

LETTER

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Awake prone positioning on diaphragmatic function: Really bad or maybe good?

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Dear editor,

We read with great interest of the report by Cammarota et al. [1] about the effect of awake prone positioning (APP) on respiratory muscles' workload among COVID-19 patients with acute hypoxemic respiratory failure (ARF) while receiving noninvasive ventilation (NIV) support. They found that the application of APP in COVID-19 patients assisted by NIV in ICU improved the oxygenation at the expense of a greater diaphragmatic thickening fraction compared to supine position. However, whether APP really acts as a negative or a positive factor for diaphragmatic function is controversial, and we would like to add some comments.

First, in Cammarota's study [1], the patients received a median NIV duration of 2 days before enrollment, and the APP was used as a rescue therapy. However, a recent study suggested that early initiation (< 24 h of HFNC use) of APP in ARF patients secondary to COVID-19 could improve 28-day survival [2]. Furthermore, NIV was delivered through full face or oro-nasal facial mask connected via a double-tube circuit to a mechanical ventilator rather than a helmet [3] via a high-performance single-tube circuit noninvasive ventilator, which may have a higher risk of air leak and more workload for triggering the ventilator on APP, and finally increase the diaphragmatic effort. Taken together, it could be the inappropriate initiating time-point of NIV, the interface and the NIV ventilator type rather than APP affected the diaphragmatic thickening fraction evaluated.

Second, in Cammarota's study [1], a significantly higher level of inspiratory thickness and thickening fraction were shown in APP than supine, and it was interpreted as a bad effect of the diaphragmatic function. However, a recent study about continuous anterior chest compression, which is a similar method to APP, has shown that it could recruit the dorsal lung region and get a potential protective effect for the whole lung [4]. And a higher inspiratory thickness and thickening fraction of the diaphragm near the dorsal lung may also be associated with a better dorsal lung recruitment and whole lung homogeneity after APP [5]. Therefore, the greater diaphragmatic thickening fraction may be a protective effect rather than a negative effect.

In summary, whether APP or actually the details of use of NIV affects the diaphragmatic function is still unclear, and an increased diaphragmatic thickening fraction after APP maybe a potential protective effect for COVID-19-induced ARF patients.

Authors' response

Reply to: Awake prone positioning on diaphragmatic function: Really bad or maybe good?

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discuss our findings. They argue that a rise in diaphragmatic thickening fraction, consequent to awake prone position application (APP), may be a protective effect in COVID-19 acute hypoxemic respiratory failure (ARF).

Non-invasive respiratory support (NIRS) [6], in combination or not to APP, has been employed to stabilize the respiratory status and avoid intubation during COVID-19 outbreak, characterized by elevated intensive care unit surge capacity. Prone position improves gas exchange, lung aeration, and survival, mainly in intubated patients undergoing sedation and paralysis. In delivering NIRS, it is of pivotal importance to assure patient's comfort, mainly when the non-invasive assistance is continuously delivered many hours per day as in COVID-19-related ARF. This is even truer with APP, when patients are requested to continuously lay in a prone obligated position.

An increase in the electrical activity of diaphragm, an index of diaphragmatic activation during assisted breath, has been previously reported in concomitance of a reduction in comfort in post-extubation NIRS patients [7]. Also, APP has not been able to reduce spontaneous inspiratory effort in all the patients from a cohort of subjects intubated for moderate-to-severe ARDS not related to COVID-19 [8]. Thus, proning awake patients seems more challenging than applying prone position or anterior chest compression in sedated and paralyzed patients undergoing invasive mechanical ventilation. This is easily understood considering that NIRS delivered for many hours a day, in combination with the APP, requires the continuous optimization of the patient-ventilator interaction, as well as the patient's full cooperation and tolerance in maintaining the prone position. In this condition, the advanced respiratory monitoring tools, i.e., diaphragm ultrasound, electrical impedance tomography, and esophageal pressure, might be a valid option to identify, early, patients at risk for self-induced lung injury.

Diaphragm ultrasound has been extensively employed to assess diaphragmatic activity in patients undergoing NIRS, yet on admission to the emergency department [9]. To date, however, data on diaphragmatic thickening fraction assessment in course of APP are scarce. Accordingly, the real impact of diaphragm ultrasound in this setting needs to be addressed in larger and multicenter investigations.

In conclusion, the increased diaphragmatic thickening fraction could also be the consequence of an improved lung aeration induced by APP, provided that this occurs without comfort deterioration. Therefore, APP's success is a simple compromise, as always.

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Authors' contributions

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