APRV – TRADITIONAL METARULES

Goal: Maintain a mean airway pressure that recruits and maintains end expiratory lung volume.

- All patients should have an ABG at the time of randomization and generally every 2 hours unless contraindicated
- Protocol will be run within 30 minutes of new ABG’s
- Use PaO2 if available, only use SPO2 if PaO2 more than 30 minutes old.

Initial settings:
- FiO2: set at current level – may have to increase initially
- Slope: always set at “0” sec. Want a square wave form.
- P High: (High level of CPAP) Set at the plateau pressure if on conventional ventilation. If on Pressure Support start at the PS level.
- T High: (amount of time at P High) Controls the number of releases (rate) from P High to P Low.
  - VR > 30 = T High of 4 sec
  - VR 21-29 = T High of 5 sec
  - VR ≤20 = T High of 6 sec
- P Low: (low level of CPAP) always set at “0”cmH2O. There will be residual or intrinsic PEEP. It will be between 1 – 5 cmH2O and can vary from breath to breath.
- T Low: (amount of time P High is released from the lung) Set at 0.4 to 1.0 sec. Adjust to have the Peak Expiratory Flow Rate percentage 50 to 75%.
- ETCO2: place the ETCO2 in line. It is a standing order for this protocol and will be for the study.
- ATC (automatic tube compensation): Enter the tube size and amount of compensation. Start with 100% compensation. When ATC is turned on, a green line will appear along the pressure wave form. If large spikes or whip are seen in the green line, decrease the amount of compensation in 20% decrements. If at 40% compensation with large spikes and whip, turn the ATC off. Some patients do not tolerate it. May help with work of breathing.
- P0.1: (occlusion pressure) Set the P0.1 to measure every 10 minutes. Set up the screen to show trend of the P0.1 as either a wave form or a short trend with either the pressure or flow wave form. P0.1 is a measure of the patient’s neuro stimulus to breath. The ventilator performs a mini NIF during the first 100 milliseconds of the breath. It will only be measured on a spontaneous breath. Normal is 2-5. 1 – 2 indicate the patient is over sedated or has no neuro stimulus to breath. Over 6 indicates an increased drive to breath. Indicates impending respiratory fatigue. For more information see article on Respiratory Care Team page.
- RSB1: (Rapid Shallow Breathing Index) Frequency / Minute volume. Set up the screen to show trend either as waveform or a short trend. Calculation is done every 6 seconds. Frequency / minute. Patients with an RSB1 less than 100 are able to wean from the ventilator.
- Draw an ABG 30 minutes after initiation.

Adjusting therapy:
- Measure the % peak expiratory flow. Freeze the ventilator screen with two or three releases on the screen.
- Move the cursor to the termination of T Low. Note the lpm.
- Move the cursor to the start of T low.
- Divide termination of T Low by start of T low.
- This is the % peak expiratory flow. For more information see article on Respiratory Care team space.

- Maintain the % peak expiratory flow between 50 to 75%.
- If the % is less than 50 – decrease T Low by 0.1 sec, wait 10 minutes and re-measure the %peak expiratory flow.
- If the % is more than 75 – increase T Low by 0.1 sec, wait 10 minutes and re-measure the % peak expiratory flow.
- The Drager Evita has an internal “High PEEP” alarm. The ventilator will alarm and release all the pressure in the circuit. This will de-recruit lung and is to be avoided. The “High Peep” alarm will be triggered when:
  - The measured PEEP is 5 cmH2O above the set PEEP for 10 breaths.
  - The measured PEEP is 8 cmH2O above the set PEEP for 2 breaths or 15 seconds.
- Lengthen T Low by 0.1 sec increments to decrease intrinsic PEEP.
- Increase T Low by 0.1 sec increments to maintain intrinsic PEEP between 1 to 5 cmH2O.
APRV Traditional

New Patient?
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<tr>
<th>Yes</th>
<th>F02. Initiation</th>
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<tbody>
<tr>
<td>No</td>
<td>T high &gt;= 12 and P High &lt;= 10 and Time = 6 to 10 a.m.?</td>
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<tr>
<td></td>
<td>Yes</td>
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<tr>
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<td>No</td>
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ABG within the last 30 minutes?
<table>
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<tr>
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<th>Changes made?</th>
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<tbody>
<tr>
<td>No</td>
<td>F03 pH adjustment</td>
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WOB increased by 3?
<table>
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<tr>
<th>Yes</th>
<th>F04 Decrease WOB</th>
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<tr>
<td>No</td>
<td>Maintain for 2 hours</td>
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</table>

Changes made?
<table>
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<tr>
<th>Yes</th>
<th>F08 Wean P High and T High</th>
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</thead>
<tbody>
<tr>
<td>No</td>
<td>F07 CPAP Weaning</td>
</tr>
</tbody>
</table>

Note:
*This protocol does not have F 06
*Use PaO2 if ABG done in last 30 minutes

<table>
<thead>
<tr>
<th>Setting</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td>T High</td>
<td>3 sec</td>
<td>12 sec</td>
</tr>
<tr>
<td>T low</td>
<td>.5 sec</td>
<td>1.8 sec</td>
</tr>
<tr>
<td>P high</td>
<td>5</td>
<td>30</td>
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</table>

Legend
CORE: Map to stratification of protocol, guide to individual flows
F followed by a number: Flows
S followed by a number: States, decisions
A followed by a number: conditions
Above used to enhance communication/ prepare for computerization

6/24/2013

*Adapted from Habashi protocol
F02. Initial APRV settings

APRV Traditional

S01
Set P high at current Plateau pressure.
If plateau unobtainable – set P high at mean airway pressure plus 3

S02
Set P high at current Pressure Support level

S03
Set P low at 0

A02
Total VR >= 30

S04
Set T high at 4 seconds

A03
Total VR 21 - 29

S05
Set T high at 5 seconds

A04
Total VR <= 20

S06
Set T high at 6 seconds

S07
Set T low at 0.8 sec.
Adjust to maintain termination flow of peak expiratory flow at 50 – 75%

S08
Set FiO2 at current FiO2
Set slope to 0
Set ATC off
ABG in 30 minutes

R01
Return to CORE

Note:
*Maintain a minimum of 5 cmH2O between P high and P low

<table>
<thead>
<tr>
<th>Setting</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>T high</td>
<td>3 sec</td>
<td>12 sec</td>
</tr>
<tr>
<td>T low</td>
<td>0.5 sec</td>
<td>1.8 sec</td>
</tr>
<tr>
<td>P high</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>P low</td>
<td>0</td>
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</tr>
</tbody>
</table>

Adapted from Habashi APRV protocol

06/24/2013
F03. pH Adjustment

APRV Traditional Ventilation Cells

S01: New ABG?
- Yes
  - S02: pH < 7.25
    - Yes
      - S03: pH > 7.42
        - Yes
          - A01: Increase T high 2 seconds to a maximum of 12 seconds
        - No
          - S04: T high ≤ 5 seconds
            - Yes
              - S05: Increase in T high with pH < 7.25 in last 2 hours?
                - Yes
                  - A03: Decrease T high 1 second to a minimum of 3 seconds
                - No
                  - S07: pH ≥ 7.20?
                    - Yes
                      - A05: Maintain ABG in one hour
                    - No
                      - A02: Decrease T High 1 second to a minimum of 3 seconds
                        - Increase P High 2 cmH2O to a maximum of 30 cmH2O
                          - Call attending MD
          - No
            - S03: Continue to monitor
            - Yes
              - A06: Decrease T high 1 second to a minimum of 3 seconds and P High 2 cmH2O to a maximum of 30 cmH2O
                - Call attending MD
            - No
              - A04: Decrease T High 1 second to a minimum of 3 seconds
                - Increase P High 2 cmH2O to a maximum of 30 cmH2O
                  - ABG in one hour
                      - Call attending MD
              - Yes
                  - R01: Return to Core

R01: Return to Core

NOTE:
* If the pH is between 7.25 and 7.40:
  * PCO2 > 35 follow the protocol
  * PCO2 25-35 contact MD
* ABG must be less than 30 minutes old to use this flow
* Maintain a minimum of 5 cmH2O between P high and P low.

Setting | Min | Max
--- | --- | ---
T high | 3 sec | 12 sec
T low | .5 sec | 1.8 sec
P high | 5 | 30
P low | 0 | 0

Adapted from Habashi Protocol
F04. Work of Breathing Assessment

APRV Traditional

S01
WOB score increased by 3 or more and/or
ETCO2 increase > 5 mmhg

S02
P high <= 20

S03
T high < 5

A01
Increase P high by 4 cmH2O to a maximum of 30 cmH2O
Maintain T high
Reassess WOB score in 15 minutes

S04
P high 20 - 29

S05
T high >= 5 Seconds

A03
Increase P high by 2 cmH2O to a maximum of 30 cmH2O
Decrease T high 0.5 seconds to a minimum of 3 seconds
Reassess WOB score in 15 minutes

S06
P high >= 30

A04
Increase P high by 2 cmH2O to a maximum of 30 cmH2O
Maintain T high
Reassess in 15 minutes

S07
T high <= 5 seconds

A05
Decrease T high .5 seconds to a minimum of 3 seconds
Maintain P high
Reassess WOB score in 15 minutes

S08
T High >= 5 seconds

A06
Decrease T high .5 seconds to a minimum of 3 seconds
Maintain P high
Reassess WOB score in 15 minutes

Return to CORE

Meta Rules
* Do not increase or decrease P high by more than 4 cmH2O each time the protocol is run.
* Do not increase or decrease T high by more than 2 seconds each time the protocol is run.

Setting  Min  Max
T high   3sec  12 sec
T low .5 sec  1.8 sec
P high   5    30
P low    0

06/24/2013

Adapted from Habashi Protocol
## F05a. Improve Oxygenation

**APRV Traditional**

After intervention based on cell Return to CORE

### SpO2 < 87 or paO2 < 55

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<thead>
<tr>
<th>P High</th>
<th>FIO2 = 0.4</th>
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<th>FIO2 = 0.6</th>
<th>FIO2 = 0.7</th>
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<th>FIO2 = 0.9</th>
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<td>↑ FIO2 0.1</td>
<td>↑ P high 2 cm H2O, FIO2 0.1</td>
<td>↑ P high 2 cm H2O, FIO2 0.1</td>
<td>↑ P high 2 cm H2O, FIO2 0.1</td>
<td>↑ P high 2 cm H2O, FIO2 0.1</td>
<td>↑ P high 2 cm H2O, FIO2 0.1</td>
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F05b. Optimize Oxygenation

After intervention based on cell Return to CORE

**SpO2 > 93 or PaO2 > 68**

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<th>P High</th>
<th>FIO2 = .4</th>
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<td>Go to CPAP Weaning</td>
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F05c. Maintain Oxygenation

After intervention based on cell, Return to Core

**SpO2 88 to 93 or PaO2 55 to 68**

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Meta Rules:
* Do not increase or decrease P high by more than 4 cmH2O every 2 hours.
* Do not increase or decrease T high by more than 2 seconds every 2 hours.

Setting | Min | Max
--- | --- | ---
T high | 3 sec | 12 sec
T low | 0.5 sec | 1.8 sec
P high | 5 | 30
P low | 0 |

Adapted from Habashi Protocol
F08. Weaning Protocol to Extubation

APRV Traditional

Pt currently on CPAP?

Yes

S01
FIO2 input <= 0.4 and P High <= 12 and T High >=12 sec And time is between 08:00 and 10:00 a.m.

No

F08 Wean P High and T High

No

S02 pH < 7.30

No

S03 SpO2 < 92%

Yes

A01 Set CPAP = 8cmH2O FIO2 = current FIO2 Set ATC = 100% Reassess in 20 minutes

No

A02 Change mode to APRV Set P high = 12 cmH2O Set T high = 6 sec ABG in 20 minutes

S04 FIO2 <= 0.5 and CPAP <= 10 cmH2O

No

S07 WOB score increased by 3 or more

Yes

A03 Decrease FIO2 by 0.1 Reassess in 20 minutes

No

S08 FIO2 > 0.4

A04 Decrease CPAP by 1 cmH2O

No

S09 CPAP <= 0.5

Yes

A05 Consider extubation

A06 Change mode to APRV Set P high = 12 cmH2O Set T high = 6 sec ABG in 20 minutes

S05 SpO2 < 88

Yes

A07 Increase CPAP to 10cmH2O Reassess in 20 minutes

No

A08 Increase FIO2 0.1

A09 Increase CPAP 2 cmH2O

Yes

R01 Return to CORE

No

Spontaneous Breathing Goals:
1. SpO2 > 90% or PaO2 > 55
2. Average spontaneous tidal volume >4 ml/kg IBW
3. Spontaneous VR < = 35 bpm
4. pH = 7.30 if measured

Reassess
1. WOB – work of breathing score
2. ETCO2
3. SpO2
4. ABG if done

Treat correctable problems before failing patient back to APRV or reassessing
1. Anxiety, pain, delirium
2. Acute bronchospasm
3. Mucus plug
4. Excessive sedation
5. Patient position
6. Ventilator circuit problem

Adapted from Habashi Protocol

06/24/2013