Paramedics in such places as Richmond, Va., San Francisco and Volusia County, Fla., reportedly loved the AutoPulse and raved about the resuscitations achieved using this new device. Moreover, studies from those systems (as well as the positive results from several animal studies) appeared to confirm these anecdotal successes. But recent studies paint a more complex picture.

Research results
In early 2005, a San Francisco prehospital study retrospectively compared 69 patients given CPR with an AutoPulse to 93 patients who received manual CPR. The findings: significantly better return of spontaneous circulation (ROSC) rates in AutoPulse patients presenting in asystole, and marginally better ROSC in AutoPulse patients with pulseless electrical activity (PEA).1

In October 2005, an EMS study from Volusia County reported that “treatment with AutoPulse CPR showed a significant increase in short-term survival overall and in patients with initially nonshockable rhythms.”2

Richmond reported its findings in the June 16, 2006, issue of the Journal of the American Medical Association (JAMA), and they were even more positive. When researchers retrospectively compared the outcomes of 278 patients who received CPR via AutoPulse with 499 who received manual CPR, they found ROSC in 34.5% of the AutoPulse patients compared with 20.2% of the manual CPR patients. More important, 20.9% of the AutoPulse patients survived to hospital admission and 9.7% to hospital discharge, whereas only 11.1% of the manual CPR patients survived to hospital admission and only 2.9% survived to hospital discharge.3

However, the same issue of JAMA contained the report of another study—the large, randomized prospective ASPIRE (AutoPulse Assisted Prehospital International Resuscitation) trial, conducted in Seattle; Columbus, Ohio;
devices to be able to see with electronic detail what was done, and how and when,” says Joseph P. Ornato, MD, medical director of Richmond (Va.) Ambulance Authority, co-investigator of a study of the AutoPulse device and co-chair for cardiac arrest of the International Resuscitation Outcomes Consortium.

ZOLL and Philips/Laerdal already offer defibrillator/monitors that measure all the elements and time intervals during CPR, and Medtronic expects to introduce such a device by the end of this year.

The ZOLL AED Plus and AED Pro defibrillators feature “Real CPR Help,” which includes a one-piece, pre-connected electrode that allows CPR compression data to appear instantaneously on its display screen, as well as an adaptive metronome to help rescuers maintain the proper rate and depth of compressions, coaching them to “push harder” when necessary.

In 2006, Philips installed a new technology, Q-CPR, developed by Laerdal in the HeartStartMRx monitor/defibrillator that provides feedback on the rate and depth of chest compressions and the frequency and quality of ventilations. It provides visual and audio clues (which can be muted) to let rescuers know if their CPR quality begins to drop and prompts them how to change what they’re doing. Q-CPR also allows the collection of CPR data that can be reviewed after the event.

“Anyone who already owns [an MRx] unit can purchase Q-CPR separately and have it configured onto the device,” says Philips Product Marketing Manager Nancy Hinckley. “This is the first in a series of products that will be introduced using Q-CPR technology.”

Medtronic is currently testing a CPR report tool with some 40 EMS customers and plans to roll out this new product before the end of 2006, according to Medtronic Senior Communications Specialist Anne Devine. It will work with the LIFEPAK 500, LIFEPAK 12, LIFEPAK CR Plus, LIFEPAK 20 and LIFEPAK 1000 defibrillators, and will allow users to “measure chest compression rates and annotate ventilations to the record, calculate performance statistics and obtain a simple, yet effective, summary report to be shared with providers.” She notes that this tool “requires no additional hardware; it uses ECG signals already obtained.”

“I think we all should be using this new technology,” says CPR researcher Tom Aufderheide, MD, professor of emergency medicine at the Medical College of Wisconsin, Milwaukee. “We all need that feedback.”

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Devices Ensure Quality CPR

Why the disparity?

In an editorial in the issue of JAMA where the two studies appeared, Roger J. Lewis, MD, PhD, and James T. Niemann, MD, two emergency physicians from University of California, Los Angeles, tried to make sense of the ASPIRE and Richmond findings.

They wrote: “The best current information suggests that the degree of benefit or harm associated with use of the [AutoPulse] device is influenced by the details of its use—perhaps including selection of the patient population with respect to presenting rhythm, time from cardiac arrest to initiation of CPR, and almost certainly time-to-deployment and the influence of deployment on time-to-defibrillation when appropriate.”

“I don’t think any of us understands all the reasons for the difference in outcomes,” says Richmond EMS Medical Director Joseph F. Ornato, an internationally recognized CPR researcher and co-investigator on the Richmond study. “But it’s probably how the device is used, when in the CPR sequence it’s used, the quality and intensity of the training, and the quality improvement (QI) provided to medics using the device.”

The ASPIRE authors could find no obvious explanation for the surprising outcomes in that study, but they posed several possibilities: Perhaps the EMTs and paramedics, knowing they were being studied, improved the quality of their manual CPR. Or perhaps there was a relatively steep learning curve for those using the AutoPulse.

“Another possible explanation for the outcomes is that deployment time for the device was prolonged,” the authors wrote, noting that first shock for patients in V-fib occurred 2.1 minutes later for the AutoPulse patients than for patients who received manual CPR.

Ornato agrees that “some differences [in the outcomes of the two studies] may be due to when the device was applied. [Richmond] protocols have medics putting the device on as quickly as possible and leaving it on.” Also, Richmond protocols (before and after AutoPulse adoption) require medics to provide 90 seconds of CPR before defibrillation (except in cases of EMS-witnessed cardiac arrest, where providers shock first).

During the ASPIRE trial, however, providers used the AutoPulse at different points during various resuscitations. “A protocol requiring device implementation at a particular point of care might produce different results,” the ASPIRE investigators wrote in JAMA.

“When we set up the study design, we tried to allow for variance in EMS system designs and protocols; some did
defibrillation with one shock first, others did two minutes of CPR and then delivered a shock if the patient was in V-fib,” explains ASPIRE co-investigator Michael Sayre, MD, professor of emergency medicine at Ohio State University. “Eventually, all five sites agreed to do two minutes of CPR—manually or with AutoPulse—and then give a shock.”

However, during the study, one of the five sites changed its protocols. “They had an extensive QI [program] and saw a 45-second-or-longer delay in chest compressions while paramedics put on the AutoPulse, so they began shocking first,” Sayre says. In addition to this site’s deviation from protocols, the ASPIRE researchers reported that EMTs and paramedics at the ASPIRE sites frequently failed to follow study protocols.

The delay in chest compression while affixing the AutoPulse could well prove to be the key. The American Heart Association’s new CPR guidelines—which were released in late 2005, after the ASPIRE trial began and ended—stress the critical importance of minimizing interruptions to chest compressions.

In Richmond, Ornato says, “We spent a lot of time training medics in the device and gave them a lot of hands-on experience with manikins, orchestrating who does what so we minimized the time without chest compressions.

“We also provided a fair amount of feedback,” he adds. “We have 100% review of each cardiac arrest and have a supervisor who responds to every critical call, so we can close the loop on exactly what our medics are doing and take whatever QI measures are needed.”

In the ASPIRE study, however, training was “highly variable” between the five sites.

“We thought about this when setting up the study, but we believed the device would work and didn’t want to create an environment where the only way it would work was if an EMS system did extensive training,” Sayre says. “We did training and some refresher training, but it was ‘catch as catch can.’”

The ASPIRE researchers speculated later that more intensive training at all sites also might have “produced different results.”

ASPIRE co-investigator Thomas D. Rea, MD, MPH, from the University of Washington (Seattle), told the Seattle Post-Intelligencer, “No study is perfect, and we want to be cautious in writing off a potentially promising technology or device.”

**Future of AutoPulse**

“More than 450 EMS [systems] and hospitals worldwide are currently using the AutoPulse,” says Robert Minicucci, ZOLL’s corporate communications manager. In late July, ZOLL reported that its revenues from AutoPulse increased from $1.7 million to $2.7 million (or 59%) in the third quarter of fiscal year 2006, compared with the third quarter of fiscal year 2005.

But at least two systems have pulled their AutoPulse devices off
the rigs—at least for now—while others continue using them.

“We were using it, but we suspended its use during release of the ASPIRE trial [findings],” says Ed Racht, MD, medical director of Austin/Travis County (Texas) EMS. “That’s not because we think it’s harmful. We believe the technology has value, but [we must learn] how to use it to improve patient outcomes.”

When asked if Richmond EMS still uses the AutoPulse, Ornato replied, “Oh my gosh, yes. We’re seeing an obvious difference favoring a positive outcome, so it would be difficult to discontinue using it.”

He adds, “Ideally, there will be another trial that reflects on what we learned from both sets of investigations, particularly with the new technology available to track the timing of the elements of CPR.” (See “Devices Ensure Quality CPR,” p. 51.)

Noted Norwegian prehospital CPR researcher Lars Wik, MD, PhD, already has begun work on another AutoPulse study that will include sites in the U.S. and Europe, according to Ward Hamilton, ZOLL’s vice president of marketing.

Such research, Lewis and Niemann say, “will need to pay particular attention to the definition and consistency of the method of use of the device, to measuring the multiple important time intervals with precision, and to ensuring the quality of the manual CPR administered in both trial groups.”

Sayre notes that neither the Richmond study nor the ASPIRE trial measured the quality of the manual CPR provided. “Only recently did we recognize the importance of that, but perhaps the medics realized that and did better CPR,” he says. “When we started the ASPIRE trial, we expected [that AutoPulse worked] or we wouldn’t have done this study.”

Meanwhile, he reports that he doesn’t know what to tell people who ask if they should continue using their AutoPulse devices. “It’s a bit of a challenge to know what to do here,” Sayre says.

The AutoPulse, like many past EMS innovations, is showing promise in some EMS programs, being challenged in others and under the EMS microscope by scientists and researchers. This process isn’t new to EMS; rather, it’s a part of the evolution and implementation of prehospital care technology.

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