Georgia Poison Center

POISON HELP: 1.800.222.1222 |ADMINISTRATION: 404.616.9237 ● FAX: 404.616.6657 ● EDUCATION: 404.616.9235
www.georgiapoisoncenter.org

ECMOTOX Consortium: Guidelines

1. **List of medications included in the ECMOTOX Consortium:**
    a. Beta blockers
    b. Calcium channel blockers
    c. Flecainide
    d. Bupropion
    e. Tricyclic Antidepressants
    f. Diphenhydramine
    g. Colchicine

    Any other potential cardiotoxic exposure.

2. **Objectives:**
    a. Provide early consultation and collaboration to identify acutely poisoned patients who may benefit from ECMO therapy after a potentially life-threatening cardioactive drug ingestion.
    b. Assist healthcare providers, particularly in lower resource areas, to gain expedited access to an ECMO team and referral to an ECMO center.

3. **Triage information:**

Medication	Actual GPC triage dose	Lowest reported toxic dose[1,2,3]	Reported lethal dose[1,2,3]*
BB: Acebutolol	>24mg/kg or >1200mg	Adult: 600mg Children: >12mg/kg	Unknown
BB: Atenolol	>5mg/kg or >250mg	Adult: >200mg (5.3mg/kg) Children: 2mg/kg	Unknown
BB: Carvedilol	>1mg/kg or >80mg	Adult: >50mg Children: 0.5 mg/kg	Unknown
BB: Labetalol	>20mg/kg or >800mg	Adult: >400mg Children: >20mg/kg	Unknown

BB: Metoprolol	SR>12.5mg/kg or >500mg Other >4mg/kg or >500mg	Adult: >450mg IR, >400mg SR; Children: >2.5 mg/kg, >5 mg/kg SR	Unknown
BB: Nadolol	>5mg/kg or 640mg	Adult: >320 mg Children:>2.5 mg/kg	Unknown
BB: Propranolol	SR >10mg/kg or >480mg Other >5mg/kg or >480mg	Adult: >240 mg Child: >4 mg/kg IR, >5 mg/kg SR	>1g
BB: Sotalol	>8mg/kg or >320mg	Adult: 160mg Child: >4mg/kg	3.2g
CCB: Amlodipine	>0.3mg/kg	Adult: >10 mg Children: >0.2 mg/kg	Child: 0.9 to 4.1 mg/kg Adult: 70mg
CCB: Diltiazem	SR >6.5mg/kg or Other >5mg/kg	Adult: 360mg IR, 700mg SR Children: 5mg/kg	Adult: 360mg IR 240–360 mg SR
CCB: Nicardipine	SR >5mg/kg or No SR >3mg/kg	Adult: 600mg Children: 1.25 mg/kg	
CCB: Verapamil	SR >15mg/kg or No SR >16mg/kg	Adult: 160mg IR, 720mg SR Children: 5 mg/kg	Single PO adult dose fatalities in children
Flecainide	n/a	>400mg	500mg
Bupropion	>10mg/kg		>9g
Cyclic antidepressants A = amitriptyline I = imipramine D = desipramine Do = doxepin N= nortriptyline	>1.5mg/kg (all)	A/I/Do: >5mg/kg D/N: >2.5mg/kg	10-20mg/kg (all) 15mg/kg (A/I/D) 250mg (A/I)
Diphenhydramine	>8mg/kg	Adult: >1g Children: 10-15mg/kg	Adult:>20mg/kg Children: 11.6 mg/kg
Colchicine	n/a	0.5-0.8mg/kg	0.8mg/kg

Table 1: Current GPC referral guidelines; Lowest reported toxic dose and longest reported delay to onset of toxicity from single ingestions reported in the literature.

*Most reported data is based on low quality evidence and should be used as guidance.

GPC= Georgia Poison Center, mg= milligram, kg= kilogram, hrs= hours, IR= immediate release, SR= sustained release, BB= beta blocker, CCB= calcium channel blocker

4. **Obtain the following information:**
    a. Medication ingested: dosage, formulation, amount, time of ingestion, co-ingestions
    b. Initial and last set of vital signs, including temperature
    c. Laboratory studies: point of care glucose level, CBC, CMP, serum lactic acid, troponin

d. **Bedside or Point-of-Care US (POCUS) echocardiogram to assess ejection fraction**
e. Medical interventions and ongoing therapies *(e.g.,* IVF, calcium, atropine, inotropes, vasopressors, high-dose insulin, mechanical interventions, positive pressure ventilation).

5. Does the patient have any of the following potential indications for ECMO?

a. Refractory cardiogenic shock despite maximum medical management?
b. Deemed by toxicologist to have concerning ingestion based on history:
    i. Concerning ingestion within toxic or lethal dose range (Refer to Table 1)
    ii. Co-ingestion of additional cardioactive medications (*e.g., CCB, BB, antidepressants)*
    iii. Evidence of end organ dysfunction (*e.g.,* acute renal failure, pulmonary edema, encephalopathy)
c. Concerning history based on discussion with toxicology + cardiogenic shock requiring more than one inotrope/vasopressor

d. <u>Exclusion criteria:</u>
    i. Standard ECMO exclusion (see Emory ECLS guideline below)
    ii. Inability to safely anticoagulated, age > 70 years old, life-limiting co-morbidities, multiple organ failures, aortic insufficiency
    iii. Double home dose
    iv. Single ingestion of immediate release product in an asymptomatic patient
    v. If you identify an exclusion criterion in an ECMO candidate, please call ECMO Coordinator on- call for further discussion
    vi. *For patients <18 years old, please contact the CHOA transfer center at 404-785-7778

6. Overall process:

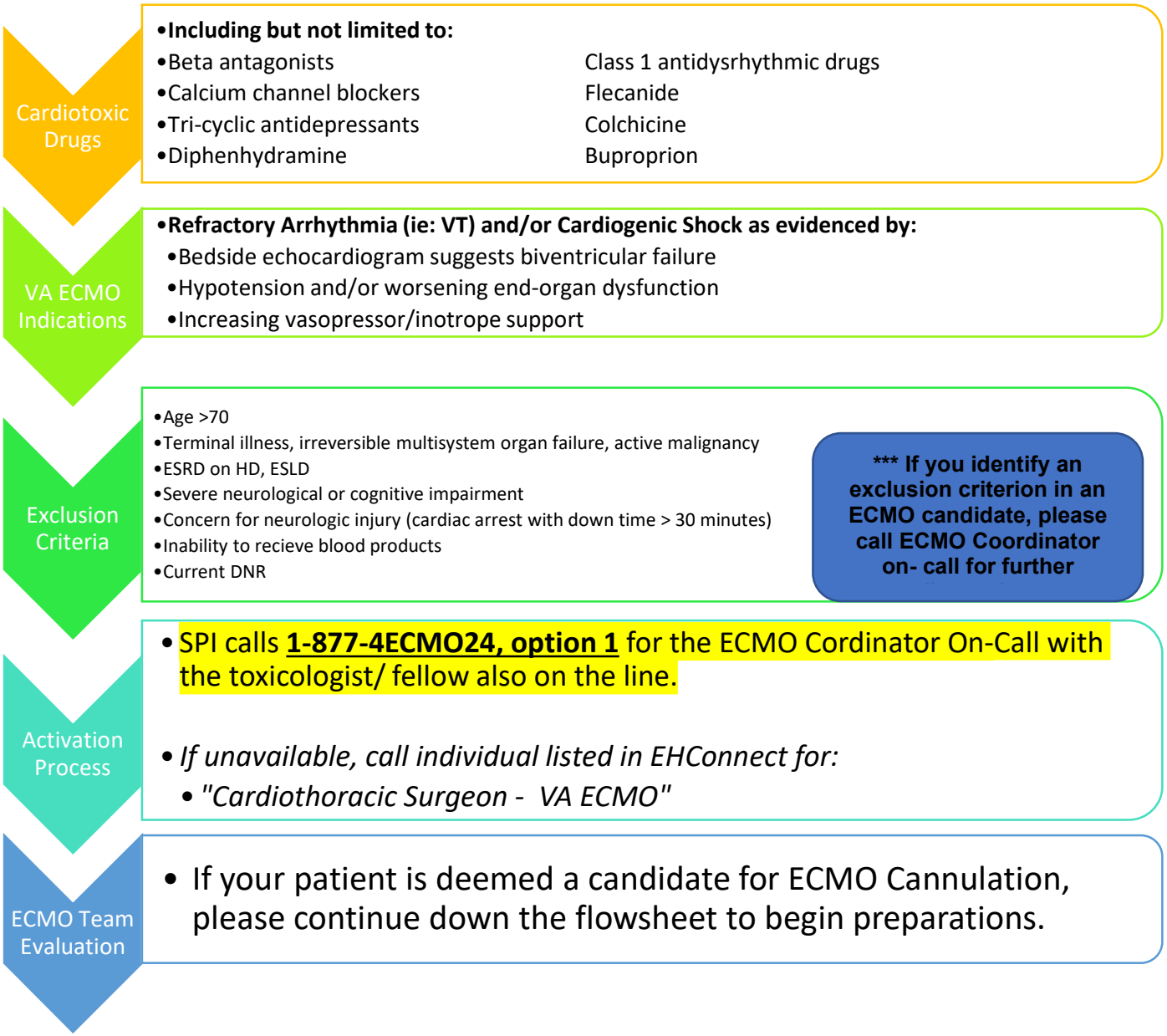
a. Provider calls GPC.
b. GPC identifies potential patient for ECMOTOX pathway and calls toxicology fellow and/or attending on call.
c. GPC starts ToxSentry chart while toxicology fellow/attending discuss case with provider.
    i. Determine if patient meets inclusion criteria for ECMOTOX pathway.
    ii. Determine if patient meets exclusion criteria for ECMOTOX pathway.
d. If the patient meets inclusion criteria, SPI connects toxicology/ fellow with on-call ECMO provider (Figure 1).
e. ECMO provider will determine if patient appropriate for ECMO
    i. Yes:
        1. GPC conference in Emory transfer center (Figure 1) (toxicologist, ECMO-provider, GPC, Emory transfer center, rural ED provider)
        2. ECMO team calls Emory transfer center
    ii. No:

1. Provide standard treatment recommendations
2. Provide plan for next steps if patient decompensates

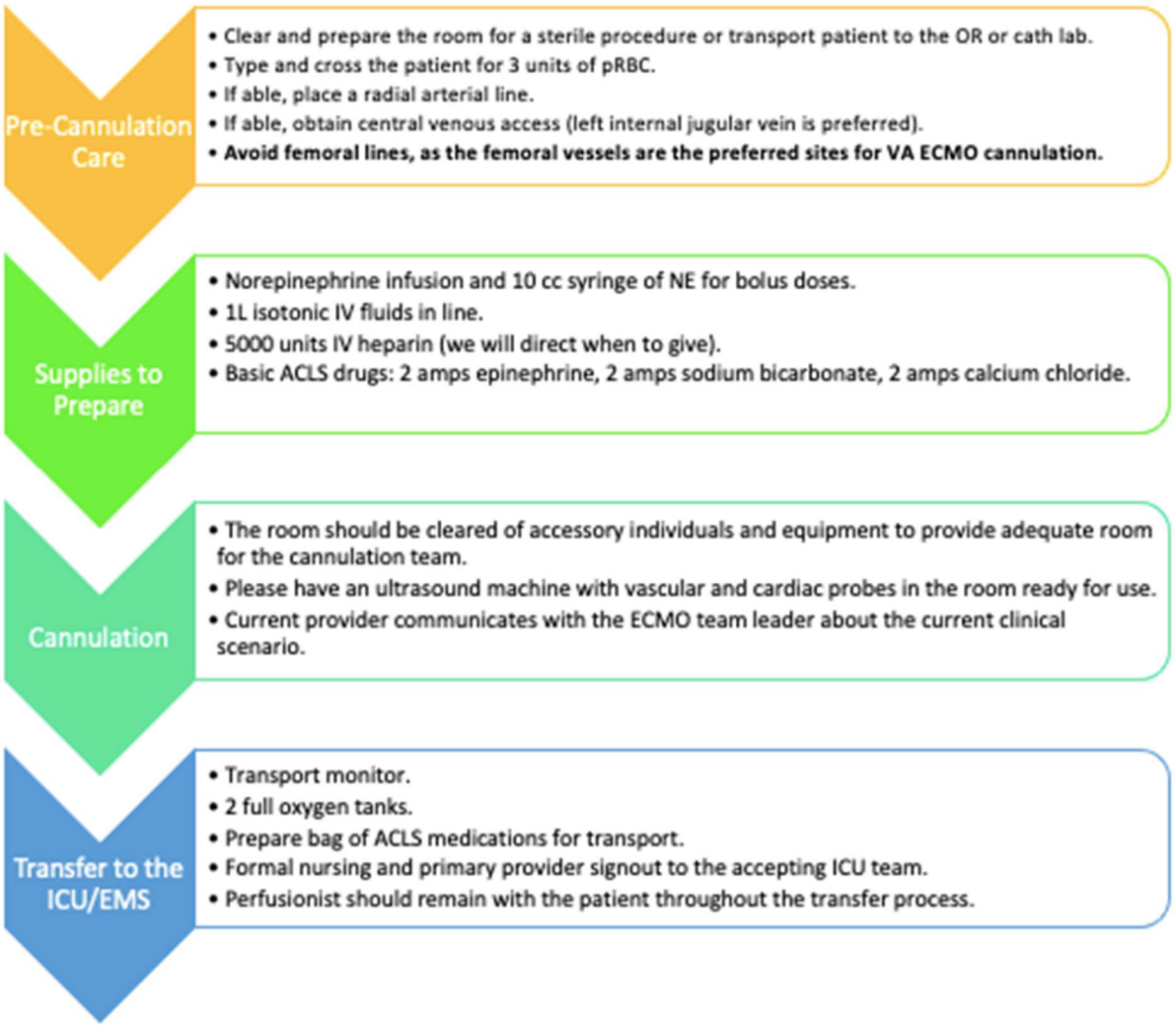
f. Alternative plan (call originates with Emory Transfer Center):
    i. Provider calls Emory ECMO team/Emory Transfer Center for potential ECMO
    ii. Emory ECMO team/Emory Transfer Center recognizes potential cardiotoxin-induced ill patient and calls GPC
    iii. GPC starts at step 6.c.

g. Toxicology team will continue to follow at bedside on arrival to Emory Hospital (non-critical care floor or ICU)*
    i. This guideline will be updated accordingly to include all ECMO centers with open beds/closest ECMO center as this information and collaboration becomes available.

Figure 1: ECMO criteria and referral process



EM: VA ECMO Criteria and Cannulation After Cardiotoxic Drug Overdose



*These instructions will only be used for EDs with the capability to cannulate for ECMO in the ED or has ECMO available in house

References:

[1]Micromedex (electronic version). IBM Watson Health; 2023. Accessed [06/20/2023]. https://www.micromedexsolutions.com .

[2] Wax PM, Erdman AR, Chyka PA, Keyes DC, Caravati EM, Booze L, Christianson G, Woolf A, Olson KR, Manoguerra AS, Scharman EJ, Troutman WG. beta-blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. Clin Toxicol (Phila). 2005;43(3):131-46. PMID: 15906457.

[3]Olson KR, Erdman AR, Woolf AD, Scharman EJ, Christianson G, Caravati EM, Wax PM, Booze LL, Manoguerra AS, Keyes DC, Chyka PA, Troutman WG; American Association of Poison Control Centers. Calcium channel blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. Clin Toxicol (Phila). 2005;43(7):797-822. doi: 10.1080/15563650500357404. PMID: 16440509.

Date: July 21, 2023

Liz Rivera Blanco
Medical Toxicology Fellow

Emily Kiernan, DO
Medical Toxicologist