Managing Patients in the Transition Between Floor and ICU

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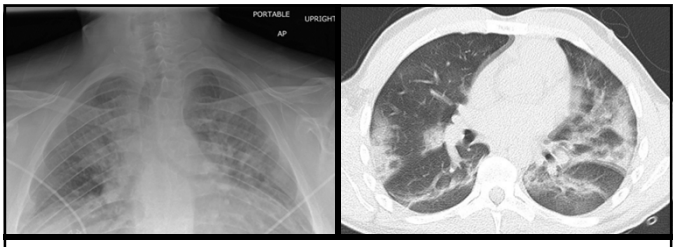


Case 1: Imaging

Disclosures

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

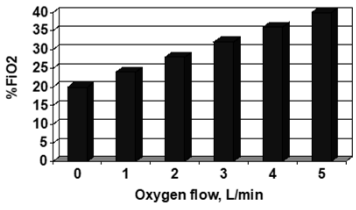
Case 1

- 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?

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

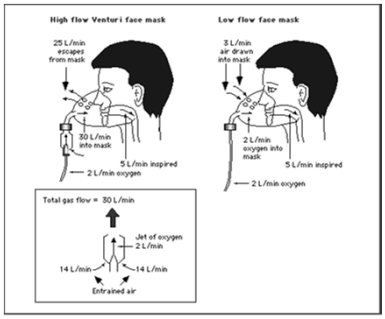
Oxygen supplementation



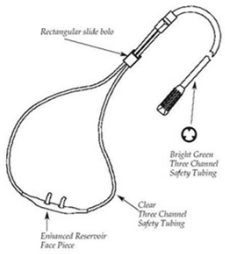
Method	FiO2 (Approximate)	Flowrate (L/min)
Non rebreather Mask	60-80%	10-15
Venti Mask	24%	3
	26%	3
	28%	6
	31%	6
	35%	9
	40%	12
	50%	15
Simple Face Mask	35-55%	5-10 lpm
Nasal Cannula	24%	1
	28%	2
	32%	3
	36%	4
	40%	5
	44%	6

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.

Case 1 continued

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

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)

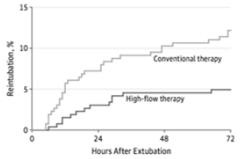
- Supportive data for:
  - Acute COPD exacerbation--greatest benefit
  - Ventilator weaning adjunct in COPD
  - Acute cardiogenic pulmonary edema
  - Hypoxemic respiratory failure, immunocompromised host in early but not later studies
- Why?
  - Improved alveolar ventilation
  - Reduced work of breathing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

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.

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

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

NIV Mask Fashion Show

Most common in the ICU.

Perhaps next? The helmet.

Patel BK et al. JAMA 2016

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?

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"

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.

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

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 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

- 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

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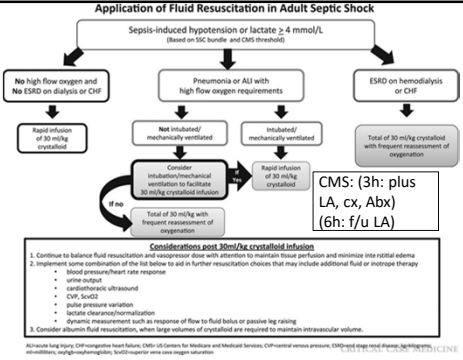
- SEPSIS: (>10% mortality)
  - Life-threatening organ dysfunction
  - Caused by *dysregulated response* to infection
  - Increase SOFA score of ≥2
- SHOCK: (>40% mortality)
  - Vasopressors for MAP≥65 mmg Hg
  - Lactate>2 mmol/L
  - In absence of hypovolemia

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



CMS: (3h: plus LA, cx, Abx) (6h: f/u LA)

Surviving Sepsis Guidelines 2016, ICM 2017

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

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

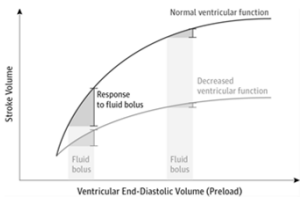


Figure Legend:

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

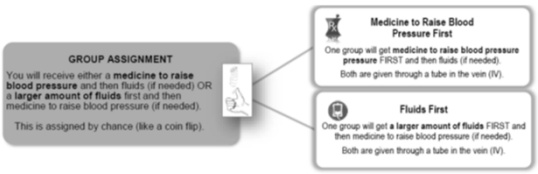
Chest 2020

FLUIDS in SEPSIS BOTTOM LINE:

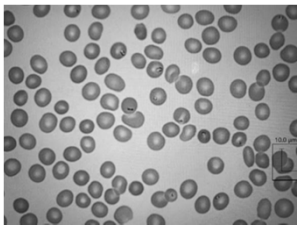
Bolus crystalloid, but don't overdo it.

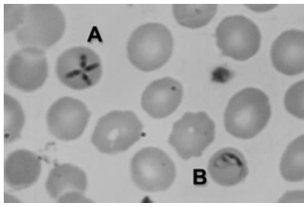
Find your favorite way(s) to target resuscitation.

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.





Blood smears: parasites consistent with *Babesia microti*

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

NO: Hetastarch
Mostly NO: Albumin
Yes: Crystalloid…moving toward favoring LR over saline

NEJM March 1, 2018

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