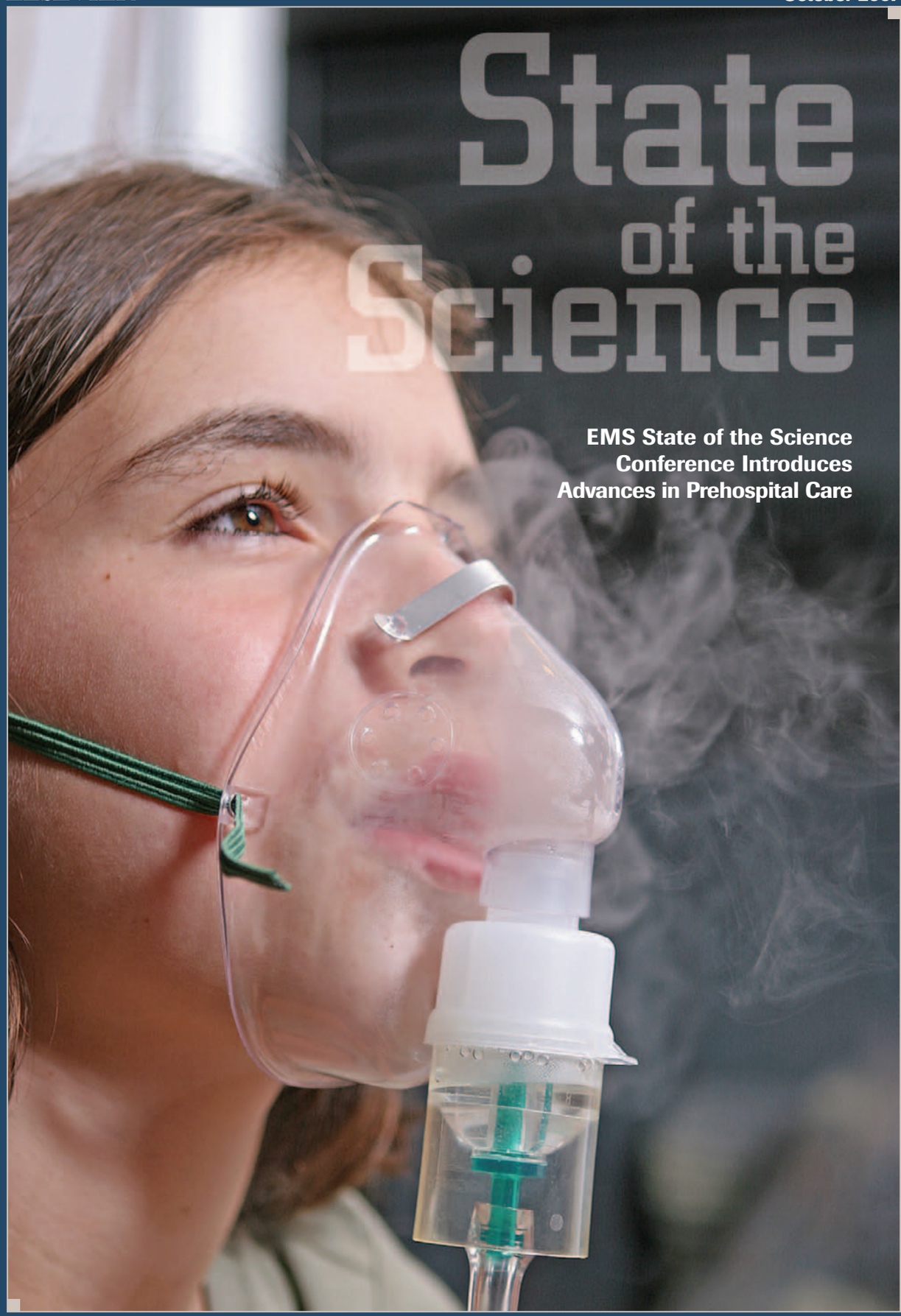
ELSEVIER

October 2007



State of the Science

EMS State of the Science Conference Introduces Advances in Prehospital Care

DEVELOPED IN CONJUNCTION WITH THE U.S. METROPOLITAN MUNICIPALITIES EMS MEDICAL DIRECTORS
An editorial supplement to *JEMS*, sponsored by Emergent Respiratory Products, Masimo, Philips Medical Systems, Physio-Control, Pyng Medical Corp., Respironics Inc., Vidacare Corp. & ZOLL Medical Corp.

The Conscience of EMS JEMS JOURNAL OF EMERGENCY MEDICAL SERVICES

BY KATHLEEN SCHRANK, MD

BETTER VENTILATION

The Science to Support Your CPAP Protocol

Continuous positive airway pressure (CPAP) by facemask has been in widespread use for respiratory distress within emergency departments and hospitals for years, and EMS use is now skyrocketing across the country. In the February 2007 *JEMS* survey of EMS agencies in the 200 most-populous U.S. cities, 45% of the 104 respondents reported they were already using CPAP in the field, up from 21% in 2003.[1] Also in February 2007, about one-third of the Eagles medical directors polled had implemented CPAP and another third planned to do so.

Weighing the minimal risks versus potentially major benefits, many EMS systems have deployed CPAP devices, and anecdotal support from providers and their medical directors is strong. So, for systems considering CPAP, you likely want to know what CPAP does for the patient (and whether it's supported by research), who's using it, what it costs, and how to plan for successful implementation.

How It Works

CPAP, BiPAP and bag-valve-mask ventilation are all forms of non-invasive positive pressure ventilation (NPPV). Normal breathing creates negative pressure on inspiration, pulling air and blood flow into the chest. Positive pressure ventilation pushes air into the chest, which overcomes airway resistance, keeps alveoli open and improves pulmonary gas exchange in patients with respiratory compromise. It also decreases blood return to the heart and may lower blood pressure.

The goals of CPAP and BiPAP treatment are to improve ventilation and oxygenation, decrease the need for endotracheal intubation and mechanical ventilation (thereby preventing the many potential consequences of both), and decrease mortality from respiratory failure. In patients with acute cardiogenic pulmonary edema, COPD or asthma, NPPV buys time for aggressive medical therapy to work.

CPAP provides the same positive pressure throughout the respiratory cycle, BiPAP has separate settings for inspiration and expiration, and BVM ventilation applies pressure during only inspiration. Several portable, efficient, easy-to-use CPAP devices are readily available. BiPAP devices are more cumbersome and complex and therefore unlikely to be amenable to EMS use.

Support for CPAP

Considerable evidence to support NPPV has been gathered in the hospital setting, primarily in the treatment of acute decompensated heart failure (ADHF) and COPD. Early studies were from the ICUs, where the devices have been in use for decades and are well accepted as standard of care. Research in the ED in the past decade strongly supports NPPV as well, with a meta-analysis of pooled data that found a 39% decrease in relative risk of mortality and a 57% decrease in the need for intubation in ADHF.[2-3]

PHOTO CAPT. CHRIS MUSSER/CITY OF MIAMI FIRE RESCUE

Inpatient and ED studies have *not* found any significant harm to patients from CPAP, even in those who failed a trial of NPPV and needed endotracheal intubation.

In the hospital, benefits are greatest in acute exacerbations of CHF (especially with hypercarbia) and COPD (used successfully even in patients with borderline mental status and pH below 7.2). Benefits include improved alveolar ventilation; decreased work of breathing; decreased mortality; decreased morbidity; decreased length of stay; decreased need for endotracheal intubation; and improved respiratory rate, tidal volume, and minute volume.

Importantly, inpatient and ED studies have *not* found any significant harm to patients, even in those who failed a trial of NPPV and needed endotracheal intubation. One study of CPAP versus BiPAP in ADHF was stopped early because the BiPAP group had more acute MIs, but reassessment later found more chest pain in that group prior to BiPAP, and that a comparison group treated without NPPV had many more MIs than the BiPAP group.[4] Early concerns about potential barotrauma and hypotension proved unwarranted. In the non-emergency setting, many chronically ill patients are using CPAP or BiPAP masks at home, typically for chronic CHF associated with morbid obesity, or for sleep apnea syndrome.

Unfortunately, available research is limited in the prehospital setting, particularly on documented improvement in patient outcomes. Prehospital research faces the challenges of obtaining prospective, fully informed consent from patients in respiratory distress; relating the brief period of prehospital care to mortality days or weeks later; and reducing inherent limitations on diagnostic accuracy outside the hospital as to the cause of respiratory distress.

Feasibility of use and patient safety were documented in several small studies, but they weren't designed to measure outcomes.[5] A prehospital study in Helsinki found that CPAP improved vital signs, oxygenation and hemodynamic parameters in presumed ADHF.[6] However, the study was not a randomized controlled trial with a non-CPAP arm, so cannot provide evidence regarding outcome improvement with CPAP (*Note*: The CPAP care was also administered by physicians in mobile ICUs).

A prehospital study in North Carolina compared ADHF patients treated by two EMS systems—one with CPAP and one without—and four hospitals. Both systems used nitroglycerin, morphine and furosemide. The primary endpoint was the need for endotracheal intubation by EMS or hospital (9% with CPAP versus 25% without; number needed to treat to prevent one ETT was 6), and the secondary endpoint was mortality (5% with verus 23% without, NNTT=6). EMS times (from scene arrival to ED arrival) averaged nearly 30 minutes in both systems.

Significantly, the prehospital impression of acute cardiac pulmonary edema proved wrong in 24% of the patients, but those with other causes were not harmed by CPAP use, and the endpoints in the subgroup with cardiac edema (76% of patients) were almost identical to the data above.[7] Thus, the benefits from CPAP were significant. However, the design using two separate systems and four hospitals is a limiting factor.

Many portable CPAP devices are on the market, but no clinical trials have compared usage on actual patients. Data is available on rate of oxygen use, pressure stability and work of breathing on a mechanical test lung, with a wide variation among the devices.[8]

The ideal prehospital CPAP study to determine the impact of CPAP on patient outcome (i.e., a large randomized, prospective, controlled trial with all prehospital and hospital factors substantially equal in both groups) remains to be done. Until more data is available, prehospital providers must focus on best practice based on known but limited evidence on prehospital CPAP—safe and appears beneficial—plus that of hospitals and EDs—safe and beneficial.

THE MIAMI FIRE RESCUE EXPERIENCE

In 2005, the City of Miami Fire Rescue implemented CPAP use, and our paramedics love it—now. Our experience was typical: Our paramedics greeted the CPAP devices with considerable skepticism, and usage was limited for the first few months. But after watching very sick patients rapidly turn around without the need for endotracheal intubation, our paramedics became strong CPAP advocates.

We started announcing our program to hospitals nine months before we started CPAP use, and distributed protocols and purchase info to them twice. We met with the ED medical directors, nursing directors, administrators and respiratory therapy staff two more times, and it still took a few months after implementation to get them all on board for rapid turnover of care.

We tracked usage closely for the first six months. We had EMS captains visit each station to give short refresher classes on the equipment and emphasize the need to keep giving drug therapy. Morphine remained on our trucks, but its use was discouraged even prior to CPAP. Interestingly, experienced paramedics were reluctant to give it up—until CPAP use was instituted.

We also sought feedback from our receiving EDs. Although a few patients couldn't tolerate the masks and a few patients failed (and needed intubation), no complications were observed and many patients had impressive responses.

We initially limited use to presumed cardiac pulmonary edema, and later expanded to allow use in all respiratory distress causes except suspected pneumothorax. Now, many providers report CPAP is "the best thing we ever put on the trucks" and our receiving EDs are enthusiastically using it, too. (Once again, EMS pushes the EDs along.)

Indications & Contraindications

EMS protocols typically specify that CPAP be applied in respiratory distress patients based on either subjective judgment ("looks bad," "heading for a tube") or objective criteria. Objective criteria include:

- Accessory muscle use/retractions;
- O_2 saturation $<$ 90% (some use $<$ 92%);
- Respiratory rate $>$ 24;
- Unable to speak full sentences;
- Abdominal/paradoxic breathing; or
- Altered mentation (GCS 11–14).

Medical directors may choose to authorize CPAP in all patients with respiratory distress or to limit use to specified groups (e.g., ADHF and COPD). Because the accuracy of diagnosing the underlying cause is limited in the field, CPAP decisions may be difficult in some patients if protocols limit the use to ADHF and/or COPD. Many severe CHF and COPD patients have so little airflow that rales and wheezes may not be heard on initial examination.

Hospital evidence supports use in acute decompensated heart failure (cardiac pulmonary edema); acute COPD exacerbation; acute asthma exacerbation; "Do Not Intubate/Resuscitate" patients (awake and in respiratory distress); non-cardiac pulmonary edema (ARDS, near-drowning, smoke inhalation); pneumonia; obstructive sleep apnea; hypoventilation with morbid obesity; immunocompromised patients in respiratory failure; trauma patients (excluding suspected pneumothorax); and cystic fibrosis patients with severe dyspnea. Also, CPAP may be of benefit in dialysis patients in respiratory distress from volume overload. CPAP is *not* needed for patients with milder dyspnea.

CPAP requires a patient who is breathing spontaneously, with enough of a mental status to cooperate and to handle secretions. The masks require a good seal. They are tight fitting, put pressure on the nose and face, and are strapped onto the head, so removal takes a few seconds. NPPV may lower BP, and all studies thus excluded hypotensive patients.

Assessment for contraindications is crucial. Use in pediatrics is unclear. Other contraindications include:

- Obvious need for endotracheal intubation (apnea, arrest);
- Hypotension (systolic BP $<$ 90 mmHg);
- Severe AMS (GCS $<$ 11, sometimes a judgment call requiring close observation);
- The patient is unable to cooperate;
- Suspected pneumothorax;
- Facial deformity/trauma/unable to obtain seal;
- Recent facial, neurologic or gastric surgery;
- High risk of aspiration of stomach contents/actively vomiting patient;
- Upper airway obstruction/foreign body (risk of harm,

although anecdotes of benefit);
- Unstable cardiac arrhythmia (borderline BP/hypotensive); or
- Age < 8 (or masks too large for the patient's face size).

Application & Complications

Protocols must be clear that providers should *not* delay medications because of CPAP. Use CPAP along with meds. The patient with cardiac pulmonary edema needs aggressive nitroglycerin therapy, and the COPD/asthma patient needs nebulizer medications.

While setting up the CPAP device, prepare the patient. Some patients feel claustrophobic or frightened by the facemask, so explain that the mask will fit tightly. Place the mask on by having the patient hold it in place for a moment, and then adjust the straps for a good seal. A lubricant, such as KY Jelly, may help with beards.

Reassure the patient and monitor their status (including vital signs, oxygen saturation, lung sounds, distress, secretions). Many patients in respiratory distress will have cardiac ischemia or infarctions, so 12-lead ECGs should be performed whenever possible, even in patients without chest pain.

While CPAP is doing its work, prepare for intubation. Assess for a difficult airway, set up suction, set up equipment and obtain IV access. If the patient deteriorates or doesn't respond to CPAP and medications, you'll be ready for endotracheal intubation. Providers should alert the receiving hospital that a patient is coming in on CPAP, so that they can be ready to continue it in the ED (or to intubate if necessary). Sudden removal of CPAP on arrival at the ED is risky, so it should be continued until the patient is clearly stabilized.

The most common problem in CPAP use is an air leak. The most dangerous complication is vomiting with massive aspiration. If a patient starts to vomit, remove the mask immediately to prevent aspiration. CPAP may cause mild gastric distension, but this is usually not a problem and requires a longer duration of use than even rural EMS will encounter. Some patients will be unable to tolerate the mask despite repeated reassurance and support. If so, it will have to be removed.

Hypotension is a potential complication, but is very rare and should be detected early by serial BP measurements. Do not continue CPAP if BP falls below 90 systolic or the patient develops signs and symptoms of shock. Barotrauma and pneumothorax are extremely rare, and have not yet been reported in the ED or EMS setting. Prolonged use in the hospital may cause local skin damage, sinus problems or eye irritation.

System Implementation

Evaluate several devices for portability, durability, oxygen consumption, ease of use (including mask and straps) and cost. Some devices require a small reusable CPAP generator plus disposable tubing and facemasks, whereas others are entirely disposable. Some devices allow adjustment of pressures and/or FiO_2; others are fixed. If using CPAP for patients with COPD or asthma, select a device that allows nebulization of medications.

Training requires only one to two hours. Protocols should include indications, contraindications, and required monitoring for complications. Additionally, a quality management program must be in place prior to implementation to ensure continued understanding and compliance with the protocol.

Because EMS needs to be able to quickly turn over care to ED staff, a key factor in the success of a CPAP program is close coordination with the receiving hospitals. CPAP drains oxygen tanks quickly, so ensure receiving EDs have connectors to switch over from EMS tanks to wall oxygen. The usual hospital CPAP and BiPAP devices are complicated and often set up by respiratory therapists who may not be readily available on EMS arrival. Therefore, if possible, the receiving EDs should stock the same CPAP device as EMS, and nurses should be trained on the initial setup of the units. Respiratory therapists can switch the patients over to more complex devices later. Also, be sure your EMS units have an adequate supply of portable O_2 tanks.

The Next Standard of Care?

Given the limitation of clinical research evidence in the prehospital arena, it's not yet appropriate to state that CPAP is the standard of care for EMS today. However, rapidly increasing deployment in EMS across the country is producing a substantial base of experience with CPAP among providers and EMS medical directors, and 2008 may be a different story.

At this point, we know it's safe and we believe it's effective. It's easy to learn and appears to be a low-risk/high-benefit treatment for patients in respiratory distress when coupled with medications to treat the underlying condition. Patients who respond well are saved from much higher risk procedures—endotracheal intubation, mechanical ventilation, sedation/paralysis. Patients who don't respond will still need intubation, but hopefully in a more controlled and prepared setting.

The systems using CPAP are uniformly and strongly positive about their results. But enthusiasm is no substitute for hard evidence. Thus, we have five challenges: 1) Conduct randomized, controlled prehospital studies with outcome measures beyond mortality (e.g., vital signs, O_2 sats, $EtCO_2$ changes, subjective distress, need for intubation, morbidity); 2) Collect more data on treating severe asthma with CPAP; 3) Evaluate CPAP in pediatric patients; 4) Conduct more prehospital studies on the optimal management in acute decompensated heart failure;[9] and 5) Objectively report complications in prehospital use. These are the challenges we must all address in order to fully validate the effectiveness and impact of CPAP in the prehospital setting. ■

KATHLEEN SCHRANK, MD, is an emergency physician at Jackson Memorial Hospital in Miami and the division chief for emergency medicine at the University of Miami Miller School of Medicine. She has served as the EMS medical director for the City of Miami Fire Rescue since 1983 and as medical director for the Village of Key Biscayne since 1993.

References

1. Williams D: "2006 JEMS 200-City Survey." *JEMS*. 31(2):38–54, 2007.
2. Kosowsky J, Storrow A, Carleton S: "Continuous and bi-level positive airway pressure in the treatment of acute cardiogenic pulmonary edema." *American Journal of Emergency Medicine*. 18:91–95, 2000.
3. Collins S, Mielniczuk L, et al: "The use of noninvasive ventilation in ED patients with acute cardiogenic pulmonary edema: a systematic review." *Annals of Emergency Medicine*. 48:260–269, 2006.
4. Mehta S, Jay G, Woolard R, et al: "Randomized, prospective trial of bi-level vs. continuous positive airway pressure in acute pulmonary edema." *Critical Care Medicine*. 25:620–628, 1997.
5. Kosowsky J, Stephanides S, et al: "Prehospital use of CPAP for presumed pulmonary edema: A preliminary case series." *Prehospital Emergency Care*. 5:190–196, 2006.
6. Kallio T, Kuisma M, et al: "The use of prehospital CPAP treatment in presumed acute severe pulmonary edema." *Prehospital Emergency Care*. 7:209–213, 2003.
7. Hubble M, Richards M, et al: "Effectiveness of prehospital CPAP in the management of acute pulmonary edema." *Prehospital Emergency Care*. 10:430–439, 2006
8. McCoy R, Diesem R: "Comparison of 3 CPAP systems used by EMS." www.jems.com/pdf/Respironics
9. Mosesso V, Dunford J, Blackwell T, et al: "Prehospital therapy for acute congestive heart failure: State of the art." *Prehospital Emergency Care*. 7:13–23, 2003.

BY MICHAEL J. HEWITT, RRT-NPS, FAARC, & DAVID E. PERSSE, MD, EMT-P, FACEP

A CPAP PARTNERSHIP THAT MAKES SENSE

Hospital & EMS Systems Form a Unique Agreement

The facts are grim: In 2004, more than 52,800 Americans died from congestive heart failure (CHF), a life-threatening condition in which the heart can no longer pump enough blood to the rest of the body, resulting in fluid backup in the lungs. That same year, nearly $26 billion was spent nationwide on CHF and related problems, including endotracheal (ET) intubations performed by EMS to relieve pressure in the lungs and restore the flow of oxygen to the body.

But, more importantly, for medically fragile CHF patients, life-saving ET intubations may mark the beginning of a downward spiral. The procedure leaves the body susceptible to infection, particularly ventilator-associated pneumonia (VAP). A single VAP treatment in the ICU costs a minimum of $56,000, and 54% of ventilated patients who develop VAP die.

In an effort to improve outcomes and reduce costs, Memorial Hermann Healthcare System and the City of Houston Fire Department Emergency Medical Services (EMS) formed a unique partnership designed to decrease the need for unnecessary ET intubations in CHF patients in a prehospital setting. This partnership marks the first time a hospital system and EMS department have worked together to help CHF patients in emergency care situations outside the hospital where every moment counts.

The solution is simple: By using continuous positive airway pressure (CPAP) machines supplied by Memorial Hermann, EMS now has another option to relieve dangerous fluid buildup in the lungs of CHF patients seen in the field. A safe and effective procedure, CPAP uses pressure and oxygen to open the airways and force fluid from the lungs noninvasively. Used successfully in hospitals since the early 1990s, CPAP has proven beneficial for patients with CHF and chronic obstructive pulmonary disease (COPD), as well as those on dialysis who become fluid overloaded.

Memorial Hermann purchased 51 CPAP machines and 900 CPAP circuits and provided them to Houston Fire Department EMS. The hospital system also purchased identical CPAP devices for each Memorial Hermann System Emergency Department (ED). When EMS brings CHF patients to a Memorial Hermann ED with CPAP applied, the CPAP circuit is replaced at no cost to the EMS service. Memorial Hermann recently added Montgomery County Hospital District, West University Fire and EMS, West Harris County EMS, Katy Fire and EMS, City of Humble Fire and EMS and Atascocita Fire and EMS to the list of CPAP participating prehospital units.

PHOTO COURTESY MEMORIAL HERMANN HEALTHCARE SYSTEM

City of Houston EMS crews routinely use CPAP in the field and have reduced the need for intubation.

"Each of Memorial Hermann's nine emergency centers now use the same equipment, which means that when CHF patients arrive on CPAP, their treatment will be consistent from the field to the hospital setting," says James Mc-Carthy, MD, medical director of the Memorial Hermann–Texas Medical Center (TMC) Emergency Center and an assistant professor in the Department of Emergency Medicine at the University of Texas Medical School at Houston. "Memorial Hermann also provided the personnel to train paramedics and emergency medical technicians in the use of CPAP."

Committed to helping bring this program to the field, HFD also changed its training calendar and helped facilitate an accelerated training program for nearly 400 paramedics in a four day period, a huge effort on the department's part. According to EMS Physician Director and Public Health Authority, David E. Persse, MD, firefighters quickly took to the new therapy and are now using it routinely. "There have been very few problems," says Persse. "Hospital emergency departments, including non-Memorial Hermann hospitals have all reported good experiences."

Launched May 1, 2007, the use of CPAP in prehospital settings has already proven successful. As of mid-August, 104 patients were admitted to Memorial Hermann emergency centers on CPAP. Only 22 (21%) were intubated, a 79% reduction in the number of patients who would otherwise have been intubated and required intensive airway care and hospital follow-up. This

resulted in a minimum cost savings of $656,000 for Memorial Hermann based on an average hospital expense of $8,000 for the first 24 hours of mechanical ventilation and care. This result doesn't include the savings realized from shortened hospital stays and reduced treatment of respiratory infections or complications from endotracheal intubations.

"Before this program most, if not all, 104 patients would have been intubated in the field," says Dr. McCarthy. "Additionally, those patients that did require endotracheal intubations received treatment in a hospital setting in a much more controlled environment than is possible in a patient's home with distressed loved-ones watching, or in the back of an ambulance."

Paramedic Craig Moreau says, "The addition of CPAP has greatly improved my ability to care for CHF patients. I feel if I can avoid intubating a pulmonary edema patient, I have provided the best care possible."

"The CPAP program is a direct benefit to patients and any hospital in the service area where the emergency patient is taken," says Randy Gleason, chief officer of risk and insurance at Memorial Hermann. "And, equally important, there is no expectation or understanding that patients must be taken to a Memorial Hermann facility simply because they are on a CPAP device that's part of this program. EMS providers still make decisions about patient transport based on the patient's acuity and the proximity of a hospital appropriately staffed and equipped to address that particular patient's medical needs."

"This gift from Memorial Hermann allowed HFD to quickly implement a new patient care option city-wide. It's very important for firefighters to be able to provide the highest level of care we can, especially to our critically ill patients," says Assistant Fire Chief Adrian Trevino.

It's a win-win situation. "Using CPAP helps keep people out of the ICU, resulting in significant benefits for our patients and for our hospitals, including reduced exposure to infections, better outcomes, shortened hospital stays and decreased costs," says Tom Flanagan, chief operating officer at Memorial Hermann–TMC. "It was a natural step to extend the care we provide our emergency patients into the field, where time is precious. We hope other hospitals and hospital systems throughout the nation will follow our lead and begin to form partnerships of their own with local EMS units." ■

MICHAEL J. HEWITT, RRT-NPS, FAARC, is director of Respiratory Care and Pulmonary Diagnostic Services at Memorial Hermann–Texas Medical Center. Hewitt is a registered respiratory therapist with nearly 25 years' experience in respiratory care. He serves on advisory committees to many Houston-area academic respiratory care programs and has been honored by the Texas Society for Respiratory Care as its Practitioner of the Year for Adult Critical Care, Education and Management.

DAVID E. PERSSE, MD, has been director of EMS for the City of Houston since 1996. In May of 2004, he was also appointed Houston's public health authority. Persse previously served as medical director of the L.A. County Paramedic Training Institute and as assistant medical director of the Los Angeles County EMS Agency. Prior to becoming a physician, he served for 10 years as a field paramedic and paramedic instructor in upstate New York and New Jersey.

BY KEITH WESLEY, MD, FACEP

THE 'BASIC' SKILL OF CPAP

Adding CPAP to the EMT-B Scope of Practice

Back when I first started working with continuous positive airway pressure (CPAP) support, I was so amazed by how well it worked for every cause of respiratory distress that I was quoted as saying "CPAP for everyone." As I continued to see its benefits, I began to wonder if it could be used as successfully by EMTs as it was by paramedics.

In the national standard curriculum for EMT-basics, we teach them to assist a patient's ventilations with bag-valve mask and to assume complete control of ventilation if the patient quits breathing. However, assisting ventilations on an awake and suffocating patient is a difficult task and is often met with physical, as well as psychological, resistance because it takes a firm hand, a calm voice and precise timing to get the desired effect. Often, the patients swallow air as they fight us, which adds to their distress and results in them vomiting.

I thought, *What if we could help these patients sooner before we had to hold them down and force air down their throats?*

Theory Tested

In Wisconsin, we had already moved CPAP into the prehospital arena, limiting it to paramedics, and shown that it dramatically reduced the need for intubation and the associated mortality of the underlying condition. Studies show that services using CPAP reduce the need for intubation from around 25% to 6% with similar reductions in mortality.[1-3] So in 2003, the Physician Advisory Committee for the State of Wisconsin and I undertook a study of BLS-administered CPAP. The goal wasn't to prove that it worked, but to show that EMT-basics had no greater failure rate than paramedics due to complications or the need for intubation.

Two years and 400 EMT-basic CPAP administrations later, we were confident enough to approve CPAP for inclusion in the EMT-basic scope of practice with additional training, education and medical oversight. Since that time, the list of states allowing CPAP use at the BLS level has grown to include Minnesota, Oklahoma, Pennsylvania, Tennessee, Ohio and Louisiana, with many more states, regions and individual services seeking to approve its use by BLS.

Our training includes a two-hour didactic presentation of respiratory anatomy and physiology, emphasizing the fact that respiratory distress is primarily a deficiency in ventilation and that as ventilation improves so does oxygenation. An hour of scenario practice further hones the EMT-basic's understanding of how to assess the severity of respiratory distress by monitoring the work of breathing and level of consciousness. Their competence is then measured with a written and practical exam.

Although some will say that EMT-basics don't "diagnose," I disagree. Although we've changed to an assessment-based curriculum, it became clear to me that an EMT with moderate patient experience could indeed develop a differential diagnosis of the cause of the patient's respiratory distress. Patients often tell us what's wrong with them based on their medical history. But even if the EMT is wrong (as paramedics and ED physicians often are) and applies CPAP, the end result is the same—decreased work of breathing and improved patient outcomes.

The big surprise came when we recognized that our EMT-basics' newfound knowledge of CPAP also improved their scores on all aspects of airway and ventilation during refresher training. Back in 2002, the poor performance of EMT-basics on National Registry exams in this particular area required the release of a National Standard Curriculum to address the need for additional airway and ventilation education. So now, not only do we have EMTs who know how to effectively use CPAP, we have EMTs who accepted in stride the new AHA guidelines that underscored the need to avoid hyperventilation during cardiac arrest.

PHOTO COURTESY EMERGENT RESPIRATORY PRODUCTS

Your crews will notice changes in the patient's condition more quickly if they're encouraged to assist the patient in holding the mask rather than using the head straps.

Point/Counterpoint

For those still unconvinced, let me address specific arguments often cited for not allowing the use of CPAP at the BLS level:

"They'll blow out a bleb." No evidence shows that judicious use of CPAP causes barotrauma. In Wisconsin, we limit the pressure level for EMTs to 5 cm H_2O, which appears sufficient to reduce the work of breathing and does not cause gastric distension. Another option is to use a patient-activated system that provides flow only when the patient inhales, so that if the patients "bucks," they won't be hit with a large pressure wave in the back of their throat or lungs.

"They won't notice the patient crashing." This concern is addressed with education. If you restrict your basic crews from using the head straps, and encourage them to assist the patient in holding the mask, they'll notice any change in the patient's condition more quickly than if they simply applied a nonrebreather mask.

"They won't call for ALS." During our pilot test, we found that BLS agencies with CPAP reduced their calls for ALS because either ALS didn't have CPAP or, more frequently, because the patients improved and didn't need it. BLS crews using CPAP will generally require fewer ALS intercepts unless it appears the patient may require intubation or ALS medications prior to arrival at the hospital. For our rural services with patient contact times in excess of an hour, we've found little benefit in calling for ALS on CHF patients, particularly if the ALS crew doesn't do RSI. Keep in mind that Lasix is being used less for CHF today, and the only real drug for CHF is nitro infusion, rarely started by ALS in the field.

"The addition of CPAP to the EMT-Basic scope of practice flies in the face of the National Scope of Practice Model." Although this may appear to be true, the reality is that those who created this document simply weren't aware of the pace at which CPAP science was progressing. Assisted ventilations is still in the scope and, as far as I'm concerned, CPAP is simply a form of assisted ventilation—one that's far superior to the alternatives.

Conclusion

Our primary objectives in the field—for BLS and ALS—are to properly assess our patients and then deliver the most appropriate treatment as rapidly and efficiently as possible. CPAP is a perfect treatment tool to help both BLS and ALS personnel meet those objectives and reduce patient morbidity and length of hospital admissions. Many patients receiving CPAP treatment early in their emergencies will avoid being intubated in the field, becoming ventilator-dependant and subjected to unnecessary respiratory infection or other complications.

So, CPAP for everyone—from EMT-basics to paramedics. ■

KEITH WESLEY, MD, FACEP, is the Wisconsin state EMS medical director and chair of the National Council of State EMS Medical Directors. He also serves as medical director for the Chippewa Fire District, Ashland/Bayfield County EMS and the Apostle Islands National Lakeshore.

References

1. Collins S, Mielniczuk L, Whittingham H, et al: "The use of noninvasive ventilation in emergency department patients with acute cardiogenic pulmonary edema: A systematic review." *Annals of Emergency Medicine*. 48:260–269, 2006.
2. Marchetta M, Resanovich M, Edmunds L: "Prehospital CPAP reduces need for intubation in respiratory emergencies (abstract)." *NAEMSP*, 2006.
3. Hubble M, Richarads M, Jarvis R, et al: "Effectiveness of prehospital continuous positive airway pressure in the management of acute pulmonary edema." *Prehospital Emergency Care*. 10(4):430–439, 2006.