Perioperative Care of the ICU Patient: Things You Need to Know

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Objectives

- Describe the various modes of mechanical ventilation
- Review the commonly used anticoagulants and their reversal prior to the OR
- Review the management of enteral and parenteral nutrition and glycemic control
- Discuss the ethical impact of DNR’s, directives, and end-of-life care

Disclosures

I have nothing to disclose,

“I’m only here so that I don’t get fined.” - Marshawn Lynch

History of Mechanical Ventilation

...mouth to mouth inflation of the victim’s might be preferable to using a pair of bellows as “the lungs of one man may bear, without injury, as great a force as another man can exert; which by the bellows cannot always be determined...”

~John Fothergill, Treatise on Resuscitation, 1745

The ICU Patient

The Iron Lung 1931-1956
The Draeger Pulmotor, predecessor to the original ICU positive pressure ventilators

**Begin at the Beginning**

- A ‘mode’ of mechanical ventilation simply defines a sequence of breath types and the timing of those breaths.

**Mechanical Ventilation**

- The then...
  - Volume Control (VC)
  - Pressure Control (PC)
  - AC or CMV
  - SIMV
  - PSV

**Basic Ventilator Lingo**

- Volume
- Pressure
- Flow
- Trigger
- Limit
- Cycle

**Mechanical Ventilation**

- ...the Now (Ventilator Alphabet Soup)
  - AC, CMV, PC, VC, PSV, IMV, SIMV
  - VC+, PRVC, VS, APV, APRV, HFV
  - BiPAP, CPAP, PS, ATC, PEEP
  - OMG, WT...!!

**Basic Ventilator Modes**

- Trigger: what the machine senses to initiate a breath
  - Time: a time interval passes
  - Patient: flow, pressure
- Limit: what limits the breath
  - Pressure
  - Flow
- Cycle: what terminates the breath and cycles the breath into expiration
  - Time, pressure, volume
  - Flow
Breath characteristics

A = what initiates a breath - TRIGGER
B = what controls / limits it – LIMIT
C = What ends a breath - CYCLING

Breath types

Control/Mandatory
Machine triggered and machine cycled

Assisted
Patient triggered but machine cycled

Spontaneous
Both triggered and cycled by the patient

Vent modes

• No proven mortality benefit of one over another
• Mostly chosen for individual patient goals and to optimize synchrony
• Some might be more sensible for ARDS or “lung-protective” ventilation

Preparation for the OR

• How is the lung compliance?
• How is the oxygenation (FiO₂, PaO₂, P/F, PEEP)?
• How is the ventilation (pH, pCO₂)?
• Will they tolerate transport to the OR?
• Do they require an ICU ventilator
• Consultation with the ICU team or a Respiratory Therapist

Some Words About Nutrition and Glycemic Control

• What we know
  o Malnutrition is associated with poor clinical outcomes
  o Critically ill patients are at high “nutritional risk”

• What we do not know
  o How to screen ICU patients for malnutrition
  o Anthropometry, screening tools, body composition are very unreliable in these patients

• New Tools
  o NUTRIC score
  o CT
  o Bedside ultrasound of quadriceps muscle
### Nutrition Goals

- Early enteral nutrition (EN)
  - Start within 24 hours
  - Functional GI tract
  - Gastric or Jejunal access

- Barriers:
  - Delayed placement of feeding tubes
  - Interruptions for transport or procedures
    - (typical 2 week ICU stay interruptions = 8% protein deficit)
  - Protocolized feeding strategies result in greater days of EN compared to standard clinician guided feeding

- Post pyloric feeding has not been shown to reduce nosocomial infection and prevent aspiration, although best practice recommendations favor it

### Parenteral Nutrition

- Severely malnourished patients
- GI dysfunction for more than 5-7 days
- EN is contraindicated

- A combination of EN with supplementation by PN may be useful and well tolerated

*Try to avoid disruption, disconnection, or contamination of the PN for operative procedures

### Gastric Residual Volumes

- Randomized studies to compare GRV of 500cc vs. 200cc have not shown a major difference in VAP, duration of MV, or ICU LOS
- Not monitoring GRVs is likely not inferior to routine measuring
- Most institutions: GRV between 300cc and 500cc every 4-6 hours as a cutoff for EN tolerance

### Glycemic Control

- The optimal target blood glucose in ICU patients remains unclear
- The landmark study by Van den Berghe et al suggested that tight glycemic control (target of 81-108 mg/dL) would benefit patients and this theory was widely adopted

- A meta-analysis by Wiener et al published in JAMA in 2008 showed that tight glycemic control did not alter mortality in critically ill adults
  - Patients assigned to the intensive glycemic control group had lower glucose levels, received more insulin, and had more episodes of hypoglycemia
- The NICE-SUGAR trial published in the NEJM in 2009 suggested that tight glycemic control does not benefit critically ill patients and may actually be harmful
  - Had more statistical power and longer follow up than the studies included in the meta-analysis

### Parenteral Nutrition

- For a long time we believed that parenteral nutrition (PN) was bad (infection, overfeeding, organ dysfunction, mortality)

- Recent and emerging evidence does not suggest that
  - Quality of the lipid emulsion
  - Central line care
  - Glucose management
  - Evaluation of organ dysfunction
**Glycemic Control**

**The Bottom Line**

- A blood glucose target of less than 180 mg/dL may be associated with a lower mortality than tight glycemic control and is less likely to be associated with hypoglycemic events.

**Nutrition and Glucose Summary**

- Remain proactive in promoting the delivery of EN to consensus targets
  - Limit fasting
  - Limit interruptions
- Continue PN when possible
- Much large scale research still needed to establish "nutritional risk", pre-op evaluation tools, intraoperative and post-operative goals, and post hospital outcomes

**Keeping up with Anticoagulants**

- Options for thromboprophylaxis
  - ASA
  - Antiplatelet drugs and IIb-IIIa inhibitors
  - SQH
  - IV UFH
  - LMWH
  - VKA's
  - Indirect Factor Xa inhibitors
  - Direct Factor Xa inhibitors
  - Oral direct thrombin inhibitors
  - Parenteral direct thrombin inhibitors
- The burgeoning array of anticoagulation poses new challenges for perioperative patients

**Reversing Anticoagulants**

- UFH: can be completely reversed with protamine
- LMWH: no reversal agents currently available, may be partially reversed with protamine
- Enoxaparin (single dose): factor Xa normal in 12h
  - (twice daily): factor Xa normal in 24h
- Fondaparinux: 36h to 48h
- VKA's: Vitamin K for mildly increased INR
- PCC for life threatening conditions or intracranial hemorrhage
- FFP
- Off-label use of recombinant factor VII

**Novel Agents**

- Odiparcil
  - An oral, indirect thrombin inhibitor which activates antithrombin II
- RB006
  - Direct factor IX inhibitor which inhibits the factor VIII-IX activation of factor X
  - Being developed in conjunction with its antidote, RB007
- Recombinant human soluble thrombomodulin(ART-123)
  - Binds to thrombin and activates protein C
- SR123781A
  - Inhibits both factor Xa and thrombin via antithrombin
Advance Directives and DNRs

- Advance Directives or living wills are becoming more common among patients.
- Often unclear whether they are helpful to guide end-of-life care once patients are being treated in the ICU.
- Many studies suggest that patient preferences set out in advance have little or no influence on end-of-life care in the ICU.
- Patients with advance directives are more likely to have DNR orders and not get CPR, but are just as likely to get circulatory support, mechanical ventilation, hemodialysis, or an operation.
- So why is there so much inconsistency??

Advance Directives

- The validity and applicability of advance directives are determined by whether the condition of the ICU patient matches the hypothetical conditions identified in the advance directive.
- Wording may be ambiguous or incongruent (e.g., Is this condition likely to cause "imminent death"?)
- The uncertainties about prognosis and the potential benefit of certain therapies leaves physicians to make subjective value judgements concerning the patient’s best interest.
- Unwarranted legal concerns and lack of legal knowledge.

DNR Orders on Operative Patients

- How do professional organizations view them?
- What defines the perioperative period?
- How does resuscitation differ in or out of the perioperative setting?
- What ethical considerations are made for members of the perioperative team?

DNR's on Operative Patients

- As the patient’s advocate we have an ethical and moral responsibility to the patient.
- As a leading member of the health care team we have a moral obligation to uphold a patient’s rights to..
  - Autonomy: respect the patient’s right to decide for themselves regarding DNR status in the perioperative setting.
  - Beneficence: do what is in the patient’s best interest.
  - Nonmaleficent: prevent harm to the patient.
  - Justice: all individuals deserve mutual respect.

DNRs in Operative Patients

- By some estimates 15% of patients with DNR orders will undergo a surgical procedure.
- Present a complex medical and ethical issue.
- Outdated and unclear policies leave us unsure and misguided.

DNR’s on Operative Patients

- Most professional societies among nurses, surgeons, and anesthesiologists recommend clarification of the patient’s wishes including a thorough review of the patient’s directives and then carefully documenting that discussion and disseminating it to other members of the perioperative team.
DNR's on Operative Patients

- The American Society of Anesthesiologists Ethical Guidelines for the Anesthesia Care of Patient with Do Not Resuscitate Orders or Other Directives that Limit Treatment affirms that patients have a right to self-determination.
- It states that automatic suspensions of DNR in the OR does NOT address this right.
- It states that existing directives should be reviewed before procedures, clarified and modified accordingly, and shared with the entire team.

Summary

- Close consultation with a respiratory therapist and an ICU physician should occur prior to taking mechanically ventilated patients to OR.
- Anesthesiologists should consider glycemic control and minimize interruptions in nutritional delivery.
- Elective surgery should be timed according to a patient’s anticoagulation and emergency surgery may require prompt reversal of anticoagulants used in the ICU.
- Thoughtful consideration of a patient’s advanced directives and DNR status should occur and may involve a multi-disciplinary discussion with patients, their proxies, medical ethicists, and the perioperative team.

DNR’s on Operative Patients

- Summarizing the position statements from the majority of professional organizations:
  - They do NOT support the common practice of routine rescinding of a DNR order for the perioperative period.
  - They do support a discussion with a patient and/or their proxy regarding how they wish the DNR to be handled.
    - A period of “required reconsideration”.

Recommendations on DNR’s

- DNR’s should not be automatically suspended.
- “Required reconsideration” should occur.
- The patient or surrogate determines the plan for resuscitation.
- The perioperative setting should be clearly defined.
- The discussion should be clearly documented and communicated.
- A process should be included for team members who conscientiously object.
- Additional discussion should occur post-operatively to direct care as the patient recovers.