Stroke Update
Region VIII EMS Systems – August 2016
Objectives

• Review brain anatomy and physiology, including vascular supply
• Review the differences between ischemic/thrombotic and hemorrhagic disruptions in cranial blood flow
• Review signs and symptoms of stroke and highlight differences in special populations
Announcements

• System: Non Impaired refusals
• Region
  – SOP errors
  – Lidocaine
  – Dextrose IO administration
ADULT VENTRICULAR TACHYCARDIA WITH PULSE (WIDE COMPLEX TACHYCARDIA)

| 6. If VT persists, repeat **SYNCHRONIZED CARDIOVERSION** at recommended energy. Check rhythm and pulse between shocks. |
| 7. If VT persists, repeat **LIDOCAINE 0.5 mg/kg IV/IO** a 3 minutes **up to 3 g/kg**. |

Repeat **SYNCHRONIZED CARDIOVERSION** at recommended energy after each **LIDOCAINE** bolus.
SME Video-Dr. Valerie Phillips

- https://www.youtube.com/watch?v=gJvTOSV sho4
Cryptogenic Stroke

• The newest AHA/ASA (2016) initiative
• Initiative seeks to improve care for the estimated 200,000 people who suffer this type of stroke each year
• Ischemic stroke of undetermined cause
  – No identifiable hemorrhage
  – No identifiable thrombosis
Cryptogenic Stroke

- 1 in 3 ischemic strokes are labeled “cryptogenic”
- Likely causes of cryptogenic stroke include:
  - Atrial Fibrillation
  - Patent Foreman Ovale
  - Thrombophillias
  - Aortic arch plaque
  - Infection
  - Autoimmune inflammatory states
Cryptogenic Stroke
Stroke, aka *Brain Attack*

- A sudden, catastrophic event
- Focal neurologic impairment
- Most often caused by occlusion or rupture of an artery that supplies a specific region of the brain

*Brain Attack*
A little history

• More than 2,400 years ago the father of medicine, Hippocrates, recognized and described brain attack or stroke

• In ancient times brain attack was called *apoplexy*, a general term that physicians applied to anyone suddenly struck down with paralysis

• Johann Jacob Wepfer was the first to identify postmortem signs of bleeding in the brains of patients who died of apoplexy
AHA data shows that public knowledge of stroke warning signs remains poor.

In one study, fewer than ½ of 911 calls for stroke symptoms were made within one hour.

Fewer than ½ of those callers thought stroke was the cause of their symptoms.

California Acute Stroke Pilot Registry (CASPR) reported that fibrinolytic treatment within 3 hours could be 7x if patients arrived early after onset.
Statistics

- In the United States alone an estimated 6.8 million people ages >20 years have had a stroke.
- Each year 795,000 experience new or recurrent stroke.
- 130,000 die from a stroke making it the 5th leading cause of death.
Stroke is a Brain Attack!

- Every second 32,000 brain cells die
- Every minute 1.9 million brain cells die
- Within 12 minutes 23 million brain cells die

If you waste time, you waste brain! Call 9-1-1 immediately!
Public Campaigns
The “5 Suddens” / FAST

- Sudden
  - Weakness
  - Speech Difficulty
  - Visual Loss
  - Dizziness
  - Severe Headache
A & P Review - Layers

• Gray matter
  – AKA cerebral cortex
  – 20 mm thick (3/4”)
  – Contains centers of cognition, personality and complicated movements

• White matter
  – Network of fibers that enable the regions of the brain to communicate with each other
Classification of Stroke

Ischemic
- Thrombotic
- Embolic

Hemorrhagic
- Sub-arachnoid (SAH)
- Intra-cerebral (ICH)

Most strokes are ischemic, caused by the sudden blockage of an artery leading to the brain.
Ischemic - Thrombotic

- **Central thrombus**
  - Large vessel athero-thrombotic disease causes ~ 14% of ischemic strokes
  - Clots form in turbulent flow areas of a large artery or plaque suddenly obstructs flow

- **Small vessel disease**
  - Narrowing or blockage of a smaller penetrating artery accounts for ~ 27% of strokes

- **Both types cause decreased tissue profusion leading to neurotransmitter failure, anaerobic glycolysis, cerebral anoxia, and cerebral edema.**

### Characteristics: Thrombotic Stroke

<table>
<thead>
<tr>
<th></th>
<th>Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prodromal warning</td>
<td>Common</td>
</tr>
<tr>
<td>Onset during sleep</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Development</td>
<td>Gradual</td>
</tr>
<tr>
<td>Quick reversal</td>
<td>Possible</td>
</tr>
<tr>
<td>Bloody CSF</td>
<td>No</td>
</tr>
<tr>
<td>Coma</td>
<td>Rare</td>
</tr>
<tr>
<td>Decreased consciousness</td>
<td>Mild</td>
</tr>
<tr>
<td>Headache</td>
<td>Mild</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Common</td>
</tr>
<tr>
<td>Nuchal Rigidity</td>
<td>No</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Rare</td>
</tr>
</tbody>
</table>
Ischemic – Embolic

- Partial or complete blockage of a cerebral artery from embolic material, generally composed of cholesterol, plaque, blood, air, or tumor tissue that migrates to the brain.
- Often occur without warning.
- Symptoms may fluctuate due to continuing movement of the embolic matter within the blood vessel.

<table>
<thead>
<tr>
<th>Characteristics: Embolic Stroke</th>
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<td>Prodromal warning</td>
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</table>
Stroke

Ischemic stroke

A clot blocks blood flow to an area of the brain

Hemorrhagic stroke

Bleeding occurs inside or around brain tissue
Stroke

Hemorrhagic Stroke
- Weakened/diseased blood vessels rupture.
- Blood leaks into brain tissue

Ischemic Stroke
- Blood clots stop the flow of blood to an area of the brain
Hemorrhagic – Subarachnoid

- Aneurysms, arteriovenous malformations and other vascular hematomas may bleed, producing a subarachnoid hemorrhage
- Especially prevalent in 35 to 65-year-olds
- Accounts for ~ 7% of all strokes

<table>
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Hemorrhagic Stroke

20% of strokes
Uncontrolled bleeding in the brain

- Interruption of the blood flow - distal
- Flooding = Increased ICP

- Subarachnoid hemorrhage
  - Aneurysm in walls of large blood vessels
- Intracerebral hemorrhage
  - Rupture of cerebral blood vessel
Hemorrhagic – Intracerebral (ICH)

- Small, deeply penetrating arteries into brain tissue are susceptible to the loss of elasticity in chronic hypertension
- The expanding mass of blood can grow to the size of a golf ball or larger and project 2 to 3 cm into the brain tissue
- The mass causes pressure on cerebral tissues and nerves leading to death of neurons
- The hematoma also can disturb normal intracranial dynamics and cause a sudden rise in intracranial pressures

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Intracerebral Stroke

Intracerebral hemorrhage

Intracerebral hematoma
Intracerebral hematoma is an accumulation of blood inside the brain, caused by the rupture of a blood vessel.

Ruptured cerebral artery

Skull

Brain

Midline shift

Bleeding

Middle cerebral artery
Lifestyle Risk Factors

• Tobacco use
• Obesity, elevated cholesterol, and elevated lipids
• Physical
• Excessive alcohol intake
• Use of some illegal drugs, particularly cocaine in any form or any injected drug

Tobacco use is a major modifiable risk factor for stroke and heart disease.
STOP SMOKING
START REPAIRING

In 1 week
your sense of taste and smell improves

In 3 months
your lung function begins to improve

In 8 hours
excess carbon monoxide is out of your blood

In 1 year
a pack-a-day smoker will save over $4,000

In 5 years
your risk of a stroke has dramatically decreased

In 12 weeks
your lungs regain the ability to clean themselves

In 12 months
your risk of heart disease has halved

In 5 days
most nicotine is out of your body

EVERY CIGARETTE YOU DON’T SMOKE IS DOING YOU GOOD

quitline.13 7848
australia.gov.au/quitnow

VIA 9GAG.COM
Zones of Injury

- **Ischemic Zone**
  - Area of severe ischemia (< 25% normal blood flow)
  - Comprised of necrotic neurons and tissue
  - The core of this area is likely to die unless immediate action is taken

- **Ischemic Penumbra**
  - Rim of mildly to moderately ischemic tissue separating ischemic zone from normally perfused tissue
  - Cells in this region will die if reperfusion is not urgently undertaken
Why is the BP elevated?

• Blood pressure is often elevated in early stages of stroke, likely as a result of a relationship between the vascular occlusion and a call for elevated blood pressure (exact mechanism is still under debate)

• Less likely is the effect of “Cushing Reflex” such as occurs during traumatic intracranial pressure increases (spike in blood pressure mostly occurs early in a stroke process)
Hyperoxia

- The combination of poor perfusion and hypoxemia will worsen and extend ischemic brain injury and has been associated with worse outcomes.
- The AHA/ASA recommends supplemental oxygen if oxygen saturation < 94%.
- However, paradoxical injury associated with reoxygenation of previously ischemic cells due to the production of oxygen free radicals is noted in the literature.
Transient Ischemic Attack

- Now defined as a transient focal brain ischemia without radiologic evidence of infarction
- TIA is considered a strong indicator of possible future stroke
- American Stroke Association guidelines recommend approaching TIA with the same urgency as stroke
  - 15% of strokes are preceded by a TIA ignored by patients
  - After TIA, 12% experience stroke within 30 days, and up to 17% within 90 days
  - 25% of TIA patients die within a year
Stroke in Special Populations

• Women
  – Stroke kills twice as many women as breast cancer every year
  – Women can have unique stroke symptoms
    • Face and limb pain
    • Hiccups
    • General weakness
    • Nausea

• Young people and children
  – CDC notes increased risk of stroke among younger population including children and teens
  – Young adults with stroke are often misdiagnosed
    • Majority of cases are mistaken as inner ear disorder; also alcohol intoxication, migraine, and vertigo
Pediatric Stroke

- Stroke remains close to the top ten causes of death in children
- Majority occur in the perinatal period
- Most perinatal strokes a cause cannot be found
- The most focused period of risk for ischemic stroke in your lifetime is the week you are born
Pediatric Stroke

- Pediatric stroke present with different symptoms
- Recognition is often delayed
- Is a common as brain tumors in the pediatric population
- Of children surviving 60% will have permanent neurologic deficits most commonly hemiparesis or hemiplegia
Pediatric Stroke

- Warning signs for babies include:
  - Seizures
  - Extreme sleepiness
  - Tendency to use one side of their body
Risk factors

- Congenital heart defects
- Sickle-cell disease
- Immune disorders
- Diseases of the arteries
- Abnormal blood clotting
- Head or neck trauma

• Maternal history of infertility
• Maternal infection in amniotic fluid
• Premature rupture of membranes
• Pregnancy related hypertension
Treatment

• Each case of pediatric stroke is treated dependent on the specific cause of the stroke.
• Treatments are evolving
• Involve comprehensive monitoring
• Blood transfusions
• Medications
• Surgery
Childhood Stroke

• For children who have an initial stroke, the risk for recurrent strokes is between 15% and 18%
• Many children are misdiagnosed with more common conditions that mimic stroke such as migraines, epilepsy or viral illness
• Early recognition critical
Childhood Stroke
Signs and Symptoms

- Weakness or numbness of the face, arm or leg usually unilateral
- Trouble walking due to weakness or loss of coordination
- Problems speaking or understanding language
- Severe headache especially with vomiting or sleepiness
Signs and Symptoms

- Trouble seeing clearly in one or both eyes
- Severe dizziness or loss of coordination
- New appearance of seizures
- Combination of progressively worsening non stop headache, drowsiness and repetitive vomiting lasting days
- Complaint of worse headache of my life
STROKES CAN HAPPEN AT ANY AGE

PERINATAL STROKE
Last few months of pregnancy to 1-month-old

The cause in most perinatal strokes remains unknown.

Risk factors: Congenital heart disease, disorders of the placenta, blood clotting disorders, infections (e.g., meningitis)

CHILDHOOD STROKE
1-month-old to 18 years

Risk factors in children: Congenital heart disease, disorders affecting the brain’s arteries, infections affecting the brain or other organs

No previous risk factor is identified in about half of childhood stroke cases.

WARNING SIGNS

The cause in most perinatal strokes remains unknown.

RISK FACTORS

Risk factors in children: Congenital heart disease, disorders affecting the brain’s arteries, infections affecting the brain or other organs

No previous risk factor is identified in about half of childhood stroke cases.

SIGN OF A PERINATAL STROKE

Signs of a perinatal stroke may go unrecognized for months or years because the signs can be subtle.

NEWBORN:
Seizures may be an early sign:
Repeated twitching of face, arm or leg
Apnea (pauses in breathing) associated with staring

DEVELOPING CHILDREN:
Decreased movement or weakness on one side of the body
Showing a hand preference, or consistently reaching out with only one hand before 1 year of age

STROKES SIGNS FAST

Additional signs in children include:
Severe sudden headache, especially with vomiting and sleepiness
Weakness or numbness on one side of the body difficulty speaking or understanding others
Vision loss or double vision
Severe dizziness or loss of coordination
New-onset of seizures usually on one side of the body

TIME IS BRAIN AT ANY AGE

NEWBORN:
Quick recognition  Prompt medical evaluation and treatment

Babies:
Early diagnosis  Rehabilitation treatment can start while a young brain is still developing

DON'T DELAY!
Prompt diagnosis and treatment of stroke in children is as critical as it is in adults.

Learn more at ipediatricstroke.org and StrokeAssociation.org

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1 min. of brain ischemia can kill 2 million nerve cells and 14 billion synapses

**IMPORTANT**

1. Patients need to access 911 as soon as symptoms are recognized
2. EMS must rapidly assess patients and recognize stroke
3. EMS must notify receiving facility ASAP so Stroke Team can be activated
Stroke Alert Documentation

• In NEMSIS v3 (Illinois adoption late 2016), “Destination Team Pre-Arrival Alert or Activation” and “Date/Time of Destination Prearrival Alert or Activation” will be required elements.
• These elements are when EMS calls Medical Control requesting that an in-hospital team be activated.
• Current standard team notifications are Stroke, STEMI and Trauma.
Key Information for Medical Control

When was patient LAST SEEN NORMAL (for them)?
ADULT STROKE

BLS/ALS
1. Adult Initial Medical Care SOP, p. 4-5
   - Limit scene time
   - **Contact Medical Control at the initial point of contact, as soon as a clinical impression has been formed from assessment findings.**
   - Spinal Motion Restriction for unconscious patient with suspected trauma
   - Obtain and record time when last at baseline / **Last Known Well**
   - Obtain and record blood glucose level. If < 60, treat per **ADULT DIABETIC / GLUCOSE EMERGENcies, p. 30**
2. Protect airway, suction as necessary.
3. Maintain head and neck in neutral alignment. DO NOT flex neck. If systolic BP > 90 mmHg, elevate head of bed 15-30°.
4. Assess and record neurological status using GCS and note any changes.
5. Assess patient using the Cincinnati Prehospital Stroke Scale (CPSS) and document new findings:
   - New Facial Droop (have patient show teeth or smile)
   - New Arm Drift (patient closes eyes and hold both arms out)
   - New Speech Deficit (have patient say “You can’t teach an old dog new tricks”)
6. If the patient has an abnormal Cincinnati Prehospital Stroke Scale they should be transported to the closest Primary Stroke Center (PSC).
7. Transport patients with an unobtainable or normal Cincinnati Prehospital Stroke Scale with any of the following symptoms to the closest PSC:
   - New onset of sudden or persistent language deficiency
   - New onset of sudden unilateral numbness or weakness
   - New onset of severe sudden headache with vomiting with or without severe hypertension (systolic BP > 200 mmHg)
   - New onset of sudden and persistent alteration of mental status
   - New onset of severe and sudden loss of balance/new onset ataxia
   - New onset of sudden visual field loss in one or both eyes

ALS
Consider 12-lead ECG
1. **INTUBATE** if GCS score ≤ 8
2. Establish IV, limit IV attempts to 2
3. If seizure activity, refer to **ADULT SEIZURES / STATUS EPILEPTICUS, p. 32**
4. Call Medical Control early and communicate time when patient was last at baseline/Last Known Well (if known)
5. Transport to the closest Primary Stroke Center for continuation of stroke care
# AHA Stroke Guidelines

## Table 5. Prehospital Evaluation and Management of Potential Stroke Patients

<table>
<thead>
<tr>
<th>ABC’s</th>
<th>Monitor</th>
<th>Normoxia</th>
<th>IV</th>
<th>Blood Glucose</th>
<th>LKW + family contact info</th>
<th>Right Destination</th>
<th>Early Notification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess and manage ABCs</td>
<td>Do NOT initiate interventions for hypertension unless directed by medical command</td>
<td>Initiate cardiac monitoring</td>
<td>Establish IV access per local protocol</td>
<td>Do NOT administer excessive IV fluids</td>
<td>Determine time of symptom onset or last known normal, and obtain family contact information, preferably a cell phone</td>
<td>Triage and rapidly transport patient to nearest most appropriate stroke hospital</td>
<td>Do NOT delay transport for prehospital interventions</td>
</tr>
<tr>
<td>Do NOT administer dextrose-containing fluids in nonhypoglycemic patients</td>
<td>Provide supplemental oxygen to maintain O₂ saturation &gt;94%</td>
<td>Do NOT administer medications by mouth (maintain NPO)</td>
<td>Determine blood glucose and treat accordingly</td>
<td>Do NOT administer dextrose-containing fluids in nonhypoglycemic patients</td>
<td></td>
<td>Notify hospital of pending stroke patient arrival</td>
<td></td>
</tr>
</tbody>
</table>
CSS – Abnormal Facial Symmetry / Movement

The Cincinnati Prehospital Stroke Scale

**Facial Droop** (have patient show teeth or smile):

- Normal—both sides of face move equally
- Abnormal—one side of face does not move as well as the other side

Left: Normal. Right: Stroke patient with facial droop (right side of face).
CSS – Abnormal Limb Strength / Movement

Arm Drift (patient closes eyes and extends both arms straight out, with palms up, for 10 seconds):

- Normal—both arms move the same or both arms do not move at all (other findings, such as pronator drift, may be helpful)
- Abnormal—one arm does not move or one arm drifts down compared with the other

NOTE: If patient has obvious weakness or paralysis in any extremity (e.g., weak hand grasp), this qualifies as abnormal
Abnormal Speech (have the patient say “you can’t teach an old dog new tricks”):

- Normal—patient uses correct words with no slurring
- Abnormal—patient slurs words, uses the wrong words, or is unable to speak

*Interpretation:* If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%.
# Stroke Mimics

## Table 1. Features of Clinical Situations Mimicking Stroke

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychogenic</td>
<td>Lack of objective cranial nerve findings, neurological findings in a nonvascular distribution, inconsistent examination</td>
</tr>
<tr>
<td>Seizures</td>
<td>History of seizures, witnessed seizure activity, postictal period</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>History of diabetes, low serum glucose, decreased level of consciousness</td>
</tr>
<tr>
<td>Migraine with aura (complicated migraine)</td>
<td>History of similar events, preceding aura, headache</td>
</tr>
<tr>
<td>Hypertensive encephalopathy</td>
<td>Headache, delirium, significant hypertension, cortical blindness, cerebral edema, seizure</td>
</tr>
<tr>
<td>Wernicke's encephalopathy</td>
<td>History of alcohol abuse, ataxia, ophthalmoplegia, confusion</td>
</tr>
<tr>
<td>CNS abscess</td>
<td>History of drug abuse, endocarditis, medical device implant with fever</td>
</tr>
<tr>
<td>CNS tumor</td>
<td>Gradual progression of symptoms, other primary malignancy, seizure at onset</td>
</tr>
<tr>
<td>Drug toxicity</td>
<td>Lithium, phenytoin, carbamazepine</td>
</tr>
</tbody>
</table>
Scenario 1 - Situation

• Dispatched to assisted senior living facility for an unconscious patient, 0930 hours
  – 84 y/o male
  – Supine in bed
  – Unresponsive to verbal, responds to painful stimulus with left arm and left leg
  – Last Known Well time ~ 2 hours prior

• What other information do you need?
Scenario 1 – Primary Assessment

• GCS score 6 (E1, V1, M4)
• Airway – snoring respirations
• Breathing – 16/min
  – Lungs clear
• Circulation – Strong radial pulse, 80/min, irregular
• Disability – Right arm and leg appear flaccid, patient moves left arm and leg purposefully
  – Pupils 6 mm PERRL
Scenario 1 - SAMPLE

- **S** – Unconscious, LKW ~ 2 hours ago, appears to be flaccid on R side, had a “stomach ache” last evening and didn’t eat much dinner before bed
- **A** – No medication allergies
- **M** – Metoprolol (blood pressure), atorvastatin (cholesterol), multivitamin, aspirin (prophylaxis), insulin
- **P** – Coronary artery disease, high cholesterol, type 1 diabetes
- **L** – Dinner as described above, no apparent intake since
- **E** – Found by facility staff in bed when he did not appear for breakfast
Scenario 1 – Secondary Assessment

- Vitals – BP 136/88, P 88, R 16
- SpO2 – 95% RA
- 12-Lead ECG – Atrial Fibrillation @ 70-90
- Blood Glucose – 22
Scenario 1 - Treatment

- Oxygen?
- IV / saline lock
- Glucose 50% 25 gm (or 10% IV to effect)
  - If no IV, Glucagon 1 mg IM
- Pt awakens, GCS score 15, wants to sign refusal, will be fed and monitored by staff for recurrence
- Do you contact Medical Control?

Target SpO2 94-98% (92% if hx of COPD)

<table>
<thead>
<tr>
<th>Respiratory Assessment / Findings</th>
<th>Oxygen Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate rate/depth, minimal distress, mild hypoxia, baseline SpO2 92-94% (88-91% COPD)</td>
<td>Low FiO2</td>
</tr>
</tbody>
</table>
Hospital Therapy

Ischemic / Thrombotic
- Rapid identification
- IV thrombolytic administration (tPA or newer agents)
- Newer technologies
  - Intra-arterial thrombolysis
  - Angioplasty
  - Stenting

Hemorrhagic
- Rapid identification
- Controlling blood pressure
- Coiling or Clipping of aneurysms
- Craniotomy
  - Evacuate clots
  - Treat underlying bleed

Thrombolysis is the use of a thrombolytic drug to open a blocked artery.
Ischemic Stroke “Window”
Could Receive rtPA Within:

3 hours from symptom onset
- Diagnosis of ischemic stroke causing measurable neurological deficit
- Onset of symptoms < 3 hours before beginning treatment
- Age ≥ 18 years
- Multiple exclusion criteria involving bleeding, trauma, blood pressure and other factors

3 – 4.5 hours from symptom onset
- Diagnosis of ischemic stroke causing measurable neurological deficit
- Onset of symptoms within 3 – 4.5 hours before beginning treatment
- Additional Exclusions:
  - Age ≥ 18 years
  - Not a “Severe Stroke” (NIHSS score > 25)
  - No hx of both diabetes and prior ischemic stroke
  - Not age > 80
EKG of the Month

Atrial Fibrillation
• Atrial fibrillation
  – Rhythm in which the atria fibrillate or quiver without organized contraction
  – Cells depolarize independently
  – Usually a sign of a serious heart problem
  – Treat the patient, not the rhythm
• Due to asynchronous beating of atria and ventricle, blood can stagnate in either chamber
• High risk of thrombus formation in stagnant blood in insufficiently anticoagulated patients
• Risk of thrombotic occlusion of blood vessels (mostly brain and extremities)
Drug of the Month

Oxygen
Oxygen

- Colorless, odorless, gaseous element
- 28% of the atmosphere by volume
- Essential to all aerobic organisms

Mechanism
- Used to reverse states of hypoxemia
Oxygen

- Indications:
  - Confirmed or suspected hypoxemia
  - Ischemic chest pain
  - Respiratory insufficiency
  - Confirmed or suspected carbon monoxide poisoning
  - All other causes of decreased tissue oxygenation
  - Decreased level of consciousness

- Cautions:
  - Certain patients with COPD or emphysema poorly tolerate oxygen concentrations > 35%
  - Patients hyperventilating without confirmed hypoxemia may not require supplemental oxygen
Oxygen

• Adverse Reactions:
  – May cause respiratory depression in patients with states of chronic CO2 retention
  – If given in high concentrations to premature infants, may cause retinopathy (maintain FiO2 of 30-40%)
2016 SOPs: Oxygen

Evaluate oxygen saturation and consider need for supplemental oxygen, especially for patients with dyspnea, suspected hypoxemia or altered mental status.

**Target SpO2 94-98% (92% if hx of COPD)**

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<td>Adequate rate/depth, moderate/severe distress, SpO2 &lt; 92% (&lt; 88% COPD)</td>
<td>High FiO2</td>
</tr>
<tr>
<td>Inadequate rate/depth with moderate/severe distress, unstable</td>
<td>High FiO2 by BVM ventilation</td>
</tr>
</tbody>
</table>

- Hyperoxia contraindicated in uncomplicated myocardial infarction / STEMI, post-cardiac arrest, acute exacerbations of COPD, stroke, newly born / neonatal resuscitation. If supplemental oxygen is used in these patients, the goal is to relieve hypoxemia without causing hyperoxia (target SpO2 94%, not 100%).
Scenario 2 – Situation

• Dispatched for a reported accident with injuries
• Single car, 25 mph country lane, appears to have driven off lane and run into a hedgerow
• Very minor damage to car
• Driver front airbag deployed
• Single patient, ~60 y/o female, still in car and wearing lap/shoulder belt as you approach
Scenario 2 - Primary Assessment

- GCS score 13 (E4, V3, M6)
- A – Open, patient verbal
- B – Unlabored breathing 14/min
- C – Strong irregular radial pulse 108/min
- D – Left facial droop and weak movement on left side
  - CSS = Abnormal
    - Slurred speech, inappropriate words
Scenario 2 – SAMPLE

• At what point would you notify Medical Control of your initial findings?
  – S – as noted
  – A – Penicillin (medical alert bracelet)
  – M – Unknown
  – P – Unknown
  – L – Unknown
  – E – As described
Scenario 2 – Secondary Assessment

- Vitals – BP 196/102, P 104, R 14
- Lungs clear
- Pupils 5 mm PERRL
- SpO2 96% RA
- Blood glucose 131
- 12 Lead – Atrial fibrillation @ ~100
Scenario 2 – Treatment

**Oxygen?**

**IV / Saline lock**

**Protect airway**

**Reassure patient**

**Package for transport to closest appropriate facility (stroke center)**

**Re-contact Medical Control when enroute with additional findings (you should have already called them from scene with initial stroke notification)**
QUESTIONS?
Sepsis

EMS Education, Pre-Hospital Screening

Developed November 2015, Revised May 2016
Objectives

- Understand how to identify sepsis in pre-hospital patients
- List the components of the pre-hospital and ED sepsis screening tool
- Describe the Loyola sepsis bundle and LUMC SOP
What is the Importance?

- Sepsis is the number one cause of death at LUMC
- The two main goals are:
  - Early recognition of sepsis
  - Early treatment
- Each hour delay in administering effective empiric antimicrobials is associated with increased mortality
  - Pre-hospital recognition may impact mortality
Progression of Sepsis

- Sepsis progresses along in several steps.
- The sooner interventions are begun, the better the outcome is for the patient.
Progression of Sepsis

Systemic Inflammatory Response Syndrome

SIRS is an inflammatory state affecting the whole body when 2 or more of the following criteria are met:

<table>
<thead>
<tr>
<th>SIRS Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature &gt;38.3° C or &lt;36° C</td>
</tr>
<tr>
<td>Heart Rate (HR) &gt;90 bpm</td>
</tr>
<tr>
<td>Respiratory rate (RR) &gt;20 breaths/minute or PaCO2 &lt;32mmHg</td>
</tr>
<tr>
<td>WBC &gt;12,000/mcL or &lt;4,000 or more than 10% band neutrophils</td>
</tr>
</tbody>
</table>
Progression of Sepsis

Sepsis

- Sepsis is confirmed when a patient:
  - Meets 2 out of 4 SIRS criteria
  - Has a suspected Infection

For example: A 62 y/o patient arrives with a temperature of 39° C, HR 102 and complains of burning with urination. Family states the patient is less alert today.
Progression of Sepsis

Septic Shock

- Septic shock is a sepsis-induced hypotension that persists despite adequate fluid resuscitation
  - 30 mL/kg IV fluids

- Septic Shock Criteria:
  - SBP <90 mmHg
  - MAP <65 mmHg
  - SBP decrease greater than 40 mmHg from baseline
Pre-hospital Identification of Sepsis ECRN

- NEW Screening Tool
- Age 18 years and older
- Suspected Infection
- RR >20 bpm
- \(O_2\) Saturation <90%
- Heart Rate >90 bpm
- SBP <90 mm Hg
- Temperature/recent fever >100.9F or <96.8
- New Onset of Mental status Change
- \(O_2\) Sat less than 90%
- 3 or more = Positive Screen
Pre-hospital Identification of Sepsis

- If 3 or more “Yes”, Sepsis field criteria are present, proceed:
  - Administer oxygen to titrate pulse oximetry to a saturation >92%
  - If there is no concern of fluid overload, and lungs are clear, initiate a 0.9NS 500 mL fluid bolus.
  - If there is concern of fluid overload, and the patient is a normotensive, initiate fluid of 0.9NS at 20 mL/hr

- Notify ECRN of Sepsis criteria during communication and immediately upon arrival to the ED

- Exclusion: <18 years of age, Trauma, Cardiopulmonary arrest, Pregnancy, STEMI, Stroke
The goal is to identify patients with presumptive sepsis in the pre-hospital setting in order to facilitate early recognition, evaluation and treatment.

- **SEPSIS CRITERIA FOR EMS**
  - Suspected Infection
  - Respiratory Rate >20 breaths per minute
  - O₂ Saturation LESS than 90%
  - Heart Rate >90 beats per minute
  - Systolic Blood Pressure <90
  - Temperature/recent fever >100.9°F or <96.8°F
  - New Onset of Mental status Change

- **STOP if Sepsis Field criteria not met**

  - If 3 or more “Yes” + Infection, Sepsis field criteria are present, proceed:
    1. Administer Oxygen to titrate pulse oximetry to a saturation >92%
    2. If there is no concern of fluid overload, and lungs are clear, initiate a 0.9NS 500mL fluid Bolus.
    3. If there is concern of fluid overload, and the patient is a normotensive, initiate fluid of 0.9mL at 20mL/hr

Notify ECRN of Sepsis criteria during communication and immediately upon arrival in the emergency department.

Exclusion: <18 years of age, Trauma, Cardiopulmonary arrest, Pregnancy, STEMI, Stroke.
Take Home

- Sepsis is common and mortality rate are high
- EMS screening will help increase recognition of sepsis
  - Early recognition $\rightarrow$ early treatment $\rightarrow$ potential to decrease mortality
- Loyola is implementing pre-hospital sepsis screening SOP
  - Anticipated date: June 1, 2016 for pilot program with Broadview, Bellwood, and Maywood now System-wide as of August 15, 2016
References

- Surviving Sepsis Campaign  
  www.survivingsepsis.org

- Sepsis Management under Loyola Clinical Protocols