501977-2678

Figure 1: Axial CT pulmonary angiography in lung window, from a 75-year-old man, who was diagnosed with COVID-19. Images show multifocal predominantly peripheral ground-glass opacities in the right lung base (a–c), with associated vacuolar sign (black arrowheads, a), fibrous streaks (white arrowheads, b), and vascular dilation sign (black arrow, c) suggestive of SARS-CoV-2 infection. In the soft tissue window, a filling defect partially outlined by contrast agent was found in the lateral branch of the right middle lobar artery, indicating acute pulmonary embolism (white arrow). Acute pulmonary embolism was unlikely to be caused by in-situ thrombosis due to interstitial COVID-19 injury since the parenchyma in the right middle lobe was normal (b). [Reproduced from: Rotzinger DC, Beigelman-Aubry C, von Garnier C, Qanadli SD. Pulmonary embolism in patients with COVID-19: Time to change the paradigm of computed tomography. *Thromb Res* 2020;190:58-59. doi:10.1016/j.thromres.2020.04.011]