

ACADEMY OF SPINAL CORD INJURY PROFESSIONALS



Case Study: Tetraplegia Following Intervention For A Massive Pulmonary Embolism Months After Severe Covid-19 Pneumonia

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Learning Objectives

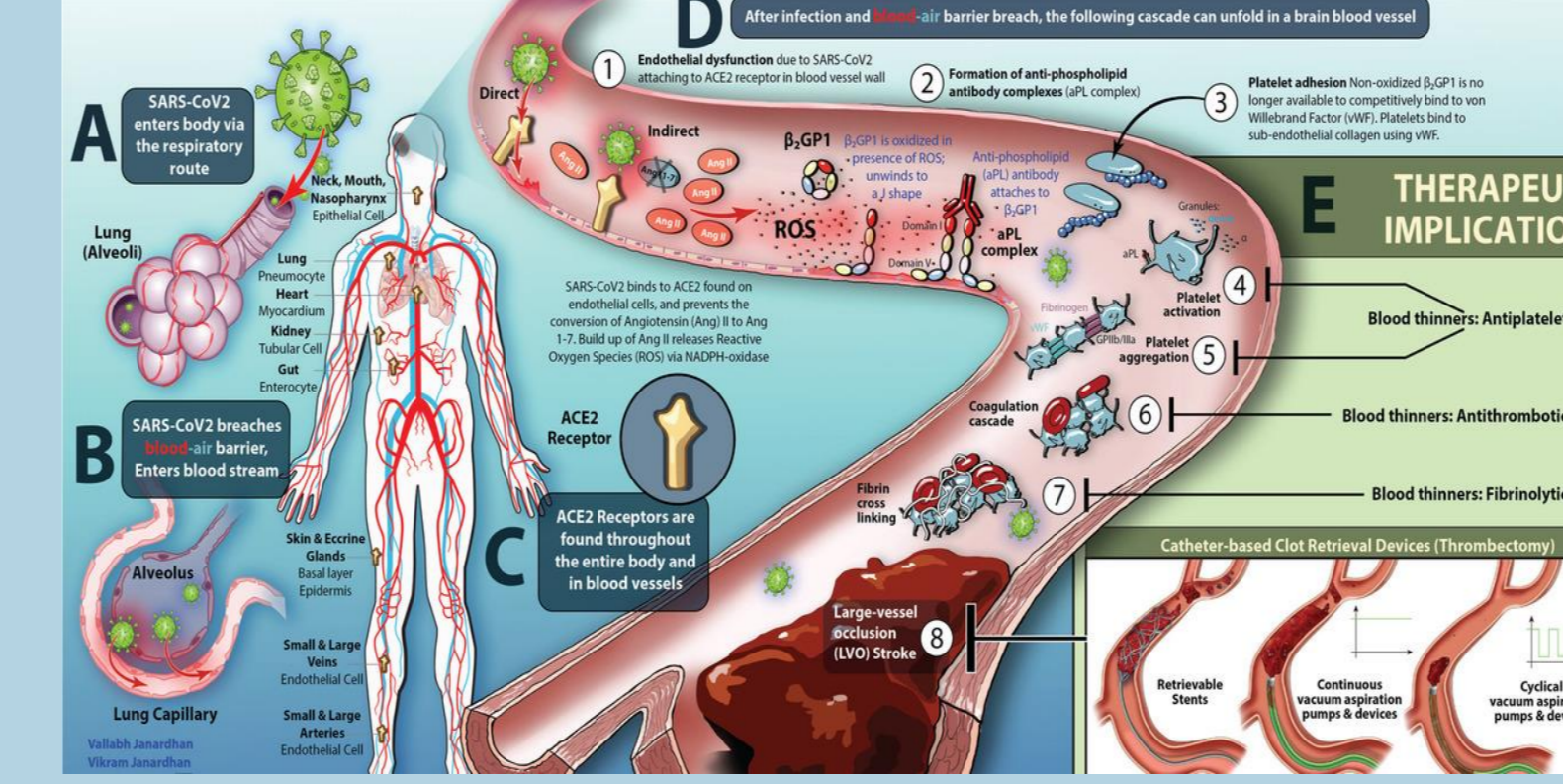
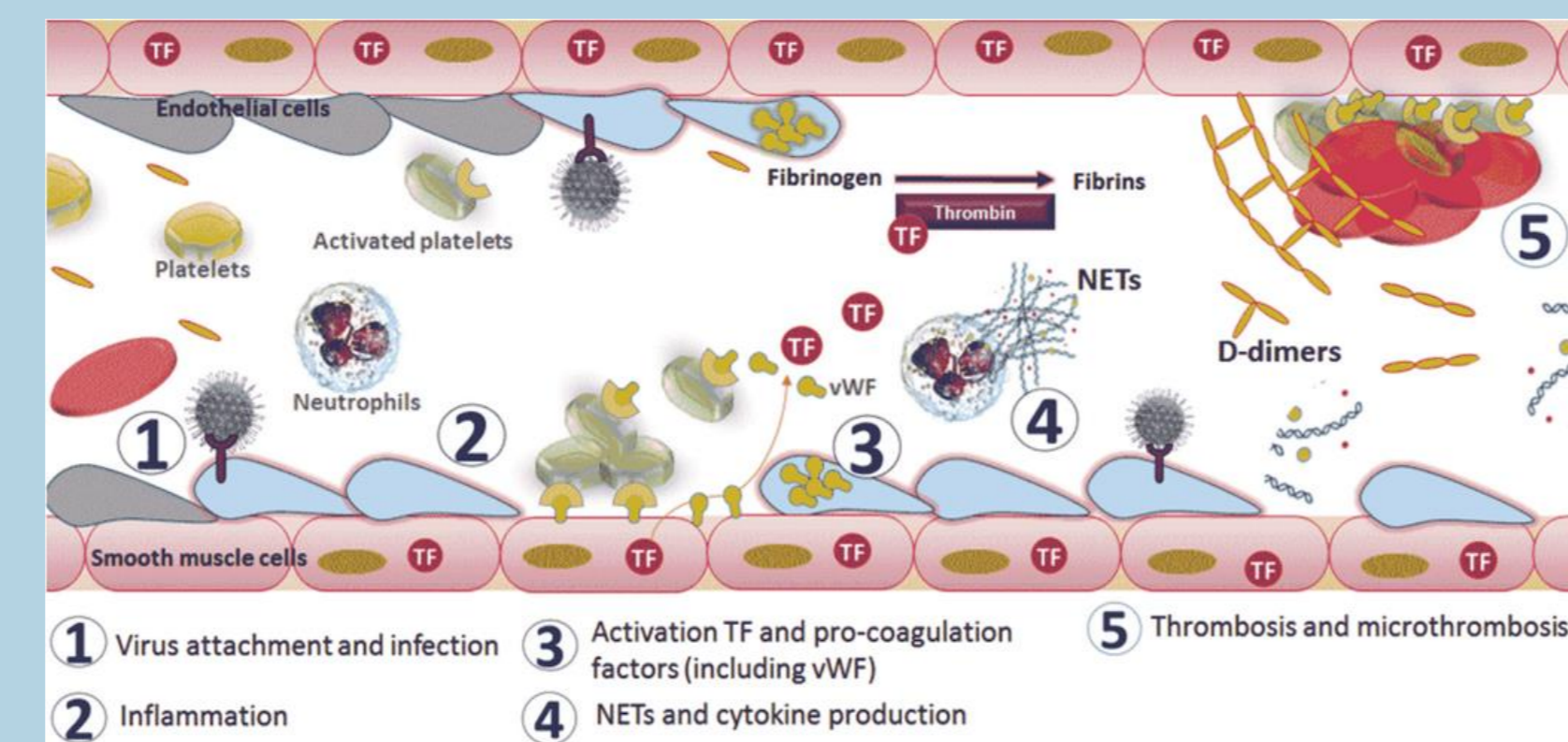
- Share experience of caring for a survivor of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) who later suffered iatrogenic tetraplegia associated with the treatment of venous thromboembolic event (VTE)
- Reinforce awareness of potential risk for VTE in post acute care.
- Review theories of hypercoagulation in SARS-CoV-2 survivors
- Identify a unique discharge planning barrier in families who have been affected by Covid-19 disease: shared infection & disability with identified caregivers

Case Description

59 y/o man with no concerning medical history was hospitalized in March 2020 with SARs-CoV-2 pneumonia complicated by post-recovery pulmonary embolism (PE) and complete C5 ASIA A tetraplegia after subsequent thrombolytic therapy resulted in hemorrhagic compression of the spinal cord. Despite severe SARs-CoV-2 pneumonia, he required hospitalization and over a weeks time recovered enough to return home. He eventually returned to work. Six months later the patient developed worsening episodes of intermittent dizziness and he presented emergently to the ER due to dyspnea and chest tightness. He was diagnosed with left femoral, popliteal, tibial deep venous thrombosis and massive "saddle" PE. He was given tissue plasminogen activator however 2 days later he was noted to have lower extremity weakness. Imaging revealed an epidural hematoma from C2-T11 causing spinal cord compression and sudden dependency. The patient was admitted to acute rehab and ultimately discharged to a community skilled nursing facility.

Hypercoagulability Associated with Covid -19

Hypercoagulability is a known phenomenon that occurs during acute covid-19 infection. demonstrated higher levels of d-dimer, fibrinogen, and fibrinogen degradation products prolonged prothrombin time (PT), international normalized ratio (INR), and thrombin time (TT) were also noted in patients with COVID-19 disease.¹ This case study describes onset of VTE and its post treatment complications leading to a spinal cord injury in a patient with no pre-existing risk factors for VTE who had previously recovered from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).



Mechanism of activation of coagulopathy in SARS-CoV-2 infection

- Virus attaches to endothelial lining and the innate immune surveillance cells, such as alveolar macrophages and neutrophils
- release of TF, IL6, and other chemokines, which attract more neutrophils and lymphocytes into the lungs.
- activated neutrophils and endothelial cells release pro-coagulation factors. Cause macrophages to secrete IL1 β
- Reactive immune molecules leak into the blood circulation and trigger the clotting process by activating platelets and thrombin, resulting in the induction of a microthrombosis process that leads to VTE/PE.⁸

Discussion

Covid-19 disease, including SARS-cov2 pneumonia is associated with acute VTE, and could be associated with a prolonged hypercoagulable state.^{1,2,3} Research data reporting the rates of Thrombosis subacute and longer term are limited. Preliminary reports suggest that 2.6-8.9% of hospitalized Covid-19 patients succumb to PE despite standard prophylaxis.⁴ Extended VTE prophylaxis in recovered patients is similarly limited with some evidence to focus 1-2 weeks of prophylaxis on individuals with limited mobility or concerning risk factors.^{4,5}

This case is thought provoking because the patient had no risk factors for VTE besides his age. He was thin, nonsmoker, non-sedentary, and had no previous personal nor family history for VTE. Bleeding risks often outweigh the benefits of VTE prophylaxis in healthy individuals. We demonstrate a need to consider that risks of foregoing extended VTE prophylaxis in healthy individuals can lead to devastating sequela of post covid-19 disease. There is a lack of literature on post-acute surveillance however monitoring coagulation markers is a consideration that may be feasible. At least one prior study of Covid19 recovered patients found elevated D-Dimers for at least 6 weeks without CT evidence of PE arguing other markers of coagulopathy may be worth investigating.⁶

Discharge Planning Strategies

During the pandemic discharge planning is more challenging especially in the case of **uncertainty of caregiver's health**. Strategies:

- **Increased time** in multidisciplinary meetings
- **Provider/Social Worker** increased separate discussions with patient for problem solving.
- Due to visitation restrictions **providing technology** for patient to interact with family/caregivers
- **Multiple team meetings** including the patient and his support group. "family" meeting.
- **Psychological support** for adjustment of disability & coping with **ill caregiver**
- Early discussion on discharge planning
- **Multiple Rehab admissions** potentially
- Seeking benefits (service connection) financial support
- Vocational Rehab specialist working with patient and employer
- **Short term and long term planning for residence, alternative caregivers**

Future Directions

- Incidence and prevalence of subacute VTE complications after Covid-19 disease/SARs Cov-2 pneumonia
- Efficacy and risk of prolonged VTE prophylaxis in these cases.
- Feasibility and effectiveness of surveillance strategies to monitor for post-acute Covid-19 VTE. (such as d-dimer, INR, etc..)

References

1. Severe COVID-19 Is a Microvascular Disease. Lowenstein CJ, Solomon SD Circulation. 2020;142(17):1609. pub 2020 Sep 2.
2. Post discharge thrombosis and hemorrhage in patients with COVID-19. Patel R, Bogue T, Koshy A, Bindal P, Merrill M, Aird WC, Bauer KA, Zwicker JI Blood. 2020;136(11):1342.
3. COVID-19 is, in the end, an endothelial disease. Libby P, Luscher T Eur Heart J. 2020;41(32):3038.
4. Bikdeli B, Madhavan MV, Jimenez D, et al. COVID-19 and Thrombotic or Thromboembolic Disease: Implications for Prevention, Antithrombotic Therapy, and Follow-Up: JACC State-of-the-Art Review. J Am Coll Cardiol 2020;75:2950-73.
5. Pulmonary embolism in patients with coronavirus disease-2019 (COVID-19) pneumonia: a narrative review Yasser Sakr1*, Manuela Giovini2, Marc Leone3, Giacinto Pizzilli4, Andreas Kortgen1, Michael Bauer1, Tommaso Tonetti4, Gary Duclos3, Laurent Zielekiewicz3, Samuel Buschbeck1, V. Marco Ranieri4 and Elio Antonucci
6. Townsend L, Fogarty H, Dyer A, Martin-Loeches I, Bannan C, Nadarajan P, Bergin C, O'Farrelly C, Conlon N, Bourke NM, Ward SE, Byrne M, Ryan K, O'Connell N, O'Sullivan JM, Ni Cheallaigh C, O'Donnell JS. Prolonged elevation of D-dimer levels in convalescent COVID-19 patients is independent of the acute phase response. J Thromb Haemost. 2021 Apr;19(4):1064-1070. doi: 10.1111/jth.15267. Epub 2021 Mar 8. PMID: 33587810; PMCID: PMC8013297.
7. Pujhari, S., Paul, S., Ahluwalia, J. and Rasgon, J.L. (2021), Clotting disorder in severe acute respiratory syndrome coronavirus 2. Rev Med Virol, 31: e2177. <https://doi.org/10.1002/rmv.2177>
8. Janardhan, V., Janardhan, V. and Kalousek, V. (2020), COVID-19 as a Blood Clotting Disorder Masquerading as a Respiratory Illness: A Cerebrovascular Perspective and Therapeutic Implications for Stroke Thrombectomy. Journal of Neuroimaging, 30: 555-561. <https://doi.org/10.1111/jon.12770>