CRISIS sessions: Mechanical Ventilation

Dr Julian Barnbrook

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THE UNIVERSITY OF BRITISH COLUMBIA
Continuing Professional Development
Faculty of Medicine

Land Acknowledgement

I acknowledge that am grateful to live, work and play on the traditional, ancestral and unceded territory of the Lheidli T'enneh First Nation

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Presenter Disclosures

None

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Learning Objectives

Identify those patients requiring mechanical ventilation

Apply knowledge to plan and enact strategies for providing ventilatory support

Manage common complications encountered in the ventilated patient

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OVERVIEW

- Indications for ventilation
- Preparation for ventilation:

what to get ready and what to anticipate

- Case examples
- Troubleshooting in a rural and remote context

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INDICATIONS FOR VENTILATION

- Primary respiratory indications:

  actual or impending respiratory failure

- Non-respiratory indications:

  neurological,

  logistical (eg for safe transfer)

  pain and procedural,

  ?severe refractory shock, ? Severe acidemia

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RESPIRATORY FAILURE

Objective markers:

ABGs, FiO2 requirements, RR and work of breathing, LOC

Subjective influences:

’looks terrible’ ‘exhausted’, expected trajectory, ‘can’t stay here’

Local context: not always appreciated!

CASE NO 1

63 year old woman with 3 day history of fever and cough

pmh: HTN, dyslipdemia,

Presents to ED in McBRIDE at 22:00 with worsening dyspnea

SpO2 83% on room air in ED. 91% on 15L/min NRBM

RR 28/min

CXR shows patchy consolidation

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CASE NO 1: RESOURCES

Human: Locally - *2 ED nurses, GP colleague at home just off shift*

Lab tec and CXR tec (both on call)

Equipment: *airway equipment and medication, Hamilton T1 transport ventilator and monitor*

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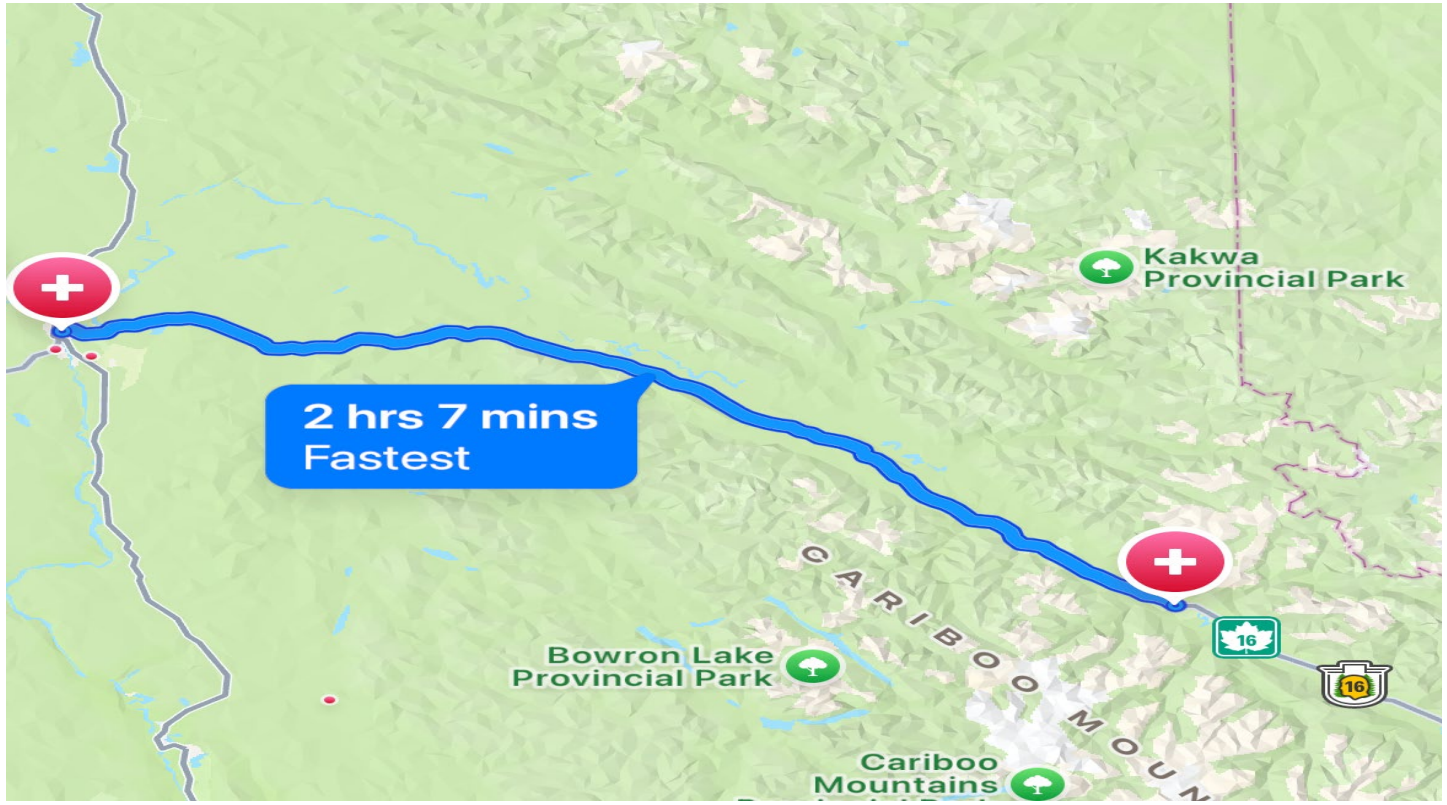
CASE NO 1: CONTEXT

211 Km to UHNBC – minimum 2 hours by road



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CASE NO 1: APPROACH

Decision making:

Task allocation:

Remote support and cognitive aids:

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CASE NO 1: DECISION MAKING

Initial Management: O2, vitals, investigations and antibiotics

HFNC: 60L/min, 80 % O2

ABG on HFNC: pH 7.34. CO2 35, O2 51 O2 sat 90%

Looks tired and unwell

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CASE NO 1: DECISION MAKING

Severe hypoxemic respiratory failure (p/f: < 100)

Trajectory?

Local resources: effect on capacity

Remote support: nearest ICU physician, RUDI etc, RT support

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CASE NO 1: PREPARATION

Equipment: ventilator, gas supply, power supply, circuit, HMEF,
monitoring, suction
operating manual

What are the initial ventilator settings?

How might this patient behave when I initiate ventilation?

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CASE NO 1: INITIAL VENTILATOR SETTINGS

Patient factors: O2 requirement, IBW and body habitus

Ventilator factors:

Hamilton T1 (NH)

Monnal T60

CASE NO 1: INITIAL VENTILATOR SETTINGS

Mode: controlled/spontaneous

Settings: FiO2

respiratory rate

tidal volume/pressure

PEEP

flow rate/I:E ratio/Ti

MICRO-TEACHING: VENTILATOR SETTINGS

Controlled modes:

PCV and VCV: variations on PCVG/VC+

CMV and AC

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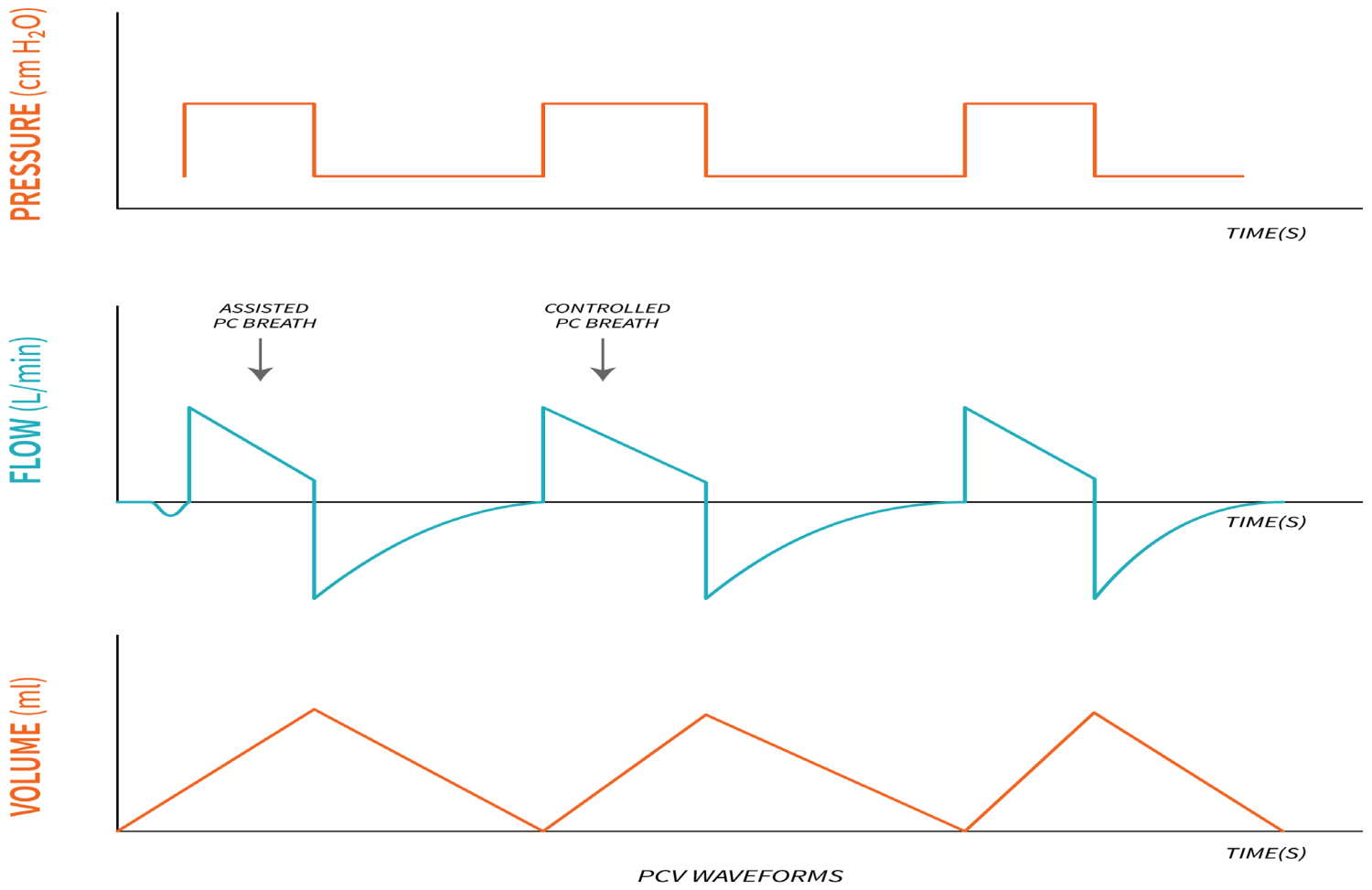
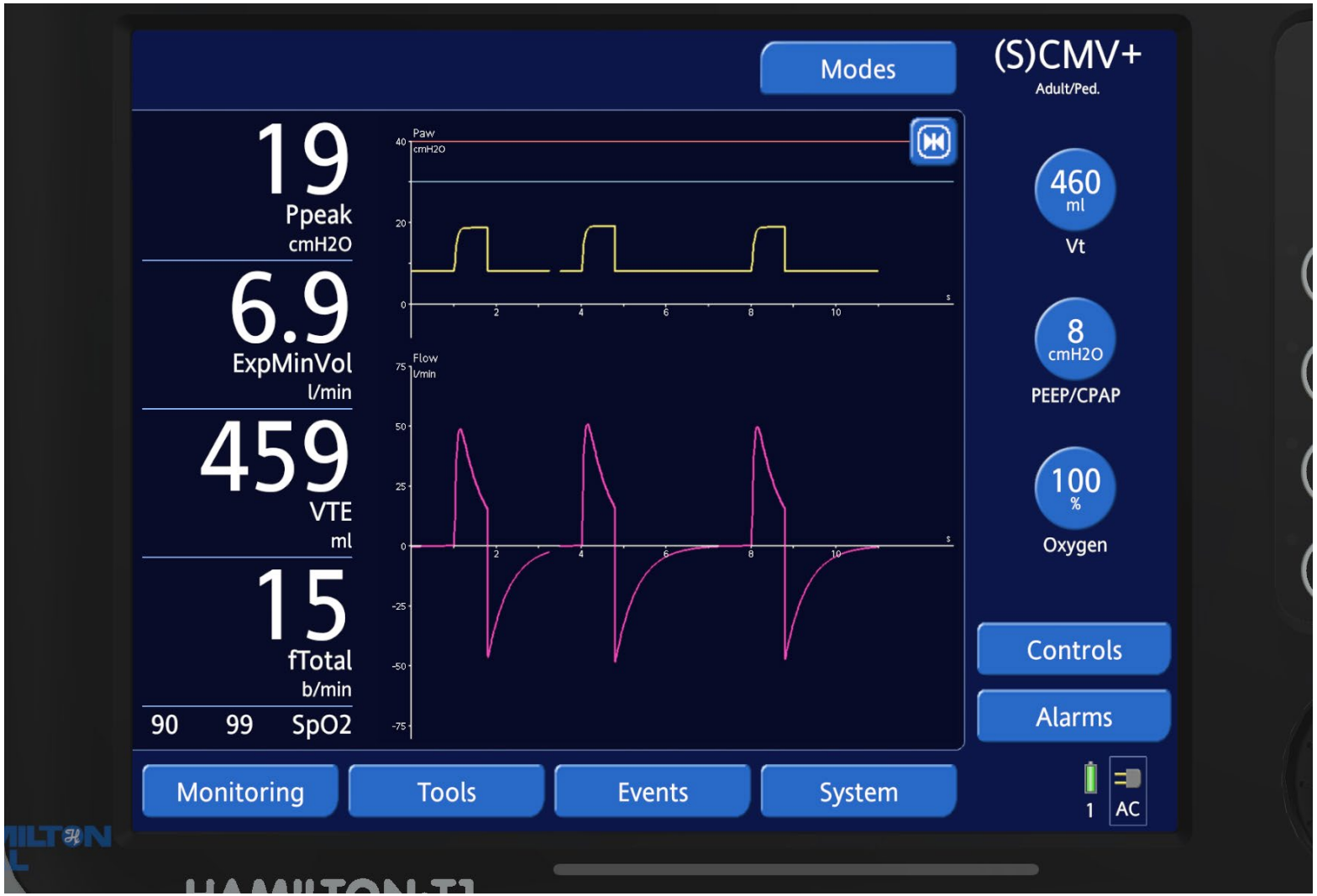
MICRO-TEACHING: VENTILATOR SETTINGS



PCV WAVEFORMS

CASE NO 1: INITIAL VENTILATOR SETTINGS



CASE NO 1: INITIAL VENTILATOR SETTINGS

After 10 minutes: SpO2 92%, peak Paw = 26cmH2O

Auscultation: decreased throughout left lung field and R base

Thoughts?

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CASE NO 1: TROUBLE SHOOTING

High peak pressures and low O2 saturations

Circuit vs patient? Disconnect and manually ventilate

Suction

CXR/withdraw ETT 2-3cm

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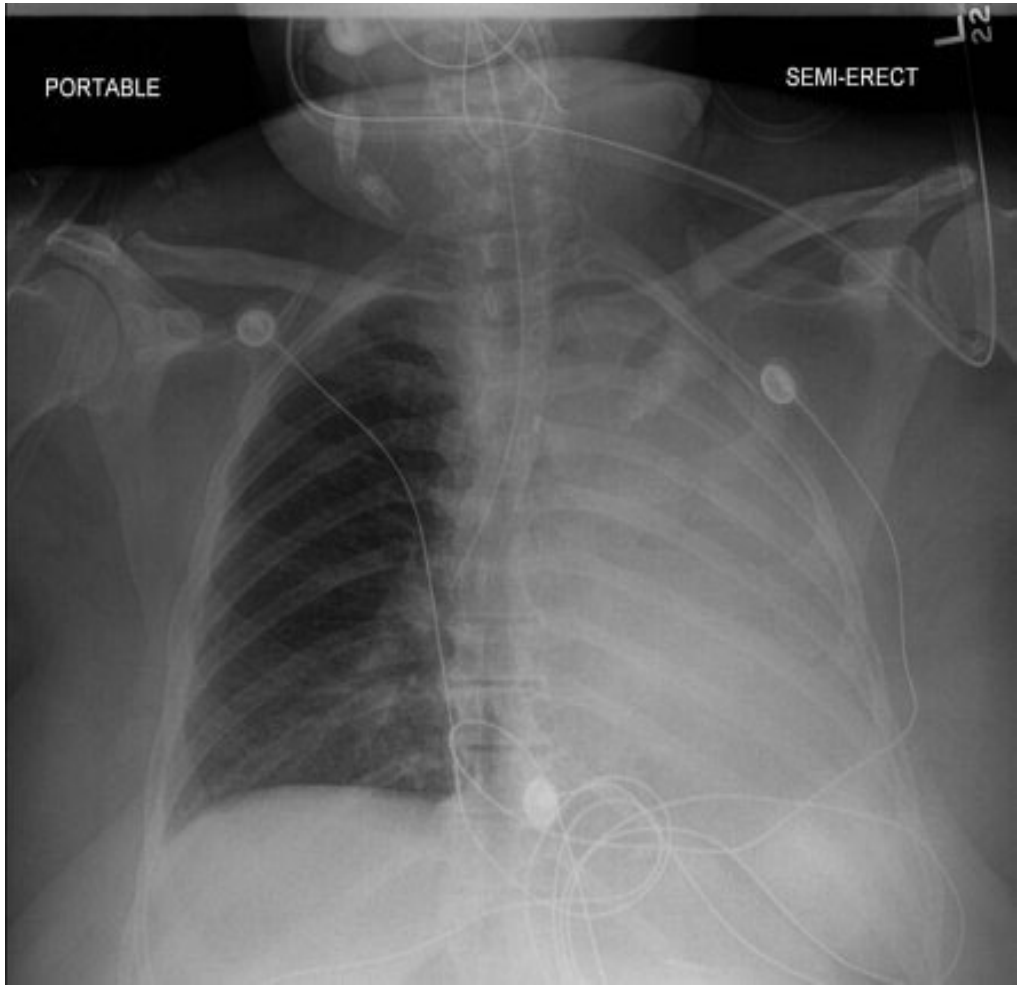
CASE NO 1: TROUBLE SHOOTING



CASE NO 1: DISCUSSION

- How would this work in your facility?

- What extra resources would (or should?) be available?

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Case NO 2: Presentation

- 38 year old male with known asthma presents to PRRH with acute onset respiratory distress.. Nil else significant in pmh.

- In ED: RR 35/min, audible wheeze and reduced air entry globally,
  SpO2 92% on 60L/min HFNC 60% O2
  CXR unremarkable

  Minimal improvement after 3 x salbutamol and ipratropium nebs, MgSO4 and methylprednisolone. Looks tired.

  Discussed with ICU IM physician at KRH – advised trial of NIV

  ABG: pH 7.24, PaCO2 57, PaO2 89

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CASE NO 2: APPROACH

Trajectory: when to intubate and ventilate in bronchospasm?
anticipated problems on initiating ventilation

Timeframe: what are the impacts on local resources?

Disposition: what will happen to this patient after ventilation is initiated?

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CASE NO 2: CLINICAL COURSE

- 38 year old male with known asthma presents to PRRH with acute onset respiratory distress.. Nil else significant in pmh.

  Increasingly tired despite initially tolerating NIV at 10/5cmH2O

  ABG: pH 7.24, PaCO2 57, PaO2 89

  re-conference with KRH and UHNBC ICU:
  accepted for transfer to UHNBC

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CASE NO 2: PREPARATION

Equipment: ventilator, gas supply, power supply, circuit, HMEF, monitoring, suction

operating manual

What are the initial ventilator settings?

How might this patient behave when I initiate ventilation?

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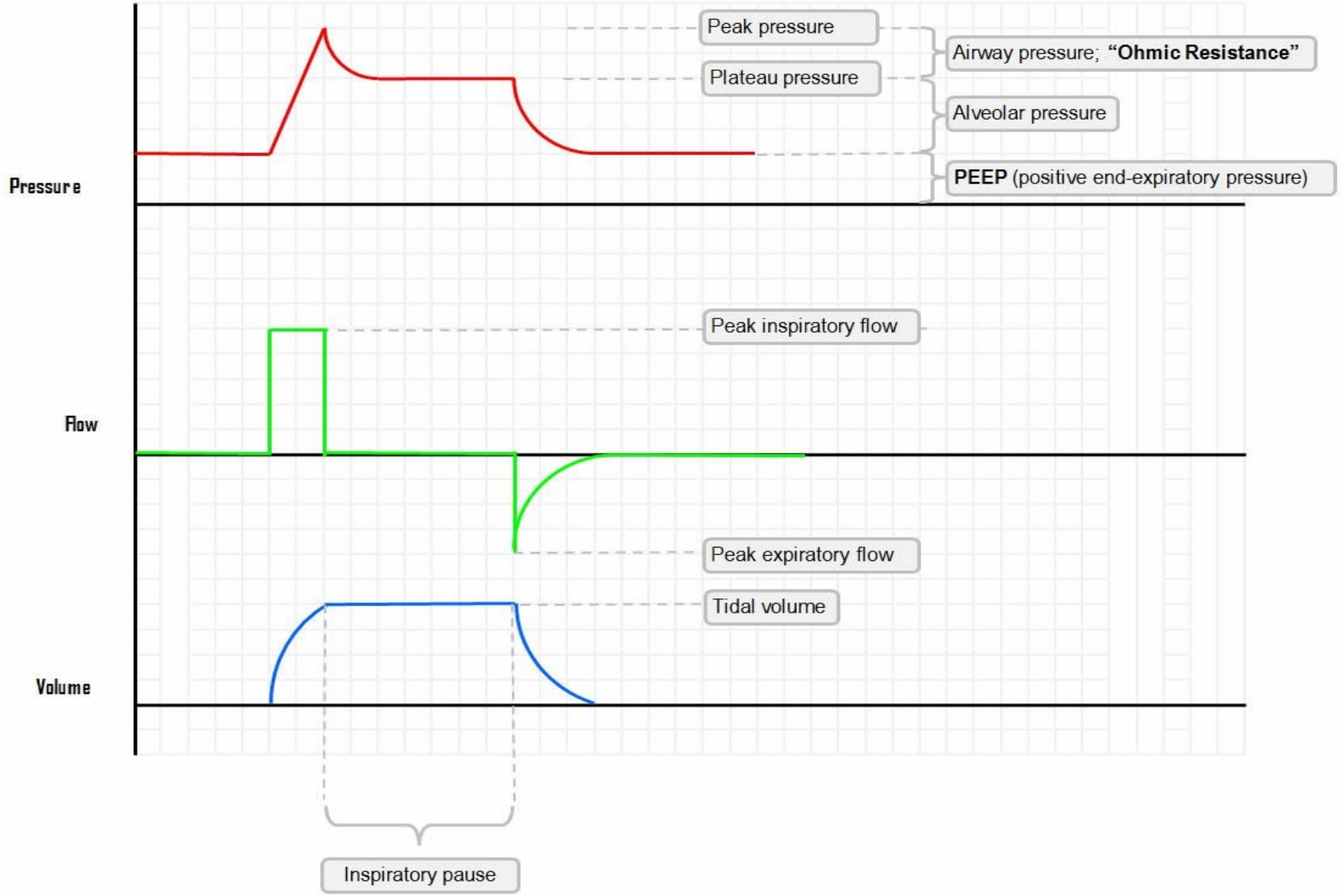
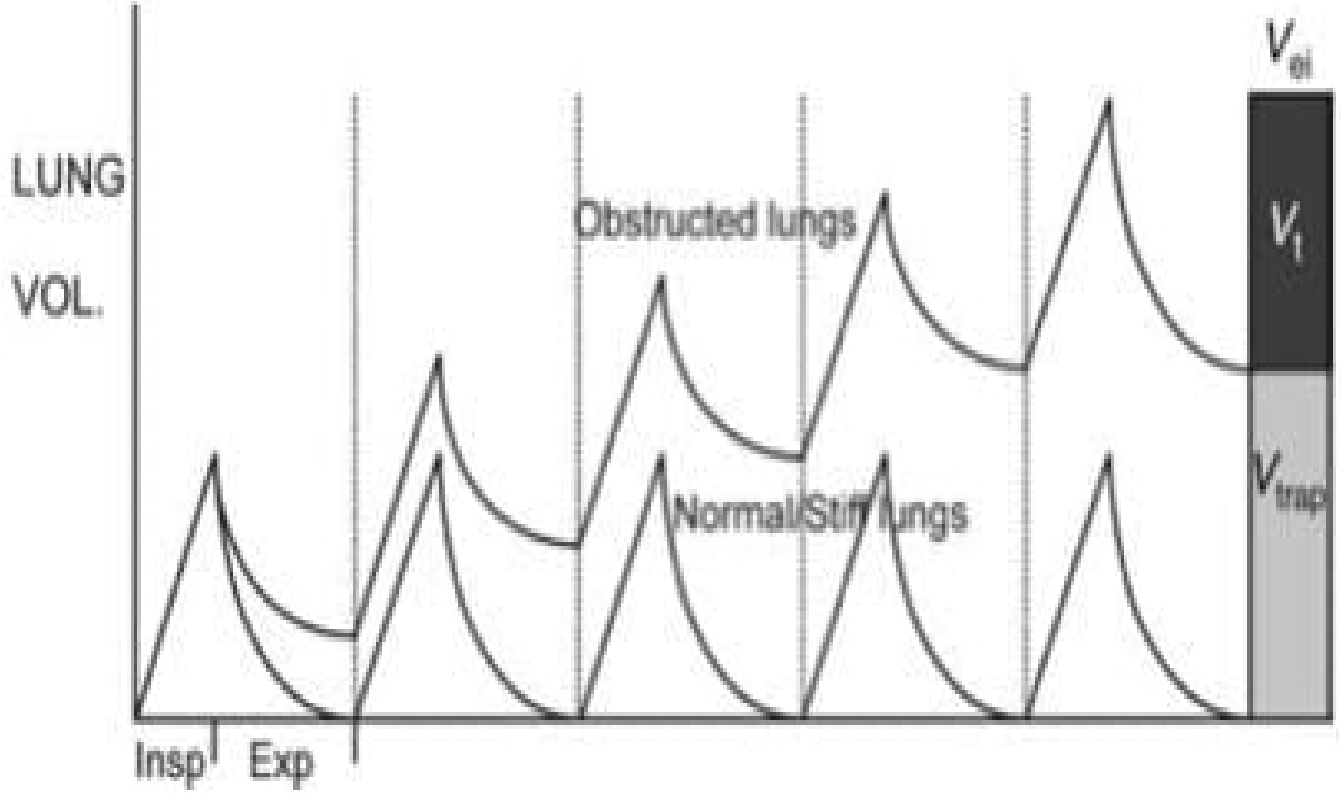
CASE NO 2 MICRO-TEACHING



CASE NO 2 MICRO-TEACHING

CASE NO 2: MICRO-TEACHING:

DHI and auto PEEP



CASE NO 2: INITIAL VENTILATOR SETTINGS

I:E ratio 1:4 (or >) (Ti may be variable)

Short Ti (high inspiratory flow)

Close attention to ventilator waveforms and hemodynamics.

Vt 4-8ml/Kg IBW

CASE NO 2: INITIAL VENTILATOR SETTINGS

Paw will be high but Pplat less raised (unless DHI)

Tolerate hypercapnia – pH > 7.1 to 7.2 to start with

In event of worsening DHI, disconnect and allow full exhalation

Reduce RR to maintain Pplat < 25cmH2O

Peep set at 60-80% PEEPi

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CASE NO 2: TROUBLE SHOOTING

High Peak Paw alarms – check Pplat – adjust alarms

(Ppeak may be 50-80cmH2O)

Ventilator dis-synchrony – ensure adequate sedation and NMBD if needed.

May require near continuous nebulized beta2 agonist

Adjuncts: ketamine/aminophylline/epinephrine/sevoflurane

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CASE NO 2: TROUBLE SHOOTING

Bronchospasm can take days to resolve

Regular discussion with closest tertiary ICU pending transfer (may, rarely, require ECMO and alternative destination)

When safe, exclude other pathology (CT chest/PA, TTE, swabs)

Therapeutic bronchoscopy – can clear mucous plugs but also risk of exacerbating bronchospasm

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CASE NO 2: DISCUSSION

- How would this work in your facility?

- What extra resources would (or should?) be available?

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OTHER INDICATIONS FOR VENTILATION

Neurologic: airway protection,
opioid toxicity (hypoventilation)
neuro-protection (eg raised ICP)

Procedural: EGD, post-surgical,

Logistical: transfer, severe agitation,

Severe shock and acidemia

POSITIONING

Always HoB at 30 degrees

Morbidly obese may need > head-up

Good-side down – semi-lateral

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WEANING AND EXTUBATION

Transition to spontaneous mode – PSV

SBT – RSBI - > 105

Neurologically capable of protecting airway

Cuff leak

Plan if fails

SUGGESTIONS:

Call early - call often. Ensure closed-loop communication

NH – UHNBC/FSJH/KRH ICU, UHNBC RT

ABG after any significant change or before any major intervention

Don’t forget endo-tracheal suction (but not too often)

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RESOURCES & REFERENCES MENTIONED

- https://www.hamilton-medical.com/en_CA/Academy/VenTrainer.html
- Local tertiary ICU/RT support and educators
- https://rccbc.ca/initiatives/rtvs/
- https://derangedphysiology.com/main/cicm-primary-exam/respiratory-system

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Q&A

POST YOUR QUESTIONS IN THE CHATBOX

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