CACCN Dynamics
Halifax, NS
Mechanical Ventilation Workshop
ARDS Case Study – JAKE
Jake – MVA

- 19 year old, 80 kg (IBW) male
- Crashed his car into a ditch at high speed
- Jake was found unconscious at the scene after approximately 3 minutes; GCS 3
- Regained consciousness in ambulance after rescue and resuscitation for 2 minutes
- Assessed in ER with GCS now 8 and NSR on monitor
Jake – MVA

- Assessment in ER revealed multiple traumatic injuries
- Bilateral fractured femurs
- Pulmonary contusions noted to left side on CT scan
- Patient stabilized in ER and went to OR for repair of fractured femurs
- Stabilized in ICU post-op
Thinking points

- What factors of Jake’s situation place him at RISK for development of ARDS?

- What cause of ARDS would he most likely develop; intra-pulmonary vs extra-pulmonary?
Jake – ICU Admission

- Jake is admitted to ICU post-op
- Intubated with 8.0 ETT, 22 cm ATL, secured
- Vitals: HR 80 b/min, BP 100/70 (80)
- SpO2 99% on transport, bagged with 100% O2
- A/E equal bilaterally, ↓ to both bases, scattered INSP crackles bilaterally
Jake – Ventilator set up

- What do you suggest for ventilator parameters for JAKE?
- Mode and Breath Type?
- VT or P level?
- RR?
- FiO2?
- PEEP?
JAKE – post admission ABGs

- pH 7.32
- PC02 49
- P02 56
- HC03– 22
- B.E. –2
- Sa02 88%

What do you suggest for ventilator parameter changes?
JAKE – CXR is assessed:

What does the CXR indicate? Explain
JAKE – Pathophysiology

- What does the CXR and diagnosis of ARDS indicate for the pathophysiology in JAKE’s lungs?
JAKE – repeat ABG

- pH 7.25
- PC02 54
- P02 52
- HC03– 20
- B.E. –4
- Lactate 4.2
- Sa02 84%

What do you suggest for ventilator parameter changes now?
JAKE – ventilation/oxygenation

- What are some strategies that should be employed with the management of Jake’s ventilation?

- What are some strategies that could be used to improve Jake’s oxygenation?
### ARDSSnet PEEP/FiO2 tables

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Optimal PEEP and VT to prevent over-distension and also atelectasis

WHICH VOLUMES CAUSE LUNG INJURY?

Volutrauma Zone

Overdistention

Volutrauma Zone

A B C D

Time

A High $V_T$, low PEEP
B Normal $V_T$, high PEEP
C Normal $V_T$, low PEEP
D Optimal ventilation

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Lung Recruitment Manouver

- Perform a **LUNG RECRUITMENT MANOUVER** on JAKE (i.e. the test lung!)
- 30 cmH20 PEEP (CPAP) for 30 seconds

*How may the LRM be effective in improving oxygenation?*

*What are risks involved with a LRM?*
Lung inflation following Recruitment Maneuver

↑Volume at the same pressure post–LRM
High Frequency Oscillation Ventilation (HFOV)

*How may HFOV achieve improved oxygenation?*

*How is it similar to a LRM?*
Complications of Open Lung Ventilation

**High PEEP**
- Barotrauma
- Hypotension
- Reduced cardiac output
- Increased pulmonary vascular resistance
- Impaired RV function

**Permissive Hypercapnia**
- Pulmonary vasoconstriction
- Myocardial depression
- Cerebral vasodilatation
- ↑ risk of hemodialysis
- ↑ need for sedation or paralysis
Jake – recovery

- 5 days after being in ICU with elevated PEEP, PC ventilation, LRMq q4h and a trial of HFOV, BOB has recovered to the point where he is now on 40% O2 & 8 cmH2O PEEP, awake/alert and with a strong cough/gag

*How do you assess Jake’s readiness to wean/extubate?*
Jake – SBT values

- RR 24 b/min
- VT 350 mls
- SpO2 94% on 40% 02
- HR 98 b/min
- BP 95/65 (75)

*What is his Rapid Shallow Breathing Index (RSBI) (RR/VT in L)?*

*Does his RSBI indicate readiness to wean?*

*What is the next step for Jake?*
Jake – discharged from ICU!

- Following a short course of weaning on minimal settings on the ventilator and mobilization/physical therapy, Jake is extubated and discharged out of ICU the following day.
- He is discharged breathing on 4 L nasal cannula with Sp02 96%.