The Utilization of the Pressure Volume Tool to Determine the Lower Inflection Point During Extracorporeal Membrane Oxygenation (ECMO)

Kenneth Miller MEd, RRT-NPS
Lehigh Valley Health Network, Kenneth.Miller@lvhn.org

Rita Pechulis MD, FCCP
Lehigh Valley Health Network, Rita_M.Pechulis@lvhn.org

James K. Wu
Lehigh Valley Health Network, james.wu@lvhn.org

Dorothea T. Watson DO
Lehigh Valley Health Network, Dorothea_T.Watson@lvhn.org

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The Utilization of the Pressure Volume Tool to Determine the Lower Inflection Point During Extracorporeal Membrane Oxygenation (ECMO)

Kenneth Miller MEd, RRT-ACCS, Rita Pechulis MD, James Wu MD, Dorothea Watson MD
Lehigh Valley Health Network, Allentown, PA

Introduction
- During the ventilation of patients with ARDS one of the primary goals is to minimize ventilator induced injury. The gold standard for lung protection is ARDSnet Protocol.
- If the oxygenation end-point cannot be achieved ECMO may be another intervention. Recently the utilization of ECMO has demonstrated a reduction in lung injury and improved outcomes.
- Gas exchange is managed by ECMO while the ventilator’s goal is to maintain lung inflation at the lowest pressures possible.
- The utilization of the Pressure-Volume Tool (P/V Tool) can help determine the lower inflection (LIP) and upper inflation points (UIP) and to provide recruitment maneuvers if required.

Methods
- The P/V Tool (Hamilton Medical Inc, Reno Nevada) is a systematic ventilator application that allows the clinician to set lower and higher starting pressures, along with a Phigh (PEEP) for a sustained time frame if desired for a recruitment maneuver.
- After the maneuver, a pressure/volume graph is visualized to assess the inspiratory and expiratory limbs of the P/V loop.
- Also, a loop hysteresis is available to determine if there is potential additional lung to be recruited.
- The P/V tool is performed every 12hrs for LIP/UIP assessment and recruitment maneuvers are performed if CI <20cmH2O for all patients placed on ECMO.

Results
- The P/V Tool has been utilized on a daily basis to determine the lower and upper inflection points on twenty-eight patients placed on V-V ECMO for ALI management.
- On thirteen of the patients whose lung compliance was <20cmH2O (8 cmH2O to 14 cmH2O 06hr recruitment maneuvers were performed for 30 seconds at a PEEP of 30 cmH2O to improve lung compliance.
- The above patients' lung compliance was maintained >20cmH2O during the ECMO utilization by performing sequential P/V tool assessment or recruitment maneuvers.

Conclusions
- The utilization of the P/V tool helped our clinical team maintain lung inflation during ECMO.
- The ability to assess and adjust ventilator settings, or perform recruitment maneuvers if indicated helps to maintain lung compliance during ECMO management.

PV Curve to Determine PEEP

P/V Tool and Recruitment Maneuver Guidelines

P/V Tool: The P/V tool is a diagnostic tool to help assess the following:
- to determine if the lung is recruitable
- to determine the lower and upper infection points
- to determine where to set your PEEP level and maximize upper limits of the set PIP

Recruitment Maneuver:
A clinical intervention to help improve the following:
- oxygenation
- lung compliance
- chest x-ray infiltrations

Objective measurement utilized where to set the “best” PEEP and what PIP to set to minimize over-inflation
- Target expired tidal volume 4-6 cc/kg/IBW
- Trending data to help assess the status of the pulmonary mechanics
- Typically performed Q 12hrs.

PV Tool-recruitment
Recruited volume can be seen and is quantifiable