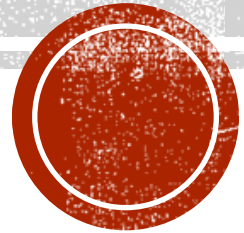
SUDDEN AMBULANCE DEATH SYNDROME

Andrew Bouland, MD

Steve Taylor, PhD



OBJECTIVES

- Define Sudden Ambulance Death Syndrome (SADS)
- Understand the proposed pathophysiology behind SADS
- Review previous literature regarding SADS
- Review current research regarding SADS
- Discuss implementation of EMS protocols to prevent SADS

WHAT IS SADS?

WHAT IS SADS?

IDENTIFY PRIORITY PATIENTS *Is the patient:*

- ✓ **C**ritical
- ✓ **U**nstable
- ✓ **P**otentially Unstable
- ✓ **S**table

- Consider the need for Advanced Life Support
- If the patient is **C**RITICAL, **U**NSTABLE or **P**OTENTIALLY UNSTABLE , begin packaging the patient during the **rapid assessment** while treating life threats and transport as soon as possible.

WHAT IS SADS?

AI Overview

Learn more

Emergency medical services (EMS) protocols for critical patients often involve rapid transport and critical care resources. **The goal is to get patients to definitive care as quickly as possible, while minimizing delays**. The mode of transportation and crew used may depend on the patient's condition and the circumstances:

WHERE DID IT ORIGINATE?

H Abraham
@DrHeidiAbraham

SADS - Sudden Ambulance Death Syndrome - critically ill patients who deteriorate quickly in the back of or on the way to the ambulance. Stabilize. Your. Patient. On. Scene. Before. You. Move. Them. #TxNAEMSP19 @veervithalaniMD

12:25 PM · Mar 30, 2019

WHERE DID IT ORIGINATE?

102. Sudden Ambulance Death Syndrome: Movement of Unstable Prehospital Patients

Veer Vithalani, Joshua Nackenson, Andrew Chou, William Gleason, Brian Miller, *MedStar Mobile Healthcare & JPS Health Network* CATEGORY OF SUBMISSION: MEDICAL

CASE

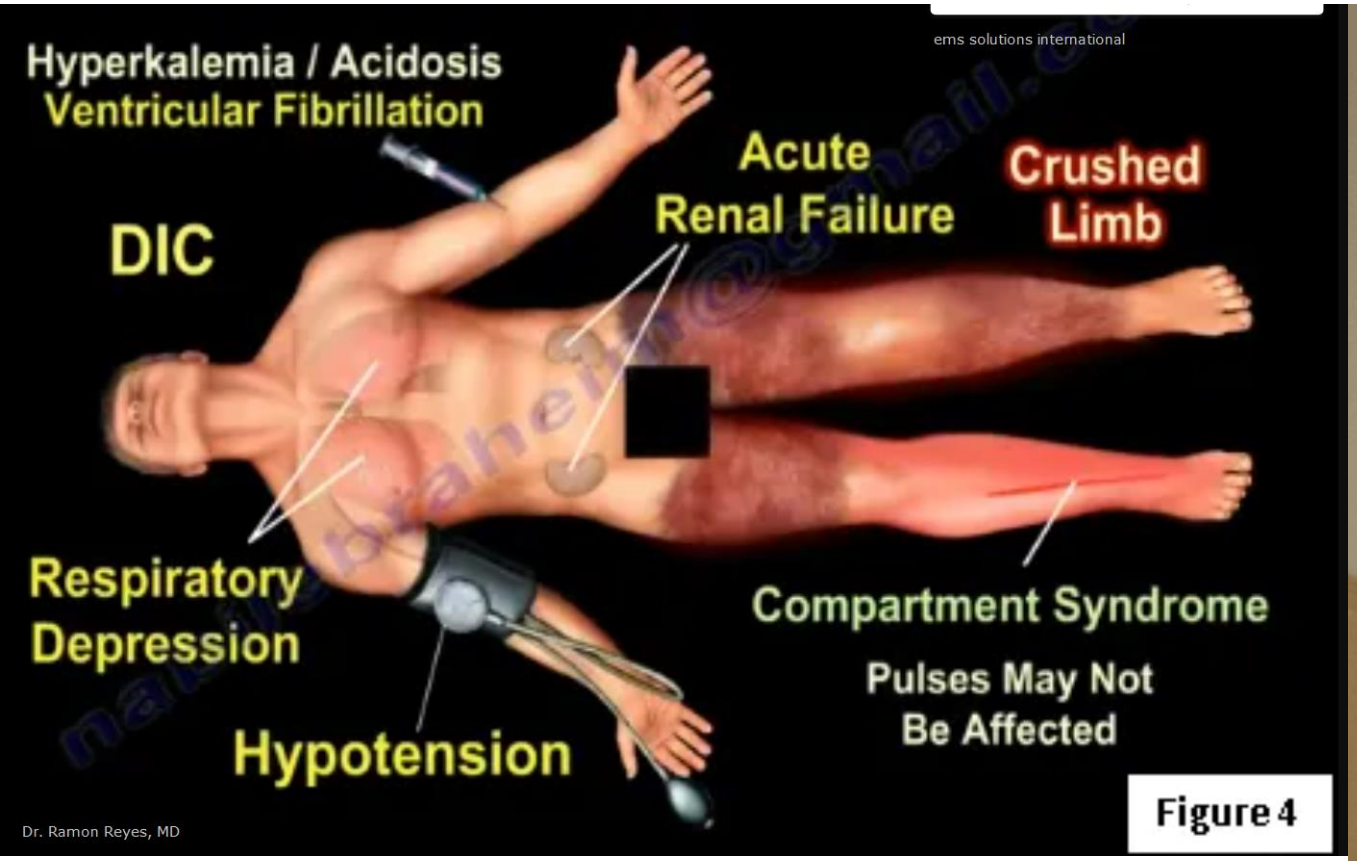
EMS X was dispatched to a 35-year-old male with difficulty breathing. Upon arrival, crew found the patient on a porch complaining of "not feeling well" and dyspnea on exertion and weakness. Pt was allowed to walk to the ambulance. Crew noted during the review that the patient appeared winded while walking to the ambulance. There was no assessment prior to walking the patient to the ambulance. Upon arrival to the unit, the patient was found to be hypoxic to 85% which improved after placement on 2L O2 via NC. Initial blood pressure was found to be in the 70s with repeat demonstrating it to be in the 90s. No venous access was ever attempted. Subsequent blood pressures read at 70/39 and 14 minutes later, 95/57. There remained no attempts at access. An EKG was completed which demonstrated peaked t waves which was not recognized by the crew. Hypotension was never communicated to the ED and the patient was assigned to triage and taken to the waiting room upon arrival at the ED. Upon triage, the patient was found to be hypoxic to the 70s and hypotensive to the 80s. The patient eventually required intubation and ICU admission.

WHY DOES IT HAPPEN?

BALTIMORE COUNTY
EST. 1882
FIRE DEPT.

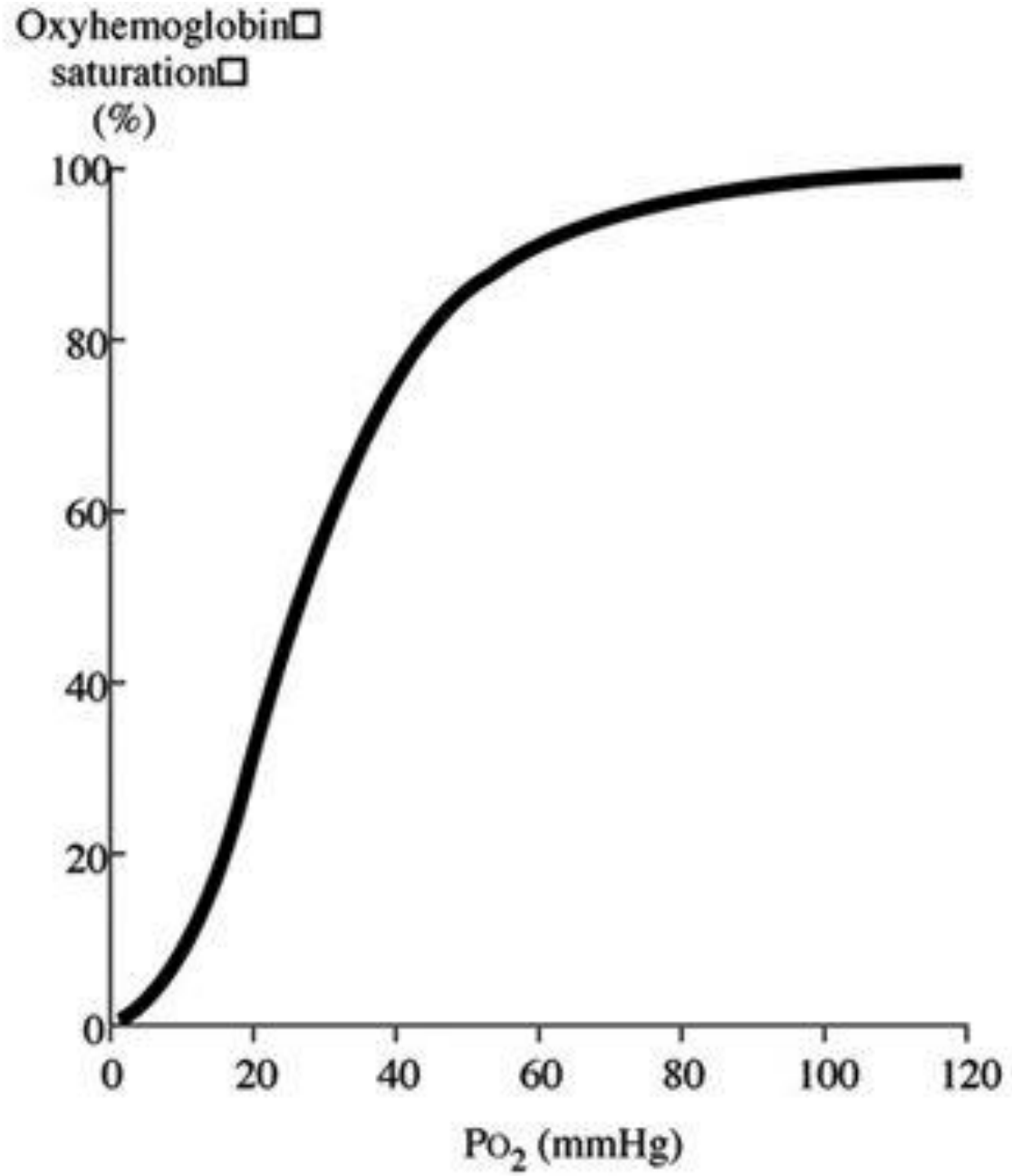
WHY DOES IT HAPPEN?

WHY DOES IT HAPPEN?

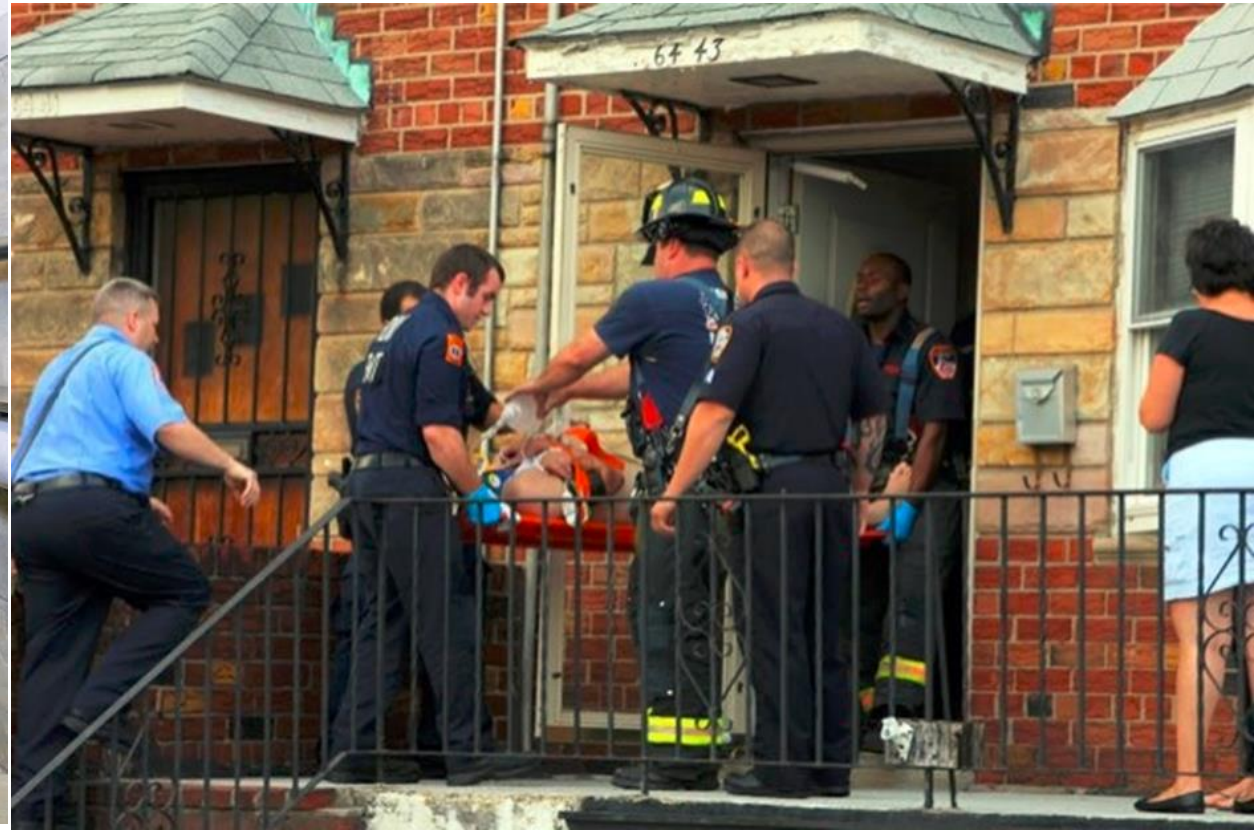


Sam Ghali @EM_RESUS · 25 Dec 2016

WHY DOES IT HAPPEN?


Oxyhemoglobin saturation (%)
100
80
60
40
20
0
0
20
40
60
80
100
120
P_{O_2} (mmHg)

WHY DOES IT HAPPEN?



WHAT DOES THE EXISTING RESEARCH SAY?

2. Utility of A Prehospital "Crashing Patient" Care Bundle in Reducing the Incidence of Post EMS Contact Cardiac Arrest of Critically Ill Medical Patients

Mark Pinchalk, Adam Palmer, James Dlutowski, John Mooney, Adam Studebaker, Simon Taxel, Jeff Reim, Jr., Phillips Frank, *City of Pittsburgh EMS*

WHAT DOES THE EXISTING RESEARCH SAY? PITTSBURGH

1) No movement of the patient until care objectives have been completed
2) Apply physiological monitoring
3) Aggressive management of the airway via basic and advanced methods
4) Aggressive management of respiratory distress/failure via CPAP/positive pressure ventilation via BVM
5) Early IV/IO access, aggressive management of hypotension via fluids and vasopressor
6) Maximal medication therapy based on the patient's underlying pathology.

- Results: 12.1% rate of EMS-witnessed arrest →5.8%

WHAT DOES THE EXISTING RESEARCH SAY?

102. Sudden Ambulance Death Syndrome: Movement of Unstable Prehospital Patients

Veer Vithalani, Joshua Nackenson, Andrew Chou, William Gleason, Brian Miller, *MedStar Mobile Healthcare & JPS Health Network* CATEGORY OF SUBMISSION: MEDICAL

WHAT DOES THE EXISTING RESEARCH SAY? MEDSTAR

- 30 cases
- Etiology:
  - Respiratory 46.7%
  - Cardiac 26.7%
  - Other 26.7%
- 16.67% had spo2 > 90% upon EMS arrival; 10% prior to movement
- 73.3% delayed ventilation

WHAT DOES THE EXISTING RESEARCH SAY?

179. Prehospital Quality Improvement And Education In Care For PARCA Patients

Tung-Lin Jesse Yuan, Mark Pinchalk, Ronald Roth, Paul Paris, *Des Moines University College of Osteopathic Medicine*

WHAT DOES THE EXISTING RESEARCH SAY? PARCA

- Examined outcomes following PARCA-directed education
- Urban EMS system, 60k calls/year
- Unannounced field-based, real-time, high-fidelity simulations + development of guidelines to limit time to critical interventions.
- PARCA incidence 5.7%→4.0%
- # of interventions completed pre-PARCA 3.65 vs 5.8 ($P<0.05$)
- Decreased time to intervention.

High Flow Diesel Fixes Everything

(and other lies they told us in paramedic school)

Johanna Innes, MD NRP FACEP FAEMS
Assistant Clinical Professor of Emergency Medicine
Program Director, Fellowship in EMS
Jacobs School of Medicine and Biomedical Sciences
Buffalo, NY

WHAT DOES THE EXISTING RESEARCH SAY? BUFFALO

- 10% of EMS arrests witnessed
- Least common initial intervention: VS
- Most common initial intervention: patient movement
- 12.6% of PARCA patients survived to hospital discharge
- Survival dependent on intervention: 17.8% in early intervention v 8.7% in late intervention

WHAT DOES THE EXISTING RESEARCH SAY?

› Prehosp Emerg Care. 2022 May-Jun;26(3):391-399. doi: 10.1080/10903127.2021.1908464. Epub 2021 Apr 13.

The EMS Modified Early Warning Score (EMEWS): A Simple Count of Vital Signs as a Predictor of Out-of-Hospital Cardiac Arrests

Brian M Clemency, William Murk, Alexander Moore, Lawrence H Brown

WHAT DOES THE EXISTING RESEARCH SAY?

Score component	Score contribution		
	+1	0	+1
Systolic BP (mmHg)	< = 89	90 – 140	> = 141
Heart rate (bpm)	< = 59	60 – 100	> = 101
Respiratory rate (bpm)	< = 9	10 – 20	> = 21
AVPU		Alert	Not alert

Table 4 of 7

Table 4. Risk of EMS-witnessed cardiac arrest, by EMEWS value

EMEWS value (count of abnormal vital signs)	Patients, N	EMS-witnessed arrest, N	EMS-witnessed arrests per 1,000 patients	Cumulative EMS-witnessed arrests per 1,000 patients
0	63,886	211	3.3	4.4
1	133,281	657	4.9	
2	99,621	1,147	11.5	22.0
3	51,713	1,497	29.0	
4	20,563	1,139	55.4	

Preventing Sudden Ambulance Death Syndrome: Analysis of Initial Vital Signs and Time to First Intervention

Andrew Bouland, MD[1], Stephen Taylor, PhD(c)[1], Alex Gordon, B.S.[2], Juan March, MD[1]

1 Department of Emergency Medicine, East Carolina University, 2 Brody School of Medicine, East Carolina University

INTRODUCTION

- Delaying interventions for critical medical patients in a "load and go" approach may be implicated in the phenomena of "Sudden Ambulance Death Syndrome" (SADS).

OBJECTIVES

- To identify whether time to intervention decreases mortality in non-traumatic patients with abnormal vitals signs.

METHODS

- Retrospective study utilizing the 2019 ESO Data Collaborative.
- Binomial logistic regression and t-tests were analyzed for association of first vital signs and time to first treatment to patient arrest.
- Inclusion Criteria: 911 paramedic service and initial vital signs of SpO2< 90 or MAP < 60 or RR 4-8 or >28 or HR < 50 or >150
- Exclusion Criteria: Age< 18, trauma, pregnancy, cardiac arrest prior to EMS arrival, or EMS-witnessed arrest within two minutes of patient contact.
- First treatment is defined as: pacing, cardioversion, IV/IO access, epinephrine administration, airway intervention (including O2 administration, NIPPV, nebs, SGA, ETT).

RESULTS

Figure 1
Survival Function of Critical SpO²

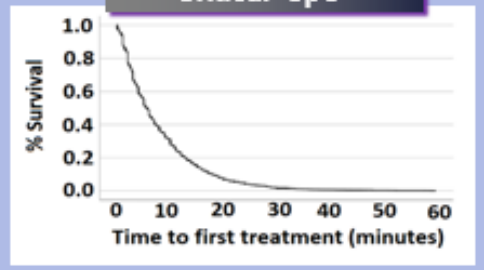


Figure 2
Survival Function of Critical Resp Rate

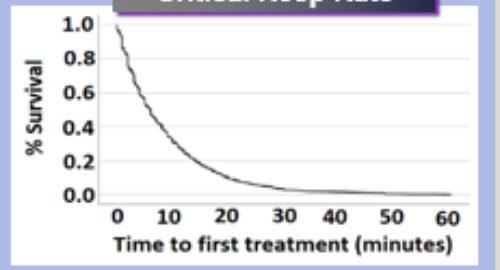


Figure 3
Survival Function of Critical Low Heart Rate

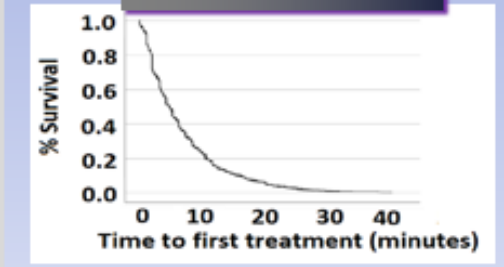


Figure 4
Survival Function of Critical Covariates Combined

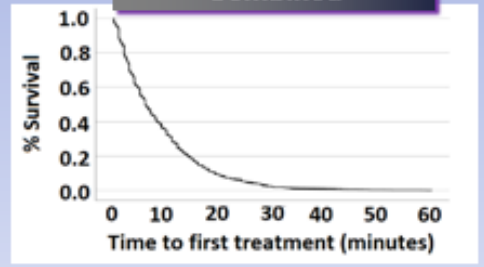
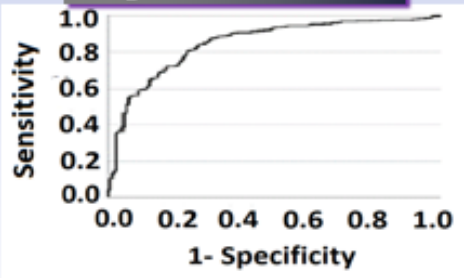


Figure 5 ROC Curve



RESULTS

- The 2019 ESO database included 7.58 million encounters; 181,822 patients met the inclusion criteria, and 5,118 experienced EMS-witnessed arrests.
- Mean time to first intervention for arrested patients was 7.05 minutes, compared to 8.54 for those who never arrested CI [6.82, 7.28].
- Vitals Signs associated with increased incidence of arrest were (Figure 1 – 3):
  - SpO^2<90 was OR=4.32, CI [2.66, 7.01],
  - RR was OR=1.89, CI [1.14, 3.12],
  - HR was OR=6.88, CI [4.19, 11.30].
- Each minute delay was associated with a 4.4% (OR=1.04) increase in arrest, p=.004, CI [1.01, 1.07] (Figure 4).
- AUROC= .850, CI [0.82, 0.89] (Figure 5).

CONCLUSION

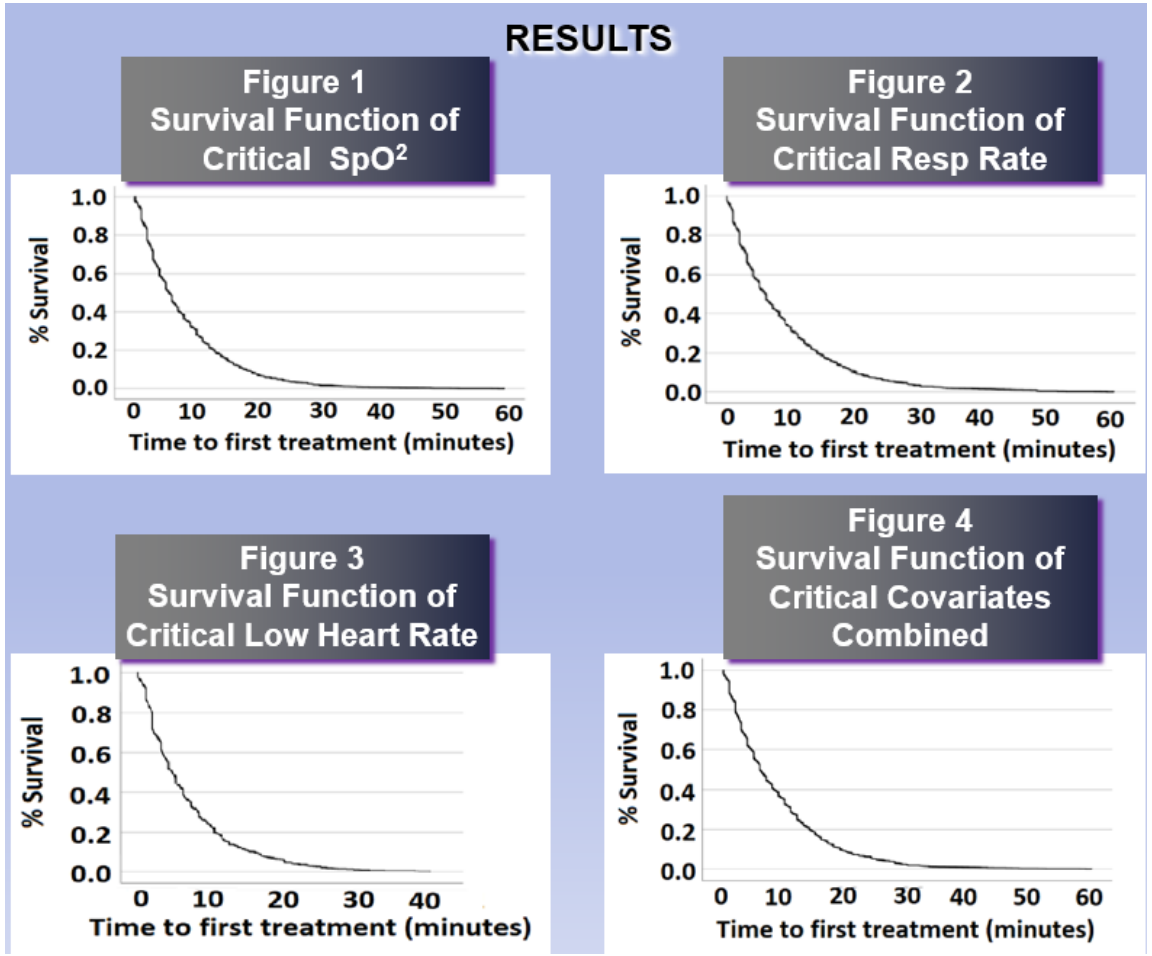
- Each minute without intervention was associated with a 4.4% increase in risk of arrest (SADS).
- Bradypnea, bradycardia, and hypoxia are associated with increased risk of SADS.

Thank you to Dr. Remle Crowe and all of our colleagues at ESO.

Want more info?

WHAT DOES OUR RESEARCH SAY?

EVERY MINUTE WITHOUT RESUSCITATION = 4.4% INCREASED RISK OF SADS



4.4%

CASE

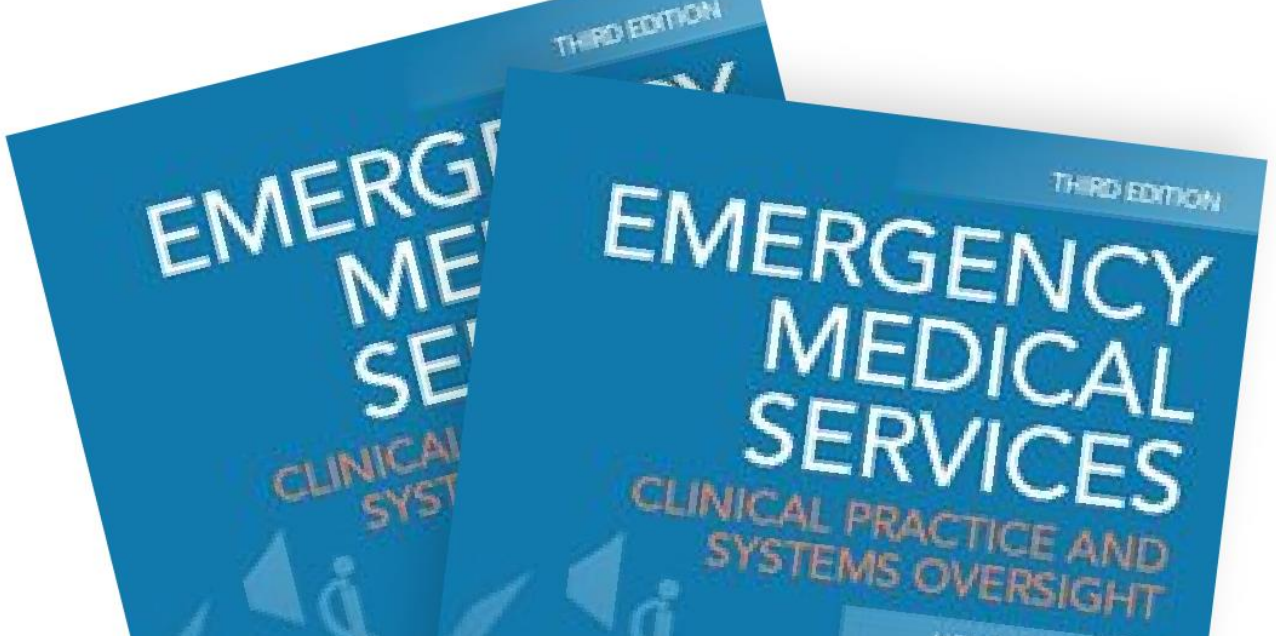
EMS X was dispatched to 71-year-old man fallen. Crew arrived to find a male patient altered and complaining of abdominal pain. Paramedic A began assessing vital signs and was unable to obtain a blood pressure despite multiple attempts using the monitor. He then placed the patient on a 4-lead which demonstrated obvious ST elevations. A 12 lead was then completed demonstrating a STEMI. The patient then went completely unconscious with a GCS of 3. No BP had been taken at this point. During the time of initial assessment, paramedic B was searching the home for signs of overdose while paramedic A was performing the initial assessment- she stated that she knew the patient was "stable" because he was "able to talk."

The patient was moved to the ambulance, and paramedic A called paramedic C on her cell phone to have her meet them at the station for additional help. There was no attempt at vascular access while on scene.

En route to the station to pick up paramedic C, the patient developed agonal respirations and became bradycardic. Pacing was initiated with mechanical and electrical capture. IV access was obtained and IV fluids started. An additional unit was called for rendezvous and transport was continued after picking up paramedic C. Of note, etco2 was never placed on the patient. Additionally, a blood pressure was never obtained on the patient and a manual blood pressure was never attempted.

Paramedics D and E rendezvoused with the crew approximately 10 minutes into transport. Upon entering the back of the unit, paramedic E immediately realized the patient was pulseless. Paramedic A had not rechecked a pulse since the initiation of pacing, so it is unknown when the patient coded. Cardiac arrest protocol was initiated, and transport was continued. The patient was pronounced dead at the hospital.

HOW DO WE USE THIS INFORMATION AS MEDICAL DIRECTORS?



Protocol

A treatment protocol for treating shock in the field should address the following factors:

1. Performing the initial assessment.
2. The definitive or life-saving interventions appropriate for these patients.
3. Access to definitive care without unnecessary prehospital delay.
4. Resources to be used in the field.
5. Skills of the various levels of EMS clinicians in the field.

D. INITIAL ASSESSMENT

Rapidly develop a general impression of the patient on first contact:

1. Identify the critically unstable patient – any patient *in extremis* or with imminent risk for deterioration to arrest:
   a) New onset of altered mental status (AVPU not alert)
   b) Airway compromise
   c) Acute respiratory distress
   d) Signs of poor perfusion
   e) Any other patient judged by the clinician to be *in extremis* or at risk for deterioration to cardiac arrest

2. If you have identified a critically unstable patient:
   a) STOP ALL MOVEMENT OF PATIENT
   b) DO NOT INITIATE TRANSPORT
   c) PROCEED TO *CRITICALLY UNSTABLE PATIENT* PROTOCOL IMMEDIATELY

2.4 General Patient Care (GPC) – CRITICALLY UNSTABLE PATIENT

a) INDICATIONS

Adult patients (18 years of age or older) who are identified to be in extremis or are at risk for deterioration to cardiac arrest at any point during their care. These patients can include, but are not limited to, patients with:

(1) New onset altered mental status (AVPU – not alert)
(2) Airway compromise
(3) Acute respiratory distress
(4) Signs of poor perfusion
(5) Any other patient judged by the clinician to be *in extremis* or at risk for deterioration to cardiac arrest

b) BLS

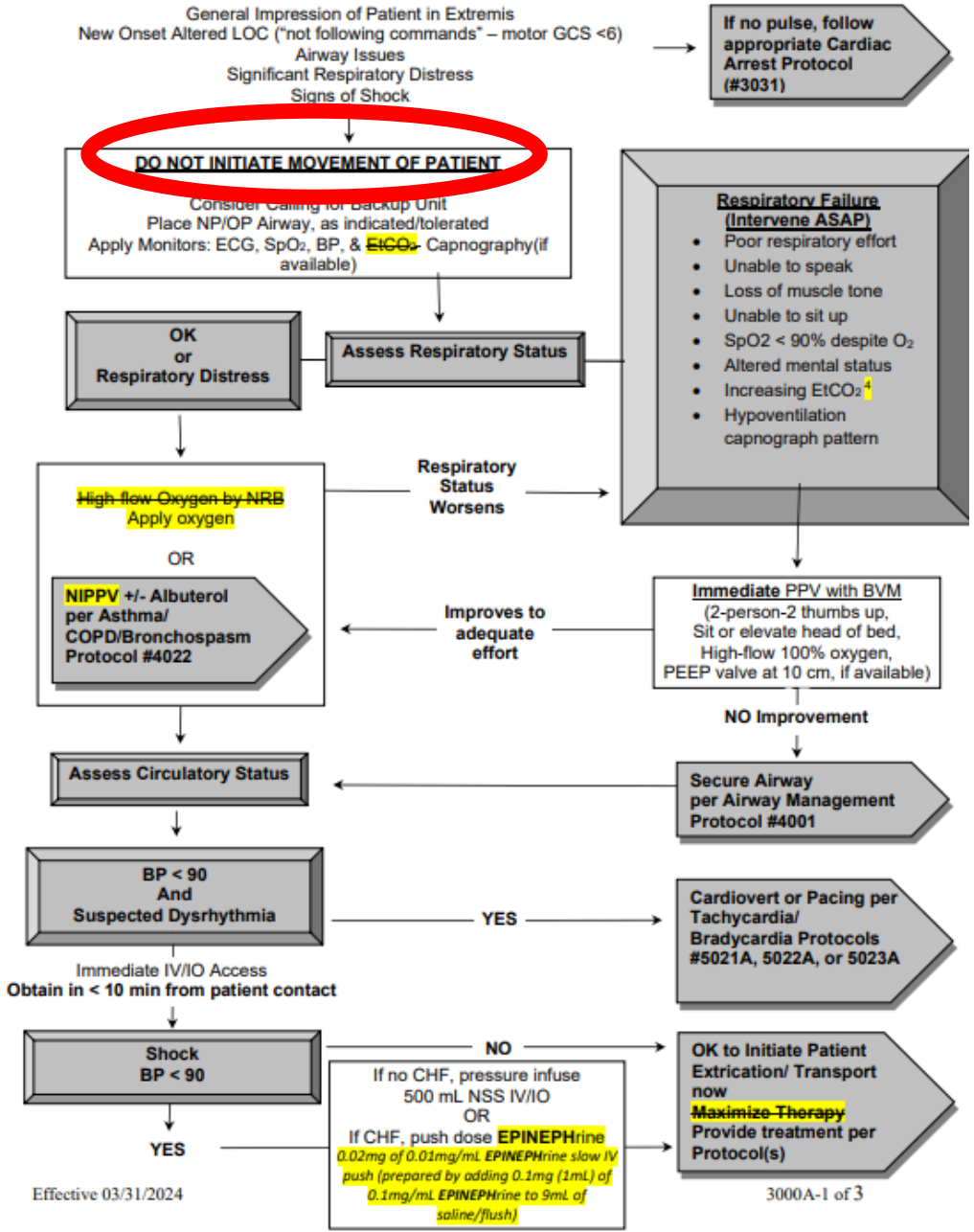
(1) Cease all efforts at patient movement until treatments in this protocol are complete.
(2) Obtain a complete patient assessment, including pulse oximetry.
(3) Consider the need for more resources, if available, including multiple ALS clinicians.
(4) Control life-threatening external hemorrhage.
(5) Manage the patient's airway and ventilation (e.g., BVM with or without OPA/NPA) as indicated and tolerated.
(6) Treat hypoxia and respiratory distress aggressively.

c) ALS

(1) Initiate $ETCO_2$ monitoring.
(2) Obtain 12-lead EKG, if appropriate for patient condition.
(3) Obtain vascular access and support perfusion with IV fluids and vasoactive medications as indicated.
(4) Address any other life threats noted on physical exam.
(5) Continue General Patient Care, including transport.


PITTSBURGH
504
PITTSBURGH
RESCUE X2
PARAMEDICS
EMS
PITTSBURGH
PARAMEDIC RESCUE
AMBULANCE

CRASHING PATIENT/ PATIENT IN EXTREMIS – ADULT
STATEWIDE ALS PROTOCOL



B. Actions within First 10 Minutes[1,2]:

1. Circulation
    a. Electrical Therapy (cardioversion or pacing) if dysrhythmia is primary cause of shock
    b. Emergent IV/IO access
    c. Administer NSS 500 mL bolus, infused under pressure unless signs of pulmonary edema

C. Actions within First 15 Minutes[1,2]:

1. Re-assess response to treatments
2. Circulation
    a. Repeat NSS 500 mL bolus if indicated

    b. If bradycardia, consider atropine 1 mg IV/IO, if indicated
    c. If no response to fluids (SBP<80 and decreased LOC), administer ~~**EPINEPH**rine 20 mcg 0.01 mg/mL~~ EPINEPHrine *0.02mg of 0.01mg/mL EPINEPHrine slow IV push (prepared by adding 0.1mg (1mL) of 0.1mg/mL EPINEPHrine to 9mL of saline/flush)***EPINEPH**rine or **DOPA**mine infusion by appropriate protocol or medical command order

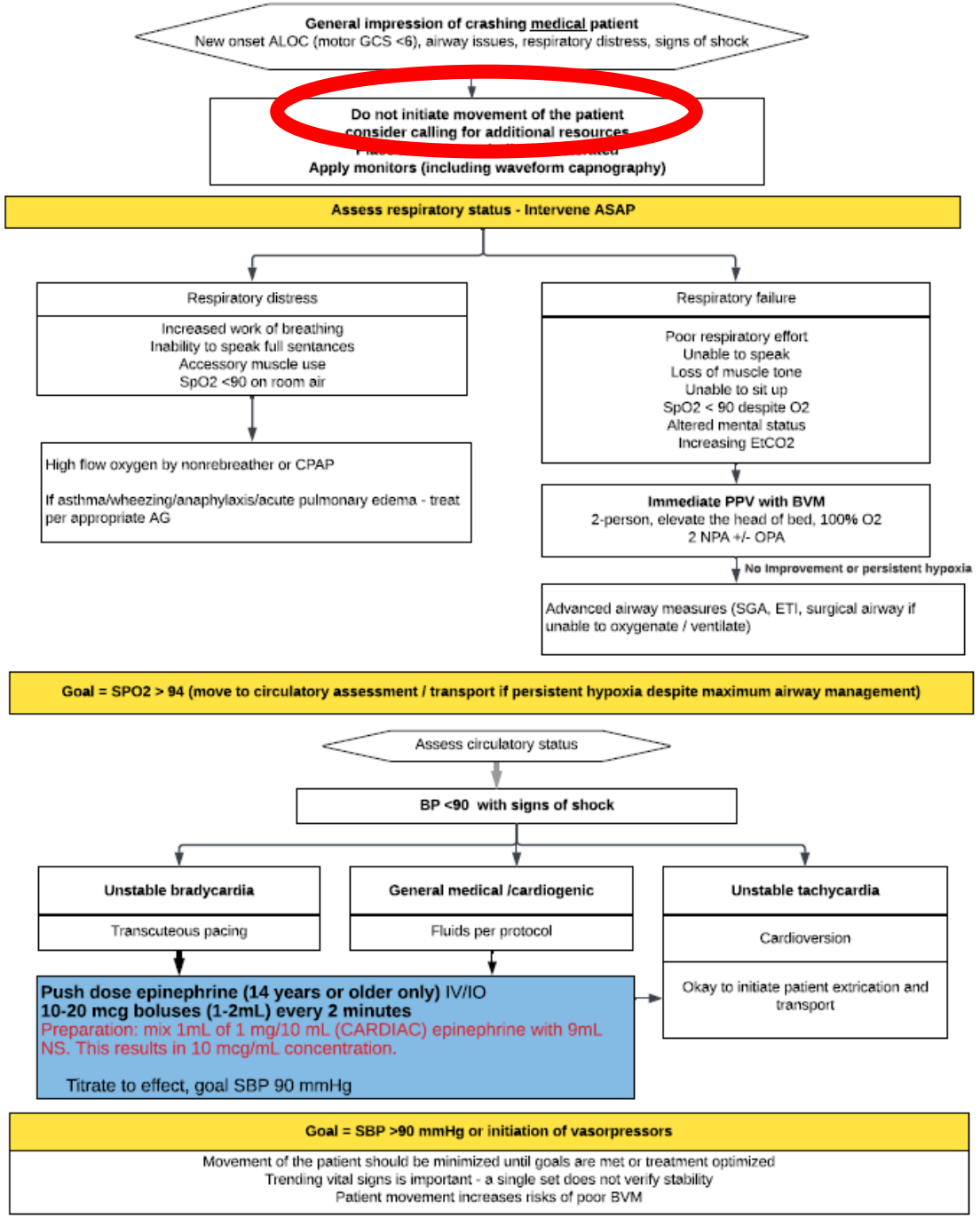
3. Airway – ~~if considering advanced airway, consider high flow NC oxygen at 15 LPM using a second oxygen tank~~ if attempting advanced airway, consider applying a nasal cannula with 15 LPM oxygen to maintain an appropriate SpO2.

D. Actions within First 20 Minutes[1,2]:

1. Re-assess response to treatments
2. Circulation – continue fluids/vasopressors (push dose or infusion) as indicated by appropriate protocol or medical command order
3. Airway – insert advanced airway if indicated

E. Once critical actions have been completed, move the patient to ambulance for transport.

Pearls for the Crashing Medical Patient




AUSTIN-TRAVIS COUNTY
EMS
EMERGENCY MEDICAL SERVICES
PARAMEDIC RESCUE
DIAL
911
EMERGENCY
MAINTENANCE ONLY

Minimum Equipment to Patient's Side

Standard:

To establish a minimum list of equipment that will be taken to the patient's side on every call.

Purpose:

ATCEMS System providers are often faced with patient conditions that require immediate intervention in order to decrease morbidity or prevent mortality. Time dependent interventions are those that must be performed immediately or within seconds/minutes to be effective.

Application:

ATCEMS System providers will ensure that the following equipment will be immediately available for use at the patient's side:

All PL Levels***

Appropriate PPE	Defibrillator	Stethoscopes
BVM with appropriate masks	Suction	B/P cuffs
O2 with delivery devices	OPA & NPA	Naloxone (IN)
Oral glucose	Tape	4x4 dressings
Kerlix	Mucosal Atomization Device	Clinical Operating Guidelines

PL2 and Higher

CPAP	Appropriate iGel airway	EPI (1mg/mL) & IM Supplies
Albuterol & nebulizer kit		

PL3 and Higher

Saline lock equipment	250mL D10W for Infusion	Naloxone (IM/IV)

PL4 and Higher

Laryngoscope & blades for FBAO	Magill forceps for FBAO	

PL5 and Higher

Thoracostomy needles	Kelly forceps for thoracostomy	Scalpels

#3
Airway

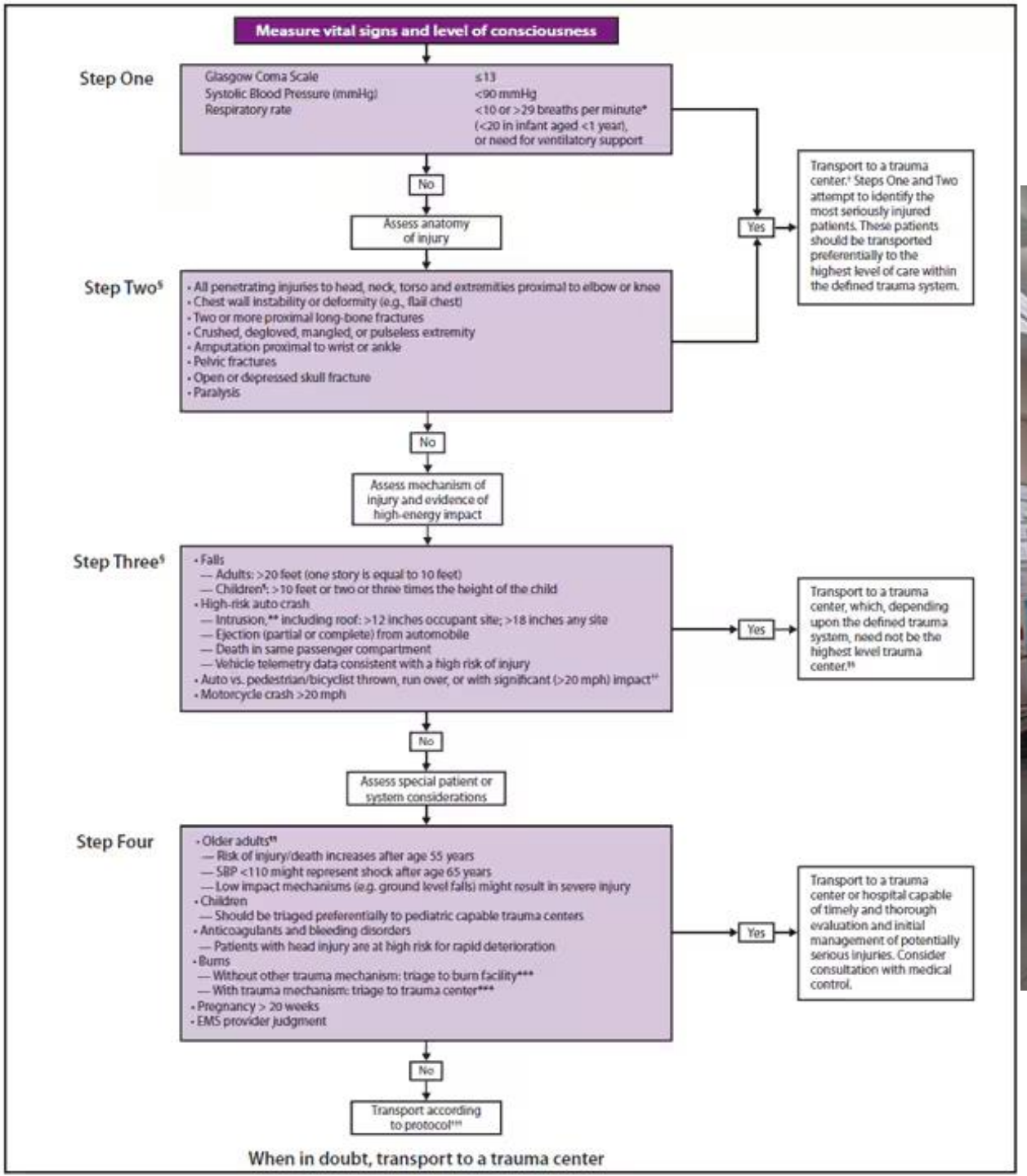
#5
CPR

#2
Monitor/defib

#1
Medications

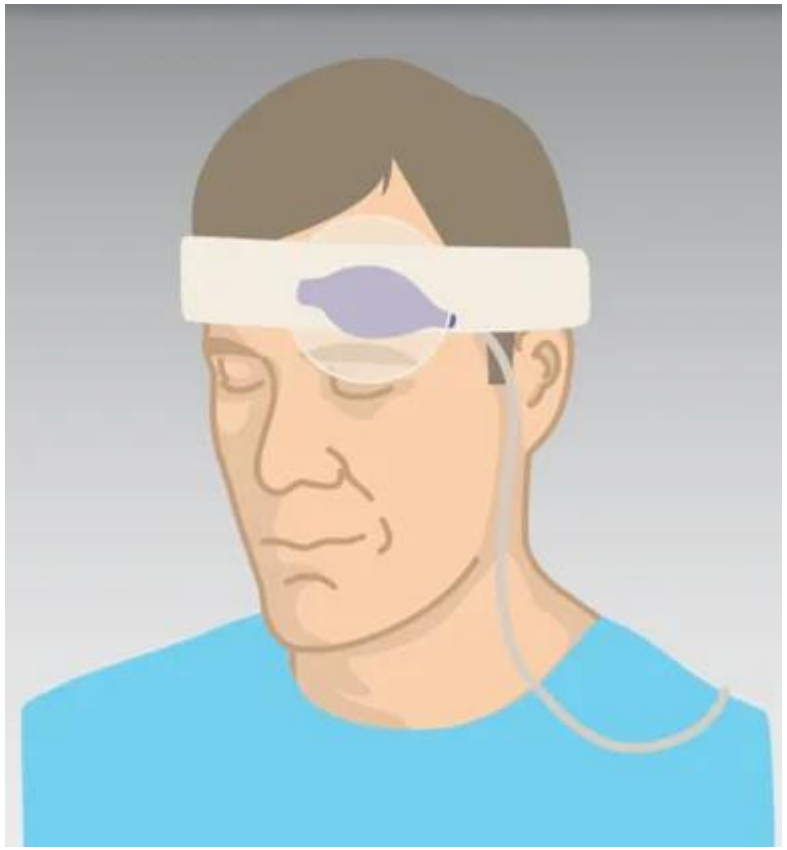
#5
Team leader


CHALLENGES
AHEAD


Measure vital signs and level of consciousness
Step One
Glasgow Coma Scale ≤13
Systolic Blood Pressure (mmHg) <90 mmHg
Respiratory rate <10 or >29 breaths per minute* (<20 in infant aged <1 year), or need for ventilatory support
No
Assess anatomy of injury
Yes
Transport to a trauma center.† Steps One and Two attempt to identify the most seriously injured patients. Those patients should be transported preferentially to the highest level of care within the defined trauma system.
Step Two§
• All penetrating injuries to head, neck, torso and extremities proximal to elbow or knee
• Chest wall instability or deformity (e.g., flail chest)
• Two or more proximal long-bone fractures
• Crushed, degloved, mangled, or pulseless extremity
• Amputation proximal to wrist or ankle
• Pelvic fractures
• Open or depressed skull fracture
• Paralysis
No
Assess mechanism of injury and evidence of high-energy impact
Step Three§
• Falls
— Adults: >20 feet (one story is equal to 10 feet)
— Children¶: >10 feet or two or three times the height of the child
• High-risk auto crash
— Intrusion,** including roof: >12 inches occupant site; >18 inches any site
— Ejection (partial or complete) from automobile
— Death in same passenger compartment
— Vehicle telemetry data consistent with a high risk of injury
• Auto vs. pedestrian/bicyclist thrown, run over, or with significant (>20 mph) impact††
• Motorcycle crash >20 mph
Yes
Transport to a trauma center, which, depending upon the defined trauma system, need not be the highest level trauma center.§§
No
Assess special patient or system considerations
Step Four
• Older adults¶¶
— Risk of injury/death increases after age 55 years
— SBP <110 might represent shock after age 65 years
— Low impact mechanisms (e.g. ground level falls) might result in severe injury
• Children
— Should be triaged preferentially to pediatric capable trauma centers
• Anticoagulants and bleeding disorders
— Patients with head injury are at high risk for rapid deterioration
• Burns
— Without other trauma mechanism: triage to burn facility***
— With trauma mechanism: triage to trauma center***
• Pregnancy > 20 weeks
• EMS provider judgment
Yes
Transport to a trauma center or hospital capable of timely and thorough evaluation and initial management of potentially serious injuries. Consider consultation with medical control.
No
Transport according to protocol†††
When in doubt, transport to a trauma center

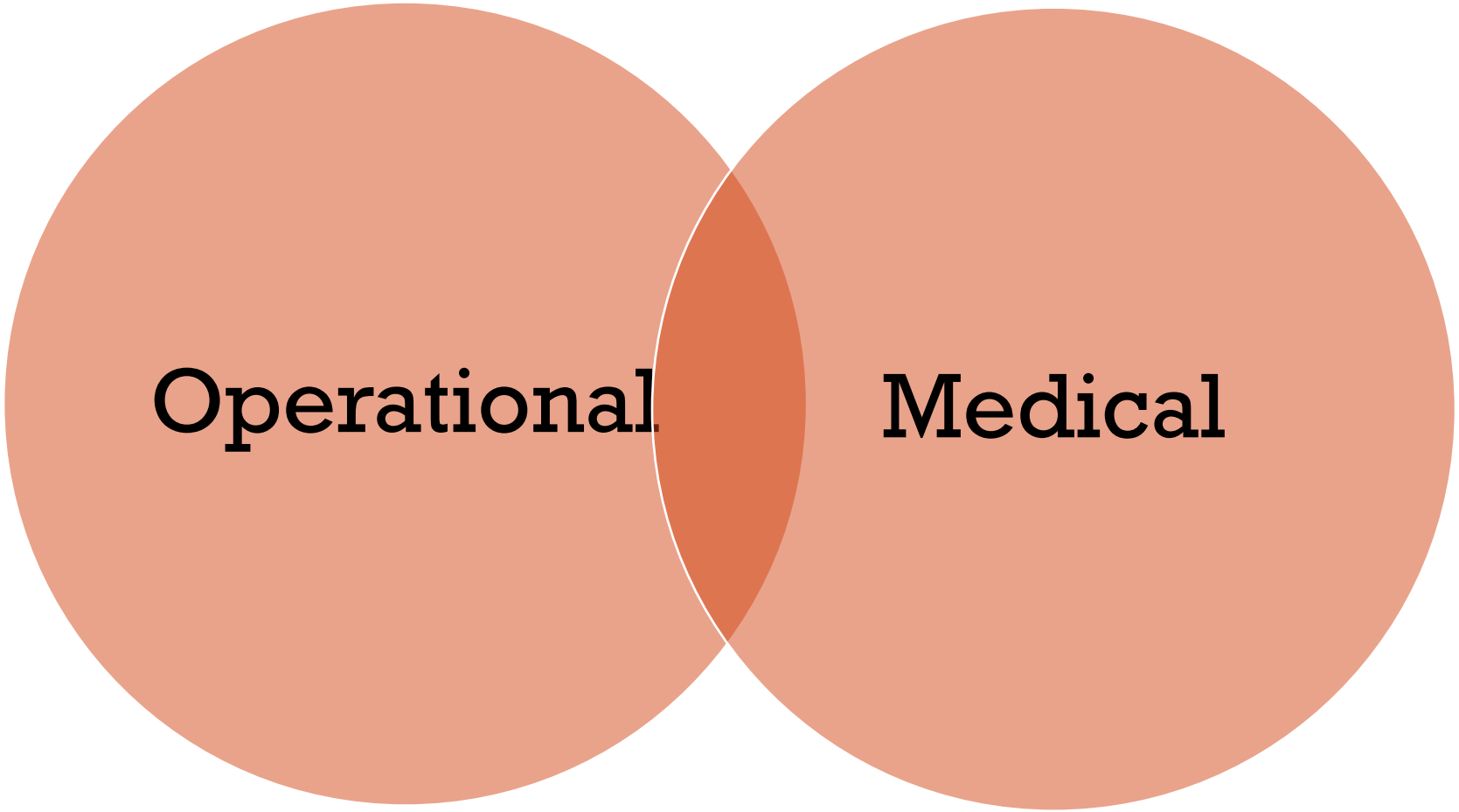
"TREAT THE PATIENT, NOT THE MONITOR"

"USE THE MONITOR TO TREAT THE PATIENT"



"DO NOT MOVE A PATIENT FROM THE INITIAL SCENE UNDER RESUSCITATED. UNLESS CONCERN FOR PATIENT AND/OR CREW SAFETY."

HOW FAR DO WE TAKE IT?



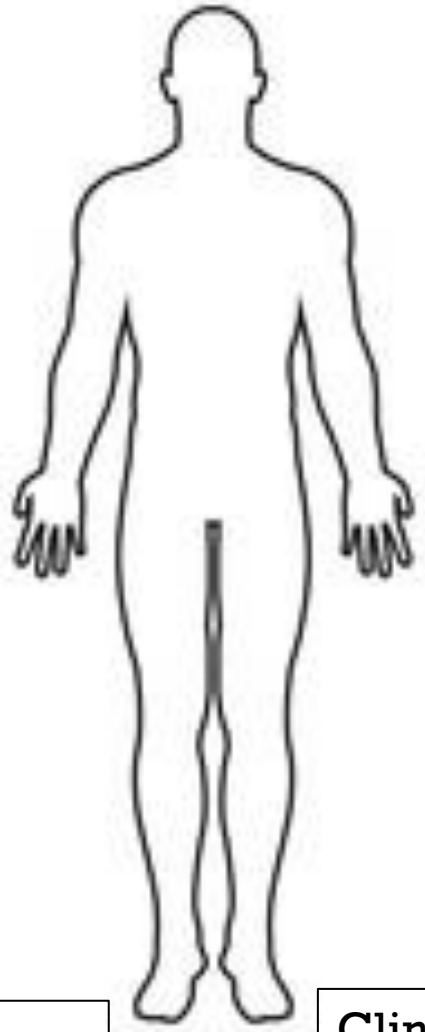
"THERE IS NO WORSE FEELING IN THE WORLD THAN HAVING A PATIENT DIE ON YOU KNOWING YOU DID NOTHING TO PREVENT THE PATIENT FROM CODING!"

FUTURE DIRECTIONS FOR RESEARCH

- How long to stay on scene?
- How about trauma patients?
- How about stroke/STEMI?

Clinician 1:

1. Pulse check (if applicable)
2. Obtain VS- Spo2/BP
3. Apply oxygen/etco2 (if applicable)
4. Apply monitor
5. Place pads/initiate electrical therapy w/Clinician 2 (if applicable)
6. Initiate CPAP, assess lung sounds and initiate respiratory therapy ie nebs (if applicable)
7. Reassess VS
8. Prepare meds/spike bags



Clinician 2:

1. Obtain meaningful access
2. Assess monitor once applied and perform electrical therapy with Clinician 1 (if indicated)
3. Initiate medical therapy

Clinician 4:

1. Obtain PMHx/HPI
2. Assist with meds/spiking bags

Clinician 3:

1. Prepare meds/spike bags
2. Obtain secondary access

Clinician 5:

1. Prepare for extrication
2. Review SADS prevention checklist

SADS PREVENTION CHECKLIST

Applies to the following *medical* patients

1. **Hypotensive** at any time
2. **Hypoxic** at any time
3. Requiring NIPPV, BVM, or advanced airway management
4. Arrythmia requiring treatment at anytime

SADS PREVENTION CHECKLIST

1. Full Set of VS has been obtained.
2. Additional resources have been summoned.
3. Minimum 10 minutes on scene
4. SBP at least 80 and up trending
5. Hypoxia addressed
6. NIPPV/BVM/advanced airway initiated (if applicable)
7. Multiple ***meaningful*** points of access obtained and **SECURED**
8. Pads applied (A/P position) and pacing/cardioversion completed and successful (if applicable)
9. If pt was hypotensive at any point, pressors prepared (if not already initiated)
10. Arrythmias have been addressed
11. Pressors maintained at current rate at least 5 minutes
12. Equipment pre-positioned and stopping points pre-determined for reassessment of VS/pulse check/further stabilization, no further apart than q2 min
13. VS have been reassessed.

THANK YOU

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