ORIGINAL RESEARCH PAPER

Pulmonary Medicine

ROLE OF PRESSURE SUPPORT VENTILATION (PSV) IN SUCCESSFUL EXTUBATION OF MECHANICAL VENTILATOR

KEY WORDS:

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INTRODUCTION :

- Discontinuation of invasive mechanical ventilation consists of 2 phases: weaning (abolishing the need for ventilatory support) and extubation (removal of the endotracheal tube [ETT] when it is no longer required).1 Extubation is a commonly performed procedure in ICUs.
- Weaning from MV accounts for up to 40% of time spent on MV and an SBT constitutes the gold standard diagnostic test to determine a patients' readiness for extubation
- Currently used SBT modalities include methods that provide ventilatory support, such as pressure support ventilation (5-8 cm H2O with or without PEEP), CPAP or automatic tube compensation; and methods without any ventilatory support, such as T-piece
- Decades of research have been dedicated to finding the optimal protocolized SBT modality that best simulates physiologic conditions post-extubation, in order to infer a patients' readiness to liberate from MV
- Recent meta-analyses and guidance have been inconclusive or contradicting
- Studies have shown that different SBT modalities and duration demonstrate no significant difference regarding success rate of extubation (PSV vs. T-piece for 2h, 30-minute vs. 2h PSV or 30-minute vs. 2h T-piece). The optimal SBT modality and duration to ascertain a patients' readiness to be extubated remains unknown

Design

- Prospective case control study
- An estimated extubation success of 75%, with an increase in absolute success rate of 7%, with a sample size of 100 patients per group to detect a significant difference of successful extubation between groups
- A prespecified interim analysis was performed when half of the sample was enrolled. There was a nonsignificant difference in successful extubation between groups
- Analysis was performed using an intention-to-treat principle

Setting

- Patients from ICU were included in the study

Population

Inclusion criteria:

- Patients ≥ 18 years of age, met weaning criteria after at least 24 hours of mechanical ventilation
- Suitable cough (Ability to raise secretions to the endotracheal tube) (or PiMax> -15 cmH2O)
- Absence of excessive secretions (<3 aspirations in the last 8 hours)
- Resolution or improvement of the pathology that led to intubation
- Clinical stability (HR <140 bpm, SBP 90-160, without vasopressors or at minimum doses)
- Adequate oxygenation (SatO2> 90% with FiO2 <0.4)
- Adequate ventilatory mechanics (RR <35 rpm, MIP <-20 cmH2O, Vt> 5 ml / kg, VC> 10 ml/ kg, RR / VT <100 rpm/l)
- Confident awareness level (Glasgow Coma Scale> 13)

Exclusion criteria:

- Patient not consenting for the study
- Tracheostomy,
- do-not-reintubate orders,
- decision of the responsible physician (e.g., due to a preference for a particular weaning technique according to the underlying pathology), absence of informed consent,
- mental incapacity without legal representation
- Baseline characteristics: well-balanced for age, APACHE score on admission, reason for admission and days on MV before SBT. Most were medical ICU patients

Intervention

- **Low respiratory work strategy**
- Spontaneous Breathing Trial (SBT) with Pressure Support Ventilation (PSV)
- PSV 8 cmH2O, PEEP 0 cmH2O for 30 minutes

Control

- **High respiratory work strategy**
- SBT with T-piece for 2 hours
- ***Management common to both groups***
- FiO2: maintained the same as before the SBT
- Postextubation non-invasive support: before SBT attending physician had to choose between providing ventilatory support with non-invasive ventilation or oxygenation support with high-flow nasal cannula or conventional low flow oxygen therapy
- One-hour rest: patients could be rested for 1hr on mechanical ventilator prior to extubation
- This was determined prior to randomization
- Failure of SBT Criteria
- Neurological causes: Agitation or anxiety. Low level of consciousness (Glasgow Coma Scale <13)
- Increased respiratory work: use of accessory muscles, facial expression suggesting stress, severe dyspnea
- Hypoxemia: PaO2 <60 mmHg or SatO2 <90% with FiO2 >0.5
- Tachypnea: RR> 35 rpm
- Hemodynamic instability: HR> 140 bpm or >20% from baseline; SBP >180 mmHg or >20% from baseline; SBT <90 mmHg; Cardiac arrhythmias

Outcome

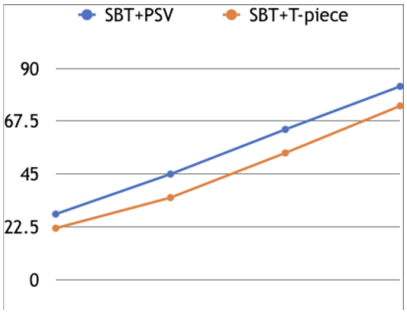
- **Primary outcome**: successful extubation, defined as remaining free of MV 72 h after the first SBT, was more frequent in the low respiratory work strategy group (SBT + PSV)
- SBT+PSV: 82.3%
- SBT+T-piece: 74%
- Absolute Risk Reduction (ARR): 8.2% (95% CI 3.4-13%)
- Kaplan-Meier curves show a higher successful extubation rate in SBT-PSV group
- Hazard Ratio (HR) 1.54 (95% CI 1.19-1.97; P <0.001)

- **Secondary outcome**: Comparing SBT+PSV vs SBT+T-piece
- Successful extubation after first SBT: 92.5% vs 84.1%
- Difference: 8.4 (95% CI 4.7 to 12.1, P <0.001)
- Reintubation within 72 h: 11.1% vs 11.9%
- Difference: -0.8 (95% CI -4.8 to 3.1, P=0.63)
- ICU length of stay: 9 days vs 10 days
- Difference: -0.3 (95% CI -1.7 to 1.1, P=0.69)
- Hospital length of stay: 24 days vs 24 days
- Difference: 1.3 (95% CI -2.2 to 4.9, P=0.45)
- Hospital mortality: 10.4% vs 14.9%

- Difference: -4.4 (95% CI -8.3 to -0.6, P=0.02)
- 90-Day mortality: 13.2% vs 17.3%
- Difference: -4.1 (95% -8.2 to 0.01, P=0.04)

- **Exploratory outcome**: comparing SBT+PSV vs SBT+T-piece
- Time to reintubation: 23 hours vs 24.5 hours
- Reason for reintubation: mostly due to excessive WOB, difficulty managing secretions and refractory hypoxemia
- Well balanced between groups
- Tracheostomy: 7.1% vs 8.7%

Post-hoc outcome:
- ICU mortality: 5% vs 6.6%
- **Conclusions:**
- Among mechanically ventilated patients, an SBT consisting of 30 minutes of PSV, compared with 2 hours of T-piece ventilation, led to significantly higher rates of successful extubation
- These findings support the use of a shorter, less demanding ventilation strategy for SBTs



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