Peter Antevy, MD, Brijesh Mehta, MD, and Fire Chief Mark Ellis are working together to develop a progressive system of stroke care in southern Florida.

Transforming Stroke Care
Technology and innovation bring EMS and hospitals together p. 20

The Promise of Mobile Stroke Units p. 26
CE Article: Spine Injury p. 36
Are You Ready for the Silver Tsunami? p. 53
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NEW! Tactical Combat Casualty Care–All Combatants (TCCC-AC): 8-hour course created by the Committee on TCCC. One day course specifically for NON-MEDICAL personnel.

NEW! Tactical Emergency Casualty Care (TECC): endorsed by the American College of Surgeons; meets TECC guidelines; uses PHTLS military textbook; teaches civilian tactical EMS. 16 hours of CECBEMS credit.

Law Enforcement and First Response Tactical Casualty Care (LEFR-TCC): for all public safety first responders; based on TCCC and PHTLS. 8 hours of CECBEMS credit.

Bleeding Control for the Injured (B-Con): teaches basic lifesaving medical interventions to first responders and civilians; meets recommendations of the Hartford Consensus. 2.5 hours.

In regard to the council’s immediate actions Lane says, “Promoting the adoption of the Just Culture concept within all EMS agencies is a main priority. The council just adopted a new position statement on this issue. Other priorities include enhancing the knowledge and skills of the EMS safety officer, and providing agencies with guidance on developing a safety program for their service.”

As part of that nationwide outreach the National EMS Safety Council will sponsor a four-hour EMS Safety Officer program at EMS World Expo in New Orleans.

The program includes the following presentations:
- How Lack of Sleep Is Making Us Slow, Stupid and Dangerous;
- Improving Safety Through Just Culture;
- Turning Mistakes Into Learning: Self-Reporting In Action;
- How To Create a Successful Behavioral Health Program;
- What Should Be Presented in OSHA/Infection Control Training.

Register today at EMSWorldExpo.com. To learn more about the National EMS Safety Council, visit EMSWorld.com/12226555.

## Collaborating on Safety

New council focuses on patient and practitioner safety

In 2013, the National EMS Culture of Safety Strategy was published. The development of this document was funded by a NHTSA project grant to identify what constitutes a safe environment for EMS patients and practitioners; the challenges to achieving a safe EMS environment; and a strategy to overcome these challenges.

The Strategy envisioned the establishment of a national entity to coordinate these efforts, which led to the formation of the National EMS Safety Council in 2015. The council is comprised of national EMS and safety organizations including the American Ambulance Association, the American College of Emergency Physicians, the Center for Patient Safety and the National Association of Emergency Medical Technicians (NAEMT).

“The 12 national organizations that form the council are committed to implementing the recommendations contained in the strategy,” says NAEMT Executive Director Pamela Lane. “We are ‘biting off’ one idea at a time.”

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Study: No Difference in Survival Between Continuous and Interrupted Chest Compressions in OHCA

A review and discussion of quality CPR

Continuous compressions have long been thought of as superior to interrupted compressions with pauses for ventilations. But a recent study by Nichol, et al. suggests that if good quality CPR is performed, there may not be a difference in survival to discharge of out-of-hospital cardiac arrest patients between receiving either continuous and interrupted compressions. Despite this, in the prehospital environment, unexpected and unavoidable pauses in compressions occur often; therefore, prehospital providers may opt to continue to perform continuous compressions in order to mitigate these unavoidable pauses.

Introduction

Recently, a team led by the University of Washington’s Graham Nichol, MD, published a randomized trial in the New England Journal of Medicine comparing continuous vs. interrupted chest compressions during cardiopulmonary resuscitation (CPR) for out of hospital cardiac arrest (OHCA) and found no difference in survival to discharge with favorable neurologic outcome. This challenges multiple previous observational studies showing a survival benefit with continuous compressions over interrupted compressions. Both groups in this large, randomized trial had good quality CPR as measured by chest compression rate, compression depth and compression fraction (CCF). This may explain the similar outcomes between the treatment arms and highlights the importance of good quality CPR in OHCA.

Quality CPR

In 1991 the Utstein variables were first proposed as a system of consistently reporting information about cardiac arrest resuscitations, but it was more than a system of reporting. They were demographic, temporal and practical variables known to be associated with cardiac arrest outcome including suspected cardiac vs. non-cardiac etiology, witnessed vs. non-witnessed arrest, initial rhythm and bystander CPR. Since then, as CPR interventions have advanced, several CPR performance variables have been found to also be associated with outcomes in cardiac arrest, including compression rate, compression depth, compression fraction, pre-shock pause, peri-shock pause and all breaks in CPR. More important, as was done in the Nichol, et al. study, recording these variables allows researchers to assess the relationship between interventions performed during CPR and patient outcomes.

The Nichol, et al. study randomized 23,711 OHCA patients into either a control group who received compressions interrupted by ventilations in a 30:2 ratio or an intervention group who received continuous uninterrupted compressions with either bag-valve mask (BVM) ventilations or passive oxygenation via non-rebreather mask. Both groups paused for rhythm analysis and shock (if indicated) about every two minutes and delayed advanced airway placement until about 6 minutes after the start of CPR, at which point both groups reverted to continuous compressions with BVM ventilations.

As seen in Table 1 by comparing the CPR performance variables of the continuous vs. interrupted compression groups, it is clear why there was not a significant difference in survival to discharge. Each group had good CPR performance variables with averages that have been associated with improved cardiac arrest outcomes. These results reiterate that whether CPR performance targets are achieved via continuous or interrupted compressions, attaining these targets will result in improved outcomes.

Discussion

Despite these results, prehospital providers may elect to continue performing continuous compressions for several reasons. In addition to being one of the few interventions with a known survival benefit in OHCA, continuous compressions likely facilitate improved compression rates and compression fractions in suboptimal pre-hospital environments. Although trials like the Nichol, et al. study prove that good quality CPR can be performed in the field, CPR quality is often poor. Pauses during extrication, transport, and to conduct other interventions like placing the patient on a defibrillator/monitor, intubating or obtaining IV/IO access are often unavoidable and unavoidable interruptions during CPR may occur often; therefore, prehospital providers may opt to continue to perform continuous compressions in order to mitigate these unavoidable pauses.

TABLE 1: CPR PERFORMANCE VARIABLES FROM THE CONTINUOUS VS. INTERRUPTED GROUPS AND TARGETS ASSOCIATED WITH IMPROVED OUTCOMES

<table>
<thead>
<tr>
<th>CPR Performance Variables</th>
<th>Continuous</th>
<th>Interrupted</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression Rate</td>
<td>110±11 /min</td>
<td>109±12 /min</td>
<td>100-120 /min[^2][^3]</td>
</tr>
<tr>
<td>Compression Depth</td>
<td>48±3 mm</td>
<td>48±2 mm</td>
<td>40-50 mm[^2][^3]</td>
</tr>
<tr>
<td>Compression Fraction</td>
<td>0.8±0.14</td>
<td>0.79±0.14</td>
<td>&gt;0.60[^2][^3]</td>
</tr>
<tr>
<td>Pre-Shock Pause</td>
<td>15±10 sec</td>
<td>12±10 sec</td>
<td>&lt;10 sec[^2][^3]</td>
</tr>
<tr>
<td>Peri-Shock Pause</td>
<td>18 sec</td>
<td>18 sec</td>
<td>&lt;20 sec[^2][^3]</td>
</tr>
</tbody>
</table>

[^2]: Sum of average pre and post shock pause lengths.

[2] Continuous and Interrupted Groups and Targets Associated with Improved Outcomes

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1 For complete specifications, including measurements, see Operator’s Manual.

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expected, especially with a small prehospital crew. Because these pauses are often unavoidable and unexpected during CPR in the field, it fundamentally makes sense to continue compressions whenever possible and only stop for unavoidable obstacles. Continuous compressions minimize the avoidable pauses, thereby mitigating the negative effects the unavoidable pauses would have on compression rate and compression fraction. Mitigating these pauses is one mechanism explaining why interventions like minimally interrupted cardiopulmonary resuscitation (MICPR), which includes continuous compressions, single shocks, immediate post-shock compressions and delayed intubation, have previously shown survival benefit in OHCA. 2

Lastly, as seen in Table S1 of the Supplementary Appendix, the Nichol, et al. study selected cardiac arrests with high mean compression fractions in both groups: >80% in the continuous compression group and between 60%–80% in the interrupted compression group. This created some selection bias in the sample population against cardiac arrests with lengthy pauses in compressions, which is the subgroup of cardiac arrests that would likely benefit most from continuous compressions. Potential Pitfalls

> Although the Nichol, et al. study did not address ventilation rates or tidal volume, continuous compressions can facilitate hyperventilation. Maintaining an appropriate ventilation rate utilizing the 1 breath every 6 seconds method is difficult and multiple studies have shown that hyperventilation with this method is common and detrimental.15–19 However, several commercially available devices are available to mitigate hyperventilation, including compression-adjusted ventilations, metronomes and CPR feedback devices.20

> Compression-only CPR may facilitate a compression rate that is too fast. Ahamid Idris, MD, et al. found that in about 1/3 of CPR cases compression rates exceeded 120/min, while in 7% of cases they exceeded 140/min. They also found that the likelihood of ROSC peaked at about 125/min and declined at greater rates.7,12

> Excessive compression rates have been associated with inadequate compression depths, potentially explaining negative outcomes with elevated rates.20

Conclusion

High-quality resuscitation trials through research networks such as ROC have helped to deepen our understanding of the impact each intervention we provide during CPR may have on patients. Regardless of the CPR technique employed (continuous or briefly interrupted), lengthy breaks in CPR for other aspects of resuscitation may be detrimental and should be avoided. The Nichol et al. study reinforces that good quality CPR with adequate compression rates, compression fraction, compression depth and minimal pauses is key for patient survival.
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**Excrement Happens**

A complicated entrapment leads to a crew’s reprimand

I magine showing up to work one day only to be pulled into your supervisor’s office and questioned, reprimanded, berated and disciplined for not following protocol. Your supervisor, after getting a notice from the quality assurance officer, refers to a trauma protocol violation you committed. He is writing you up for not providing oxygen on the scene of a major trauma case.

**Case Report**

In this case the patient’s legs were trapped in an auger at a rural chicken-processing plant. This auger is a large machine used to grind chicken excrement. The machine accidently restarted as the patient was inside trying to clear a jam. The auger pulled the patient’s legs down and into the machinery.

Rescue crews chose to use an acetylene torch to free the patient. The torch works by superheating and cutting the metal. The difficulty was that the excrement also would be superheated and create a highly volatile methane gas. As a result, adding oxygen to the proximity of a torch and methane gas in a confined space would be less than ideal. The team decided to limit any oxygen in favor of safety.

Upon seeing the entrapment, the helicopter crew requested a second helicopter to transport the surgeon, saying they would be unable to lift off due to the patient’s legs dragging. They didn’t trust the ground crew’s assessment skills.

The ground crew got out, they didn’t have the requested surgeon. They thought they would “assess the scene” on their own. They thought they would “assess the scene” on their own.

**Discussion**

If you have read previous columns, you will not be surprised to hear a reiteration of the importance of critical thinking in a world where “excrement happens.”

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**CRM Tips: Just Culture**

Just culture encourages reporting. As a result of a punitive work environment, and because healthcare workers and the lay public often believe healthcare-related errors are caused by personal carelessness, most healthcare organizations are unaware of the extent of their errors and injuries.

Our protocols have traditionally been considered standing orders, mandatory actions from our medical directors. Many times they’re thought of as directives that require compliance instead of guidelines for best-case scenarios that may need modification in this context, “deviation” is “violation.” But it is critical we learn to think of these cases in a more commonsense way: with a calm, patient-centered approach. Sometimes our care is really about thinking critically and determining a reasonable course of action within the principles and guidelines of good healthcare.

In 1997 Dr. Lucian Leape, a Harvard professor and member of the Committee on Quality of Health Care in America, testified that only 2%–3% of major errors were reported because people hide their mistakes. Leape went on to say, “A punitive approach shuts off the information that is needed to identify faulty systems and create safer ones.”

These concepts are at the core of establishing a no-blame “just culture.” At its core just culture describes three duties: the duty to act, to follow procedural rules and to avoid causing unjustifiable risk. In this case the crew was forced to modify their initial care approach to avoid risk—an action that should be rewarded, not punished.
It is true the crew could have placed oxygen on the patient during transport. This was a human error—an oversight, not a choice. In this case just culture would guide us to console the crew for having such a challenging case in which it would be natural to forget something; reward them for thinking critically during a crisis; then obtain more information to identify a root cause for the error and refine processes to mitigate future mistakes. Medicine, like aviation, has made significant progress in establishing a just culture. Unfortunately many EMS agencies continue to focus on holding individuals accountable for errors instead of improving systems that protect patients from the mistakes we know humans commit. We know we are not perfect—to err is human, mistakes we know humans commit. We need to focus on holding systems accountable for errors instead of improving systems that protect patients from the mistakes we know humans commit. To err is human, to forget something; reward them for thinking critically during a crisis; then obtain more information to identify a root cause for the error and refine processes to mitigate future mistakes. Medicine, like aviation, has made significant progress in establishing a just culture. Unfortunately many EMS agencies continue to focus on holding individuals accountable for errors instead of improving systems that protect patients from the mistakes we know humans commit.

Sonas™ is a portable, battery-powered ultrasound device developed by San Diego based Burl Concepts, Inc. for detecting strokes in a prehospital environment, such as emergency vehicles (e.g., ambulances, helicopters). To date, there is no diagnostic device which allows the detection of a stroke at the place where the patient is afflicted. Every minute the patient is kept from treatment, irreversible damage can occur, “time is brain.”

It is critical to have immediate information whether a patient might suffer from a major stroke or not. Neuro-interventional procedures, for example, which are recommended by the American Heart & Stroke Association for major, embolic strokes can only be performed in specialized centers. Hence, to gain knowledge whether a patient might suffer from a major stroke at the earliest time possible is extremely important. Learn more at www.burlconcepts.com or see it in person at the Burl Concepts booth #1334 at EMS World Expo Oct 5-7 in New Orleans.

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Your AED is ready. Now what?
Technology and Collaboration Drive Dramatic Improvements in Stroke Treatment

Nearly 800,000 strokes happen in the United States each year. Like heart attacks, strokes are time-sensitive emergencies. Nearly two million neurons are at risk of permanent damage for every minute that elapses until the blocked artery is opened up and circulation is restored, meaning “time is brain” during a stroke.

At Memorial Healthcare System in South Florida, a team of physicians and EMS professionals have transformed stroke care and more than halved the median door-to-needle time for the administration of IV tPA from 82 to 34 minutes from 2014 to Q1 of 2016.

The team, led by a neurointerventional surgeon, an EMS medical director and a fire chief, overhauled the stroke care system by implementing the latest findings on effective prehospital stroke triage and in-hospital treatment to achieve better patient outcomes. This collaborative approach to stroke care allows EMS providers to communicate with specialists in real time, making it possible for the EMS team to activate the catheterization lab from the field, and helping create a transparent time-tracking system for all healthcare providers involved in a code stroke, which drives accountability and quality improvement.

Transformation of Stroke Care Motivated by Personal Experiences

For Peter Antevy, MD, a pediatric emergency physician at Memorial Healthcare and EMS medical director for several agencies in Broward and Palm Beach counties, improving stroke care is personal. His grandfather suffered a stroke in 2005, soon after Antevy moved to Florida.

“I was coming back home from Pittsburgh when he was taken to the hospital,” says Antevy. “They didn’t do the right thing; they didn’t take him to the cath lab. We ended up with my grandfather in a vegetative state for seven years.”

After that experience, Antevy carefully evaluated regional stroke treatment patterns and regularly followed up on stroke patients that his EMS team cared for. He began to realize that some hospitals were better equipped to treat stroke patients than others. He started advocating for Broward County’s EMS services to use a pre-hospital stroke assessment tool and to bypass primary stroke centers in favor of comprehensive stroke centers for patients with severe strokes, as they might require treatment in the cath lab.

Mark Ellis was motivated to advocate for systemic change after his wife had a stroke nearly a decade ago. “She made a near full recovery, but the experience showed Ellis that many people with stroke symptoms do not receive appropriate treatment and timely evaluation, possibly costing them a chance at recovering.”

New approach allows EMS providers in the field to communicate with specialists in real time
However, even when patients do arrive at the hospital, overall treatment rates remain abysmally low. Less than one third of patients receive IV tPA within the first 60 minutes of arrival, treatment referred to as the “golden hour” because of the potential for treatment within the first hour to have a significant, positive impact on the patient’s outcome.

“With a stroke patient, you don’t see the same acuity as with trauma: There’s no blood, there’s no guts,” says Ellis. “What you have is someone who is basically trapped inside their body, wondering why everything they normally do is not working anymore.”

Yet, treating stroke victims quickly is just as important as it is for trauma patients, says Ellis. “Although you can’t see it, their brain is suffering a traumatic injury,” he explains. “It’s just that these people’s trauma is simply from within.”

Making Evidence-Based Changes in Prehospital and Hospital Stroke Treatments

Although the majority of ischemic strokes (which make up 87% of all strokes)1 are small-vessel blockages, as many as 34%–50% are caused by large-vessel occlusions (LVOs).2

LVOs occur when a large vessel in the brain is blocked, and these types of strokes are considered more severe and more likely to result in death or lasting deficits.3 With these cases, the standard treatment IV tPA is far less effective.4

In 2015, results from a large study out of the Netherlands, referred to as the MR CLEAN trial, demonstrated the effectiveness of intra-arterial treatment known as mechanical thrombectomy to open up blocked arteries, in preventing permanent disabilities and saving lives in patients with LVO strokes.5

These findings made it imperative for healthcare professionals to quickly identify and treat patients who might be experiencing a stroke due to a LVO. In cases of heart attack or trauma, prehospital notification of hospital-based care teams by EMS has been shown to reduce delays in treatment upon arrival to the ER. For stroke patients with an LVO, this is also important because stroke care involves many care teams—neurology, radiology, pharmacy, cath lab and anesthesia—all of which could benefit from early notification of patient arrival.

The ability for prehospital providers to identify LVOs in the field has the potential to transform how quickly stroke patients get the most appropriate treatment. Several studies have indicated that new stroke scales will be able to help triage stroke patients based on severity of symptoms.

“Historically, the old stroke scales just helped you identify a patient who was having a stroke but did nothing to gauge severity beyond that,” says Ellis. “But for a person suffering from a minor stroke versus a major stroke, they’re not the same thing.”

For example, a new scale called the Rapid Arterial Occlusion Evaluation (RACE) has been shown to be effective in aiding in prehospital identification of large-vessel occlusion stroke.6 For patients with severe neurological deficits will have an elevated RACE score, which is considered to be predictive of their risk for having experienced LVO and can serve as a reliable trigger for mobilizing the acute stroke team members. Other scales, such as the Cincinnati Prehospital Stroke Severity Scale,7 have also been developed and shown to have potential for helping EMS providers identify LVO. As these scales are further tested, validated and refined, EMS systems and stroke centers can determine which is the best fit for their communities.

Primary vs. Comprehensive Stroke Centers

The designation of hospitals as primary or comprehensive stroke centers by the healthcare accreditation organization The Joint Commission was another big change in stroke care.8 The designations were intended to offer EMS and other healthcare professionals a quick way to direct patients to facilities that are appropriately triaged to treat stroke.

The American Stroke Association recognizes primary stroke centers as hospitals that are able to administer IV tPA in a timely fashion, have a stroke neurologist on-call 24/7 and have round-the-clock rapid imaging capabilities and a designated stroke unit, where stroke patients can be managed and monitored. Comprehensive stroke centers include all the capabilities of a primary stroke center, but also provide a neurosurgical/neurointerventional team on-call 24/7 to treat LVO strokes as well as bleeding in the brain, for example, in cases of a ruptured aneurysm.8,9

Depending on a patient’s location and the distance to the closest stroke center, patients may be taken to either a comprehensive or primary stroke center. However, in cases of suspected LVO strokes, it becomes imperative to get a patient to a hospital with neurointerventional capabilities, typically recognized as a comprehensive stroke center by state mandates or the Joint Commission.

Transforming Stroke Care at Memorial Healthcare

With stroke specialists anticipating the results of the MR CLEAN trial, as well as several additional positive landmark studies that followed, and a national push toward using the primary and comprehensive stroke center designations for appropriately triaging patients, Memorial Healthcare hired Brijesh Mehta, MD, in 2014 to overhaul its stroke program.

A neurointerventional surgeon by training, Mehta came on as the medical director for stroke and neurocritical care. He had previously worked at the Massachusetts General Hospital (MGH) in Boston, where he led a clinical process improvement program and a successful project to streamline stroke care through workflow analysis and reform.

Changing Perceptions of Stroke

Antevy and Ellis were not alone in their frustration with the response to strokes. Despite advances in stroke care, including FDA approval of the clot-busting medication IV tPA in 1996,4 treatment of acute stroke has not changed significantly in the past two decades.

One of the biggest challenges to improving stroke response is educating community members, EMS teams and other healthcare professionals to recognize stroke symptoms and take fast action. Very few stroke patients call 9-1-1 within the first hour of acute onset. Only about 8% of patients arrive at the hospital within three hours of symptom onset,2 the window for administering IV tPA. Recent clinical trials suggest this window could be extended up to 4½ hours in a subset of patients that meet specific safety criteria, although the FDA has not yet approved the longer timeframe.9

The Golden Hour for IV tPA

Door-to-needle time ≤ 60 minutes

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- CT Scan
- CT & labs interpreted
- IA green light administered
- In-hospital consultation with interventional radiology

- Visible Clot
- CT Scan
- CT & labs interpreted
- IA green light administered
- In-hospital consultation with interventional radiology

We don’t have 59 mins to give tPA!!!

Dr. Mehta, Lataya Roberts
Mehta. “You absolutely have to have a stroke champion in the ER and Mehta held regular meetings with other teams involved in the stroke EMS, was essential to achieving meaningful change in the system. minutes of hospital arrival. 19 drew heavily from the American Stroke Association “Target: Stroke” stroke coordinator, as well as prehospital response teams. His plan care stroke program and plans for reform to hospital executives, the best care possible.”

“Expect patients to come here, but then we were not providing them “If we call ourselves a comprehensive stroke center that means we were very long, and I found it personally unacceptable,” says Mehta. Mehta recognized many of the same challenges at Memorial Health- and Ellis, who were eager for someone to take the helm of the =EMS, the ER, radiology, neurology and the neurointervention- alist—rather than the traditional response where the patient is transitioned from one team to the next in a series of steps that take up valuable time. The second key change is enabling a system for real-time feedback and concurring by tracking the care process between and among each link in the stroke care chain. “We want accountability at each hospital that performs stroke treatment and the best way to do that is data transparency,” says Mehta. However, Pulsara is not the panacea for better stroke care, cau- tions Antey. Rather, the mobile app is one tool that helps hospi- tals detect, understand and work to correct delays in their stroke response systems.

As a part of the system overhaul, Mehta also led a concerted data collection effort, modeled on work he had done at MGH, with the goal of using data to drive continual system analysis and improvement. “We started collecting times and metrics and reviewing those numbers at stroke committee meetings,” says Mehta. “We went case by case, figuring out where the delays were and how we could resolve these issues prior to the next stroke patient.”

A Mobile App Connecting Teams for Better Care

The next step in transforming the stroke care system at Memorial Healthcare was the introduction of a mobile platform, Pulsara, which enables better coordination of acute care teams via its apps for iPhone and Android.

Initially envisioned simply as a logistics tool, the new technology can help care teams understand critical delays and other recurring problems in the stroke process, says Mehta. First, it offers EMS teams the ability to quickly and easily trigger stroke alerts and activate the stroke team from the field. This key change allows stroke response to start among multiple teams simultaneously —EMS, the ER, radiology, neurology and the neurointervention-alist—rather than the traditional response where the patient is transitioned from one team to the next in a series of steps that take up valuable time.

Using Pulsara, teams can better account for the time taken from call to first contact with the provider and to first dose of medication, including the time taken from call to first contact with the provider and to first dose of medication, including the time taken from call to first contact with the provider and to first dose of medication. Automation of the stroke response system via the mobile app can help teams understand delays and other recurring issues,

Soon after joining Memorial Healthcare, Mehta met with Antey and Ellis, who were eager for someone to take the helm of the regional stroke systems of care and implement broad-scale changes. Mehta recognized many of the same challenges at Memorial Health- care that he and his colleagues had faced at MGH. As a first step, he spent weeks investigating the reasons for delays in the stroke system.

“Our times to treatment for IV tPA and treatment in the cath lab were very long, and I found it personally unacceptable,” says Mehta. “If we call ourselves a comprehensive stroke center that means we expect patients to come here, but then we were not providing them the best care possible.”

Mehta brought the results of his analysis of the Memorial Health- care stroke program and plans for reform to hospital executives, including the CEO, ER director, neurologists, radiology group and stroke coordinator, as well as prehospital response teams. His plan drew heavily from the American Stroke Association “Target: Stroke” initiative, which outlines proven steps to improve pre-hospital and in-hospital stroke care with the goal of delivering IV tPA within 60 minutes of hospital arrival.22,23 Mehta says building rapport within the hospital, as well as with EMS, was essential to achieving meaningful change in the system. Mehta held regular meetings with other teams involved in the stroke response and ran mock stroke scenarios to practice new protocols.

“It takes a lot of support from the [hospital] administration,” says Mehta. “You absolutely have to have a stroke champion in the ER and someone who is going to support you from the prehospital setting.”

As a part of the system overhaul, Mehta also led a concerted data collection effort, modeled on work he had done at MGH, with the goal of using data to drive continual system analysis and improvement.

“Stentriever Devices

Applying Traction Is Easy

When you have the right splint...
By John Erich, Senior Editor

"Imagine if you are able to both give IV tPA, as any primary stroke center does, and quickly identify the patient with emergent large-vessel occlusion," says Alexandrou. "Then you can bypass the nearest primary stroke center and go directly to the comprehensive stroke center."

MOBILE STROKE UNITS

Bring the Hospital to the Home

With CT scanners, tPA and more, MSUs are helping slash treatment intervals and should improve outcomes

Lucky woman, Maureen Osaka.

Her stroke was an especially rare and lethal type, a basilar artery occlusion. Those have a mortality rate of more than 85%. Their survivors are often left paralyzed or severely disabled.

But Osaka, born in Nigeria and a world traveler doing philanthropic work, happened to be in Houston when her stroke occurred in 2014. Even better, she was within a few miles of Texas Medical Center, new home to the country’s first mobile stroke unit.

A quick call to 9-1-1 when her symptoms began brought that unit to Osaka, and its crew—a paramedic, neurologist, critical-care nurse and CT technician—initiated a level of care at her home that was previously unknown in America’s prehospital realm.

She got a CT scan in the ambulance courtesy of a CereTom portable scanner. Confirming her stroke was ischemic, the crew performed some quick point-of-care lab testing, then began treating Osaka on scene with intravenous tPA (tissue plasminogen activator), the only treatment for such strokes approved by the FDA.

The stuff works, but only within three hours of symptom onset, and the faster, the better. With that accomplished the crew set out for the local comprehensive stroke center.

Once upon a time those critical interventions would have had to wait until a stroke victim reached the hospital, even as two million brain cells a minute died. Bringing them to the patient earlier in the process saves essential time—which means, in stroke, essential brain.

With CT scanners, tPA and more, MSUs are helping slash treatment intervals and should improve outcomes...
For Osaka it saved both. She received treatment about 78 minutes after symptom onset, faster than 99% of stroke patients. And within days she was moving her affected left side, speaking clearly and walking on her own. “In just one day,” Osaka told media reps from the University of Texas Health Science Center at Houston (UTHealth), which fields the unit, “I went from not being able to speak to speaking but no one could understand me to now speaking and pronouncing things perfectly. Before the end of that same day, I could also move my hand again. It was like a dream! I could even stand up and walk!”

A Broad Range of Solutions
Mobile stroke units began in Germany almost a decade ago but have only recently come to the U.S. UTHealth’s was first (see page 33), but others have quickly followed. The Cleveland Clinic rolled its out soon after in 2014. More started the next year in Toledo and Colorado. Another that debuted allowed. The Cleveland Clinic rolled its out soon after in 2014. More have only recently come to the U.S.

These things aren’t cheap, and that systems are investing in them to a price tag of about $38 billion. Around 800,000 Americans a year have them, in the U.S., and a top cause of disability. Indeed it is—the cost of strokes is terrible. They’re the fourth-leading cause of death in the U.S., and a top cause of disability. Around 800,000 Americans a year have them, to a price tag of about $38 billion.

The ischemic variety accounts for 87%, and while ischemic strokes are quite treatable with tPA, that needs to happen within a limited time window. All kind of obstacles work against that, from delays in recognition and calling 9-1-1 to prolonged scene and ED times and times to getting patients scanned and treated. Mainly because of such delays, just 3%–8.5% of American patients who are eligible for tPA get it. More than 40% should. So anything we can do to get it to them faster should benefit them—right?

That would seem to be the case with mobile stroke units (MSUs). Because they’re so new, there’s not yet a huge volume of data amassed, but what there is has been positive:

> A 2014 JAMA report of the German PHANTOM-S study reported alarm-to-treatment times averaged 15 minutes faster during weeks when a stroke vehicle (STEMO) was available, and patients for whom it was deployed had a mean alarm-to-treatment time 25 minutes shorter than during control weeks. Thrombolysis rates were 21% during control weeks, 29% during STEMO weeks and 33% after STEMO deployment. 1

> A 2012 Lancet report found that prehospital stroke treatment reduced the median alarm-to-therapy-decision time from 76 minutes to 35. A team led by Silke Walter, MD, of Germany’s University Hospital of the Saarland discovered similar gains in intervals from alarm to CT completion, alarm to end of laboratory analysis, and to the overall rate of IV thrombolysis for eligible ischemic stroke patients. 2

> A preliminary 2010 piece by most of the same authors used case studies to show the “feasibility of guideline-adherent, etiology-specific and causal treatment of acute stroke directly at the emergency site.” One of those patients had a hemorrhagic stroke; she received guideline-based differential blood pressure management. Both patients had call-to-therapy-decision times of approximately 35 minutes and good outcomes.

The cases, Walter and company concluded then, “illustrate the broad range of medical solutions made available by use of the MSU. The MSU...encompasses all major aspects of prehospital stroke medicine, such as prehospital organization of bridging to timely way they need. To that end, mobile stroke units could represent a big advance.

“Historically strokes have had to be identified in the field and brought to the hospital for a CAT scan,” says Andrei Alexandrov, MD, chair of the neurology department at the University of Tennessee Health Science Center and medical director for the Memphis project. “Only recently have the CAT scanners become mobile. So placing one on the ambulance essentially allows the door-to-needle time to become the time from the field to the door of the ambulance. This can shorten the time from symptom onset to treatment and in turn result in more patients recovering from stroke. It’s a very exciting opportunity.”

Strokes are the fourth-leading cause of death in the U.S., and a top cause of disability. Around 800,000 Americans a year have them, to a price tag of about $38 billion.

The ischemic variety accounts for 87%, and while ischemic strokes are quite treatable with tPA, that needs to happen within a limited time window. All kind of obstacles work against that, from delays in recognition and calling 9-1-1 to prolonged scene and ED times and times to getting patients scanned and treated. Mainly because of such delays, just 3%–8.5% of American patients who are eligible for tPA get it. More than 40% should. So anything we can do to get it to them faster should benefit them—right?

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You don’t always have to spend big money to make a difference. A low-cost, low-tech, decidedly simple mechanism in St. Louis is proving a novel way get faster help to stroke victims.

It’s a basic business card that says this: **We Need Your Help**

Please call 314-362-9233

Your friend or loved one may be having a stroke and is being taken to the Barnes-Jewish Hospital Emergency Room.

When the operator answers, please say, “Hello, I am calling with an ambulance stroke card. May I speak to the stroke doctor?”

A Washington University stroke specialist will assist you.

With that minimalist mechanism—a simple statement of concise instructions given to a witness or bystander when someone’s had a stroke—an ambulance crew can get a patient en route to Barnes-Jewish, the city’s sole comprehensive stroke center, that person can pass on key information directly to the treatment team while the patient is being transported, and informed BIH clinicians can expedite the process to treat patients faster.

“We went through and looked at our processes,” says Scott Gilmore, MD, EMT-P, FACEP, medical director for the St. Louis Fire Department and an assistant professor of emergency medicine at the Washington University School of Medicine (Barnes-Jewish is part of Washington University Medical Center), “we identified that while EMS is driven from the scene to the hospital, we’re losing valuable time that might be better spent in another process.”

The solution, devised in conjunction with WU stroke physicians, is to let crews get off scene faster by employing witnesses (often friends and family) to relay key information directly to the hospital.

The card is carried with the glucometer, and a crew member will give it to the bystander and ask them to follow its instructions before heading to the hospital. The specialist they speak with gathers a brief medical history and, if possible, the last-known-normal time. At the same time, medics in transit alert Barnes-Jewish to activate its stroke team.

**RESULTS TO DATE**

Without much data yet it’s hard to draw conclusions on the card program’s effect on treatment intervals, but from 2014 to 2015, BIH’s average door-to-bolus time for ED administration of IV tPA dropped by 25% (from 40 minutes to 30), and its number of IV tPA patients jumped by about 50%.

Overall, Barnes-Jewish has worked to streamline its processes, and its stroke barometers have been trending positively for more than a decade. From 2005–2015, the hospital’s average door-to-bolus time fell by 53% (from 64 to 30 minutes); arrival-to-CT-completed times fell by 53% (from 17 minutes to 8); and the number of IV tPA patients roughly quadrupled.

Multiple factors have contributed to the improvements, including best practices like starting the drug before the patient is removed from the CT scanner. “But what set that up,” notes Gilmore, “was these witnesses and bystanders calling in ahead of time and talking to the neurologist, so the neurologist can get a lot of the inclusionary and exclusionary criteria out of the way. So as soon as the patient hits the door, we can do a quick stroke scale, scan ‘em, finish it up and make a decision, right then and there.”

“There are many opportunities for improving stroke care, and not everything has to be high-tech or expensive. The biggest advantage we’ve found is actually looking at our stroke process itself and seeing how you can change just a few little things here and there and make huge differences in the grand scheme.”

Scott Gilmore spoke about this program at the Gathering of Eagles in Las Vegas, Visit gatheringofeagles.us for information on the 2017 conference.
CT Angiography

In Memphis stroke incidence beats the national average by 37%. Its MSU is the first in the southeastern “stroke belt” and billed as the most comprehensive in the world. That’s largely due to the CT angiography of which it’s capable. The SOMATOM scanner has an automated gantry that moves the patient and provides as many slices (pictures) as can be obtained in the hospital. This allows visualization of blood vessels and the ability to identify patients who need endovascular interventions, neurosurgery and neurocritical care from the field. These capabilities make the Tennessee unit the mobile equivalent of the ER at any primary stroke center.

“Imagin if you are able to both give IV tPA, as any primary stroke center does, and quickly identify the patient with emergent large-vessel occlusion,” says Alexandrov. “Then you can bypass the nearest primary stroke center and go directly to the comprehensive stroke center. And then bypass the nearest primary stroke center and go directly to the comprehensive stroke center.”

“Then you can bypass the nearest primary stroke center and go directly to the comprehensive stroke center. And then bypass the emergency room and bring the patient directly to the cath lab. The CT angiography images can be sent directly to the endovascular suite, so the interventionist who can see what kind of occlusion they will be dealing with when we bring the patient in.”

The Memphis truck was funded through a public-private collaboration that raised more than $3 million to run it for three years. Built by Medical Coaches, it will be based in the city’s most stroke-heavy area but available throughout the metro region.

“When it came to staffing, UTHSC chose a middle ground between doc and box, using fellowship-trained, doctorally prepared nurses certified as advanced neurovascular practitioners.”

“We wanted to explore the presence of a fellowship-trained nurse practitioner just because we want to understand all the nuances of the procedures” work and how we can best integrate mobile technologies and treatment capabilities into it,” says Alexandrov. “The United States has the advantage of several hospitals and stroke teams and cities that have fellowship-trained nurse practitioners.”

“In anticipation of an eventual switch to teleuroendovascular teleradiology, project leaders plan to run connectivity tests throughout the city and make sure there are no dead spots. (Cleveland did the same to ensure broadband reliability.)

Vascular neurologists are a scarce resource, so the Cleveland Clinic turned to telemedicine to connect its stroke unit to physician expertise.

Two Years In With the Nation’s First Mobile Stroke Unit

In the Houston area, its on-scene times are averaging 20 minutes

The main goal of the Memphis project is to treat as many patients as possible in the first 60 minutes after symptom onset; leaders will also track 90-day functional outcomes. That’s something they expect to interest the payers who will, if the MSU is successful, have to sustain it beyond its initial three years.

“We are working to address this issue with Medicare,” says Alexandrov. “To make progress here, we need Medicare and third-party payers to recognize that this can be a cost-effective and lifesaving approach.”

‘Quite a Surprise’

Down in Houston they’ve already incorporating lessons from the first two years of their MSU, including switching to the telemedicine option. But as far as data, try this: Forty-two percent of the patients being treated by the UTHouston MSU are being treated within the first hour of their symptoms. In the control group, that number is zero.

“Whatever we can hopefully say we know,” says David Persse, MD, Houston’s EMS physician director and public health authority, “is that way more patients are being treated within the first hour of their symptoms with a mobile stroke unit than among those who go by ambulance to the hospital.”

That’s particularly exciting in light of another finding observed in Cleveland and

The Houston MSU’s box includes a power source for the CT scanner.

The first mobile stroke unit (MSU) in the United States was created in 2014 by the McGovern Medical School at the University of Texas Health Science Center at Houston (UTHealth).

“It is a research study,” explains Stephanie Parker, RN, program manager for UTHealth’s MSU. “We want to compare the treatment of stroke patients that are brought into the stroke receiving hospitals by the Houston Fire Department (HFD) ambulances versus those treated by the MSU. It is a controlled, randomized study. The mobile unit is on for seven days and off for seven days. This is a collaboration with the other four comprehensive stroke centers within the city of Houston: Harris Health, Memorial Hermann, Houston Methodist and St. Luke’s Baylor. We are looking at the cost-effectiveness, patient outcomes and if permanent MSUs are feasible.”

The MSU is funded by donations. There is no grant funding for the program. Many organizations, businesses and individuals donated money to fund the equipment and personnel.

“We are hoping to show better outcomes with faster treatment. If we can, it will show a cost savings to the healthcare industry. If we could prove this, we could get a higher reimbursement for MSUs on the front side and will provide an increase in the quality of life for the patient and save money long-term. That would show the value of the MSU and make the program sustainable.”

ABOUT THE AUTHOR

Barry D. Smith is a professor at the Education Department at the Regional Emergency Medical Services Authority (REMSA) in Houston, TX. Contact him at bsmit@remsa-cf.com.
If time is essential for the stroke patient, it makes sense to enlist the earliest link in the 9-1-1 chain in the cause. A program in San Antonio uses dispatchers to help launch a rapid response across multiple fronts when a call for a suspected stroke comes in.

“Whatever we’re trying to do,” says David Miramontes, MD, FACEP, NREMT, medical director for the San Antonio Fire Department and an assistant clinical professor of medicine at the UT Health Science Center San Antonio, “is decrease the time from call to arrival at the emergency department, so we can then expedite the hospital response and get more people eligible to actually get tPA.”

When a suspected stroke is called in to 9-1-1, the dispatcher does a simple screening exam using MPDS card #28. They’ll ask why the caller thinks it’s a stroke and inquire about the FAST elements. Answers are scored to determine the likelihood of stroke.

If the total score exceeds 2, they notify the responding crew of a positive stroke score and instruct them to initiate rapid assessment, stroke center notification and speedy transit if alert criteria are met.

AT THE SCENE
The first-arriving fire crew will assess the ABCDs and get vital signs, then do a rapid assessment, stroke center notification and speedy transit if alert criteria are met.

The medic unit has its own choreography: On arrival the medic unit will begin to be treated at the scene. Maybe the patient handoffs, the report is based on the MIST acronym: mechanism or medical complaint, including age; sex; injuries/inspection; vital signs, including glucose and any changes; and treatment.

When the nurse calls “EMS time out,” all activities stop so full attention is on the report. It takes just 30 seconds, and the overall door-to-treatment goal is an hour or less.

RESULTS TO DATE
Collectively these measures, implemented at the end of 2015, are helping shave down response intervals. Median on-scene times went from 16.3 minutes last December to 13.1 in February/March (a decrease of 20%), and median dispatch-to-hospital-door times from 33.3 minutes to 30.5 (a decrease of 8.4%).

David Miramontes spoke about this program at the Gathering of Eagles in February. Visit gatheringofeagles.us for information on the 2017 conference.

Inside the Gathering of Eagles: Utilizing Dispatchers Against Stroke

A range of speakers spanning continents, trauma experts and in-the-field practitioners who are on the frontlines of trauma care—ensuring you will not only gain insight, but practical and cutting-edge thinking to improve your clinical care and your patients’ outcomes. All attendees receive 8 hours of CECBEMS- accredited CE, CME or Nursing CE.
Spine Injury for the Prehospital Provider

Spinal cord injuries range from simple contusions to complete cord transection.

Spinal cord injuries are often permanent and debilitating. Despite the best medical care, these patients have poor chance of returning to independent life. Long-term management is also extremely expensive. The lifetime medical expense for a 25-year-old patient who experiences complete quadriplegia is more than $4 million. These figures emphasize the importance of pre-injury education and prevention. Measures that help prevent spinal cord injury include seat belt use campaigns, safe driving courses, firearm awareness courses, and safety education programs in sports.

Epidemiology

Every year, 12,000 people in the U.S. experience spinal cord injury (SCI), a sudden and debilitating injury that can devastate their lifestyle and livelihood. Spinal cord injuries range from simple contusions to complete cord transection. Presently more than 100,000 persons in the U.S. are living with limitations following a spinal cord injury. Traditionally, Caucasian males between age 16 and 30 have been the most commonly injured age group in the U.S. However, since 2005, individuals experiencing SCI had an average age of 42.2 years with 80% of the injuries occurring to males.

The vast majority of spinal cord injuries occur in the cervical spine region. These injuries occur at a rate of 4.06 per 100,000 person years, compared to rates of 0.34 per 100,000 person years for thoracic injuries and 0.75 per 100,000 person years for lumbar injuries. The fewest injuries occur in the thoracic region because the vertebrae are stabilized and protected by the chest wall. Nearly half (42%) of all spinal cord injuries occur during motor vehicle collisions. Other common causes of SCI are falls (26.7%), acts of violence (15%) and sporting injuries (7.6%). Other mechanisms of injury include diving accidents, motorcycle collisions and surgical complications. Nearly 20% of these injuries result in complete tetraplegia, which is the paralysis of all four extremities. Incomplete tetraplegia occurs in 31.6% of spinal cord injuries, complete paraplegia occurs in 24.6% of cases, while incomplete paraplegia occurs in 18.6%. The remaining patients are discharged from hospitals with minimal deficits.

Anatomy & Physiology

Picturing the spinal column anatomy allows visualization of why most injuries occur in the cervical spine. The head sits on top of the smallest and most fragile vertebrae. These vertebrae lack the protection and

Figure 1: Nerve roots leaving the spinal cord and the regions they innervate. Fran Milner, www.franimation.com

C1, C2, C3 - Phrenic nerve roots
C4, C5, C6 - Arm flexion (biceps brachii muscle)
C7, C8, T1 - Finger abduction
T1, T2 - Chest and intercostal muscles
T3 - T10 - Sympathetic nerves
L1, L2, L3, L4 - Knee extension (Quadriceps muscle)
S1, S2, S3 - Ankle plantar flexion (gastrocnemius muscle)
S3, S4, S5 - Bladder and anal sphincters

OBJECTIVES

- Review the anatomy and physiology of the spinal column
- Describe types of spinal cord injuries
- Review treatment of spinal cord injuries
- Discuss immobilization protocols

By Kevin T. Collopy, BA, FP-C, CCEMT-P, NREMT-P, WEMT
support found in the thoracic and sacral spinal regions. Each vertebra has two distinct parts: the body and spinal processes. The vertebral body makes up most of the mass of the vertebra and provides strength and stability. It is located on the anterior spine. When the posterior aspect of the spine is palpated, what is actually being felt is a spinous process. Three spinous processes are found on the lateral and posterior aspects of the vertebral body and are connected by bony articular processes. Together, the spinous processes make a canal with the vertebral body inside which the spinal cord travels the length of the column.

The spinal canal itself is divided into four regions: cervical, thoracic, lumbar, and sacral. Located in the neck are the seven vertebrae of the cervical spine, numbered C1–7. Of note, C1 is also known as the atlas; C2 is also known as the axis. There are 12 thoracic vertebrae numbered T1–12. Each of these vertebrae has ribs attached which serve to increase their strength and stability.

**Mechanism of Injury**

Sudden forces of any sort—including direction changes, speed shifts, or blunt and penetrating impacts—that cause the head and the body to move, twist, flex or extend in exaggerated or abnormal directions can fracture the spinal column and injure the spinal cord. The following few simple principles can help paramedics evaluate a mechanism of injury in a patient with potential spinal cord injury:

- An object in motion will stay in its current motion unless acted on by another force with enough energy to cause a shift in the first object’s motion or direction.
- The head is positioned on top of the spinal column and generally moves in the opposite direction of any force applied to the spinal column.
- The greater the force, the greater the injury potential.
- The absence of neurological deficit does not rule out a spinal cord injury.

A skilled paramedic can immediately recognize a situation in which the mechanism of injury has clear potential for spinal cord injury. These are called obvious mechanisms of injury. Such an incident often involves direct trauma to the head or torso, as well as large, sudden accelerations, decelerations or high-velocity penetrating forces. Examples of obvious mechanisms of injury are updated by the Centers for Disease Control and Prevention with its Guidelines for the Field Triage of Injured Patients. Updated criteria may be viewed at www.cdc.gov/fieldtriage. They currently include the following:

- A motor vehicle crash in which the patient’s head strikes the windshield.
- A patient ejected from a moving vehicle.
- A pedestrian struck by a vehicle and knocked to the ground.
- A motorcycle crash at a high speed.
- A fall greater than three times the patient’s height. In the case of an infant, this could be as small as a fall from a high chair or table.

Based on the above information, injuries isolated to one specific body region without an obvious mechanism of injury may not require a spine assessment or immobilization.

The following are the two types of trauma to the spinal region:

- Direct trauma: Impacts against the spinal column and the spinal cord are considered direct trauma. Depending on the amount of energy exchanged, an impact that strikes only the spinal column can transfer energy through the column to the spinal cord, causing the cord to swell and become impaired. Impacts passing through the spinal column may actually lacerate, puncture or transect the spinal cord. Examples of direct trauma to the spine include gunshot wounds, stabbing wounds and blunt force trauma, such as in an assault with a tire iron. During blunt trauma, spinal column injury can cause bone fragments to lacerate the spinal cord; cord compression can occur as a result of swelling as well.

- Indirect trauma: Forces other than those that directly impact the spinal column or cord can result in spinal cord injury as well. Indirect traumas result in hyper—or exaggerated—movements, which can result in vertebral fractures or dislocations, herniated spinal disks, or bruise, tear or stretch the spinal cord. Other indirect traumas can transmit energy from the point of impact through the body ultimately affecting the spinal cord.
Axial loading: Also known as vertical compression, axial loading occurs when a force is significant enough to compress vertebrae together. The compression forces may result in squeezing of intravertebral disks, causing herniation or rupture, or bursting fractures of the vertebrae. Axial loading injuries can occur chronically when someone repeatedly lifts heavy loads or acutely such as in a fall where the patient lands on their head.

One of the most common acute axial loading injuries occurs when a patient falls from a significant height and lands on their feet, bringing their lower body to a sudden stop. The patient’s upper body continues to move downward, resulting in compression of the lower thoracic and upper lumbar vertebrae. This also occurs in diving accidents when a significant height and lands on their head.

A hanging, laceration, puncture from a knife or bone fragment, and compression from a crush injury. Symptoms of spinal cord injury are limited and are specific to spinal cord injury that is not permanent. The spinal cord is not immune to swelling, which can develop later.

Types of Spinal Cord Injury
The great variety in mechanisms for spine trauma; however rotational forces can also affect the lower spinal regions as well. Sport injuries are common sources of twisting spinal cord injuries. Athletes wearing cleats in contact sports can plant themselves just as another athlete hits them, causing their torso to twist awkwardly.

Secondary cord injuries: Trauma directly insulting the spinal cord causes a primary cord injury; the energy force directly impacts the cord. Primary cord injuries result in immediate impairment of cord function by disrupting, distracting or transecting the spinal cord. Most often, a spinal column injury also results. Primary injuries include tearing/shearing during a hanging, laceration, puncture from a knife or bone fragment, and compression from a crush injury. This also occurs in diving accidents when a significant height and lands on their head.
A cord transection eliminates spinal cord integrity. The transection is termed a cord compression as a result of swelling developing from soft tissue injury. Regardless of the mechanism, cord compression can lead to cord ischemia. Crushed vertebrae and intravertebral disks can lead to direct compression. An example of a secondary cord injury is compression resulting from a swelling developing from soft tissue injury. Left untreated, ischemia can lead to necrosis and non-repairable cord damage.

### Complete cord transection

Any time a mechanism causes a complete cut across the spinal cord, the injury is termed a complete cord transection. A cord transection eliminates the body’s ability to send or receive signals distal of the injury site; this is a permanent injury that is not repairable and often results in paralysis. When a transection occurs above T-1, or the first thoracic vertebra, the patellar tendon will weaken, which is the paralysis of all four extremities. Transactions that occur below T-1 cause paraplegia. Patients with paraplegia can have full use of their upper extremities but are unable to use their lower extremities.

The specific site of the transaction determines the amount, if any, of movement or sensation the patient might retain. Patients with paraplegia typically retain use of the muscles aiding breathing—but not always. Table 1 summarizes the expected function level following cord transection.

### Incomplete cord transection

Spinal cord injuries do not always result in complete cord lacerations. Often, only part of the spinal cord is cut or transected during a spine injury. This injury, called an incomplete cord transection, results in some nerve bundles remaining intact while others are severed. Only part of the spinal cord is affected by an incomplete cord transection, which leaves the potential for some neurological recovery following injury. The following three types of incomplete cord transection are of note for EMS providers.

#### Anterior cord syndrome

A transection or infarction of the anterior portion of the spinal cord causes anterior cord syndrome. Typically, anterior cord syndrome occurs when the anterior spinal artery is obstructed or interrupted, resulting in anterior cord ischemia and then infarction. Below the infarction site limited paralysis develops as well as impaired pain and temperature sensation. Patients often maintain a sense of touch, vibration, and proprioception, which is the ability to detect the location of body parts relative to the rest of the body.

#### Central cord syndrome

The most common cause of this presented to EMS providers is traumatic injury, such as hyperextension of the neck. Central cord syndrome resulting from trauma most often occurs in the cervical spine and results in destruction of the motor nerves found in cord's center.

#### Anterior cord syndrome

This occurs when bleeding is occurring in the spinal cord and suggests the mechanism of injury was more significant. Over time the symptoms will completely resolve as the cord heals. It is not expected that a paramedic distinguish a transection from a cord compression. For More Information Circle 35 on Reader Service Card

### TABLE 1: ANTICIPATED FUNCTION LEVEL FOLLOWING SPINAL CORD TRANSECTION

<table>
<thead>
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<td>Patient may be able to speak; completely dependent upon others for assistance with all daily functions</td>
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<td>C-4 through C-5</td>
<td>Full head and neck movement present, limited shoulder movement, no use of hands, wrists, forearms or lower extremities</td>
<td>Capable of diaphragmatic breathing, no cough reflex present; needs assistance clearing the airway</td>
<td>May speak with a voice recognition computer. Requires assistance completing daily functions</td>
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<tr>
<td>C-5</td>
<td>Full use of head, neck and shoulders. Can flex elbows but not extend them. No finger or wrist movement</td>
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<td>C-6</td>
<td>Full use of head, neck and shoulders, can flex elbows, extend wrists, cannot move fingers</td>
<td>Same as C-4</td>
<td>Passive grip strength possible with some objects. Can speak but still needs aid with regular daily functions</td>
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<tr>
<td>C-7</td>
<td>As above, but gains use of thumbs and some fingers as well</td>
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</tr>
<tr>
<td>T-5 through T-9</td>
<td>Full upper body use above injury, strength is dependent on the injury site, legs remain paralyzed</td>
<td>Able to breathe without assistance but has limited endurance</td>
<td>Relatively independent</td>
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<tr>
<td>T-10 through L-1</td>
<td>Limited paralysis of lower body and lower extremities</td>
<td>Normal respiratory system</td>
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Source: Modified from: http://calder.med.miami.edu/providers/PHYSICAL/goals.html, Miami/Jackson Memorial Medical Center ©1998, Rehab Team Site

Classic symptoms are an initial presentation of complete quadriplegia followed by a rapid return of lower extremity function. The return of lower extremity use develops over several minutes, followed later by the return of upper extremity function, and a decrease in bladder function. Patients may also complain about burning sensations in their extremities. A Brown-Squard Syndrome: Penetrating trauma and spinal disk herniation can both cause this syndrome, which compresses and impairs one side of the spinal cord, essentially creating a hemisemicordectomy, which causes loss of motor control, proprioception, and vibration sensation on the same side of the body as the spinal cord is injured. The patient may also experience loss of pain control and sensation control on the opposite (contralateral) side of the body. A careful and complete spine assessment should be completed when time allows. Incorporating a spine assessment into the routine physical exam may result in aspects of the spine assessment being overlooked. To avoid missing any component of the spine assessment, complete it at a separate time with the intention of specifically evaluating the spinal column and spinal cord. Approach a spine assessment with the mentality that you are looking for a reason to immobilize a patient: You’re looking for an injury. An accurate spine assessment identifies the presence or absence of injury to the spinal column and/or cord. If both are absent, full spine stabilization may not be indicated in some protocols, and there is no need to transport the patient on a longboard.

Note: Use caution and take appropriate time because inaccurate and rushed spine assessments can lead to ruling out a spine injury when one is actually present. The spine assessment not only identifies when a spine injury is present but also identifies the injury extent.

There are three components to the detailed spine assessment: determine reliability, a clear history, and a clear physical exam. All three components must be evaluated and have the appropriate findings to rule out spine injury. Completion takes time; rushing through a spine assessment can result in missing a spine injury and failure to immobilize patients who have spine injuries. An accurate spine assessment requires a completely reliable patient. Reliable patients are completely awake and oriented times four (person, place, time, events). The patient must also be cooperative and consistent with the situation. For More Information Circle 35 on Reader Service Card

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This is especially true for musculoskeletal injuries, which are often very painful prior to management. Repositioning musculoskeletal injuries into their anatomical position, providing padding, and a quality splint often substantially decrease the patient's pain level. Completing an accurate spine history requires the patient's focus and undivided attention. Ask them two questions: "Do you have any numbness, tingling or sensations of electrical activity anywhere in your body?" and "Do you have any pain on your spine?" Try to differentiate discomfort along the ribs and muscles of the back from the spine. Many patients have chronic lower back discomfort in their muscles though they do not have bone pain. When assessing for spine pain, it may be helpful to ask the patient to close their eyes and visualize their spine. Having the patient mentally walk their mind down each vertebra and asking if it hurts may help the patient separate injuries of the spine from muscle pain. Pain in any vertebra suggests a spinal column injury. Suspect spinal injury whenever the patient identifies numbness, tingling or electrical sensations shooting through their body. Any evidence of column or cord injury here indicates full spine immobilization is required. Even when evidence in their history suggests a spine injury continue the spine assessment so you can fully identify the injury's severity.

The final component to the complete spine assessment is the physical spine exam. A potential spinal injury indicates the need to have several responders assist in log rolling the patient to potentially limit spinal movement. To evaluate the spine itself, roll the patient onto their side, exposing the entire back and neck (the entire spine), and slowly palpate each vertebra from C-1 to L-5 in an attempt to elicit tenderness. To assess for tenderness press firmly on the posterior spinous process for each vertebra; tenderness on any bone suggests that there may be a fracture. Although it may be reasonable to assess the spinal column first, it can be done at any point throughout the exam. For example, should a patient have a fracture. Although it may be reasonable to assess the spinal column first, it can be done at any point throughout the exam. For example, should a patient have a possible fracture? It is reasonable to test for the patient's ability to send and receive signals between the distal aspect of an extremity and the spinal cord itself. Do not confuse these two assessments.

A distal motor and sensory exam evaluates the patient's extremities for bilateral equality of strength and sensory skills. Perform full spine immobilization whenever a patient demonstrates inequality between strength or sensory function. Motor strength in the upper extremities can be evaluated with either wrist extension or finger abduction against moderate resistance. Both the wrist and fingers are innervated by the upper extremity's most distal dermatome. To test wrist extension, stabilize the lower arm firmly (usually against the ground), and apply moderate pressure with one hand against the posterior aspect of the patient's hand. Then, ask the patient to extend their hand upward against your pressure. Repeat this on the other side. Alternatively, test the patient's finger abduction strength when the patient cannot extend their wrist for a non-spine injury-related reason (e.g. splinted extremity). Have them spread their fingers apart and ask them to resist your attempt to squeeze their index and ring finger together. The resistance should be identical in each hand.

Test lower extremity motor strength with the extension and flexion of either the patient's ankle or great toe. Bear in mind that this is different from the upper extremity motor test, which only evaluates extension. Apply pressure against both feet simultaneously and ask the patient to pull their feet toward their head. Immediately place your hands on the inferior aspect of the feet and ask the patient to push down as if pressing the gas pedal. Both legs normally have equal strength. Abnormal weakness on one side suggests spinal cord injury. Use the same flexion and extension process with only the great toe whenever an injury or illness prevents the patient from moving their ankle normally.

The final portion of the spine assessment is a sensory skill examination. Successful completion requires the patient distinguish between light/soft touch and sharp (pain) touch at the distal end of each extremity. Evaluating pain sensation tests the free nerve endings in the skin, and light touch evaluates the Meissner corpuscle. Good tools must be used to accurately test these nerve endings cotton balls or Kling are great objects capable of triggering a light touch sensation, and a safety needle or pointed tweezers effectively trigger pain sensors. Pressure sensors are not being tested, only pain and light touch nerve endings. To be sure the patient can effectively distinguish the two objects selected test them on the patient's forehead, the skin of the forehead is nearly always unaffected by a spine injury. While testing an extremity, keep it out of sight of the patient, but do not hold it with your hand or arm as this will trigger other nerves in the patient's extremity. In the

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**TABLE 2: MOTOR STRENGTH IN SPINAL CORD INJURY**

<table>
<thead>
<tr>
<th>Strength Score</th>
<th>Motor Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No contractions or movement</td>
</tr>
<tr>
<td>1</td>
<td>Minimal movement noted</td>
</tr>
<tr>
<td>2</td>
<td>Limited movement with no resistance, no movement against resistance or gravity</td>
</tr>
<tr>
<td>3</td>
<td>Active movement against gravity but no resistance</td>
</tr>
<tr>
<td>4</td>
<td>Active movement against some resistance</td>
</tr>
<tr>
<td>5</td>
<td>Active movement against full resistance</td>
</tr>
</tbody>
</table>


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Trauma is never planned... but you can always be prepared.
Immobilization

In recent years, the frequent use of backboards and current EMS cervical immobilization devices has come under scrutiny. The National Association of EMS Physicians (NAEMSP) and the American College of Emergency Physicians (ACEP) are challenging routine use of these devices and recommending that spine immobilization be limited because current strategies lack evidence. Current immobilization fails to properly immobilize the head in 42% of patients and the body in up to 88% of patients. In addition, immobilization causes tissue hypoxia, which places patients at risk for pressure ulcers. It also increases spine pain and the potential for developing pressure sores.

In 2013, the joint position paper between the NAEMSP and the American College of Surgeons Committee on Trauma recommended that spinal immobilization is not necessary when patients meet the following criteria:

- Normal level of consciousness (Glasgow coma scale ≥ 15);
- No spinal column tenderness or abnormality;
- No distracting injury; and
- No intoxication.

This position paper also advised that patients with penetrating trauma without evidence of spinal cord injury do not need immobilization and that immobilizing these patients may worsen outcomes. Rather than attempting spine immobilization, which is nearly impossible, focus on spinal motion restriction with the goal of eliminating all unnecessary motion of the spine. In this approach, the best patient care strategy may be to apply a cervical immobilization device and then keep the patient supine on the stretcher without a long backboard. Patients supine on a mattress are likely to be more comfortable and less likely to develop pressure sores. This strategy may be particularly helpful when a patient is found ambulatory on the scene of a traumatic injury, when there is an extended transport (greater than 30 minutes), or when immobilization is being performed purely because of protocol requirements.

Both the American College of Emergency Physicians and the NAEMSP support the use of an evidence-based and validated spine assessment, such as the NEXUS Long Backboard Assessment device or Canadian C-Spine Rule, to rule out spine injury. The specifics of these examinations need to be established by local medical direction.

bands, press one of the two objects at a time along the top and lateral aspects, asking the patient to state if they feel pain or light touch. Randomly alternate between the two objects several times on each hand before moving on to the lower extremities. In the lower extremities, complete the sensory exam along the anterolateral surface of the foot and along the lateral aspect of the ankle. If a patient cannot distinguish between light touch and sharp sensation multiple times in an extremity, or cannot distinguish the two apart at all, suspect a spinal cord injury and perform complete spine immobilization.

A reliable patient with a clear history and a clear physical examination does not need immobilization. Performing unnecessary immobilization causes discomfort for the patient. Any impaired motor or sensory skill, or the presence of numbness, tingling or electrical sensations suggests the patient has a spinal cord injury. Pain or tenderness along the spine indicates the column itself is injured. Carefully document your assessment findings, justifying why you did or did not perform spine immobilization. Identify when you suspect a spinal column or cord injury, and when you suspect both.

Whenever motor weakness is appreciated in an extremity you use a strength scale endorsed by the American Spinal Injury Association to rate the patient’s motor skills. (See Table 2.) As the score lowers cord injury worsens:

- Blunt trauma and altered mental status;
- Spinal column pain or tenderness;
- Neurologic complaints suggestive of SCI (e.g., numbness);
- Anatomic spine deformity and
- High-energy mechanisms with patient intoxication, inability to communicate or distracting injury.

Several agencies in different regions of the country have changed their spinal immobilization protocols. Examples include Alameda County (CA.) and Johnson County EMS (KS). In addition, the North Carolina Office of EMS has endorsed a statewide selective spine immobilization protocol.

Conclusion

Spinal cord injuries are catastrophic injuries that result in serious morbidity and can create the need for a lifetime of intensive medical care. When prehospital providers manage patients with the mechanism for a spinal cord injury it is important to take the time to perform a thorough spine assessment to determine whether or not patients require spinal motion restriction. Only 0.01% of penetrating trauma and less than 5% of blunt force trauma patients experience spinal cord injury.

When spinal motion restriction is deemed necessary the use of a long backboard for immobilization is unproven. On-scene time can be reduced and patient care improved by placing a patient supine on a soft mattress with a cervical collar rather than using a backboard. Spinal motion restriction means elimination of unnecessary spine motion by controlling the three weight centers that move the spine: the head, shoulders and hips, by controlling the weight centers the spine remains stable.

A thorough spine assessment helps to avoid the unnecessary use of the long backboard. By avoiding unnecessary immobilizations, there is also a decreased risk for patients developing pressure ulcers and backboard-associated neck pain. Limit the use of a backboard to times when it is needed for extrication and for stabilization of the major trauma patient with an altered mental status or those with known evidence of spinal cord injury.

Contact information available online at EMSWorld.com/12113830.

ABOUT THE AUTHOR

Kevin Collopy, BA, FP-C, CCEMT-P, EMT-P, CEM, is clinical education coordinator for WakeMed Health & Hospitals in Wake, NC, and chief instructor for WakeMed Public Safety/EMS. He can be reached at Kevin.collopy@gmail.com.

For More Information Circle 38 on Reader Service Card
Preventing Invisible Wounds

By Rosemary Masters, JD, LCSW

For the past five years, faculty of the prehospital care program at LaGuardia Community College in New York City have studied the challenge of reducing the risk of post-traumatic stress disorder (PTSD) for patients served by emergency medical personnel. The effort has been led by a committee of senior faculty in consultation with specialists in psychological trauma affiliated with the Trauma Studies Center of the Institute for Contemporary Psychotherapy. The result is an innovative educational approach that gives LaGuardia’s EMS and paramedic students a sense of ownership in their ability to manage the symptoms of PTSD as defined by the Diagnostic and Statistical Manual of Mental Disorders.\(^1\) Symptoms that can emerge shortly after a traumatic event include exaggerated startle response, hypervigilance, increased irritability, sleep disturbance, poor concentration and painful intrusive memories. Norris and Stone concluded that at any given time, between 2%–3% of the U.S. adult population suffers from PTSD. This figure amounts to somewhere around 6.3 million American adults.\(^2\)

As summarized by authors Sandy McFarlane and Rachel Yehuda, rates of recovery from PTSD vary around 6.3 million American adults.

Perceived Social Support

Perceived social support is defined by social scientists as the perception that a person is cared for, valued and part of a group.\(^3\) The word perceived is important. A person may receive excellent social support (for example, first-rate emergency medical care) but still experience themselves as unimportant and alone. In surveys of trauma survivors, Fatih Ozbay, MD, and colleagues concluded that social support can enhance resilience to stress, help protect against developing trauma-related psychopathology, decrease functional consequences of trauma-induced disorders such as post-traumatic stress disorder, and reduce medical morbidity and mortality. Similarly, in a meta-analysis of PTSD and in theory can be fostered by psychologically skilled personnel. Consultants interviewed individuals who had received emergency care from EMT and paramedic personnel. The interviewees were eloquent and emphatic about the importance of the quality of social support they did or did not receive. Consider the experience of one patient: “My partner was driving. A friend was in the back and I was in the passenger seat. The car hit black ice and skidded. My partner was severely injured and I had bad abrasions on my leg. The EMT team arrived with an atmosphere of camaraderie. They were joking back and forth with each other. They took no interest in me. They were very skillful. They had to get the door of the car open, which was very difficult, but the whole time they were joking with each other, tuned in to each other. One of them had a cell phone and was finishing up some conversation with a friend. The impact on me was disturbing and unsettling. I felt absolutely dismissed; I was irrelevant to their concerns.”

Contrast this experience to that of another patient: “I was hit by a car that ran through a red light on a busy New York street. My legs were fractured. I was in terrible pain and, since I was still flat on my back in the street, terrible that I would be hit again. The EMTs were great—consoling and tuned in. They reassured me that the police had all traffic stopped. They acknowledged that I was scared but told me they were going to stay right with me until we got to the hospital. It was an awful experience, but the EMTs made it a lot better than it could have been.” As these testimonials illustrate, EMTs provide for patients the emotional distress of patients and can do so by skilled social support. On the other hand, indifference to patients’ need for social support might be fostered in the context of a medical emergency. Almost by definition, medical emergencies entail unanticipated situations in which individuals experience helplessness, confusion and disorientation. How in such circumstances can a person see themselves as in control of their lives? The committee concluded that psychological stress might be neutralized if emergency personnel used interventions that were more or less the same. Each individual’s interest might be shared with the patient: “I see you are wearing a Yankees t-shirt. That’s my favorite team. How about you?”

Self-Efficacy

Perceived coping self-efficacy (self-efficacy for short) is defined by social scientists as a person’s confidence in their ability to manage and control their problems.\(^4\) Numerous surveys and interviews with survivors of traumatic stress support the conclusion that a patient’s sense of control over events to which they will suffer post-traumatic symptoms. Charles Benight, PhD, and his colleagues studied the incidence of PTSD and other post-traumatic stress symptoms experienced by survivors of rape, terrorism, floods, fires and other natural disasters.\(^5\)

They consistently found that individuals who experience themselves as in charge of their circumstances and able to plan ahead are significantly less likely to experience psychological trauma symptoms. The LaGuardia faculty committee considered how patients’ perceived self-efficacy might be fostered in the context of a medical emergency. Almost by definition, medical emergencies entail unanticipated situations in which individuals experience helplessness, confusion and disorientation. How in such circumstances can a person see themselves as in control of their lives? The committee concluded that psychological stress might be neutralized if emergency personnel used interventions that were more or less the opposite of a trauma’s characteristics. To offset their sense of helplessness, patients can be offered choices: “Should I take your blood pressure on your right or left arm?” “Do you prefer to be called by your first or last name?”

Patients will be less disoriented if they can be helped to anticipate what is going to happen next: “I am going to insert a needle in your arm. It will pinch a bit, but then it will feel fine OK.” “We are about to take you down the stairs. We will be careful not to let you fall.”

Confusion can be reduced if patients can be helped to plan for their needs: “Do
The eSCAPE Project

The eSCAPE project has been supported by the Northeast Resiliency Consortium (NRC), a group of seven community colleges in the Northeast region of the country dedicated to training resilient workers for resilient communities. Funded by a $23 million grant from the Trade Adjustment Assistance Community College and Career Training, the NRC, in partnership with Achieving the Dream and the Carnegie Foundation for the Advancement of Teaching, was formed to build a highly skilled, qualified workforce to help mitigate communities' short- and long-term vulnerabilities. See northeasteriocity.org.

you need to bring anything with you to the hospital? What about an insurance card?"; “Should we call anyone for you?"

Interventions aimed at providing social support and fostering self-efficacy might seem nothing more than just being nice to a patient, but a lot more is going on. The effectiveness of these interventions is based on a new understanding of the biological underpinnings of psychological trauma. In essence, trauma theory suggests that the rush of adrenaline and cortisol released into the blood during a life-threatening situation dysregulates the formation of adaptive memory, resulting in the survivor continuing to “live in the past,” subject to flashbacks and hyperarousal. Trauma theory implies that the sooner cortisol and adrenaline levels fall to normal, the less likely the survivor is to have long-term psychological problems. The calming effects of social support and fostered self-efficacy are likely to support that process. This knowledge is revolutionizing ideas about how traumatized people should be treated and how PTSD might be prevented.

Unfortunately, prevention of psychological trauma is rarely an integral aspect of EMS education. If the topic is mentioned, it usually occurs in a short stand-alone course. Students usually have no chance to practice trauma-informed psychological interventions. The LaGuardia faculty committee concluded that psychological trauma prevention should become a standard component of every aspect of EMS education. As a matter of routine, trainees should learn to offer social support and encourage patient self-efficacy when they meet the patient, as they treat them and before they transfer them.

The eSCAPE Curriculum

The committee revised the LaGuardia prehospital curriculum to incorporate psychological trauma prevention in both didactic and practice aspects of its courses. A one-hour didactic class gives an overview of the neurobiology of psychological trauma and its prevention. Students are shown videos that demonstrate bad and good psychological treatment. Students are required to memorize a simple mnemonic device, escape psychological trauma, to help them remember the components of social support and self-efficacy:

- e—every patient;
- S—Provide social support;
- C—Give patients choices;
- A—Anticipate what will happen next;
- P—Help patients plan and organize;
- e—every time.

An essential component of the new curriculum is that it requires students to use the eSCAPE principles as they practice lab skills. For example, when students demonstrate placing a splint on a patient, they are expected to use one or more eSCAPE interventions:

- Social support: “Mrs. Jones, I am Dave and this is Bill. I see you are in pain from your leg. We are going to take very good care of you.”
- Anticipation: “Bill will take your blood pressure, and I am going to put a splint on your leg.”
- Choices: “After we put the splint on, would you like a blanket before we take you outside?”
- Planning: “Is there anyone you would like us to call? Is there anything you would like to bring with you to the hospital?”

Note that the eSCAPE skills do not necessarily have to be done in the same order as the mnemonic.

In 2015 and 2016, the eSCAPE curriculum was introduced to LaGuardia’s EMT and paramedic programs. Students and faculty completed qualitative and quantitative evaluations of the curriculum at the end of each program. The results were heartening and enlightening: Students found the LaGuardia eSCAPE principles easy to learn. The requirement to use them did not interfere with learning medical skills. Noteworthy was that students reported increased pride and confidence in their sense of themselves as professionals. An EMT student reported, “I didn’t know what to say to patients. Now I know what to do.” One paramedic said, “This has changed the way I practice in the field—every call is better.” Faculty concurred. It was not difficult to teach eSCAPE. Students understood the principles and were able to voice them as they practiced medical skills.

For the EMS profession, it is no exaggeration to say a new day is dawning in patient care. Emergency medical responders can be justifiably proud of the advances made in saving lives and minimizing physical harm. Starting today there is an opportunity to prevent the invisible wounds of PTSD too. In so doing, literally millions of people will be protected from enduring psychological pain.

For more information, contact Christine Alvarez at christinea@lagcc.cuny.edu.

Article references available online at EMSWorld.com/12223916.

About the Author

Rosemary Masters, JD, LCSW, is a psychotherapist who specializes in the treatment of psychological trauma. She is founding director of the Trauma Studies Center of the Institute for Contemporary Psychotherapy in New York City (see icpny.org/trauma). She has taught the theory and treatment of psychological trauma in Uganda and Russia and regularly presents seminars on psychological trauma to health, mental health, social service and educational agencies in the New York City metropolitan area.

FEATURED SPEAKERS

On Tuesday, October 4, from 5:30–6:30 p.m., Christine Alvarez, BS, EMT-P, and David Brenner, PD, MS, EMT-P, from LaGuardia Community College CUNY, will present “Preventing Invisible Wounds: Introducing Psychological Care into Prehospital Care.”

EMS World Expo

Oct 3–7 | New Orleans, Louisiana
The Silver Tsunami: Are You Ready?

America’s elderly population is exploding, and EMS services will have to reflect that.

By Raphael M. Barishansky, MPH, MS, CPM
The geriatric population, defined as those 60 and older, is expected to double by the year 2030, older patients will account for just 12.5% of the population, accounting for one-third of all traumatic deaths.10 The types of trauma seen most frequently in the elderly are blunt trauma from falls, motor vehicle crashes and pedestrians struck by automobiles. Falls are responsible for half of all accidental deaths in the elderly and are a common cause of head injuries. There are various reasons why the elderly fall. Environmental factors may include stairways and pathways without handrails, slippery bathtubs, slipping rugs, steep steps or improperly fitting footwear. There are also a number of medical reasons why the elderly fall. The most common are dizziness, side effects from medications, heart rhythm problems, spinal weakness, syncope, transient ischemic attacks, low blood pressure, internal bleeding and poor vision.

Since falls have been shown to be a major issue for geriatrics, it is incumbent on your EMS agency to either develop a fall prevention program or join with your local/ regional public health partners to develop one. As the typical mobile integrated health care/community paramedicine program is geared toward patients with chronic health problems not defined by age, patients with mental health issues and/or patients with severe social problems (homeless, etc.), CP programs could potentially play a big role in identifying issues in the home.

Elder Abuse
One of the frightening realities for this aging population is the surge in cases of elder abuse. According to the best available estimates, between 1 and 2 million Americans 65 or older have been injured, exploited or otherwise mistreated by someone they depended on for care or protection.1 Additional statistics show that more than 9.3% of the geriatric population will suffer some form of abuse annually.12 Elder abuse can affect men and women of all ethnic backgrounds and social statuses. The following are commonly defined as the major categories of elder mistreatment:

Physical abuse—Inflicting, or threatening to inflict, physical pain or injury on a vulnerable elder, or depriving them of a basic need.

Emotional abuse—Inflicting mental pain, anguish or distress on an older person through verbal or nonverbal acts.

Sexual abuse—Nonconsensual sexual contact of any kind, or coercing an elder to witness sexual advances.

Neglect—Refusal or failure by those responsible to provide food, shelter, health care or protection for a vulnerable elder.

Abandonment—Desertion of a vulnerable elder by anyone who has assumed the responsibility for their care or custody.12

In the 1990s, Acadian Ambulance in Louisiana analyzed its customer base and took the initiative to develop a highly interactive course known as “Carpe Diem,” offering the Geriatric Education for Emergency Medical Services (GEMS) course. While maintaining a scenario-based approach with emphasis on the uniqueness of the geriatric population, GEMS lectures include slides that highlight geriatric-specific content that EMS providers must know, such as fall prevention, epidemiology, polypharmacy and more. According to NAEMT, future geriatric-specific initiatives include an all-scenario-based class to supplement the one-day GEMS class, a lecture on unique geriatric challenges in a disaster, and a lecture on mobile integrated healthcare—community paramedicine (MIMP-CP) and the opportunity to make a difference with older patients. EMS agencies should ensure classes like these are mandatory for personnel. Furthermore, the EMS provider must know that the presence of acute illness symptoms, older age and poor social and physical function, rather than health beliefs, predicts EMS use among elders. These factors must be considered when managing the demand for EMS services.

The aforementioned increase in overall population numbers could potentially impact the number of calls received and amount of time your units spend on scene, as these calls for chronic medical issues are more clinically intricate. One statewide survey showed the proportion of patients using EMS to reach emergency departments increased steadily with age and estimated, by the year 2030, older patients will account for approximately half of all EMS transports to North Carolina’s EDs.14 These trends were also confirmed by the CDC’s National Hospital Ambulatory Medical Care Survey from 2009–2010, which showed the percentage of ED visits made by nursing home residents, patients arriving by ambulance and patients admitted to the hospital increased with age.

Most Common Emergencies
Elders report using EMS because of immunodeficiency, perceived medical needs or requests by others. Similarly, the presence of acute illness symptoms, older age and poor social and physical function, rather than health beliefs, predicts EMS use among elders. These factors must be considered when managing the demand for EMS services.

A review of the most common traumatic and medical emergencies this population encounters can be found in the National EMS Information Systems (NEMSIS), in 2014, 45% of all calls for EMS were from patients 65 or older, and females comprised 54% of these patients. NEMSIS also identified the most common geriatric emergencies, based on provider impression, that year as follows:

Traumatic injury 10%;
Respiratory distress 8%;
Syncpe/fainting 6%;
Abdominal pain/problems 6%;
Altered level of consciousness 5%.

Geriatric patients are at increased risk of morbidity and mortality when experiencing trauma. Although they currently account for just 12.5% of the population, they account for one-third of all traumatic deaths.10 The aforementioned increase in overall population numbers could potentially impact the number of calls received and amount of time your units spend on scene, as these calls for chronic medical issues are more clinically intricate. One statewide survey showed the proportion of patients using EMS to reach emergency departments increased steadily with age and estimated, by the year 2030, older patients will account for approximately half of all EMS transports to North Carolina’s EDs.14 These trends were also confirmed by the CDC’s National Hospital Ambulatory Medical Care Survey from 2009–2010, which showed the percentage of ED visits made by nursing home residents, patients arriving by ambulance and patients admitted to the hospital increased with age.

Additional Challenges

POVERTY
According to the National Council on Aging, more than 23 million Americans 60 or older are economically insecure, which is defined as living at or below 200% of the federal poverty level.13 According to the American Association of Retired Persons (AARP), from 2001–09, the number of Americans 50 or older threatened by hunger increased by 79%, to nearly 9 million people. This translates into a population that cannot afford basic nutrition, medications and necessary medical and even basic services.

ALCOHOLISM
Another issue with significant implications for the geriatric population is alcoholism. Alcohol abuse is associated with poor mental health functioning, as well as increased risk of suicide, liver disease, cancer and falls. Some medical conditions, such as high blood pressure, ulcers and diabetes, can worsen with alcohol use. Many medications—prescription, over-the-counter and herbal—are associated with dangerous or even deadly when mixed with alcohol. This is a special concern for older people because the average person over 65 takes at least two medicines a day.

Training Realities
In the early 1990s, Acadian Ambulance in Louisiana analyzed its customer base and took the initiative to develop a highly interactive course known as “Carpe Diem,” which focuses on the geriatric patient’s distinct social, physical and cognitive needs. Class participants utilize training aids to mimic hearing loss, vision loss and even cognitive ability to report, or because they don’t want to get the abuser (90% of whom are family members) in trouble. Many states have designated EMS providers as mandated reporters of elder abuse, and this designation comes with the need to understand your role in reporting, to whom you should report, any additional requirements related to reporting and any protections you are afforded as a reporter. EMS agencies need to develop and promulgate policies that take into account all the elements of mandated reporting mentioned above, as well as your state’s laws, which may differ.

What You Should Be Doing
The most time-consuming, resource-consuming, medically challenged population in your service area is about to explode in the next 10–20 years, and chances are, you are not ready. Your EMS agency must with increased risk for fire, failing, poor sanitary conditions, disability and health risks. Elderly, failing patients may not be able to escape a resulting clutter may exacerbate existing health conditions and lead to improper management of medical illnesses.11 Results from a Johns Hopkins study show that hoarding behavior is more prevalent among older adults,12 and a study of hoarding complaints to a Massachusetts health department found that 40% of individuals referred were elders.10 Hoarding can result in extremely cluttered living spaces as well as blocked access to toilets, refrigerators, and routes of ingress and egress—all concerns for EMS providers.

EMS Specifics
Is your EMS agency ready for this paradigm shift and what it means for utilization of your service, the types of calls you will see, the need for greater interaction with social services and even potential changes to clinical protocols?

Patients 65 and older utilize EMS twice as often as younger populations.1 Americans over 85 use it three times as much.13 That both these population groups are increasing will have significant impact on your call volume. The increasing geriatric population will also translate into a need for geriatric-specific training programs, understanding how the facilities that typically house geriatric patients operate and even studying utilization patterns for geriatric residents.

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Training Realities
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develop and implement a plan to handle the demands this upsurge will place on your agency. Such a plan should include:

» Understanding how the aging population will impact the operational aspects of your EMS system. Plan accordingly with analysis of what time of day these calls typically occur, the most common treatment modalities/interventions needed, and whether staffing patterns should change to reflect these realities. Your dispatch center should have this information available. Additionally, your state EMS office could potentially provide statistics regarding geriatric use of EMS for both your agency and your state.

» Spearheading a group of stakeholders. Consider local hospitals, public health agencies, assisted living facilities and anyone else with an interest in delivering services to the geriatric population. This group should be proactive in understanding the growing population and needs of the geriatric, informing governmental decision-makers about these changes, ensuring services are in place for these patients, and educating geriatrics on what services are available as well as when to call 9-1-1.

Conclusion

There is clearly a silver tsunami coming. By 2030, the number of older Americans will double to 72.1 million. These geriatric patients will utilize your services for a variety of calls that require unique communication and training. This population will also have social services needs that could potentially be unrealized and, combined with the aforementioned increase in elder abuse, will challenge your EMS agency like never before. Be proactive in understanding these elements and how this population will impact your EMS system, or you will get hit by the tsunami.

REFERENCES


ABOUT THE AUTHOR

Raphael M. Barishansky, MPH, MS, CPM, is a solutions-driven consultant working with EMS agencies, emergency management and public health organizations on complex issues including leadership development, strategic planning, policy implementation and regulatory compliance. A frequent contributor to and editorial advisory board member for EMS World, he can be reached at rbarishansky@gmail.com.
Mirror, Mirror on the Wall
Your words and actions reflect on everyone who shares your profession

I am not my brother’s keeper, I am his. My words and actions reflect upon everyone who shares my patch and profession. What should we do when we do not like the way we look?

On June 9, broadcasting live on Periscope, an EMS crew in Newark, NJ, delayed a response while waiting for food. (I know the face, I know the uniform—the place I left just eight months ago.) I watched the death throes of a provider’s career in that brief clip and saw the display of sarcasm and lack of concern for the call to which they were being dispatched. I am surprised by neither of those things. To claim you have never screamed at fate (aka dispatch) for sending you on a call when you are about to eat is to throw some pretty big rocks from inside a glass ambulance. What is concerning is that in addition to delaying the response, both he and his partner were OK with broadcasting live—violation of multiple policies and creating significant privacy concerns.

His face is all over the EMS and local news outlets. He looks hard and angry. He orders his food and, while waiting at the drive-through, gets a call. You cannot hear the initial dispatch, but the crew does not respond immediately. When viewers ask why he is not responding, he says he does not want to forego his food for what he says will be a “taxi ride.” When he does go en route, they get diverted to a higher-priority call. He is operating his vehicle with lights and sirens on the road, responding to the assignment, yet his words negate that he is doing his job. Anything he does now no longer matters in the court of public opinion. After watching that unvarnished glimpse, would you trust him to be a provider fully invested in quality care?

My heart breaks a little because I know what those few minutes of video will do to the rest of the organization, what an awful reflection it is on the patch and the profession. Many departments have scars, made when a reputation suffers damage from an incident where the actions of one person resonate throughout a community. I am also angry. Let’s not forget there is a second person in that truck. Not three feet away, someone is letting him do that. You cannot see the second person, although the news report mentions them commencing to one another. Why would they not stop it, knowing it violates department policies and puts them both at risk? Perhaps the person is new or not comfortable enough to speak up. That would be upsetting, to think a new provider would be subjected to this derision.

Agencies need to look at this event with a wide lens: How do staff members get to this point where this behavior is acceptable?

Onion of bad behavior—because that is how it propagates within a department. That’s how a culture of deviance develops as the norm.

The second possibility is even more upsetting, and that is that whoever is in the other seat did not care. Apathy is dangerous, leading to errors that can kill both careers and people. By not speaking up, they are part of that negative reflection. Their reward for implied consent is that they too face damage to their career.

I need to be very clear here: I do not defend or excuse the response delay depicted in this video. Agencies need to look at this event with a wide lens: How do staff members get to the point where this behavior is acceptable? What can be done about it, and what measures can we take to ensure it doesn’t happen in the future?

Inner-city EMS is not for heroes seeking glory. Poverty, no primary care, beat-up equipment, distant management and sitting on street corners in cramped quarters takes a toll. The daily reality is low-acuity calls in a high-volume system, period. Some shifts you are going to go hungry, possibly for nothing more than a series of non-acute “taxi rides” to the ED for patients with no other way to get there.

What if he delayed a call by the same amount of time for another reason? What if there was a medical or policy reason for a delay? Where I work now there are dispatches where certain protective equipment is required—the expectation is that you will not do that before arriving at the patient, which causes a brief, but necessary, delay. What constitutes an “unreasonable” delay?

Thanks to the magic of social media, we know he delayed his response for mozzarella sticks. That unfortunate vignette raises questions: Is this a common practice? How many other times has this happened?

What kind of care is the community receiving if this is acceptable?

What you do, what you say and how you present yourself at work every day matters. Your bad day could shatter the good reputations of hundreds of providers. The worst part about incidents like these is that after they are discovered, the offenders are removed, leaving the rest of the department to shoulder the repercussions and public response. Comments, jokes, outright anger and a basic loss of community trust. I am 4,000 miles away, and I heard, “Hey isn’t that where you came from?”

Mirror, mirror... how do you like the way you look?

ABOUT THE AUTHOR

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