



**Online Medical Control (OMC):** 1-888-404-8029

You can expect the call to ring for up to 15-20rings as it cycles through all physicians on call. Call volume will continue to be monitored to ensure adequate resources are allocated to answering paramedic patches.

### PATCH Failure Protocol

**PATCH failure** = You've made **reasonable attempts** to contact a BHP but **can't connect**.

Here's what to do:

1. **Document it** in the **Procedures section** of the ACR using appropriate PATCH failure codes
2. If this affected patient care, provide an **explanation** on the ACR
3. **Contact CEPCP** as soon as possible to report the incident

**When to PATCH – Quick Reference for ACPs** As an **Advanced Care Paramedic**, you must PATCH to the **Base Hospital Physician (BHP)** in the following situations:

### **Core Directives – Mandatory PATCH Required**

#### Medical Cardiac Arrest Directive

→ PATCH to request **Termination of Resuscitation (TOR)** authorization (if criteria met)

#### Trauma Cardiac Arrest Directive

→ PATCH to request **TOR** authorization (if criteria met)

### **Tachydysrhythmia Directive**

→ PATCH for permission to give **Lidocaine**  
→ PATCH for permission to give **Adenosine** in a **monomorphic wide complex regular rhythm** → PATCH for permission to proceed with **synchronized cardioversion**

### **Intravenous and Fluid Therapy Directive**

→ PATCH before giving **NaCl IV bolus** to a **hypotensive child <12 years old with suspected DKA**

### **Pediatric Analgesia**

→ PATCH for **authorization and dosage confirmation** before giving **Morphine or FentaNYL** to any **child under 12 years old**.

→ PATCH for **authorization and dosage confirmation** before giving **Ketamine** to any **child under 18 years old**.

### **Special Care Directives**

→ PATCH for **authorization** to administer Cyanokit for patients that meet the medical directive

### **Discretionary PATCH (Optional)**

You may PATCH the BHP anytime to discuss patient care that:

- Doesn't fall under a current directive
- But **is within your scope of practice**

## PATCH Failure Protocol

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# Effective PATCH Communication – Dr. Moran’s Key Recommendations

To ensure smooth, efficient communication with the Base Hospital Physician (BHP), follow the **SBAR** format:

## **S – Situation**

Start with a **clear statement of why you’re patching**. Be concise and direct.

*Example: “I’m patching to request TOR for a medical cardiac arrest.”*

## **B – Background**

Include **relevant clinical context** (e.g., patient history, events leading to 911 call, findings).

*“The patient is a 74-year-old male with a history of CHF. Witnessed arrest, CPR in progress.”*

## **A – Assessment**

Report your **findings** and **vital signs**.

*“Initial rhythm was VF, shocked twice. No ROSC. CPR ongoing. Vitals as follows...”*

## **R – Recommendation**

State what you’re asking for or confirming.

*“Requesting permission to terminate resuscitation under the Medical Cardiac Arrest Directive.”*

## **IMIST-AMBO – A Structured Handover Framework**

IMIST-AMBO helps frontline providers deliver concise, complete, and clinically relevant patient summaries. It reduces cognitive overload and miscommunication in high stress environments.

### **I – Identification**

#### **Who is the patient?**

- Full name
- Age
- Date of birth
- Gender

### **M – Mechanism / Medical Complaint**

#### **Why was EMS called?**

- Mechanism of injury (for trauma)
- Primary medical complaint (for medical cases)
- Clear, concise wording (e.g., "found unconscious at home after a fall" or "chest pain radiating to jaw")

### **I – Injuries / Information Relevant**

#### **What are the key findings so far?**

- Injuries noted on assessment
- Pertinent negatives or positives
- Clinical impressions or suspected diagnosis
- Focused on what matters most

## S – Signs

### What are the vital signs?

- Heart rate
- Blood pressure
- Respiratory rate
- Oxygen saturation
- Temperature
- Glasgow Coma Scale (GCS)

- Blood glucose level

*Tip: Give a trend, not just a snapshot.*

## T – Treatment and Trends

### What's been done and how has the patient responded?

- Medications administered
- Interventions performed
- Patient response (improved, deteriorated, no change)
- Time of key events

## A – Allergies

### Any known allergies?

- Medication, food, latex, etc.
- Nature of the reaction if known

## **M – Medications**

**What regular or recent medications is the patient taking?**

- Include prescribed, over-the-counter, or recent medications of significance (e.g., anticoagulants)

## **B – Background**

**What is the patient's medical history?**

- Relevant chronic conditions
- Recent surgeries or admissions
- Social context if important (e.g., lives alone, palliative, DNR)

## **O – Other Information**

**Anything else relevant to care or safety?**

- Scene details (e.g., unsafe home environment)
- Witness statements
- Contact information for caregivers or family
- Mental health concerns or advanced directives

## Why IMIST-AMBO Works

- Reduces information gaps
- Supports memory recall under stress
- Encourages team situational awareness
- Builds trust and clarity between prehospital and hospital teams

## **Dr. Moran's Recommendations – What Every Paramedic Should Remember:**

- 1. State the purpose of your patch right away.** Be specific. Don't make the physician guess why you're calling.
- 2. Identify your paramedic service.**  
This helps physicians track call volumes and understand the regional context.
- 3. Always provide vital signs.**  
They are essential for clinical decision-making. Even in cardiac arrest or trauma, vitals from the scene can help guide the discussion.

# Adrenal Issues

# Hydrocortisone – Safe Administration Practices

- **Common Trade Name:** Solu-Cortef®
- **Dosing:** May be **rounded to the nearest 10 mg** to simplify preparation while maintaining therapeutic efficacy.
- **All patients receiving hydrocortisone must be transported.**
  - Reflects underlying adrenal insufficiency or critical illness requiring monitoring.

## *Labeling & Preparation*

- **Verify the concentration** carefully before drawing up the medication.
- **Formulations:**
  - **Premixed vials**, or
  - **ACT-O-VIAL® system** (requires activation and mixing prior to withdrawal).

*Incorrect mixing or dose misidentification are common error points—use double-check protocols.*

# Airway And Allergy

# Bronchoconstriction – High Reliability Medication Administration

## *1. Epinephrine First for severe asthma patients*

- In patients who are **apneic with suspected bronchoconstriction, epinephrine is the priority medication.**
- Early administration improves oxygenation and reverses life-threatening airway narrowing.
- **Action cue: Do not delay epinephrine** while preparing adjuncts such as salbutamol.

## *2. Salbutamol MDI via BVM Adapter (If Available)*

- Salbutamol **may be administered after epinephrine**, ideally through a **BVM-MDI adapter.**
- **There is no recommendation to utilize salbutamol with the BVM adapter during a cardiac arrest caused by asthma exacerbation because of impaired absorption and task saturation**

## *3. Nebulization Contraindicated in Febrile Settings*

**Do not administer nebulized medications if:**

- The patient has a **known or suspected fever,**
- There is an active **febrile respiratory illness outbreak** (as declared by the local Medical Officer of Health).

#### 4. MDI Administration Guidelines

- **Dose:** 100 mcg of salbutamol **every ~4 breaths.**
- **Spacer use is strongly recommended** (if available), as it:
  - Increases drug deposition in the lungs,
  - Reduces oropharyngeal deposition, and

A spacer should be used when administering Salbutamol MDI (if available).

CPAP can be utilized with Salbutamol

Below is the proper set up



## What is Dexamethasone?

Dexamethasone is a potent corticosteroid with strong anti-inflammatory and immunosuppressive effects. It plays a critical role in managing acute respiratory conditions by:

- Reducing airway inflammation
- Minimizing mucus production
- Enhancing responsiveness to beta-agonists like salbutamol

## Key Benefits of Dexamethasone in the Prehospital Setting

### 1. Early Anti-inflammatory Action

Asthma and COPD exacerbations are driven by inflammation, not just bronchospasm. While steroids don't act immediately, administering dexamethasone early in the prehospital phase initiates suppression of the inflammatory response, helping to shorten the overall duration and severity of the episode.

### 2. Reduced Relapse and Hospital Admission

Multiple studies demonstrate that systemic corticosteroids reduce the likelihood of hospital admission and lower the rate of relapse. A single prehospital dose can provide significant benefit in preventing return ED visits.

### 3. Flexible Administration (Oral, IM, or IV)

Dexamethasone is effective when given orally or via injection. Its long half-life (36–72 hours) allows for single dose administration—ideal in the prehospital setting where continuity may be limited. **However, the preferred route is**

**PO.**

#### **4. Improved Response to Beta-Agonists**

Corticosteroids upregulate beta-2 receptors, making bronchodilators like salbutamol and epinephrine more effective. This is especially helpful in patients who are steroid-dependent or experiencing severe bronchoconstriction.

#### **5. Fewer Side Effects Compared to Prednisone**

Dexamethasone is generally better tolerated than prednisone, with fewer reports of gastrointestinal discomfort, insomnia, or mood changes. It is often easier for patients to take in acute settings.

### **Clinical Relevance for Paramedics**

A **20 pack-year smoker** is someone who has smoked the equivalent of **one pack of cigarettes per day for 20 years**.

#### **How Pack-Years Are Calculated:**

Pack-years = (Packs per day) × (Years smoked)

So, for a **20 pack-year history**, this could mean:

- 1 pack per day × 20 years
- 2 packs per day × 10 years
- 0.5 packs per day × 40 years

This metric is commonly used in clinical settings—especially in **respiratory and cardiovascular assessments**—to estimate a person's risk for:

- Chronic Obstructive Pulmonary Disease (COPD)
- Lung cancer
- Cardiovascular disease

# CPAP (Continuous Positive Airway Pressure)

- **Indication Update:**

CPAP is no longer limited to acute cardiogenic

**pulmonary edema.** It can be considered for **any form of pulmonary edema**, including:

- Cardiogenic causes
- Non-cardiogenic causes (e.g., aspiration, ARDS, high-altitude pulmonary edema)

*Clinical judgment is critical in assessing the appropriateness of CPAP based on work of breathing, oxygenation, and clinical trajectory.* **Early CPAP application can reduce the work of breathing, improve oxygenation, and support alveolar recruitment across a wide range of clinical presentations.**

**It is acceptable practice to administer nitroglycerin and/or Dexamethasone to patients receiving CPAP-this short time will not interfere with continuous pressure that has been built up.**

# Croup – Prehospital Management

- **Nebulized Epinephrine:**
  - Titrate oxygen flow to **6–8 L/min** until **visible misting** is observed to ensure effective aerosol delivery.
- **Dexamethasone Administration:**
  - **Oral (PO) route only** is permitted for prehospital management of croup.
  - **Alternative routes** (e.g., IM or IV) **require a Base Hospital patch** for authorization.
- **Route Tolerance:**
  - If the patient is **unable to tolerate oral or nebulized administration**, consult the **Base Hospital Physician** to consider an alternate route.
- **Do not mix dexamethasone in liquids** (e.g., orange juice) for administration.
  - This practice **alters absorption**, impairs dosing accuracy, and violates best practice for medication safety.

**PPE Consideration:** *Nebulized epinephrine is an aerosol generating medical procedure (AGMP).*

**Airborne precautions** must be taken:

- N95 respirator (fit-tested)
- Eye protection (face shield or goggles)
- Gown and gloves
- Perform in a **well-ventilated area** or with the **vehicle's ventilation system on maximum air exchange** if possible.

# Tracheostomy, ETT, and SGA Suctioning

## Emergency Tracheostomy Reinsertion

- **Definition of Attempt:**

An attempt is defined as **inserting a cannula into the tracheostomy stoma.**

- **Reinsertion Guidelines:**

- **Maximum of two attempts** permitted.
- Use a **new inner or outer cannula** when available—**avoid reusing** a contaminated device.
- Involve a **knowledgeable caregiver or family member** when available to assist with reinsertion.

## ETT / Tracheostomy Suctioning

- **Pre-oxygenation:**

- Always **pre-oxygenate with 100% oxygen** before suctioning.

- **Technique:**

- **Maximum suction duration: 10 seconds.**
- Apply suction **only during withdrawal** of the catheter.
- In alert patients, **encourage coughing** to assist in airway clearance prior to suctioning.

## SGA with Gastric Suction Port

- **Assessment Before Suctioning:**
  - If **no gastric secretions are present**, evaluate for other causes of poor ventilation:
    - Incorrect device size or depth
    - Inadequate seal
      - Posterior/inferior pressure not applied
    - Mechanical airway obstruction
- **Suction Procedure:**
  - If fluid clears or is absent after **15 seconds**, **stop suction** to avoid gastric injury.

## Measuring Catheter Depth for SGA Suctioning

- **Measurement Technique:**
  - Measure the **iGel cradle length** and add **2–5 cm**.
  - Apply **circumferential colored tape** at the depth marker to aid insertion control and avoid over advancement.

# Advanced Airway Management – Safety-Critical Guidelines

## Orotracheal Intubation (ETT)

- **Maximum of two intubation attempts.**
  - **Definition:** An attempt is the **insertion of the laryngoscope blade into the mouth** for the purpose of intubation, regardless of success.
- **Confirmation of Tube Placement:**
  - **Waveform ETCO<sub>2</sub> (capnography) is mandatory.**
  - If unavailable, use **at least three secondary confirmation methods** (e.g., chest rise, auscultation, fogging, SpO<sub>2</sub> trend).
- **Failure to Confirm ETCO<sub>2</sub>:**
  - If no ETCO<sub>2</sub> is detected **despite thorough troubleshooting, extubation is recommended.** ○ *This minimizes risk of unrecognized esophageal intubation—a known high-harm event.*

## Tube Maintenance – Sedation and Analgesia

- Consider **FentaNYL and Midazolam** under the **Procedural Sedation Medical Directive** to maintain comfort and prevent tube dislodgement.
- All **intubated patients with a pulse** should be assessed for the need for **FentaNYL and Midazolam** under the **Procedural Sedation**

**Medical Directive** to ensure comfort, reduce distress, and prevent tube dislodgement.

- **Sedation and analgesia should not be withheld solely due to the absence of a gag reflex or overt signs of distress.**
- The decision to administer should be based on clinical context and anticipation of discomfort, not reactive cues alone.
  - *Proactive sedation improves patient safety, reduces adverse movement, and supports airway integrity.*
- **Reconfirmation After Movement:**
  - Reconfirm tube placement **immediately following any patient movement**, including transfer, repositioning, or CPR..

# Moderate to severe Allergic Reaction

## 1. Epinephrine must be administered first.

Epinephrine is the only medication proven to reverse the life-threatening pathophysiology of anaphylaxis. *Delays or reliance on adjuncts (e.g., antihistamines) increase the risk of deterioration and death.*

- **Anaphylaxis is a severe, life-threatening generalized or systemic hypersensitivity reaction that is characterized by rapidly developing life threatening airway, breathing, and/or circulatory problems, usually associated with skin and mucosal changes. They do not need two or more body systems-it is any life threat.**

*(EAACI Guidelines, 2021; ASCIA 2020)*

## 2. Dose rounding supports timely action.

To minimize calculation errors and decision delays under stress, **round the epinephrine dose to the nearest 0.05 mg.**

- **Example:** For pediatric dosing (e.g., 0.11 mg), round to 0.10 mg.
- **Safety rationale:** Dose rounding aligns with cognitive offloading strategies and reduces arithmetic burden in critical moments.

### **3. Diphenhydramine (Benadryl) is supportive, not definitive.**

This antihistamine is often familiar and available, but **should not delay epinephrine administration**. It does not address the airway or cardiovascular collapse central to anaphylaxis.

- **Cognitive trap to avoid:** Mistaking symptom relief (e.g., rash improvement) for true stabilization.

### **4. Dexamethasone may worsen outcomes in acute bronchospasm.**

In patients with anaphylaxis complicated by bronchoconstriction, **dexamethasone is not indicated. It has no immediate effect and may lead to worse outcomes.**

- **Patient safety principle:** Avoid interventions that offer no acute benefit and carry risk—particularly when time sensitive care is required.

# Analgesia

# Analgesia – Safe and Effective Pain Management

## Multimodal Analgesia Principles

- **Co-administer acetaminophen and ibuprofen**, when appropriate, to provide **multimodal pain relief** through different mechanisms of action.
- For **renal colic**, combining an **NSAID with morphine or FentaNYL** can improve symptom control and reduce opioid requirements.

## Opioid Use Guidelines

- **Use extra caution in opioid-naïve patients and those aged 65 or older**, due to increased risk of respiratory depression and sedation.
- **Administer IV morphine or FentaNYL in small aliquots every 3 minutes**, titrated to effect.

*Small, titrated dosing supports safety and reduces risk of overdose or hypotension, especially in fragile patients.*

- **Do not combine morphine and FentaNYL** unless **explicit authorization** is obtained via **Base Hospital Physician (BHP)** patch.
- **Maximum intranasal volume for FentaNYL is 1 mL per nare.**

## Ketamine, Morphine, and FentaNYL – Sequencing and Safety

### Sequential Administration Only

- Ketamine **must not** be co-administered with morphine or FentaNYL.  
Always administer **sequentially**, not simultaneously.

### Dosing Intervals

- **Wait 15 minutes after morphine** before administering ketamine.
- **Wait 5 minutes after FentaNYL** before administering ketamine.

*These intervals help prevent additive CNS effects and ensure safety in sedation and analgesia.*

## Ketamine Use Principles

- **Not a first-line analgesic.**
  - Use **with an opioid** for synergistic effect, or **alone** if:
    - The patient has a known or suspected **opioid use disorder**, or
    - **Opioids are contraindicated** (e.g., allergy, adverse reactions).
- **Maximum intranasal volume for ketamine is 1 mL per nare.**

## **Important Note on Intranasal (IN) Drug Administration**

- When calculating volumes for IN medications, **account for dead space** in the mucosal atomizer device.

*This ensures accurate dosing and effective delivery.*

Cardiogenic

# Acute Cardiogenic Pulmonary Edema (ACPE) – Clinical Parameters

## 1. Primary Cause Consideration

If ACPE is present in the setting of a STEMI, →  
Treat according to the STEMI medical directive  
nitroglycerin dosing.

- Administer **0.4 mg nitroglycerin SL x3**, as per STEMI medical directive.
- **Rationale:** The underlying cause of ACPE is likely **STEMI-induced cardiac dysfunction**.

## 2. Hypotension Management After Nitroglycerin

If the patient becomes hypotensive following  
nitroglycerin,

→ **Administer a fluid bolus to restore normotension**,  
even if pulmonary crackles are present.

- Goal: Achieve **perfusion-level blood pressure**.
- Once normotension is restored:  
→ **Withhold further nitroglycerin administration**.

# Cardiogenic Shock – Medication and Management Principles

## 1. *Discontinuing Dopamine*

- **If dopamine is to be discontinued electively, taper gradually over 5–10 minutes** to avoid rebound hypotension or hemodynamic instability.
- **If discontinuing DOPamine electively, do so gradually over 5-10 minutes.**

**Contact BHP if patient is bradycardic.**

- **Human factors rationale:** Sudden cessation may lead to abrupt cardiovascular collapse in preload-dependent patients.

## 2. *Bradycardia Management*

- **If the patient is bradycardic, contact the Base Hospital Physician (BHP)** for guidance prior to continuing or modifying vasoactive support.
  - Bradycardia may signal evolving conduction abnormalities or require alternate pharmacologic support (e.g., atropine or pacing).

### 3. Fluid Bolus Considerations

- If a **fluid bolus is contraindicated** (e.g., presence of **crackles indicating pulmonary edema**), **consider initiating dopamine** as an inotrope/vasopressor. ○  
    **Dopamine supports perfusion** in fluid overloaded patients by improving cardiac contractility and systemic vascular resistance without worsening pulmonary congestion.

### Patient Safety and Human Factors Notes

- Use **clear visual indicators** (e.g., monitor crackles, SpO<sub>2</sub> trends, MAP targets) to determine fluid tolerance. •  
    Ensure **shared mental models** among team members when transitioning between fluid and pressor therapy.

### Human Factors Best Practices

#### *Buretrol Setup (Microdrip Control Device)*

1. **Close both roller clamps** (top and bottom).
2. **Spike the IV bag.**
3. **Open the top roller clamp** (between bag and Buretrol).
4. **Fill the Buretrol chamber with 30 mL.**
5. **Close the top roller clamp** to stop further filling.
6. **Prime the tubing** and set the desired infusion amount in the chamber.

### *Rate Control Infusion Sets (Dial-a-Flow Devices)*

- **Pay close attention to units of measure** – usually in mL/hr, not gtt/min.
- **Fully open the dial before setting the correct rate**, as partial openings can cause inaccurate flows.
- **IV bag must be elevated ~80 cm (2.6 feet)** above the catheter to ensure proper gravitational flow.

# Cardiac Ischemia – Prehospital ECG and Nitroglycerin Guidance

- **Obtain a 12-lead ECG before administering nitroglycerin.**

This ensures ischemic patterns are identified before introducing preload-reducing medications.
- **If ST elevation is present in two or more of the inferior leads (II, III, aVF):**
  - **Perform a 15-lead ECG, including V4R, to assess for right ventricular infarction (RV STEMI).**
- **Do NOT administer nitroglycerin** if there is evidence of **right ventricular STEMI**, as this may cause critical hypotension.
- **Time Target:**
  - Aim to complete the **12-lead ECG within 10 minutes** of patient contact to guide time-sensitive decision-making.

## STEMI Recognition and Initial Actions

- **Apply defibrillation pads immediately** upon identifying a **STEMI** on the 12-lead ECG.
- **Follow local STEMI bypass protocol** to expedite transport to a PCI-capable facility if criteria are met.

## **Intravenous Access**

- Establish **IV access in the left arm** when possible in STEMI patients.  
Rationale: Preserves right arm for potential interventions (e.g., radial catheterization) at receiving hospitals.

## **Medication Considerations**

- **Nitroglycerin** is indicated **only for patients presenting with ischemic chest pain**.
- **Screen carefully** for contraindications, including recent use of **phosphodiesterase 5 inhibitors**, which may cause life-threatening hypotension when combined with nitrates.

**Phosphodiesterase 5 Inhibitors Chart on Next Page**



## Phosphodiesterase 5 Inhibitors

<b>Medication Name (Generic)</b>	<b>Trade Name(s)</b>	<b>Primary Formulations</b>	<b>Clinical Status / Notes</b>
<b>Sildenafil</b>	<b>Viagra, Revatio, Liqrev</b>	<b>Oral tablet, Oral suspension, IV solution</b>	<b>Approved. First-in-class; used for ED and PAH.</b>
<b>Tadalafil</b>	<b>Cialis, Adcirca, Tadliq, Alyq</b>	<b>Oral tablet, Oral suspension</b>	<b>Approved. Long half-life (~17.5 hours); used for ED, BPH, and PAH.</b>
<b>Vardenafil</b>	<b>Levitra, Staxyn, Vivanza</b>	<b>Oral tablet, Orally disintegrating tablet (ODT)</b>	<b>Approved. Highly potent; ODT form (Staxyn) avoids first-pass metabolism.</b>
<b>Avanafil</b>	<b>Stendra Spedra</b>	<b>Oral tablet</b>	<b>Approved. Fast onset of action (approx. 15–30 minutes).</b>

<b>Udenafil</b>	<b>Zydena</b>	<b>Oral tablet</b>	<b>Approved (Select Markets). Used in South Korea and Russia; long-acting.</b>
<b>Mirodenafil</b>	<b>Mvix</b>	<b>Oral tablet, Orally disintegrating film (ODF)</b>	<b>Approved (South Korea). Available in film form for faster absorption.</b>
<b>Lodenafil</b>	<b>Helleva</b>	<b>Oral tablet</b>	<b>Approved (Brazil). A prodrug formulated as a carbonate dimer.</b>
<b>Icariin</b>	<b>N/A (Natural)</b>	<b>Powder, Capsule (Extract)</b>	<b>Natural Product. Active component of <i>Epimedium</i> (Horny Goat Weed); lower potency than synthetic PDE5is.</b>

<b>Acetildenafil</b>	<b>N/A</b>	<b>Found in illicit supplements</b>	<b>Unapproved Analog. Often used as an adulterant in "all-natural" ED products.</b>
<b>Aildenafil</b>	<b>N/A</b>	<b>Found in illicit supplements</b>	<b>Unapproved Analog. Similar to sildenafil; typically identified as an adulterant.</b>

# Symptomatic Bradycardia

## Transcutaneous Pacing (TCP) and Bradycardia Management – Safety-Critical Guidelines

### 1. Do Not Delay TCP for IV Access

- Transcutaneous pacing should be initiated without delay** when indicated.
  - **Do not wait to establish IV access**, as this can lead to harmful treatment delays in unstable bradycardia.
- Attach** limb leads
- Attach** defibrillation pads
- Activate pacing function
- Increase CURRENT (mA) until electrical capture is evident (pacer spike followed by a QRS complex)
  
- Check for mechanical capture (assess for a pulse equivalent to the pacing rate) Assess BP
- Consider reducing the RATE to 60 bpm **if BP is adequate**
- Continuously reassess BP

Consider FentNYL and Midazolam (as per the Procedural Sedation Medical Directive) administration for this patient to relieve discomfort post TCP.

Clinical considerations: Ensure the patient's chest is shaved (if applicable) and pad placement is correct to optimize a successful transcutaneous pacing.

## *2. Consider a Fluid Bolus in Symptomatic Bradycardia*

- Evaluate the need for a **fluid bolus in all symptomatic bradycardia** cases.
  - May improve preload and perfusion, particularly in hypovolemic or distributive contributors to bradycardia.

## *3. Preferred Site for Pulse Assessment*

- Use the **right radial pulse** to assess for **mechanical capture** during pacing.
  - **Rationale:** Left wrist palpation may produce **false positives due to muscle stimulation** from pacing pads.

## *4. Seamless Handover of Pacing to Hospital*

- To **maintain continuous pacing during transfer**, coordinate with hospital staff as follows:
  - Have **hospital pads applied** while paramedic pacing is still active.
  - Hospital staff should **set their pacing rate higher** than the current paramedic rate.
  - The hospital's **demand pacer will take over automatically** once the patient's heart rate falls below their set rate.
  - **Outcome:** Prevents loss of capture or rhythm

instability during the transition.

- **1. Discontinuing Dopamine**

- **If dopamine is to be discontinued electively, taper gradually over 5–10 minutes** to avoid rebound hypotension or hemodynamic instability.

- **Human factors rationale:** Sudden cessation may lead to abrupt cardiovascular collapse in preload dependent patients.

## **2. Bradycardia Management**

- **If the patient is bradycardic, contact the Base Hospital Physician (BHP)** for guidance prior to continuing or modifying vasoactive support.

- Bradycardia may signal evolving conduction abnormalities or require alternate pharmacologic support (e.g., atropine or pacing).

## **3. Fluid Bolus Considerations**

- **If a fluid bolus is contraindicated** (e.g., presence of crackles indicating pulmonary edema), **consider initiating dopamine** as an inotrope/vasopressor. ◦

- **Dopamine supports perfusion** in fluid overloaded patients by improving cardiac contractility and systemic vascular resistance without worsening pulmonary congestion.

## **Patient Safety and Human Factors Notes**

- Use **clear visual indicators** (e.g., monitor crackles, SpO<sub>2</sub> trends, MAP targets) to determine fluid tolerance. •
- Ensure **shared mental models** among team members when transitioning between fluid and pressor therapy.

### ***Buretrol Setup (Microdrip Control Device)***

- **Close both roller clamps** (top and bottom).
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- **Fill the Buretrol chamber with 30 mL.**
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- **Prime the tubing** and set the desired infusion amount in the chamber.

### ***Rate Control Infusion Sets (Dial-a-Flow Devices)***

- **Pay close attention to units of measure** – usually in mL/hr, not gtt/min.
- **Fully open the dial before setting the correct rate**, as partial openings can cause inaccurate flows.
- **IV bag must be elevated ~80 cm (2.6 feet)** above the catheter to ensure proper gravitational flow.

# Cardiac Arrest and ROSC

# Medical Cardiac Arrest

## 1. ETCO<sub>2</sub> Monitoring

- A **sudden spike in ETCO<sub>2</sub>** to above-normal levels may indicate **Return of Spontaneous Circulation (ROSC)**.
  - Perform a **pulse check at the next interpretation window** following this ETCO<sub>2</sub> rise.

## 2. Defibrillation Strategies: DSED & Vector Change

- **After 3 consecutive shocks**, consider:
  - **Dual Sequential External Defibrillation (DSED)**,  
or
  - **Vector Change Defibrillation (VCD)** if DSED is not possible.
- You may include **confirmed shocks** delivered by:
  - **Fire services**, or
  - **Public Access Defibrillators (PADs)** if the rhythm remains shockable.

*Defibrillation pad placement must change for DSED/VCD:*

- Use a **fresh set of pads**.
- **Move anterior pad to the back** (posterior), and **shift lateral pad over the left chest** for optimal current vector.

### 3. Advanced Airway Considerations

- Consider **SGA** or **ETT** if basic airway techniques (**OPA/NPA with BVM**) are insufficient to maintain ventilation.

### 4. Medication Administration Routes

- **Preferred Routes:** IV, IO, or CVAD.
- **ETT administration** is acceptable **only if vascular access is delayed  $\geq 5$  minutes.**

### 5. Naloxone

- **Routine naloxone is not indicated in confirmed cardiac arrest**, as evidence of benefit is lacking.

### 6. Termination of Resuscitation (TOR)

- Even if the patient meets TOR criteria, **Base Hospital Physicians may decline authorization** based on:
  - **Location factors** (e.g., in public space),
  - **Clinical indicators:** ETCO<sub>2</sub>, patient age, bystander CPR, witnessed arrest, transportation time,
  - **Mechanism:** suspected **electrocution, hanging, or toxicologic arrest.**

## 7. DSED/VCD Device Selection

- **Preferred second defibrillator:**
  - **Paramedic service defibrillator**
  - **Fire service defibrillator**, if available and agreeable
- If a second defibrillator is **not available**, proceed with **Vector Change Defibrillation**.

## 8. CPR Ratios – Per AHA Guidelines

- **<30 days old:** 3:1 compression-to-ventilation ratio.
- **≥30 days old:**
  - **Two rescuers:** 15:2
  - **Single rescuer:** 30:2

# Neonatal Resuscitation Guidelines

## 1. CPR Ratio

**AHA Guideline:** For neonates <30 days of age, use a **3:1 compressions-to-ventilations ratio** during resuscitation.

## 2. Initial Assessment and Monitoring

- Initiate cardiac monitoring.
- Place **pulse oximetry on the newborn's right hand** (pre-ductal).
- Begin **warmth, drying, and stimulation** immediately after birth.

## 3. Cord Clamping Recommendations

- If the newborn is vigorous: **Delay cord clamping for 30–60 seconds** while warming, drying, and stimulating.
- If resuscitation is required: Clamp and cut the cord after 30–60 seconds, then proceed with interventions.

## 4. Gestational Age–Based Resuscitation Approach

For neonates born between **20 and 25 weeks' gestation**, survival is uncertain and they may deteriorate rapidly. In these cases, paramedics should initiate resuscitation efforts, maintain warmth, and transport the infant without delay.

If the **gestational age is unknown**, it should be treated as a potentially viable delivery. Begin resuscitation and prioritize rapid transport to the nearest appropriate facility.

For deliveries occurring at **less than 20 weeks' gestation**, the likelihood of survival is extremely low and resuscitation is generally considered non-beneficial. In these situations, focus on providing comfort care and consult with the Base Hospital Physician (BHP) for further direction.

## **5. Needle Thoracostomy in Neonates**

- **Preferred site:** 4th intercostal space, anterior axillary line (AAL)
- **Alternate site:** 2nd intercostal space, mid-clavicular line (MCL)
- **Needle:** 18G or 20G catheter attached to a 10 mL syringe for air aspiration
- In an intubated patient with decreased right-sided air entry, rule out right mainstem intubation before decompression.

## MR SOPA Mnemonic for Difficult Ventilations (NRP)

Letter	Action Step	Intervention
<b>M</b>	<b>Mask Adjustment</b>	Adjust or reposition the face mask to improve seal
<b>R</b>	<b>Reposition Airway</b>	Place infant's head in neutral or "sniffing" position
<b>S</b>	<b>Suction</b>	Suction mouth, then nose if obstructed by secretions
<b>O</b>	<b>Open Mouth</b>	Gently open mouth and lift the jaw forward
<b>P</b>	<b>Pressure Increase</b>	Gradually increase PEEP (if available) until chest rise observed
<b>A</b>	<b>Alternative Airway</b>	Consider placement of endotracheal tube or supraglottic airway if above steps unsuccessful

### 7. Common NRP Questions and Answers

- **Do we stay on scene for 20 minutes?**
  - No. ACPs transport before the third epinephrine. PCPs may depart scene after 90 seconds of working through the algorithm

## 8. Suspected or Confirmed Hypovolemia in Neonates

- **Clinical Signs:** Pale/cyanotic skin, weak pulses, bradycardia, poor cap refill (>3 sec)
- **Risk Factors:** Placental abruption, previa, cord rupture, massive hemorrhage (e.g., vasa previa)

# ROSC (Return of Spontaneous Circulation) – Clinical Management

## 1. Blood Pressure Support

- **Titrate dopamine** to maintain a **systolic blood pressure (SBP) between 90–110 mmHg**.
- If discontinuing dopamine **electively**, do so **gradually over 5–10 minutes** to prevent rebound hypotension.

## 2. Oxygenation

- **Target oxygen saturation: 94–98%**.
- Avoid hyperoxia—do not exceed  $SpO_2 >98\%$  unless otherwise indicated.

## 3. Ventilation & Capnography

- **Avoid hyperventilation.**
- Use **continuous waveform capnography** to monitor ventilation.
- **Target  $ETCO_2$ : 30–40 mmHg.**
  - This range supports cerebral perfusion and guides post-arrest care quality.

## 4. Post-ROSC ECG

- **Obtain a 12-lead ECG after:**
  - ABC management,
  - Full vital signs,
  - Cardiac monitor placement.
- Early ECG may identify ischemic changes and guide transport or intervention decisions.

# Traumatic Cardiac Arrest – Modified Priorities

## 1. Distinguish from Medical Arrest

- If no obvious signs of significant blunt trauma, treat as medical arrest.

## 2. Signs of Life

- Includes:
  - Spontaneous movement
  - Respiratory effort
  - Organized ECG activity
  - Reactive pupils

## 3. Fluid Resuscitation

- May be considered if:
  - It does **not delay transport**, and
  - Other reversible causes are concurrently being addressed.
  - 20ml/kg to a maximum of 2000ml

## 4. Transport Considerations

- If **penetrating traumatic cardiac arrest** and **<30 minutes from a Lead Trauma Hospital (LTH)**, initiate **transport** without delay.

## Needle Thoracostomy Site Selection

- The **4th intercostal space at the anterior axillary line (AAL)** is the **preferred site** for **all age groups** due to:
  - Enhanced anatomical consistency
  - Lower risk of vascular and pleural complications
  - Greater provider access in confined environments (e.g., ambulance or aircraft)
  - Improved standardization across the lifespan, reducing cognitive load
- **Alternate site (for ACPs treating adults ≥13 years only):**
  - The **2nd intercostal space at the mid-clavicular line (MCL)** remains acceptable for **adults**. However, providers must be aware of its increased variability in anatomy and higher risk of misplacement.

## Neonatal Considerations: High-Risk Group, Precision Required

- Preferred anatomical site: **4th intercostal space, anterior axillary line**
- Alternate (if necessary): **2nd intercostal space, mid clavicular line**
- Always confirm placement using **air aspiration with a syringe** due to subtle clinical cues and small anatomical targets

# Child Birth

# Emergency Childbirth

## Shoulder Dystocia

- Perform ALARM twice on scene (Approx 7-8 minutes). If successful, deliver the neonate. If unsuccessful, transport to closest appropriate facility

## Breech Delivery

- Hands off the breech. Allow neonate to deliver to the umbilicus
- Consider carefully releasing the legs & arms as they are delivered, if needed
- Once hairline is visible **AND/OR** 3 minutes has passed since umbilicus was visualized, attempt Mauriceau Smellie-Veit maneuver
- If successful, deliver the neonate. If unsuccessful, transport to closest appropriate facility

## Prolapsed Cord

- Elevate fetal part to relieve pressure on the cord
- Assist patient to the knee-chest or exaggerated Sims position
- Insert gloved fingers/hand into the vagina and apply gentle manual digital pressure to the presenting part; this is maintained until transfer of care

## **Postpartum Hemorrhage - Pre-Placental Delivery**

If the placenta **has not** yet been delivered, consider:

Gentle cord traction while guarding the uterus Bimanual  
compression if bleeding continues

## **Postpartum Hemorrhage - Post-Placental Delivery**

If the placenta **has been delivered**, consider:

- External uterine massage while guarding the uterus
- Encouraging patient to void bladder
- Bimanual compression if bleeding continues

Oxytocin and manual maneuvers have been shown to be effective in the majority of postpartum hemorrhage cases. If these are not effective, consider patching to OMC for consideration of TXA administration

## Combative Patient

# Combative Patient Management – Safety-Critical Considerations

## *1. Rule Out and Treat Reversible Causes First*

Before considering pharmacologic sedation, assess and treat reversible medical causes of agitation, including:

- **Hypoglycemia**
- **Hypoxia**
- **Hypovolemia**

*Failure to identify these can lead to inappropriate sedation, masking deterioration.*

## *2. Midazolam – Judicious Dosing*

- Paramedics may **administer a lower weight-based dose** (e.g., **0.05 mg/kg**) at their discretion.
- Factors influencing dose reduction include:
  - **Patient age** (e.g., frailty, pediatrics),
  - **Severity of agitation,**
  - **Suspicion of hypotension or hypoxia.**

*Clinical judgment must prioritize both efficacy and risk mitigation (e.g., respiratory depression).*

### **3. Do Not Co-Administer Midazolam and Ketamine**

- **Concurrent use of Midazolam and Ketamine is not permitted unless explicit authorization is received via Base Hospital Physician (BHP) direction.**

*This minimizes risk of additive sedation, respiratory compromise, or unpredictable pharmacodynamics.*

### **4. Post-Sedation Monitoring**

- **Apply ETCO<sub>2</sub> monitoring** once the patient is sedated to monitor ventilation status and detect early signs of hypoventilation or apnea.

*Supports continuous physiological assessment and proactive airway management.*

### **5. Ketamine – Special Considerations**

- **Emergence Reaction:**
  - If agitation or hallucinations occur during recovery from ketamine sedation, contact the **BHP for further sedation authorization.**
- **IM Administration Limits:**
  - **Maximum single IM injection = 5 mL** (vastus lateralis site).
  - For doses exceeding **250 mg**, **split into two syringes** to avoid tissue injury and ensure absorption.

IV, CVAD, IO

# CVAD (Central Venous Access Device) – Safe Access Protocol

## Preparation

- Equipment:
  - 2 × 10 mL syringes (1 empty, 1 with 10 mL NS)
  - Alcohol swabs
  - Sterile gloves
  - Prepared IV infusion set

## Access Procedure

1. **Close all clamps.**
2. **Disinfect** the med-port and luer lock thoroughly with an alcohol swab.
3. **Remove** the med-port from the luer lock.
4. **Attach the empty syringe.**
5. **Open the clamp** (if present).
6. **Withdraw** any catheter fluid and ~2 mL of blood.
7. **Close the clamp**, then **remove the syringe.**
8. **Attach the saline-filled syringe.**
9. **Open the clamp** and flush with **push/pause technique.**
  - a. If resistance is met, **discontinue immediately.**
10. **Close clamp and remove syringe.**
11. **Attach the IV line, open clamp, and begin infusion.**
12. Administer IV medications through the **IV line's medication ports.**

# Intraosseous (IO) Access – Device Selection & Sizing

## 1. Jamshidi / Cook IO Needles

- **Infants <1 year:**  
Use an **18-gauge IO needle**
- **Patients >1 year:**  
Use a **15- or 16-gauge IO needle**
- **Humerus IO (proximal humerus):**  
May be used in patients **≥8 years old** for faster flow rates and reduced discomfort in conscious patients.

## 2. EZ-IO Device – Needle Selection by Weight & Site

Colour	Length	Indication
<b>Pink</b>	15 mm	Patients <b>3–39 kg</b>
<b>Blue</b>	25 mm	Patients <b>≥40 kg</b>
<b>Yellow</b>	45 mm	Patients <b>≥40 kg</b> OR with <b>excessive tissue</b> over insertion site

*Choose longer needles (e.g., yellow 45 mm) for patients with increased soft tissue thickness to ensure access to the medullary space.*

### 3. SAM IO – Sizing

- **Follows the same color-coding and sizing guidelines as the EZ-IO:**
  - **Pink (15 mm)** for small pediatric patients (3–39 kg)
  - **Blue (25 mm)** and **Yellow (45 mm)** for larger patients or where more tissue depth exists

### Intraosseous (IO) Access

#### Guidelines Humeral IO Access:

- **May be used in patients aged 8 years and older.**

#### Jamshidi / Cook Needle Selection:

- **< 1 year of age: Use an 18-gauge needle**
- **> 1 year of age: Use a 15- or 16-gauge needle**

# Intravenous Fluid Therapy

- **Titrate to Normotension:**  
Administer fluid boluses **until the patient reaches normotension**, guided by clinical response and hemodynamic status.
- **PATCH to BHP for authorization to administer 0.9% NaCl fluid bolus to hypotensive patients <12 years with suspected Diabetic Ketoacidosis (DKA).**
- Micro-drips and/or volume control administration sets should be considered for patients under 12 years old.

# Hyperkalemia – Recognition and Management

## *Indications for Treatment:*

Initiate treatment in patients with suspected or confirmed hyperkalemia who present with any of the following:

- **Hypotension**
- **Altered level of awareness (LOA)**
- **Symptomatic bradycardia**

## *12-Lead ECG Findings Suggestive of Hyperkalemia:*

- **Peaked T-waves**
- **Widened QRS complexes** ( $\geq 120$  ms), often described as “bizarre” morphology
- **Loss of P-waves**
- **Sine wave pattern** (fusion of QRS and T-waves)

*A 12-lead ECG should be obtained in non-arrest patients to assess QRS duration **before and after treatment.***

## *Treatment Principles:*

- **Administer both Calcium Gluconate and Salbutamol whenever possible** to stabilize the myocardium and promote potassium shift into cells.

## Hypoglycemia, Seizures, and Opioids

# Hypoglycemia – Treatment and Documentation Protocols

- **Treatment Escalation:**

- If the patient exhibits **mild symptoms only**, oral glucose or simple carbohydrates may be administered **without the need for Dextrose or Glucagon**.
- If the patient **responds** to Dextrose or Glucagon, provide oral glucose or simple carbohydrates to sustain euglycemia.

- **Informed Refusal of Transport:**

- If a patient **refuses transport** after treatment, a **final full set of vital signs**, including **blood glucose**, must be attempted and documented.

- **Intranasal Glucagon:**

- Supplied as a **commercial single-dose, dry powder device**.

Use according to manufacturer's instructions and document route and response

# Seizure Management – Clinical Guidelines

- **Consider Mimics:**

Conditions such as **cardiac arrest** and **hypoglycemia** may present as seizures and should be ruled out early in the assessment.

- **Midazolam Administration:**

- Do **not delay Midazolam** administration while awaiting blood glucose results **if hypoglycemia is not strongly suspected**.
- **Timely seizure control** takes priority when clinical presentation supports an epileptic seizure.

# Procedural Sedation

- Consider **FentaNYL and Midazolam** under the **Procedural Sedation Medical Directive** to maintain comfort and prevent tube dislodgement.
- All **intubated patients with a pulse** should be assessed for the need for **FentaNYL and Midazolam** under the **Procedural Sedation Medical Directive** to ensure comfort, reduce distress, and prevent tube dislodgement.
  - **Sedation and analgesia should not be withheld solely due to the absence of a gag reflex or overt signs of distress.**
  - The decision to administer should be based on clinical context and anticipation of discomfort, not reactive cues alone.
    - *Proactive sedation improves patient safety, reduces adverse movement, and supports airway integrity.*

# Nausea and Vomiting – Antiemetic Guidelines

## 1. First-Line Antiemetic Therapy

- **Ondansetron is the preferred agent for patients  $\geq 65$  years old**
- **If ondansetron is unavailable, assess risk-benefit before administering dimenhyDRINATE, especially in patients  $\geq 65$  years old:**
  - Consider an **initial reduced dose of 25 mg** in older adults to reduce the risk of sedation or anticholinergic effects.

## 2. Refractory Symptoms

- If nausea and vomiting **persist 30 minutes after initial antiemetic**, consider **administering the alternative antiemetic** (e.g., switch from ondansetron to dimenhyDRINATE or vice versa), based on clinical judgment and contraindications.

## 3. IV Administration of DimenhyDRINATE

- **Dilution protocol:**  
Dilute **50 mg of dimenhyDRINATE** with **9 mL of normal saline** to create a **10 mL total solution**.

- **Administer slowly IV** over several minutes to minimize side effects such as hypotension or dizziness.

#### 4. Contraindications – Medication Classes That Interact with DimenhyDRINATE

**Do NOT administer dimenhyDRINATE** to patients who have overdosed on or are actively taking medications from the following classes, due to risk of additive anticholinergic or CNS depressive effects:

##### **A. Antihistamines**

- Examples:  
DiphenhydrAMINE (Benadryl), Cetirizine (Reactine), Loratadine (Claritin), Chlorpheniramine, Hydroxyzine, Promethazine, Fexofenadine, Desloratadine

##### **B. Tricyclic Antidepressants (TCAs)**

- Examples:  
Amitriptyline, Nortriptyline, Clomipramine, Doxepin, Trimipramine, Desipramine

##### **C. Anticholinergics**

- Examples:  
Atropine, Ipratropium (Atrovent), Tiotropium (Spiriva), Oxybutynin (Ditropan), Hyoscine, Glycopyrrolate

*This list is not exhaustive; always assess for potential interactions before administering dimenhyDRINATE.*

Trauma

# Lateral Patella Dislocation Reduction

## Treatment: Patellar Reduction

### Patient Positioning

- Place the patient in a **seated** or **supine (lying)** position for comfort and stability.

### Reduction Technique

- **Gently extend the knee** while performing both of the following:
  - **Lift the patella superiorly** (upward).
  - Apply **medial pressure** to the **lateral edge** of the patella to guide it back into alignment.

### Attempt Limit

- **Maximum of 2 attempts per patient.**
  - If unsuccessful after two attempts, immobilize and transport.

### Clinical Considerations

- Analgesia before and/or after is all contextual to each patient
- Always assess **distal neurovascular status** before and after the reduction attempt.
- Document the time of reduction, patient response, and any complications.

# Traumatic Hemorrhage – TXA

## Administration and Prioritization

- **TXA should not delay transport** or take precedence over the management of other **reversible life threats** (e.g., airway, tension pneumothorax, uncontrolled hemorrhage).
- **IV TXA administration is limited to PCP AIV providers.**
- **Administration Technique:**
  - Administer **slow IV over 5 minutes** to minimize the risk of **transient hypotension** associated with rapid bolus delivery.
- **TXA is not currently indicated** for use in **traumatic cardiac arrest** as there is not currently any evidence of benefit

### Intramuscular (IM) TXA – When IV Access is Delayed

- IM TXA is a viable alternative when vascular access is not immediately obtainable.
- **Preparation:**

TXA comes as **1000 mg in 10 mL**; divide into **multiple injection sites** to avoid tissue damage.
- **Recommended IM Injection Sites and Maximum Volumes:**
  - **Vastus Lateralis:** up to 5 mL
  - **Gluteal (each side):** up to 5 mL
  - **Deltoid (each side):** up to 2.5 mL

*Site selection and dose distribution should be based on muscle mass and accessibility.*

# **Cricothyrotomy Medical Directive**

[Cricothyrotomy Procedure Video](#)

# Cyanide Exposure Medical Directive

CYANIDE	COMMON TO BOTH	CARBON MONOXIDE
<ul style="list-style-type: none"> <li>• Chest tightness</li> <li>• Altered mental status (e.g., confusion, disorientation)</li> <li>• Mydriasis</li> <li>• Tachypnea/Hyperpnea (early)</li> <li>• Bradypnea/Apnea (late)</li> <li>• Hypertension (early)/Hypotension (late)</li> <li>• Cardiovascular collapse</li> <li>• Plasma lactate concentration <math>\geq 8</math> mmol/L</li> </ul>	<ul style="list-style-type: none"> <li>• Headache</li> <li>• Nausea</li> <li>• Vomiting</li> <li>• Confusion</li> <li>• Dyspnea</li> <li>• Coma</li> <li>• Seizure</li> </ul>	<ul style="list-style-type: none"> <li>• Dizziness</li> <li>• Vertigo</li> <li>• Irritability</li> <li>• Flu-like symptoms</li> <li>• Fatigue</li> <li>• Delirium</li> <li>• Ataxia</li> <li>• Loss of consciousness</li> <li>• Chest pain</li> <li>• Myocardial infarction</li> <li>• Stroke</li> </ul>

## Clinical Considerations

Hydroxocobalamin must be reconstituted with 200 ml normal saline prior to use.

## Hydroxocobalamin Dosing Chart

Weight (kg)	Dose	Concentration	Volume of Administration
5	350 mg	25 mg/ml	14 ml
10	700 mg	25 mg/ml	28 ml
15	1050 mg	25 mg/ml	42 ml
20	1400 mg	25 mg/ml	56 ml
25	1750 mg	25 mg/ml	70 ml
30	2100 mg	25 mg/ml	84 ml
35	2450 mg	25 mg/ml	98 ml
40	2800 mg	25 mg/ml	112 ml
$\geq 41$	5g	25 mg/ml	200 ml