Chicken or the Egg: Case Studies in COVID-19 & Stroke

Michelle A. Dedeo DNP, ARNP-CNS, ACCNS-AG, CCRN, CNRN, SCRN

Neuroscience Clinical Nurse Specialist

Seattle, WA

Disclosure

I have no financial relationships, commercial relationships, or conflicts of interest to disclose

Objectives

- Review and discuss evolving research of risk, incidence & prevalence for stroke development related to COVID-19.
- Discuss & review neuro and stroke assessment techniques connected to pathophysiology & COVID-19 illness to support early identification of acute stroke.
- Utilize patient case studies & discuss current evidence in the care & treatment guidelines for management of acute stroke related to COVID-19 infections

Patient Case Study

- 60-year-old male
- Presented to the emergency department with severe SOB late February 2020
- O_2 saturations 72% on RA
- PMH: Sciatica, DM type 2, OSA, HLD
- COVID +
- Rapid decline requiring intubation, NMB, & prone positioning

Patient Case – Continued

- Extubated after 17 days – severe generalized weakness assessed.
- The patient was not able to raise his arms
- MRI performed

MRI Results

Small clustered (2-3 foci) sub centimeter diffusion restrictions in bilateral centrum semiovale suggestive of recent internal **WATERSHED** distribution infarcts such as from hypotensive event.

Microsoft Stock Image- Access April 2022

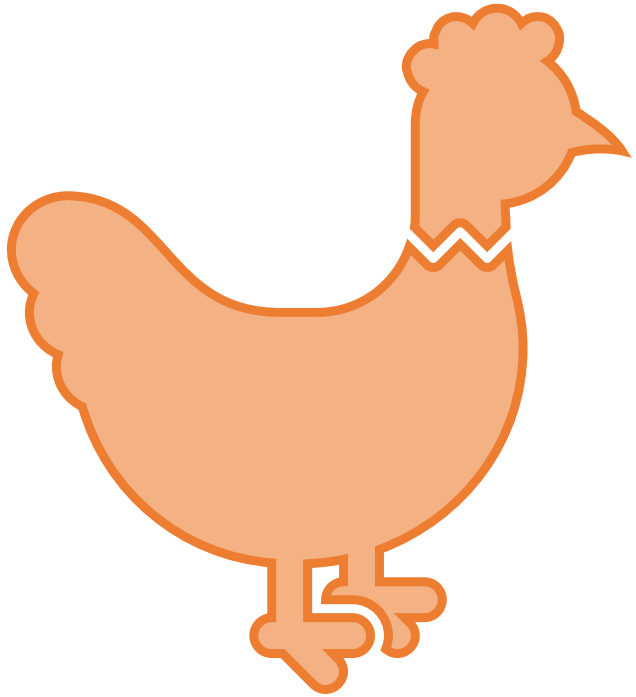
Patient Case Summary

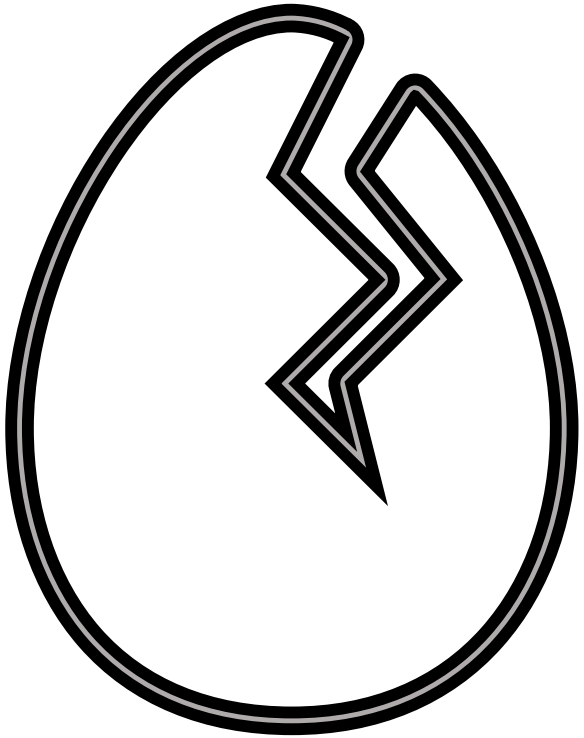
- Had been placed on Sub Q Heparin on admission
- Developed a GI Bleed & AKI while intubated requiring blood transfusion and HD.
- Developed viral myocarditis (EF 45%)
- Discharge at hospital day 30 to acute rehab
- Discharged from acute rehab to home after 10 days with full mobility!

COVID-19 in Seattle

COVID-19 Pandemic Response began in Seattle February 29th, 2020

Working to Understand COVID-19





COVID Pathophysiology

The Mechanism of COVID's Destruction

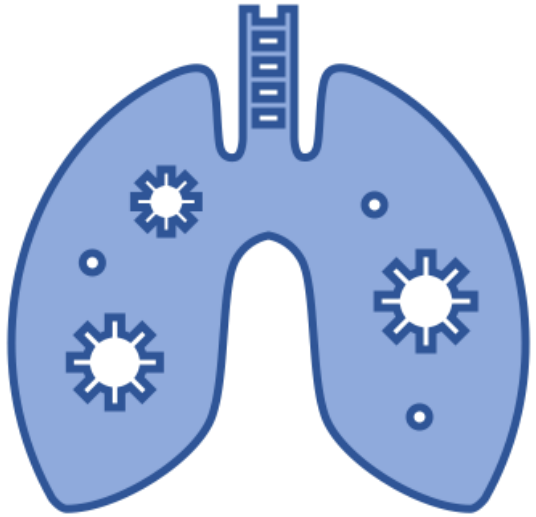
- SARS-CoV-2 RNA virus which enters the body via nasal & bronchial epithelial cells & pneumocytes.

- It infects human cells by binding to angiotensin-converting enzyme 2 (ACE2) on the cell surface.

The Mechanism of COVID's Destruction

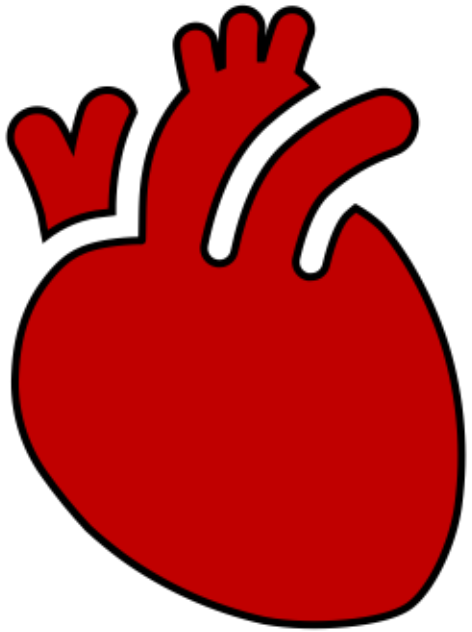
- ACE2 is a main component of the renin-angiotensin system
- Maintains fluid & salt balance, maintains blood pressure homeostasis
- ACE generates Angiotensin II which is a key effector causing vasoconstriction
- Major driver in the inflammatory process

Understanding the Pathophysiology of COVID



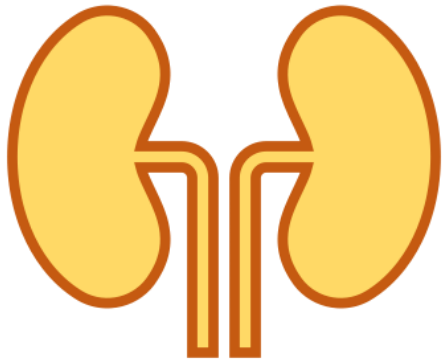
Respiratory System	
Clinical Features	Radiographic Findings
• Cough • Dyspnea • Sore throat • Rhinorrhea	• Lower lobe & peripheral predominant opacities • Ground glass opacities or consolidations • Pleural effusions • Pulmonary embolism

Understanding the Pathophysiology of COVID



Cardiovascular System	
Clinical Features	Radiographic Findings
• Chest pain • Edema • Pulselessness • Pallor • Skin changes • Necrosis	• Heart strain • Myocarditis • Acute coronary syndrome • Venous or arterial thrombi

Understanding the Pathophysiology of COVID

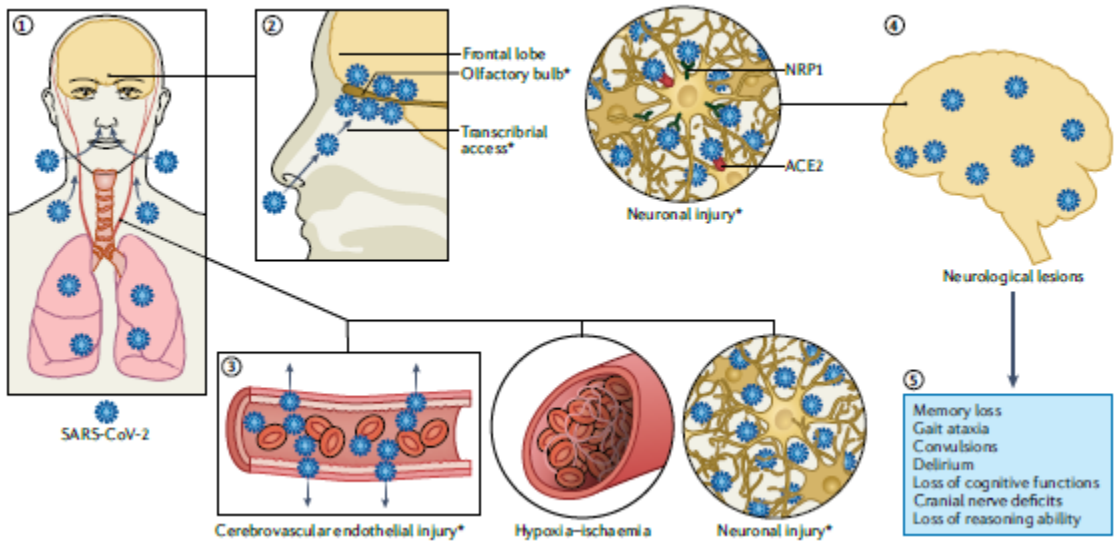


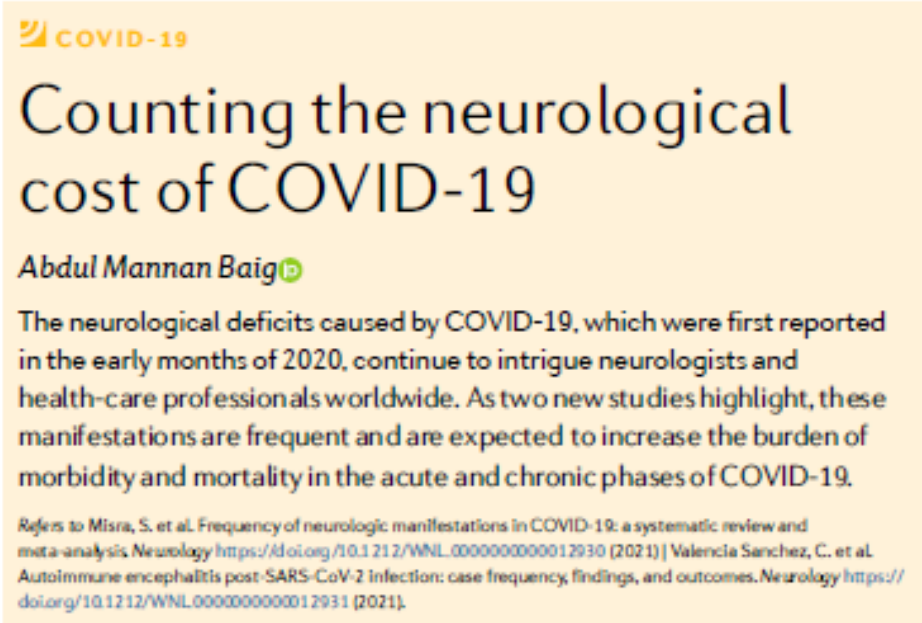
Gastrointestinal & Genitourinary Systems	
Clinical Features	Radiographic Findings
• Nausea & Vomiting • Diarrhea • Abdominal pain • Elevated creatinine • Proteinuria • Hematuria • Hyperkalemia	• Bowel wall thickening • Inflammation of adjacent mesenteric fat • Small volume ascites • Small bowel obstruction • Mesenteric vessel ischemia • Enlarged, echogenic kidneys • Renal infarcts

Understanding the Pathophysiology of COVID

Neurologic	
Clinical Features	Radiographic Findings
• Headache • Altered mentation • Anosmia • Lethargy & confusion • Stroke • Hemiparesis & paresthesia • Aphasia	• Vasculitis pattern • Restricted diffusion on MRI • Ischemic stroke • Venous sinus thrombosis • Hemorrhagic stroke • PRES • Microhemorrhages

Pathophysiology of Neurologic Deficits





COVID-19

Counting the neurological cost of COVID-19

Abdul Mannan Baig

The neurological deficits caused by COVID-19, which were first reported in the early months of 2020, continue to intrigue neurologists and health-care professionals worldwide. As two new studies highlight, these manifestations are frequent and are expected to increase the burden of morbidity and mortality in the acute and chronic phases of COVID-19.

Refers to Misra, S. et al. Frequency of neurologic manifestations in COVID-19: a systematic review and meta-analysis. *Neurology* https://doi.org/10.1212/WNL.0000000000012930 (2021) | Valencia Sanchez, C. et al. Autoimmune encephalitis post-SARS-CoV-2 infection: case frequency, findings, and outcomes. *Neurology* https://doi.org/10.1212/WNL.0000000000012931 (2021).

Baig, A.M. Counting the neurological cost of COVID-19. *Nat Rev Neurol* 18, 5–6 (2022)

*Image Copyright of *Nature Review Neurology* & Used with Permission

Neurologic Complications Post-COVID Infection

Encephalopathy

Intracerebral Hemorrhage

Cerebral Venous Thrombosis

COVID & Stroke- Early Literature

Stroke
Volume 52, Issue 3, March 2021; Pages 905-912
https://doi.org/10.1161/STROKEAHA.120.031786

American Heart Association.

CLINICAL AND POPULATION SCIENCES

Acute Ischemic Stroke and COVID-19

An Analysis of 27 676 Patients

Adnan I. Qureshi, MD, William I. Baskett, BS , Wei Huang, MA, Daniel Shyu, BS, Danny Myers, PhD, Murugesan Raju, PhD, Iryna Lobanova, MD , M. Fareed K. Suri, MD, S. Hasan Naqvi, MD, Brandi R. French, MD , Farhan Siddiq, MD, Camilo R. Gomez, MD, and Chi-Ren Shyu, PhD

Acute ischemic stroke may occur in patients with coronavirus disease 2019 (COVID-19), but risk factors, in-hospital events, and outcomes are not well studied in large cohorts. We identified risk factors, comorbidities, and outcomes in patients with COVID-19 with or without acute ischemic stroke and compared with patients without COVID-19 and acute ischemic stroke.

We analyzed the data from 54 health care facilities using the Cerner deidentified COVID-19 dataset. The dataset included patients with an emergency department or inpatient encounter with discharge diagnoses codes that could be associated to suspicion of or exposure to COVID-19 or confirmed COVID-19.

Stroke risk, phenotypes, and death in COVID-19

Systematic review and newly reported cases

Sebastian Fridman, MD, MPH, Maria Bres Bullrich, MD, Amado Jimenez-Ruiz, MD, Pablo Costantini, MD, Palak Shah, MD, Caroline Just, MD, Daniel Vela-Duarte, MD, MSCR, Italo Linfante, MD, FAHA, Athena Sharifi-Razavi, MD, Narges Karimi, MD, Rodrigo Bagur, MD, PhD, Derek B. Debicki, MD, PhD, Teneille E. Gofton, MD, David A. Steven, MD, MPH, and Luciano A. Sposato, MD, MBA

Correspondence
Dr. Sposato
Luciano.Sposato@LHSC.on.ca

Neurology® 2020;95:e3373-e3385. doi:10.1212/WNL.0000000000010851

Abstract

Objectives

To investigate the hypothesis that strokes occurring in patients with coronavirus disease 2019 (COVID-19) have distinctive features, we investigated stroke risk, clinical phenotypes, and outcomes in this population.

Methods

We performed a systematic search resulting in 10 studies reporting stroke frequency among patients with COVID-19, which were pooled with 1 unpublished series from Canada. We

COVID & Stroke- Developing Literature

Journal of
Clinical Medicine

MDPI

Article

SARS-CoV-2 Is a Culprit for Some, but Not All Acute Ischemic Strokes: A Report from the Multinational COVID-19 Stroke Study Group

Shima Shahjouei [1], Michelle Anyaehie [1], Eric Koza [2], Georgios Tsivgoulis [3], Soheil Naderi [4], Ashkan Mowla [1,5], Venkatesh Avula [1], Alireza Vafaei Sadr [6], Durgesh Chaudhary [1], Ghasem Farahmand [7], Christoph Griessenauer [1,8], Mahmoud Reza Azarpazhooh [9], Debdipto Misra [10], Jiang Li [11], Vida Abedi [11,12], Ramin Zand [1,*] and the Multinational COVID- Stroke Study Group [†]

1 Neurology Department, Neuroscience Institute, Geisinger Health System, Danville, PA 17822, USA; sshahjouei@geisinger.edu (S.S.); MAnyaehie@som.geisinger.edu (M.A.); mowla@usc.edu (A.M.); vavula1@geisinger.edu (V.A.); dpchaudhary@geisinger.edu (D.C.); cgriessenauer@geisinger.edu (C.G.)
2 Neuroscience Institute, Geisinger Commonwealth School of Medicine, Scranton, PA 18510, USA; EKoza@som.geisinger.edu
3 Second Department of Neurology, "Attikon" University Hospital, National and Kapodistrian University of Athens, School of Medicine, 12462 Athens, Greece; tsivgoulisgiorg@yahoo.gr
4 Department of Neurosurgery, Tehran University of Medical Sciences, Tehran 14155-6559, Iran; soheilnaaderi@gmail.com
5 Division of Stroke and Endovascular Neurosurgery, Department of Neurological Surgery, Keck School of Medicine, University of Southern California, Los Angeles, CA 90033, USA
6 Department de Physique Theorique and Center for Astroparticle Physics, University Geneva, 1211 Geneva, Switzerland; vafaei.sadr@gmail.com
7 Iranian Center of Neurological Research, Neuroscience Institute, Tehran University of Medical Sciences, Tehran 14155-6559, Iran; Ghasem.farahmand89@gmail.com
8 Research Institute of Neurointervention, Paracelsus Medical University, 5020 Salzburg, Austria
9 Department of Clinical Neurological Sciences, Western University, London, ON N6A 3K7, Canada; azarpazhoohr@gmail.com
10 Steele Institute of Health and Innovation, Geisinger Health System, Danville, PA 17822, USA; dmisra@geisinger.edu
11 Department of Molecular and Functional Genomics, Geisinger Health System, Danville, PA 17822, USA; jli@geisinger.edu (J.L.); vabedi@geisinger.edu (V.A.)
12 Biocomplexity Institute, Virginia Tech, Blacksburg, VA 24060, USA
* Correspondence: rzand@geisinger.edu
† Please see the supplemental material.

Citation: Shahjouei, S.; Anyaehie, M.; Koza, E.; Tsivgoulis, G.; Naderi, S.; Mowla, A.; Avula, V.; Vafaei Sadr, A.; Chaudhary, D.; Farahmand, G.; et al. SARS-CoV-2 Is a Culprit for Some, but Not All Acute Ischemic Strokes: A Report from the Multinational COVID-19 Stroke Study Group. *J. Clin. Med.* **2021**, *10*, 931. https://doi.org/10.3390/jcm10050931

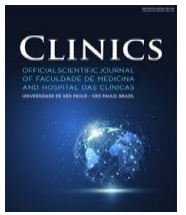
Academic Editor: Hugues Chabriat

Clinics 77 (2022) 100012

CLINICS
OFFICIAL SCIENTIFIC JOURNAL
OF FACULDADE DE MEDICINA
AND HOSPITAL DAS CLÍNICAS
UNIVERSIDADE DE SÃO PAULO – SÃO PAULO, BRAZIL

CLINICS

journal homepage: https://www.journals.elsevier.com/clinics



Review articles

Ischemic stroke in 455 COVID-19 patients

Josef Finsterer[a,*], Fulvio Alexandre Scorza[b], Carla Alessandra Scorza[b], Ana Claudia Fiorini[c,d]

[a] *Neurologiy and Neurophysiology Center, Vienna, Asutria*
[b] *Disciplina de Neurociência, Universidade Federal de São Paulo/Escola Paulista de Medicina (UNIFESP/EPM), São Paulo, SP, Brazil*
[c] *Programa de Estudos Pós-Graduado em Fonoaudiologia, Pontifícia Universidade Católica de São Paulo (PUC-SP), São Paulo, SP, Brazil*
[d] *Departamento de Fonoaudiologia, Escola Paulista de Medicina/Universidade Federal de São Paulo (EPM/UNIFESP), São Paulo, SP, Brazil*

ARTICLE INFO

Keywords:
Ischemic Stroke
Hypercoagulability
SARS-CoV-2
COVID-19
Neurology
Thrombosis

ABSTRACT

There is increasing evidence that COVID-19 can be associated with ischemic stroke (COVID-stroke). The frequency and pathogenesis of COVID-stroke, however, remains largely unknown. This narrative review aimed at summarizing and discussing current knowledge about frequency and pathogenesis of COVID-stroke in 455 patients collected from the literature. COVID-stroke occurs in all age groups and predominantly in males. The anterior circulation is more frequently affected than the posterior circulation. COVID-stroke is most frequently embolic. The severity of COVID-stroke ranges from NIHSS 3 to 32. Cardiovascular risk factors are highly prevalent in patients with COVID-stroke. COVID-stroke occurs simultaneously with the onset of pulmonary manifestations or up to 40 days later. Clinical manifestations of COVID-19 are most frequently mild or even absent. The majority of patients with COVID-stroke achieve complete or partial recovery, but in one-quarter of patients, the outcome is fatal. In conclusion, the frequency of ischemic stroke has not increased since the outbreak of the SARS-CoV-2 pandemic. COVID-stroke predominantly affects males and the anterior circulation. COVID-stroke is multifactorial but predominantly embolic and more frequently attributable to cardiovascular risk factors than to coagulopathy.

COVID & Stroke

- People with COVID & Stroke have a increased mortality & morbidity, worsening exam, & increased likelihood of ICU admission.
- The proportion of people experiencing stroke with COVID-19 infections is higher than other viral respiratory infections.
- Stroke can be a presenting clinical feature of a COVID-19 infection.
- Arterial thrombus related to hypercoagulability makes LVO a higher likelihood in young people.
- The gap in the evidence is real!

Seizure

Immune & Inflammatory Complications

Long COVID

Long COVID*

*What We Know So Far

JAMA Network | Open

Research Letter | Infectious Diseases

Sequelae in Adults at 6 Months After COVID-19 Infection

Jennifer K. Logue, BS; Nicholas M. Franko, BS; Denise J. McCulloch, MD, MPH; Dylan McDonald, BA; Ariana Magedson, BS; Caitlin R. Wolf, BS; Helen Y. Chu, MD, MPH

Introduction

Many individuals experience persistent symptoms and a decline in health-related quality of life (HRQoL) after coronavirus disease 2019 (COVID-19) illness.[1] Existing studies have focused on hospitalized individuals 30 to 90 days after illness onset[2-4] and have reported symptoms up to 110 days after illness.[3] Longer-term sequelae in outpatients have not been well characterized.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Methods

A longitudinal prospective cohort of adults with laboratory-confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was enrolled at the University of Washington with a concurrent cohort of healthy patients in a control group (eAppendix in the Supplement). Electronic inform[illegible] the study was approved by the University of Washington human

nature reviews microbiology

https://doi.org/10.1038/s41579-022-00846-2

Review article

Check for updates

Long COVID: major findings, mechanisms and recommendations

Hannah E. Davis [1], Lisa McCorkell [2], Julia Moore Vogel [3] & Eric J. Topol [3]

Abstract

Long COVID is an often debilitating illness that occurs in at least 10% of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections. More than 200 symptoms have been identified with impacts on multiple organ systems. At least 65 million individuals worldwide are estimated to have long COVID, with cases increasing daily. Biomedical research has made substantial progress in identifying various pathophysiological changes and risk factors and in characterizing

Sections

Introduction

Major findings

Diagnostic tools and treatments

Impact of vaccines, variants and reinfections

Challenges and

Evolving Treatment Evidence

Microsoft stock image-Accessed July 2021

Medications & Therapeutic Treatments

- Vaccination
- Antiviral treatments
- Anticoagulation
- ACE Inhibitors
- Corticosteroids

Nursing Best Practice

Evaluating the Patient's Stroke Risk

- Maintain a high suspicion until COVID has resulted
- Understand the PMH
- Assess vaccination & exposure history
- Serum labs
- Multisystem organ assessments

Neurologic Assessment!

- Maintain consistency in assessment & documentation
- Perform & confirm neurologic assessments at handoff
- Ensure assessment of hospitalized patients includes: LOC, Language & Speech, CN, Motor & Sensation
- Prioritize eye movements & pupillary reaction in critically ill patients or those with altered level of consciousness

Neurological Assessment of the Adult Hospitalized Patient

Susan D. Bell, MS APRN-CNP CNRN
Chen-Chen T. Lee, MSN ARNP-CNS RN-BC ACNS-BC CNRN SCRN
Julie Zeeman, MS RN CNS-BC CNOR CNRN SCRN CCRN
Michelle Kearney, DNP APRN ACNP-BC
Lauren Macko, MSN RN ACCNS-AG CCRN SCRN
Cathy C. Cartwright, DNP RN-BC PCNS FAAN

AANN
American Association of Neuroscience Nurses

Nursing Priority Interventions

- Safety & prevention (Fall risk, HAI, Aspiration pneumonia)
- Medication Therapy
- Blood pressure management
- Continued assessment for neurologic changes
- Facilitating family communication & collaboration

A Few More Patient Cases!

Patient Case #2

Patient Case Review

- 69 year old male
- PMH: DM, CAD, HTN, OSA
- ED arrival with cough, fever, & SOB
- Acute inpatient admission for 4 days – COVID +
- Discharged home on Day 4
- Returned to the ED with persistent vertigo and n/v for 24 hours after being home 2 days

Patient Case Continues

- MRI in the ED negative for stroke.
- Admitted and treated with hydration, antiemetics, anti-vertigo meds.
- He was started on steroids for presumed labyrinthitis.

Patient Case Continues

- ✓Woke up with right hand numbness and weakness.
- ✓MRI brain repeated that shows a right PCA infarct.
- ✓MRA of the demonstrated vertebral artery dissection.

Patient Summary

- Remained inpatient for 4 days, evaluated for acute rehab but was deemed more appropriate for SNF with Rehab initially.

- Antiplatelet therapy- recommend dual antiplatelet therapy- Aspirin 325 mg daily and Plavix 75 mg daily for 3 weeks- transition to Eliquis

Patient Case #3

Patient Case Review

- Patient is a 60-year-old female
- PMH: prediabetes, HLD, Hx of latent TB s/p INH
- Presented with confusion to the ED. The patient noted while driving to have trouble staying in the lane & difficulty working the phone. Was with spouse, pulled over & called 911
- On arrival to the ED having trouble following simple commands

Patient Case Continued

- **Non Contrast Head CT:** Large intraparenchymal hematoma in the posterior right frontal lobe with surrounding edema.
- Local mass effect & 3mm leftward midline shift.

Continuing on:

- Doesn’t take any medications or natural supplements
- No recent head trauma
- COVID 19 positive (Screened as part of admit protocol)

Patient Case Summary

- Thrombocytopenia on admission – Platelets < 100
- Admitted to critical care
- VS: 37.9, HR 70 (regular), BP 134/60, SpO2 92% on RA
- No NSG indicated at the time of inpatient admission
- No etiology
- COVID +- Resulted on swab done for admission
- Discharged home after day 17

Thank you!

References

- Bell, S.D., Lee, C.C.T., Zeeman, J., Kearney, M., Macko, L., & Cartwright, C.C. (2021). Neurologic assessment of adult hospitalized patients. *AANN White Paper.*
- Davis, H.E., McCorkell, L., & Vogel, J.M. et al. (2023). Long COVID: major findings, mechanisms and recommendations. *Nature Reviews Microbiol*ogy. *21*, 133–146.
- Fridman, S, Bullrich, M.B., Jimenez-Ruiz, A., & et al . (2020). Stroke risk, pheynotypes, and death in COVID-19: Systematic review and newly reported cases. *Neurology*, e3373-e3385.
- Hingori, K.S., Bhadola, S., & Cervantes-Arslanian, A.M. (2022). Covid-19 and the Brain. Trends in Cardiovascular Medicine. 32, 323-330

References

- Kansagra, A., Goyal, M., Hamilton, S., & Albers, G. (2020). Collateral effect of Covid-19 on stroke evaluation in the United States. *New England Journal of Medicine*, 383(4), 400-401.
- Merkler, A., Parikh, N., Mir, S., et al. (2020). Risk of ischemic stroke in patients with coronavirus disease 2019 (COVID-19) vs patients with influenza. *JAMA Neurology*, *77*(11), 1366.
- Oxley, T., Mocco, J., Majidi, S., et al. (2020). Large-vessel stroke as a presenting feature of Covid-19 in the young. *New England Journal of Medicine, 382(20*), e60.
- Qureshi, A.I., Baskett, W.I., Huang, W., et al. (2021). Acute Ischemic Stroke and COVID-19. *Stroke.* 905-912.
- Trougakos, I.P., Stamatelopoulos, K., Terpos, E., et al. (2021). Insights to SARS-CoV-2 life cycle, pathophysiology, and rationalized treatments that target COVID-19 clinical complications. *Journal of Biomedical Science, 28(9*). 1-18