Impact of Early Mobilization Added to Respiratory Physiotherapy Postextubation on Weaning Success

To the Director,

A significant number of patients with severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) disease developed acute respiratory distress syndrome (ARDS)\(^1\) and invasive mechanical ventilation (IMV) is cornerstone in its supportive treatment. Within this pandemic situation with a focus on critical patients over those on mechanical ventilation, we considered how to improve the hospital stay. Clinicians face several challenges when taking care of COVID-19 patients,\(^2\) and intensive care unit (ICU) acquired weakness (AW) – (ICU-AW) – is historically one of those specially in IMV patient.

Chest physiotherapy (CPT) in the mechanically ventilated patient has been recognized as an essential component of respiratory care within the ICU. The main goal of CPT includes airway clearance that helps reduce airway resistance and improve lung compliance.\(^3\)\(^4\) The benefits of CPT are reflected in a reduced incidence of ventilator associated pneumonia (VAP), reduced duration of ICU stay and greater success of liberation from mechanical ventilation. Moreover, ICU acquired weakness (ICU-AW) is a potential risk factor for extubation failure and prolonged weaning, increasing patient mortality and morbidity by up to 25%.\(^5\)\(^6\) The integration of early mobilization (EM) protocols in ICUs has been recognized as a preventative strategy against the incidence of ICU-AW with strong recommendations (Grade 2+) supporting their use for extubation success.\(^7\)\(^8\) However, there is no evidence that promotes the combination of EM with early CPT following extubation to increase weaning success. During the COVID-19 pandemic, there has been a high incidence of ICU-AW and prolonged weaning from invasive mechanical ventilation (IMV), which may consequently prolong ICU and hospital length of stay.\(^9\)\(^10\) Therefore, the aim of our study is to determine whether early CPT following extubation reduces the risk of reintubation with in 24–72 h, in addition to an EM protocol in a COVID-19 population.

An observational study was completed at the ICU of Vall d’Hebron Hospital. Adult patients admitted to ICU with severe SARS-CoV-2 pneumonia for IMV care were studied. Severe respiratory illness was defined as acute respiratory distress syndrome (ARDS) in accordance with the Berlin criteria.\(^11\) Only patients who received intubation via an endotracheal tube were studied, where tracheostomized patients and prolonged weaning cases were excluded. Prolonged weaning is defined as failure of 3 spontaneous breathing trials (SBT) or ongoing need for IMV 7 days after the first SBT.\(^12\) The weaning protocol included daily screening for weaning readiness according to general criteria and extubation failure, which was defined as the need for reintubation within 48 h of tube removal.\(^3\) Spontaneous breathing trials were performed, varying between T-piece and pressure support ventilation.\(^13\)

All patients received CPT during mechanical ventilation, however not all patients received CPT within two hours of IMV withdrawal. This situation occurred in cases when extubation took place outside of physiotherapy service hours and when extubation took place during weekend hours when the on-call physiotherapist was not informed. CPT sessions following extubation included treatments such as airway clearance techniques, assisted cough using mechanical in-exsufflation devices, manual hyperinflation, rib cage compressions, positive expiratory pressure devices and inspiratory muscle training. In addition, an EM protocol was followed for all patients within the first 24 h of initiating IMV, with the sole exception of cases with hemodynamic instability or pulmonary thromboembolism. Deep sedation or neuromuscular blockade was not an absolute contraindication to EM. In cases where patients were proned, EM was not implemented until they were supinated.

The EM interventions included active, assisted or passive limb mobilization, cycle-ergometry, transfers to sitting and standing. The duration of EM sessions was a total of 1 h/day/patient (30 min, twice daily). The outcome measures included extubation success, days of IMV, length of ICU stay and hospital survival. The study was approved by the local Clinical Research Ethics Committee (PR(CTR)164/2021).

Twenty-eight patients were included in this study. The main characteristics of our population, such as age, gender and comorbidities, are presented in Table 1. Prone ventilation and neuromuscular blockade was used in 57% and 82% of the population, respectively. The main complication during IMV was VAP [20 (71%)]. All patients required high-flow nasal cannula (HFNC) post-extubation [28 (100%)], where 7% required additional support from non-invasive ventilation (NIV). As there were no contraindications in our sample, EM protocol was implemented for all patients and no patient was denied EM treatment [28 (100%)]. CPT within two hours of extubation was provided to 32% of our study population. This study shows that only two patients (7%) required reintubation and eventual need for a tracheostomy.

Our study is the first to investigate how the combination of early CPT within 2 h of extubation and an EM protocol may imply a decrease in extubation failure rate. In a similar approach to ours, a randomized controlled study in Taiwan observed that EM and CPT during IMV significantly reduced the reintubation rate by half [8% vs 16%].\(^13\) However, unlike our research, this study considers the benefits of CPT during IMV and not immediately after extubation. On the whole, research regarding physiotherapy in weaning from IMV mainly focuses on EM protocols. The benefits of EM in the ICU were first studied in 2008 for their association with a decreased length of ICU stay when compared to standard care.\(^1\) However, unlike in our study where EM began within 24 h, this study began EM within 48 h of initiating IMV. A more recent study considered a
multimodal rehabilitation program for IMV patients however this was provided to a prolonged weaning group, with IMV for greater than 14 days.17 It does not consider early CPT post extubation in simple weaning and first attempt extubation. Moreover, the general evidence suggests that there is a 10–20% of reintubation rates following planned extubation in ICUs.18 However, in a more recent study, where the use of CPT and EM was not considered, the extubation failure rate was 38% as opposed to our study’s 7%; thus highlighting the importance of our findings. It is key to mention that in our study, extubation success may have also been supported by using HFNC for all of our patients. Hernandez et al described a reintubation rate of 22.8% with the use of HFNC post extubation, however this was not a study that included the use of CPT post extubation and EM protocols, alongside HFNC.

We recognize that our study has several limitations. This study is a single-center study and the typology of patients only includes those affected by SARS-CoV-2 pneumonia, creating a homoge-
Consent for publication
The study was approved by the local Clinical Research Ethics Committee (PR/AG/270/2020) with exemption from informed consent.

Conflict of interest
The authors have no conflicts of interest to declare.

Acknowledgement
No contributions from individuals or organizations.

References

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