Airway Management in COVID-19: It’s more than just about aerosols

Hilary P. Grocott, MD, FRCPC
Professor, Departments of Anesthesia, Perioperative & Pain Medicine and Surgery
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Canadian Journal of Anesthesia
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TEXT QUESTIONS: 204-291-8377
Disclosures

• Stipend from the

Canadian Anesthesiologists’ Society

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• Not prescriptive
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• Be comfortable with uncertainty
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• Not prescriptive
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• Be comfortable with uncertainty
• Be adaptable to change
Weekly Publications: “COVID-19” or “coronavirus” or “SARS-CoV-2”

- December 1, 2019
- February 12, 2020
- April 7, 2020
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Surge
Weekly Publications: “COVID-19” or “coronavirus” or “SARS-CoV-2”

Flattening of the curve

Surge

December 1, 2019
February 12, 2020
April 7, 2020
Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients

Directives concrètes à l’intention des équipes de soins intensifs et d’anesthésiologie prenant soin de patients atteints du coronavirus 2019-nCoV

Randy S. Wax, MD, MEd, FRCPC, FCCM · Michael D. Christian, MD, MSc (Public Health), FRCPC, FCCM
The COVID-19 Infodemic

Total annual downloads: 1.3M
The COVID-19 Infodemic

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17 COVID-related articles

Downloads past 7 weeks: 290K
Consensus guidelines for managing the airway in patients with COVID-19

Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists

Airway Management Algorithm

**Personnel and PPE**
Staff must don full checked PPE and share plan for failure
Most appropriate airway manager to manage airway

**Pre-oxygenate and checklist**
Position: head up if possible
Assess airway and identify cricothyroid membrane
Waveform capnograph
Pre-oxygenate: Mapleson C / Anaesthetic circuit - with HME
Optimise cardiovascular system
Share plan for failure

**Plan A: Tracheal Intubation**

- **Laryngoscopy**
  - Maximum three attempts

- **Maintain oxygenation**
  - May use low flow, low pressure 2-person mask ventilation
  - Full neuromuscular block
  - Videolaryngoscopy +/- bougie or stylet
  - External laryngeal manipulation
  - Remove cricoid

  **Fall**
  - Declare "failed intubation"

  **Succeed**
  - Confirm with capnography

  **First failure**
  - Call HELP
    - Before entering room
    - Staff must don full checked PPE
    - Get front of neck Airway (FONA) set

**Plan B/C: Rescue oxygenation**

- **Second-generation supraglottic airway**
- **Maximum 3 attempts each**
  - Change device / size / operator
  - Open front of neck Airway set

  **Fail**
  - Declare 'cannot intubate, cannot oxygenate'

  **Succeed**
  - Stop, think, communicate
    - Options
      - Wake patient if planned
      - Intubate via supraglottic airway x1
      - Front of neck Airway

**Plan D: Front of neck airway: FONA**

- **Use FONA set**
- **Scalpel cricothyroidotomy**
  - Extend neck
  - Neuromuscular blockade
Managing the Airway in *Acutely-ill* COVID-19 patients
Managing the Airway in *Acutely-ill* COVID-19 patients

**Personnel and PPE**

- Staff must don full checked PPE and share plan for failure
- Most appropriate airway manager to manage airway
Managing the Airway in *Acutely-ill* COVID-19 patients

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![Diagram showing personnel and equipment layout]

- **Inside**
  - Monitor
  - Intubator
  - Drugs and monitor
  - Cricoid and equipment
- **Outside**
  - Runner
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Airway PoCUS

Airway PoCUS: cricothyroid membrane

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Airway PoCUS: cricothyroid membrane

Mark it prior to anesthesia induction in the “uncertain airway”

Front Of Neck Access
Managing the Airway in *Acutely-ill* COVID-19 patients

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**Induce Anesthesia**
Managing the Airway in **Acutely-ill** COVID-19 patients

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**Induce Anesthesia**
“Rapid Sequence Induction”
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Induce Anesthesia
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**Succeed**

Confirm with capnography
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Managing the Airway in *Acutely-ill* COVID-19 patients

1. Declare "failed intubation"

2. Plan B/C: Rescue oxygenation
   - Second-generation supraglottic airway
   - Facemask
     - Two person
     - Adjuncts

   Maximum 3 attempts each
   - Change device / size / operator
   - Open front of neck Airway set
Managing the Airway in *Acutely-ill* COVID-19 patients

 Declare "failed intubation"

Plan B/C: Rescue oxygenation

- Second-generation supraglottic airway
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**Plan D: Front of neck airway: FONA**

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Declare "failed intubation"
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- Optimize cardiovascular system
- Share plan for failure

---

**Induce Anesthesia**

**Optimize the cardiovascular system**
COVID-19: myocardial effects

N = 416 hospitalized COVID-19 patients

COVID-19: myocardial effects

N = 416 hospitalized COVID-19 patients
N = 82 (19.7%) with cardiac injury
hs-Troponin-I > 99\textsuperscript{ile}

COVID-19: myocardial effects

COVID-19: myocardial injury pathophysiology

Increased Oxygen Demand

Tachycardia

Fever

Myocardial Ischemia

COVID-19: myocardial injury pathophysiology

Increased Oxygen Demand

- Tachycardia

Decreased Oxygen Supply

- Fever
- Hypotension
- Hypoxemia

Myocardial Ischemia

COVID-19: myocardial injury pathophysiology

Myocardial Ischemia
- Increased oxygen demand
- Decreased oxygen supply

COVID-19: myocardial injury pathophysiology

COVID-19: myocardial injury pathophysiology

COVID-19: myocardial injury pathophysiology

COVID-19: myocardial injury pathophysiology

- Direct Myocardial Infection
- Secondary Myocardial Involvement

Fulminant viral myocarditis
Most cases mixed?
Type-2 myocardial infarction

Hemodynamic Considerations of Intubation

- “Acutely-ill” COVID-19 patient
- Myocardial dysfunction
Hemodynamic Considerations of Intubation

• “Acutely-ill” COVID-19 patient
• Myocardial dysfunction
• ARDS (acute respiratory distress syndrome)
COVID-19 pneumonia: different respiratory treatments for different phenotypes?

Luciano Gattinoni1, Davide Chiumello2, Pietro Cairo3,4, Mattia Busana1, Federica Romitti1, Luca Brazzi5 and Luigi Camporota6

COVID-19: new concepts in ARDS
COVID-19: new concepts in ARDS

**L-phenotype**

- Low elastance
- Low lung weight and recruitability
- V/Q mismatch
- Loss of hypoxic vasoconstriction
- Hypoxemia-hypocapnia
- “Absence” of dyspnea
- Pulmonary artery pressures normal
COVID-19: new concepts in ARDS

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- Low elastance
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**H-phenotype**
- High elastance
- High lung weight and recruitability
- Shunt
- Hypoxemia-hypercapnia
- Pulmonary hypertension
COVID-19: new concepts in ARDS

**L-phenotype**
- Low elastance
- Low lung weight and recruitability
- V/Q mismatch
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**H-phenotype**
- High elastance
- High lung weight and recruitability
- Shunt
- Hypoxemia-hypercapnia
- **Pulmonary hypertension**

Progression of infection
Patient self-inflicted lung injury (P-SILI)
Hemodynamic Considerations of Intubation

- “Acutely-ill” COVID-19 patient
- Myocardial dysfunction
- ARDS
- Pulmonary hypertension
- RV dysfunction
Right Ventricular Dysfunction
Right Ventricular Dysfunction

- Normal RV
- RV Dysfunction
Managing RV failure and Pulmonary Hypertension

Acute Right Ventricle Failure in the Intensive Care Unit: Assessment and Management

Carmen Hrymak, MD, FRCPC, Johann Strumpfer, MBChB, FRCPC, and Eric Jacobsohn, MBChB, MHPE, FRCPC

a Department of Internal Medicine, Section of Critical Care, Rady Faculty of Health Sciences, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada
b Department of Anesthesia and Perioperative Medicine, and Department of Internal Medicine, Section of Critical Care, Rady Faculty of Health Sciences, Max Rady College of Medicine, University of Manitoba, Winnipeg, Manitoba, Canada

Hrymak C et al. Can J Cardiology 2017;33:61-71
Transeptal gradient (TSG) & Ventricular interdependence

Normal: TSG = 100 mmHg

Modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Transeptal gradient (TSG) & Ventricular interdependence

- TSG maintains normal RV architecture/scaffold
- 20-40% of RV function depends on normal LV function

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**Normal:** TSG = 100 mmHg

**Elevated PA pressures:** TSG = 20 mmHg

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Transeptal gradient (TSG) & Ventricular interdependence

- TSG maintains normal RV architecture/scaffold
- 20-40% of RV function depends on normal LV function
- Hypotension decreases TSG
- Increase in PVR decreases TSG

Normal: TSG = 100 mmHg
Elevated PA pressures: TSG = 20 mmHg

modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Right Ventricular Blood Flow/Ischemia

modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
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Importance of systolic & diastolic pressure (MAP)

Modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Right Ventricular Blood Flow/Ischemia

Importance of systolic & diastolic pressure (MAP)

Hypotension ➔ RV Ischemia

modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Hemodynamic Goals for RV failure: fluid loading?

Cardiac Output

Atrial Pressure

Normal RV

Failing RV

2

9

modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Hemodynamic Goals for RV failure: fluid loading?

Don’t over-fill!

Cardiac Output vs. Atrial Pressure

Normal RV

Failing RV

modified from Hrymak C et al. Can J Cardiology 2017;33:61-71
Hemodynamic Management of the Airway in *Acutely-ill* COVID-19 patients

- Optimize fluid loading (Ringer’s Lactate 250 mL)
- Avoid hypotension - vasopressors
Vasopressor and Inotropic Support for RV failure

<table>
<thead>
<tr>
<th>Drug</th>
<th>Inotropy</th>
<th>SVR</th>
<th>PVR</th>
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<tbody>
<tr>
<td>Phenylephrine</td>
<td>–</td>
<td>↑</td>
<td>↑</td>
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<tr>
<td>Norepinephrine</td>
<td>↑</td>
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- Inotropic support
# Vasopressor and Inotropic Support for RV failure

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<td>Vasopressin</td>
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<tr>
<td>Dobutamine</td>
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<tr>
<td>Epinephrine</td>
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<td>↑</td>
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<tr>
<td>Milrinone</td>
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Managing the Airway in Acutely-ill COVID-19 patients

SUMMARY
Managing the Airway in *Acutely-ill* COVID-19 patients

**Pre-oxygenate and checklist**
- Position: head up if possible
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- Waveform capnograph
- Pre-oxygenate: Mapleson C / Anaesthetic circuit - with HME

**Optimise cardiovascular system**
- Share plan for failure

"Rapid Sequence Induction"

**Induce Anesthesia**
Managing the Airway in *Acutely-ill* COVID-19 patients

- **“Rapid Sequence Induction”**
  - rocuronium 1.5 mg/kg
  - ketamine
  + midazolam/propofol/fentanyl

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### Induce Anesthesia
- Norepinephrine
- Infusions: Epinephrine
- or Dobutamine
Managing the Airway in *Acutely-ill* COVID-19 patients

**Induce Anesthesia**

- rocuronium 1.5 mg/kg
- ketamine
+ midazolam/propofol/fentanyl
- Phenylephrine bolus syringe
- Infusions: Norepinephrine + Epinephrine (or Dobutamine)

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