

---

# Caring for Critically Ill Complex Populations: Neurologically Injured, History of Substance Abuse or Obese Patients

Hira Shafeeq, PharmD, BCPS, BCCCP

Professor

St. John's University

&

Clinical Specialist

Trauma Intensive Care Unit, Nassau University Medical Center

February 5<sup>th</sup>, 2025

# Conflicts of Interest

- None

# Learning Objectives-Pharmacists

1. Describe infrequently encountered critically ill patient populations in an ICU: Neurologically Injured, History of Substance Abuse or Obese patients.
2. Identify risk factors for complications for these critically ill special populations.
3. Define pharmacokinetic and pharmacodynamics alterations in these specific patient populations.
4. Outline interventions for critical care pharmacists for these special patient populations.

# Learning Objectives-Technicians

1. Identify infrequently encountered critically ill patient populations in an ICU: Neurologically Injured, History of Substance Abuse or Obese patients.
2. List risk factors for complications for these critically ill special populations.
3. State pharmacokinetic and pharmacodynamic alterations in these specific populations.
4. Specify alternate therapies for these special patient populations.



# NEUROLOGICAL INJURY & THE ICU

# Question

Have you encountered any “neuro” patients in your ICU patient population in the past 30 days?

- a) Yes
- b) No

# Question

If yes, approximately how many “neuro” patients do you typically need to verify medications for in your hospital ICU setting daily?

- a) <5 per day
- b) 5 – 10 per day
- c) >10 patients daily

# Neurologically Injured Patients in the ICU

- Stroke
  - Ischemic (87%)
  - Hemorrhagic (13%)
- Vascular abnormalities → hemorrhagic stroke
- Traumatic Brain Injury

# Ischemic Stroke - Management

- TPA
  - Alteplase
  - Tenecteplase
- Mechanical thrombectomy

Or BOTH

TPA = tissue plasminogen activator

# Post Ischemic Stroke -Management

- Post thrombectomy and/or TPA
  - Bleeding – neurological exam q15 mins during and until 2 hours post procedure (or infusion), q30 mins x 6 hours and then QD
  - Maintain BP  $\leq$  180/ 105 mmHg during and up to 24 hours after the procedure
    - Intravenous Therapy
      - Nicardipine
      - Labetalol
      - Hydralazine



Resume home anti-hypertensives


# Seizures Prophylaxis

- Early vs. Late onset
- Can occur for both Hemorrhagic and Ischemic Stroke
- Seizure prophylaxis
  - Moderate - Severe Traumatic Brain Injury = GCS < 8
  - $\leq 7$  days

## NCS GUIDELINES

# Guidelines for Seizure Prophylaxis in Adults Hospitalized with Moderate–Severe Traumatic Brain Injury: A Clinical Practice Guideline for Health Care Professionals from the Neurocritical Care Society



Jennifer A. Frontera<sup>1,11†</sup> , Emily J. Gilmore<sup>2†</sup>, Emily L. Johnson<sup>3</sup>, DaiWai Olson<sup>4</sup>, Appaji Rayi<sup>5</sup>, Eljim Tesoro<sup>6</sup>, Jamie Ullman<sup>7</sup>, Yuhong Yuan<sup>8</sup>, Sahar F. Zafar<sup>9</sup> and Shaun Rowe<sup>10</sup>

# Post Stroke Seizure Management

- Limited clinical evidence
- One episode vs. multiple episodes
- Most experts → one anti-epileptic medication
- Duration
  - One episode → discontinue on discharge from hospital
  - >1 episode → 3 months
  - Late onset seizures → lifelong antiepileptics

---

# Common drugs may influence motor recovery after stroke

Larry B. Goldstein, MD

[AUTHORS INFO & AFFILIATIONS](#)

May 1995 issue • 45 (5) 865-871 •

## Phenytoin Exposure Is Associated With Functional and Cognitive Disability After Subarachnoid Hemorrhage

Andrew M. Naidech, MD, MSPH; Kurt T. Kreiter, PhD; Nazli Janjua, MD; Noeleen Ostapkovich, MS; Augusto Parra, MD, MPH; Christopher Commichau, MD; E. Sander Connolly, MD; Stephan A. Mayer, MD; Brian-Fred M. Fitzsimmons, MD

# Hypertonic Saline

- Bolus
- Continuous infusion
- Various concentrations
  - 1.5%
  - 2%
  - 3%
  - 23.4% (30 ml bolus)
- Volume expander – can worsen heart failure



**Emergency Neurological Life Support  
Pharmacotherapy Protocol  
Version 5.0**

<b>Concentration</b>	<b>Dose</b>	<b>Infusion duration</b>
3%	5 ml/kg	5-20 min
5%	3 ml/kg	5-20 min
7.5%	2 ml/kg	5-20 min
23.4%	30 ml	10-20 min

**Pediatric considerations:**

Hypertonic saline 3%: 2-5 mL/kg over 10-20 min

Hypertonic saline 23.4%: 0.5 mL/kg (max dose: 30 mL)

# Mannitol

- Frequently used for neurological emergencies
- Dose 0.5 – 1 g/kg
- Pearls
- Requires in-line filter (precipitates—crystal formation)— may require warming to dissolve crystals before administration
- May be given via peripheral access
- Duration of effect 90 min to 6 h
- Monitor trough osmolar gap (Goal < 20 mOsm/kg)

# Osmolar Gap

- Osmolar Gap = Measured Serum Osmolarity - Calculate Osmolarity
- Calculated Osmolarity =  $2 \times [\text{Sodium (Na}^+)] + (\text{Glucose} / 18) + (\text{Blood Urea Nitrogen (BUN)} / 2.8)$
- Should be drawn as a trough
- Plasma osmolality of  $>320$  mOsm/kg is not a contraindication of ongoing administration of mannitol
- An osmolar gap of  $>20$  mOsm/kg indicates incomplete drug clearance between doses and increases risk of reverse osmotic shift and nephrotoxicity
- Pearl-OK to administer mannitol of osmolar gap  $<20$  mOsm/kg

# Patient Case

32 yr old male, admitted to the ICU post TBI

Patient has received 2 doses of mannitol in the past 24 hours

Patient has a new stat order for mannitol 1g/kg x 1 dose


## Laboratory Parameters

Na	154 mEQ/L	BUN	29 mg/dL
K	4.5 mEQ/L	Cr	1.1 mg/dL
Cl	119 mEQ/L	Gluc	188 mg/dL
HCO <sub>3</sub>	18 mEQ/L		
Serum Osmolarity – 341 mOsm/L			

## Patient Case

Na	154 mEQ/L	BUN	29 mg/dL
K	4.5 mEQ/L	Cr	1.1 mg/dL
Cl	119 mEQ/L	Gluc	188 mg/dL
HCO <sub>3</sub>	18 mEQ/L		
Serum Osmolarity – 341 mOsm/L			

1. Determined the Osmolar Gap for this patient
2. Can this patient receive an additional dose of mannitol?

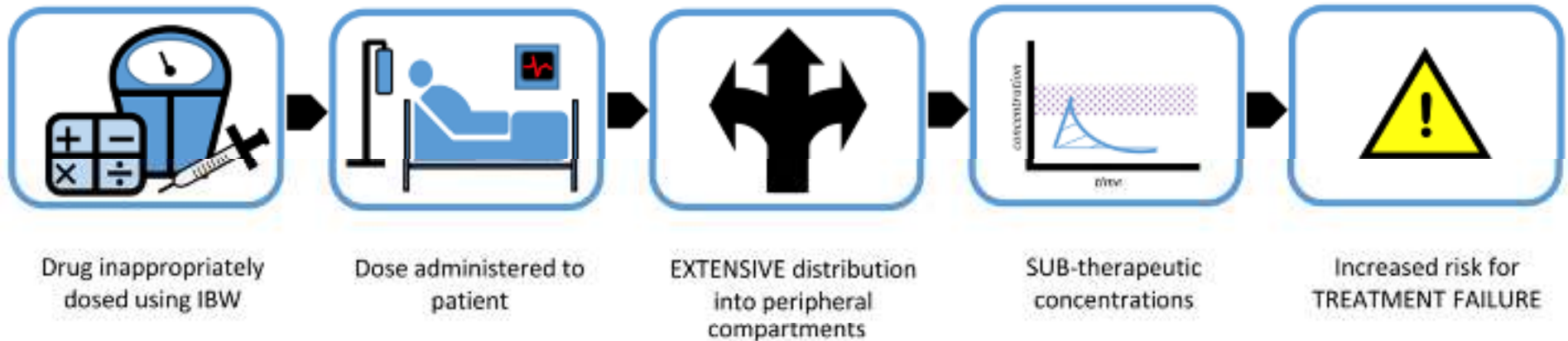


# OBESITY & THE ICU

# Obesity in America

- Obesity: BMI  $\geq 30$  kg/m<sup>2</sup>
  - ~ 40%
- Severe obesity: BMI  $\geq 40$  kg/m<sup>2</sup>
  - ~ 9.4%

# Consequences of Incorrect Dosing



# Commonly Use Equations for Weight in Drug Dosing

Weight measure	Equation
Body mass index (kg/m <sup>2</sup> )	TBW/height (m) <sup>2</sup>
Ideal body weight (kg)	Males: 50 kg + 2.3 kg/inch for height over 5 feet Females: 45.5 kg + 2.3 kg/inch for height over 5 feet
Lean body weight (kg)	Males: (9270 × TBW) / (6680 + 216 × BMI) Females: (9270 × TBW) / (8780 + 244 × BMI)
Adjusted body weight (kg)	CF (TBW – IBW) + IBW, where CF = correction factor (usually 0.4)

# Medication Pearls for Obese Patients

- Vasopressors
- Corticosteroids (based on indication)
  - Community acquired pneumonia and Shock – Hydrocortisone <400 mg /day
  - Acute Respiratory Distress Syndrome (ARDS) – Methylprednisolone 1 mg/kg (use IBW or AdjBW)
- Stress Ulcer Prophylaxis
- VTE Prophylaxis
  - Enoxaparin
    - BMI  $\geq 40$  kg/m<sup>2</sup> – 40 mg BID
    - BMI  $\geq 50$  kg/m<sup>2</sup> – 0.4–0.5 mg/ kg twice daily based on total body weight
  - Heparin –consider increasing dose to 7500 IU Q8H for BMI  $\geq 50$  kg/m<sup>2</sup>



**PATIENTS WITH  
SUBSTANCE  
ABUSE DISORDER**

# Substance Use Disorder

- Significant impact on on critical illness and post-ICU outcomes
- Types of Substance Use Disorders
  - Alcohol withdrawal
  - Hallucinogen related disorder
  - Cocaine
  - Opioids

# Identifying Substance Abuse Disorder in the ICU

- Patients → unable to communicate
- Families can be unaware
- Utox
- Consider detailed history if signs and symptoms of withdrawal

# Withdrawal – Signs and Symptoms

Substance	Symptoms
Alcohol	Tremors. Sweating. Severe anxiety. Confusion. Seizures.
Opioids	Diarrhea and vomiting, thermoregulation disturbances, insomnia, muscle and joint pain, anxiety, and dysphoria
Cocaine	Fatigue, vivid dreams, sleep disturbance, increased appetite, agitation
3,4-Methylenedioxymethamphetamine (MDMA)	Serotonin depletion (depressed mood, fatigue)
Synthetic Cannabinoids	Craving, anxiety, tachycardia, hypertension, nausea, tremor, diaphoresis, and nightmares
Synthetic Cathinones “Bath salts”	Depression, anxiety, sleep disorder, paranoia, and cravings,

# Pain Management in Patients with Opioid Use Disorder

- Misconceptions
  - Medication used for OUD should cover the acute painful condition
  - Pain medications may result in relapse
  - Added opioids are likely to result in central nervous system (CNS) and respiratory depression,
  - Complaints of pain may constitute “drug-seeking” behavior
- Patients with Buprenorphine maintenance therapy
  - Discontinue buprenorphine during acute care
  - Transition to Methadone
  - Change to short acting Buprenorphine with additional opioids for pain
  - Keep maintenance therapy and add short acting opioids for pain management



# Conclusion

- Evidence for special populations such as neurologically injured, obese and substance abuse disorder patient populations is always evolving
- Pharmacists and technicians should review key interventions for prevention of complication in these special patient populations
- Pharmacist and pharmacy technicians are key players for ensuring timely delivery of critical medications for these patients



QUESTIONS?