

Hemodynamics of Maintaining Transportation of All Nutrients in Blood Flowing: Drinking (Boiled) Warm Water and Complete Nutrition Fluids for Primary and Secondary Prevention of Coronavirus Disease 2019 in Clinic

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ABSTRACT

Backgrounds: The coronavirus disease 2019 (COVID-19) pandemic has killed more than 1.5 million and infected more than 65.8 million people in the whole world as of July 12, 2020. The scientific research data show that severe acute respiratory syndrome coronavirus 2 is etiologic agent of COVID-19. The virus invasion can damage alveolus capillaries. The wounds may cause the hemorrhage, coagulation, clots, and (or) thrombosis. The thrombi can block blood circulation completely or partially. **Methods and Results:** Based on our estimation with hemodynamics, the blood flow rate decreases about 40% or 34% when the diameter or height of the blood vessels decreases 10%. The complete or partial obstructions also slow down transportations of O₂, CO₂ (conveying in red blood cells or plasma) and all nutrients in blood flows as well as increase risks of turbulence that can produce more thrombi, called “a vicious cycle” in hemodynamics. Therefore, fatal risks of ischemia or hemorrhage strokes as well as anemia increase. The viscosity of water is only 1/4–1/3 of that of human blood; drinking (boiled) warm water can decrease the viscosity as well as dissolve the blood clots to increase the blood flow and transportations of all nutrients without side effects. In addition, when people are (seriously) infected by COVID-19, they usually have fever, pulmonary hemorrhage or edema, and do not have much appetite to eat. Therefore, based on hemodynamics, we suggest drinking (boiled) warm water and complete nutrition fluids, for easy digestion, energy supplementation, and primary and secondary preventions of blood clots (or thrombi) in clinic. **Conclusions:** The complete nutrition fluids can provide all nutrients to maintain human bio-energy for daily lives and increase strength of immune system. Drinking warm (boiled) water can directly compensate the loss of water and the heat, keep the blood volume and reduce the blood viscosity without side effects to prevent or cure blood clots or thrombosis caused by COVID-19. Therefore, it is very important to drink (boiled) warm water and complete nutrition fluids to maintain transportations of all nutrients in blood flowing for primary and secondary preventions of COVID-19 in clinic.

Key words: Blood, Clinic, Clots, Coagulation, Coronavirus disease 2019, Hemodynamics, Hemorrhage, Ischemia, Nutrition, Prevention, Thrombosis, Transportation, Viscosity, Water

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has killed more than 1.5 million and infected more than 65.8 million people in the whole world as of July 12, 2020.^[1]

Severe acute respiratory syndrome coronavirus 2 is etiologic agent of COVID-19; the viruses invade the respiratory systems, lead to injuring the airway epithelium, alveoli (including pneumocytes), and pulmonary blood vessels. The injuries can cause pulmonary hemorrhages, edema, blood coagulation, clots, hemostasis, microthrombosis and

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inflammation, as well as macrothrombosis. Viral infection in areas of ongoing active injury contributes to persistent and temporally heterogeneous lung damage^[2-6] that is very dangerous to human lives.

Treatment of acute lung injury (ALI) and its most severe form, acute respiratory distress syndrome (ARDS), remain unsolved problems of intensive care medicine. ALI/ARDS are characterized by lung edema due to increased permeability of the alveolar-capillary barrier and subsequent impairment of arterial oxygenation. Lung edema, endothelial, and epithelial injury are accompanied by an influx of neutrophils into the interstitium and bronchoalveolar space.^[5,7]

In our previous studies, we proposed models of complete nutrition therapy to prevent or cure strokes caused by sickle cell anemia, ischemia, or hemorrhage,^[8] constipation and diarrhea,^[9] and obesity.^[10] In general, to normally ingest O_2 , H_2O , and sunlight are the most basic to maintaining our daily lives; the ingestions are critical respectively every minutes, hours, and days.

In our recent studies of preventing COVID-19 with mask-wearing, based on information theory as well as Newton's and Fick's laws, we proposed biomedical infophysical models of filtering ghost airflows of COVID-19 viruses and related infecting death rates and information at a human society level. Our models indicate that the infection is very dangerous in enclosed or confined spatial environments because the smaller the space, the higher the virus density; it is more dangerous in the environments with air conditioning systems or fans because the higher the wind level, the faster the virus velocity; the higher density or faster velocity of the viruses (droplets or airborne) will force people to inhale more viruses within the same time period. Therefore, we strongly suggested people to wear face masks for primary and secondary preventions of COVID-19 in clinic.^[11,12]

In this article, we mostly focus on theoretic analysis of human blood circulation system at a tissue level using hemodynamics^[13,14] and complete nutrition therapy (without side effects) for primary and secondary preventions of COVID-19 in clinic.

METHODS

Our theoretical analysis is based on published data^[1-7,15,16] as well as theories of hemodynamics,^[13,14] nutrition and physiology,^[17-19] infection, and virus.^[20]

ANALYSING RESULTS

A lung has two circulation systems: The hemodynamic for the blood flow and the aerodynamic for the air flow.^[13,14] We mostly focus on the hemodynamic system in this investigation.

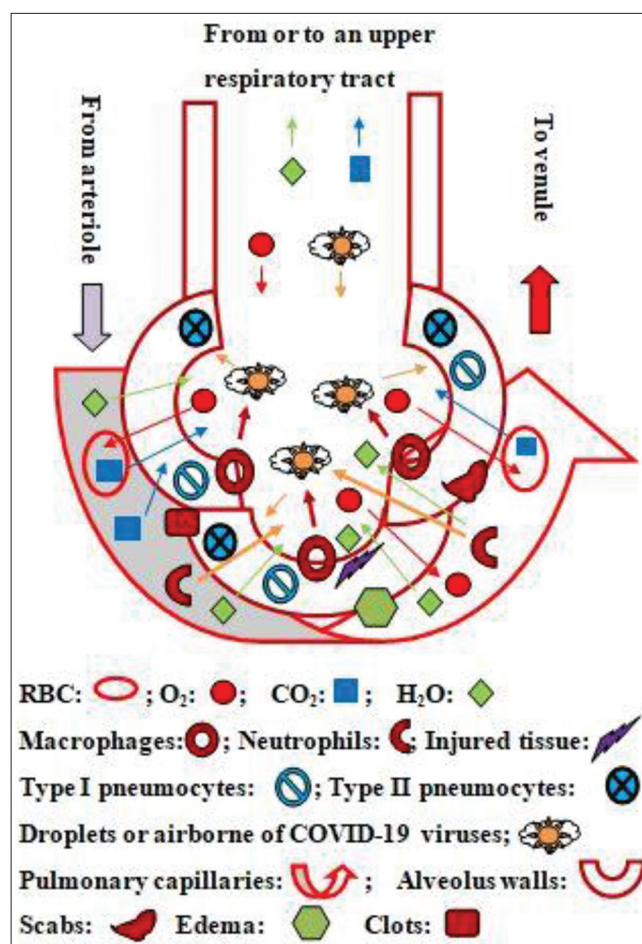


Figure 1: Invading and injuring an alveolus in a lower respiratory tract by COVID-19 viruses, and transportations across a capillary and an alveolus. Alveolus RBC: Red blood cells; arrows denote moving directions.^[17] We consider interstitial tissues between the blood vessels and alveoli as meridian channels.^[21] The draw is not to the scale

COVID-19 invasion leads to immune cells, such as macrophages or neutrophils, injuring alveolus walls, as well as killing the viruses^[5,6] [Figure 1]. After containment of an injury, the tissue repair phase starts with removal of toxins and waste products. Clotting (coagulation) reduces blood loss from damaged blood vessels and forms a network of fibrin proteins that trap blood cells and bind the edges of the wound together. A scab forms when the clot dries, reducing the risk of infection. Sometimes a mixture of dead leukocytes and fluid called pus accumulates in the wounds.^[17]

The wounded walls may produce pulmonary hemorrhages, edema, blood clots, scabs, and (or) thrombi. The scabs, edema, or clots can decrease the exchange of O_2 and CO_2 by decreasing the effective interface area between the alveolus wall and air or increasing the thickness of the diffusion of O_2 and CO_2 . A normal blood flow [Figure 2a] can be partially [Figure 2b] or completely [Figure 2c] blocked by thrombi.

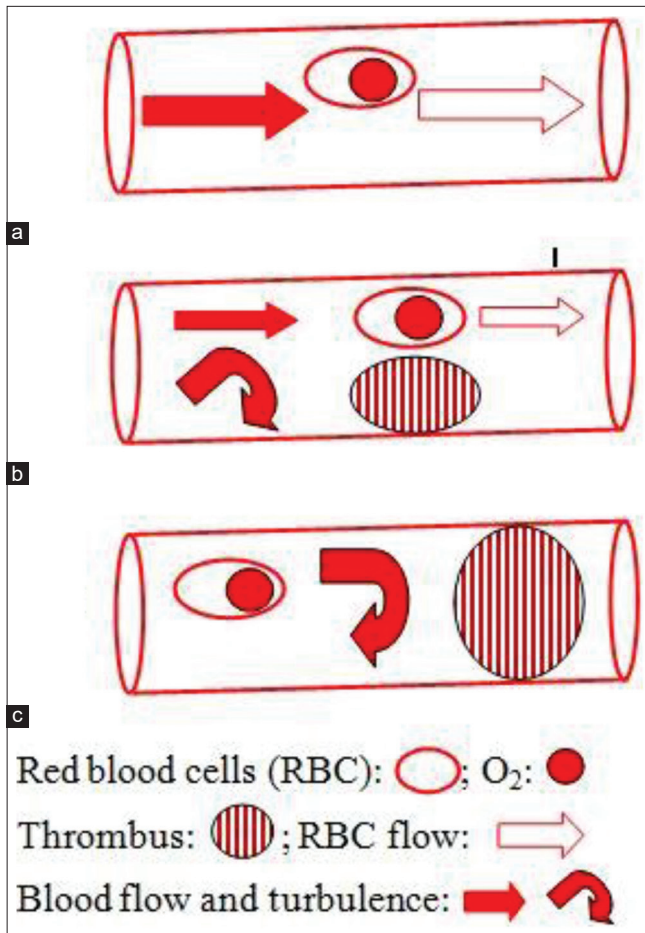


Figure 2: Blood flows in arteries: (a) normal; (b) partially blocked by thrombi; (c) completely blocked by thrombi.^[13,14,17] The draw is not to the scale.

The completely blocked blood vessels do not provide any transportation of the nutrition. The partially blocked blood vessels decrease the blood flow rates by narrowing the blood vessels, increasing the viscosity, or forcing the red blood cells (RBC) to have to flow in a side way or become severe deformed.^[13]

The both complete and partial obstructions can lead to decreasing transportations of O₂, CO₂ (conveying in RBC or plasma), H₂O, and all nutrients in blood as well as increasing risks of turbulence that can produce more thrombi^[13] and called “a vicious cycle” in hemodynamics.^[22] Therefore, fatal risks of ischemia or hemorrhage strokes as well as anemia^[17,18] increase.

To further understand what happened “a vicious cycle” in blood flowing in hemodynamics, we introduce two models to quantitate the human blood flow rate Q (volume/time)^[13] mathematically and physically.

The human blood flow rate Q (volume/time) can be modeled with Poiseuille’s law (flow equation):^[13,19]

$$Q \propto \frac{a^n}{u} \quad (1)$$

And

$$u \propto \frac{1}{T} \quad (2)$$

Where u and T , respectively, denote viscosity and temperature of the blood; a and n , respectively, denote size and integer; for pulmonary capillaries: a = Height and n = 4; for other blood vessels: a = Diameter and n = 5. The flow speed of the RBC is usually faster than that of the blood.^[13]

Based on our estimation with hemodynamics, the blood flow rate decreases about 40% or 34% when the diameter or height decreases 10%; and the blood flow rate decreases about 10% when the blood viscosity increases 10%.

The viscosity of water is only 1/4–1/3 of that of human blood.^[13] Therefore, modeling equations 1 and 2 elucidate drinking more warm water can decrease the viscosity as well as dissolve the blood clots (or thrombi)^[23,24] to increase the blood flow and transportations of all nutrients.

When people are (seriously) infected by COVID-19, they usually have fever, cough, pulmonary hemorrhage, or edema,^[5,6] and do not have much appetite to eat. Therefore, we suggested to drink (boiled) warm water and complete nutrition fluids, for easy digestion, energy supplementation, and blood clots prevention,^[25] to prevent or cure COVID-19 in our previous studies.^[11,12] We think the complete nutrition fluids can provide all nutrients to maintain human bio-energy for daily lives and increase strength of immune system; drinking warm water can directly compensate the loss of water and heat, reduce the blood viscosity, and maintain the normal flows of the blood and red cells, that is, maintain the normal transportations of O₂, CO₂ (conveying in RBC or plasma), H₂O, and all nutrients, to prevent or cure COVID-19 [Figure 3].

By our observation, beef, pork, and chicken oils become waxy consistency (non-fluids: High viscosities) or quasi solid when their temperatures, respectively, reach about 25°C, 20°C, and 15°C;^[10] but most consume plant cooking oils are still oil liquids (fluids: Low viscosities) when they reach about 4°C in refrigerators. Our body temperatures can be as low as 24°C in some parts, such as feet.^[26] The thrombi can be formed in the veins, transported to the arteries, and they become emboli to block the arteries.^[27,28] Therefore, we suggest to use vegetable oil or chicken soups with low viscosities and (or) low risks of blood clotting or thrombosis for primary and secondary preventions of COVID-19 in clinic.

Based on theory of human physiology,^[18] H₂O plays a very important role in maintaining human bodies’ homeostasis with bicarbonate buffer system; therefore, we think this is

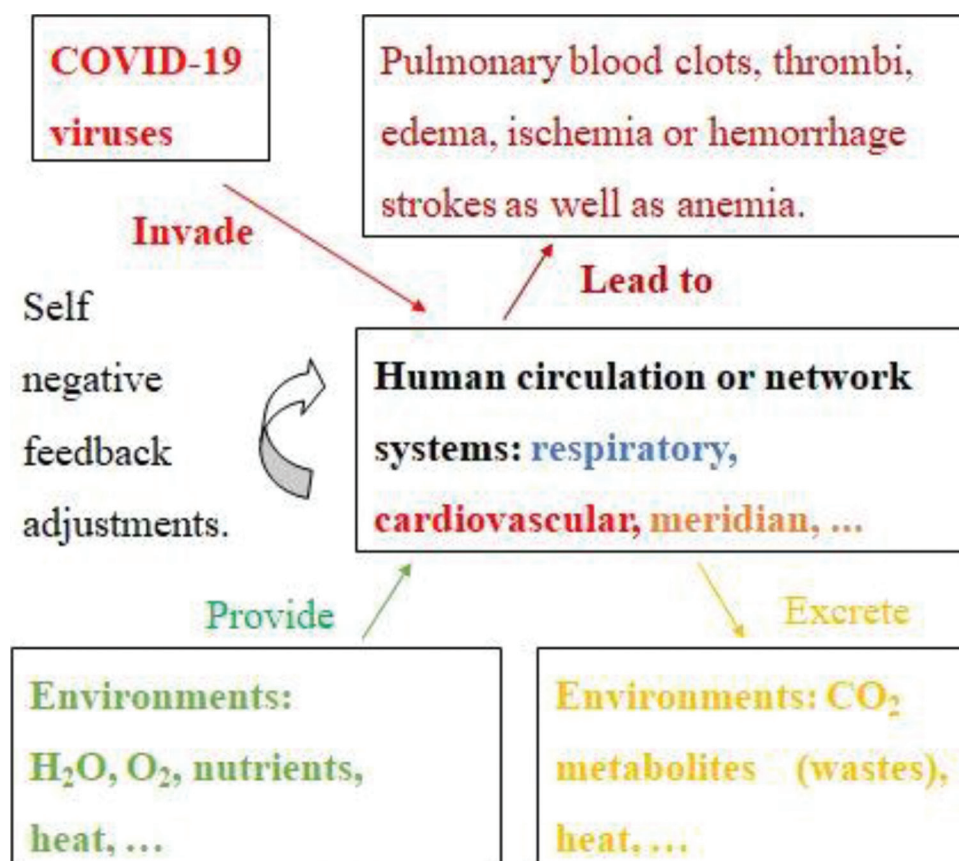


Figure 3: Human bodies like human societies are open systems: They exchange information, energy, and matters with their environments.

one of reasons why or how drinking more warm (boiled) water is very helpful for primary and secondary preventions of almost all of the respiratory diseases.^[10,29,30]

We also believe, for primary and secondary preventions of COVID-19 in clinic, drinking more warm water is a similar solution to altitude sickness during hypoxia;^[11,12] sipping distilled liquors, 60–70% by volume, 1 cc or ml/an hour (for adults only) is helpful too, according to our previous initial clinical trials of treating flu infection.^[29,30]

DISCUSSION

We also believe that it is very helpful to clear the viruses that are on or in our bodies or upper respiratory tracts but have not enter our lower respiratory tracts or lungs by frequently cleaning (washing or gargling) our nostrils, tongue, throats, and mouths, for example, blowing our nose, sneezing, and spitting; washing hands, faces, eyes, and ears; and taking warm showers and deep breaths for primary and secondary preventions of respiratory infection diseases.^[11,12]

We believe our analysis results in this study are also applicable or helpful for primary and secondary preventions of other respiratory diseases in clinic.

CONCLUSIONS

In this article, we mostly focus on theoretic analysis of human blood circulation system at a tissue level using hemodynamics and complete nutrition therapy (without side effects) for primary and secondary preventions of COVID-19 in clinic. We introduce two hemodynamics models to quantitate the human blood flow rate Q (volume/time) and to understand the principle that the relationships among blood flowing, blood viscosity, temperature of the blood, and blood vessels mathematically and physically.

Our calculated data show that the blood flow rate decreases about 40% or 34% when the diameter or height decreases 10%; and the blood flow rate decreases 10% when the blood viscosity increases 10%.

Our analyzing results show that drinking more warm (boiled) water can decrease the viscosity, dissolve the blood clots (or thrombi), increase the blood flow and transportations of all nutrients, as well as can directly compensate the loss of water and the heat, and keep the blood volume, to prevent or cure blood clots or thrombosis caused by COVID-19. The complete nutrition fluids can provide all nutrients to maintain human bio-energy for daily lives and increase

strength of immune system. Therefore, it is very important to drink (boiled) warm water and complete nutrition fluids to maintain transportations of all nutrients in blood flowing for primary and secondary preventions COVID-19 in clinic as well as for easy digestion.

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