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Chief of Operations
The Dallas Metropolitan BioTel System

Co-Chief in the Section on
EMS, Disaster Medicine, and Homeland Security
Critical Issues in Pediatric Emergencies

- Small Size
- Confusing Clinical Picture
- Infrequent Procedures
- Lack of practice and skill
- Intimidation
- Avoiding overventilation
What’s different about kiddies?

- Small Size: They cool off quickly!
- Assessing vital signs
- Difficult IV status
- Tough intubation
- Crying, fear, struggling
- Dealing with families
Airway

Breathing

Circulation

Neurological

Scene Survey/Mechanism/# pts.
LOC/Airway/Cspine
Respiratory Rate and Labor
Pulses R & Q, N & W
Skin CMT/CRT/External Bleeding
Neck appearance, JVD, Trachea
Chest appearance, BS, HT
Quick survey of abdomen, pelvis, and extremities

...the vital elements of the Primary Survey...
Scene Survey/Mechanism/# pts.
LOC/Airway/Cspine

Vintage BTLS
1984

Chest appearance, BS, HT
Quick survey of abdomen, pelvis, extremities, and back

The Ventilation of the Critically Ill Child
In short, we overventilate people
Organs are UNIQUESTLY SENSITIVE to overventilation during shock
Everybody who has looked at this has found that medical providers cannot control the rate of ventilation.
Death by hyperventilation: a common and life-threatening problem during cardiopulmonary resuscitation.

Aufderheide TP, Lurie KG.

Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin, USA.

CONTEXT: This translational research initiative focused on the physiology of cardiopulmonary resuscitation (CPR) initiated by clinical observation of consistent hyperventilation by professional rescuers in out-of-hospital cardiac arrest. This observation generated scientific hypotheses that could only ethically be tested in the animal laboratory. OBJECTIVE: To examine the hypothesis that excessive ventilation rates during performance of CPR by overzealous but well-trained rescue personnel causes a significant decrease in coronary perfusion pressure and an increased likelihood of death. DESIGN AND SETTING: In
CONCLUSIONS:

Despite seemingly adequate training, professional rescuers consistently hyperventilated patients during out-of-hospital CPR.
What happens with hyperventilation?

- Decreased brain blood flow
- Altered mental status
- Decreased blood to the heart muscle
- Reduced cardiac output
- Increased size of brain trauma
Hyperventilation effects on the traumatized brain

- Areas of injury increase in size
- Brain blood flow is reduced
- Survival is decreased
Why did we ever start hyperventilation to begin with???

We thought that in acute brain injury, intracranial pressure was increasing, so we had to make more room by decreasing the size of the brain.
We didn’t know that we were making things worse
Hyperventilation, after all, reduces blood flow to the brain
“There is a direct and immediate transfer of the increase in intrathoracic pressure to the cranial cavity with each positive pressure ventilation, reducing cerebral perfusion... compromising hemodynamics to the heart and brain.”
Ventilate ONLY sufficient to maintain a capnography level of 35 to 40, perhaps slightly higher.
Some evidence exists that we might even want to go for a slightly higher capnography level to improve brain blood flow.
In adults, begin with a ventilation rate of one breath every eight seconds, using a **ONE HANDED SQUEEZE!**
In children, reduce the tidal volume accordingly (the size of the squeeze) and increase the rate to maintain a capnography level of 35 to 40.
Conclusions: Brain tissue oxygen monitoring may be a safe and useful addition to ICP monitoring in the treatment of pediatric patients with severe TBI.
Pediatric intubation may be the hardest skill to learn…
…and the hardest to maintain…
It may not be done for years.
It may have been done ONCE in training, if at all

All of the complicating issues
The King LTS-D

May be an airway revolution
Comes in multiple sizes
Coming soon for small kiddies
The second lumen of the KING LTS-D, which is open at the distal tip of the tube, provides three key additional benefits:

- Passage of gastric tube up to 18 French
- Channel for regurgitation, which significantly reduces potential for regurgitation to get past the cuff and therefore aids in reducing the chance for aspiration.
- Provides “vent” for gastric pressure and stomach decompression.

Some additional design features unique to the KING LTS-D are:

- Smaller, softer tip. This aids in easier placement.
- New tapered ramp design provides additional ventilation outlets.
- Ramp for passage of tube exchanger or fiberoptics located at the proximal eye. This reduces the need to withdraw the tube when using a tube exchanger or fiberoptics.
Mortality went up substantially in traumatized children who were intubated in the field.
Los Angeles has removed endotracheal intubation for children as a paramedic skill.
Per Dr. Eckstein:

Based upon their airway study, no benefit in any category, trended in worse in certain categories.

Before waveform capnography; short, urban transport times.

No plans for mini-King LTS-D or similar.

Currently: BVM and transport.
High-Fidelity Medical Simulation as an Assessment Tool for Pediatric Residents' Airway Management Skills.

Original Articles

Overly, Frank L. MD *+++; Sudikoff, Stephanie N. MD +++; Shapiro, Marc J. MD *++

Abstract:
Objectives: To evaluate high-fidelity medical simulation as an assessment tool for pediatric residents' ability to manage an acute airway.
POSITION PAPER

INTRAOSSEOUS VASCULAR ACCESS IN THE OUT-OF-HOSPITAL SETTING
POSITION STATEMENT OF THE NATIONAL ASSOCIATION OF EMS PHYSICIANS

- EMS agencies that provide advanced level care should provide at least one method of IO access for pediatric patients, and each agency should also consider providing at least one method of IO access for adult patients.
...the intraosseous route should be the first alternative to difficult or delayed intravenous access.

With these considerations, the role of intraosseous vascular access in the out-of-hospital environment should be reemphasized.
**National Registry of Emergency Medical Technicians**  
**Advanced Level Practical Examination**

**PEDIATRIC INTRAOSSEOUS INFUSION**

<table>
<thead>
<tr>
<th>Candidate:</th>
<th>Examiner:</th>
</tr>
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<tbody>
<tr>
<td>Date:</td>
<td>Signature:</td>
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<table>
<thead>
<tr>
<th>Time Start:</th>
<th>Possible Points</th>
<th>Points Awarded</th>
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<tbody>
<tr>
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</tbody>
</table>

- Checks selected IV fluid for:
  - Proper fluid (1 point)
  - Clarity (1 point)  
  **2**

- Selects appropriate equipment to include:
  - IO needle (1 point)
  - Syringe (1 point)
  - Saline (1 point)
  - Extension set (1 point)  
  **4**

- Selects proper administration set  
  **1**

- Connects administration set to bag  
  **1**

- Prepares administration set [fills drip chamber and flushes tubing]  
  **1**

- Prepares syringe and extension tubing  
  **1**

- Cuts or tears tape [at any time before IO puncture]  
  **1**

- Takes or verbalizes body substance isolation precautions [prior to IO puncture]  
  **1**

- Identifies proper anatomical site for IO puncture  
  **1**

- Cleanses site appropriately  
  **1**

- Performs IO puncture:
  - Stabilizes tibia (1 point)
  - Inserts needle at proper angle (1 point)
  - Advances needle with twisting motion until “pop” is felt (1 point)
  - Unscrews cap and removes stylette from needle (1 point)  
  **4**

- Disposes of needle in proper container  
  **1**

- Attaches administration set to IO needle [with or without 3-way]  
  **1**

- Slowly injects saline to assure proper placement of needle  
  **1**

- Adjusts flow rate as appropriate  
  **1**

- Secures needle with tape and supports with bulky dressing  
  **1**

<table>
<thead>
<tr>
<th>Time End:</th>
<th>TOTAL</th>
<th><strong>23</strong></th>
</tr>
</thead>
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</tbody>
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Intraosseous Administration of Drugs in Infants and Children

Posted 02/21/2007

Marcia L. Buck, Pharm.D., FCCP
Author Information

Abstract

Intraosseous (IO) infusion of fluids via the sternum was first suggested by Drinker and colleagues in 1922. The use of the IO route for administration of fluids, drugs, and blood products became relatively common in the 1930's and 1940's, but eventually fell out of favor with improvements in plastic catheters which allowed for more rapid attainment of intravenous (IV) access. The IO route reemerged in the 1980's as an option for fluid and drug delivery during emergencies. In 1986, the American Heart Association (AHA) approved use of the IO route for administration of fluids and medications during pediatric resuscitation. In their 2005 guidelines on pediatric basic and advanced life support, the AHA and the International Liaison Committee on Resuscitation (ILCOR) reiterated the recommendation for establishing intraosseous (IO) access if vascular access is not rapidly achieved in any infant or child requiring IV drugs or fluids.
Pediatric Intraosseous Access (DVD-Format Video)

70-2346  $45.00
Ships Same Day

Designed for use in the vascular access skills practice station of the PALS course, this video demonstrates how to establish intraosseous (IO) access in critically ill or injured children. The detailed video presentation covers:

- sites for IO infusion
- indications for IO access
- proper technique for placing an IO needle
- appropriate immobilization
- complications associated with IO access, and
- removal of the device.

In VHS or DVD format; 10 mins.
EZ-I0® Product System
For patients of all ages and weights
Central Line Alternative

Currently, when IV insertion is challenging in the emergency room or hospital setting, a physician's first instinct is to place a central line. However, new American Heart Association ACLS guidelines as well as numerous studies suggest that adult IO infusion provides venous access similar to that achieved by central lines faster, with less expense and lower complication rates. Additionally, throughout the ACLS protocols and algorithms, IO is paired with IV access and is recommended over central lines and ET tube drug administration for cases of cardiac arrest.
|--------------------------------|-----------------|-----------------|-----------------|

**EMS research information**

Resuscitation Outcomes Consortium (R.O.C.) Information

<table>
<thead>
<tr>
<th>Links</th>
<th>Biotel E-Mail Links</th>
<th>D/FW FD's</th>
<th>D/FW Hospitals</th>
<th>Search &amp; Site Map</th>
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</table>

Today is 3/3/2007
The time in Dallas is 8:00:00 AM
You Are Visitor Number
000,197,18

Site last modified 3 March 2007  Questions? Comments? Suggestions? E-mail Biotel

OUTSW/2001. All rights reserved. Website built and maintained by Rick LeChle, UT Southwestern Medical Center Dallas

UTSW / BIOTEEL EMS SYSTEM: APPENDIX M
PEDIATRIC INTRAOSSEOUS INFUSION PROCEDURE

INDICATIONS:
• Children < 8 yrs - in shock, cardiac arrest, unconscious or unresponsive to verbal stimuli AND:
  Unconscious or seriously ill with immediate need for venous access to administer fluids or drugs,
  when 1 or 2 attempts at peripheral venipuncture have been unsuccessful within 90 seconds.
• Proceed immediately to an IO if peripheral veins are NOT readily obtainable in the unconscious,
  seriously ill or injured pediatric patient.

MATERIALS:
1. Alcohol and Iodine Preps.
2. IV Infusion Set, with regular (macro) size tubing: this must be flushed and ready to go.
   a. If not, the needle may clot in the marrow cavity, making infusion impossible.
   b. This is even more critical than it is when starting a peripheral IV.
3. Intraosseous needle, assembled, with stylet in place.
4. Two 10 cc. syringes for aspirating bone marrow and flushing needle after insertion.
   a. One EMPTY syringe
   b. One filled with Normal Saline
5. Glucometer, Gauze rolls, tape.

CONTRAINDICATIONS:
Fracture of that extremity, Osteomyelitis, Bony lesion at site.
Potential access sites:

Proximal tibia
Humeral head
Distal tibia
Vidacare’s EZ-IQ® Product System Receives FDA Clearance for Distal Tibia Access

*Body Site Access to Help EMS Personnel Treat Morbidly Obese Patients*
Mucosal Atomization Device
For seizures (versed) and overdose (narcan)
STANDING ORDER #122
Persistent Seizure Activity

This Standing Order is for the treatment of Persistent seizure activity. The Medic should perform a thorough primary survey, obtain a detailed history if possible, and contact Medical Control as soon as possible while carrying out these orders.

Assess ABC’s - Airway, Breathing, and Circulation

For a pulseless patient, proceed to ACLS guidelines

Apply 100% oxygen via NRB (non-re-breather) mask to the seizing patient

Suction airway if necessary

Perform a glucose check if the patient has a history suggestive of Diabetes. If the blood sugar is less than 60 (and no stroke suspected) follow Diabetic standing order

Use age based table to determine proper volume of Midazolam (Versed) for atomization

<table>
<thead>
<tr>
<th>Patient age (yr)</th>
<th>Weight (kg)</th>
<th>IN Midazolam volume in ml* 5mg/ml concentration</th>
<th>Midazolam volume dose (mg)</th>
</tr>
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<tbody>
<tr>
<td>Neonate</td>
<td>3</td>
<td>0.3 ml</td>
<td>0.6 mg</td>
</tr>
<tr>
<td>&lt;1</td>
<td>6</td>
<td>0.4 ml</td>
<td>1.5 mg</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.5 ml</td>
<td>2.0 mg</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>0.7 ml</td>
<td>2.8 mg</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>0.8 ml</td>
<td>3.5 mg</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>0.9 ml</td>
<td>3.6 mg</td>
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<tr>
<td>5</td>
<td>20</td>
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<td>4.0 mg</td>
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<td>6</td>
<td>22</td>
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<td>1.3 ml</td>
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<td>1.4 ml</td>
<td>6.0 mg</td>
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<td>11</td>
<td>32</td>
<td>1.4 ml</td>
<td>6.4 mg</td>
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<tr>
<td>12</td>
<td>34</td>
<td>1.5 ml</td>
<td>6.8 mg</td>
</tr>
<tr>
<td>Small teenager</td>
<td>40</td>
<td>1.8 ml</td>
<td>8.0 mg</td>
</tr>
<tr>
<td>Adult or full grown teenager</td>
<td>50 or more</td>
<td>2.6 ml</td>
<td>10.0 mg</td>
</tr>
</tbody>
</table>

* This volume is based on the calculated dose PLUS 0.12 ml dead space and rounded off to the next highest 0.1 ml. Slightly higher doses may be appropriate at the lower range of volume due to measurement difficulties and possible under dosing which may not stop the seizure.
I take a position that we must not allow needlesticks to happen to our employees.
HEP C or HIV can ruin a life...
...or many lives
The “‘Networking’” of Hospitals”
Trauma
Stroke
Chest Pain
Pediatric Emergency Receiving Facilities

Will there be demonstrated a benefit from bypassing ALL local hospitals during pediatric emergencies??
Pediatric Emergency Receiving Facilities

We don’t know yet...

...but it will fall to EMS to carry it out...
Pediatric Emergency Receiving Facilities

This may be the hardest yet for us to prepare for...
Pediatric Emergency Receiving Facilities

Airway
Ventilation
Vascular Access
Monitoring
Is it possible for ALL emergency receiving facilities to maintain skills in pediatric resuscitation?
Reasons:

• *It happens rarely*
• Vascular access
• Airway problems
• Dosages
Case #1
You are called out for an 18 months old child who was having difficulty in breathing.

On arrival the child is bright-eyed, alert, playful, respirations 44, chest “congested”; he had been coughing heavily just before Mom called…

Diagnosis? Treatment?
Case #2
You respond to the scene of an MVC car vs. 4 y/o girl

You find the child with altered mental status, rapid respirations, a weak, rapid radial pulse, and tenderness to the anterior chest and abdomen.

Diagnosis? Treatment?
Signs of Shock

Early
- Weak, thirsty, lightheaded
- Pale, then sweaty
- Tachycardia
- Tachypnea
- Diminished urinary output

Late
- Hypotension
- Altered LOC
- Cardiac arrest
- Death
Blood pressure =

(Cardiac output) x 
(Volume) x
(Peripheral resistance)
Looking further, you find the following clinical findings:

- Flat neck veins
- Midline trachea
- Diminished breath sounds on the right side with dullness to percussion

Diagnosis?

Treatment?
Hemorrhagic Shock associated with Bradycardia

Relative bradycardia in patients with traumatic hypotension.


Department of Surgery, University of Southern California, Los Angeles 90033, USA.
demetria@hsc.usc.edu
CONCLUSION:

Relative bradycardia in hypotensive trauma patients is a common hemodynamic finding.

Mortality among tachycardic patients was more predictable than among bradycardic patients...

The presence of relative bradycardia in some subgroups of patients with severe injuries seems to be associated with better prognosis than the presence of tachycardia.
On the Cutting Edge...
The combination of terlipressin to epinephrine during cardiopulmonary resuscitation may have a beneficial effect in children with cardiac arrest.
Pediatric patients in septic shock may benefit from steroid therapy
The results show that airborne transmission may be a route for infection by *S. aureus* and is responsible for contaminating the environment.
Less than 5 minutes' duration of CPR and reactive pupils at the onset of cardiopulmonary arrest (CPA) were the most important factors that predicted long term survival.
Electroencephalography patterns during the initial 7 days after in-hospital cardiac arrest were associated with neurologic outcome in children.
Air collections were found in both venous and arterial circulations, including the splenoportal system.
Summary Thoughts
The emerging of a profession: Paramedicine
The End of the Beginning

The End of the Beginning

• Innocence is over
• You are COMPLETELY accountable for what you do
• Becoming a professional requires you to always be able to explain your actions
• EMS is ONLY and ALWAYS about patient care
You, the heroes of the streets, have never had greater challenge or opportunity.
Thank you for your kind attention!
drray@doctorfowler.com

www.emergencymedicine.ws

“the emergency medicine website”