estos enfermos. Como muestra nuestro análisis estos tienen su alcance en un análisis de costes[10]. Sin duda, la implicación en la elección de una estrategia terapéutica que muestra un RCEI superior a los 200.000 euros por cada alta de UCI debe ser analizada en términos de impacto en las partidas presupuestarias; más aún en los tiempos de pandemia y desaceleración económica.

En resumen, nuestros datos no pueden confirmar la hipótesis inicial que consideraba a la HFNO una terapia eficaz en el manejo de la insuficiencia respiratoria hipóxica por SARS-CoV-2 en UCI. No solo eso, sino que parece obligado realizar análisis de mayor robustez que confirmen el impacto económico de dicha estrategia en términos de coste-efectividad.

Anexo. Material adicional

Se puede consultar material adicional a este artículo en su versión electrónica disponible en doi:10.1016/j.medin.2020.12.004.

Bibliografía

1. Tinelli V, Cabrini L, Fominskiy E, Franchini S, Ferrante L, Ball L, et al. High flow nasal cannula oxygen vs conventional oxygen therapy and noninvasive ventilation in emergency department patients: A systematic review and meta-analysis. J Emerg Med. 2019;57:322–8, http://dx.doi.org/10.1016/j.jemermed.2019.06.033.
2. Ferreyro BL, Angriman F, Munshi L, del Sorbo L, Ferguson ND, Rochwerg B, et al. Association of noninvasive oxygenation strategies with all-cause mortality in adults with acute hypoxemic respiratory failure: A systematic review meta-analysis. JAMA. 2020;324:57–67, http://dx.doi.org/10.1001/jama.2020.9524.
3. Cinesi Gómez C, Peñuelas Rodríguez Ó, Luján Torné M, Egea Santaolalla C, Masa Jiménez JF, García Fernández J, et al. Clinical consensus recommendations regarding non-invasive respiratory support in the adult patient with acute respiratory failure secondary to SARS-CoV-2 infection. Med Intensiva. 2020;S0210–5691:30094–102, http://dx.doi.org/10.1016/j.medin.2020.03.005.
4. Ballesteros Sanz MA, Hernández-Tejedor A, Estella A, Jiménez Rivera JJ, González de Molina Ortiz FJ, Sandiumenge Camps A, et al. Recomendaciones de «hacer» y «no hacer» en el tratamiento de los pacientes críticos ante la pandemia por coronavirus causante de COVID-19 de los Grupos de Trabajo de la Sociedad Española de Medicina Intensiva Crítica y Unidades Coronarias (SEMICYUC). Med Intensiva. 2020;44, http://dx.doi.org/10.1016/j.medin.2020.04.001.
5. Raboud J, Shigayeva A, McGeer A, Bontovics E, Chapman M, Gravel D, et al. Risk factors for SARS transmission from patients requiring intubation: A multicentre investigation in Toronto, Canada. PLoS One. 2010;5:e10717, http://dx.doi.org/10.1371/journal.pone.0010717.
6. Fowler RA, Guest CB, Lapinsky SE, Sibbald WJ, Louie M, Tang P, et al. Transmission of severe acute respiratory syndrome during intubation and mechanical ventilation. Am J Respir Crit Care Med. 2004;169:1198–202, http://dx.doi.org/10.1164/rccm.200305-715OC.
7. Zhang Q, Shen J, Chen L, Li S, Zhang W, Jiang C, et al. Timing of invasive mechanic ventilation in critically ill patients with coronavirus disease 2019. J Trauma Acute Care Surg. 2020, http://dx.doi.org/10.1097/TA.0000000000002939. En prensa.
8. Modesto I, Alapont V, Khemani RG, Medina A, del Villar Guerra P, Molina Cambra A. Bayes to the rescue: Continuous positive airway pressure has less mortality than high-flow oxygen. Pediatr Crit Care Med. 2017;18:e92–9, http://dx.doi.org/10.1097/PCC.0000000000001055.
9. Chisti MJ, Salam MA, Smith JH, Ahmed T, Pietroni MA, Shahunja KM, et al. Bubble continuous positive airway pressure for children with severe pneumonia and hypoxaemia in Bangladesh: An open, randomised controlled trial. Lancet. 2015;386:1057–65, http://dx.doi.org/10.1016/S0140-6736(15)60249-5.
10. Gc VS, Franklin D, Whitty JA, Dalziel SR, Babl FE, Schlapbach LJ, et al. First-line oxygen therapy with high-flow in bronchiolitis is not cost saving for the health service. Arch Dis Childhood. 2020;105:975–80.

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https://doi.org/10.1016/j.medin.2020.12.004

High flow nasal cannula useful for severe SARSs-CoV-2 pneumonia

Oxigeno mediante cánula nasal de alto flujo, utilidad en neumonía severa por SARSs-CoV-2

Dear Editor,

Mortality associated with mechanical ventilation in patients with ventilatory failure due to Covid 19 is around 50%–60%,[1,2] often associated with many complications. With the use of HFNO and prone position, some patients can improve the hypoxemia and fatigue, avoiding in some cases invasive ventilation.[3,4] Even though the guidelines for the treatment of respiratory failure secondary to covid-19 do not include the use of HFNO as first-line therapy, our institution used this as an initial strategy for these patients in the ICU.[5,8] The primary goal of the intervention was to reduce the need for mechanical ventilation and its associated mortality.

This is a retrospective cohort of patients admitted to Hospital Manuel Uribe Angel (HMUA) in Envigado, Colombia. The study was approved by the hospital's ethics committee and informed consent was signed by each patient. Patients were admitted from May 1 to October 31, 2020. Eligible

Table 1 Factors related to success vs failure of HFNO.

Characteristics	Total, *n* = 60	Success, *n* = 35	Failure, *n* = 25	*p*-Value
Age, median IQR	59 (50–70.75)	56 (45.5–61.50)	65 (54–77)	0.007
BMI, median IQR	26.95 (23.72–30.57)	27.20 (24.95–31.25)	27.08 (23.40–29.30)	0.227
Male sex	48 (80)	29 (82.9)	19 (76)	0.532
Immunosuppression different than VIH	3 (5)	0 (0)	3 (12)	0.067
Smoking	4 (6.7)	0 (0)	4 (16)	0.049
SOFA				
0	3 (5)	2 (5.7)	1 (4)	0.019
1–3	37 (61.7)	27 (77.1)	10 (40)	
≥4	14 (23.3)	4 (11.4)	10 (40)	
Altered mental status	4 (6.7)	0 (0)	4 (16)	0.026
Respiratory rate ≥30	23 (38.3)	10 (28.6)	13 (52)	0.058
Vasopressors/inotropes	23 (38.3)	0 (0)	23 (92)	0.000
LDH H, median IQR	415 (287–493)	345 (268–435)	490 (421–557)	0.003
LDH U, median IQR	415 (316–476)	336.5 (264.6–448.25)	470 (426–566)	0.001
Total days of antibiotics, median IQR	7 (4.75–14.50)	6 (2–6.50)	16 (10.50–17.50)	0.000
Statins during hospitalization	10 (16.7)	3 (8.6)	7 (28)	0.051
ACE inhibitors during hospitalization	33 (55)	14 (40)	19 (76)	0.006
Full dose anticoagulation	28 (46.7)	7 (20)	21 (84)	0.000
Curb65 Score, median IQR	1 (0–2)	1 (0–1)	2 (1–2)	0
PSI, median IQR	78.50 (60–98)	68	95 (74.50–124)	0

Table 2 Factors related to failure over time.

Variable	*N*	Estimated HR (95% CI)	*p*-Value	Adjusted HR (95% CI)	*p*-Value
Age (per year increase)	60	1.02 (0.99–1.05)	0.165		
BMI (per one point increase)	60	1.0 (0.92–1.09)	0.879		
Males vs. females	48	1.35 (0.52–3.50)	0.526		
Immunosuppression (vs. no.)	3	21 (4.3–106.32)	0.000	11 (1.6–84.27)	0.013
Smoker (vs. no.)	4	3.37 (1.08–10.55)	0.036		
Sofa at admission (per one point increase)	60	1.25 (1.00–1.56)	0.047		
Respiratory frequency ≥30	24	0.47 (0.20–1.06)	0.06		
LDH H (per point increase)	60	1.00 (1.00–1.09)	0.017		
Statins during hospital stay	10	0.89 (0.56–1.43)	0.656		
ACE inhibitors during hospital stay	33	0.72 (0.45–1.15)	0.177		
Vasopressor support	23	0.26 (0.12–0.54)	0.000	0.179 (0.04–0.80)	0.025
Full dose anticoagulation	28	0.48 (0.28–0.83)	0.009		
Curb 65	60	2.40 (1.62–3.56)	0		
PSI	60	1.02 (1.01–1.04)	0.001		

participants were 18 years or older, with COVID-19 infection confirmed by reverse transcriptase PCR admitted to the ICU, and treated with HFNO. Patients were placed in HFNO if they had ventilatory failure. Patients that had severely altered consciousness at admission, severe work of breathing (exhaustion), or shock were placed on invasive mechanical ventilation. The awake prone position was encouraged.

Support was given by a high-flow oxygen system (Fisher and Paykel RT-330). All patients treated with HFNO were admitted to the ICU, as they required a high standard of care and supervision due to the risk of treatment-refractory hypoxemia or severe respiratory failure requiring rescue invasive ventilation. The flow was initiated at 40 L/min and titrated up by 5 L increments depending on the patient's tolerance up to 60 L/min with an initial FIO2 at 100% and titrated depending on the patient's clinical evaluation and ROX index.

The primary endpoint was success measured as weaning of HFNO without the need for intubation or mechanical ventilation. Failure was defined as the need for intubation, mechanical ventilation, or death. The secondary endpoint was finding the predictors associated with failure or success.

Categorical variables were compared using Chi-square tests or Fisher's exact tests. Continuous variables were expressed as medians with interquartile ranges. The Mann–Whitney *U* test was used for the mean difference. The crude cumulative proportion of HFNO success was calculated. Predictors of intubation were analyzed using a Cox proportional hazards model. The index date was the

date of initiation of HFNO, with censoring occurring upon intubation, death, or the end of the study. Data were analyzed by the Statistical Package for Social Sciences software.

We analyzed 90 patients that were admitted to the ICU with ventilatory failure secondary to Covid 19 infection confirmed by imaging and RT-PCR. Of this group, 30 (33%) received invasive mechanical ventilation as first-line therapy, and 60 (67%) patients received HFNO as first-line therapy. In the HNFO group, the median age was 59 years, 80% male, mean BMI of 26.95. The most common comorbidities were hypertension 50% and diabetes 28%. The mean APACHE II scores for the success group was 7.11 and the failure group was 10.95. Full doses of anticoagulation were given to 28 patients (66%), 38% required vasopressor support with norepinephrine. Superinfection was a complication in 69% of the patients that failed HFNO. Every patient received steroids and thromboprophylaxis.

The survival of the group that initially received mechanical ventilation and did not receive at any point HFNO was 42.2%; the overall survival of the HNFO group was 76%. Of the 60 patients who received HFNO, 35 (58%) were successfully weaned off the device and eventually discharged from the hospital. Failure of the intervention was seen in 25 patients (42%). Of these patients, 24 required subsequent mechanical ventilation, and 13 died. The mortality of the group that received exclusive oxygenation via HFNO was 0%, for the entire HFNO group it was 23% and for the group that received mechanical ventilation it was 57.8%.

The mean PaO2/FIO2 at the admission of patients in the success group was 188 and the failure group was 160. The Curb 65 median for the success group was 1 and for the failure, group was 2. The median duration of high-flow nasal cannula was 6 days IQR (4–8) in the success group and 17 days IQR 9.25–24 in the failure group, *p* value of =0.000.

Table 1 summarizes the predictors of failure of HFNO. Higher PSI, CURB-65, SOFA scores, and LDH levels at ICU admission were significantly associated with failure. Vasopressor use and a full dose of anticoagulation were associated with worse overall outcomes. Table 2 summarizes the factors associated with failure over time.

Of the 60 patients that required HFNO, 46 were eventually discharged. Mortality associated with covid 19 in the ICU of our institution was lower than other institutions in our geographical area (28% vs. 55%).

We show evidence of the utility of HFNO in severe covid 19 patients that required ICU admission for the treatment of severe respiratory failure. We achieved a high survival and posterior discharge rate. Several severe hypoxemic patients that were treated with HFNO avoided mechanical ventilation and were eventually discharged.

The use of HFNO has been evaluated in multiple studies, including promising results from a multicenter prospective study in South Africa that had a success rate of 47%, and overall survival of 52%, and a mortality of 48%.[6] Rochwerg et al. evidenced a 15% relative risk reduction of the need for mechanical ventilation in HFNO compared to conventional oxygen therapy. This benefit is related to the alveolar recruitment and possibly the reduction of the airway and alveolar collapse, acting as a continuous positive airway pressure (CPAP).[7]

We believe that the use of HFNO as an initial strategy to treat respiratory failure in these patients has greatly impacted this result. Limitations in our study include the small number of patients participating. HFNO is a simple intervention and does not require extensive training for safe and appropriate use, but does require close patient monitoring.

Bibliografía

1. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Respir Med. 2020;8:475–81.
2. Castaneda C, Ah Rhee CJ, Magh A, Eng C, Mann J, Sanso L, et al. Impact of ventilator model on mortality: a retrospective cross-sectional study in 147 mechanically ventilated patients with Covid-19 ARDS. Chest. 2020;158:A617.
3. Xie J, Covassin N, Fan Z, Singh P, Gao W, Li G, et al. Association between hypoxemia and mortality in patients with COVID-19. Mayo Clin Proc. 2020;95:1138–47.
4. Contributors, Zucman N, Mullaert J, Roux D, Roca O, Ricard J-D. Prediction of outcome of nasal high flow use during COVID-19-related acute hypoxemic respiratory failure. Intensive Care Med. 2020;46:1924–6.
5. Roca O, Riera J, Torres F, Masclans JR. High-flow oxygen therapy in acute respiratory failure. Respir Care. 2010;55:408–13.
6. Calligaro GL, Lalla U, Audley G, Gina P, Miller MG, Mendelson M, et al. The utility of high-flow nasal oxygen for severe COVID-19 pneumonia in a resource-constrained setting: a multi-center prospective observational study. EClinicalMedicine. 2020;28:100570.
7. Rochwerg B, Granton D, Wang DX, Einav S, Burns KEA. High-flow nasal cannula compared with conventional oxygen therapy for acute hypoxemic respiratory failure: author's reply. Intensive Care Med. 2019;45:1171.
8. Massachusetts General Hospital. Massachusetts General Hospital (MGH) COVID-19 treatment guidance. The General Hospital Corporation Massachusetts General Hospital. 2020;1:1–22.

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https://doi.org/10.1016/j.medin.2021.01.002