Managing Patients in the Transition Between Floor and ICU

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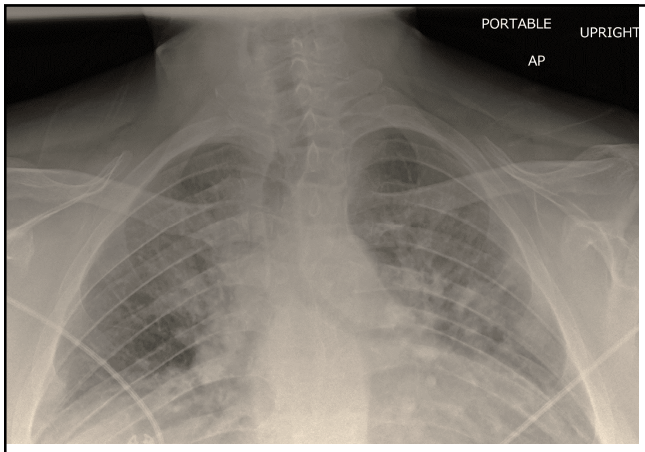
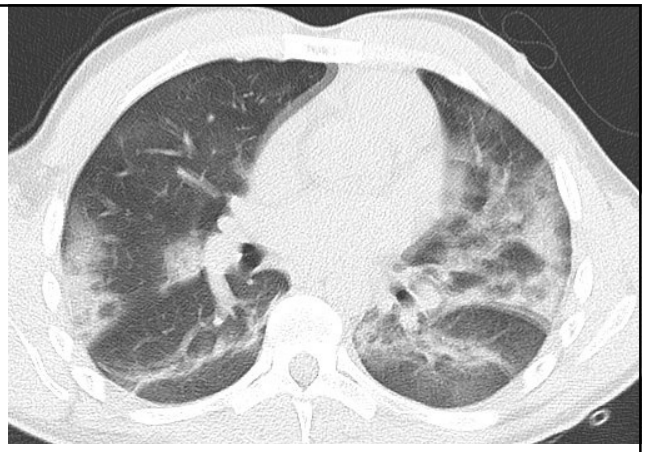
Disclosures

- Rebecca Baron, MD: Advisory Boards for Genentech and Merck (not relevant to this presentation).

Case 1

- 47 M landscaper
- PMHx hypertension, Type 2 diabetes, smoker
- Not COVID vaccinated
- Presents with 5 days of dry cough, fever, progressive dyspnea
- Exam: T 38.7 ^{o}C (101.7 ^{o}F), RR 20, Sat 90% on room air, bibasilar crackles
- ABG on room air: pH 7.42, $PaCO_2$ 36, PaO_2 63
- SARS-CoV-2 PCR positive, CRP 242
- CXR: bilateral infiltrates
- CT chest: ground-glass opacities, worse in bases and periphery



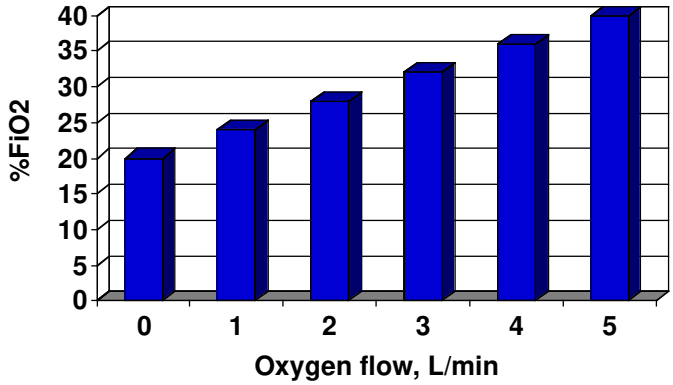


Case 1: Imaging

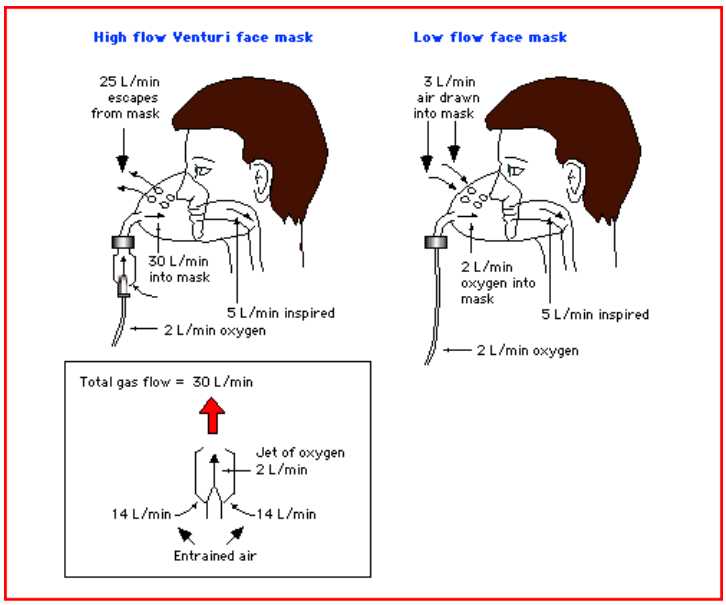
Case 1

- Started on remdesivir, dexamethasone, casirivimab/imdevimab
- On hospital day 2, respiratory status is worse
- RR 30, on 50% face mask
- ABG: pH 7.46, $PaCO_2$ 33, PaO2 66
- What options can be used to increase respiratory support on the floor?

Oxygen supplementation



Method	FiO2 (Approximate)	Flowrate (L/min)
Non rebreather Mask	60-80%	10-15
Venti Mask	24% 26% 28% 31% 35% 40% 50%	3 3 6 6 9 12 15
Simple Face Mask	35-55%	5-10 lpm
Nasal Cannula	24% 28% 32% 36% 40% 44%	1 2 3 4 5 6



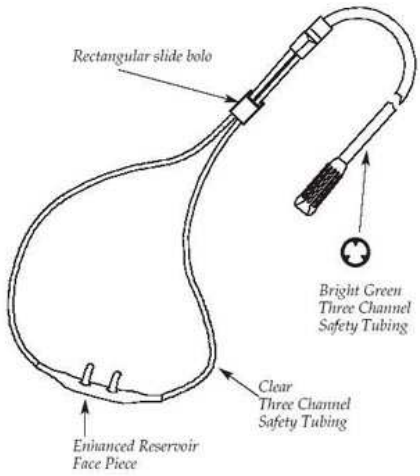
Case 1 continued

- Increasing O2 requirements to 10L
- Continued desaturations and increased work of breathing
- Next steps?
- High flow NC vs NIPPV?

High-flow nasal cannula (HFNC)

- 30 to 60 LPM oxygen heated to body temperature at 100% relative humidity
- Dramatically reduces dilution of inspired oxygen by room air
- Washes out dead space in the airways
- Increases tidal volume
- Generates low-level continuous positive airway pressure (CPAP)
- Moistens secretions, improves mucociliary transport
- Greater comfort and adherence
- Limitations: doesn't provide as much positive pressure or reduce the work of breathing as much as non-invasive ventilation; in COVID, does it help prevent intubation, or "delay

Fancy New Nasal Cannulas, e.g., "Salter"
Higher Flows, 6-15L and perhaps higher (e.g. 70L)



Facilitated by tubing diameters and humidification of O2 delivery.

Non-invasive ventilation: bilevel intermittent positive air pressure (BiPAP)

- Baseline positive pressure
  - Ventilates areas of atelectasis, and prevents other areas from becoming atelectatic
- Inspiration raises the system to a higher positive pressure, reducing the work of breathing
- May also provide supplemental oxygen
- Limitations: uncomfortable, may be poorly tolerated, unclear benefit vs. harm in ARDS

Noninvasive positive pressure ventilation (NIPPV)

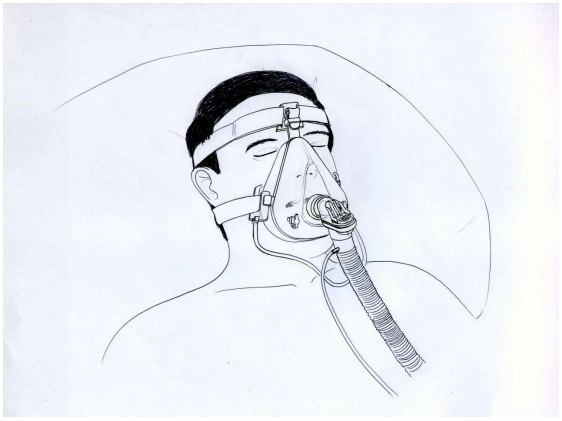
- Supportive data for:
  - Acute COPD exacerbation--greatest benefit
  - Ventilator weaning adjunct in COPD
  - Acute cardiogenic pulmonary edema
  - Hypoxemic respiratory failure, immunocompromised host in early but not later studies
- Why?
  - Improved alveolar ventilation
  - Reduced work of breathing
  - Relieving fatigued respiratory muscles
- Outcomes
  - Decreased infections
  - Fewer intubations

NIPPV, cont'd

- Facemask: better effect, less comfort
- Need "protocol-driven" initiation, with careful monitoring, esp in 1st 1-2 hours
- Contraindications:
  - Mental status, hemodynamics, facial deformity, upper airway obstruction, SECRETIONS, aspiration risk
  - Concern re: aerosolization in COVID; unclear benefit vs. harm in lung injury

NIV Mask Fashion Show

Most common in the ICU.



Perhaps next? The helmet.

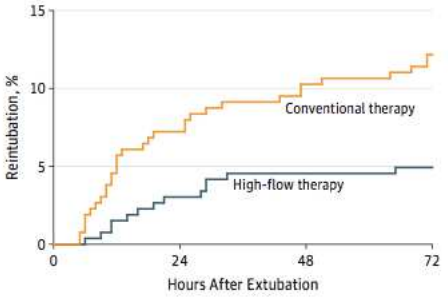
Patel BK et al. JAMA 2016

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Postextubation High-Flow Nasal Cannula vs Conventional Oxygen Therapy on Reintubation in Low-Risk Patients*

A Randomized Clinical Trial

Figure 2. Kaplan-Meier Analysis of Time From Extubation to Reintubation



- HFNC was superior in preventing reintubation
- Increasing attention to HFNC vs. NIV in general

* High % of post-surgical, neuro-critical care patients

JAMA. 2016;315(13):1354-1361. doi:10.1001/jama.2016.2711
Published online March 15, 2016.

HFNC vs BiPAP in clinical trials

In a meta-analysis of 29 RCTs, HFNC was associated with lower need for intubation, lower mortality, and greater comfort than non-invasive ventilation

Ann Intern Med 2021;174:952

Case 1 continued

- Started on high flow NC
- Ongoing desaturations and escalating O2 requirement
- Anesthesia called for intubation

What is the optimal timing for intubation in the patient with deteriorating respiratory status?

As an example: 2019 AHA update: Airways

- Data isn't clear when/how to intubate during a code situation due to varying patient and provider circumstances.
- Use best judgement based on situation and provider expertise.
- It is suggested that proficiency be encouraged to acquire and maintain airway insertion skills for relevant personnel.

Other considerations in COVID management

- Other Anti-inflammatory agents (e.g., TOCI, JAK inhibitors)
- Awake proning
- Anti-coagulation (prophylaxis level, consideration of therapeutic in “moderate COVID” (NEJM 2021))

Case 1 conclusion

- Intubated for 2 weeks with slow improvement
- Required trach
- Discharged to a ventilator weaning rehab facility
- Now being followed in our “Long-haul COVID clinic”

Case 2

- 72 M PMHx type 2 diabetes on metformin
- Brought in with confusion, hypoglycemia
- Given D50W in the field by EMS for glucose 40 mg/dl (2.2 mmol/L)
- Exam: T 92^{o}F (33.3^{o}C), P 90, BP 65/40, RR 20, Sats 97% RA
- Also notable for jaundice, crackles at both lung bases, tender palpable liver tip 5 cm below costal margin

Case 2

Laboratory workup:
WBC 18, hgb 8.1, platelet 46K
Na 124, K 5.2, bicarb 11, BUN 60 mg/dl, Cr 4.0 mg/dl (354 µmol/L)
LFTs: total bilirubin 16 mg/dL, AST 578, ALT 435
INR 4.8, D-dimer >2000
Haptoglobin less than assay

Next steps?
Treatment of the patient's hypotension?

What is Sepsis (2001-15)?

- Systemic Inflammatory Response Syndrome (SIRS):
  - Temp >38°C or <36°C
  - Heart Rate > 90 bpm
  - Resp Rate > 20/min
  - WBC >10000, <4000, or Bandemia>10%
- Sepsis: SIRS + Infection
- Severe Sepsis: Sepsis+ Organ Dysfunction
- Septic Shock: Sepsis+Refractory Hypotension

Special Communication | CARING FOR THE CRITICALLY ILL PATIENT

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

Mervyn Singer, MD, FRCP; Clifford S. Deutschman, MD, MS; Christopher Warren Seymour, MD, MSc; Manu Shankar-Hari, MSc, MD, FFICM; Djillali Annane, MD, PhD; Michael Bauer, MD; Rinaldo Bellomo, MD; Gordon R. Bernard, MD; Jean-Daniel Chiche, MD, PhD; Craig M. Coopersmith, MD; Richard S. Hotchkiss, MD; Mitchell M. Levy, MD; John C. Marshall, MD; Greg S. Martin, MD, MSc; Steven M. Opal, MD; Gordon D. Rubenfeld, MD, MS; Tom van der Poll, MD, PhD; Jean-Louis Vincent, MD, PhD; Derek C. Angus, MD, MPH

- SEPSIS: (>10% mortality)
  - Life-threatening organ dysfunction
  - Caused by *dysregulated response* to infection
  - Increase SOFA score of ≥2
- SHOCK: (>40% mortality)
  - Vasopressors for MAP≥65 mmg Hg
  - Lactate>2 mmol/L
  - In absence of hypovolemia

JAMA. 2016;315(8):801-810. doi:10.1001/jama.2016.0287

SOFA Score: 6 Organ Systems, 0-4 Points

Points	0	1	2	3	4
PaO2/FiO2	≥400	<400	<300	<200 + mechanical ventilation	<100 + mechanical ventilation
Platelets	≥150	<150	<100	<50	<20
Bilirubin	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Blood Pressure	MAP ≥70	MAP <70	Dopamine <5 or Dobutamine	Dopamine 5.1-15 or Epinephrine <0.1 or Norepinephrine <0.1	Dopamine >15 or Epinephrine >0.1 or Norepinephrine >0.1
Glasgow Coma Scale	15	13-14	10-12	6-9	<6
Creatinine	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 or <500cc urine/d	>5.0 or <200cc urine/d

Vincent et al, Intensive Care Med 1996

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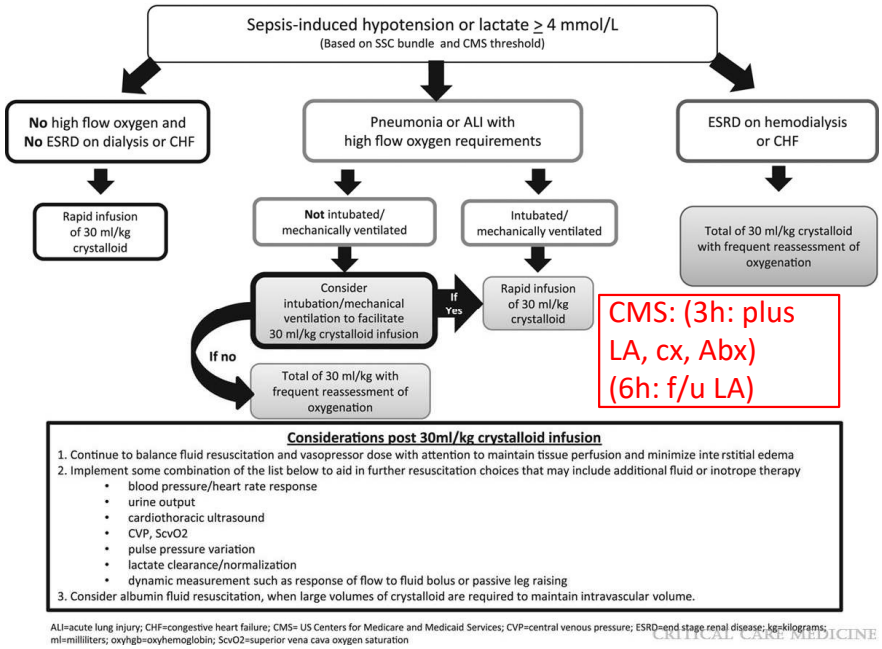
- qSOFA
  - Out of hospital, ED, Ward settings
  - *Worse outcomes* predicted from sepsis with 2 of:
    - Respiratory Rate ≥ 22/min
    - Altered mental status (GCS ≤ 13)
    - SBP ≤ 100 mmHg
  - Ongoing inquiry as to its validation
  - *LESS SENSITIVE* but *MORE SPECIFIC* than SIRS for sepsis screening.

JAMA. 2016;315(8):801-810. doi:10.1001/jama.2016.0287

Application of Fluid Resuscitation in Adult Septic Shock



Surviving Sepsis Guidelines 2016, ICM 2017

The JAMA Network

From: Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids?

JAMA. 2016;316(12):1298-1309. doi:10.1001/jama.2016.12310

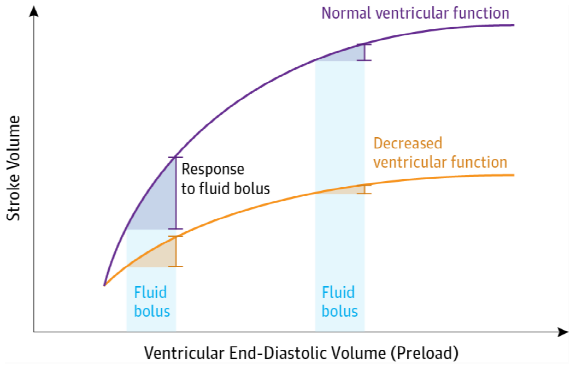


Figure Legend:

Effect of Increase in Preload on Stroke Volume of Ventricles With Normal and Decreased Contractility. Frank-Starling curves illustrate that the effect of a given increase in preload on stroke volume is dependent both on ventricular contractility and on baseline preload.

Fluid Response Evaluation in Sepsis Hypotension and Shock

A Randomized Clinical Trial

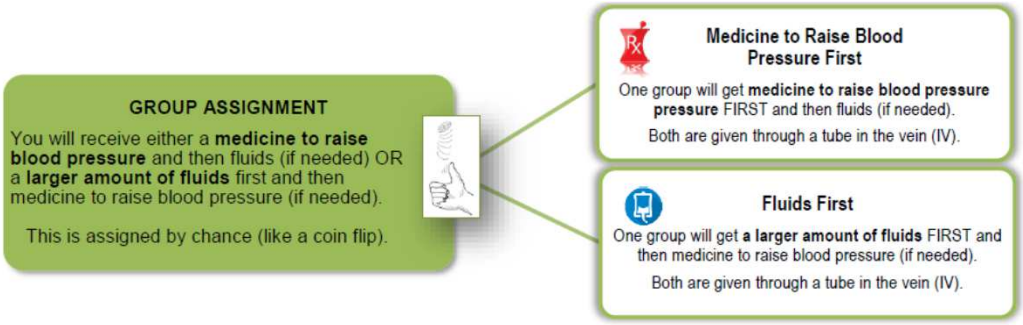
Ivor S. Douglas, MD; Philip M. Alapat, MD; Keith A. Corl, MD; Matthew C. Exline, MD, MPH; Lui G. Forni, PhD; Andre L. Holder, MD; David A. Kaufman, MD; Akram Khan, MD; Mitchell M. Levy, MD; Gregory S. Martin, MD; Jennifer A. Sahatjian, PsyD; Eric Seeley, MD; Wesley H. Self, MD; Jeremy A. Weingarten, MD; Mark Williams, MD; and Douglas M. Hansell, MD

Fluid responsiveness assessed by Passive Leg Raise to guide fluid resuscitation (n=83) vs. Usual Care (n=41). With intervention:

- Lower net positive fluid balance
- Lower risk of renal replacement and mechanical ventilation

Chest 2020

Enrolling now at an ICU near you: CLOVER trial design (PETAL Network)



Small studies recently examining earlier pressors initiation and suggest volume overload not beneficial.

What 'flavor' of fluid should we be using in sepsis?

NO: Hetastarch

Mostly NO: Albumin

Yes: Crystalloid…moving toward favoring LR over saline

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Balanced Crystalloids versus Saline in Critically Ill Adults

Matthew W. Semler, M.D., Wesley H. Self, M.D., M.P.H., Jonathan P. Wanderer, M.D., Jesse M. Ehrenfeld, M.D., M.P.H., Li Wang, M.S., Daniel W. Byrne, M.S., Joanna L. Stollings, Pharm.D., Avinash B. Kumar, M.D., Christopher G. Hughes, M.D., Antonio Hernandez, M.D., Oscar D. Guillamondegui, M.D., M.P.H., Addison K. May, M.D., Liza Weavind, M.B., B.Ch., Jonathan D. Casey, M.D., Edward D. Siew, M.D., Andrew D. Shaw, M.B., Gordon R. Bernard, M.D., and Todd W. Rice, M.D., for the SMART Investigators and the Pragmatic Critical Care Research Group*

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Balanced Crystalloids versus Saline in Noncritically Ill Adults

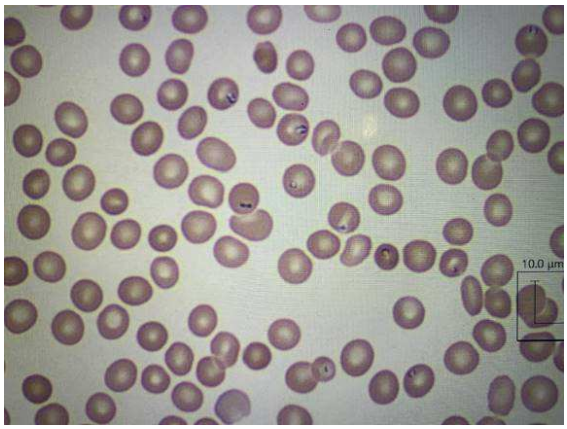
Wesley H. Self, M.D., M.P.H., Matthew W. Semler, M.D., Jonathan P. Wanderer, M.D., Li Wang, M.S., Daniel W. Byrne, M.S., Sean P. Collins, M.D., Corey M. Slovis, M.D., Christopher J. Lindsell, Ph.D., Jesse M. Ehrenfeld, M.D., M.P.H., Edward D. Siew, M.D., Andrew D. Shaw, M.B., Gordon R. Bernard, M.D., and Todd W. Rice, M.D., for the SALT-ED Investigators*

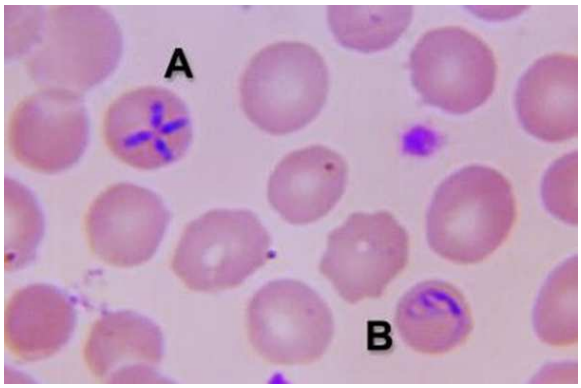
NEJM March 1, 2018

FLUIDS in SEPSIS BOTTOM LINE:

Bolus crystalloid, but don't overdo it.

Find your favorite way(s) to target resuscitation.





Blood smears: parasites consistent with *Babesia microti*

Other considerations in Babesia management

- Antibiotics (Clinda/quinine)
- Exchange transfusion
  - End-organ dysfunction
  - DIC
  - Elevated parasitemia
  - Significant hemolysis
  - Asplenia

Case 2 continued

- Course complicated by ARDS, AKI requiring HD, delirium
- Babesiosis improves with exchange transfusion, antibiotics with decreasing parasitemia
- Requires trach for prolonged chronic respiratory failure
- Hemodynamically stable but still requiring a lot of care:
  - Delirious
  - Increased secretions requiring frequent suctioning
  - Extremely weak
  - EOL discussions with family have been challenging
- Transfer to floor!

Case 2 continued

- As hospitalists what are the most common challenges with transitions between floor and ICU?

Take Home Messages

- Wide spectrum of illness from floor to ICU and back
- Multiple options exist for O2 delivery and respiratory support
- Early recognition and treatment of sepsis is key
- Judicious fluid resuscitation (avoiding volume overload) is important
- Close communication between floor and ICU is critical for optimal management