One hundred eighteen days on a ventilator: a COVID-19 success story against all odds

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SUMMARY

Emerging data suggest that patients with certain comorbidities requiring intensive care unit (ICU) admission for COVID-19 have a poor prognosis. This report describes a case of a patient with multiple comorbidities who contracted COVID-19 pneumonitis but was successfully weaned off invasive mechanical ventilation after 118 days, despite his admission being complicated by recurrent septic episodes and requirement for advanced cardiovascular support and renal replacement therapy. Of note, our patient received three courses of steroids in total during his ICU stay,and current literature strongly supports the use of steroids in critically unwell patients with COVID-19. To the best of our knowledge, this is the longest reported ventilated time and intensive care/hospital stay for a surviving patient with COVID-19 and highlights the importance of allowing sufficient time for clinical interventions to take effect, even when the prognosis appears bleak.

BACKGROUND

The COVID-19 pandemic has led to an unprecedented number of patients requiring critical care worldwide, with a large proportion receiving invasive mechanical ventilation. Emerging data suggest that patients with comorbidities are less likely to survive intensive care unit (ICU) admission for severe COVID-19.[1] This case report describes successful respiratory weaning of a patient with multiple comorbidities admitted with COVID-19 pneumonitis after 118 days on a ventilator. To the best of our knowledge, this is the longest reported ventilated time for COVID-19 in the UK at the time of writing.

CASE PRESENTATION

A 53-year-old man of Lebanese origin presented to another hospital within our critical care network in mid-March 2020 with 2 weeks of sore throat and cough. His comorbidities included type 2 diabetes, hypertension, obstructive sleep apnoea (OSA) and severe gastro-oesophageal reflux disease (GORD). He was admitted for oxygen therapy and antibiotics for PCR-positive COVID-19 pneumonitis with possible superadded bacterial pneumonia. By the third day of hospital admission, he had developed hypoxia refractory to continuous positive airway pressure (CPAP) and was intubated and transferred to the ICU for mechanical ventilation. He quickly developed acute kidney injury requiring haemodiafiltration and cardiovascular collapse requiring inotropic support. After initial stabilisation, he had a tracheostomy on day (D) 23 of his ICU admission to facilitate respiratory weaning.

On D24, the patient was transferred to our ICU for ongoing renal replacement therapy (RRT) and, on arrival, had profound type 2 respiratory failure with high peak pressures and high oxygen requirements (fraction of inspired oxygen (FiO_2) was consistently above 70%). There was minimal improvement on proning or with fluid removal via haemodiafiltration. CT scan of the thorax was consistent with a fibrotic acute respiratory distress syndrome (ARDS) picture, and so, he was treated with pulsed methylprednisolone (500 mg once daily for 3 days followed by rapid weaning over the next 3 days). By D31, his FiO_2 requirement improved to 0.45.

Over the next 2 months, the patient had multiple further episodes of significant respiratory deterioration secondary to a combination of ventilator-associated and aspiration pneumonia, prolonging his respiratory wean. This was complicated by recurrent episodes of bacteraemia often associated with septic shock, secondary to *Corynebacterium striatum* and coagulase-negative staphylococci on one occasion and *Delftia lacustris* on another, and slow neurological recovery. During a significant proportion of this time, he required maximal respiratory support with FiO_2 increasing to 1.0 and switch to airway pressure release ventilation alongside lung-protective ventilation strategies and proning. In spite of this, his pulse oxygen saturation was often consistently below 85%, even during the periods where his FiO_2 was 1.0. Furthermore, he also required maximal inotropic and vasopressor support and haemodiafiltration to optimise his fluid balance.

Given the lack of progress with his respiratory wean, the patient had a CT thorax on D63, which showed bilateral, widespread airspace opacification affecting more than 75% of the lungs alongside prominent airways consistent with worsening fibrotic ARDS and small bilateral pleural effusions suggesting a mild degree of fluid overload (figure 1). Thus, on D66, he commenced a second trial of pulsed methylprednisolone 1 g daily for 3 days followed by prednisolone weaning (50 mg daily for 5 days, then 30 mg daily for 3 days, then 20 mg daily for 3 days, then 10 mg daily for 3 days and then 5 mg daily for 3 days). Eventually, with the combination of steroids, optimisation of antimicrobials and best supportive care, the patient's condition stabilised sufficiently to allow him to embark on a slow respiratory wean with slow improvement in neurological function although with superimposed delirium. He recovered his renal function, requiring

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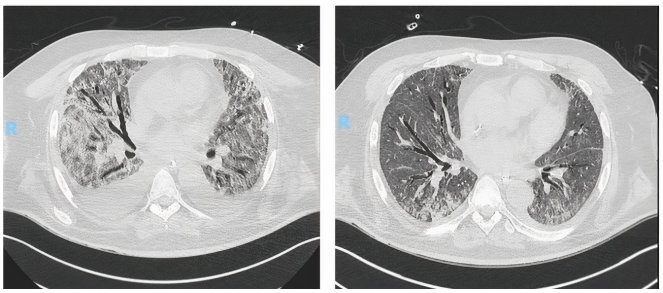

Figure 1 (Left) CT thorax on day (D) 63 (after the first course of pulsed methylprednisolone) showing bilateral widespread ground-glass opacificaties affecting more than 75% of the lungs and prominent airways consistent with worsening fibrotic acute respiratory distress syndrome. In addition, there are bilateral pleural effusions suggesting a degree of fluid overload. (Right) CT thorax on D102 after completion of the second course of pulsed methylprednisolone. This shows significant improvement in the degree of ground-glass opacification and bilateral pleural effusions but persistent interstitial changes predominantly peripheral in distribution with similar degree of traction bronchiectasis. This is consistent with resolution of fluid overload and extensive residual fibrotic change.

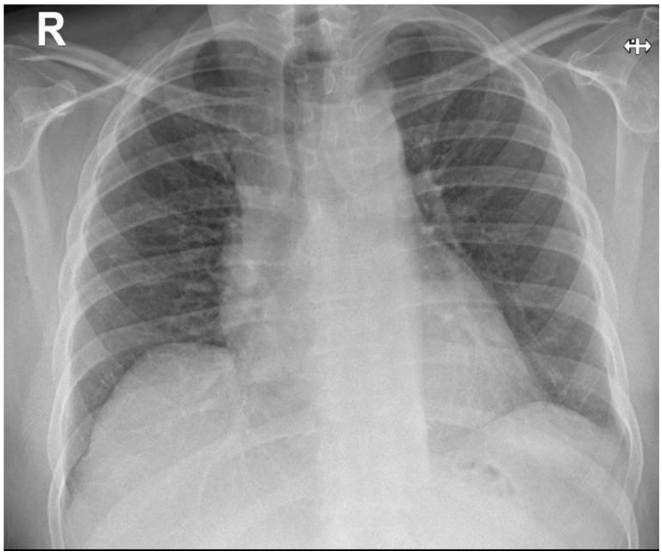

Figure 2 Chest radiograph taken 3 months after the patient's discharge from the intensive care unit, reported as showing resolution of previous COVID-19-associated findings.

no further RRT. An interval CT thorax on D102 showed significant improvement in the bilateral opacification and resolution of the small pleural effusions compared with his previous CT but similar degree of traction bronchiectasis and extensive residual fibrotic change (figure 1).

TREATMENT

The patient had two courses of pulsed methylprednisolone (with steroid weaning during the second course), and he also received intravenous hydrocortisone as an adjunctive treatment for refractory shock. He had multiple courses of antimicrobials throughout his admission due to septic shock. During each of these septic episodes, the patient was often on maximum medical support with FiO_2 greater than 70%, maximum doses of vasopressors and haemodiafiltration. Multiple discussions were had between the medical team and patient's family warning them of the seriousness of the patient's conditions. Irrespective of the outlook, the medical team pursued full and active medical treatment, resulting in the patient's successful liberation from mechanical ventilation and discharge from the ICU.

OUTCOME AND FOLLOW-UP

The patient was liberated from a ventilator on D118 postintubation, subsequently decannulated and later discharged from the ICU on D134. He left the hospital several weeks later to continue inpatient rehabilitation in a dedicated facility.

After spending a further 2 months in the rehabilitation unit (6 months in total as an inpatient), the patient was finally discharged home. He continues to experience exertional breathlessness and requires mobility aids including a wheelchair and walker frame due to back pain. This has resulted in severe limitation on his 6-minute walk test (total distance 10 m managed). Follow-up pulse oxygen saturation was 97% without supplementary oxygen, chest radiograph (figure 2) was reported as showing a resolution of the COVID-19-associated findings and an echocardiogram demonstrated good biventricular systolic function. Further chest imaging in the future is planned to reassess the lung parenchyma. He is also awaiting investigation for peripheral neuropathy due to severe pain affecting his hands and feet. It is unclear if these are sequelae of his prolonged ICU admission or of COVID-19, although likely to be a combination of both.

To the best of our knowledge, this is the longest reported ventilated time and intensive care/hospital stay for a surviving patient with COVID-19 and highlights the importance of allowing sufficient time for interventions to take effect in critically unwell patients.

DISCUSSION

Use of steroids in COVID-19 ARDS

The use of corticosteroids in the treatment of non-COVID-19 ARDS is controversial.[2–4] While some studies have suggested a reduction in ICU mortality, length of ICU stay and ventilated days, other studies suggest that corticosteroid treatment is associated with increased mortality in certain aetiologies of ARDS, including influenza and Middle East respiratory syndrome coronavirus (MERS-CoV).[5] The heterogeneity of ARDS as a condition and the treatment regimens used in the literature, with significant variability in dosing, treatment duration and corticosteroid used, limit the generalisability of results and hence application in clinical practice. Furthermore, the potential benefit of corticosteroids in ARDS has been demonstrated early in the disease course[6 7] with possible increased mortality if given later.[6]

The decision to treat the patient in this case with steroids was therefore a difficult one particularly since results from more recent clinical trials supporting the use of systemic steroid therapy in critically unwell patients with COVID-19[8–11] were not yet available. Nevertheless, the patient received methylprednisolone on two occasions, both more than 14 days after initiation of mechanical ventilation. The decision to administer steroids was taken following a departmental discussion where it was felt that the potential benefit of treatment for this patient outweighed the possible adverse effects. On both occasions, his FiO_2 requirements reduced in the subsequent days, and on the second occasion, he was able to resume tracheostomy weaning. Towards the end of his stay in the ICU, dexamethasone treatment was reported to reduce mortality in critically unwell patient receiving mechanical ventilation for COVID-19 in the RECOVERY (Randominsed Evalutions of COVID-19 Therapy) trial.[8]

Following the publication of results from the dexamethasone arm of the RECOVERY trial, further data have also emerged on the use of systemic steroids in critically unwell patients with COVID-19. The REMAP-CAP (Randomised, Embedded, Multifactorial, Adaptive Platform Trial for Community-Acquired Pneumonia) trial reported 93% probability of superiority for 7-day fixed-dose course of hydrocortisone (50 mg or 100 mg every 6 hours) and 80% probability of superiority for shock-dependent course of hydrocortisone (50 mg every 6 hours in patients clinically in shock) compared with no hydrocortisone for the primary outcome of organ support-free days within 21 days.[10] In the CoDEX (COVID-19 Dexamethasone) trial,[11] 10 mg or 20 mg of intravenous dexamethasone given as a 5-day course resulted in a statistically significant increase in ventilator-free days but did not reduce all-cause mortality or ICU-free days in the first 28 days. There was also no difference in the duration of mechanical ventilation at 28 days.

With regard to methylprednisolone, the Metcovid (Methylprednisolone as Adjunctive Therapy for Patients Hospitalized With COVID- 19) trial found no statistically significant difference in 28-day mortality in patients treated with intravenous methylprednisolone 0.5 mg/kg versus placebo.[12] Although the results of this study were published after the initial prospective meta-analysis carried out by the WHO REACT (REal-time Assessment of Community Transmission) working group, these data were subsequently included in an additional meta-analysis performed by the same group, which concluded an overall finding of reduction in 28-day mortality (OR 0.66, 95% CI 0.54 to 0.82) in critically unwell patients with COVID-19 treated with corticosteroids (dexamethasone, hydrocortisone or methylprednisolone).[8]

Patient survival in spite of the odds

When considering the patient in the context of the Intensive Care National Audit and Research Centre reports on COVID-19, there are multiple factors that made his survival unlikely.[13] Over a third of patients aged 50–59 died in critical care in the UK. In addition, his ethnicity, male gender, type 2 diabetes mellitus and hypertension increased his risk of severe disease.[14] He also suffered from OSA, requiring nocturnal CPAP; was obese; and had severe GORD awaiting consideration for surgery. All these comorbidities severely impacted the patient's lifestyle and mobility. OSA and obesity have also been linked with an increased risk of severe COVID-19.[14 15] Lastly, he developed acute renal failure necessitating RRT and required significant cardiovascular support for significant lengths during his ICU stay. These poor prognostic factors during his ICU stay dramatically increased his mortality risk,[16] making it an even more significant achievement, both for the patient and for the ICU team, that he was successfully weaned off ventilatory support and discharged. This case highlights that patients with severe COVID-19 ARDS, particularly those with significant medical comorbidities, may take longer to recover and supports the decision to continue caring for the patient in ICU to allow sufficient time for interventions to take effect. This is especially relevant given the current global situation where there is limited ICU capacity but emphasises that certain patients may benefit from aggressive care for extended periods.

Long-term sequelae

There have been increasing reports in the mainstream media of 'long COVID-19', a term used to describe persistence of COVID-19 symptoms beyond resolution of the acute COVID-19 infection. While research is still in progress to further scientific understanding of this area, a recent Italian study suggested that 87.4% of patients continue to experience one or more symptoms post-COVID recovery, with 53.1% of patients reporting fatigue, 43.4% reporting breathlessness, 27.3% reporting joint pain and 21.7% reporting chest pain.[17] On the other hand, intensive care admission is also associated with long-term complications including impairment in lung function and physical function and neuromuscular weakness, with corresponding impact on patients' quality of life.[18] The patient's persistent symptoms serve as a reminder of the potential sequelae resulting from a combination of both COVID-19 infection and prolonged ICU admission and that long-term follow-up is required in this patient group.

Learning points

- Patients can benefit from multiple courses of steroids if clinically indicated.
- In light of the results from recent studies supporting the use of steroids in treating critically unwell patients with COVID-19, the courses of corticosteroids that the patient received likely played a significant role in facilitating his respiratory wean.
- Although prognostic markers may help guide clinical decision making, this case highlights the importance of allowing sufficient time for interventions to take effect in critically unwell patients, even when the prognosis appears bleak
- Patients, even with significant comorbidities, can survive irrespective of disease severity and length of ventilated days. The clinical judgement and experience of the primary treating team remain of paramount importance in such complex cases where findings from available literature may not be easily generalisable or where there may be a paucity of evidence when crucial clinical decisions need to be made.

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REFERENCES

1 Li X, Xu S, Yu M, *et al*. Risk factors for severity and mortality in adult COVID-19 inpatients in Wuhan. *J Allergy Clin Immunol* 2020;146:110–8.
2 Meduri GU, Bridges L, Shih M-C, *et al*. Prolonged glucocorticoid treatment is associated with improved ARDS outcomes: analysis of individual patients' data from four randomized trials and trial-level meta-analysis of the updated literature. *Intensive Care Med* 2016;42:829–40.
3 Sweeney RM, McAuley DF. Prolonged glucocorticoid treatment in acute respiratory distress syndrome – Authors' reply. *The Lancet* 2017;389:1516–7.

4 Claesson J, Freundlich M, Gunnarsson I, *et al*. Scandinavian clinical practice guideline on fluid and drug therapy in adults with acute respiratory distress syndrome. *Acta Anaesthesiol Scand* 2016;60:697–709.
5 Singh AK, Majumdar S, Singh R, *et al*. Role of corticosteroid in the management of COVID-19: a systemic review and a clinician's perspective. *Diabetes Metab Syndr* 2020;14:971–8.
6 Meduri GU, Golden E, Freire AX, *et al*. Methylprednisolone infusion in early severe ARDS: results of a randomized controlled trial. *Chest* 2007;131:954–63.
7 Steinberg KP, Hudson LD, Goodman RB, *et al*. Efficacy and safety of corticosteroids for persistent acute respiratory distress syndrome. *N Engl J Med* 2006;354:1671–84.
8 Horby P, Lim WS, *et al*, RECOVERY Collaborative Group,. Dexamethasone in Hospitalized Patients with Covid-19 - Preliminary Report. *N Engl J Med* 2020;384.
9 WHO Rapid Evidence Appraisal for COVID-19 Therapies (REACT) Working Group, Sterne JAC, Murthy S, *et al*. Association between administration of systemic corticosteroids and mortality among critically ill patients with COVID-19: a meta-analysis. *JAMA* 2020;324:1330–41.
10 Angus DC, Derde L, Al-Beidh F, *et al*. Effect of hydrocortisone on mortality and organ support in patients with severe COVID-19: the REMAP-CAP COVID-19 corticosteroid domain randomized clinical trial. *JAMA* 2020;324:1317-1329.
11 Tomazini BM, Maia IS, Cavalcanti AB, *et al*. Effect of dexamethasone on days alive and Ventilator-Free in patients with moderate or severe acute respiratory distress syndrome and COVID-19: the Codex randomized clinical trial. *JAMA* 2020;324:1307.
12 Jeronimo CMP, Farias MEL, Val FFA, *et al*. Methylprednisolone as adjunctive therapy for patients hospitalized with COVID-19 (Metcovid): a randomised, double-blind, phase IIb, placebo-controlled trial. *Clin Infect Dis* 2020:ciaa1177.
13 ICNARC Case Mix Programme Database. *ICNARC report on COVID-19 in critical care 24 July 2020*, 2020.
14 McSharry D, Lam MT, Malhotra A. Osa as a probable risk factor for severe COVID-19. *J Clin Sleep Med* 2020;16:1649.
15 Caci G, Albini A, Malerba M, *et al*. COVID-19 and obesity: dangerous liaisons. *J Clin Med* 2020;9:2511.
16 Gasparini M, Khan S, Patel J. Renal impairment and its impact on clinical outcomes in patients who are critically ill with COVID-19: a multicentre observational study. *Anaesthesia* 2020.
17 Carfì A, Bernabei R, Landi F, *et al*. Persistent symptoms in patients after acute COVID-19. *JAMA* 2020;324:603–5.
18 Desai SV, Law TJ, Needham DM. Long-Term complications of critical care. *Crit Care Med* 2011;39:371–9.