Letter to the Editor

Trajectories of vital signs in patients with Covid-19

Dear Prof Nolan,

We read with interest the recent article from Oxford exploring using trajectories of vital signs and inspired FiO_2 in hospitalised Covid-19 patients.[1] Given the paucity of published research in vital sign trends to predict clinical deterioration, this is an opportune addition to the literature.[2,3] Our recent multicentre paper also highlights the potential added value of inclusion of dynamic trajectory and inspired FiO_2 in a postoperative population.[3]

The Oxford group report that deteriorating patients with COVID-19 experience rapidly-worsening respiratory failure, with low SpO_2 and high FiO_2, but only minor abnormalities in other vital signs and an unchanged national early warning score (NEWS2).[1]

The binary weighting of oxygen therapy and consequent failure to detect increasing oxygen requirements has been of longstanding concern to cardiothoracic centres since NEWS was conceived in 2012.[4] We totally endorse the clear take home message that 'early warning scores (EWS) could be enhanced by accounting for the degree of oxygen usage.'[1,3,4]

Our initial challenge is to persuade a future NEWS3 steering group of the need for change and to provide guidance on implementation options. We suspect the complex formula used by Oxford to estimate FiO_2 and centile based EWS approach may struggle to gain steering group acceptance.

Papworth hospital collaborated with 'The Learning Clinic, London' to create a cardiothoracic (CT) EWS using vitalPAC™.[5] Nurses entered oxygen saturation and selected the most appropriate oxygen therapy option on a handset at the bedside. Allocation of oxygen therapy into one of three FiO_2 categories (0.3, 0.4 and $\geq$0.5) and calculation of pO_2/FiO_2 ratio was performed by vitalPAC™.[5] We confirm that nurses found the various oxygen therapy options straightforward to enter. Most quickly grasped the concept of pO_2/FiO_2 ratio though we accept that SpO_2/FiO_2 ratio (as utilised by Oxford) would be easier to implement.

We believe the Oxford centile based EWS giving equal weightings to positive and negative deviation of each vital sign from median values in a normal dataset is clinically naive. If this was true, their graphs of 'respiratory rate' and 'heart rate' versus 'time to event' would be identical 'flat' lines. We interpret the trajectory of the graphs as confirmation that tachypnoea and tachycardia should be given greater weighting than bradypnoea and bradycardia (see Chiu, Fig. 2).[4]

In conclusion, the Oxford Covid-19 and cardiac surgical papers collectively make a powerful case for subdividing oxygen therapy based on inspired FiO2.[1,3,4] Current snapshot approaches do not reflect best use of existing data. Finally, the absence of major changes in heart rate, blood pressure and temperature in Covid-19 appears to challenge the basic premise of NEWS2 that one standard scoring system is suitable for all adult in-patients without type 2 respiratory failure.

Conflicts of interest

The authors declare that they have no conflicts of interest

REFERENCES

1. Pimentel MAF, Redfern OC, Hatch R, Young JD, Tarassenko L, Watkinson PJ. Trajectories of vital signs in patients with COVID-19. Resuscitation 2020;156:99−106.
2. Brekke IJ, Puntervoll LH, Pedersen PB, Kellett J, Brabrand M. The value of vital sign trends in predicting and monitoring clinical deterioration: a systematic review. PLOS ONE 2019;14:e0210875.
3. Zhu Y, Chiu YD, Villar SS, et al. Dynamic individual vital sign trajectory early warning score (DyniEWS) versus snapshot national early warning score (NEWS) for predicting postoperative deterioration. Resuscitation 2020;157:176−84.
4. Chiu YD, Villar SS, Brand JW, et al. Logistic early warning scores to predict death, cardiac arrest or unplanned intensive care unit re-admission after cardiac surgery. Anaesthesia 2020;75: 162−70.
5. Mackay JH. Resuscitation after adult cardiac surgery. In: Valchanov K, Jones N, Hogue CW, editors. Core Topics in Cardiothoracic Critical Care. 2nd ed. Cambridge: Cambridge University Press; 2018. p. 211−9.

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