Physical Therapy Considerations of Neurologic Presentations in COVID-19

Hosts
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Presenters
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Sponsors
Objectives

• Recall a brief overview of the pathophysiology of COVID-19 as it relates to the neurologic system
• Discuss emerging evidence related to neurologic impairments found in patients diagnosed with COVID-19
• Consider the importance of vital sign monitoring when working with neurologic patients with this condition
• Review assessment of delirium, weakness and other impairments found in this population
• Discuss treatment strategies
Neurologic Implications of COVID-19 Pathophysiology

Vital Signs and Hemodynamics

Presented by

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Proposed COVID-19 Staging

**Stage I** (Early Infection)
- Viral response phase
- Clinical Symptoms: Mild constitutional symptoms (Fever >99.5°F, Dry Cough, diarrhea, headache)
- Clinical Signs: Lymphopenia, increased prothrombin time, increased D-Dimer and LDH (mild)
- Potential Therapies: Remdesivir, chloroquine, hydroxychloroquine, convalescent plasma transfusions

**Stage II** (Pulmonary Phase)
- IIA: Shortness of Breath, Hypoxia (PaO2/FiO2 ≤ 300 mmHg)
- IIB: Abnormal chest imaging, Transaminitis, Low-normal procalcitonin

**Stage III** (Hyperinflammation Phase)
- Host inflammatory response phase
- ARDS, SIRS/Shock, Cardiac Failure
- Elevated inflammatory markers (CRP, LDH, IL-6, D-dimer, ferritin, Troponin, NT-proBNP elevation)

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Siddiqu 2020
Neurologic Sequela of Sepsis

Sepsis
Peripheral cytokines

Endothelial activation

Neural pathway
Blood-Brain Barrier alterations
Humoral pathway

Microglial activation

Circulatory failure
Systemic hypotension
Cerebral blood flow dysregulation

NO, cytokines and ROS release in brain parenchyma

Metabolic disturbances
glucose dysregulation, dysnatremias, prolonged hypoxemia, fever

Environmental factors
Physical restraints
Light exposure
Noise ...

Acute brain dysfunction

Long-term neurologic sequelae

Medications

Sonneville 2013
From Delirium to Dementia

Chung 2020
Olfactory Nerve Entry Point for COVID-19

Wu 2020
Pathways of Potential Virus Associated Neurologic Injury and Impairment

Wu 2020
ACE2 Receptor Mediated COVID-19 Neurologic Injury

Baig. 2020.
Cytokine Storm to Coagulation Cascade

Zhou 2020, Lippi 2020
Cerebral Hemodynamics

Factors Affecting Cerebral Blood Flow and Intracranial Pressure

References


STREAMLINING YOUR ASSESSMENT FOR COVID-19 PATIENTS

Sowmya Kumble, PT, MPT, NCS
Clinical Resource Analyst
Johns Hopkins Hospital
• Chart review
• Medications
• Assessment of cognition
• Cranial Nerve Exam
• Vital signs
• Neuromuscular/Musculoskeletal System
• Integumentary system
Chart review

• Co-morbidities (old stroke, any other NM disorders, seizures, dementia, psychiatric, HTN, DM)
• Baseline functional status
• Lab values (troponins, D-dimer)
• Orders – O2 titration
• Imaging (CT/MRI brain)/EEG reports if done
• Medications – CNS side effects of sedation/paralytics
Medications

• Sedative-analgesics
  – Benzodiazepines (Midazolam)
  – Opioid analgesics (Fentanyl/Propofol)
  – Antipsychotics (Haloperidol)
  – α2-adrenoceptor agonists – Dexmedetomidine (Precedex)

• Neuromuscular blocking agents
  – Vecuronium

• Vasopressors (if <60 mmHg of MAP)
  – Norepinephrine(Levophed)

• Inotropes w/ vasodilator effect
  – Dobutamine
Cognition

- Beyond AOx3
- Arousal
  - Richmond Agitation Sedation Scale (RASS)
- Speech/Communication
- Safety awareness

### RASS Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4</td>
<td>Combative</td>
</tr>
<tr>
<td>+3</td>
<td>Very Agitated</td>
</tr>
<tr>
<td>+2</td>
<td>Agitated</td>
</tr>
<tr>
<td>+1</td>
<td>Restless</td>
</tr>
<tr>
<td>0</td>
<td>Calm and Alert</td>
</tr>
<tr>
<td>-1</td>
<td>Drowsy; eye opening &amp; contact ≥ 10 secs</td>
</tr>
<tr>
<td>-2</td>
<td>Light sedation; eye open &amp; contact &lt; 10 sec</td>
</tr>
<tr>
<td>-3</td>
<td>Moderate sedation (Movement or eye opening to voice; no eye contact)</td>
</tr>
<tr>
<td>-4</td>
<td>Deep sedation; no response to voice, eye open to physical stimulation</td>
</tr>
<tr>
<td>-5</td>
<td>Unarouseable</td>
</tr>
</tbody>
</table>
Delirium

“Disturbance in consciousness and cognition that develops over a short period of time (eg, hours to days) and tends to fluctuate during the course of the day”

The American Psychological Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV*

- **Risk factors**
  - Predisposing factors (baseline)
  - Precipitation factors (hospitalization –related)
## Risk factors for Delirium

<table>
<thead>
<tr>
<th>Age</th>
<th>Severity of illness</th>
<th>Lack of daylight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTN</td>
<td>Respiratory disease</td>
<td>Isolation</td>
</tr>
<tr>
<td>Pre-existing cognitive deficit/Dementia</td>
<td>Need for mechanical ventilation</td>
<td>Lack of visitors</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>Medications (sedatives – Benzos; opiates)</td>
<td>Immobility</td>
</tr>
<tr>
<td>Depression</td>
<td>Hypotension</td>
<td>Sleep deprivation</td>
</tr>
</tbody>
</table>
ICU Delirium - Screening

• Screening tools:
  – Confusion Assessment Method (CAM)- ICU
  – Intensive Care Delirium Screening Checklist (ICDSC)
1. Acute change or fluctuating course of mental status over the past 24 hours

2. Inattention:
   * Squeeze my hand when I say the letter ‘A’
   * SAVE A HAART

3. Altered level of consciousness (Current RASS)
   - RASS = 0

4. Disorganized thinking:
   1. Will a stone float on water?
   2. Are there fish in the sea?
   3. Does one pound weigh more than two
   4. Can you use a hammer to pound a nail?

**CAM-ICU**

- RASS ≠ 0
  - CAM-ICU positive
  - Delirium present

- >1 error
  - www.icudelirium.org
Types of Delirium

- Hypoactive
  - Lethargic/drowsy/infrequent spontaneous movement
- Hyperactive
  - Agitated/combative/risk for self-extubation/falls/line dislodgment
- Mixed
Cranial nerves

- CN I – Smell
- CN II – Asymmetrical pupil size; reaction to light
- CN III, IV, VI- Oculomotor (eye movements)
- CN V - Facial sensation, if awake and oriented
- CN VII- Facial movements/sensation of tongue
- CN VIII- Vestibular/ hearing
- CN IX and X - taste/hoarseness of voice
- CN XI – shoulder shrug (Trapezius) & head rotation (SCM)
- CN XII – Tongue movement
Vital Signs

- Breathing pattern
- Accessory muscle use
- O2 saturation / O2 requirement
- Blood pressure (Mean arterial pressure)
- Heart rate (Tachycardic → PE)
- EKG abnormalities
- RPE scale, if alert/oriented
Neuromuscular/Musculoskeletal

- Observation - Abnormal posture/positioning
  - foot drop /shoulder subluxation
- Tone
- ROM
- Muscle strength (Brachial Plexus Injuries/PNI/ ICU acquired weakness/Stroke/Guillain-Barré Syndrome):
  - Symmetrical vs Asymmetrical
  - Proximal vs Distal
  - UE vs LE
- Sensation – Touch/Proprioception
- Coordination
- Balance – static/dynamic/ functional
Integumentary System

• Positioning
  – Prone
• Pressure relief
Functional mobility & hemodynamic stability

- Positional changes
  - Raising the head of bed gradually
  - Continuous monitoring for tolerance to position change

- O2 saturation
  - time to recover
  - additional O2 needs to recover (Titrate as needed if ordered)

Take Home Messages

• Oxygenation & perfusion is vital for brain function
  – PT role in early detection of neurological manifestations

• Adverse effect of prone positioning
  – Screen for peripheral nerve injuries

• As much info in very little contact time

• COVID-19 is NOT JUST a pulmonary condition
  – “Patient as a whole”
PT Management of Patients with COVID-19

Akanshka Verma, PT MA
NCS
REHAB MANAGEMENT OF COVID-19 patients

Goals of a rehab program:

- reducing the complications associated with a prolonged ICU stay
- improving tolerance to activity
- improve cognitive and emotional domains, in order to
  - promote the quality of life and
  - facilitate home discharge
REHAB MANAGEMENT OF COVID-19 patients

- Acute ICU phase
  - Assistance with proning to improve oxygenation
  - Prevention of skin breakdown
  - Management of ICU delirium/encephalopathic changes/CNS changes due to metabolic disarray
  - Management of cognitive changes
Importance of diagnosing and managing ICU delirium

- Delirium is defined as a disturbance of consciousness, with inattention accompanied by a change in cognition or perceptual disturbance that develops over a short period (hours or days) and fluctuates over time.

- 60-80 percent of ICU patients on mechanical ventilation experience delirium

- One in three patients with ARDS experiences PTSD a year after the medical event

- Assessment of delirium
  Confusion assessment method for ICU- CAM

Factors that increase risk of delirium
- HTN
- Smoking
- Pre Existing dementia
- Obesity
- Precipitating factors are hypoxia, metabolic disturbances, withdrawal syndromes, dehydration, and medications.
  - Loss of sleep awake cycles, sleep deprivation, excessive noise, lighting
Delirium

- Disorganized thinking
- Fluctuating Mental status
- Acute disturbance in cognition
- Acute mental Status changes
- Psychomotor disturbance
- Inattention
## Management of Post ICU Delirium

**ABCDEF (A2F) bundle**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Assessment &amp; Management of pain</td>
</tr>
<tr>
<td>B</td>
<td>Spontaneous Awakening trial &amp; Spontaneous Breathing trial</td>
</tr>
<tr>
<td>C</td>
<td>Choice of analgesia &amp; sedation</td>
</tr>
<tr>
<td>D</td>
<td>Delirium: assess, prevent &amp; manage</td>
</tr>
<tr>
<td>E</td>
<td>Early mobility &amp; exercise</td>
</tr>
<tr>
<td>F</td>
<td>Family engagement &amp; empowerment</td>
</tr>
</tbody>
</table>
Management of Post ICU Delirium

- Management must be specific to Patient population
- Repeated reorientation of patients
- Provision of cognitively stimulating activities
- ROM exercises
- Early mobilization with caution
- Timely removal of noxious factors- restraints, catheters
- Delirium specific multidisciplinary education of staff
REHAB MANAGEMENT OF COVID-19 patients

Acute non-critical care management:

- Closely monitor for worsening of respiratory status & orthostatic changes
- Low intensity, interval training
- Outcome measures
- Cognition
  - Subjective measures of fatigability
Modified rate of perceived exertion

<table>
<thead>
<tr>
<th>RPE Scale</th>
<th>Rate of Perceived Exertion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Max Effort Activity</strong></td>
</tr>
<tr>
<td>10</td>
<td>Feels almost impossible to keep going. Completely out of breath, unable to talk. Cannot maintain for more than a very short time.</td>
</tr>
<tr>
<td>9</td>
<td><strong>Very Hard Activity</strong></td>
</tr>
<tr>
<td></td>
<td>Very difficult to maintain exercise intensity. Can barely breath and speak only a few words</td>
</tr>
<tr>
<td>7-8</td>
<td><strong>Vigorous Activity</strong></td>
</tr>
<tr>
<td></td>
<td>Borderline uncomfortable. Short of breath, can speak a sentence.</td>
</tr>
<tr>
<td>4-6</td>
<td><strong>Moderate Activity</strong></td>
</tr>
<tr>
<td></td>
<td>Breathing heavily, can hold short conversation. Still somewhat comfortable, but becoming noticeably more challenging.</td>
</tr>
<tr>
<td>2-3</td>
<td><strong>Light Activity</strong></td>
</tr>
<tr>
<td></td>
<td>Feels like you can maintain for hours. Easy to breathe and carry a conversation</td>
</tr>
<tr>
<td>1</td>
<td><strong>Very Light Activity</strong></td>
</tr>
<tr>
<td></td>
<td>Hardly any exertion, but more than sleeping, watching TV, etc</td>
</tr>
</tbody>
</table>

https://www.cdc.gov/physicalactivity/basics/measuring/exertion.htm

https://thefittutor.com/rpe-scale/
The rehab phase

- Understanding of patient specific impairments & activity limitations

- Aerobic exercise: for those cases with respiratory/motor problems and physical deconditioning, incorporate functional tasks

- Strength training for peripheral muscle weakness

- Static and dynamic balance training for balance dysfunction

- Neuropsychological training: counselling sessions, psychological support, and cognitive training.
REHAB MANAGEMENT OF COVID-19 patients

Exercise Prescription

- **Mode**
  - Self-care and functional training
  - Aerobic – postural change, supervised ambulation
  - Breathing with overhead activities.
    - Pair inhalation and exhalation patterns with movement to enhance the motor task and improve oxygenation

- **Intensity**
  - Consider using RPE
  - Correspond SpO2 ratings with RPE scale in order to be independent with pacing

- **Duration**
  - Begin with intermittent bouts lasting 3-5 minutes as tolerated
  - Rest periods at patients’ discretion
    - Aim for shorter rest than exercise – 2:1 ratio

- **Frequency**
  - Consider all disciplines that interact with patients
REHAB MANAGEMENT OF COVID-19 patients

**Patient Education**

- Instruct to watch for signs of hypoxemia at home
- Energy conservation techniques
- Walking program
- Field questions as you are able re: diagnosis and disease progression
- Handouts
References

An updated study-level meta-analysis of randomised controlled trials on proning in ARDS and acute lung injury F Abroug, I Ouanes-Besbes, F Dachraoui, I Ouanes… - Critical Care, 2011

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