CASE 1: 24 y Male Cardiac Arrest

24 yo M 100 kg CC: CPR - Medical

“Per friends at the residence, patient was playing ping pong in the garage of a private residence when he suddenly collapsed and was pulseless and apneic. Friends activated 911 and bystanders started CPR.”

EMT arrived at 16:11. Patient was found to be in pulseless electrical activity (PEA). After 2 min of CPR, the rhythm changed to ventricular fibrillation (VF). Throughout the resuscitative course, patient was defibrillated 5 times, received 3 doses of epinephrine via an intraosseous device (IO), was successfully intubated and was enrolled in the ALPS study. They departed at 16:24 and arrived to ED at 16:31. He had spontaneous return of circulation during transport. Patient began to attempt to breathe on his own in route to the hospital and respirations were assisted.

WHAT HAPPENED IN THE ED

Patient’s additional history revealed that he had a history of heart failure, coronary artery disease, focal segmental glomerular sclerosis with chronic kidney disease, a history of myocardial infarction at age of 22 with cardiac stents, and was on dialysis.

In the hospital he had a witnessed VF arrest and had a defibrillator implanted. His cardiac angiogram showed no stenosis. The determined likely etiology of his cardiac arrest was scarring from prior myocardial ischemia versus other disorder such as the long QT syndrome or Arrhythmogenic Right Ventricular Dysplasia (ARVD).

His hospital course was complicated with multi-organism pneumonia and septic shock. He left the hospital with some neurological sequelae that had resolved a month later.

Arrhythmogenic Right Ventricular Dysplasia (ARVD): Rare autosomal dominant infiltrative RV cardiomyopathy.

1/10,000 prevalence in the general US population.

Presentation: Exercise related syncope or sudden cardiac death, most commonly in an adolescent, due to ventricular arrhythmias

Testing: ECG (T-wave inversion in leads V1-V3, epsilon wave in 50%); Echo (hypokinetic, thin RV wall, tricuspid regurg); cardiac MRI; angiogram; biopsy

Tx: +/- beta-blocker, anticoagulation, ablation, ICD, family screening

Commentary Pre-Hospital

Dr. Donofrio: The team did a great job on their high quality cardiac arrest care. They had an IO within 2 minutes of arrival. The code was well organized, they enrolled the patient in the ALPS protocol without delaying treatment, and they obtained ROSC.

Hindsight being 20/20, knowing the patient was on dialysis would have changed pre-hospital management and can be discovered by looking for the AV graft on the arms. This wasn’t discovered until he arrived in the ED. If it was known, CaCl 500 mg IV/IO, NaHCO3 1mEq/Kg IV/IO, and albuterol 6mL 0.083% nebulizer may have been helpful prehospital.

Obtaining an ECG to look for STEMI would have been helpful once ROSC was obtained, especially given his cardiac history.

This brings up ROSC. With a 7-minute transport time, it is good to be aware of the AHA ROSC guidelines:

- Maintain O2 ≥ 94%, assess capnography and waveform, do not over-ventilate
- Treat hypotension (SBP < 90 mmHg): IV/IO bolus, vasopressor infusion, consider treatable causes, 12 lead commands
- Consider hypothermia if not following commands
- Consider coronary reperfusion for STEMI or high suspicion of AMI
Amiodarone, Lidocaine, or Placebo in Out-of-Hospital Cardiac Arrest.

4/4/16.
DOI 10.1056/NEJMo1514204

This was a randomized, double-blind multicenter resuscitation outcomes consortium (ROC) study that compared parental Amiodarone (A), Lidocaine (L) and saline placebo (P) in adults with non-traumatic out-of-hospital (OOH) cardiac arrest with shock-refractory VF or pulseless VT after ≥ 1 defibrillation.

3026 patients were randomly assigned: A (974), L (993) or P (1059). The survival to discharge rates were: 24.4% (A), 23.7% (L) and 21% (P). There was no significant difference in survival to discharge: A vs P 3.2% (95% CI -0.4 to 7.0; P=0.08); L vs P 2.6% (95% CI -1.0-6.3; P=0.16); and A vs L 0.7% (95% CI -3.2 to 4.7; P=0.70). There was also no difference in neurologic outcomes between the groups.

A subgroup analysis did find heterogeneity of treatment effect with significantly increased survival to discharge when given active medications (A or L) compared to placebo in patients with a witnessed arrest (P=0.05).

The authors concluded that neither Amiodarone nor Lidocaine resulted in a significantly higher rate of survival or improved neurological outcome than the patients that received the placebo among patients with OOH cardiac arrest due to initial shock refractory VF or pulseless VT.

This study is another that brings to question the value of medications in CPR. This again points to the need for improving bystander CPR and promoting high quality CPR.
hung out together. So, uh, that’s all we have to go on.

ETA 3-5 min
Last normal 20 minutes ago” (End of recording)
Per transcripts:
Initial recorded vitals: HR 130  BP 220/110 RR 4 SpO2 98% on O2
GCS 7: E1V1M5

WHAT HAPPENED IN THE ED

Patient arrived to the emergency department with the stroke and neurocritical care teams waiting for her. CT head found a large right-sided bleed from an underlying arterio-vascular malformation and subdural bleed. She was given Mannitol, 3% saline, intubated and taken to the operating room for a craniotomy. Three days later, she was still unresponsive so her family placed her in comfort care and she died shortly after.

Commentary Pre-Hospital

Dr. Donofrio: While this is a tragic case, there are some great learning points to be taken away. First of all, I would like to commend the first responders for initiating good basic life support- immediately recognizing her respiratory efforts were poor and assisting with ventilation.

In the Oct 2015 Annals of Internal Medicine, Sanghavi et al found similar or better health outcomes associated with prehospital BLS than ALS for major trauma, stroke, and respiratory failure. While there are many confounding variables with the paper, it does highlight the importance of good BLS. The basics save lives and I always appreciate hearing runs where the BLS aspects are immediately recognized and addressed.

In regards to strokes, I wanted to focus my commentary on two subjects - stroke prevention and stroke centers.

According to the CDC, “stroke is the fifth leading cause of death in the United States and is a major hospital disability. About 800,000 people in the United States have a stroke each year. One American dies from a stroke every four minutes on average.”

The same advice we give our patients we need to take ourselves. Healthy diet, exercise, and quitting smoking are three important factors to preventing stroke. Regular checkups and treatment for diabetes, high blood pressure, atrial fibrillation, hypercholesterolemia, and sickle cell anemia are other important factors.

My second commentary is on stroke centers. The Joint Commission (JC) recognizes three types of stroke receiving hospitals: acute stroke receiving hospitals (ASRH), primary stroke centers (PSC), and comprehensive stroke centers (CSC). The AHA and JC began recognizing PSC in 2003 as hospitals that have stroke units and that follow specific guidelines. In 2013, with new interventional radiology techniques for strokes available, the JC came up with regulations for CSCs. (See figure above). San Diego currently has 16 stroke receiving hospitals, including 10 PSC and 2 CSC.

Ischemic strokes, which may benefit from tPA, are the most frequent, accounting for 80% of strokes. However, hemorrhagic strokes, where tPA is a contraindication, are more fatal with a 50% mortality at 1 month and have had less treatment options in the past.

While tPA is a controversial subject in emergency medicine at this time, the current guidelines support the use of intravenous tPA if it can be given within 3 hours of stroke onset to a specific subgroup of patients. Both ASRH and PSC can provide this level of care. The

https://www.urmc.rochester.edu/imaging/patients/procedures/thrombolysis.aspx

CSC also has interventional radiology which may include: intra-arterial tPA to dissolve clots in the artery; angioplasty and stents to open narrowed arteries; provide coiling to block ruptured vessels or aneurysms; and using devices to remove blood clots.

Intra-arterial tPA, while not FDA approved, is being used in patients who
strokes are diagnosed in the six hour window. Devices for mechanical embolus removal in cerebral ischemia have been approved.

This brings about the question - are there patients we should be sending directly to the CSC instead of a PSC, regardless of the ETA? Should we be waiting for more evidence?

Dr. Kahn:
At this time, we don’t have the evidence base needed to bypass a PSC in favor of a CSC. We do know that high quality stroke care saves lives, though – even with the tPA controversy, people agree that careful attention to good stroke rehab services and other interventions are very helpful. Good job on recognizing a sick patient and getting them stabilized quickly.

CASE 3: The grunting toddler

“Mom is requesting closest facility, normally gets her care at Childrens.”

“This is Medic X on scene for an 11 month old first time seizure. Lying on the ground when mom described about a minute and a half or so full body seizure. Full color change while she was on the phone with 911. Baby is Red on the Broselow. When I got there, she was lying on the ground. Kind of tracking as I walked in and making a lot of grunting. She’s been grunting now for 20 minutes, really heavy grunts. Other than that, secondary negative. Gc 121. HR 167 sinus tach on the monitor. 98% room air. She was 94% when we got there and we put her on some blow by.

Baby is just hanging out, looks like she’s frowning a lot. In her carseat. Nothing further, just monitoring vital signs. Mom gets all of her medical care at Childrens. Due to her abnormal presentation she wants to go to closest facility."

“Let me ask you this, why does she want to go to Childrens? What is wrong with the child? What kind of medical history does the baby have that Children’s is where she wants to go? Is there some kind of care I’m missing? And the grunting, I can’t understand why she’s grunting.”

“Sounds like she just gets all her care at Children’s, like every other pediatric. No history of medical, allergies, or whatever. She’s just requesting Children’s because everything goes to Children’s. I did recommend going to the closest facility just due to the abnormal presentation. I know pediatrics do grunt sometimes, but she’s never ever heard her grunting like this before. (Screaming in the background)…”

“I do hear her in the background, that’s good. I don’t know what’s wrong. Um, did you tell me that the baby had a temp or anything yet? Did you guys happen to get a temp?”

“This is the first time that she’s been crying. Ever since she’s been in our presence, it’s been like a really heavy grunting. Temp 98.6.”

“Copy that.”

Electronic report:
17:00- HR 180 then 200, RR 30, 98% RA, GCS 12 (E4V2M6)

WHAT HAPPENED IN THE ED

Unfortunately, we do not have access to the records from the accepting facility. This would have been a great case to follow up on.

Commentary Pre-Hospital

Dr. Donofrio: I have to be honest, this case scared me and I wanted to jump in immediately. I wish I had heard the patient’s stability prior to the long discussion about the receiving facility. Hearing the fact that the patient was grunting for 20 minutes and while the medic was on the phone really concerns me. Always treat the patient first. My first question was whether the patient was still seizing, especially if she was tachycardic. I think I held my breath and bit my nails until I heard the patient screaming in the background. Secondly, hearing that the patient is grunting and the sats were 94%, it was obvious to me she was having ineffective respirations. Kids, like adults, need effective ventilation and oxygenation. Back to the basics, they are useful no matter the patient or the scenario. This is a good reminder that pediatric cases seem to make everyone nervous - stick to the basics and you’ll do great.

First let’s talk about seizures, then a word on grunting.

Not all seizures are generalized tonic-clonic seizures. Often the

IS THE SEIZURE OVER?

The following clinical signs suggest that the patient may still be seizing

1. Eye gaze deviation or eyes rolled back

2. Clenched jaw or tongue thrusting

3. Tachycardia
4. One or more stiff extremities
5. Any twitching of a muscle group that does not stop when it is held (ex- forearm twitching that continues when you hold the arm)
initial few minutes of a seizure may include tonic-clonic like movements that progress to a subclinical seizure that can be difficult to assess. Differentiating whether the patient is simply post-ictal or in subclinical status epilepticus is very important and will change treatment plans.

**Versed is to be given as a standing order for:**

- Ongoing generalized seizure lasting five or more minutes including seizure time prior to arrival of prehospital provider
- Partial seizure with respiratory compromise
- Recurrent tonic-clonic seizures without lucid interval

**But Doc, Versed is not required for simple febrile seizures.**

True - Versed is not required for simple febrile seizures.

In order to find out if this was a simple febrile seizure, more information is needed. A simple febrile seizure is a primary generalized seizure that lasts for less than 15 minutes and does not recur within 24 hours. A description of the seizure, completely generalized versus partial, helps distinguish simple from complex febrile seizures. Additionally, having a febrile illness is the key to this diagnosis. If the child had a fever at any time during that day and met the criteria, we would still count the seizure as a simple febrile seizure.

In fact, this case would benefit from more history. Events such as closed head injuries, accidental ingestions, fevers, and prior history of seizures are very helpful with choosing which EMS protocol to select for the child and also helps the receiving ED prepare for the child.

Just a touch more information on simple febrile seizures - they occur in 2 to 5% of children in the range of 6 to 60 months of age. Children with simple febrile seizures in previous studies have had no evidence of paralysis, developmental delay, or increased mortality. The risk of epilepsy after a simple febrile seizure is only slightly higher than that the general population. However, 30% of these children may have a repeat simple febrile seizure during childhood. This means that in addition to parental reassurance, anticipatory guidance for seizure management is key for simple febrile seizures.

**More importantly, the kid is grunting!**

The paramedics describe this child as having “really heavy grunts” and mentioned that the oxygen saturation was 94%.

To me, this describes a hypo-ventilating child in respiratory distress. This is a big deal.

To treat it, back to the basics, as in: BLS:

- **Ensure patient airway, O2, and/or ventilate as needed**
- **Secretion problems; position on the affected side**

Children have large heads. Positioning them in a sniffing position and suctioning their secretions can help you a lot. Don’t be afraid to use a nasal airway or an oral airway in the child without a gag reflex.

If the child is grunting, tachypneic, and especially if the oxygen saturation is lowered, there is hypoventilation present. If repositioning and sectioning secretions does not help, prepare to BVM.

Here is a great video on first aid for seizures by the British Red
Cross that has a video of a child with grunting and seizing:
https://www.youtube.com/watch?v=vSnRdmR6xciE

Dr. Kahn:

One of the scary things about kiddos is figuring out when they’re sick. The thing is, most of us don’t actually have a problem with the intellectual part of recognizing illness in children. Instead, many of us are hesitant to “pull the trigger” and switch to resuscitation mode. We see this in adult patients as well; the first few moments of a CPR case are often taken up by assessing pulses, looking for breathing, hooking up the monitor… and convincing ourselves that the patient really is apneic and pulseless.

In this case, both the MICN and the field crew, while appropriately recognizing that something wasn’t right, may not have gotten to the “we need to ventilate this baby” conclusion as quickly as we might like. It doesn’t appear to have affected the outcome, to our knowledge, although we don’t have records from the receiving facility.

Fortunately, there are backup options when we have patients that we’re just not sure about. The quickest is to ask the MICN to contact the base hospital physician. It’s okay to bring the doctor in even without requesting a base hospital physician order or MD variation. For special circumstances involving highly complex neonatal/pediatric patients, we might be able to get Children’s involved, possibly including deployment of the Children’s Hospital Emergency Transport team.

I have to agree that focusing on the BLS skills is often a really good idea. While medics save lives, BLS can save medics in tight spots. Even in the operating room, the anesthesiologists with all of the fancy airway equipment and monitoring tools generally agree that their most important and difficult skill is performing good BVM ventilation.

Thanks to all for their good work on this tough case.

The 2016 EMS Week is May 15th-21st.

Stay tuned for celebrations all over the county!

It’s hard work out there, and the UCSD EMS Division appreciates the effort and dedication you put into making sure that we get the right care to the right patient at the right time, every time.

So, thank you all for giving your all to our patients and our communities. Stay safe out there, and we look forward to seeing you in our EDs soon!

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**References**

http://www.med.umich.edu/lrc/ecgoftheweek/cases/case10/deltawaves.html


http://lifeinthefastlane.com/ecg-library/basics/arrhythmogenic-right-ventricular-cardiomyopathy/


https://www.urmc.rochester.edu/imaging/patients/procedures/thrombolysis.aspx

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