The Mechanical Ventilation–Respiratory Distress Observation Scale as a surrogate of self-reported dyspnoea in intubated patients

To the Editor:

Intensive care unit (ICU) patients are exposed to many sources of discomfort, among which dyspnoea is one of the more severely distressing [1]. In invasively mechanically ventilated patients, dyspnoea is frequent (47% of intubated patients report breathing discomfort when they can first communicate with caregivers) and severe (median rating of 5 on a dyspnoea visual analogue scale (D-VAS); association with anxiety and neurovegetative signs of stress) [2]. It is often linked to ventilator settings and seems to be associated with poorer clinical outcomes (*e.g.* delayed extubation and post-traumatic stress disorders) [2, 3]. As in other settings, identifying and quantifying dyspnoea in mechanically ventilated patients is therefore a major clinical issue. This is challenging because self-report and self-assessment, prerequisites for D-VAS assessment [4], are often impossible or very difficult in this setting. Unfortunately, caregivers markedly underestimate dyspnoea in this context [5, 6]. The risk of occult respiratory suffering is therefore major in the ICU setting and neglecting it would amount to medical error [7].

Observation scales incorporating physical and behavioural signs have been developed and validated as surrogates for self-reported dyspnoea in palliative care [8]. Recently, we validated the Intensive Care–Respiratory Distress Observation Scale (IC-RDOS) [9], a five-item scale tailored to best correlate with D-VAS in communicative ICU patients (heart rate, neck muscle use during inspiration, abdominal paradox, facial expression of fear and supplemental oxygen). IC-RDOS is also promising in noncommunicative ICU patients [10] but it is not fully adapted to an intubated population because of the "supplemental oxygen" item that will almost always be present in intubated patients. The aim of the present study was to develop a dyspnoea observation scale suitable for mechanically ventilated and intubated patients, and to evaluate its performance.

For this purpose, we carried out an ancillary analysis of the data prospectively collected from 220 unselected communicative ICU patients (31 (15%) invasively mechanically ventilated patients) enrolled for the validation of the IC-RDOS [9].

Statistical analyses used are described in the IC-RDOS study methods [9]. To move from IC-RDOS to the Mechanical Ventilation–Respiratory Distress Observation Scale (MV-RDOS), we first removed "supplemental oxygen" from the selected items. This gave a four-item correlate of D-VAS (r=0.47, 95% CI 0.32–0.60; p<0.0001) of which a 2.2 value predicted a D-VAS >3 with 48.1% sensitivity and a 93.9% specificity (area under the curve (AUC) 0.763, 95% CI 0.679–0.848). To improve these performances, we then added the item "respiratory rate" to the four remaining items. We chose respiratory rate because of an initial modest but significant correlation with D-VAS (Spearman's r=0.262, 95% CI 0.09–0.42; p=0.004) and because of its contribution to the third factorial dimension of the principal component analysis. This choice was also guided by the clinical knowledge that therapeutic interventions aimed at improving patients' comfort under mechanical ventilation tend to slow down respiratory rate (*e.g.* optimisation of ventilator settings or the administration of opiates). We hypothesised that the presence of a "respiratory rate" item in MV-RDOS would make its responsiveness to interventions more likely.

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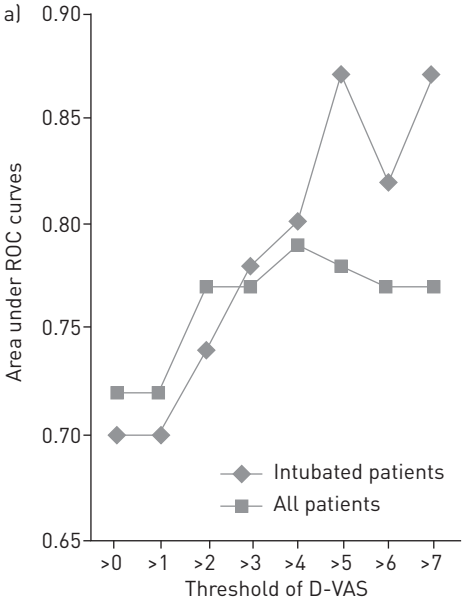
a)



b)

Variables	Score
0)	3.3
1) HR beats per min	+HR/65
2) Use of neck muscles during inspiration	
If present	+1
If absent	−1
3) Abdominal paradox during inspiration	
If present	+1
If absent	−1
4) Facial expression of fear	
If present	+1
If absent	−1
5) RR cycles per min	+RR/50

FIGURE 1 a) Comparison of the areas under the receiver operating characteristic (ROC) curves for the Mechanical Ventilation–Respiratory Distress Observation Scale (MV-RDOS) according to the dyspnoea visual analogue scale (D-VAS) thresholds between intubated patients and the whole cohort. b) Calculation of the MV-RDOS. HR: heart rate; RR: respiratory rate.

Iterations were performed to determine weighting factors that optimised the model. This led to a maximal Spearman's r-value of 0.47 (95% CI 0.36–0.57; p<0.001) with MV-RDOS=3.3+(heart rate/65)+(respiratory rate/50)+IF(paradox breathing=0,−1,1)+IF(accessory muscles=0,−1,1)+IF(fear=0,−1,1). This model was simplified into MV-RDOS=3.3+(heart rate/65)+(respiratory rate/50)+(1×paradox breathing)+(1×accessory muscles)+(1×Fear) (figure 1). A MV-RDOS of 2.3 predicted a D-VAS >3 with 72% sensitivity and a 74% specificity (AUC 0.769, 95% CI 0.690–0.849), which was slightly better than the four-item IC-RDOS.

Finally, because the MV-RDOS is thought to be more applicable for intubated patients, we also tested its performance in the subgroup of 31 intubated patients. Figure 1 shows the receiver operating characteristic AUCs for the MV-RDOS according to the D-VAS thresholds in intubated patients and the whole cohort. Among intubated patients, a MV-RDOS of 2.6 predicted a D-VAS >3 with 57% sensitivity and a 94% specificity, with an AUC of 0.782 (95% CI 0.581–0.982). The ability of the MV-RDOS to detect significant dyspnoea (D-VAS>3) is likely to be better among intubated patient than in the whole cohort (figure 1).

Critically ill intubated patients are more likely to be exposed to risk factors of dyspnoea than nonintubated patients. Moreover, they may equally exhibit clinical and behavioural signs of respiratory discomfort [10], which can be compiled in scoring systems used as surrogates of D-VAS [8–10]. However, this heteroevaluation approach to dyspnoea in the ICU setting reveals its full usefulness among intubated patients in whom self-report and self-assessment are impossible or very difficult. Our results suggest that MV-RDOS could be of value to identify intubated ICU patients experiencing dyspnoea or highly suspected of suffering from it, regardless of their self-report abilities. They pave the way for clinical validation studies among intubated patient (exclusively) who will have to assess the feasibility of MV-RDOS in clinical practice and above all its responsiveness to therapeutic interventions aimed at reducing dyspnoea. It will never be possible to be certain that a noncommunicative intubated patient actually suffers from dyspnoea because clinical or neurophysiological surrogates will never replace self-report. However, the poor ability of caregivers to adequately identify dyspnoea in intubated patients [5, 6] indicates that there is an unmet need for tools allowing caregivers to at least suspect that a patient might be suffering from dyspnoea. Such tools would probably be of major clinical relevance if, for example, they prompted a clinical checklist aimed at identifying factors known to induce dyspnoea and that are often simple to correct, including suboptimal ventilator settings [2]. We believe that MV-RDOS could be such a tool.

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