

Treating Long COVID with Nasal Viral Disinfection, That Contributes A Novel Pathological Mechanism Underlies Study on the Impact of Nasal Virus on Central Nervous System

Yong Tan^{1*}

Department of General Practitioner, Society, Clinical University, China.

*Correspondence:

Yong Tan, Department of General Practitioner, Society, Clinical University, China, E-mail: yongtan_navigation@outlook.com.

Received: 29 Jun 2024; Accepted: 13 Aug 2024; Published: 21 Aug 2024

Citation: Yong Tan. Treating Long COVID with Nasal Viral Disinfection, That Contributes A Novel Pathological Mechanism Underlies Study on the Impact of Nasal Virus on Central Nervous System. Trends Int Med. 2024; 4(2): 1-6.

ABSTRACT

Background: It is a global health crisis for Long coronavirus-disease whom Severe-acute-respiratory-syndrome-coronavirus-2 infection causes for prevalence increasing over the time; as researchers increasingly concern its pathological impact on patient's central nervous system.

Materials and Method: With cold (equal or less than 0 degree Celsius) hypertonic solution with 2% NaCl (w/v) and ethanol up to 5% (v/v) as viral disinfectant in use to douse nasal cavity. A cohort who with Long coronavirus-disease develops the syndrome of digestive system were acquired in control referring to observable in our clinical study.

Result: Sterilization intended on Severe-acute-respiratory-syndrome-coronavirus-2 actually amounts to covering conspecific nasal virus for their homogenic envelope. The outcome is stunning not only to mitigate the clinical manifestations but subjects getting younger identifies virus is capable of sitting at nasal lining to exert their dangerous virulence into patient's cranial cavity. Meanwhile, a novel finding in treatment demonstrates there is a physical pathway in tissue serving such viral behaviors.

Conclusion: Controlling the viral infection in up respiratory airway, including Long coronavirus disease is no longer a challenge. For doing that, a new-brand health condition has turned upside down a consensus over life: Debilitating people's physical condition over time, the nasal virus should share the largest responsibility rather than human senescence. And, a novel pathological mechanism involved explains how does it; that holds a profound significance to future an extensively exploration on human health.

Keywords

Long COVID, Nasal Virus, Pathological Mechanism, Central Nervous System, Basal Ganglia, Autonomic System.

Abbreviations

BG: Basal Ganglion, CF: Cerebrospinal Fluid, CFS: Chronic Fatigue Syndrome, CNS: Central Nervous System, COVID: CoronaVirus Disease, GI: Gastrointestinal, IcBM: Icing-cold Beer Method, ME: Myalgic Encephalomyelitis, MMR: A Room closure

by Mucin-film the bottom of mucus and Membrane of epithelium or olfactory epithelium, NV: Nasal Virus, RS: Ruan YuHua Syndrome, SARS-CoV-2: Severe Acute Respiratory Syndrome CoronaVirus 2.

Introduction

What is Long COVID? That refers to a cohort whose chronic conditions occurs, that may be a prolonged syndrome after SARS-CoV-2 infection and thus would last for 3 months [1] or beyond.

Despite of so far more than 200 symptoms have been identified or multi organs may in failure in clinic [2], there might be 3.92 billion individuals infected with SARS-CoV-2; among them 3.7% (144.7 million) developed post COVID-19, and then 15.1% (22 million) persistent symptoms present at 12 months [3]. That incidence has been in the spotlight as a growing health crisis spilling out around the world.

The experts have long to counsel the public [4]: The prevalence can be about 10% of the patients who develop Long COVID, among whom the incidence of ME or CFS may contribute up to 50% from the first wave of COVID to which cause, except discovering COVID homogenous with other viral strains, there four possible ones are summarized: First is viral persistence that denotes a virus reservoir subsisting in somewhere of body continuously assaults you. Second, the autoimmune been triggered against inflammation but yields aberrant impairment in your tissue. Third, virus wakes up from its latent or dormant to exert its virulence. With a corresponding change, a chronic impairment is thus conferred to tissue, is the last.

Accordingly, an individual may have exposure to multi viral infections and suffer from pathological effect overlapping; with a set of rather entangled clues, if without a clear pathophysiologic model, none the easy to give rise to a right diagnosis/prognosis, especially the differential one.

Meanwhile this problem has been a challenge not only in medicine in terms of that Long COVID the pathological mechanism is still elusive thus brings out a difficult to discern a set of useful evidence that with correspondingly clinical significance from all tested in laboratory, as even more concerns to society [1,5] for patients who may thus hard to defend for their conditions.

Consider employing treatment, that also may be an important role in clinic to share the diagnostic mission. In this paper, we locate nasal cavity to do sterilization against SARS-CoV-2, in contrast to those [6,7] whose endothelial dysfunction that contributes a more complex pathological effect at etiology; conversely, we just not more than spot a cohort who with shallowing lesion, this is the infected apex of epithelium or olfactory epithelium, is identifiable of drawing on the observational outcome that availably correlates to treatment. Well, nevertheless being imparted of rather subjective but better than none.

An interesting problem thus arises that should be credited to viral envelope, besides COVID which clinical manifestations render homogeneous [1,4,5] in patients compares to other NV strains such as influenza, however, these pathogens belong to a sort of with a lipoid envelope [8], and thus refers to in a spectrum of disinfectant covering. There are two agents in our formulation [9], one is *sodium* can accelerate the contracted cell dies due to in a serious downregulating metabolism, another is *ethanol* which inactivates virus responsible to inserted into viral envelope thus wrought a lot of fatal pores to elicit a content leaking. Therefore, our treatment should offer a set of clinic manifestations past contracted as similar

as COVID, meliorated.

Our Contribution

A systematic rehabilitation we obtain though, yet than which, the yielding significance gets more profound for disinfection actually covering a set of NVs therein including SARS-CoV-2. Therefore, a new health condition obtained for partly removing NV's control, that presents either the musculoskeletal system restoring or the reproductive system restoring, that both attain is far beyond that level by COVID pandemic arising whom we initially looked forward; said, getting younger; even more turns upside down the consensus. We have long been educated to human's increasingly asthenia their aging should share the majority of responsibility but now turns to NV.

To this phenomenon, a novel finding deserves highlight to explain with that mimics a quasi-virus to mediate ethanol accessing to medulla. With a trace of quantity, it can manifest subjects with asynergia yet none the drunk. So, we discover a terrible truth that NV only just sitting at mucosa but is capable of remote controlling your CNS or BG.

Materials and Methods

Beginning on Jan, 2024 subjects applied IcBM as personal daily hygiene therein the cold solution less than 0 degree Celsius in use of tape water as dissolvent is 100 mL in which agents have 2% NaCl (hypertonic) the table salt compounding with 5% ethanol from edible alcohol.

We mainly follow up a couple whose age between 50 and 60 both presenting with chronic digestive system syndrome, and the time-span is 12 months counting from Jan, 2023 when from then they were awareness of themselves having captured Long COVID with a history of being infected by Omicron strain and acute symptoms onset; as they attempted to mitigate their mild clinical manifestation in use of isotonic saline rinsing nasal cavity.

The protocol can be cold solution dousing each nasal cavity for at least 2 minutes but generally not exceeding 4 minutes for possibly hurt on mucosa by low temperature. In general, we suggest perform IcBM at evening before going to bed in order to reduce viral shedding as possible as it can for gravity able to confer mucus easy dropping into pharynx further into the lower respiratory airway. Meanwhile, we have to have consideration on possible infection occurring from viral variants. Accordingly, these practical purposes can be integrated well into one: Besides daily hygiene when any symptom onset, in particular to the myalgia, or irritation/cough in throat; patients advised automatically adds treating times per day even to taking two times within two or less hours for subdue serious symptoms that may always refer to a caution of serious viral shedding or invasion emerging in nasal cavity.

The Results

The Syndrome

That couple we followed up may be typical case [10]: Myalgia is the prolonged symptom features with pain wandering on body,

often found on limbs; or chronically exertional fatigue presenting. Cough or throat irritation/pain was most often should be contributed by viral shedding when hard to do a differential diagnosis between sequela and new infection in pandemic.

Yet the GI symptoms onset on individual assumes a chronic presenting of constipation occurred on Jun, 2023 for 6 months after getting through onset of the acute syndrome of infection at the last of 2022 when, from then, *isotonic* saline rinsing had long been applied as suppressing the mild symptoms (without the low respiratory tract syndromes) onset, yet briefly alleviation was acquired in contrast to nothing on GI, withal bowel lavage is the unique measure availed subjects to defecate. The GI syndrome even more presents a systemic phenotype with the clinic manifestations listed in following.

Table 1: The digestive system symptom.

No.	Symptom or Sign	Clinical Presenting
1	Less Stomach acid	Vegetables in stomach without acidized into dark brown and translucency, hard digested so, keeping green in feces
2	Loss of appetite	None the hunger
3	Constipation	No bowel movement, defecation relying on lavage with a deal of water
4	Lower body temperature	less than 36 degrees Celsius; even more down to 34.8 degrees Celsius the postprandial
5	Leadens face or lips	Bowel lavage can meliorate this acute poisoning
6	Pigmentation on face	At forehead or double cheeks, bowel lavage unavailable to meliorate

This secondary syndrome is really dangerous for develop the endophenotype [11] morbid involving the so-called gut microbiome-brain axis, ascribed to enteric immunological response malfunction [12] in presence of altering microbiota in enteron that leads to the dysbiosis. With encephalalgia and meningeal irritation simultaneously occurring on subjects it manifests an aseptic meningitis [13].

The encephalalgia could be mitigated by bowel lavage but would be elicited at 6-8 hours the postprandial, especially exacerbated for uptake a lot of plant-based food, opposite to that endorsed in [14]. An important sign the pigmentation assumes similar as lupus or sclerosis on face, according to our observation, that can indicate a systemic toxicity persisting by which hue, light, or dark, respectively connected with meliorated or exacerbated [15].

Outcome

A week counted from then of beginning the IcBM treatment on Jan 15, 2024, subjects had bowel movement and body temperature restored up to 36 degrees Celsius sustaining in most time till now. After the first fortnight treating, headache had been rarely even after uptake a handful of vegetables that may signal enteric immune restoring; moreover, a greatly melioration was acquired for myalgia within a low frequent onset, slight, and relatively

fixating on shoulders; as the pain/irritation in throat substantially no longer occurred unless contracting new variants, all signaling less viral shedding occurs. With insisting at 6 months, the peristalsis approached to normal for without help from bowel lavage in subject's defecation in which stool, the acidized plant patches visible; yet rather instable, particularly assuming easily relapse in damp weather for which; a possible cause can be the SARS-CoV-2 Spike protein it is able to penetrate mucosal barrier [16] to innermost layers of gut; but needs further evidence to justify.

The systemic toxicity diminishing is credited to digestive syndrome subdued, reflected on the pigmentation for its holistic receding a lot, and skin thus recovers for lighter. In sum, disinfection on nasal mucosa renders the rehabilitation systematic to which, the interesting is a topic treatment lesion seems linking to affect CNS rather than the peripheral neurons in torso. And, a stunning change appearing on subject's physical condition likes happening in fairy story.

Discussion

It is interesting that a nasal treatment is conferred with CNS phenotype, for instance, recovery from syndrome on GI suppressed should due to a certain inhibition over autonomic system dismissed, that includes [17]: sympathetic nervous system, parasympathetic nervous system, and enteric nervous system. But what happens among two portions, nose and CNS, should they be highlighted without direct association, at least, according to what we have known, less seen in literatures?

Alternatively, what our result discovers is opposite to such the hypothesis that causative serotonin lacking elicits the Long COVID [23] as the peripheral receptors linking to vagal neuron thus dysfunction from which, the central nuclei siting in medulla oblongata cannot receive the right information leading to the nervous reflex disturbed thus to contribute a holistic functional disruption within the autonomic system.

Well, with this neuropathological disorder, they disagree, who with probing for demonstrate viral invasion subsists in peripheral vagal ganglia or morbid myelin sheath; and their attempt most often is vain for with less evidence from lesion supposed in advance [30-32], just as the information we have gleaned.

With pathological images from radiology, these pictures always display a degeneration occurs on the BG [24] rather than gyrus in subjects; what is implied in clinic, commonly is lesion diagnosed of downregulated metabolism. This morbidity appears to discover the virus direct invades into CF for blood-brain barrier disruption corroborated by animal trial [22] in which, the infected cerebral cell is observable. Yet, however, a lot of the CF testing which attempt to find the evident of direct invasion, denies this pathological model with poor evidence [18-20,34] yielded by viral inflammation in CF, even in the case that patients with anosmia that marks virus has populated olfactory epithelium [25], nor provides conclusive evidence to prove the invasion occurs along the olfactory filament.

Well, how about other possible models, for example, a viral reservoir outside cranial cavity [21,33] which supplementary sourcing to nasal cavity but can exert their influence onto CNS. There is still two of evidence not to support: these radiological images contribute a location for lesion that at BG not to exceed the cerebral limbic [24]; nor are intrathecal cytokines [33] found so, means no virus to mediate.

A Profound Bonus

A bonus spilled out from our treatment implies these pathogens are still inhabiting on nasal mucosa. According to our observation, the rehabilitation on subjects is not only at digestive system should including musculoskeletal system and reproductive system and holistic metabolism. The subjects on whom the first melioration is chronic fatigue gone away, and the prominent is skeletal muscles especial in male for strength or stamina which restoring can attain the state of age between 20 and 30 if retrospect the history of himself, what is more the sexuality. The temporal-window of getting younger has covered COVID duration and, obviously the effect can be credited to subduing the overlapping morbidity multi viral strains impose on subjects.

The result from our sterilization covering NVs that with lipid enveloping [15] such as influenza or H5N1 or of course including SARS-CoV-2, that carries a stunning message: debilitating people is not the senescence; conversely, the NV should share the majority of responsibility.

Consequently, an elusive mechanism, that has long to bewilder people, is being deciphered: Is it possible there is a pathway beneath cranial bottom serving viral to commit its virulence accesses to medulla further onto other ganglia, withal, how to prove that?

A Novel Syndrome

A novel finding, the **RS** named for a failed IcBM that contributes asynergia as without drunk but deserves cerebation.

A cold solution which can be in three concentrations of NaCl respectively represents hypoosmolality (0%), osmotic (0.9%), or hyperosmolality (2%). When we appraise the three of performance in administration with a change in MMR, into which, by the help of low temperature that mucus-film torn since mucin polymer shrivels, the cold solution thus can breach for salt and ethanol accessing to membrane to complete available administration.

To hyperosmolality, we often apply in IcBM, of course, enables sodium transmembrane penetrates into endoplasm from which, as exchanged, water inversely into MMR. This water refilling is responsible to liquidus strain increasing that makes swelling portion of solution against mucus-film which, once unable to sustain, would be torn once again by physical force, and solution discharged with diluted ethanol; amounts to an autonomic cleaning.

Conversely, the one, either hypoosmolality or osmotic, is unable to dilate MMR; conversely, there can be a lockdown on ethanol to secure entering to endoplasm as much as it goes; however, must

be responsible to subjects in malaise, a focal headache on the cerebellum level, and myalgia on double shoulders for persisting in hours, a set of clinical neurological manifestations, like intrathecal impairment.

Especially, with asynergia occurring (unable to walk on straight line), hypoosmolality it assumes more severity. Maybe, water from solution refilling endoplasm can more effectively elicit aseptic inflammation to accelerate ethanol entering into cranial cavity; fortunately, without loss of consciousness like drunk presenting lower toxicity, subjects could recover from symptoms within 12 hours.

Consequently, conversely while **RS** occurs, the cold hypertonic saline can be used to discharge the ethanol out of MMR as the remedy for rescuing from drug toxicity.

The phenomenon of medulla irritated in **RS** can well explain the acute/chronic myalgia/fatigue occurs in viral infection in up respiratory airway. Take an instance of COVID, as though how serious patients feel the myalgia can be over all the skeletal muscles, yet the impairment in muscles is still due to hypoxia [35] insists and they are right for that the myalgia is just no more than a hallucination. And colchicine [26,27] can mitigate these acute systemic symptoms upset by inhibiting cytokines releasing, like IL-1 β , TNF- α , and nitric oxide; these proinflammatory factors yielded from mucosa likely accelerate some agents into cranial cavity to disrupt the normal mechanism [28,29] of Dopaminergic reward, as well as in Long COVID. Sometimes, a sort of agent virus mediates into cranial cavity we likely have long to ignore; such glucose as in mice trial [36] showing the neurotoxicity; maybe, the osmolality of local CF thus upregulated.

In sum, NV, which pathological CNS phenotype can be outlined with a relatively fixed model: Pathogen which behavior would encompass the nasal mucosa as host to sustain a loop with egress or entry. This loop guarantees pathogen available to avoid extinction from nasal cavity since hosted cells can adopt a strategy of quickly dying to resolve the challenge of their contracting virus. Take SARS-CoV-2 as being instance, which acute infection would upregulate immunological response against viral invasion that would downregulate CNS metabolism thus yielding a set of serious systemic symptoms. Lavage on nasal lining can disrupt viral loop by discharge pathogen out of nasal cavity. The way curtailing invasion resulting in that the inflammation receding is thus acquired that offers patients or health workers an impression of individual already into convalescence no longer viral activity expresses.

In fact, a small viral tribe is sustaining the loop as has rooted mucosa; however, that yields a chronic impact on patients' BG in order to downregulate autonomic immune to a certain balance, patients thus contract Long COVID.

Conclusion

The interesting theme should be getting younger that benefits from months nasal rinsing if without COVID pandemic, it is

impossible to our insistence. On other hand, debilitating people and their physical condition should be characterized as: Over the time, with the focal infection the area may increasingly getting larger than before, the viral impairment rising attenuates human autonomic system in order to downregulate autoimmune. To this immunological retracting people cannot catch the signal, on contrary, they have long been educated that is the Nature Law for senescence and their life is so. But this failure can be due to without efficacious treatment to inhibit viral infection in nasal cavity.

The essential pathological model of **RS** is conferred, for any sake, except to explain the correlation virus employs between nasal cavity and cranial cavity, an important mission can be on assessing administration or vaccination; to former, in order to avoid the hazardous agents into cranial cavity; therefore, within formulation of cold solution in our treatment, till now suggests salt or ethanol.

In particular to the latter, which should never go to generate a chronic impairment on nasal mucosa that can strengthen the viral control within cranial cavity, resulting in exacerbating certain chronic condition. The last question may be what number will population life expectancy attains, if with technological approach to keep double laterals of nasal cavity off viral infection?

Our Limitation

Of course, cases report is playing a minor role contribute to medicine. But, however, suffered from such horrible COVID pandemic that lasts until now; all beings are equal, it believes that there is none who had gotten fully ready. As same as other researchers, when we decided to employ IcBM against Long COVID, we absolutely could not forecast the yielding outcome we wanted nevertheless, we must bear; fortunately, beyond a lot. So, as you have seen, our subjects have long to do nasal rinsing against COVID particularly for attempt to mitigate the myalgia; for that, our symptoms are impossible serious as ones in [2] yet still dangerous; therefore, as you have seen, there are less of data from labs in this paper. But with an essential pathological mechanism given at length, future exploration would become interested or thoroughly to secure our health.

Acknowledgement

Thank members in our family who always support our exploration in science, especially in current COVID pandemic to survive all. Among them, we specially thank my mother-in-law; Ruan, Yuhua, who made wrong the formulation of cold solution by without salt (we never try that unless osmotic for one time and once again stops headache) and bore the severe soreness from nose; so, by her name denotes this interest syndrome.

References

1. Long COVID Basics. June 11, 2024. site: <https://www.cdc.gov/coronavirus/2019-ncov/longterm-effects/index.html>
2. Golzardi M, Hromic Jahjefendic A, Sutkovic J, et al. The Aftermath of COVID 19: Exploring the Long-Term Effects on Organ Systems. *Biomedicines*. 2024; 12: 913.

3. Post Covid-19 conditions. Available until Jul 3, 2024. site: <https://www.who.int/teams/healthcare-readiness/post-covid-19-condition>
4. Carrie Macmillan. Long COVID, 'Long Cold': What to Know About Post-Acute Infection Syndromes. Oct 17, 2023. site: <https://www.yalemedicine.org/news/long-covid-long-cold-post-acuteinfection-syndromes>
5. Astin R, Banerjee A, Baker MR, et al. Long COVID: mechanisms, risk factors and recovery. *Exp Physiol*. 2023; 108: 12-27.
6. Xu Sw, Ilyas I, Weng Jp. Endothelial dysfunction in COVID-19: an overview of evidence, biomarkers, mechanisms and potential therapies. *Acta Pharmacol Sin*. 2023; 44: 695-709.
7. Wu X, Xiang M, Jing H, et al. Damage to endothelial barriers and its contribution to long COVID. *Angiogenesis*. 2024; 27: 5-22.
8. Harrison AG, Lin T, Wang P. Mechanisms of SARS-CoV-2 Transmission and Pathogenesis. *Trends Immunol*. 2020; 41: 1100-1115.
9. Tan Y. Nasal Rinsing Efficacious Curing COVID-19, Low Temperature May Be Crucial of Priming Intranasal Administration for Viral Sterilization. *Ann Infect Dis Prev Med*. 2024; 4: 1009.
10. Sherif ZA, Gomez CR, Connors TJ, et al. Pathogenic mechanisms of post-acute sequelae of SARS-CoV-2 infection (PASC). *Elife*. 2023; 12: 86002.
11. Gareau MG, Barrett KE. Role of the microbiota-gut-brain axis in postacute COVID syndrome. *Am J Physiol Gastrointest Liver Physiol*. 2023; 324: 322-328.
12. Sasso JM, Ammar RM, Tenchov R, et al. Gut Microbiome-Brain Alliance: A Landscape View into Mental and Gastrointestinal Health and Disorders. *ACS Chem Neurosci*. 2023; 14: 1717-1763.
13. Appleton J. The Gut-Brain Axis: Influence of Microbiota on Mood and Mental Health. *Integr Med (Encinitas)*. 2018; 17: 28-32.
14. Storz MA. Lifestyle Adjustments in Long-COVID Management: Potential Benefits of Plant Based Diets. *Curr Nutr Rep*. 2021; 10: 352-363.
15. Boson B, Legros V, Zhou B, et al. The SARS-CoV-2 envelope and membrane proteins modulate maturation and retention of the spike protein, allowing assembly of virus-like particles. *J Biol Chem*. 2021; 296: 100111.
16. Renata R Nascimento, Cristhyane C Aquino, José K Sousa, et al. SARS-CoV-2 Spike protein triggers gut impairment since mucosal barrier to innermost layers: From basic science to clinical relevance. *Mucosal Immunol*. 2024.
17. Elizabeth Coon. Overview of the Autonomic Nervous System. 2024. site: <https://www.merckmanuals.com/home/brain,-spinal-cord,-and-nerve-disorders/autonomic-nervous-system-disorders/overview-of-the-autonomic-nervous-system>.

18. Schweitzer F, Goereci Y, Franke C, et al. Cerebrospinal Fluid Analysis Post-COVID-19 Is Not Suggestive of Persistent Central Nervous System Infection. *Ann Neurol.* 2022; 91: 150-157.
19. Jarius S, Pache F, ortvelyessy P, et al. Cerebrospinal fluid findings in COVID-19: a multicenter study of 150 lumbar punctures in 127 patients. *J Neuroinflammation.* 2022; 19: 19.
20. Lewis A, Frontera J, Placantonakis DG, et al. Cerebrospinal fluid in COVID-19: A systematic review of the literature. *J Neurol Sci.* 2021; 421: 117316.
21. Eden A, Grahn A, Bremell D, et al. Viral Antigen and Inflammatory Biomarkers in Cerebrospinal Fluid in Patients with COVID-19 Infection and Neurologic Symptoms Compared with Control Participants Without Infection or Neurologic Symptoms. *JAMA Netw Open.* 2022; 5: 2213253.
22. Song E, Zhang C, Israelow B, et al. Neuroinvasion of SARS-CoV-2 in human and mouse brain. *J Exp Med.* 2021; 218: 20202135.
23. Wong AC, Devason AS, Umana IC, et al. Serotonin reduction in post-acute sequelae of viral infection. *Cell.* 2023; 186: 4851-4867.
24. Rudroff T. Decoding Post-Viral Fatigue: The Basal Ganglia's Complex Role in Long-COVID. *Neurol Int.* 2024; 16: 380-393.
25. Purja S, Oh S, Kim E. A Systematic Review on Neurological Aspects of COVID-19: Exploring the Relationship Between COVID-19-Related Olfactory Dysfunction and Neuroinvasion. *Front Neurol.* 2022; 13: 887164.
26. Skrzypczak Wiercioch A, Sal K. Lipopolysaccharide-Induced Model of Neuroinflammation: Mechanisms of Action, Research Application and Future Directions for Its Use. *Molecules.* 2022; 27: 5481.
27. Ledford H. Long COVID trial provides tentative hope for treatment. *Nature.* 2024; 601: 356-357.
28. Sanghavi D, Bansal P, Kaur IP, et al. Impact of colchicine on mortality and morbidity in COVID-19: A systematic review. *Ann Med.* 2022; 54: 775-789.
29. Saucier J, Comeau D, Robichaud GA, et al. Reactive gliosis and neuroinflammation: Prime suspects in the pathophysiology of post-acute neuroCOVID-19 syndrome. *Front Neurol.* 2023; 14: 1221266.
30. Andersson U, Tracey KJ. Vagus nerve SARS-CoV-2 infection and inflammatory reflex dysfunction: Is there a causal relationship? *J Intern Med.* 2024; 295: 91-102.
31. Lladós G, Massanella M, Coll Fernandez R, et al. Vagus nerve dysfunction in the post-COVID-19 condition: a pilot cross-sectional study. *Clin Microbiol Infect.* 2024; 30: 515-521.
32. Jammoul M, Naddour J, Madi A, et al. Investigating the possible mechanisms of autonomic dysfunction post-COVID-19. *Auton Neurosci.* 2023; 245: 103071.
33. Reinhold D, Farztdinov V, Yan Y, et al. The brain reacting to COVID-19: analysis of the cerebrospinal fluid proteome, RNA and inflammation. *J Neuroinflammation.* 2023; 20: 30.
34. Tuma RL, Guedes BF, Carra R, et al. Clinical, cerebrospinal fluid, and neuroimaging findings in COVID-19 encephalopathy: a case series. *Neurol Sci.* 2021; 42: 479-489.
35. Kucuk A, Cumhuri Cure M, Cure E. Can COVID-19 cause myalgia with a completely different mechanism? A hypothesis. *Clin Rheumatol.* 2020; 39: 2103-2104.
36. Raza MU, Chhabra KH. Osmotic Minipump Implantation for Increasing Glucose Concentration in Mouse Cerebrospinal Fluid. *J Vis Exp.* 2023; 7: 10.