



Prince Sultan Military Medical City

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وزارة الدفاع
MINISTRY OF DEFENSE

Departmental Policy	Dept.: Intensive Care Services	Policy No: 1-2-9451-03-006 Version No: 02		
Title: Adult Respiratory Ventilator Policy (ARVP) – Mechanical Ventilation Initiation		JCI Code: COP		
Supersedes: 1-2-9451-03-006 Version No: 02; 23 January 2020	Issue Date: 31 May 2023	Effective Date: 21 May 2023	Revision Date: 20 May 2026	Page 1 of 11

1. INTRODUCTION

The Adult Respiratory Ventilator Policy (ARVP) is based on a goal oriented respiratory expectation.

2. PURPOSE

To serve as a guide to Respiratory Care Practitioner (RCP's) and physicians in the management of patients on mechanical ventilation in the Intensive Care Unit (ICU). It is set to ensure that medical based practice in ventilator management is provided on a continuous basis.

3. APPLICABILITY

- 3.1 To all health care practitioners (HCP) who give direct patient care to patients receiving mechanical ventilation. i.e. physicians, nurses, and respiratory care practitioners (RCP's).
- 3.2 ARVP is used on all patients on mechanical ventilation who meet the following inclusion criteria:
 - 3.2.1 Appropriate age i.e. age > 14 years
 - 3.2.2 A standing order to 'ventilate as per ARVP' is issued.
 - 3.2.3 No evidence of adult respiratory distress syndrome (ARDS)

4. RESPONSIBILITIES

4.1 Physicians

- 4.1.1 Order medications and therapies to optimize mechanical ventilation.
- 4.1.2 Consults with RCPs and nurses during medical rounds regarding patient care.

4.2 Nurses

- 4.2.1 Administers any necessary medications and therapies as ordered.
- 4.2.2 Continuous monitoring of patient's vital signs.
- 4.2.3 Communicates changes in patient's condition to attending physician and bedside RCP.

4.3 RCP's

- 4.3.1 Verify physician's order to "Ventilate per ARVP".
- 4.3.2 Ventilate all adult patients per ARVP including initiation and management.



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- 4.3.3 Document all ventilator settings, patient assessment, blood gases and changes on the Cerner.
- 4.3.4 Document critical events, sustained changes despite appropriate respiratory interventions. Including the following ventilator parameters:
- 4.3.4.1 Peak inspiratory pressure
 - 4.3.4.2 Plateau pressure
 - 4.3.4.3 Positive end expiratory pressure (PEEP)
 - 4.3.4.4 Increased resistance
 - 4.3.4.5 Decreased compliance
 - 4.3.4.6 Respiratory rate
 - 4.3.4.7 Increased or decreased FIO₂
- 4.3.5 Inform the physician of any such parameter changes.
- 4.3.6 Follow protective lung strategy i.e. uses of small tidal volumes and appropriate levels of PEEP in all patients requiring ventilator support for acute failure.
- 4.3.7 Initiate ventilation as follows:
- 4.3.7.1 **Modes of Ventilation**
 - 4.3.7.1.1 Once the need for mechanical ventilation has been established, the clinician must select the type of ventilator, breath type, and ventilator mode appropriate for the patient.
 - 4.3.7.1.1.1 Type of breath: mandatory breaths
 - 4.3.7.1.1.2 Spontaneous breaths
 - 4.3.7.1.1.3 Assisted breaths
 - 4.3.7.1.2 Initially use a full support mode until the reason for establishing ventilation is reversed and the patient is assessed for weaning.
 - 4.3.7.1.3 The choice of mode depends on patient tolerance and the clinician's preference.
 - 4.3.7.1.4 These modes may be used:
 - 4.3.7.1.4.1 Volume Ventilation: Continuous Mandatory Ventilation (CMV) with auto flow. (Pressure regulated mode), Volume Control/Assist



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control (VC/AC) with auto flow. (Pressure regulated mode), Pressure Regulated Volume Control (PRVC), Volume Control (VC), Pressure control ventilation-volume guarantee (PCV-VG), Volume-Synchronized Intermittent Mandatory Ventilation (V-SIMV)

4.3.7.1.4.2 Pressure Ventilation: Pressure Control Ventilation (PCV), pressure- Synchronized Intermittent Mandatory Ventilation (P-SIMV) if peak inspiratory pressure (PIP) > 35 cmH₂O and/or plateau pressure ≥ 30 cmH₂O.

4.3.7.1.4.3 Pressure support modes include:

4.3.7.1.4.3.1 Pressure Support Ventilation (PSV)

4.3.7.1.4.3.2 PS with CPAP (continuous positive airway pressure)

4.3.7.1.4.3.3 Pressure- Mandatory Minute Ventilation (P-MMV)

4.3.7.1.4.3.4 Smart Care PS.

4.3.7.1.4.3.5 Synchronized Intermittent Mandatory Ventilation (SIMV) with PS for slow weaning (TIPS protocol)

4.3.7.2 Tidal Volume (VT)

4.3.7.2.1 Set at 6 to 8 ml/kg IBW for most patients if the plateau pressure ≤ 30 cmH₂O and the delta P (PIP_PEEP) is ≤ 20 cmH₂O.

4.3.7.2.1.1 Where:

IBW = ideal body weight

Kg = kilograms

H = height in inches

IBW (male) = 50 + 2.3(H-60)

IBW (female) = 45.5 + 2.3 (H-60)

(To convert centimeters to inches ÷2.54)



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4.3.7.2.1.2 Set tidal volume between '6-8 ml/kg IBW range' with the following:

- 4.3.7.2.1.2.1 Newly intubated patient.
- 4.3.7.2.1.2.2 Patients with healthy lungs and have neuromuscular disease.
- 4.3.7.2.1.2.3 Patients with healthy lungs who are newly post-operative
- 4.3.7.2.1.2.4 Patients with chronic obstructive lung disease
- 4.3.7.2.1.2.5 (COPD) allow for a shorter inspiratory time and longer **expiratory time** to avoid air-trapping.

4.3.7.2.2 Set VT on low side, i.e. 6-8 ml/kg IBW of with patients with COPD and/or severe asthma.

4.3.7.2.3 In-patient with chronic or acute restrictive disease, such as pulmonary fibrosis or ARDS, an initial VT of 4-6 ml/kg is indicated.

4.3.7.2.4 In general, a VT more than 9-10 ml/kg IBW is not recommended because of risk of high pressures and accompanying over distention and trauma to the lung, in addition to other complications.

4.3.7.3 Respiratory Rate (RR)

4.3.7.3.1 Initially set respiratory rate between 10 and 22 bpm (breaths per minute).

4.3.7.3.2 Adjust to achieve optimal total cycle time.

4.3.7.3.3 Maintain acceptable minute ventilation (VE). i.e. VE = 100 ml/kg IBW.

4.3.7.3.4 In patient with chronic or acute restrictive disease, such as pulmonary fibrosis or ARDS, an initial high rate 15-25breath/min is indicated.



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4.3.7.3.5 In-patient with chronic or acute obstructive lung disease, such as COPD or asthma, an initial low rate 8-12 breath/min with for a shorter inspiratory time and longer expiratory time to avoid air-trapping.

4.3.7.3.6 While setting RR maintain plateau pressure ≤ 30 cmH₂O and delta P ≤ 20 cmH₂O.

4.3.7.4 **Inspiration to Expiration Ratio (I: E)**

4.3.7.4.1 An initial inspiratory time of 1 second (0.8 to 1.2 seconds) with resultant I: E of 1:2.

4.3.7.4.2 Set small I:E with longer T_E to optimize patient/ventilator synchrony and minimize air trapping and auto-PEEP.

4.3.7.4.3 Set large I:E with longer T_I may be used for patients requiring high P_{aw} and high gas distribution time.

4.3.7.5 **Inspiratory Flow**

4.3.7.5.1 Maintain peak flow between 40-100 liters/minute.

4.3.7.5.2 Assess airway pressure-time waveform and V-P loop to insure goal is met.

4.3.7.5.3 Optimal flow pattern is highly variable and dependent on the individual patient's lung and airway condition.

4.3.7.6 **Fractional Inspired Oxygen (FiO₂)**

4.3.7.6.1 Initially set FiO₂ at 50-100% until results from ABG can be obtained and setting adjusted.

4.3.7.6.2 Initial ABG should be obtained 15-60 minutes from start of ventilation.

4.3.7.6.3 Pulse oximetry should be correlated with initial ABG.

4.3.7.6.4 Patient should be subsequently monitored with continuous pulse oximetry to maintain saturation (SpO₂) at or above patient's normal or $> 90\%$.



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4.3.7.6.5 Titrate FiO₂ down to maintain a PaO₂ 60-80 mmHg and a SpO₂ ≥ 90%.

4.3.7.7 **Positive End Expiratory Pressure (PEEP)**

4.3.7.7.1 Initially set at 5 cmH₂O.

4.3.7.7.2 Keep PEEP between 5 to 12 cmH₂O unless otherwise indicated.

4.3.7.7.3 In patient with chronic or acute obstructive lung disease, such as COPD or asthma, an initial PEEP 3-5cmH₂O

4.3.7.7.4 Adjust PEEP level to achieve a minimum PaO₂ of 60 mmHg and a SpO₂ >90% with a FiO₂ 40-50%.

4.3.7.7.5 **Contraindications:** excessive PIP, P_{plato} >30cmH₂O, hypotension, untreated pneumothorax, increase ICP, large B-P fistula, and possibly unilateral lung disease or COPD.

4.3.7.8 **Pressure Support (PS)**

Use guidelines to set PS from the 'Weaning from Mechanical Ventilation Protocol'.

4.3.7.9 **Ventilator Alarms**

Alarms are set so that they warn the clinician of important changes, without becoming a nuisance. The ventilator alarms are as follow:

4.3.7.9.1 High pressure limit = 5-10 cmH₂O above PIP

4.3.7.9.2 Low pressure limit = 5-10 cmH₂O below PIP

4.3.7.9.3 Low exhaled VT = 10-15% below set VT

4.3.7.9.4 Low exhaled VE = 10-15% below baseline VE

4.3.7.9.5 High exhaled VE = 10-15% above baseline VE

4.3.7.9.6 Apnea Delay = 20 seconds

4.3.7.9.7 Apnea values set to achieve full ventilator support



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4.3.7.10 Trigger Sensitivity

4.3.7.10.1 The trigger sensitivity should be set at the lowest possible level to minimize trigger work while avoiding ventilator auto-cycling.

4.3.7.10.2 Typically, newer ventilators are flow-triggered which offers slightly lower trigger work than pressure triggering.

4.3.7.10.3 The flow trigger should be set between 1-3 liters/minute or a standard of 2Liters/minute.

4.3.7.10.4 The pressure trigger should be set between 0.5-2.0cmH2O

4.3.8 Indication for ventilator support

4.3.8.1 *Apnea* or Impending Respiratory Arrest.

4.3.8.2 *Failure to maintain airway tone*: upper airway swelling, facial or neck trauma with oropharyngeal bleeding.

4.3.8.3 *Failure to protect airway against aspiration*: decrease consciousness.

4.3.8.4 *Failure to ventilate*: fatigue due to prolonged respiratory effort in asthmatics or severe COPD.

4.3.8.5 *Failure of oxygenate*: end result of failure to maintain, diffuse pulmonary edema, ARDS, pneumonia, pulmonary embolism CO toxicity.

4.3.8.6 *Anticipated clinical course or deterioration*: severe cardiogenic shock, severe traumatic brain injury, septic shock, uncooperative patient with life threatening injuries who needs procedure e.g., chest tube

5. POLICY

5.1 The physician must write an order for mechanical ventilation stating: “Initiate Mechanical Ventilation per ARVP”.

5.2 May discontinue “Initiate Mechanical Ventilation per ARVP” at any time patient’s condition warrants i.e. the patient meeting one of the following criteria:

5.2.1 Patient < 14 years of age



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- 5.2.2 Patient with terminal illness and not for aggressive ventilator management.
- 5.2.3 Patient with ARDS, follow the policy of “Mechanical ventilation for ARDS Patients”
- 5.2.4 When an order of “Do not follow ARVP” is issued, there should be a written order of “Do not follow ARVP” and initial ventilator parameters in the physician’s order sheet.

6. **DEFINITION OF TERMS**

A protocol is a “rigid code of procedures in which medical treatment results in: assessment, then interaction, then assessment.” It is a set of guidelines that organize the process of mechanical ventilation initiation and management.

7. **PROCEDURES**

7.1 **Preliminary Steps:**

- 7.1.1 Review medical records for medical history, diagnosis, and current pulmonary status.
- 7.1.2 Verifies physician order for ventilator protocols and assesses for appropriateness.
- 7.1.3 Reviews hemodynamic status of patient, i.e. heart rate, BP.
- 7.1.4 Locates and reviews labs and chest x-ray.
- 7.1.5 Reviews current medications related to cardiopulmonary status.
- 7.1.6 Reviews fluid intake/output.
- 7.1.7 Ensures patient privacy, washes hands, and implements Standard Precautions.

7.2 **Patient Interaction and Equipment Preparation:**

- 7.2.1 Properly assemble the ventilator circuits and correctly attach breathing circuit to ventilator.
- 7.2.2 If using a heat moisture exchange (HME), place in line as per manufacture’s recommendation.



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- 7.2.3 If using a heated humidification system, attached heater wire and temperature probe, add sterile water to appropriate fill level as per manufacturer's guidelines.
- 7.2.4 Inspect and connect electrical cord and/or pneumatic power (Ensure ventilator is connected to emergency power outlet).
- 7.2.5 Ensure ventilator is connected to oxygen and air (if the air compressor not available).
- 7.2.6 Correctly perform the ventilator pre-use check as per manufacturer's operation manual.
- 7.2.7 Choose and apply 100% Automatic Tube compensation (ATC) when available.
- 7.2.8 Monitors and trends ventilator changes and ensures appropriateness of current settings.
- 7.2.9 Ensures endotracheal tube is secure, notes placement, size, position and depth.
- 7.2.10 Assess patient for optimal positioning. Head of the bed at 30-45 degrees as condition tolerates.
- 7.2.11 Verify presence of manual resuscitation bag and mask and ensure connection to oxygen source.
- 7.2.12 Auscultate patient chest and documents breathe sounds.
- 7.2.13 Assesses patient work of breathing and ventilator/patient synchrony.
- 7.2.14 Suctions oropharynx and subglottic secretions.
- 7.2.15 Monitors endotracheal tube cuff pressures to avoid micro-aspiration of subglottic secretions.
- 7.2.16 Suctions patient as needed with closed suction system, avoids the use of routine lavage.
- 7.2.17 Administers inhaled medications per protocol or as ordered by physician.
- 7.2.18 Notes current ventilator settings and monitors all alarm values for appropriateness.
- 7.2.19 Assesses respiratory rate, heart rate, and non-invasive monitors.



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7.2.20 Measures plateau pressures, dynamic compliance and auto-PEEP, per RCS policy.

7.2.21 Monitor ventilator waveforms and graphics as applicable.

7.2.22 Ensures appropriate respiratory equipment at bedside. i.e. manual resuscitation bag and mask, suction supplies.

7.3 Patient Evaluation and Termination of Procedure:

7.3.1 Discuss care plan with multidisciplinary healthcare team during physician rounds and as needed.

7.3.2 Suggest possible respiratory care interventions and formulate a plan to wean and extubate patient as per RCS protocols.

7.3.3 Review and interpret ABG's and possible trends in ABG values.

7.4 Documentation and Records:

7.4.1 Documents ventilator monitoring and assessment in Cerner.

7.4.2 Effectively communicates results to other members of the healthcare team and documents care plan using approved documentation format. i.e. SOAP

8. REFERENCES

8.1 Cox Health, Adult Respiratory Ventilator Protocol, RVP Version 3.2, Respiratory Care Department, Springfield, Mo

8.2 Egan's Fundamentals of Respiratory Care, 9th Edition. Initiating and Adjusting Ventilatory Support, 44: 1045-1058.

8.3 Interdisciplinary mechanical Ventilation Protocol: Acute Phase, South General Hospital, Platteville, WI

8.4 MICU guidelines- Mechanical Ventilation, Respiratory Therapy Section of Pulmonary Disease Department, Cleveland Clinic, Cleveland OH

8.5 Respiratory Care Department Ventilator Management Protocol, Revision 4, Respiratory Care Department, Lakeland Regional Medical center, Lakeland, FL.

8.6 Sheinhorn, D.J. et al, Outcomes in Post ICU Mechanical Ventilation, Chest, 119:236-242.



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9. ORIGINATING DEPARTMENT/S

Intensive Care Services Department-Respiratory Care Services

Compiled by: • Mrs. Ekhlās Al-Hefdhī Team Leader & Chairman of Respiratory Care Services Policy and Procedure Committee	Signature: 	Date: 17-4-2023
• Mrs. Bodour Al-Dossari Head of Respiratory Care Services	Signature: 	Date: 26/4/2023
Reviewed by: Dr. Muhammad Kashif Malik Consultant & Head, CQI&PS Division, Intensive Care Services	Signature: 	Date: 2/APRIL/2023
Reviewed by: Dr. Samir Mohammed Bawazir Director, Continuous Quality Improvement & Patient Safety (CQI&PS)	Signature: 	Date: 27.4.2023
Authorized by: Brig. Gen. Dr. Adnan Al Ghamdi Director of Intensive Care Services (ICS)	Signature: 	Date: 26-4-2023
Authorized by: Brig. Gen. Dr. Abdulrahman Al Robayyan Director of Medical Administration	Signature: 	Date: 27/4/23
Authorized by: Brig. Gen. Dr. Rashed Al Otaibi Executive Director for Health Affairs Chairman, Senior Medical Management Team (SMMT)	Signature: 	Date: 11.5.2023
Approved by: Maj. Gen. Khalid Abdullah Al Hadaithi General Executive Director of Prince Sultan Military Medical City	Signature: 	Date: 21.5.2023