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Pediatric Heart Transplant After Cardiocirculatory Death

### HEART TRANSPLANT AFTER CARDIOCIRCULATORY DEATH

We have performed pediatric heart transplants for years after the declaration of brain death in donors. To this point those who die of cardiovascular complications have not been considered as donors. How are advances in this area forcing us to reconsider the prospect of a heart transplant after cardiocirculatory death?

You are listening to ReachMD XM 157, The Channel for Medical Professionals. Welcome to the clinician's roundtable. I am your host, Dr. Mark Nolan Hill, Professor of Surgery and Practicing General Surgeon and our guest is Dr. Mark Boucek, Director of Pediatric Cardiovascular Services at Joe DiMaggio Children's Hospital in Hollywood, Florida. Dr. Boucek is the lead author of research published in the New England Journal of Medicine on 3 cases of pediatric heart transplantation after cardiocirculatory death.

**Dr. MARK NOLAN HILL:**

Welcome Dr. Boucek.

**Dr. MARK BOUCEK:**

Well thank you. It's a pleasure to be here.

**Dr. MARK NOLAN HILL:**

Dr. Boucek could you define for us the difference between death as defined by brain death and death as defined by cardiocirculatory death?

**Dr. MARK BOUCEK:**

As you may know the typical organ donation process as it exists today in most circumstances requires that testing be done on a potential donor to establish the fact that there are no higher brain functions and that includes things like breathing and thinking and responding appropriately, so the patient is unresponsive and shows no signs of higher brain function and no interfering factors that would be causing it, so its an injury.

**Dr. MARK NOLAN HILL:**

Does that mean that you then cannot take a donor who has a cardiocirculatory death up to this point?

**Dr. MARK BOUCEK:**

It has been done in adult and in some pediatric patients, but it has been generally restricted to the donation of liver or kidneys, occasionally, now some lungs and we were sort of moving into the area where the consideration of the heart itself as a potential organ for donation following what you and I would think of is physiologic death where the heart stops beating ultimately.

**Dr. MARK NOLAN HILL:**

Well as I understand that there is only 1 previously documented case of a heart transplant performed after that type of death. Could you tell us a little bit about that case and the history, the pertinent history?

**Dr. MARK BOUCEK:**

Well the history goes a way back. Actually the very first heart transplant that was ever done as you probably recall back in the 60s with Christian Barnard in South Africa. That donor actually was allowed to die what we call cardiocirculatory or physiologic death. The heart stopped beating and then after the heart stops beating, then the patient is declared dead the way you and I do on a daily basis and then they proceed with the process of organ procurement despite the fact that the heart has stopped beating and I think that, you know the fundamental concept is that the individual as we all are, is a component of all of our organs and they need to function together synchronously for us to be an intact individual. What happens when there is cardiocirculatory death is that these individuals have suffered enough damage that they are not able to maintain normal physiology. Generally it means that they are not able to breathe; they require a ventilator or something to stay alive. So that if you withdraw a life support, a ventilator for example, then they are unable to breathe adequately and they develop hypoxia. After a period of time that hypoxia starts to interfere with cardiac function and usually over a period of minutes, maybe as long as 20 to 30 minutes, the heart will stop and death is declared at that point.

**Dr. MARK NOLAN HILL:**

Now why is this an issue, cardiocirculatory death versus brain death in terms of donors?

**Dr. MARK BOUCEK:**

Well I think that there are 2 issues that have come out of this, that it is new and so that, relatively new. It is somewhat back to the future since the first heart transplant was done this way and actually a number were done this way in the 60s. Before the legal definition of brain death was established this was how they were done. Their just were not very many and the concern is that the heart is perhaps the most vulnerable organ to ischemic injury or so the theory had been. So that when there is brain death, obviously the donor still has circulation, the heart is being perfused as oxygen and at the time of organ donation then, the heart is felt to be in reasonably good shape to undergo the process of transplantation. When there is cardiocirculatory death, the heart has suffered by being in a body that is no

longer physiologically capable of functioning and so there is that hypoxic ischemic injury to the heart and that has led to the concerns that well maybe these hearts will not be able to work adequately in the donor. So that is the first concern. The second concern, which the ethicists, I think, have tried to raise, is if an individual dies from their heart stopping, how is it possible for that heart could then support another individual?

**Dr. MARK NOLAN HILL:**

And how do you respond to both of those issues?

**Dr. MARK BOUCEK:**

Well we had some experience in pediatrics in particular of organ donation following brain death in children that had sustained significant hypoxic ischemic injury such as children who die from sudden infant death syndrome and we had learned over the years that those children are able to donate and the heart works as well as a heart that had not had that kind of ischemic injury. So it is seemed like there was much more reserve in the heart than we had given it credit for and that addresses the first issue. So we were not just flying off on our own. This really seemed to be based on experience over a number of years that the heart was able to cope with that. The second issue I think it is into more of a cultural domain where you and I and many in the culture tend to think of the heart as the place where the love resides and perhaps where the soul is and there is a lot of other spiritual aspects that we locate to the anatomic structure of the heart, and whether they belong there or not I don't know and so I think the concern is that if the heart stops, then that means that it stopped and is unable to beat in somebody else. If it could beat in somebody else then why couldn't it beat in that same person? Why did the person die? I think that's the logic that's followed and it gets a little bit complicated when you throw in these sort of cultural visions of what the heart represents.

**Dr. MARK NOLAN HILL:**

Dr. Boucek why is transplantation with respect to a child different than an adult?

**Dr. MARK BOUCEK:**

It's not in many respects. There are some different demands. Obviously for a child, we expect that the heart transplant is going to provide a lifelong relative cure for their cardiac problem whereas in adults we don't have such a great expectation.

**Dr. MARK NOLAN HILL:**

Do they have an increased risk of dying an infant or a child versus an adult?

**Dr. MARK BOUCEK:**

Yes, and I think that is one of the reasons that we were pushed to forge into this area perhaps ahead of our adult colleagues and that is that infants, in particular children under a year of age have about a 20% to 25% risk of dying while awaiting a donor organ for heart transplantation. The biggest issue is that there has been sort of a limitation of donors and these children tend not to be stable, the children that are awaiting heart transplant, when we reach the point where we realize that there is no other way for this child to survive,

they tend to be more critically ill and we do not have the artificial hearts and the left ventricular assist devices and things like that that are of appropriate size in children that would allow us to sustain an individual whose heart has failed in a way that you can in adults. So, there is really a more urgent, a greater urgency to identifying an appropriate donor within weeks of when we become aware of the fact that this child is not going to live without a transplant.

**Dr. MARK NOLAN HILL:**

So, how would be modification of the dead donor rule with respect to the cardiocirculatory death affect these children and infants waiting for a heart?

**Dr. MARK BOUCEK:**

Well, it should hopefully make the donor organs much more available. You may or may not know, but parents of children are tremendously in support of organ donation. All of the surveys have indicated 80% or more in favor of organ donation and that makes sense. You know when you have children, you are investing in the future and you want things to work out when you are faced with the terrible news that you are going to lose the child, parents still want something good to come of it and unfortunately, in many situations, children do not reach the classic criteria of brain death and those families are unable to consider organ donation at this time. So there are a lot of potential donors. It is very common these days to withdraw life support of a severely injured child in an intensive care unit and the child dies and you know the family has requested no resuscitation and they are not able to donate organs. What this potential would bring up is that the option of organ donation would be possible for those families; it is not something that they want. They want to feel that some component of their child is living on and it is helping another family so that they don't have to face the terrible loss that they are facing.

**Dr. MARK NOLAN HILL:**

Isn't the definition legally of death in the situation being brain dead?

**Dr. MARK BOUCEK:**

Well, it is not really brain dead. It is what you and I for years have used as a definition of death and I think most people in society recognize as death when their loved one or their grandparent or someone who they may be at the bedside ceases to breath and the physician examines the patient and says I cannot detect a heartbeat, there is no sign of life, there is no breathing, this patient is dead.

**Dr. MARK NOLAN HILL:**

But, is it that considered now not adequate because I know certainly that was the way many years ago, no pulse, no spontaneous respirations, etc. but is it required now that you do neurologic functions before you withdraw care?

**Dr. MARK BOUCEK:**

Now, the neurologic requirements are for the definition of brain death, which is a concept that was developed in the late 60s to define that state of absence of higher cortical function, which then was the equivalent of lack of life despite the fact that the organs may be

working and I do not think that this process violates the dead donor rule at all because in fact, these individuals have died and the families have requested or in a case of adult, the individual may have requested that no resuscitation be performed on them.

**Dr. MARK NOLAN HILL:**

What if someone asks you and I say well you are taking a heart from a child that had a cardiocirculatory death and you are able to put it in another child and restart it? So therefore since you could restart it, maybe should you have pursued that donor in terms of trying to save their life more?

**Dr. MARK BOUCEK:**

Well, I think that is where the confusion sets in, but I think it is only confusing if you don't realize the process of how this occurs. This is a child who suffered a significant injury, one that is felt to be incompatible with life by the primary physicians caring for the child, by the family frequently by consulting neurologists, but yet the child does not reach the standard criteria of brain death. So, the decision is made to withdraw life support and this is a decision that is done in concert with the family and the physicians and the expectation is that if the child is able to maintain their circulation, the signs of life without artificial help, then we would continue to support the child. If, however, the child is not able to sustain himself, then that child is allowed to die and the families request do not resuscitate. They don't want resuscitative efforts. They don't want an artificial heart used if we had such a thing for a young child. They don't want a ventilator use. They want the child to be able to live on their own, if they are able to and if they are not able to, they want them to die with dignity.

**Dr. MARK NOLAN HILL:**

I want to thank our guest Dr. Mark Boucek. We have been discussing pediatric heart transplantation after cardiocirculatory death. I am Dr. Mark Nolan Hill and you have been listening to The Clinician's Roundtable on ReachMD XM157, The Channel for Medical Professionals. Be sure to visit our web site at [reachmd.com](https://reachmd.com) featuring on-demand pod casts of our entire library. For comments and questions, please call us toll-free at 888-MD-XM157 and thank you for listening.