

Traditional and high tidal volumes are associated with prolonged mechanical ventilation and organ failure after cardiac surgery

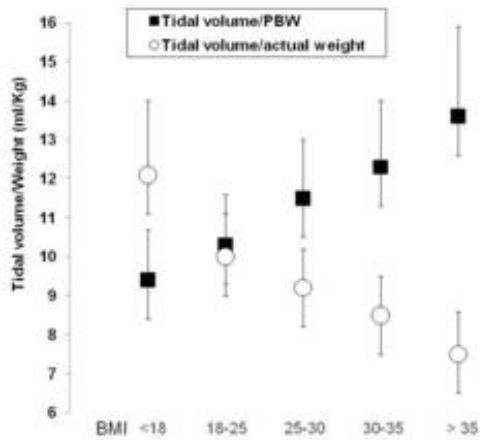
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Rationale: High tidal volumes in mechanically ventilated patients with ARDS lead to baro/bio-trauma and increase mortality. Also, it was recently shown that ventilation with high tidal volumes is a risk factor for “acquired ARDS” in a medical population. We evaluated the impact of high tidal volumes after cardiac surgery.

Method: We analysed the prospectively recorded data of 3434 consecutive patients who underwent cardiac surgery from 2004 to 2006. We predefined 3 groups of patients based on the tidal volume delivered immediately after surgery: (i) Low: 7 to 9.9 (ii) “traditional”: 10 to 12.9 (iii) High: above 13 ml/Kg of predicted body weight (PBW). We assessed the risk factors for organ dysfunction (prolonged mechanical ventilation, hypoxemia, hemodynamic failure and renal failure) by univariate and multivariate analysis, including the tidal volume at ICU admission in the models.

Results: Mean tidal volume/actual weight and mean tidal volume/PBW was 9.2 ± 1.3 and 11.1 ± 1.5 in men ($P<0.0001$), 9.1 ± 1.4 and 12.5 ± 2.2 in women ($P<0.0001$). 411 patients (12%) were ventilated with low tidal volumes, 2194 (63.9%) with “traditional” TV and 829 (24.1%) with high TV. The mean body mass index in the 3 groups was 23.8 ± 4.0 , 27.0 ± 4.1 and 31.5 ± 5.4 Kg/m² respectively ($P<0.0001$). With increasing BMI, the tidal volume/actual weight decreased while the tidal volume/PBW increased (Figure). The percentage of women was 12.2, 20.8 and 52.2% respectively for low, “traditional” and high TV ($P<0.0001$). Traditional and high tidal volumes were associated with prolonged intubation (>48h) (1.5% vs. 2.7% vs. 4.3%, $P=0.009$), hypoxemia (2.7% vs. 3.6% vs. 5.3%, $P=0.03$), renal failure (8.8% vs. 9.9% vs. 13.5%, $P=0.007$) and prolonged use of inotropes/vasopressors (5.8% vs. 7.4% vs. 11.3%, $P=0.004$). In a multivariate analysis, use of high tidal volumes was an independent risk factor for mechanical ventilation > 48 hours (traditional vs. low: OR: 2.2 [0.8-6.0], $P=0.13$ and high vs. low: OR: 3.1 [1.1-8.6], $P=0.04$) and prolonged use of inotropes/vasopressors (traditional vs. low: OR: 1.7 [0.9-3.0], $P=0.11$ and high vs. low: OR: 2.4 [1.2-4.5], $P=0.01$).

Figure: Tidal volume/predicted body weight and tidal volume/actual weight for different BMI.



Conclusion: Traditional and high tidal volumes are associated with prolonged mechanical ventilation and organ dysfunction after cardiac surgery and use of high tidal volumes is an independent risk factor. “Prophylactic” protective ventilatory strategy should be provided in this population with inflammatory state at risk to develop ventilator induced pulmonary edema. Women and patients with high BMI are more at risk to be ventilated with injurious tidal volumes.