

Body Position Dependent Participation of Abdominal and Thoracic Breathing Movements During the Breathing Cycle

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Abstract

Aims: Both abdominal and thoracic breathing movements play important roles in the mechanics of breathing, participating differently in various body positions with abdominal breathing having a greater role. Recent studies showed that an early proning position of awake, non-intubated patients during the COVID-19 pandemic, even during pregnancy (PMID: 32320506, PMID: 33309507, PMID: 34915799) significantly affected the ventilatory parameters and mortality of SARS-CoV-2 patients. Thus, we hypothesized that in different body positions the participation of abdominal (AB) and thoracic breathing (TB) during the complete respiratory cycle (CRC) is different. To test this, we measured the participation of AB and TB to the CRC in different body positions under resting conditions. **Methods:** In young participants (N=26) age between 18 and 24 ($M=21.3\pm1.6$), changes in abdominal and chest circumferences were measured using plethysmography respiratory belts, during inhalation and exhalation in standing (ST), sitting (SI), supine (SU), prone (PR), and all on fours (AF) body positions. Respiratory frequency was also measured. **Results:** In different positions, the contribution of AB and TB to CRC were significantly different ($F(4,100)=4.999$, $p=0.004$, $\eta^2_p=0.17$). AB was significantly higher than TB in all positions ($p<0.001$). More specifically, AB gradually increased, while TB gradually decreased in the following order: $SU(AB/TB) = 74.8\pm12.9\%/25.2\%$, $ST =$

69±16%/31%, PR = 66.8±20.2%/33.2%, SI = 65.5±14.8%/34.5%, AF = 61.1±15.1%/38.9%. A significantly higher value was measured in the SU position compared to AF ($p<0.001$) and SI ($p=0.011$) positions; PR and ST positions showed intermediate values, which were not significantly different from those yielded by either of the other positions. Respiratory frequency was similar in different body positions. Conclusions: These data show that different body positions significantly affect the participation of abdominal and thoracic breathing during resting condition, underscoring not only the importance of respiratory distress patients positioning during hospitalization, but its usefulness in developing a respiratory training plan for elite athletes to optimize their physical and mental performance in competitive sports.

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