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Uncoupling

By Matthew Lorenz

"I think your patient has died," the nurse says, confirming what we thought was inevitable. "But something doesn't make sense: the monitor says his heart rate is 60."

Puzzled, I go to the bedside. My patient's eyes are open—unblinking—the pupils fixed and unreactive. There is no pulse, no spontaneous respirations, no withdrawal from painful stimuli. I pause—am I missing something? I learned the examination for pronouncing death from senior residents, none of whom expressed doubt when assessing a patient's demise. I watch him, awaiting a sudden gasp for air, but he is still. I look at the monitor above his bed. The lines representing respiratory rate and oxygen saturation are flat, consistent with my exam. But the heart rate—the line that dramatically flatlines on TV medical dramas—continues to pulse across the screen at 60 beats per minute.

I press my stethoscope to his chest, hearing nothing. I move the stethoscope right and left—still nothing. Finally, I come across a small plateau rising just beneath his clavicle: a pacemaker—the source of the persisting rhythm. Its wires embedded in the heart, the pacemaker's electrical impulses quickly spread across the heart's conduction system and, under normal circumstances, trigger the heart's ventricles to contract and pump blood to the body. The paced rhythm on the monitor leaves no doubt that my patient's heart is conducting electricity. But his heart is not pumping, at least not that I can hear with my stethoscope or feel as a pulse.

In effect, what I'm observing is akin to pulseless electrical activity, or PEA, a form of cardiac arrest in which there is an uncoupling of the heart's electrical conduction system and its mechanical function. The monitor shows a rhythm but the patient has no pulse.

Unlike the jolt of an implantable cardioverter defibrillator, or ICD, patients do not perceive the signal transmitted by a pacemaker. But I struggle to reconcile the pacemaker's ongoing function in my patient's functionless heart. The rhythmic bursts of energy feel misplaced, a ripple in a still pond. I ask my supervising fellow if there is a hospital protocol regarding pacemaker deactivation after a patient's death. There is none; he reminds me that a pacemaker is simply an energy source akin to the heart's intrinsic automaticity. Unlike the defibrillator function of an ICD, which is easily disabled by a magnet applied to the chest, a pacemaker's deactivation requires a wireless programming device, which we do not have. The fellow urges me to keep working—the ICU is always busy, never static. I return to my patient's room and, ignoring my own emotions, hear myself tell the nurse that we don't need to worry about the pacemaker. I watch the cardiac lead pace across the screen as the nurse snaps the monitor off, the sound echoing in my brain. I return to my workstation, trying to snap back to work.

In hindsight, I remember my first encounter with PEA as a medical student. My supervising resident and I have just run up several flights of stairs to a room where a "code blue" is

underway. Inside, I hear shouting punctuated by irregular whacks—chest compressions, presumably—but cannot see the patient because of the crowd of hospital staff spilling into the hall. Like dyssynchronous myocytes in a fibrillating heart, the staff's lack of direction has led to disarray.

My resident pushes into the room and takes charge at the foot of the bed, quickly assigning individual roles: chest compressions (where I will take part), defibrillator pad placement, airway management, IV access, medication preparation, and data recording. A pulse check reveals nothing to match the mountains and valleys on the rhythm monitor. My resident identifies this disparity as PEA, and promptly requests ongoing compressions and epinephrine boluses. The pattern repeats twice more, each time revealing PEA despite the team's improved approach. Minutes later the patient's family arrives while I'm pounding on their loved one's chest. Horrified by the sound of cracking ribs, they tearfully ask us to stop. I step back, breathless, traumatized by the sudden realization that I can't lift my arms. They've gone numb, as if they were not my own.

Today, when I admit patients to the hospital, I recall this unraveling sense of chaos as I discuss what CPR entails. The ensuing query feels absurd: if you wish, we will beat you and shock you in an attempt to keep you alive. Nevertheless, most patients say yes. My patient, who was admitted for the third time in as many months for complications from chronic obstructive pulmonary disease and congestive heart failure, said no.

I pronounce him dead at one o'clock in the morning. But the time feels arbitrary—won't his body still be dying ten minutes from now? His myocardial cells, increasingly starved of oxygen following his last breath, continue to conduct electricity transmitted by his pacemaker. If left connected to the monitor, the cardiac waveform will eventually distort and flatten as the cells ultimately die. In the absence of deactivation, his pacemaker will stubbornly continue to trigger impulses until its battery fails. Pacemaker batteries, unlike dying myocytes, typically work for an average of seven years. As such, many people who have died are buried with functioning pacemakers, which pulse futilely underground until they ultimately die, too.

A patient's death, like many hospital events, triggers a protocol. As the physician, I perform the exam confirming my patient's demise. Notify the next-of-kin—his daughter. Inquire about her interest in an autopsy—she refuses. Phone the organ bank to discuss his candidacy for organ transplantation—he doesn't qualify. Fill out a death certificate by hand. Click through the electronic medical record's section entitled "Discharge as Deceased," an unsettling heading for documenting death. Upon completion of this last task, his chart ominously changes color from blue to gray, as if it also dies. Meanwhile, in the patient's room, nurses and medical assistants turn off monitors and medication pumps, their beeps now mute. They untangle what had been a life-supporting web of IV lines, catheters and monitor wires. A staff transporter wheels my patient, now physically disconnected from the ICU, on a transport stretcher out of the room. Draped with a clean white sheet, my patient glides away like a ghost, disappearing into a service elevator that leads to the morgue. Last, a janitor cleans the now-unoccupied room, effectively erasing any trace of my patient's presence.

Peering into the empty room, I wonder how many patients have passed through this space. Some survived what ailed them on account of the lifesaving interventions offered here; others, like my patient, did not. Regardless of outcome, the room always returns to this shell-like, lifeless state.

But such stillness is fleeting, interrupted by the surrounding din of the ICU. An IV pump begins to alarm in the next room. A ventilator hisses repeatedly. A phone rings incessantly. Each pulsing rhythm reminds me that somewhere, out of sight, my patient's pacemaker is still pacing every second.

An elevator opens. A new patient on a transport stretcher rolls toward me—past me—into the empty room. The staff works quickly, their hands moving in unison to slide the patient onto the ICU bed, mirroring the last patient's exit. They quickly disconnect and reconnect wires from transport equipment to bedside monitors, rebuilding the scaffold of lines and tubes they had previously undone. I watch through the door, my body unable to move as my brain strains to uncouple the patient in front of me from the one still in my mind.

Beep. Beep. Beep.

The sound draws my eyes to the monitor. A pulsing rhythm moves quickly across the screen—a heart rate of 124. I look at the patient, their face half-covered by an oxygen mask. Their wide eyes meet mine for a moment.

I reach for my stethoscope, and step into the room.

Matthew Lorenz, MD, is an internist-pediatrician in Rhode Island.