innovations
in physical medicine and rehabilitation

JOHNS HOPKINS MEDICINE

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Intense Rehab for Intense Cases

All rehab professionals know that moment when they first stare at a new patient's chart to size up what they're dealing with. With luck, they only have to deal with a single diagnosis, but often that's not the case. Each illness, each multiple chronic condition, makes the job that much harder, and a positive, lasting outcome more difficult to achieve.

On Johns Hopkins Hospital's Halsted 3—which **R. Samuel Mayer** calls "our rehab ICU,"— patients have everything from heart transplants to metastatic cancer. "It's very common," Mayer says, "for us to admit a patient with 20 different diagnoses. So we have some very complicated issues involving multiple organ systems."

Yet for all that complexity, Mayer's rehab team has excellent results. "We get 80 percent of our patients directly from the hospital to their home," says the medical director for inpatient rehabilitation at The Johns Hopkins Hospital. "And three months later, 95 percent of our patients get home."

To deal with the many concurrent issues that arise in difficult cases, Mayer has educated Hopkins' specialists on the need to follow their patients regularly through rehab. That's why Halsted 3 is often teeming with physicians. "The specialists are great about working with us," says Mayer. "We've taught them the role of rehab, especially with regard to keeping patients from getting sick or running into trouble on the unit. It keeps our patients on the recovery track."

"IT'S VERY COMMON FOR US TO ADMIT A PATIENT WITH 20 DIFFERENT DIAGNOSES."

—R. SAMUEL MAYER

Complication prevention programs ensure that common—and sometimes devastating—long-term hospitalization issues are kept at bay. "We have a prevention program for deep venous thrombosis and pulmonary emboli," notes Mayer. "They're a major cause of death in hospitals and particularly in rehab patients. We've been able to reduce these problems almost fivefold by making sure everybody's on the appropriate prophylaxis, such as heparin or warfarin."

The acute comprehensive inpatient rehab unit may not be an ICU in the literal sense, but its medical director, Sam Mayer, gets serious results for seriously ill patients.

But the real difference on Halsted 3, Mayer says, is that the team of therapists, nurses, social workers and other PM&R colleagues includes patients and their family. "Every patient gets a patient/family conference before they go home. We ask patients what their goals are. The patients and their families are the team captains. We follow their lead."

Mayer means that literally. Patients make the transition from hospital to home aided by PM&R staff. The team plans every detail before release "because it's critical," Mayer says, "to order rehab items quickly and correctly so things are in place once the patient gets home."

Mayer says staff also arrange home or outpatient rehabilitation after discharge to show patients and caregivers the steps necessary to reach their goals. "Say someone wants to play golf again. Well, you don't go from major surgery to hitting the links in a week. First we emphasize how they can be safe at home, the basic stuff such as getting off the toilet safely or climbing the stairs. And then we show them how to build up their stamina and other elements from there. We also improve the family's capabilities for making this happen."

The size of Mayer's unit is scheduled to increase dramatically over the next few years, which he says truly shows that the administration, the physicians, the specialists are all seeing the success. "They're pleased and gratified with what the patients can do."

And no one is more pleased than the patients themselves. ■

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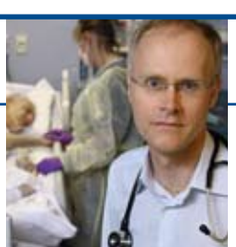
Inside

2
A Cool Idea to Ward Off Brain Damage

3
For Stroke Patients, 1+1>2



4
Getting a Move On in the ICU

One of the gratifying aspects of working in rehabilitation is that it intersects nearly every aspect of medicine. At Johns Hopkins, our talented physiatrists, therapists and technicians work with patients whose challenges range from adjusting to life with a prosthesis following amputation to the multiple comorbidities we see in more than 30 different rehabilitation service units.

But we're also avid researchers committed to improving care for our patients. Although we have dozens of ongoing research projects, this issue of *Innovations* focuses on five that we feel offer a glimpse of the breadth and depth of our efforts.

For therapists who work with stroke patients, Cathy Pelletier's study of dysphagia and foods that may help swallowing is fascinating. Dale Needham's work mobilizing ICU patients will appeal to those of you in acute care, as will Sam Mayer's excellent results in our "rehab ICU." Pablo Celnik's research on ways that stroke patients can supercharge their task learning could literally amp up neurological rehab, while James Christensen's unusual niche offers kids who suffer cardiac arrest a better chance at normal brain development.

If it sounds like we're covering a wide swath of medical *terra firma*, that's what makes coming to work here so rewarding. Every day, we are the conduit from hospital to home for our patients. Helping them heal better, quicker and more comfortably requires constant effort and innovation, which is why I'm blessed to be surrounded by a team that embraces this ongoing challenge. In this way they not only support each other's work, but hopefully yours as well.

Jeffrey Palmer, M.D.
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To refer a patient:
1-888-JHU-REHAB
For urgent referrals
and consultations:
1-800-765-5447 (Hopkins Access Line)

A Cool Idea to Ward Off Brain Damage

James Christensen is taking a page out of adult research.

When kids go into cardiac arrest—and it happens more often than people think—surviving without brain and neurological damage is often elusive. One possible answer may be the inverse of the electric heating blankets we all grew up with. Instead of warming the body, a pioneering study is taking children resuscitated from an arrest and quickly covering them in the intensive care unit with a cooling mesh that lowers their body temperature for 48 hours.

James Christensen, director of pediatric rehabilitation at The Johns Hopkins Hospital and Kennedy Krieger Institute, is an expert on brain damage that occurs following injury or the type of ischemic damage induced by a heart attack. Cooling, he says, "decreases the cascade of injury that occurs in the brain, slowing the metabolic processes that are set into motion by the trauma and that can take an injured cell and further injure or kill it."

Christensen notes that the cooling concept has worked to control brain injury in studies involving animal models, adults who've had heart attacks and neonates who are born asphyxiated, but the study he's now involved in is the first to look at children. It's important to study kids separately, he says, because they often go into cardiac arrest for different reasons than adults. "Many adults are essentially healthy people who have a sudden cardiac arrest, so up until then they've been breathing fine and their brains were properly oxygenated."

Children, by contrast, are often dealing with numerous health issues that finally compromise their heart. "Kids often go into arrest because of major respiratory complications, which may be associated with lack of oxygen in their system," says Christensen. "Consequently, they're often already hypoxic when shock or something else causes the cardiac arrest. In that case the brain is much more vulnerable to injury because it's already not being perfused and oxygenated well."

Still, Christensen is optimistic. He points to work involving preemies and the use of a cooling head cap. "We know that in babies born with hypoxic ischemic encephalopathy—an injury to the brain at the time of birth because the brain wasn't getting enough oxygen or blood—cooling them down improved their outcomes."

Christensen and his colleague, neuropsychologist **Beth Slomine,** will be collecting and helping analyze the data from the study, which will involve 900 patients ranging in age from 2 days to 18 years at 15 academic medical centers including Johns Hopkins. He's following patients for a year and assessing their neurological outcomes based in part on Vineland Adaptive Behavior Scales questionnaires conducted with parents.

"We think the most important measure," he says, "is how are these children doing in their daily life, in their growth and development? Hopefully, by intervening this way, their brains will develop more normally."

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For Stroke Patients, 1+1>2

Here's a potential treatment right out of *The Matrix:* Physiatrist and neurologist **Pablo Celnik** has spent his career finding better ways to help stroke patients overcome neurological deficits. Specifically, he's looked at how patients process and perform tasks during physical therapy and whether those processes could somehow be enhanced—and he's found a way that might even impress Morpheus.

By "plugging" patients into a device that delivers tiny, painless electrical currents to both the brain cortex (anodal direct current stimulation, or tDCS) and peripheral nerves (PNS), Celnik has given stroke patients a tremendous benefit. "We had a 40 percent improvement in learning," he says.

Celnik's latest work, just published in *Stroke*, is the culmination of a decade's worth of research. Previously, Celnik studied brain stimulation of healthy people, showing that their learning and retention nearly doubled when compared to a non-stim control group. Celnik and others had also studied the separate effects of brain stimulation and peripheral nerve stimulation on stroke patients.

However, Celnik says, studying both types of stimulation together "is a breakthrough in our field. One of the questions we had was whether the combination of interventions could be more effective than one intervention by itself. We knew the stimulation 'excited' the brain, but was there a ceiling effect? Could you max out what you could change?"

The findings proved that the whole was greater than the sum of the individual effects. "We found that the effect potentiates," he says. "Individually, the separate stimulations offer no more than 10 or 15 percent enhancement. Put 'em together and you get a much larger improvement."

Pablo Celnik's concept is both simple and elegant.

Celnik cautions that more testing needs to be done before the treatment is ready for clinical applications, but he's encouraged by the simplicity of the approach.

"The machines we're testing aren't expensive and they aren't fancy," he says. "They're accessible to everybody."

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When Having a Sour Taste Is a Good Thing

Can making a sour face help patients overcome swallowing difficulties? Speech-language pathologist **Cathy Pelletier** has been studying whether certain foods can improve function in people with dysphagia from neurogenic causes such as stroke.

To date, dysphagia treatment has focused on the physical—using different postures and exercises—and on diet modification to make swallowing easier. This includes pureeing foods and thickening liquids to give them extra density. However, outcomes vary greatly, which is of considerable concern given both the prevalence of dysphagia (one-third of the elderly have it) and consequences ranging from fatal aspiration to chronic malnutrition.

Pelletier, who also has a Ph.D. in food science, became intrigued by studies of dysphagia patients given a lemon juice concentrate. "Results showed that people with stroke and neurologic dysphagia swallowed better, but it was extremely unpalatable," says Pelletier. So she began seeking "what was it about a high citric acid content or a high sour perception that triggers better swallow? Is it saliva production? A quicker swallow time?"

Pelletier thinks the answer lies in a process called chemesthesis. It's the third way in which we perceive "flavor" (the first is through the taste buds, the second through smell, which comes both orthonasally, as when we sniff simmering spaghetti sauce, and retronasally, when food aromas travel via the back of the throat to the olfactory epithelium). Pelletier says chemesthesis isn't a taste or smell but is responsible for the hotness of a chili pepper or cool menthol of a peppermint. It certainly adds to the "taste experience," says Pelletier, which is interesting given that chemesthesis is sensed from a nerve on the tongue that is not a taste nerve.

Now, working with 80 healthy women split into two groups of those under 35 and over 60, she's testing how stimulating taste and chemesthetic response affects swallowing and whether genes or age also play a role. Each age group has equal numbers of women: Half—called nontasters—are missing a specific gene associated with taste. The other half—called supertasters—have this gene and experience certain tastes more intensely than nontasters. In two recently published abstracts, Pelletier reports that chemesthesis appears to stimulate greater nerve response and stronger swallow, confirming her sense that chemesthesis is worth pursuing as a possible treatment for dysphagia.

"My hope is that this research can help tease out a taste that is palatable and has the right chemesthetic properties to improve the swallow," says Pelletier. "If so, it could be huge."

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Cathy Pelletier

Getting a Move On in the ICU

Dale Needham's idea went against prevailing care dogma.

An intensive care unit hardly seems like the ideal place for a workout, but it turns out that bedside exercise and early mobilization may help patients have better long-term outcomes.

In his NIH-funded study following patients for five years after ICU discharge, **Dale Needham,** medical director of the critical care physical medicine and rehabilitation program at The Johns Hopkins Hospital, found that in patients with acute respiratory distress syndrome, no more than percent 20 percent received an OT or PT consult during their entire ICU stay.

"Through this study," he says, "I could see firsthand the devastating long-term neuromuscular complications of critical illness; it was more frequent than we thought."

What would happen, Needham wondered, if these patients were offered physical medicine and rehabilitation while still in the ICU?

After gathering a lot of data and educating his multidisciplinary ICU and PM&R staff for almost two years, Needham launched an early mobilization program (described in the Oct. 8, 2008, issue of JAMA) in Hopkins Hospital's medical intensive care unit. This initiative changed everything from standard orders—discontinuing bed rest as the default activity level in the admission orders—to training staff on how to avoid heavy sedation. Needham also worked with the biomedical engineering department at The Johns Hopkins University to create a novel mobility aid that could accommodate a ventilator and the other life-support equipment tethered to the patient.

An early success story was an acute respiratory failure patient who reported being comfortable ambulating with a walker and the ICU's portable ventilator. Despite having monitors, a urinary catheter and an IV infusion pump, the patient went on three walks, traversing more than the length of a football field. Seven months after discharge, Needham says, the patient's muscle strength and physical functioning continue to improve.

Needham says this early experience is bolstered by a recent randomized trial showing that in 104 patients on mechanical ventilators, 59 percent who received early PT and OT regained independent functional status, versus only 35 percent in the control group. Furthermore, the mobilized group had less delirium and more ventilator-free time in the 28 days of follow-up.

"This trial shows that early mobility improves outcome and helps patients regain independence," says Needham, who adds that his program is advancing even further. "We are now using a specialized cycling device that can be rolled up to a patient's ICU bed, so even those who can't get out of bed can begin to exercise while supine." And one of Needham's research fellows is conducting a randomized trial of neuromuscular electrical stimulation therapy in the ICU to improve strength in mechanically ventilated patients.

Needham credits these encouraging results at Johns Hopkins to the willingness of ICU and PM&R staff to take on the labor-intensive effort. "You need lots of teamwork and cooperation," he says, "but if we're going to invest all this effort into saving lives, we should do it with the goal of restoring patients to a decent quality of life. Early mobilization helps us get them there."

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