Insights on Innovation
by Dan White

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EMS Telemetry: From BioCom to Bluetooth

Medical telemetry is often thought of as just a means of sending an ECG to the hospital. But it could and should be so much more. Advances in specialized patient care have increased the demand for data communication systems. However, years of neglect have presented challenges in establishing the infrastructure to move forward.

When I first started in EMS back in the '70s, you usually had to give the ER doctor an ECG before you were allowed to administer a cardiac drug. And this was a difficult and challenging task due to the technology at the time. The heavy, low-power, orange UHF BioCom Biophone had very limited range. They were mostly useless inside dense urban structures or in a moving ambulance.

So, we often defaulted to the optional telephone modem — a device that looked like a radio-headset that was strapped onto the patient's landline phone. We then plugged the connection into our BioCom and then to our LifePak 4. It was primitive, but was one of the few options that worked.

Courtesy photo
The CAREpoint Workstation by General Devices

The much lighter and more compact Motorola APCOR soon followed the BioCom. It worked better, especially when coupled with an ambulance repeater. It was half the weight and size and was much easier to carry. But it was still plagued by many of the same limitations as the BioCom.

During the '80s, physicians and nurses grew to learn the capabilities of our fledgling profession and a greater confidence in our ECG analysis skills began to develop. Simultaneously, the growing AHA ACLS program broadened the base of physicians, nurses and paramedics who followed the same treatment protocols during the first few minutes of a cardiac arrest. ER doctors began to trust our ECG interpretations.

By the '90s, the development of standardized protocol resulted in a lesser perceived need to send ECGs to ER doctors. In many departments, paramedics stopped sending data because they felt doctors trusted their interpretation of cardiac arrhythmias and soon the infrastructure of medical telemetry began to crumble. The hospital-based ECG screens became coffee cup coasters.

The advent of the pre-hospital 12-lead cardiac monitor and defibrillator promised to help EMS systems identify STEMI patients in the field. With early identification came the opportunity to route these patients to specialized cardiac care centers for improved outcomes. Today, we face a rapidly growing need for improved medical telemetry, but with little infrastructure to accomplish it. However, the demands for improvements are growing and persuasive.

Connecting to future possibilities
In many areas, there is a growing awareness of how many emergent conditions could benefit from specialized treatment pathways. We learned to take trauma patients to trauma centers, burn patients to burn centers, and so on. There are now cardiac specialization centers in most urban areas, lead by the efforts of the Society of Chest Pain Centers, among many others.

In Missouri, new Time-Critical Diagnosis legislation was recently passed — taking the successful principles of the Trauma System model and using them to improve clinical outcomes for STEMI and stroke patients. However, this vision for the future could remain unfulfilled without rapid improvements in telemetry infrastructure.

Part of many EMS systems' efforts to improve pre-hospital cardiac care now involves sending ECGs, but there is still no good public system. Today, ECG telemetry is mostly transmitted via cellular phones using a dizzying array of proprietary software and hardware systems from defibrillator companies. There are no data transmission standards.

During a meeting of the Mid-America Regional Council in Kansas City last week, Darryl Coontz — deputy director of Clinical Services for Kansas City's MAST Ambulance — presented a summary of the existing commercially available telemetry systems. He shared an impressively detailed excel spreadsheet which detailed two popular pre-hospital 12-lead monitor-defibrillator vendors and their various telemetry cost models. I was astonished at the number and variety of different costs involved for an EMS system to send ECGs. It's even worse for the larger urban hospitals.

While most EMS systems only use one brand of cardiac monitor, a busy urban ER could receive patients from a dozen different systems in a single day, which can result in the nightmarish challenge of trying to receive 12-leads from all these systems.

One system that is pretty close to achieving universal telemetry standards is the CAREpoint Workstation from General Devices. This robust, hospital-based station functions as a hub for all medical command. It can receive 12-leads from

different brands of defibrillators and has “integral connectivity with radio, cellular, landline, intra-net and Internet systems.” However, the interface still requires all the different software systems to be cabbaged together.

The future of telemetry lies in a broadband public safety network with telemetry data standards. On February 4, 2008, the Federal Communications Commission’s Joint Advisory Committee submitted a report that recommended and encouraged deployment of interoperable broadband networks built on standard Internet protocols that would serve as a nationwide “backbone.”

With such a network, many things would become possible. For example, let’s take a look at a busy ER that is swamped with patients. Instead of having to waste time detailing a long laundry list of basic physiological data to the physician, you can send the BP, P, R, ECG, SAO2 and PCO2 beforehand. You share the pertinent history and summarize your treatment plan and get to the point quickly. The whole event takes less than a minute. This scenario is not fantasy; it’s already been done.

In February 2005, participants at the “Gathering of Eagles” conference in Dallas previewed an advanced EMS telemedicine system where real-time video images, digital voice communications and physiologic data were sent from a specially equipped Garland Fire Department ambulance. The project was a joint effort by General Devices, Philips Medical Systems, Mesh Networks, the University of Texas Southwestern, and the University of Chicago.

There is even more exciting new telemetry technology on the horizon, such as the NcIQ from Non-Invasive Medical Technologies of Las Vegas. This device allows first responders to arrive on scene and apply a small credit card-sized device to each victim, which monitors and measures cardiac output, heart rate and respiration.

However, none of these advancements will bring benefit to our patients without a better public safety mobile data infrastructure to support them. Years of benign neglect have left EMS without the mobile bandwidth to transmit life-saving information. Existing technologies, such as Bluetooth, have the potential to allow all our equipment to conduct local communication wirelessly. This would redistribute valuable resources and help pry open new possibilities for delivering better and more efficient patient care.

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Dan has designed many emergency medical products since his first one, the White Pulmonary Resuscitator in 1978. His most recent EMS product inventions are the AllMed® AVC Helmet, RapTag Triage System, and the top-selling Ultra-X Coat.

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