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Objectives

- Think like an Emergency Physician
- Review the case of MP
- Discuss a differential diagnosis
- Modify the differential diagnosis
- Review treatment for an arrest
- “Guess what I’m thinking”
MP

- 38 year-old male with a history of SVT, transferred from outside hospital with GI bleed
MP – Hospital #1

- Presented to first hospital the previous night after syncopal episode that had no prodrome and no seizure activity
- Was feeling weak, vague abdominal pain and nauseated
- EKG unremarkable, 2 sets of cardiac enzymes negative, improved with ondansetron and morphine
- Discharged with “anxiety”
Any Thoughts?
Differential for Syncope?
## Differential Diagnosis in Syncope

### Box 19-1 Causes of Syncope

<table>
<thead>
<tr>
<th>Focal Hypoperfusion of CNS Structures</th>
<th>Vasomotor—neurally mediated (reflex vasodepressor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular disease</td>
<td>Neurocardiogenic (vasovagal)</td>
</tr>
<tr>
<td>Hyperventilation</td>
<td>Emotion</td>
</tr>
<tr>
<td>Subclavian steal</td>
<td>Pain</td>
</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
<td>Situational</td>
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<tr>
<td>Basilar artery migraine</td>
<td>Carotid sinus sensitivity</td>
</tr>
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<td>Cerebral syncope</td>
<td>Necktie syncope</td>
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<tr>
<td></td>
<td>Shaving syncope</td>
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<tr>
<td>Systemic Hypoperfusion Resulting in CNS Dysfunction</td>
<td>Miscellaneous reflex</td>
</tr>
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<td>Tussive, sneeze</td>
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<td>Gastrointestinal—swallowing, vomiting, defecation</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
<td>Postmicturition</td>
</tr>
<tr>
<td>Atrial myxoma</td>
<td>Elevated intrathoracic pressure (weightlifting)</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>Other causes of hypoperfusion</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>Orthostatic hypotension—volume depletion</td>
</tr>
<tr>
<td>Cardiac tamponade</td>
<td>Anemia</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>Drug-induced</td>
</tr>
<tr>
<td>Reduced cardiac output</td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td></td>
</tr>
<tr>
<td>Supraventricular tachycardia</td>
<td></td>
</tr>
<tr>
<td>Ventricular tachycardia</td>
<td></td>
</tr>
<tr>
<td>Ventricular fibrillation</td>
<td></td>
</tr>
<tr>
<td>Wolff-Parkinson-White syndrome</td>
<td></td>
</tr>
<tr>
<td>Torsades de pointes</td>
<td></td>
</tr>
<tr>
<td>Bradycardia</td>
<td></td>
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<tr>
<td>Sinus node disease</td>
<td></td>
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<tr>
<td>Second-degree and third-degree A-V block</td>
<td></td>
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<tr>
<td>Prolonged Q-T syndrome</td>
<td></td>
</tr>
<tr>
<td>Pacemaker malfunction</td>
<td></td>
</tr>
<tr>
<td>Implanted cardioverter-defibrillator malfunction</td>
<td></td>
</tr>
<tr>
<td>Other cardiovascular disease</td>
<td></td>
</tr>
<tr>
<td>Aortic dissection</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td></td>
</tr>
<tr>
<td>Cardiomyopathy</td>
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<tr>
<td>CNS Dysfunction with Normal Cerebral Perfusion</td>
<td>Hypoglycemia</td>
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<tr>
<td></td>
<td>Hypoxemia—asphyxiation</td>
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<tr>
<td></td>
<td>Seizure</td>
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<td></td>
<td>Narcolepsy</td>
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<tr>
<td>Psychogenic</td>
<td>Anxiety disorder</td>
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<tr>
<td></td>
<td>Conversion disorder</td>
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<tr>
<td></td>
<td>Somatization disorder</td>
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<tr>
<td></td>
<td>Panic disorder</td>
</tr>
<tr>
<td></td>
<td>Breath-holding spells</td>
</tr>
<tr>
<td>Toxic</td>
<td>Drugs</td>
</tr>
<tr>
<td></td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td></td>
<td>Other agents</td>
</tr>
<tr>
<td></td>
<td>Undetermined causes</td>
</tr>
</tbody>
</table>
Dangerous Causes of Syncope?
Dangerous Causes of Syncope

<table>
<thead>
<tr>
<th>Critical Diagnoses to Consider in Syncope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial infarction</td>
</tr>
<tr>
<td>Life-threatening dysrhythmias</td>
</tr>
<tr>
<td>Thoracic aortic dissection</td>
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<td>Critical aortic stenosis</td>
</tr>
<tr>
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<td>Pericardial tamponade</td>
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</tr>
<tr>
<td>Subarachnoid hemorrhage</td>
</tr>
<tr>
<td>Stroke</td>
</tr>
<tr>
<td>Toxic-metabolic derangements</td>
</tr>
<tr>
<td>Severe hypovolemia or hemorrhage</td>
</tr>
</tbody>
</table>
2 episodes of bright red blood per rectum and 1 episode of coffee ground emesis immediately after discharge from the first hospital

Presented to hospital #2
Modify the Differential?
# Differential Diagnosis in Syncope

## Causes of Syncope

### Focal Hypoperfusion of CNS Structures
- Cerebrovascular disease
- Hyperventilation
- Subclavian steal
- Subarachnoid hemorrhage
- Basilar artery migraine
- Cerebral syncope

### Systemic Hypoperfusion Resulting in CNS Dysfunction
- Outflow obstruction
  - Mitral, aortic, or pulmonic stenosis
  - Hypertrophic cardiomyopathy
  - Atrial myxoma
  - Pulmonary embolism
  - Pulmonary hypertension
  - Cardiac tamponade
  - Congenital heart disease
- Reduced cardiac output
  - Tachycardia
  - Supraventricular tachycardia
  - Ventricular tachycardia
  - Ventricular fibrillation
  - Wolff-Parkinson-White syndrome
  - Torsades de pointes
- Bradycardia
  - Sinus node disease
  - Second-degree and third-degree A-V block
  - Prolonged Q-T syndrome
  - Pacemaker malfunction
  - Implanted cardioverter-defibrillator malfunction
- Other cardiovascular disease
  - Aortic dissection
  - Myocardial infarction
  - Cardiomyopathy

### Vasomotor—neurally mediated (reflex vasodepressor)
- Neurocardiogenic (vasovagal)
- Emotion
- Pain
- Situational
- Carotid sinus sensitivity
- Necktie syncope
- Shaving syncope

### Miscellaneous reflex
- Tussive, sneeze
- Exercise/postexercise
- Gastrointestinal—swallowing, vomiting, defecation
- Postmicturition
- Elevated intrathoracic pressure (weightlifting)

### Other causes of hypoperfusion
- Orthostatic hypotension—volume depletion
- Anemia
- Drug-induced

### CNS Dysfunction with Normal Cerebral Perfusion
- Hypoglycemia
- Hypoxemia—asphyxiation
- Seizure
- Narcolepsy
- Psychogenic
  - Anxiety disorder
  - Conversion disorder
  - Somatization disorder
  - Panic disorder
  - Breath-holding spells

### Toxic
- Drugs
- Carbon monoxide
- Other agents
- Undetermined causes
# Dangerous Causes of Syncope

## Table 19-3: Critical Diagnoses to Consider in Syncope

- Myocardial infarction
- Life-threatening dysrhythmias
- Thoracic aortic dissection
- Critical aortic stenosis
- Hypertrophic cardiomyopathy
- Pericardial tamponade
- Abdominal aortic aneurysm
- Pulmonary embolism
- Subarachnoid hemorrhage
- Stroke
- Toxic-metabolic derangements
- Severe hypovolemia or hemorrhage
MP – Hospital #2

- Hemodynamically stable
- Started on pantoprazole drip
Differential Diagnosis for GIB?
Differential Diagnosis for GIB

**BOX 22-1**

<table>
<thead>
<tr>
<th>Etiology of Significant Gastrointestinal (GI) Bleeding in Adults*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upper</strong></td>
</tr>
<tr>
<td>Peptic ulcer disease</td>
</tr>
<tr>
<td>Gastric erosions</td>
</tr>
<tr>
<td>Varices</td>
</tr>
<tr>
<td>Mallory-Weiss tear</td>
</tr>
<tr>
<td>Esophagitis</td>
</tr>
<tr>
<td>Duodenitis</td>
</tr>
<tr>
<td><strong>Lower</strong></td>
</tr>
<tr>
<td>Diverticulosis</td>
</tr>
<tr>
<td>Angiodysplasia</td>
</tr>
<tr>
<td>Upper GI bleeding</td>
</tr>
<tr>
<td>Cancer/polyps</td>
</tr>
<tr>
<td>Rectal disease</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
</tr>
</tbody>
</table>

*Potential causes listed in decreasing frequency.
MP – Hospital #2

- Risk factors include daily ibuprofen use (800mg BID) for knee pain
- Denies heavy alcohol use
- No history of GI bleed or abdominal ulcers
- No history of diverticulosis/diverticulitis
MP – Hospital #3

- Transferred to us
- Reports lower abdominal pain, non-radiating epigastric pain and lightheadedness
MP

- **Past Medical History**
  - SVT

- **Surgical History**
  - none

- **Medications**
  - Ibuprofen
  - Flexeril

- **Social History**
  - Denies alcohol use, smoking, illicit drugs

- **Family History**
  - Heart murmur, no history of GI bleed, ulcer, colonic polyps, diverticulosis/diverticulitis
Exam

T 97.7 HR 93 RR 16 BP 192/93 POx 98% RA

General: **Mild distress**
Skin: Dry, no rash, **pale**
Eye: PERRL, **pale conjunctiva**
ENMT: oral mucosa moist

Cardiovascular: **tachycardic**, 2/6 systolic ejection murmur heard best at apex radiating to axilla, no carotid bruit

Respiratory: CTA with symmetric breath sounds

GI: soft, **mildly distended**, hypoactive bowel sounds, no rebound, no guarding, non-rigid, **rectal exam with gross blood present**, normal sphincter tone

Neurological: A/Ox4, no focal neurologic deficit observed, CN II-XII intact
Now What?
Now What?

- How do you resuscitate MP?
EKG
MP – Hospital #3

- Na 134
- K 4.6
- Cl 107
- CO2 16*
- Glucose 140
- BUN 20
- Cr 1.28*
- Alk Phos 67
- ALT 47
- AST 83
- TBili 1.0
- Amylase 143
- Lipase 79
MP – Hospital #3

- WBC 19
- Hb 13.6
- PLT 215
- INR 1.23
- Trop 0.02
EKG with sinus tachycardia, no TWI, ST changes or delta waves
IVF infusing and 2 units PRBCs ordered despite “stable” Hb
NG tube placed with coffee ground return
Started on ciprofloxacin and metronidazole for possible diverticulitis
Now What?
GI called and will be coming for upper endoscopy
Called to the room for HR 220, hypotensive, mentating well
EKG
Treatment?
MP – Hospital #3

- Adenosine given (6, 12 and 12mg) with no initial rhythm change
- 30 seconds after 12mg dose of adenosine given MP went unresponsive
Treatment?
Treatment

- Cardioverted with precordial thump, sinus rhythm, mentating well
Reassessment, sinus tachycardia with HR 120s and systolic blood pressures 140s
Mentating well
MP – Hospital #3

- GI performed upper endoscopy which did not show any acute bleeding
- Appeared to be acute duodenitis with diffuse erythema
- Recommended PPI drip and admission
Called back to the room for respiratory distress, followed by loss of pulses and respiratory effort
Now What?
Now What?

- ABC’s
  - Intubated
  - Symmetric breath sounds
  - Pulseless, does have slow organized electrical activity on the monitor
  - Pulses present with compressions
Differential for PEA?
Differential for PEA

- Hypovolemia
- Hypoxia
- H⁺ (acidosis)
- Hypo-/Hyperkalemia
- Hypothermia
- Hypoglycemia
- Thrombus (PE/MI)
- Trauma
- Tension Pneumothorax
- Tamponade (Cardiac)
- Toxins
Differential for PEA in this patient

- Hypovolemia
- Hypoxia
- H+ (acidosis)
- Hypo-/Hyperkalemia
- Hypothermia
- Hypoglycemia
- Thrombus (PE/MI)
- Trauma
- Tension Pneumothorax
- Tamponade (Cardiac)
- Toxins
Differential for PEA in this Patient

- Hypovolemic (GI Bleed)
  Given blood
  No change
Differential for PEA in this patient

- Hypoxia
  - Intubated
  - No improvement
Differential for PEA in this patient

- No suggestion of electrolyte abnormality on initial exam (Cr 1.28 but K⁺ normal)
- Repeat blood glucose normal
- Not hypothermic
Differential for PEA in this patient

- Toxins
  Received fentanyl and midazolam for the procedure
When do you give Flumazenil?
When do you give Flumazenil?

- Not on chronic benzodiazepines
- Not an alcoholic
- No seizure history
- Benzodiazepine overdoses are usually treated with supportive care, but consider if patient decompensates in front of you after you gave a benzodiazepine for sedation
Differential for PEA in this Patient

- Toxins
  - Received fentanyl and midazolam for the procedure
  - Given naloxone and flumazenil
  - No change
Differential for PEA in this Patient

- PE
Differential for PEA in this Patient

- PE

Can you give thrombolytics with a massive GI bleed?
Differential for PEA in this Patient

- Following a procedure
Differential for PEA in this Patient

- Following a procedure
  - Tension pneumothorax?
  - Cardiac tamponade?
Tension Pneumothorax
Tension Pneumothorax

- Penetrating chest trauma
- Tracheal or bronchial injury
- Occlusive dressing over open pneumothorax
- Positive pressure ventilation
Tension Pneumothorax

- Penetrating chest trauma
- Tracheal or bronchial injury
- Occlusive dressing over open pneumothorax
- Positive pressure ventilation
- Esophageal rupture
Treatment?
Needle Thoracotomy
Cardiac Tamponade

- Acute accumulation of fluid (blood) in pericardium is more associated with tamponade than gradual accumulation
Cardiac Tamponade

- Penetrating trauma
- Blunt trauma (rib or sternal fractures)
- Cardiac or vascular procedures (including central lines that penetrate the RA/RV or SVC)
- Pneumopericardium (with pneumothorax or pneumomediastinum)
Cardiac Tamponade

Pathophysiology
Pericardium usually has 25mL of serous fluid
Pericardium is not rapidly elastic
Can tolerate additional 80-120mL of fluid with little difficulty, but additional 20mL may double intrapericardial pressure
Cardiac Tamponade

- Exam
Cardiac Tamponade

- Exam
  - Beck’s Triad
Cardiac Tamponade

- Exam
  - Beck’s Triad
    - JVD
    - Hypotension
    - Distant heart sounds
Cardiac Tamponade

- Exam
  - Pulsus paradoxus
Cardiac Tamponade

Exam

Pulsus paradoxus

- Exaggeration of normal decrease in systolic pressure with inspiration
- > 12mm Hg is abnormal
- Not pathognomonic (asthma, obesity, heart failure, PE, cardiogenic shock)
Cardiac Tamponade

- Pulsus paradoxus
Cardiac Tamponade

- Exam
  - Ultrasound
Cardiac Tamponade

- Exam
  - PEA
Treatment?
Pericardiocentesis
Pericardiocentesis

Procedure

Attach a precordial (V) lead to the needle immediately after the skin is entered.

Advance the needle slowly, while aspirating, until fluid is returned.

Do not advance the needle after fluid begins to be returned.

If the epicardium is contacted, a current of injury pattern will be seen on the EKG monitor.
Pericardiocentesis

Contact with Epicardium

Needle Withdrawn
Pericardiocentesis

- Pericardiocentesis performed
- No return of fluid or air
- No change
MP – Hospital #3

- Code called after 45 minutes without return of spontaneous circulation
- Patient expired approximately 6 hours after arriving at our emergency department
Differential Diagnosis?
Post-Mortum

- Type A aortic dissection from aortic root through iliacs resulting in bowel necrosis
Aortic Dissection

Pathophysiology

3 layers of the aortic wall
- Intima, media and adventitia
- Degeneration of the media

Flexion of the ascending aorta and the descending aorta (distal to left subclavian) with each contraction of the heart

Forces of ejected blood weaken the intima
Aortic Dissection

- Pathophysiology
  - Column of blood passes through an intimal tear into the media
  - This hematoma can spread both proximally and distally in the weakened media
  - Hematoma eventually ruptures through the adventitia
Aortic Dissection
Aortic Dissection
Aortic Dissection

Classification

Stanford Classification

- Type A involves the ascending aorta (62%)
- Type B does not involve the ascending aorta (38%)
Aortic Dissection
Aortic Dissection

- Risk Factors
  - Male
  - Age > 40
  - Hypertension
  - Connective tissue disorder
  - Prior cardiac surgery
  - Bicuspid aortic valve
  - Family history
Aortic Dissection

- Symptoms
  - Pain (90%)
    - Excruciating, abrupt, sharp (> tearing)
    - Anterior with ascending
    - Back with descending involvement
    - Migrating (17%)
  - Visceral symptoms
    - Diaphoresis
    - Nausea/vomiting
    - Severe apprehension
Aortic Dissection

- Syncope
  - Present in 9% of dissections
  - Suggestive of dissecting into the pericardium and tamponade
  - May be due to hypovolemic shock
  - May be due to arrhythmias
Aortic Dissection

- Symptoms
  Depend on where blood flow is compromised
  - Stroke/coma
  - Pulse deficits/ischemia
  - MI (RCA most commonly involved)
  - Spinal arteries
  - Mesenteric ischemia
  - Renal failure
Aortic Dissection

- Diagnosis

<table>
<thead>
<tr>
<th>Table 83-2</th>
<th>Sensitivities and Specificities of Imaging Modalities for Diagnosing Aortic Dissection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST</td>
<td>TEE</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>98</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>95</td>
</tr>
</tbody>
</table>

CT, computed tomography; MRI, magnetic resonance imaging; TEE, transesophageal echocardiography.

Aortic Dissection

- **Treatment**
  - Opioids to decrease sympathetic tone
  - Reduce blood pressure (goal SBP: 100-120 mmHg)
  - Decrease rate of rise of arterial pressure (dP/dT) by keeping HR < 60 to reduce shear forces
  - $\beta$ -blockers
  - Caution with vasodilators which will have reflex increased heart rate (start $\beta$ -blockade first)
Aortic Dissection

- Surgery
  - Type A dissections require surgical repair
    - Resection of intimal tear and grafting
    - Possible AV replacement
  - Most type B dissections are managed with blood pressure control
    - Surgery for continued pain, major arterial trunk involvement, uncontrolled hypertension, frank leak/hemorrhage
Aortic Dissection
Aortic Dissection

- Interventional Radiology
  Some centers are performing interventional fenestration if renal or mesenteric ischemia

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