The First 60 Days: Physical Therapy in a Neurosurgical Center Converted Into a COVID-19 Center in Brazil

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Objective. The purpose of this case report was to describe the role of physical therapists in a neurosurgical center that was converted into a COVID-19 center for critically ill patients.

Methods (Case Description). On March 16, 2020, the state government of Rio de Janeiro, Brazil, determined that a neurosurgical center with 44 ICU beds equipped with mechanical ventilators should immediately transfer all patients with neurological conditions to other institutions and prepare for patients who were critically ill with COVID-19. The staff, including physical therapists, were trained to handle patients with COVID-19, many of whom were developing acute respiratory distress syndrome (ARDS) with complex and multifactorial ventilatory support needs. Adjustments were made to the physical therapy routine and protocols. Following the stabilization of patients’ respiratory condition, physical therapist interventions focused on restoring physical function.

Results. A total of 116 confirmed COVID-19 cases were treated from March 17 to May 17, 2020. Sixty percent were men (70) and 40% were women (46), with a median age of 59 years. Eighty-nine percent (103) underwent mechanical ventilation during hospitalization, of which 11% (11) were successfully extubated. Thirty percent (31) of patients underwent tracheostomy, and 26% of those (8) were successfully decannulated. Of the total patients, 57 patients died (mortality rate of 49%), 4 (3%) were transferred to another institution, 23 (20%) were discharged home, and 32 (28%) continued to be hospitalized.

Conclusion. Physical therapists in the ICU can facilitate care for critical events such as intubation, patient positioning, ventilatory adjustments, extubation, and functional training.

Impact. The coronavirus pandemic has highlighted the importance of physical therapists, specifically in the care of patients who are critically ill with COVID-19. The availability and expertise of physical therapists in the ICU are important for managing critical events such as intubation, patient positioning, ventilatory adjustments, extubation, and functional training.
Physical therapists are part of the professional teams involved in the management and care of patients infected with coronavirus disease (COVID-19). Their specific role varies widely in different parts of the world. In several countries, the emphasis of physical therapy is on restoring physical function and rehabilitation; in others, the focus rests predominantly on ventilatory care. In Brazil, where respiratory therapy is not viewed as a separate field, the patient's ventilatory management is performed by physicians and physical therapists in the intensive care unit (ICU).

The work dynamic of ICU-based physical therapy in Brazil is different when compared with settings in which respiratory therapists perform respiratory and ventilatory care. According to Brazilian National Health Surveillance Agency regulations, a certified ICU must have at least 1 physical therapist for every 10 ICU beds. Brazilian physical therapists are part of the decision-making team for invasive and noninvasive ventilatory management. In times of COVID-19, this means being at high risk for contamination and aerosol-generating procedures—intubation, extubation, and noninvasive ventilation procedures—placing physical therapists in direct contact with SARS-CoV-2 (the virus causing COVID-19).

Becoming a COVID-19 Center for People Who Are Critically Ill

The first reported case in China occurred on December 1, 2019; the first death in Wuhan province was reported on January 11, 2020; and, on March 13, the United States had already declared a national health emergency. The first confirmed case in Brazil was on February 26, and the first death was registered on March 17. By that date, Brazil was far behind in preparations for COVID-19: hospitals were already reporting personal protective equipment (PPE) shortages; viral testing was being conducted only in patients who were critically ill, contradicting recommendations by the World Health Organization; and public hospitals in the country already were reporting 95% occupancy of ICU beds. Instituto Estadual do Cérebro Paulo Niemeyer (IECPN) is a public neurosurgical center of excellence with 44 ICU beds in Rio de Janeiro, Brazil. Until early March 2020, it handled a vast range of neurosurgical procedures, from aneurysmal repairs to complex tumor resections. The emergency conversion of IECPN into a COVID-19 center for people who were critically ill occurred on March 16. On that date, the state government of Rio de Janeiro determined the hospital should immediately transfer all patients with neurological conditions to other institutions and get ready for patients who were critically ill with COVID-19. IECPN had to write its own unprecedented conversion roadmap. After suspending scheduled neurosurgeries and transferring all patients, the hospital equipped all 44 ICU beds with mechanical ventilators and began training the staff for their new role. Our team of physical therapists, until then proficient in treating patients after neurological surgery, started to handle patients critically ill with COVID-19, many of whom were developing acute respiratory distress syndrome (ARDS) with complex and multifactorial ventilatory support needs.

Team Resizing and Restructuring

The department, originally staffed with 37 physical therapists, was increased by an additional 18 hires to meet the influx of patients requiring constant mechanical ventilation adjustments and complex care. Reports of increased contamination among health care workers abroad were also contemplated for possible future sick leave.

Other disciplines also quickly adapted to the new demands. Anesthesiologists, who normally assisted in neurosurgeries, became part of the team of intensivists caring for patients with COVID-19. Their expertise in difficult intubations and other invasive procedures were of immense benefit. Outside physicians joined the inhouse intensivist staff, and neurointensive care pediatricians began caring for adult patients. Adaptability became the greatest challenge for each member of every team.

On March 17, the first patient with COVID-19 arrived, 1 day after receiving the state guidelines to convert. All 44 beds were occupied in the succeeding weeks and have since been fully occupied with patients with COVID-19.

Planning and Training

As the staff began receiving specific PPE (protective glasses, N95/PPF2 masks, rubber-soled shoes, face shields, and impermeable gowns), the infectious disease (ID) control team created training protocols on the proper use of each PPE. Knowing that most health care professional contamination occurs during the donning of PPE, special care was given to the proper sequence of donning and discarding each item. The training sessions were led by the ID physician and nurses, who ensured that every professional correctly demonstrated the donning/doffing sequencing. All staff practiced 2 to 3 times in group sessions that lasted 30 to 40 minutes.

Another cause for concern was the continuous reports of worldwide PPE unavailability and the ongoing perception that IECPN could also run short of such crucial equipment. As suppliers struggled to provide the items and keep up with the hospital’s demands, the infection...
control team implemented extended-use and limited-reuse guidelines to prevent PPE shortage during times of peak demand. The N95/PFF2 masks, which were discarded following each use prior to the COVID-19 outbreak, had to be reused for 30 consecutive days. The once disposable impermeable gowns were now used for extended periods (2 gowns per 12-hour shift).

As of mid-June, 8 of the 55 physical therapists (15%) at IECPN have tested positive for SARS-CoV-2. All of these infected professionals also worked extra shifts at different institutions.

Proning Protocol
From the early months of the pandemic, articles in medical journals suggested that the prone position, widely used since the 1990s to increase oxygenation in patients with ARDS,20 could be effective for appropriately selected patients with COVID-19.21,22 This information led to a hospital-wide effort, led by the physical therapy department, to develop and implement a protocol for prone positioning in patients who are mechanically ventilated. Although the procedure was uncommon in our pre-coronavirus routine for neurosurgical patients, we provided training in proning to all health care professionals handling patients with COVID-19.

The “bed sheet envelope-technique”23 was adopted based on the experience of senior physical therapists and in conjunction with colleagues from other hospitals in Rio de Janeiro. Essentially, this technique uses 2 bedsheets to wrap the patient and allows the patient to be swaddled for a 3-point turn to be performed in sequential movements: first, the patient is moved to the side of the bed opposite of the mechanical ventilator; next, the patient is placed in side-lying, and then turned to the prone position.23 Mock bedside training stations were set up for practice sessions. Figures 1 through 6 show the sequence of the maneuver during practice sessions. (Consent forms were obtained from all team members who participated in the training, of which photographs were taken.) The maneuver
requires a team of 5 professionals: 1 physician, 1 nurse, 1 physical therapist, and 2 nursing technicians (or another physical therapist, if possible). It is a high-risk procedure because accidental extubation can lead to the patient's death and environment contamination. Relying on their expertise in airway management, anesthesiologists were designated to be stationed at the headboard to reintubate promptly if needed. Rigorous team synchronization and effective communication were essential. Each nurse, nurse's aide, physician, and physical therapist was trained at least once for the specific sequence of events by performing a simulation of the maneuver using one of the staff members as a mock patient. This preparation led to increased staff confidence for the arrival of the first patient. As of June, no adverse event has been registered in over 72 proning maneuvers.

Adjustments to the Physical Therapy Routine and Protocols

The regular monthly journal clubs and weekly inservice discussions related to our usual neurosurgical patient population were temporarily suspended. New physical therapy protocols were developed or adjusted, according to the current patients' clinical needs.

The weaning protocol was adapted to the new patient profile and consisted of a 3-step assessment:

1. Evaluation of the patient's readiness to undergo the spontaneous breathing trial (SBT) checklist: resolution of the cause that led to intubation, absence of fever, partial pressure of arterial oxygen/fraction of inspired oxygen (PaO2/FiO2) ≥200 mm Hg, positive end-expiratory pressure (PEEP) ≤8 cm H2O, pressure support (PS) ≤10 cm H2O, and FiO2 ≤40%.

2. If approved on all items, the patient would undergo the SBT in a closed system with PS of 5 cm H2O and PEEP of 0 cm H2O for 60 minutes.

3. If approved on step 2, the patient's ability to protect the airway was assessed prior to artificial airway removal: the patient was asked to follow 4 simple commands, and coughing was assessed using closed-system tracheal aspiration. The institutional extubation protocol was also adjusted to include the use of an acrylic box and the administration of...
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Figure 5.
The patient is appropriately positioned with rolls and pillows, according to body shape to ensure appropriate thoracic expansion during ventilation and to decrease pressure areas. The patient is positioned in the alternate “swimmer position”—raising one arm overhead while placing the other arm at the patient’s side. The neck is rotated towards the side of the ventilator.

intravenous lidocaine (by the medical team or nursing) to decrease coughing, 2 techniques meant to reduce droplet spread during the procedure.25,26

A specific protocol for the application and management of noninvasive ventilation took into account the high transmissibility of the virus and ways to minimize staff contamination during this procedure.27 Specific measures included using double-limb breathing circuit, full face masks, high-efficiency particulate air (HEPA) filter, and, when available, an isolation room.27

Following the stabilization of the patient’s respiratory condition, the physical therapist interventions focused on restoring physical function. When the patient lacked trunk control, physical therapists regularly used the tilt-table, and, prior to discharge, all patients sat at the edge of the bed, stood, and walked during the physical therapy session.

Figure 6.
Proper position is verified. Check that lines and tubes are not pressing against skin and catheters and mechanical ventilator tubing is not kinked.

Snapshot
A total of 116 confirmed COVID-19 cases were treated from March 17 to May 17, 2020. Sixty percent were men (70) and 40% were women (46), with a median age of 59 years. Eighty-nine percent (103) of these patients underwent mechanical ventilation during hospitalization, of which 11% (11) were successfully extubated. Thirty percent (31) of patients underwent tracheostomy, and 26% of those (8) were successfully decannulated. Of the total patients, 57 patients died (mortality rate of 49%), 4 (3%) were transferred to another institution, 23 (20%) were discharged home, and 32 (28%) continue hospitalized.

Conclusion
The day our institution opened its doors for the first patient with COVID-19, there were 291 confirmed cases in Brazil. As of the date this report was revised, the country holds third place in global ranking on number of confirmed cases, tallying 4,330,455 cases and 131,625 deaths.28 The role that physical therapists played in the
treatment of the patients with COVID-19 thus far has been fundamental throughout the entire hospitalization period. The availability and expertise of physical therapists in our ICU has facilitated care for critical events such as intubation, patient positioning, ventilatory adjustments, extubation, and functional training.

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