Sepsis, Severe Sepsis and Septic Shock
Evidence based approach
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Objectives
- Historical perspective
- Definition
- Epidemiology
- Protocol and Guidelines
- Evidence based approach
- Allegheny Health Network initiative

History of Sepsis
- Derived from a Greek word meaning PUTRID
- The Austrian obstetrician Ignaz Philipp Semmelweis and the English surgeon Joseph Lister in the 19th century
- Invasion of microorganisms or their toxins into the bloodstream together with the host response to this invasion

Definition
- Systemic, deleterious host response to infection
- Severe sepsis is acute organ dysfunction secondary to documented or suspected infection
- Septic Shock is severe sepsis plus hypotension not reversed with fluid resuscitation
- Hypotension is systolic BP < 90 mmHg or MAP <70
- Hypoperfusion is defined as infection-induced hypotension, elevated lactate or oliguria

Severe Sepsis: A Significant Healthcare Challenge
- Major cause of morbidity and mortality worldwide
- Leading cause of death in non-coronary ICU (US)*
- 11th leading cause of death overall (US) 15
- More than 750,000 cases of severe sepsis in US annually4
- In the US, more than 500 patients die of severe sepsis daily3

Sepsis is the #1 Cause of Medicare Inpatient Deaths

* Leading cause of death in non-coronary ICU (US)
†§ 11th leading cause of death overall (US)
4 More than 750,000 cases of severe sepsis in US annually
3 In the US, more than 500 patients die of severe sepsis daily
2016 updates

- $20 billion spent in sepsis in 2011 (5.2% of total hospitals costs)
- Incidence is increasing
- Pathobiology is still not fully understood

New 2016 definition

- Defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection

Why a focus on Sepsis?

- The Network has recognized how sepsis impacts patients. AHN has made Sepsis an organization initiative to standardize best practices and improve patient outcomes
- Beginning October 1, 2015 Sepsis began as a CMS (Centers of Medicaid and Medicare Services) core measure. They will begin to look at how care is provided to these patients

Severe Sepsis Protocol

- Highmark initiative
- Started at St Vincent Hospital in 2013
- Very successful
- Over 3 years, mortality has been reduced to below the national average

Key Concepts of Sepsis (2016)

- Sepsis is the primary cause of death from infection, especially if not recognized and treated promptly. Its recognition mandates urgent attention.
- Sepsis is a syndrome shaped by pathogen factors and host factors (eg, sex, race and other genetic determinants, age, comorbidities, environment) with characteristics that evolve over time. What differentiates sepsis from infection is an aberrant or dysregulated host response and the presence of organ dysfunction.
- Sepsis-induced organ dysfunction may be occult; therefore, its presence should be considered in any patient presenting with infection. Conversely, unrecognized infection may be the cause of new-onset organ dysfunction. Any unexplained organ dysfunction should thus raise the possibility of underlying infection.
- The clinical and biological phenotype of sepsis can be modified by preexisting acute illness, long-standing comorbidities, medication, and interventions.
- Specific infections may result in local organ dysfunction without generating a dysregulated systemic host response.

<table>
<thead>
<tr>
<th>TABLE 1: Diagnostic Criteria for Sepsis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection, documented or suspected, and one of the following</td>
</tr>
<tr>
<td>General variables:</td>
</tr>
<tr>
<td>Fever (temperature &gt;38°C)</td>
</tr>
<tr>
<td>Hypothermia (core temperature &lt;36°C)</td>
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<tr>
<td>Heat rate &gt;90/min in a patient &gt;70 years or &gt;100/min in a patient ≤70 years</td>
</tr>
<tr>
<td>Respiratory status:</td>
</tr>
<tr>
<td>Minimum arterial blood oxygen saturation &gt;90%</td>
</tr>
<tr>
<td>Lactic acidosis (arterial lactic acid &gt;4 mmol/L)</td>
</tr>
<tr>
<td>Hypoalbuminemia (albumin &lt;35 g/L)</td>
</tr>
<tr>
<td>Hypoglycemia (serum glucose &lt;70 mg/dL)</td>
</tr>
<tr>
<td>Hemodynamic instability, with at least two of the following</td>
</tr>
<tr>
<td>Hypotension (systolic blood pressure &lt;90 mm Hg)</td>
</tr>
<tr>
<td>Lactic acidosis (serum lactate &gt;4 mmol/L)</td>
</tr>
<tr>
<td>Hypothermia (core temperature &lt;36°C)</td>
</tr>
<tr>
<td>Hyperglycemia (serum glucose &gt;200 mg/dL)</td>
</tr>
<tr>
<td>Plasma C-reactive protein more than two or above the normal value</td>
</tr>
<tr>
<td>Plasma procalcitonin more than two or above the normal value</td>
</tr>
<tr>
<td>Hematocrit decrease or hemoglobin decrease &gt;4 g/dL in adults or less than two or above normal for age</td>
</tr>
</tbody>
</table>

4/25/2016
Severe Sepsis

**Organ dysfunction variables**
- Arterial hypoxemia (PaO2/FiO2 < 300)
- Acute oliguria (urine output < 0.5 mL/kg/hr for at least 2 hrs despite adequate fluid)
- Creatinine increase > 0.5 mg/dL or 44.2 μmol/L
- Coagulation abnormalities (INR > 1.5 or aPTT > 60 s)
- Leuk (absent bowel sounds)
- Thrombocytopenia (platelet count < 100,000 μL⁻¹)
- Hypotinobulinemia (plasma total bilirubin > 4 mg/dL or 70 μmol/L)

**Screening**

1. Baseline screening of potentially affected units if patients for sepsis to allow early implementation of therapy (grade 1C)
2. Hospital-based performance improvement efforts in severe sepsis (grade 1C)

**Caveats**

- In mechanically ventilated patients, a higher target of CVP of 12 to 15 mm Hg is the goal
Diagnosis

III. Diagnosis

1. Cultures as clinically appropriate before antimicrobial therapy if no significant delay (0-40 min) in the start of antimicrobial therapy in patients with severe sepsis or septic shock (grade IC)

2. Blood cultures (both aerobic and anaerobic) performed before antimicrobial therapy with at least 1 set per major body area and 1 set through each vascular access device, unless the device was recently (≤ 48 h) implanted (grade IC).

3. Use of the 2-site E. coli assay (grade IC), urinary and anti-enteric antibody assays (grade IC), if available and feasible, can aid in differential diagnosis of a source of infection.

4. Imaging studies performed promptly to confirm a potential source of infection (grade II).

Antibiotic Selection

Sepsis requires the correct antibiotic selection.

The SVH Severe Sepsis Order set (found in both the ER and Hospital McKesson system), has specific recommendations depending upon infection source:

• Pneumonia
• Urinary Tract Infection
• Intra-abdominal Infection
• Central Line Related
• Neutropenic Sepsis
• Unclear or Undetermined Source
• Clostridium difficile colitis

Source control

E. Source Control

1. A specific anatomic diagnosis of infection requiring consideration for emergent source control (e.g., abscess) is sought and diagnosed or excluded as rapidly as possible, and interventional techniques are undertaken for source control within the first 24 h after the diagnosis is made.

2. When clinical symptoms and signs are consistent with a specific source of infection, drainage is started, if appropriate, until definitive treatment of the associated infection has occurred (grade IB).

3. When source control is a surgical or medical procedure, the initial intervention associated with the least physiologic insult should be used, e.g., percutaneous catheter drainage rather than surgical incision of an abscess (grade IC).

4. If interventional source control, a possible source of severe sepsis or septic shock, is visible and present proximally after catheterization using a guidewire, source control must be achieved (grade IC).

Prevention of infection

F. Infection Prevention

1. Selective decontamination and selective digestive decontamination should be introduced and investigated as a method to reduce the incidence of ventilator-associated pneumonia. This infection control measure can then be initiated in health care settings and regions where this methodology is found to be effective (grade IB).

2. One chlorhexidine-impregnated catheter used as a form of original prophylaxis to reduce the risk of ventilator-associated pneumonia in ICU patients with severe sepsis (grade IC).
Surviving Sepsis Campaign Bundles

To be completed within 3 hours:
1. Measure lactate level.
2. Obtain blood cultures prior to administration of antibiotics.
3. Administer broad-spectrum antibiotics.
4. Administer 30 mL/kg crystalloid for hypotension or lactate ≥4 mmol/L.

To be completed within 6 hours:
6. Apply vasopressors for hypotension that does not respond to initial fluid resuscitation to maintain a mean arterial pressure (MAP) of 65 mm Hg.
7. In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥4 mmol/L, administer vasopressors.
8. Measure central venous oxygen saturation (ScVO2).
9. Remind the team if initial lactate was elevated.

*Targets for quantitative resuscitation included in the guidelines are CVP of 20 mm Hg, ScVO2 of ≥70%, and normalization of lactate.

Septic Shock Volume Status and Tissue Perfusion Assessment must be completed within 6 hours

- Focused exam- Physician, CRNP, or PA-C must document all 5 of the following:
  1. Vital Sign review
  2. Cardiopulmonary exam
  3. Capillary refill evaluation
  4. Peripheral Pulse
  5. Skin Exam

Hemodynamic support

G. Fluid Therapy of Severe Sepsis

1. Crystalloids as the initial fluid choice in the resuscitation of severe sepsis and septic shock (grade 1D).
2. Against the use of hydroxyethyl starch for fluid resuscitation of severe sepsis and septic shock (grade 1B).
3. Hemoconcentration to resuscitate severe sepsis and septic shock when patients are inadequately resuscitated (grade 2C).
4. Initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with a resuscitation dose of 30 mL/kg of crystalloids to prevent shock in patients who may already be dehydrated. More rapid administration and greater amounts of fluid may be needed in some patients (grade 1C).
5. Fluid challenge techniques and dynamic fluid administration are continued as long as there is hemodynamic improvement (either based on dynamic (dP/dt) or pressure changes, invasive or noninvasive) or static (eg, arterial pressure, heart rate, and variability).

Hemodynamic therapy

H. Vasopressors

1. Vasopressin therapy initially to target a mean arterial pressure (MAP) of 65 mm Hg (grade 1C).
2. Norepinephrine as the first choice vasopressor (grade 1B).
3. Epinephrine added, but norepinephrine should be used at a dose high enough to maintain adequate perfusion (grade 2B).
4. Vasopressin, D5W or glucagon can be added to norepinephrine (NE) with benefits of either increasing MAP or decreasing INH (grade 2B).
5. Low-dose vasopressin is recommended to the initial vasopressor treatment for vasopressor-induced hypotension (MAP < 70 mm Hg at 15 minutes start) and should be continued for sedation and therapy. An initial dose of norepinephrine (0.07 μg/kg/min) can be added to achieve adequate MAP with vasopressor agents (0.01 μg/kg/min).
6. Dopamine as an alternative vasopressor agent in nonresponder only in highly selected patients (eg, patients with low risk of hemorrhage and absence of relative organ hypoperfusion, grade 1A).
7. Dobutamine is not recommended in the treatment of shock. Dopamine can be used in specific clinical conditions where high norepinephrine is associated with severe hypotension (grade 1A).
8. Low-dose dopamine should not be used for renal protection (grade 1A).
9. All patients requiring vasopressors have an arterial catheter placed as soon as practical if resources are available (grade 1D).

Hemodynamic therapy

I. Inotropic Therapy

1. A fluid bolus of solution up to 20 mg/kg can be administered or added to vasopressor if used in the presence of hypovolemia or hemodynamic failure (grade 2C).
2. Norepinephrine can be added to increase cardiac output (grade 2B).

More therapy?

J. Corticosteroids

1. Not using corticosteroids in all shock patients (grade 1C).
2. Norepinephrine and dopamine can be added to the treatment of shock (grade 2B).
3. Norepinephrine can be added to the treatment of shock (grade 2C).
4. Corticosteroids can be added to the treatment of shock (grade 2C).
Dopamine?

- Epinephrine is the second agent of choice
- Phenylephrine produces less tachycardia but it may decrease stroke volume and it is recommended only when norepinephrine caused arrhythmias, cardiac output is high or as a salvage therapy
- Vasopressin may be added to Norepinephrine

Caveats

### Other therapies

K. Blood Product Administration

1. Once base hypertonic has resolved and in the absence of estivating circumstances, such as myocardial ischemia, severe hypoxia, acute heart failure or chronic heart failure, we recommend re-loading of vasopressor

2. Not using vasopressive as a specific treatment of anemia associated with severe sepsis (grade B)

3. Fresh frozen plasma can be used to correct labile coagulability in the absence of bleeding or planned invasive procedures (grade B)

4. Not using alprostadil for the treatment of severe anemia and septic shock (grade B)

5. For patient with severe sepsis, admission platelet plumply when platelets ≤ 150,000/μL (15 x 10^9/L) for the absence of apparent bleeding. We regard prophylactic platelet transfusions when platelets ≤ 50,000/μL (5 x 10^9/L) (grade B)

6. If the patient has significant risk following higher additive dosage ≥100,000/μL (≥ 10 x 10^9/L) are advised to avoid bleeding symptoms, or massive transfusions (grade B)

### ARDS

O. Mechanical Ventilation of Severe Acute Respiratory Syndrome (Severe Acute Respiratory Syndrome (ARDS))

1. Target tidal volume of 6-8 ml/kg ideal body weight in patients with sepsis-induced ARDS (grade A) or 15 ml/kg (grade B)

2. Pressure-controlled ventilator is recommended in patients with sepsis-induced ARDS and initial target goal for plateau pressure in an acutely infected lung be ≤30 cmH₂O (grade B)

3. Avoid high mean airway pressure (VAP) and/or any other maneuver that may result in increased VAP or other ventilator-induced lung injury (grade B)

4. Ventilation strategies that use lower tidal volumes (≤ 6 ml/kg) and lower peak pressures (≤ 30 cmH₂O) have been associated with lower mortality in septic ARDS patients (grade B)

5. The use of inhaled nitric oxide (NO) for the treatment of severe sepsis-induced ARDS has not been associated with improved outcomes (grade B)

6. The use of inhaled nitric oxide (NO) for the treatment of severe sepsis-induced ARDS has not been associated with improved outcomes (grade B)

### Sedation and analgesia

P. Sedation, Analgesia, and Neuromuscular Blockade in Sepsis

1. Continuous or intermittent sedation is recommended in patients who have been intubated or tracheostomized (grade A)

2. Neuromuscular blocking agents (NMBA) are not recommended in patients who have been intubated or tracheostomized (grade A)

3. The use of a mechanical ventilation with low tidal volume (≤ 6 ml/kg) and low peak airway pressure (≤ 30 cmH₂O) is recommended (grade B)

4. The use of a mechanical ventilation with low tidal volume (≤ 6 ml/kg) and low peak airway pressure (≤ 30 cmH₂O) is recommended (grade B)

5. The use of a mechanical ventilation with low tidal volume (≤ 6 ml/kg) and low peak airway pressure (≤ 30 cmH₂O) is recommended (grade B)
Glucose control

Q. Glucose Control
1. A critical care approach to glucose management in ICU patients with severe illness cannot be done given
   2-3 consecutive blood glucose levels of 180 mg/dl, or higher, in the absence of an acute medical illness (grade A).
2. Blood glucose values should be measured every 1-2 hrs post-glucose levels and insulin infusion rates are stable and every 4 hrs
   thereafter (grade C).
3. Glucose levels obtained with portable care testing of capillary blood should be interpreted with caution, as such measurements may not
   accurately reflect blood or plasma glucose values (SG).

Renal failure and HCO3

R. Renal Replacement Therapy
1. Continuous renal replacement therapies and hemofiltration/hemodiafiltration are equivalent in patients with severe acute
   and acute renal failure (grade B).
2. Use continuous therapies to facilitate management of fluid balance in hemodynamically unstable septic patients (grade B).

Prophylaxis

P. Deep Venous Thrombosis Prophylaxis
1. Patients with severe sepsis receive daily prophylaxis against venous thromboembolism (VTE) (grade B). This should
   be accompanied with daily leg and foot exercises (grade B), and routine daily leg exercises (grade B) to prevent
   deep venous thrombosis (DVT) (grade C).
2. Patients with severe sepsis should be treated with a combination of pharmacologic therapy and intermittent pneumatic compression
   devices, whenever possible (grade C).
3. Severe sepsis patients have an increased risk of developing deep venous thrombosis, intravenous heparin, intravenous heparin
   (grade B) is recommended as prophylaxis treatment, such as prophylactic compression stockings or intermittent compression devices
   (grade B). Continue concomitant therapy until the risk diminishes (grade C).

U. Mainline Uroprophylaxis
1. Select patient prophylaxis using the most effective and most cost-effective method (grade C).
2. When routine use of prophylactic measures is considered, patient pump infusions rather than I.V. (grade B).
3. Patients with renal failure do not require prophylactic measures (grade B).

Goals of care

W. Setting Goals of Care
1. Discuss goals of care and support with patients and families (grade B).
2. Incorporate goals of care with treatment and end of life care planning (grade B).
3. Address goals of care as early as feasible, but no later than within 72 hours of ICU admission (grade C).

Nutrition

V. Nutrition
1. Select a nutritional and respiratory feeding, an intravenous route rather than either complete feeding or provision of only
   central line glucose within the first 48 hours after a diagnosis of severe acute respiratory (grade C).
2. Avoid mandatory full calorie feeding in the first week (grade B), sugaring (up to 50% calories per day) (grade B).
3. Use continuous glucose and intravenous feeding rather than bolus parenteral (grade B) alone or parenteral nutrition in
   combination with enteral feeding in the first 7 days after a diagnosis of severe acute respiratory illness (grade C).
4. Use nutrition with specific immunomodulating supplements rather than nutrient providing specific immunomodulating
   supplements in patients with severe acute (grade C).

New 2016 Score system

- SOFA score system
- Grades abnormality by organ system
- Laboratory data is needed for completion
SOFA

<table>
<thead>
<tr>
<th>Organ system</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
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<tbody>
<tr>
<td>Pneumothorax</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
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<td>Respiratory</td>
<td>□</td>
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<tr>
<td>Renal</td>
<td>□</td>
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<tr>
<td>Systolic BP &lt;90</td>
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</tr>
</tbody>
</table>

qSOFA

- Quick assessment for Sepsis
- New/worsened altered mentation
- Respiratory rate >22
- Systolic BP <100
Objective

- Understand the definition and underlying pathophysiology of concussions
- Recognize signs of a concussion
- Know the domains of concussion symptoms
- Acutely evaluate and treat a patient with a concussion
- Review potential short and long term complications

Statistics: Sports - Related Concussions

- Estimated 1.6 to 3.8 million sports related concussions annually in US
- 1 million ED visits
- Greatest frequency in pediatric and young adult age ranges
- 9% of all athletic injuries at the high school level are concussions
- At high school level
  - 33% of concussions occur at practice
  - 47% of concussions occur in football

Traumatic Brain Injury

Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Level</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
</tr>
<tr>
<td>Mod</td>
<td>9-12</td>
</tr>
<tr>
<td>Severe</td>
<td>≤8</td>
</tr>
</tbody>
</table>

Definition

- Caused either by a direct blow to the head, face, neck or elsewhere on the body with an ‘impulsive’ force transmitted to the head.
- Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness.
- Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
- Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural one.
Definition Continued

Complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces and resulting in functional impairment.


Basic Science

- Biomechanical forces
  - Direct or Indirect blow
  - Rotational and shearing forces to brain
- Complex Pathophysiology
  - Shear forces -> random unorganized depolarization
  - Potassium efflux to extracellular space
  - Leads to increase of calcium and excitatory amino acids extracellularly
  - Energy mismatch
    - Na-K pumps restore balance
    - Tremendous glucose demand followed by a decrease in glucose metabolism
    - Paradoxical decrease in cerebral blood flow

Basic Science

- Functional Impairment
  - Rapid onset of short lived neurological impairment that resolves spontaneously
  - LOC may or may not be involved
  - No structural abnormality on CT or MRI

Signs and Symptoms: Domains

Physical Signs

- Headache
- Dizziness
- Nausea
- Vomiting
- Fatigue
- Vision changes
- Balance Difficulty

Sleep-Related

- Difficulty falling or staying asleep
- Sleeping more or less than usual
- Drowsiness
- Dreams/Nightmares
Behavioral Changes
- Irritability
- Emotional Liability
- Depression
- Anxiety

Cognitive Impairment
- Loss of consciousness
- Post-traumatic amnesia
- Difficulty concentrating
- Difficulty with memory
- Difficulty integrating new information

Evaluation
- Rule out serious structural injury
- Cervical spine evaluation
- Full Neurological exam
  - SCAT3: Includes GCS, SAC, BESS
  - Oculomotor exam
  - Neurocognitive testing

Neuroimaging: Rule Out Structural Injury
- Deterioration
- LOC for >5 min
- Confusion or conscious impairment for >30 min
- Persistent vomiting
- Convulsions
- Neurological deficits
- Patient factors
  - Uncooperative (intoxicated)
  - History of bleeding disorder or on anticoagulant
  - Children (+/-)

Guidelines from American College of Emergency Physicians
- Loss of consciousness or amnesia if at least one of the following present:
  - Diffuse headache
  - Vomiting
  - Age older than 60
  - Intoxication
  - Deficits in short-term memory
  - Evidence of trauma above the clavicle
  - Seizures
  - GCS score less than 15
  - Focal neurologic deficits
  - Coagulopathy

Neuroimaging: Rule Out Structural Injury
- Guidelines from American College of Emergency Physicians
  - No Loss of consciousness or amnesia if at least one of the following:
    - Focal neurologic deficit
    - Vomiting
    - Severe headache
    - Age older than 65
    - Signs of basilar skull fracture
    - GCS score less than 15
    - Coagulopathy
    - Significant mechanism of injury
### Cervical Spine
- Bony Tenderness
- Muscle spasm
- Range of motion

### Full Neurological Exam
- Mental Status
  - GCS
  - Orientation
- Cranial Nerves
- Motor/Sensory/Reflexes
- Coordination
  - Rapid alternating movements
  - Finger to nose
  - Heel to shin
- Cognition
  - Memory
  - Concentration (serial 7s, months in reverse)
- Gait/Balance

### Oculomotor
- Smooth Pursuit/Saccade
- Convergence/Accommodation
- King Devick

### Sport Concussion Assessment Tool
- Components
  - Glasgow Coma Scale
  - Standardized Assessment of Concussion
  - Balance Error Scoring System (BESS)
- Recommended as sideline assessment in Zurich consensus
- Influential factors
  - Age
  - Gender
  - Previous concussions
- Testing Setting

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Acute Concussion Evaluation Form

• CDC’s form for evaluation
• Discharge Instruction
• Outcomes after implementation in a pediatric ER
  • Increase in follow up with PCP or concussion specialist
  • Higher incidence of remembering being educated on symptoms, return to play, and school restrictions
  • Longer return to play time
  • More days of school missed


Neurocognitive Testing

• Test a range of cognitive function:
  • Memory
  • Attention
  • Reaction time
  • Processing Speed
  • Psychomotor speed
  • Fine motor coordination
• Examples
  • Impact
  • Automated Neuropsychological Assessment Metrics
  • Axon Sports
  • C-3 Logics

ImPACT

• Impact = Immediate Post-Concussion Assessment and Cognitive Testing
• Computerized test from the University of Pittsburgh Medical Center (UPMC)
• Demographic/Concussion History Questionnaire
• Concussion Symptom Scale
• Neurocognitive Measures Scores Generated
  • Verbal memory
  • Visual memory
  • Reaction time
  • Visual motor processing speed
• Detailed Clinical Report
  • Automatically computer scored
  • Outlines demographic, symptom, neurocognitive data

More information available at impacttest.com.
C3 Logix

- Developed by Cleveland Clinic
- Symptom checklist
- Neurocognitive testing
  - Reaction time
  - Memory
  - Processing Speed
  - Balance/Vestibular
  - Vision

C3 Logix Test

Treatment

- Cognitive and Physical rest
- Symptomatic treatment
- Patient Education

Physical and Cognitive Rest

- Physical Rest
  - No training, games, exercise, weights
  - Beware of exertion with activities of daily living
  - Sledding in winter/Bikes in summer
- Cognitive Rest
  - No ‘screens’, extensive reading, video games
  - Work/School
    - Not all concussions require extensive or any adaptation to academic life.

Symptomatic Treatment

- No FDA approved medications for treatment of concussions
- Physical
  - Headaches: Tylenol, SSRIs, Amitriptyline, amantadine
  - Neck pain: Muscle relaxants
  - Dizziness: Meclizine
  - Vision: Prism Glasses
- Cognitive
  - Stimulants
  - Behavioral
    - SSRIs
    - Amitriptyline
- Sleep-Related
  - Melatonin
  - Amitriptyline

Symptomatic Treatment

- Specialist referral options
  - Neuropsychologist
  - Cognitive Therapist
  - Neurologist
  - Physical therapist
  - Ophthalmology
  - Psychiatry
Patient Education
• Avoid Triggers
  • TV/Computers/Cell phones
  • Lights
  • Sounds
  • Medications
  • Tylenol
• Sleep
  • Sleep is good!!!
• Alcohol
• Driving
• Return to work/school
• Follow up

Recovered…?
• Ask the patient ‘Are you 100%?’
• Normal physical exam
• Off any meds that had been started
• Symptom checklist resolved or back to baseline
• Neurocognitive testing back to baseline

Return to Play
Table 1 Graduated return to play protocol

<table>
<thead>
<tr>
<th>Rehabilitation stage</th>
<th>Functional exertion at each stage of rehabilitation</th>
<th>Objective of each stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No activity</td>
<td>Complete physical and cognitive rest</td>
<td>Recovery</td>
</tr>
<tr>
<td>2. Light aerobic exercise</td>
<td>Walking, swimming or stationary cycling keeping intensity &lt;75% maximum predicted heart rate</td>
<td>Increase heart rate</td>
</tr>
<tr>
<td>3. Sport-specific exercise</td>
<td>Sledding drills in ice hockey, running drills in soccer. No head impact activities</td>
<td>Add movement</td>
</tr>
<tr>
<td>4. Non-contact training drills</td>
<td>Progression to more complex training drills, eg. pressing drills in football and ice hockey</td>
<td>Exercise, coordination, and cognitive load</td>
</tr>
<tr>
<td>5. Full contact practice</td>
<td>Proving medical clearance participate in normal training activities</td>
<td>Restore confidence and awareness functional skills by coaching staff</td>
</tr>
<tr>
<td>6. Return to play</td>
<td>Normal game play</td>
<td></td>
</tr>
</tbody>
</table>

Prevention
• Helmets
• Mouth Guards
• Neck muscle strengthening
• Rule Changes
• Aggression
• Practices

Second Impact Syndrome
• Occurs when an already injured brain gets impacted a second time
• Overall poorly understood
  • Characterized as rapid swelling of the brain
  • Usually fatal and at minimum causes extensive neurological impairment
• Vast majority suffering from SIS are male and under the age of eighteen
• 35 probable cases in a 23 year period

Chronic Traumatic Encephalopathy
• Cause and effect
  • Sub concussive/ concussive blows vs. underlying disease vs. genetic
• Symptoms
  • Cognitive decline
  • Aggression
  • Depression
  • ADHD
• Treatment
• Cases
  • 151 in literature today
<table>
<thead>
<tr>
<th><strong>SAINT VINCENT</strong></th>
<th><strong>Pediatric Considerations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Children and adolescents may require longer recovery time than adults</td>
</tr>
<tr>
<td></td>
<td>• As much as 10 days longer</td>
</tr>
<tr>
<td></td>
<td>• Most research applies to high-school aged and older</td>
</tr>
<tr>
<td></td>
<td>• Little is known about concussions in children</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SAINT VINCENT</strong></th>
<th><strong>Multiple Concussions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• No concrete rules on this</td>
</tr>
<tr>
<td></td>
<td>• Individualized plan based upon overall clinical scenario and desired activity.</td>
</tr>
<tr>
<td></td>
<td>• Concussion increases risk of recurrent injury with longer recovery times.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>SAINT VINCENT</strong></th>
<th><strong>Summary</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Increasing incidence and awareness</td>
</tr>
<tr>
<td></td>
<td>• Wide array of mechanisms can cause concussions; strike to the head doesn’t always equal a concussion</td>
</tr>
<tr>
<td></td>
<td>• Assessment tools available but must correlate with clinical evaluation</td>
</tr>
<tr>
<td></td>
<td>• REST!</td>
</tr>
<tr>
<td></td>
<td>• Follow up with PCP 4-6 days</td>
</tr>
<tr>
<td></td>
<td>• No great preventive measures</td>
</tr>
<tr>
<td></td>
<td>• Minimize long term risk factors by not returning to play before symptoms clear</td>
</tr>
</tbody>
</table>
Pediatric Emergency Medicine Updates: From Otitis Media to Cardiopulmonary Arrest

April 22, 2016

Dhimitri Nikolla, DO
Ravi Chekka, MD

Case 1

5yo M presents with fever and you find an otitis media on exam. He is up to date on his immunizations including his Pneumococcal and Haemophilus influenzae type B vaccines.

- Have these vaccines reduced his risk of acquiring otitis media and other infections from these organisms?
- If they do reduce his risk, are these organisms still the most likely causative bacteria? Does this change antibiotic choice?
4yo F presents with 3 days of fever, nausea, and vomiting. She is febrile on exam at 39 deg C, her eyes are sunken, but she is alert.

- You would like to treat her fever. What medication do you choose, ibuprofen or acetaminophen?

- What is her risk of acute kidney injury if ibuprofen is chosen?
Case 3

2yo M presents with his mother who states that he has been coughing, wheezing, and has a fever. You ask, “How high was the fever?” And she replies, “I don’t know. He felt like he had a fever.” His temperature now in the ED is 37.2 deg C.

• How accurate is maternal palpation at detecting and ruling out fever in children?

Case 4

10 month old F presents with her father via EMS stating that she had a fever and a seizure. The seizure lasted about 5 minutes, it was generalized, and it was her first one.

• What is her risk of having bacterial meningitis?

Case 5

10yo F with a PMHx of mild persistent asthma presents with her mother c/o wheezing and SOB worsening over the past three days. She takes inhaled fluticasone daily and albuterol as needed at home. Her last exacerbation requiring steroids was 6 months ago. She has never been intubated. You want to treat her with an oral steroid.

• How does single dose dexamethasone compare to a three day course of prednisolone?
yio F presents with her mother complaining of fever, wheezing, and tachypnea getting progressively worse for one day. There is no history of eczema or a family history of asthma in a first-degree relative.

- What are the AAP Bronchiolitis Recommendations pertaining to albuterol, nebulized hypertonic saline, steroids, antibiotics, and oxygen?
- What risk factors may portend central apnea?
9yo M presents with his father c/o abdominal pain for 2 days, N/V, and high fevers. On exam, he is drowsy but arousable, hypotensive, febrile, and has significant RLQ tenderness. You begin IVF and IV antibiotics.

- He remains hypotensive after two fluid boluses. You want to begin a vasopressor. Which do you choose?
- How quickly does he need to get to the OR?
Impact of Dispatcher-Assisted Bystander Cardiopulmonary Resuscitation on Neurological Outcomes in Children With Out-of-Hospital Cardiac Arrests: A Prospective, Nationwide, Population-Based Cohort Study

Yoshitaka Goto, MD, PhD; Tetsuo Mieda, MD; Yumiko Goto, MD, PhD

(J Am Heart Assoc. 2014;3:e000449 doi: 10.1161/JAHA.113.000449)

2010 American Heart Association Recommended Compression Depths During Pediatric In-hospital Resuscitations are Associated with Survival

Robert M. Sutton, MD, MScCE1; Benjamin French, PhD2; Dana E. Nilles, MS1; Aaron Donoghue, MD, MScCE1; Alexis A. Toussaint, MD, MScCE1; Akira Nishioka, MD, MScCE1; Jessica Leffelman, Heather Wolfe, MD1; Robert A. Berg, MD; Vinay M. Nadkarni, MD, MSc1; and Peter A. Mearney, MD, MPH1


Deeper chest compression – More complications for cardiac arrest patients??

Harsh MadHAVI1; Margo Sarron; Saiba Navigante; Ivan Huttala; Klaus T. Okinaka; Urii Tanaka; Sanee Hapoo

Critical Care Medicine:

Critical Care Medicine:
April 2015 - Volume 43 - Issue 4 - p 840–848
doi: 10.1097/CCM.0000000000004624

Clinical Investigations

Chest Compression Rates and Survival Following Out-of-Hospital Cardiac Arrest

Sawh L. H., Ahmed M. MD2; Gugley, Danielle MS2; Papal, Paul E. MD2; Brown, Sklofman K. MD2; Brooks, Stannes C. MD2; Callaway, Clifton W. MD, PhD1; Chandrasekar, Jan MD1; Davis, Daniel P. MD1; Daya, Moharram M. MD2; Gray, Ronald E. MD, MA Ed, NREMT-P1; Kudenchuk, Peter J. MD1; Laros, Jonathan NREMT-P1; Lin, Steve MD2; Meneguzzo, James J. MD2; Shoshani, Keller BSNF; Simpson, George MD, MPH1; Stiell, Ian J. MD, MSc1; Nichol, Graham MD2; Audet-Rickards, Tim P. MD1; for The Resuscitation Outcomes Consortium Investigators

<table>
<thead>
<tr>
<th>Chest Compression Rate Categories</th>
<th>ROSC</th>
<th>Survival to Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30 compressions/min (n = 258)</td>
<td>0.08 (0.04–0.12)</td>
<td>0.01 (0.00–0.02)</td>
</tr>
<tr>
<td>30–50 compressions/min (n = 1200)</td>
<td>0.06 (0.03–0.09)</td>
<td>0.01 (0.00–0.02)</td>
</tr>
<tr>
<td>50–70 compressions/min (n = 3240)</td>
<td>0.05 (0.03–0.07)</td>
<td>0.01 (0.00–0.02)</td>
</tr>
<tr>
<td>≥ 70 compressions/min (n = 5050)</td>
<td>0.04 (0.03–0.06)</td>
<td>0.01 (0.00–0.02)</td>
</tr>
<tr>
<td>Global test for ROSC</td>
<td>0.00</td>
<td>Global test for survival</td>
</tr>
</tbody>
</table>
Pneumococcal and Haemophilus influenzae type B vaccines have reduced infections from these organisms, but they remain the most common cause of otitis media.

Consider avoiding ibuprofen in dehydrated children.

When a mom says that she felt a fever, she was probably right!

Bacterial meningitis is rare in infants 6 to 11 months with first time simple febrile seizure.

Consider a single dose of dexamethasone in children with a mild to moderate asthma exacerbation.

Avoid steroids and antibiotics in bronchiolitis.
Summary

- Predictors of central apnea in infants:
  - Parental report of apnea
  - Previous history of apnea
  - Congenital heart disease
  - Birth weight ≤2.5 kg
  - Lower weight
  - Age ≤6 weeks are high risk features for central apnea.
- Time from symptom onset > 48 hr in appendicitis is associated with perforation and prolonged hospital LOS, not ED LOS.

References

References


49

References


50
In-Flight Medical Emergencies during Commercial Travel

What do they have

- Flight attendants
  - Trained in CPR
- AED
- Medical Kits
  - Vary between international and domestic flights
    - Aspirin, benadryl, IV lidocaine, Epi (1:1000 and 1:10,000), non-narcotic pain medication, nitro tabs, dextrose, atropine, albuterol

In-Flight Emergencies

- 1 in 604 flights
- Cardiac arrest – 0.3%
- Cardiac symptoms – 8%
- Syncope – 37%
  - Economy Class Syndrome
    - Virchow's triad
      - dehydration
      - immobilization
      - predisposing factors increasing the risk of deep vein thrombosis.
MONA – morphine for MI

- Association of intravenous morphine use and outcomes in acute coronary syndromes: results from the CRUSADE Quality Improvement Initiative. (2005)

IMPRESSSION 2016

Morphine delays and attenuates ticagrelor exposure and action in patients with myocardial infarction: the randomized, double-blind, placebo-controlled IMPRESSION trial

Academic EM

Patterson return after CT 2015

Weinstock 2015

- Review of prospectively collected database
- Outcome – arrhythmia, STEMI, arrest, death
- Primary Characteristics
  - Chest pain
  - Two negative troponins (0, >1 hrs)
- Secondary characteristics
  - Normal vital signs
  - No ischemic EKG changes, no LBBB, no pacer
- 2008-2013

Weinstock 2015

- 45,416 patients
- 11,230 met inclusion (primary)
- Adverse outcome – 20 (0.18% (0.11-0.27))
- 7,266 (Secondary)
- Adverse outcome – 4 (0.06% (0.02-0.14))
Weinstock 2015

- Low risk of MACE after two negative trops
- Rate of complications for hospitalization
  - 1 in ....

Lee et al. 2016

- Radiation exposure goes up
  - 25% anterior pelvis

Lee et al. 2016

- The effect of trauma backboards on computed tomography radiation dose

Fettiplace et al. 2015

- Confusion About Infusion: Rational Volume Limits for Intravenous Lipid Emulsion During Treatment of Oral Overdoses

Overview

- Cardiac arrest
- Flight Medicine
- Everything we know is wrong
- What happens after the ED visit?
- Tox articles  www.lipidrescue.org
- EM #1  www.acep.org
That is Going to Leave a Mark!
Updates in Trauma

Al Philip, MD, FACS, FCCM
AHN Trauma Director, etc. etc.

This is Not ACLS

- The ABC’s changed in ACLS for a reason
  - Most survivable arrests aren’t GSW
  - Defibrillation the key to survival
- Defibrillating doesn’t fix:
  TBI, liver lac, crushed pelvis, etc.

Old Woman on Coumadin Faints

- Admitted for syncope workup
- “Feels fine” so little else looked at...
- Until she arrests

Not an Update: Still ABCDE

- Airway with c-spine stabilization
- Breathing with supplemental O2
- Circulation with hemorrhage control and IV access
- Disability with neuro exam
- Exposure with temperature control

Having Said That...Some “New” ATLS Tweaks...

- Video tools for airway replace bronchoscopy
  - Cuffed ETT for all children > 1yo
- “Balanced resuscitation” of blood products (after 1L crystalloid)
- Pelvis as source of blood loss, with binder/blood
- DPL and pericardiocentesis replaced with ultrasound

Rates Actually Falling
USA Vs. “Modern” Nations

Murder with Firearms by State

What People Use to Kill Other People in the USA

“THREAT” Approach

- Threat suppression
- Hemorrhage control
- Rapid Extraction
- Assessment by medical providers
- Transport to definitive care
Efforts Locally

- Hospital based violence intervention program
  - Partnership between regional trauma centers
  - Funded largely by foundation grants
  - Available to all victims of violence

- Pittsburgh gun violence coalition
  - Seeks to codify local/regional gun violence
  - Identify highest risk populations and direct community intervention

Richard Garland, Pitt Public Health

That’s a Lot of Blood!

- Ongoing hemorrhage = worse outcome
- Transfusion has complications
- Acute hemostasis falls into
  - Stop external bleeding
  - Stop internal bleeding
  - Stop coagulopathic bleeding

The Ideal Topical Hemostatic

- Stops hemorrhage
- Doesn’t clot working vessels
- Limited side effects
- Easy to store and use
- Cheap

Topical Hemostatics

- Combat Gauze is TCCC recommended 1st line
  - Medics prefer gauze due to ease of application
  - Kaolin mineral

Comparison of novel hemostatic dressings with QuikClot combat gauze in a standardized swine model of uncontrolled hemorrhage

Jason M. Rall, PhD, Jennifer M. Cox, BS, Adam G. Senger, MD, Ramon E. Costers, MD, and James B. Rose, PhD, San Antonio, Texas

CONCLUSION: These results suggest that the combat gauze product is better, based on a study by the current Committee on Tactical Combat Casualty Care and the standard for point-of-care technology derived. Despite these differences, no single one was superior in all areas. No statistical difference in blood loss, time to hemostasis, or survival.

No one gauze was superior in all areas
Evaluation of the iTClamp 50 in a human cadaver model of severe compressible bleeding

Kelly Murrut, MSC, Donnie Filips, MD, Sarvottal Logchetty, MD, and Jan Atkinson, PhD, Edmonton, Alberta, Canada

J Trauma, 2013

Self-expanding polyurethane polymer improves survival in a model of noncompressible massive abdominal hemorrhage

Michael Duggan, BV M, Adam Ruse, NS, Upma Sharma, PhD, Greg Zagonis, PhD, Toby Freeman, PhD, Rami Benid, BS, John Cashman, NS, Gyesye-Pham, PhD, Venkatsi Cheng, PhD, All Stiglitz, MD, John Raulo, BS, George Valentiou, MD, PhD, Marc deMars, MD, Lawrence Zuckerberg, MD, Tae Fong Ng, PhD, and LTC David R. King, MD, MC, USA

J Trauma, 2011

Self-expanding foam for prehospital treatment of severe intra-abdominal hemorrhage: Dose finding study

Miroslav P. Pore, MD, Adam Ruse, PhD, NS, John O. Balsevich, MD, Michael A. Duggan, BV M, John Beagle, BS, John Marini, BS, Greg Zagonis, BS, Mark Broekl, PhD, Info Freeman, PhD, George S. Valentiou, MD, PhD, Marc A. deMars, MD, Daniel Batek, MD, Peter J. Engels, MD, Upma Sharma, PhD, and David Richard King, MD, Boston, Massachusetts

J Trauma, 2014

What’s Available Now

• PRBC
• Plasma
• Platelets
• Cryoprecipitate
• Recombinant Factor VIIa
• Prothrombin Complex Concentrate (PCC)
• FEIBA

Prothrombin Complex Concentrate

• Problem is loss of factors – “watery Coolaid”
• PCC contains factors II, VII, IX, X, and proteins C/S – 1 dose PCC = 10u FFP
• Theory is that clotting includes multiple components

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

Summary

Background: Tranexamic acid can reduce bleeding in patients undergoing surgery. We assessed the effects of early administration of a single dose of tranexamic acid on death, vascular occlusive events, and the volume of blood transfusion in trauma patients who sustained severe haemorrhage:

Methods: This randomised controlled trial was undertaken in 279 hospitals in 49 countries. 24,231 adult trauma patients with a rise of significant bleeding were randomly assigned in 1:1 ratio to either tranexamic (a dose of 1 gram in 50 ml delivered in 10 minutes) or matching placebo. Both participants and study staff (who investigated and held contributing centre were masked to treatment allocation. The primary outcome was death in hospital within 28 hours of injury, and was described with the following categories: bleeding, vascular occlusion (pulmonary infarction, stroke, and pulmonary embolism), multiple organ failure, and death. All analyses were in intention to treat. The study is registered on ISRCTN06075086, ClinicalTrials.gov NCT00701228, and WHO African Clinical Trial Registry ISRCTN30140795.

Results: Tranexamic acid was allocated to 12,225 patients and 12,006 to placebo, of whom 10,360 and 10,196, respectively, were evaluable. 2,701 patients were excluded for various reasons. Among all 21,421 patients, patients randomised to tranexamic acid had a significantly lower risk of death in hospital within 28 days of injury (HR 0.69, 95% CI 0.57 to 0.83, p = 0.0004). Tranexamic acid reduced the risks of death, vascular occlusion, and need for blood transfusion, and was associated with a significant reduction in survival rates in all subgroups of patients (p < 0.0001).

Interpretation: Tranexamic acid safely reduced the risk of death in bleeding trauma patients in this study; the basis of these results, tranexamic acid should be considered for use in clinical practice.

Funding: UK NHS Health Technology Assessment Programme, Sainsbury Foundation, and EF Education Medical Charitable Foundation.
A Big % Deal

- Demonstrated increase in SURVIVAL
- Really, really cheap
  - $200 compared to $5000+
- Bolus followed by an infusion
  - Few hemodynamic side effects
  - Must be used early to be effective
- However, bleeding stops....

The impact of preinjury anticoagulants and prescription antiplatelet agents on outcomes in older patients with traumatic brain injury

Kimberly A. Peck, MD, Richard Y. Cahng, PhD, Tanya, Mark S. Schechter, MD, C. Beth Sisc, MSN, Jennifer E. Lark, BA, McKens C. Shanker, BA, Steven R. Shanker, MD, Michael J. Sisu, MD, and Donald J. Rinkieon, MD, San Diego, California

CONCLUSION: Older TBI patients premedicated with any anticoagulant or antiplatelet agents and other advanced antiplatelet agents had a higher risk of in-hospital mortality, and other advanced antiplatelet agents were associated with a higher risk of mortality. (J Trauma Acut Care Surg 2013;75:411-415. Copyright © 2013 by Lippincott Williams & Wilkins)

higher mortality

Thromboelastography (TEG)

Resurgence of Intraosseous Lines?

- Limited data (other than from companies)
- Increasingly difficult population
  - Older patients
  - Heavier patients
- Several series showing safe prehospital placement and use

Tranexamic acid in trauma: How should we use it?


What We Know

- TXA improves survival a bit in traumatic bleeding
- Most pronounced in the sickest group
- Most pronounced when started quickly
- Not associated with increased thrombosis

What We Don’t Know

- How exactly it works
- What optimal dosing is
- Whether it works for other kinds of bleeding

Guidelines for the Receipt of Antifibrinolytics in the Setting of Injury or Life-Threatening Hemorrhage

<table>
<thead>
<tr>
<th>Agent/Route</th>
<th>Indication/Contraindication/Agent</th>
<th>Dose/Concentration</th>
<th>Reference</th>
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<tr>
<td>TXA 50mg/ml</td>
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</tr>
</tbody>
</table>
Where to Put It?

- Tibia most common
  - Proximal
  - Distal
- Sternal
  - Not widely used outside military
- Humerus increasingly used
  - Much higher flow rates (5 vs 1 L/hr)
  - Technically more difficult

One Cell To Rule Them All

- Embryonic Stem Cells
  - Much more powerful
  - Acquisition an issue
- Adult Stem Cells
  - Less powerful
  - Easier to obtain (bone marrow)

Success?

- Barcelona, Spain 2008 – BMSC used to develop trachea
  - Rare transplant not requiring immunosuppression
  - Limited function of trachea
- Osaka, Japan 2009 – BMSC used in spinal cord injury patients
  - Showed some improvement
  - Small series being generated

The Vision

- Patients supported through injury/organ failure
- When stabilized, stem cells used to regenerate damaged organs which are printed
  - Brain/Spinal Cord
  - Liver/Kidney
  - Tissue for wound coverage

What’s Cooler than Cool? Robots!

- Already used for eICU
  - Centralized ICU care
  - “Eyes on” with a screen
- How about the next step of cyborg?
So Close...But Not There...

- 6 million crashes/year in US
  - 2 million injuries
- 26,000 crashes analyzed
- Data for velocity, change in velocity, seat belts, air bag deployment, etc.
- Sensitivity 32%

So...Does it Work?

- “Force multiplier” in “less than ideal situations”
- Does not appear to replace trained medic
- What if no medic is available...

Who Should We Transfer?

- Anyone that “exceeds institutional resources”
- Obviously a moving target...
- Consider:
  - Complex Ortho
  - CNS injury
  - Multisystem trauma
  - Hemorrhage without ability to control locally

Who Should We Transfer?

- The answer from AGH should be “YES”
- If it isn’t, call me directly

THE ONLY ANSWER IS YES
HUMAN LIVES FOR SALE:

NO COUPONS NECESSARY

The International Labor Organization estimates that forced labor and human trafficking is a $150 billion industry worldwide.

The U.S. Department of Labor has identified 136 goods from 74 countries that are made by forced labor and or child labor.

Coffee, strawberries, blueberries, bananas, cakes, tomatoes, chocolate, tulip, shrimp, sugarcane, Brazil nuts, cashews, pineapples, rice, lobster, melons, vegetables, tea, tobacco, cocoa, coffee, soy sauce, fish, oil, gas, rubber, cotton, tobacco, shoes, toys, clothing, textiles, electronics, and other goods.

Diamonds, rubies, gold, electronics, pornography, fireworks, clothes, shoes, toys, fabric, yarn, thread, bricks, timber

Human Trafficking:

- “The recruitment, transportation, transfer, harboring, or receipt of a person through force, fraud, or coercion, for the purpose of exploitation.”
- Commercial Sex Trafficking
- Labor Trafficking
- Domestic Servitude

<table>
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<tr>
<th>Act</th>
<th>Means</th>
<th>Purpose</th>
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Commercial Sex Trafficking
- Forcible prostitution
- Pimp, gang, organized crime
- Intimate partner/familial
- In the streets, motels, truck stops, residential brothels, online escort services
- Commercial-front brothel (labor and sex)
- Massage, nail, hair salon
- Pornography/internet
- Exotic dancers (labor and sex)
- Bars, strip clubs, etc.
- Mail order brides or arranged marriage

Labor Trafficking
- Domestic servitude
- (slave maid, labor and sex)
- Agricultural, ranching, landscaping
- Mining, fishing
- Factories (skilled and unskilled laborers)
- Construction sites
- Motel, hotel, janitorial
- Restaurant, food and shops
- Sales crews
- Street begging
- Elder care facilities

Domestic Servitude
- (slave maid, labor and sex)
- Agricultural, ranching, landscaping
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Diamonds, rubies, gold, electronics, pornography, fireworks, clothes, shoes, toys, fabric, yarn, thread, bricks, timber

Vulnerabilities
- Poverty
- Limited education
- Language barriers
- Unfamiliar with rights or services
- Low self-esteem
- Real or perceived opportunity for a better life
- History of abuse
- History of discrimination
- Mental health/addiction problems

Vulnerable Populations
- Minors
- Girls
- LGBTQI
- Runaway/Homeless
- Orphans
- Women and girls
- Migrants
- Indigenous groups
- Refugees

80% of victims of sex trafficking in the U.S. are U.S. citizens (DOJ)

100,000 – 300,000 youth at risk each year for DMST (National Center for Missing and Exploited Youth)

40-70% of runaways engage in prostitution to meet their basic needs

In 2014, an estimated 1 out of 5 endangered runaways reported to the National Center for Missing and Exploited Children were likely child sex trafficking victims.

Of these, 74% were in the care of social services or foster care when they ran.
Red Flags

- Environmental/ Situation
- Suspicious employment situation
- Dependence on "friend" or co-worker to answer questions
- Abusive relationships
- Verbal/Emotional/ Psychological
- Providing health provider with contradictory information
- Suicidality, depression
- Fearfulness, anxiety, trauma symptoms

Medical Indicators:
- Medical indicators:
- Delayed medical care
- Headaches
- Fatigue
- Abdominal Pain
- Back pain
- Severe/untreated dental problems
- High blood pressure
- Malnourishment
- Drug or alcohol addiction

Medical Indicators:
- Headaches
- Fatigue
- Abdominal Pain
- Back pain
- Severe/untreated dental problems
- High blood pressure
- Malnourishment
- Drug or alcohol addiction

Psychological Indicators

Psychological trauma of daily mental abuse and physical abuse: depression, anxiety, suicidal ideation, stress related disorders, disorientation, confusion, phobias and panic attacks.

Feelings of helplessness, shame, guilt, humiliation, shock, denial or disbelief.

PTSD and dissociative disorders: numbness or flat affect.

Drug and alcohol issues.

Fear of law enforcement or other authorities.

Trauma bonds or Stockholm Syndrome

Lack of self or identity

Branding and Tattoos

States she lives with a lot of other people in her house

Accompanied by an older woman who does not speak English

Well dressed

Anxious

Declines CXR and states, “I have to get back”

Will not answer domestic violence screening

The Making of a Girl

https://youtu.be/Zv0lYa3PAh

Chief Complaint: Cough and Congestion

States she lives with a lot of other people in her house

Accompanied by an older woman who does not speak English

Well dressed

Anxious

Declines CXR and states, “I have to get back”

Will not answer domestic violence screening
How to respond

Use the same word that the patient uses

Expect unexpected narratives and stories

Use your authority to create a safe place for the patient

Do they feel safe?

Do they feel safe talking with you right now?

When was the last time they received medical care?

What are their immediate needs medically, physically etc.

Document your conversations with the patient.

Have the victim’s consent to contact local authorities and collaborate with local supportive agencies.

Use a victim centered trauma informed approach when talking with your patient

Be mindful of your own safety, you are dealing with a trafficker’s business.

Methods of Control

- Providing basic needs
- Faking a romantic relationship
- Isolation
- Violence or threat of violence (threatens family, kids, friends)
- Physical restraints
- Forced drug intake, addiction
- Shaming and blackmailing victims (usually with photos or video).

- Controlling victims’ money
- Debt bondage- imposing false debts or financial obligations
- Confiscating travel documents or identification
- Threat of police/immigration
- Limiting contact with family
- Continuous relocation
- Religion/Cultural beliefs

Prevalence in Pittsburgh

- Domestic Minor Sex Trafficking
  - 1,600 Missing persons in PGH, primarily habitual youth runaways
  - FBI receives a new DMST case almost every day
  - Successful prosecution in January 2014

- Sex Trafficking
  - Adult and child victims; foreign and U.S. citizens; females and males
  - Commercial front brothels; residential brothels; pimp or gang controlled; intimate partner/familial, truck stops

- Labor Trafficking and Labor and Sex Trafficking
  - Agriculture, landscaping, restaurant, factories are primarily adult male foreigners, sometimes boys
  - Sales crews are usually domestic minors
  - Nail/hair salons, domestic servitude are usually foreign adult females

2015 Polaris Statistic Map

Resources

Local Law Enforcement or 911

Carol Finotti
Abby Widdowson

814-455-9414
Guillain-Barre’ Syndrome

Daniel Myers, MD

Case presentation

- 18 yo female
- Local college student
- Visiting student from Indonesia
- HPI: Illness onset 1 week ago
  - Cough, low grade temperature, sore throat
  - Seen at campus health center and diagnosed with bronchitis and otitis media
  - RX given for Amoxicillin
  - Steroids
  - Cough medicine

Case presentation

- 18 yo female
- Past medical history
  - No medical problems
- Past surgical history
  - No surgery
- Social history
  - No smoke, no drink, no drug use, no recent travel
- Medications
  - None
- Allergies
  - Amoxicillin

Case presentation

- ED visit #1
  - Comes to ED with nausea, vomiting, cough and sore throat
  - Prior day with recurrent vomiting
  - That was the symptom that prompted the ED visit
  - She has myalgias- mostly her legs
  - No weakness
  - Complained of fever

Case presentation

- ED visit #1
  - Vital signs
    - 126/72, 76, 98H, 36.4
  - Examination
    - Unremarkable exam
  - Labs
    - WBC = 12.6
    - LFTs- WNL
    - BMP normal with normal glucose and calcium
    - UA
      - +2 ketone, +1 esterase, 3-5 RBC, 10-20 WBC, 10-20 squamous cells, many bacteria
  - Treatment
    - Patient given IV fluids, Zofran and Toradol
    - Nausea was improved
    - Prior to discharged complained that her legs felt restless and she needed to get up and walk
    - Urine cultured
    - Rx given for Keflex to cover possible UTI and Zofran for vomiting
Case presentation

- ED visit #2
  - Following day
    - Patient found by a friend at home on floor. Complains of leg weakness and will not stand and walk, comes to ED via EMS
    - Complains of nausea and sore throat
    - Vitals 120/80, 84, 16, 100%, 36.6
    - Lab work essentially unchanged

Guillain-Barre' Syndrome

- Acute peripheral neuropathy and a polyneuropathy
  - Typically affects both peripheral spinal nerves and may effect cranial nerves
  - Autoimmune mediated
  - Classic symptoms of ascending paralysis and areflexia
  - Multiple subtypes of the illness

Guillain-Barre’ Syndrome

- Jean Baptiste Octave Landry de Thézillat
  - French physician and researcher
  - Described 10 cases of Guillain-Barre’ in 1859.

Guillain -Barre’ Syndrome

- Other names
  - Landry’s Ascending Paralysis
  - Guillain-Barre’-Strohl Syndrome
  - AIDP
    - Acute inflammatory demyelinating polyradiculoneuropathy
  - French polio
  - Variants
    - AMAN: Acute motor axonal neuropathy
      - Chinese paralytic syndrome
    - AMSAN: Acute motor and sensory axonal neuropathy
    - Miller-Fisher syndrome

Guillain-Barre’ Syndrome

- Georges Charles Guillain
  - French physician and neurologist
- Jean Alexandre Barre’
  - French physician and neurologist
  - Also worked with a physician named Babinski
- André Strohl
  - French physician and physiologist
Guillain-Barre’ Syndrome

- Acute polyneuropathy felt to be secondary to an immune mediated peripheral nerve myelin sheath and axonal injury
- Antibodies form in response to an illness, usually an upper respiratory infection (often viral).
  - Also associated with Campylobacter jejuni infections
- These antibodies then damage the myelin sheath and axon causing weakness, pain and paresthesia

Molecular Mimicry

- Antibodies form in response to an illness, usually an upper respiratory infection (often viral).
- Antibodies form in response to an illness, usually an upper respiratory infection (often viral).
- Also associated with Campylobacter jejuni infections
- These antibodies then damage the myelin sheath and axon causing weakness, pain and paresthesia

Guillalian-Barre’ Syndrome

- Epidemiology
  - Mean age of onset of 40 years
  - Affects slightly more males than females of all ages, races and nationalities.
  - The worldwide incidence of GBS ranges from 0.6 to 4.0/100,000 people.
  - Literature review of the epidemiology of GBS found the overall incidence of GBS to be 1.1 to 1.8/100,000 and it was however lower in children at 0.34 to 1.34/100,000
  - The incidence of GBS increases after age 50 years from 1.7/100,000 to 3.3/100,000.
  - Two-thirds of cases of GBS are associated with an antecedent infection.
  - Most cases are sporadic although epidemics have been reported

Guillain-Barre’ Syndrome

- Variants
  - Acute inflammatory demyelinating polyradiculoneuropathy (AIDP)
    - Multifocal peripheral demyelination
    - Slow remyelination
    - Probably both humoral and cellular immune mechanisms
  - Most common subtype (up to 90 percent of GBS cases in the United States)
  - Progressive, symmetrical weakness, hyporeflexia or areflexia

Guillain-Barre’ Syndrome

- Variants
  - Acute motor axonal neuropathy (AMAN)
    - Antibodies against gangliosides GM1, GD1a, GalNAc-GD1a, and GD1b in peripheral motor nerve axons; no demyelination
    - Acute motor axonal neuropathy accounts for 5 to 10 percent of GBS cases
    - Strongly associated with Campylobacter jejuni infection; more common in the summer, in younger patients, and in China or Japan
    - Only motor symptoms
    - Deep tendon reflexes may be preserved

GBS Timeline

- Course of GBS infection and Antiganglioside antibodies
- Time from onset of weakness (weeks)
**Guillain-Barre’ Syndrome**

- **Variants**
  - Acute motor-sensory axonal neuropathy (AMSAN)
    - Mechanism similar to that of acute motor axonal neuropathy, but with sensory axonal degeneration
    - Symptoms similar to those of acute motor axonal neuropathy, but with predominantly sensory involvement
    - Also associated with C. jejuni infections

**Guillain-Barre’ Syndrome**

- **Variants**
  - Miller Fisher syndrome
    - Demyelination
    - Immunoglobulin G antibodies against gangliosides GQ1b, GD3, and GT1a
    - Rare – 5% of cases in USA but up to 25% of cases in Japan
    - Bilateral ophthalmoplegia
    - Ataxia
    - Areflexia
    - Facial and bulbar weakness occurs in 50 percent of cases
    - Trunk and extremity weakness occurs in 50 percent of cases

**Guillain-Barre’ Syndrome: Is it related to Multiple sclerosis?**

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<th><strong>GUILLAIN-BARRE’</strong></th>
<th><strong>MULTIPLE SCLEROSIS</strong></th>
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<td>Peripheral nervous system</td>
<td>Central nervous system</td>
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<tr>
<td>Acute and ascending</td>
<td>Multiple white matter lesions separated by time and space</td>
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<tr>
<td>80% of patients have good functional recovery</td>
<td>Often progressive</td>
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</table>

**Guillain-Barre’ Syndrome**

- **Clinical history**
  - Progressive symptoms which typically start 1-4 weeks following an upper respiratory illness or gastrointestinal illness
  - Has been linked to CMV, EBV, Campylobacter jejuni, and vaccinations
  - 1976 swine flu vaccines saw a small jump in GBS with an increase in cases of about 1:100,000
  - Also associated with vaccinations, stressful events, surgery and other disease states

**Guillain-Barre’ Syndrome**

- **Clinical features**
  - Ascending symmetric weakness or paralysis and areflexia or hyporeflexia
  - Symptoms may progress and become severe with inability to walk, respiratory failure and autonomic dysfunction
  - Numbness, tingling and abnormal sensations in fingers and toes, then ascends ascending
  - Throbbing or aching pain in shoulder girdle, low back, hips and thighs
  - Cranial nerve lesions
  - Autonomic dysfunction

**Guillain-Barre’ Syndrome**

- **Diagnosis**
  - Diagnosis is largely clinical with history of progressive symptoms and appropriate physical examination findings
  - CSF analysis
    - Normal pressure
    - Elevated protein and normal CSF otherwise
    - Protein > 50 mg/dl
    - Less than 10 WBC/mm3
    - WBC present are mostly mononuclear
  - Electrolytes
    - May have low sodium or low potassium but clearly not diagnostic
Guillain-Barre’ Syndrome

- **Diagnostic Criteria for Typical Guillain-Barré Syndrome**
  - Progressive weakness in more than one limb
  - Anesthesia
  - Features strongly supporting diagnosis
  - Progression of symptoms over days and up to four weeks
  - Relative symmetry of symptoms
  - Mild sensory symptoms or signs
  - Cranial nerve involvement, especially bilateral weakness of facial muscles
  - Recovery beginning two to four weeks after progression ceases
  - Autonomic dysfunction
  - Absence of fever at onset
  - High concentration of protein in cerebrospinal fluid, with fewer than 50 cells per cubic millimeter
  - Typical electrodiagnostic features

- **Differential Diagnosis**
  - Acute inflammatory demyelinating polyradiculoneuropathy
  - Acute idiopathic polyneuropathy
  - Human immunodeficiency virus (HIV) peripheral neuropathy
  - Intrinsic metabolic causes
  - Paraneoplastic neuropathy
  - Plexopathy
  - Polyneuropathy, sensory, or motor (diabetic)
  - Polyneuropathy, sensory, or motor (hereditary)
  - Polyneuropathy, sensory, or motor (idiopathic)
  - Polyneuropathy, sensory, or motor (infectious)
  - Toxic neuropathy (arsenic, lead)
  - Vitamin deficiency neuropathy
  - Hypoglycemia

- **Respiratory failure**
  - Occurs in 30% of patients
  - Often proceeded by bulbar muscle weakness with facial muscle weakness
  - Respiratory muscle weakness
  - May have associated autonomic dysfunction

- **Electrodiagnostic studies**
  - Serial studies will be abnormal, however a single study may initially show normal function
  - Slowed nerve conduction velocity
  - Partial nerve conduction blocks
  - Abnormal temporal dispersion
  - Prolonged distal nerve latencies

- **Treatment**
  - ABC’s with supportive care
  - Admit to ICU
  - 1/3 of patients experience respiratory failure and require intubation and mechanical ventilation
  - Monitor vital capacity at bedside
  - Avoid depolarizing neuromuscular blockers like succinylcholine as it may precipitate hyperkalemia
  - Supportive care to maintain hydration, support nutrition, and prevent complicating illness
  - DVT/PE and infections
Guillain-Barre’ Syndrome

- Treatment
  - IV immunoglobulin
    ▪ Generally more widely available and easier to administer
  - Plasmapheresis
    ▪ Requires a dialysis like treatment where whole blood is removed, plasma is removed and blood cells are returned to the body

Guillain-Barre’ Syndrome

- Treatment
  - IV immunoglobulin
    ▪ IV IgG
      ▪ Easy to administer and widely available
      ▪ Indicated for those who are unable to ambulate without assistance within 4 weeks of onset of symptoms

Guillain-Barre’ Syndrome

- IV IgG
  - How does it work?
    ▪ Immuno modulation
      ▪ Modulates complement activation
      ▪ Suppression of idiotypic antibodies
      ▪ Binds pathologic antibodies and allows them to be cleared
      ▪ Saturation of macrophage receptors
      ▪ Suppression of other inflammatory mediators
      ▪ B and T cells
  - Dosing?
    ▪ Standard dosing is 2 mg/kg
    ▪ Often administered at 0.4 mg/kg/day over 5 days
    ▪ Many patients often require second course depending on response

Guillain-Barre’ Syndrome

- IV IgG
  - Side effects
    ▪ Expands plasma volume
    ▪ Caution in those with CHF and renal failure
    ▪ Fever, myalgia, headache, nausea and vomiting common
    ▪ “Flu” like symptoms are typically self limited
    ▪ Aseptic meningitis
    ▪ Neutropenia
    ▪ Hypertension
    ▪ Anaphylaxis
    ▪ Renal failure
    ▪ Risk of blood borne viral infection

Guillain-Barre’ Syndrome

- Plasmapheresis
  - Requires a dialysis like set up
  - Removes and dilutes the offending antibodies and immune factors contributing to the weakness
  - Seems to be the treatment of choice in more severe cases
  - 4-6 exchanges typically performed
    ▪ Exchange 50 ml/kg with albumin or FFP

Guillain-Barre’ Syndrome

- Plasmapheresis
  - Side effects
    ▪ Hypotension
    ▪ Arrhythmia
    ▪ Malaise
    ▪ Fever
    ▪ Hypocalcemia
    ▪ Sepsis
    ▪ Depletion of immunoglobulins
    ▪ Hemorrhage
    ▪ Pulmonary embolism
    ▪ Risks of blood borne infection with FFP
### Guillain-Barre’ Syndrome

**Which is better?**
- IV IgG versus plasmapharesis
  - Multiple studies show IV IgG and plasmapharesis are equally efficacious
  - Cochrane review of six studies
    - No change in disability scores post treatment
    - No change in time for discontinuation of ventilator support
    - No difference in time needed to recover unassisted walking
    - Fewer side effects recorded with IV IgG
    - Combination therapy no better than either therapy alone

**What about steroids?**
- Have been used and tried in the past
- Currently not indicated
- There is a number of studies that suggest patients actually may do worse with steroid therapy

**Prognosis**
- Patients typically reach maximal weakness by 3-4 weeks after onset of weakness
- 85% have a full functional recovery in 6-12 months
- 7-15% have permanent neurologic sequelae
  - Minor weakness, foot drop, areflexia, hand muscle wasting, ataxia,paresthesia
  - 5% mortality rate in tertiary care centers
    - ARDS, sepsis, pneumonia, pulmonary embolism
- Predictors of poor outcome
  - Age > 60 years
  - Severe and rapidly progressive symptoms
  - Prolonged mechanical ventilation
    - Greater than 1 month
  - Pre-existing pulmonary illness
  - Timing to initiation of treatment
  - Low nerve conduction amplitudes in distal nerve testing
    - Indicates axonal loss
  - Relapse rate is <5%
  - Unrelated to type of treatment

**Rehabilitation**
- Should be started early while patient is hospitalized and in the ICU
- May require prolonged physical and occupational therapy
  - Months to years is not uncommon
  - Patients may have life-long physical and emotional sequelae

**Case presentation**
- 18 yo female
  - Seen in ED by Neurology
  - Guillain-Barre’ Syndrome diagnosed
  - Patient admitted to ICU for monitoring
  - Nephrology consult to start plasmapharesis
  - Patient with progressive weakness and ultimately respiratory failure within 3 hours of admission to ICU
Case presentation

- 18 yo female
- Patient intubated and placed on mechanical ventilation
- Plasmapharesis initiated
- Patient transferred to Cleveland Clinic the following day

Questions?

Guillain-Barre’ Syndrome

- Famous people with Guillain-Barre’ Syndrome
  - Andy Griffith- diagnosed in 1983
  - Danny Wuerffel
    - 1996 Heisman trophy winner
  - William “The Refrigerator” Perry
  - Luci Baines Johnson-2010
    - Daughter of Lyndon B. Johnson
  - FDR
    - Many believe his illness was more consistent with Guillain-Barre’ rather than Polio
Direct Versus Video Laryngoscopy for Intubating Adult Patients with Gastrointestinal Bleeding

Jason Crofts, DO, Jestin N. Carlson, MD, MS, Calvin A. Brown III, MD

Conflict of Interest Disclosure

Jason Crofts, DO – none
Jestin N. Carlson, MD, MSc – none
Calvin A. Brown III, MD none

Introduction

• Endotracheal intubation (ETI) in the emergency department (ED)
• Vital skill for the resuscitation of the critically ill patient
• Multiple attempts at ETI have been linked with several adverse outcomes:
  • Hypoxia
  • Brain Damage
  • Death

Objective

• We sought to compare intubation outcomes between VL and traditional direct laryngoscopy in patients intubated with gastrointestinal bleeding.

Introduction

• Video laryngoscopy (VL) is one tool that has been developed to assist in airway management
• Some areas of Emergency Medicine there are concerns with using VL
• Large volume hematemesis secondary to gastrointestinal bleeds is one area of concern

Methods

• Retrospective analysis of NEARIII database
• NEARIII database
  – National database
  – Collaboration of academic and community hospitals
  – Strict inclusion guidelines
Methods

- NEARIII
  - Intubation details recorded in standardized fashion
  - Intubations recorded from 7/1/2002 through 12/31/2002
  - Variables captured and recorded

- Selected for Indication for intubation - "GI bleed"
- Compared outcome data between VL and Direct Laryngoscopy (DL)
- Parametric and non-parametric tests when appropriate
- Univariate odds ratio for successful first attempt

Tables

Table 1. Patient and operator demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
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<th>L: 95% CI (SD)</th>
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Table 2. Number of attempts, and contact larynx before first attempt

<table>
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<td>1.04 (1.38)</td>
</tr>
</tbody>
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Discussion

- 325 intubations with 295 DL and 30 VL
  - No difference in intubation outcomes
  - Larger number of DL then VL
    - Several reasons why
  - Experience of the operators similar between groups
    - PGY 2 had lower odds of first attempt success
### Discussion

- GI Bleeding is common presentation
  - Number of patients that requires intubation is unknown
  - Likely small percentage
  - Limits to future studies
- Intubation in GI bleeds may be managed with DL or VL
- There still may be concern with this population

### Limitations

- Self reporting registry
- Unable to confirm the amount of bleeding
- Number of DL cases is much higher than VL
- Not a randomized trial
- Decision of VL or DL was operator preference

### Conclusion

- In our retrospective analysis of a national airway registry, VL has similar intubation outcomes compared to DL in patients intubated for GI bleeds.

### Questions?
Introduction
- Emergency medical services (EMS) must provide care for patients of all ages in the out-of-hospital setting
- Critically ill pediatric patients present to acute care settings less frequently than adults and opportunities to perform critical procedures are rarely available

Objective
- Characterize procedural performance in out-of-hospital pediatric patients in the United States

Conflicts of Interest Disclosure
- Elizabeth Gannon, DO, MPH – none
- Jestin N. Carlson, MD, MSc – none
- N. Clay Mann, PhD, MS – none
- Karen E. Jacobson, BA, NREMT-P – none
- Mengtao Dai, MS – none
- Caroline Colleran, DO – none
- Henry E. Wang, MD, MS – none

Methods
- Retrospective study
  - 2011 National Emergency Medical Services Information Systems (NEMSIS) database
    - NEMSIS
      - Collects information on 83 required "national variables" from EMS offices in each participating state
    - Data includes all EMS responses in patients age <18 years old (1/1/11-12/31/11)
Methods
• Demographics
  • Determine the frequency of procedures that directly involve the patient
  • Identify critical procedures that may be required during advanced cardiac life support (ACLS) or pediatric advanced life support (PALS)

Methods
• Critical Care Procedures
  – Airway-Intubation
  – CPR
  – Venous Access – IO
  – Venous Access – Central Line
  – Defibrillation-Manual
  – Defibrillation-Automated (AED)
  – Chest Decompression
  – Chest Tube Placement

Methods
• Critical care procedure success and complications
• Analysis
  – Descriptive statistics
  – Frequency of procedures performed per 1000 pediatric EMS responses

Results
• There were 14,371,941 total responses in the 2011 NEMSIS database
• 865,591 (6%) responses were in patients less than 18 years old

Demographics

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<th>Factor</th>
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Demographics

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<td>7,425</td>
<td>1.1</td>
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<tr>
<td></td>
<td>Black or African American</td>
<td>202,053</td>
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<tr>
<td></td>
<td>Native Hawaiian or Other Pacific Island</td>
<td>1,821</td>
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<td></td>
<td>White</td>
<td>399,606</td>
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<tr>
<td></td>
<td>Other Race</td>
<td>60,726</td>
<td>8.9</td>
</tr>
</tbody>
</table>
Results

- Provider impression
  - Most common
    - Traumatic injuries
    - Respiratory complications
    - Seizures
  - Respiratory (0.4%) and cardiac (0.6%) arrests were rare

Results

- 616,913 procedures performed on 246,016 pediatric patients
- 0.7 procedures/patient
- 13.3 critical care procedures/1000 EMS responses

Critical Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Frequency</th>
<th>% of total</th>
<th># per 1,000 Responses (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Airway-Intubation</td>
<td>3,795</td>
<td>0.6</td>
<td>4.4 (4.2-4.5)</td>
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<tr>
<td>Venous Access – IO</td>
<td>2,711</td>
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<td>3.1 (3.6-3.3)</td>
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<tr>
<td>CPR</td>
<td>2,626</td>
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<td>3.0 (2.9-3.2)</td>
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<tr>
<td>Venous Access – Central Line</td>
<td>1,598</td>
<td>0.3</td>
<td>1.8 (1.7-1.94)</td>
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<tr>
<td>Defibrillation-Manual</td>
<td>266</td>
<td>&lt;0.01</td>
<td>0.3 (0.27-0.35)</td>
</tr>
<tr>
<td>Chest Decompression</td>
<td>177</td>
<td>&lt;0.01</td>
<td>0.2 (0.18-0.24)</td>
</tr>
<tr>
<td>Defibrillation-Automated (AED)</td>
<td>176</td>
<td>&lt;0.01</td>
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<tr>
<td>Chest Tube Placement</td>
<td>64</td>
<td>&lt;0.01</td>
<td>0.07 (0.06-0.09)</td>
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All other procedures

<table>
<thead>
<tr>
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<th>Frequency</th>
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<th># per 1,000 Responses (95% CI)</th>
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<tbody>
<tr>
<td>Venous Access – Peripheral IV</td>
<td>133,885</td>
<td>21.7</td>
<td>154.7 (154-155)</td>
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<tr>
<td>Pulse Oximetry</td>
<td>107,508</td>
<td>17.4</td>
<td>124.2 (123.5-124.9)</td>
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<tr>
<td>Spinal Immobilization</td>
<td>82,905</td>
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<tr>
<td>Cardiac Monitor</td>
<td>80,272</td>
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<tr>
<td>Blood Glucose Analysis</td>
<td>47,570</td>
<td>7.7</td>
<td>55.0 (54.8-55.4)</td>
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<tr>
<td>Pain Measurement</td>
<td>30,916</td>
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<td>35.7 (35.3-36.1)</td>
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</table>

Critical Procedure Success

<table>
<thead>
<tr>
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<th>Frequency</th>
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<tbody>
<tr>
<td>Airway-Intubation</td>
<td>2324/3849</td>
<td>59.6%</td>
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<tr>
<td>Airway-Cric/Trach</td>
<td>1722</td>
<td>77.3%</td>
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<tr>
<td>Cardiac Pacing-External</td>
<td>20/27</td>
<td>72.7%</td>
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<td>Cardiac Pacing-Transvenous</td>
<td>3/3</td>
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<tr>
<td>Cardioversion</td>
<td>5/6</td>
<td>77.8%</td>
</tr>
<tr>
<td>Chest Decompression</td>
<td>147/154</td>
<td>95.5%</td>
</tr>
<tr>
<td>Chest Tube Placement</td>
<td>333/333</td>
<td>100%</td>
</tr>
<tr>
<td>Defibrillation-Automated (AED)</td>
<td>102/126</td>
<td>81.0%</td>
</tr>
<tr>
<td>Defibrillation-Manual</td>
<td>128/175</td>
<td>72.5%</td>
</tr>
<tr>
<td>Pericardiotomy</td>
<td>7/7</td>
<td>100%</td>
</tr>
<tr>
<td>Venous Access-Central Line</td>
<td>133/1432</td>
<td>91.6%</td>
</tr>
<tr>
<td>Venous Access-IQ</td>
<td>1966/2414</td>
<td>81.4%</td>
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</tbody>
</table>

Complications

- The most common complication was esophageal intubation
Limitations

- Study design
  - Retrospective study
  - Confounding
- Reporter bias
- Missing data
- Voluntary database

Discussion

- Critical procedures were performed in only 1.3% of all pediatric EMS responses
- Intubation was performed in only 4.4 per 1000 total EMS responses
- The overall critical care procedure success rate was 81.4%
  - Success rates ranged from 73-100%

Discussion

- Complications have been linked to poor outcomes in adult patients
- Inexperience with pediatric medical management could lead to adverse patient outcomes
- Evaluation of EMS protocols

Conclusion

- Pediatric patients represent a small percentage of total EMS responses nationwide
- Few critical care procedures are performed during EMS responses
- Procedures involving the airway have the most complications

Acknowledgements

- Jestin N. Carlson, MD, MSc
- N. Clay Mann, PhD, MS
- Karen E. Jacobson, BA, NREMT-P
- Mengtao Dai, MS
- Caroline Colleran, DO
- Henry E. Wang, MD, MS

Questions?
Classification and Frequency of Emergency Medical Services Procedures Performed in the United States

Christopher Karns, DO, Jestin N. Carlson, MD, MS, N. Clay Mann, PhD, MS, Karen E. Jacobson, BA, NREMT-P, Mengtao Dai, MS, Caroline Colleran, DO, Henry E. Wang, MD, MS

Methods and Results

- We conducted an analysis of the 2011 National Emergency Medical Services Information System (NEMSIS) research data set, encompassing EMS emergency response data from 40 states and two territories. From these data, we report the number and incidence of EMS procedures. We also characterize procedures performed.

Introduction

EMS provides a wide range of care. Procedural competency is related to frequency. Limited data is available relating to the frequency of these procedures.

Objective:

We sought to characterize procedures performed by EMS in the United States.

Discussion/Conclusions

- These data highlight the frequency with which EMS providers perform procedures across the United States. This may help to guide future EMS training and education efforts by highlighting the relative frequency and infrequency of specific procedures.

Tables

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Total</th>
<th>Percent</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPR</td>
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<td>8.7</td>
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<td>0.1*</td>
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<td>Cardiac Arrest</td>
<td>2,016</td>
<td>&lt;0.1</td>
<td>0.3*</td>
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<tr>
<td>Defibrillation</td>
<td>12,381</td>
<td>0.1</td>
<td>1.6*</td>
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<td>Automated Defibrillation</td>
<td>3,241,534</td>
<td>28.4</td>
<td>422.0</td>
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<tr>
<td>Monitoring</td>
<td>31,439</td>
<td>0.3</td>
<td>4.1</td>
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<tr>
<td>Critical Procedures</td>
<td>29,149</td>
<td>0.3</td>
<td>3.8*</td>
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<tr>
<td>Critical Wound Access</td>
<td>5,411</td>
<td>&lt;0.1</td>
<td>0.7*</td>
</tr>
<tr>
<td>Critical Rhagmas</td>
<td>490</td>
<td>&lt;0.1</td>
<td>0.4*</td>
</tr>
<tr>
<td>Critical Pain Access</td>
<td>3,323</td>
<td>&lt;0.1</td>
<td>0.4*</td>
</tr>
<tr>
<td>Critical Central Nervous Access</td>
<td>1,667</td>
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<td>0.2*</td>
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<td>Critical Splinting</td>
<td>410</td>
<td>&lt;0.1</td>
<td>0.1*</td>
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<td>Critical Immobilization</td>
<td>490</td>
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<td>0.1*</td>
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<tr>
<td>Critical Physical Support</td>
<td>2,243</td>
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<td>Critical Pharmacological Support</td>
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<td>4</td>
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<td>Maintenance</td>
<td>55,035</td>
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<tr>
<td>Decontamination</td>
<td>490</td>
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<td>0.4*</td>
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<tr>
<td>Patient Pacing</td>
<td>3,335</td>
<td>&lt;0.1</td>
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<td>Patient Patient Monitoring</td>
<td>2,555</td>
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<td>Patient Ventilation</td>
<td>1,219</td>
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<td>2.2</td>
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<td>2,041</td>
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<td>0.3*</td>
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<td>35</td>
</tr>
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<td>3.7</td>
<td>55.2</td>
</tr>
<tr>
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<td>655,451</td>
<td>5.7</td>
<td>85.3</td>
</tr>
<tr>
<td>Ventilation</td>
<td>2,131,882</td>
<td>18.5</td>
<td>247</td>
</tr>
</tbody>
</table>

Limitations

- Convenience Sample
- 30% of the U.S. population not included
- Did not compare complications related to procedures
- Only Focused on Adult Population
Questions?

References:


Decreasing Neonatal Intubation Rates: Trends at a Community Hospital

Anastasia Marx, DO
AHN - Saint Vincent Hospital – Erie, PA

Conflicts of Interest Disclosure
• Anastasia Marx, DO – none
• Cynthia Arnemann RNC – none
• Rose Horton MRM, RNC – none
• Kim Amon RN, MSN, MBA, LLCE – none
• Nicole Joseph, BS - none
• Jestin Carlson, MD, MSc – none

Introduction
• Endotracheal intubation (ETI) is a technically complex skill, critical in resuscitation of the neonatal patient
• Decreasing rates of ETI have been noted in several patient populations
• Providers to seek additional training to maintain proficiency

Objective
• We sought to determine secular trends in intubation rates in the community neonatal intensive care unit (NICU) setting

Methods
• Study performed at Saint Vincent Hospital NICU
  – Level III NICU
  – 21 beds
  – Admits 150-300 patients annually
  – Referral center
  – Flight crew
Methods

• Retrospective study
  – 2010 - 2014
  – Vermont-Oxford Expanded database
    • prospectively tracks neonatal intubations
      with the goal of improving care for high-risk
      newborn infants
  – Saint Vincent EMR
  – Data included all neonatal patients (<30
days old) intubated at Saint Vincent
    (1/1/10-12/31/14)

Methods

• ETI procedure success and complications

• Analysis
  – Rate of neonatal intubations (patients
    intubated/total NICU admissions/year)
  – Chi-squared test for trend

Methods

• Demographics

• Identify characteristics of the patient
  population and ETI procedures

• Determine number of neonatal ETI per
  year

Results

• There were 274 total charts reviewed

• 255 neonatal intubations over 5 years

Demographics

• 37% female (95/255)
• 63% male (160/255)
• Race
  – Caucasian 78%
  – African American 13%
  – Hispanic 6%
  – Other 3%

Demographics

<table>
<thead>
<tr>
<th>Factor</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
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<tr>
<td>Gestational age</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>32</td>
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<tr>
<td>Age at ETI</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Weight at ETI</td>
<td>2.1</td>
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<td>2.0</td>
<td>1.9</td>
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<td>Birth weight</td>
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<td>1.9</td>
<td>2.3</td>
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<td>1.9</td>
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<tr>
<td>Vaginal deliveries</td>
<td>28 (26%)</td>
<td>33 (41%)</td>
<td>20 (48%)</td>
<td>9 (32%)</td>
<td>9 (39%)</td>
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<tr>
<td>Cesarean deliveries</td>
<td>78 (74%)</td>
<td>33 (59%)</td>
<td>22 (52%)</td>
<td>19 (68%)</td>
<td>14 (61%)</td>
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## Results – ETI location

<table>
<thead>
<tr>
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<th>2014</th>
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<td>N intubations in NICU</td>
<td>53</td>
<td>22</td>
<td>20</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>(50%)</td>
<td>(39%)</td>
<td>(48%)</td>
<td>(50%)</td>
<td>(35%)</td>
<td></td>
</tr>
<tr>
<td>N intubations in L&amp;D</td>
<td>38</td>
<td>24</td>
<td>16</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>(16%)</td>
<td>(43%)</td>
<td>(38%)</td>
<td>(25%)</td>
<td>(57%)</td>
<td></td>
</tr>
<tr>
<td>N intubations in ED</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(13%)</td>
<td>(18%)</td>
<td>(14%)</td>
<td>(25%)</td>
<td>(9%)</td>
<td></td>
</tr>
<tr>
<td>N intubations at referring hospital by</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>the transport team</td>
<td>14</td>
<td>10</td>
<td>6</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>(13%)</td>
<td>(18%)</td>
<td>(14%)</td>
<td>(25%)</td>
<td>(9%)</td>
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## Results – ETI provider

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<tbody>
<tr>
<td>N ETI by RN</td>
<td>51</td>
<td>30</td>
<td>20</td>
<td>11</td>
<td>4</td>
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<tr>
<td>(48%)</td>
<td>(54%)</td>
<td>(48%)</td>
<td>(29%)</td>
<td>(17%)</td>
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<tr>
<td>N ETI by RN-C</td>
<td>21</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>13</td>
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<tr>
<td>(20%)</td>
<td>(14%)</td>
<td>(26%)</td>
<td>(14%)</td>
<td>(34%)</td>
<td></td>
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<tr>
<td>N ETI by attending physician</td>
<td>26</td>
<td>14</td>
<td>8</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>(25%)</td>
<td>(25%)</td>
<td>(26%)</td>
<td>(32%)</td>
<td>(9%)</td>
<td></td>
</tr>
<tr>
<td>N ETI by other provider</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>(4%)</td>
<td>(7%)</td>
<td>(5%)</td>
<td>(2%)</td>
<td>(0%)</td>
<td></td>
</tr>
<tr>
<td>N ETI by unknown provider</td>
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<td>0</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>(4%)</td>
<td>(0%)</td>
<td>(2%)</td>
<td>(28%)</td>
<td>(43%)</td>
<td></td>
</tr>
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</table>

## Results – ETI rates

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<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>N total deliveries</td>
<td>2583</td>
<td>1158</td>
<td>1130</td>
<td>951</td>
<td>1210</td>
</tr>
<tr>
<td>N babies delivered</td>
<td>2639</td>
<td>1180</td>
<td>1151</td>
<td>967</td>
<td>1227</td>
</tr>
<tr>
<td>N NICU admissions</td>
<td>330</td>
<td>198</td>
<td>165</td>
<td>128</td>
<td>140</td>
</tr>
<tr>
<td>N NICU infants intubated</td>
<td>106</td>
<td>56</td>
<td>42</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>(32%)</td>
<td>(28%)</td>
<td>(25%)</td>
<td>(22%)</td>
<td>(16%)</td>
<td></td>
</tr>
</tbody>
</table>

## Results

![Graph showing yearly intubation rates](image)

## Limitations

- Study design
  - Retrospective study
  - Small sample size
- Records review bias
- Missing data

## Discussion

- Rates of neonatal intubation decreased over the 5-year study period
- Factors in the decreasing rates have been postulated
  - non-invasive oxygenation techniques (NIPPV)
  - C-sections performed later
  - Changing indications for intubation


## Discussion

- Similarly declining ETI trends noted in other studies
- Practitioners may not achieve enough ETI volumes to maintain proficiency
- With 20 NICU nurses and 23 intubations annually (2014), community practitioners perform ETI roughly once annually

## Conclusion

- NICU ETI rates in the community setting have decreased from 2010 to 2014
- As the landscape of neonatal intubation changes, it will be vital to maintain practitioners' intubation skill-set through other methods

## Acknowledgements

- Jestin N. Carlson, MD, MSc
- Cynthia Arnemann RNC – none
- Rose Horton MRM, RNC – none
- Kim Amon RN, MSN, MBA, LLCE – none
- Nicole Joseph, BS – none

## Questions ?