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Among paralyzed, mechanically ventilated adult patients within the ICU, does ventilator compliance compared to train-of-four (TOF) monitoring affect adequate paralysis?

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Background & Significance

Acute respiratory disease syndrome (ARDS) has a mortality rate of 40% (Villar et al., 2014).

ARDS is treated with a neuromuscular blocking agent (NMBA) with mechanical ventilation. This paralytic needs to be monitored and titrated every four hours. This is done using Train of Four (TOF) monitoring or using ventilator compliance and the assessment.

TOF Monitoring – uses electrical stimulation on nerves and observing the "twitch" response to assess the degree of neuromuscular blockage (Hadique et al., 2021; Murray et al., 2016).

- 2/4 twitches = well paralyzed patients
- 4/4 twitches = under-paralyzed patient
- 0/4 twitches = over-paralyzed patient

TOF is difficult to measure correctly because:
1) electrodes placed in exactly the correct position over the nerve &
2) subjective readings that are difficult to observe.
TOF can be unreliable due to edema, perspiration, or electrode non adhesion (Hadique et al., 2021).

Clinical Assessment & Ventilator Compliance - observing patients for spontaneous movement, ventilator asynchronies, and presence of a cough (Rezaiguia-Delclaux et al., 2021). This generally results in lower dosages of paralytic agent used (Ali et al., 1970; Monroe et al., 2020; Thompson Bastin et al., 2021).

Methods

Evidence was obtained by searching academic journals that were peer-reviewed primary research articles. Search parameters included keywords *TOF monitoring* and *ventilator compliance* and *ARDS*. Additional literature reviews were consulted as they included primary research published in the past seven years that is relevant to this review.

Evidence Summary & Conclusions

Author Study type	What was tested	Findings & Conclusions	Level (Melnyk & Fineout-Overholt, 2019) & Quality of Evidence (Newhouse et al., 2005)
Baumann et al. (2004) Randomized sampling control trial	Examine the use of clinical assessment and TOF monitoring to assess dosage efficacy for paralyzed patients within the ICU	Careful titration of the paralytic by clinical assessment alone is sufficient, not needing TOF monitoring.	Level I study A Quality rating
Dibridge et al. (2021) Retrospective non-experimental study	Compare fixed dose, TOF monitoring, and ventilator compliance to determine which dosing strategy used the least amount of paralytic without compromising oxygenation efficacy for paralyzed patients within the ICU	Ventilator Compliance used significantly less paralytic and should be used instead of TOF or fixed-dose monitoring	Level III study B Quality rating
Groetzinger et al. (2016) Retrospective non-experimental study	Compare the depth of paralysis, as determined by TOF monitoring, correlates with gas exchange in patients with moderate to severe ARDS within the ICU	Depth of paralysis that patients experience is not correlated between TOF monitoring and clinical assessment	Level III study B Quality rating
Bouju et al. (2017) Descriptive study	Compare the use of both ulnar and facial nerve TOF monitoring with clinical assessment during mechanically ventilated paralyzed patients within the ICU	Depth of paralysis that patients experience is not correlated between TOF monitoring and clinical assessment	Level I study A Quality rating
Rezaiguia-Delclaux et al. (2021) Randomized sampling control trial	Compare the use of TOF monitoring with clinical assessment during mechanically ventilated paralyzed patients within the ICU with ARDS	Altering paralysis monitoring from TOF monitoring to clinical assessment did not change mortality, but increased amount of paralytic agent used	Level I study A Quality rating

Conclusion: both monitoring styles were effective, but ventilator compliance required less paralytic agent given. This has implications for:

- Cost – nursing time & cost of drug
- Patient fluid balance
- Quicker rehabilitation time
- Less skeletal muscle degeneration
- Less time using mechanical ventilation
- Lower morbidity and mortality

Implications for Nursing Practice

Overall Nursing Practice Implications:

- Not quite enough evidence to alter practice – need more studies with larger sample sizes
- Enough evidence to utilize horizontal leadership during interprofessional meetings to start to discuss alternative ways to monitor paralysis for mechanically ventilated patients within the ICU

CNL Role Implications:

- Patient advocacy
- Lateral integration
- Ethical implications

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References