

# A MEDICAL FIRST

## Some called it a medical miracle

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**D**uring our ICU rounds in mid-July 2019, we were discussing the case of Emmanuel, a 15-year-old boy who had drowned a week earlier, when several of our colleagues started talking about a miracle. “How could he have survived and woken up after drowning in a warm water pool? Nobody survives after 15 minutes underwater on a warm July day in Minnesota.”

After several minutes we chimed in: “Friends, this wasn’t a miracle, we used some new CPR devices together for the first time and they worked!”

### EMMANUEL’S STORY

Indeed, Emmanuel moved from Liberia to join his father for the dream of a new life in America in December 2018. He loved basketball and his new classmates, but, against his father’s request, went to play with his friends at their apartment in the same complex on July 11, 2019.

His father returned from work and learned a boy was drowning underwater in the apartment complex pool. The dad ran to the pool and jumped in but couldn’t get the boy up from the bottom on his first attempt.

When he resurfaced, he learned that it was his own son he was trying to save. His son had never learned to swim and accidentally fell into the pool. His dad’s second attempt to lift him up from the bottom of the 9-foot-deep pool was similarly futile.

Two New Brighton, Minn., police officers suddenly appeared on the scene, running down a hill to the pool carrying a host of cardiac arrest resuscitation equipment.

One officer ripped off his bulletproof vest, pulled his holstered weapon and handed it to his partner, and dove in. Within seconds, Emmanuel was removed from the pool and receiving manual BLS CPR with the combination of active compression-decompression (ACD) CPR and an impedance threshold device (ITD); components of ZOLL Medical’s ResQ CPR System carried by the patrol officers.

Emmanuel’s legs were still in the water and the

AED advised no shock. As CPR continued, the officers deployed the EleGARD head and torso elevation system that was recently added to the patrol officers’ vehicle. The device provides controlled, sequential elevation of the head and thorax.

After 15 minutes, a LUCAS mechanical chest compression device was used in place of the manual ACD CPR pump to ensure consistent compressions and free up the officers, and other rescuers to attend to Emmanuel.

After 20 minutes of poolside mechanical CPR, a pulse returned. Five minutes later, Emmanuel was breathing on his own. And while en route to Children’s Hospital of Minneapolis, he started pulling on his ET tube.

Then the debate began, to cool or not to cool? There is no definitive data in this area, so discussion ensued. After a lengthy back and forth, we agreed that he should be cooled, so then we discussed whether to cool him to 33 degrees C, or cool him to just 36 degrees C. We agreed to take



Emmanuel with staff on the day of his discharge from the rehab facility.

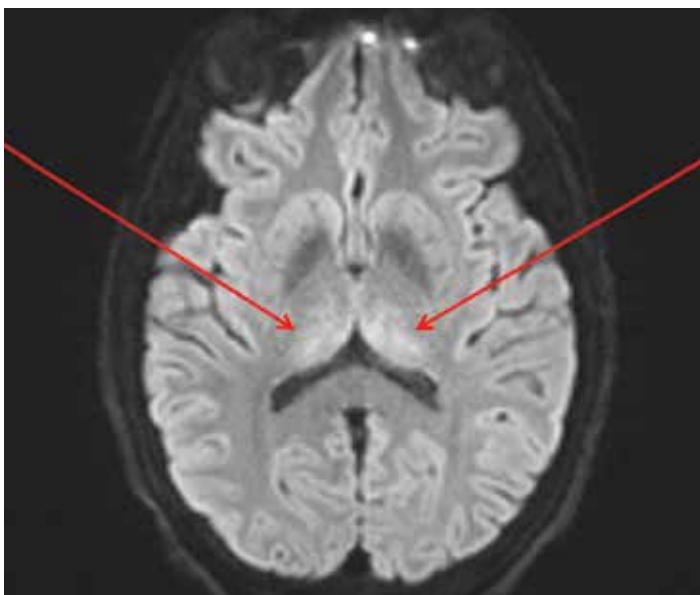


**New Brighton, Minn., police officers who rescued and resuscitated Emmanuel.**

him to 36 degrees C.

Putting together the reports from witnesses and the 9-1-1 response times, Emmanuel was estimated to have been submerged under water for at least 13–17 minutes. So, then we waited for the dreaded brain edema that occurs ever so commonly, if not inevitably, after a prolonged warm water drowning.

Between 4–48 hours after his arrest, Emmanuel’s EEG summary read, “The background is diffusely slow and nonreactive. It becomes more suppressed toward the part of the recording. The



**Figure 1: MRI T2 signal abnormality and restricted diffusion involving the bilateral thalami concerning for ischemic change.**

findings suggest a non-specific encephalopathy. No seizures are noted.”

His head MRI was worrisome, with diffuse mid-brain swelling bilaterally. (See Figure 1.)

Then, on day five, he started moving his arms and legs and, by day seven, he was trying to wake up.

Three weeks after his cardiac arrest Emmanuel walked, normally, out of Children’s Hospital to Bethesda, our local rehab hospital.

Less than three weeks later he left Bethesda and returned to high school in the fall.

## DISCUSSION

We caught up with Emmanuel and his family at an awards ceremony for the New Brighton police heroes who saved him, and then later at his apartment where we discussed his remarkable recovery.

Although Emmanuel and his father report that he had to learn how to talk, eat, move, walk and throw a baseball, all over again, as though he never knew how to perform any of these tasks, his cognitive ability post-resuscitation was amazing. A resuscitation specialist who visited him brought him a chess set for Christmas, and, incredibly, within minutes, Emmanuel learned the names of each of the game pieces and the appropriate moves for each! He was waiting eagerly for clearance to play basketball again.

So, was this a miracle resuscitation? It may not be miraculous, but it’s certainly a remarkable resuscitation that occurred following the first police deployment of the combination of ACD+ITD CPR and head up CPR with the EleGARD device.

The New Brighton Police Officers are first responders who take their jobs seriously, members of a police department that’s actively involved in EMS training and resuscitation science, and that’s interested in adopting and utilizing the latest resuscitation tools.

We have known about head up CPR since 2015 and were the first to have a save with it when it was introduced into the Anoka County Minnesota EMS system in April 2019.

We believe that the New Brighton Police may have been the only police in the world to carry and utilize all three devices (ResQPUMP, ITD, EleGARD) at all cardiac arrest cases, such as at the time of Emmanuel’s resuscitation.

We know from multiple studies that ACD+ITD CPR generates a significant intrathoracic vacuum during the decompression phase of CPR and results in a doubling of blood flow to the heart and brain and 50% more 1-year survivors after out-of-hospital cardiac arrest in adults.

We also now know that controlled sequential elevation of the head and thorax during CPR with

ACD+ITD doubles brain blood yet again, lowers intra-cranial pressure (ICP) immediately, and nearly normalizes cerebral perfusion pressures.

Finally, we also now know that conventional manual CPR in the flat position, which nearly everyone still receives, not only just propels 25% of normal blood flow forward, but also propels venous blood backwards, and causes the ICP to increase with each compression. This effectively creates a brain concussion with each compression, as the high-pressure arterial and venous pressure compression waves reach the brain simultaneously.

It has been shown that ACD+ITD CPR, along with controlled elevation of the head and thorax, mitigates against this harmful combination of ischemia, anoxia, and high ICP from the CPR.

In Emmanuel's case, his head was always elevated higher than the rest of his body, with CPR initially performed with his feet in the water while his torso and head were on the side of the pool. Next his head and heart were elevated by the police officers via the EleGARD.

The whole time he received ACD+ITD CPR and then mechanical CPR via the LUCAS compression device. This combination has been shown in the pig lab to result in sustained and normal cerebral perfusion pressures, and a six-fold higher neurologically intact survival rate compared with conventional flat CPR.

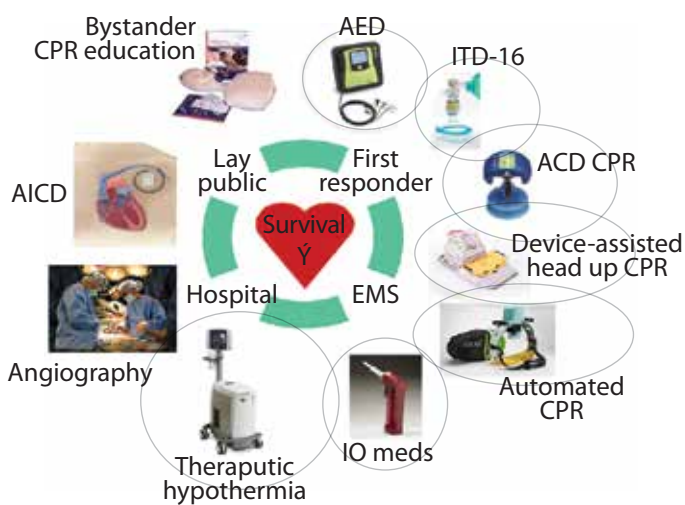
## CONCLUSION

Emmanuel was successfully resuscitated as a result of fast, state of the art knowledge and technology by the police officers of the New Brighton police department. (See Figure 2 for the bundle of care used by the progressive law enforcement agency.)

It takes the whole bundle, including controlled patient hypothermia, to help save a young child such as Emmanuel. Hypothermia shouldn't be controversial in a 15-year-old teenager: a reduction in core temperatures to 33 degrees C for 24 hours works in adults 18 years of age and older, so we believe it is only common sense that it be utilized in selected patients under the age of 18.

Emmanuel survived after a terribly unlucky fall into a swimming pool, despite having never learned to swim in his native Liberia. He is back playing basketball, his favorite sport, and is thriving in school.

The New Brighton City Council offered him and his friends free swimming lessons at the award ceremony for his rescuers. We know swimming is a life skill all should learn. We offer you another life skill, a way to increase the likelihood for full restoration of life after cardiac arrest, for anyone who needs it. This new approach focuses on technologies



**Figure 2:** The Take Heart America bundle of care techniques and technologies used to resuscitate Emmanuel.

that when used collectively restore normal brain flow and lower ICP and prevent reperfusion injury. Emmanuel's remarkable case should become the blueprint for all patients in need of CPR.

We need our police officers, medics, nurses, and doctors to understand these breakthroughs and to use them as the new standard of care. It would be an enormous step forward and a gift for all future patients who would benefit from this first very unlucky and then very lucky boy from Liberia.



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An alert and exuberant Emmanuel at home with his parents at Christmas 2019.