

Rehabilitation

A publication from Kessler Institute for Rehabilitation



Research to reduce pneumonia in spinal cord injury patients

◆ Steven Kirshblum, M.D.

Pneumonia is the leading cause of death and the third most common cause of hospitalization for individuals with spinal cord injuries (SCI). Persons with chronic SCI have a 36 times greater risk of death from pneumonia than those without SCI. Disturbingly, the risk is escalating.

Sparse data exist on strategies for reducing the risk of respiratory infection in individuals with SCI. The Northern New Jersey Spinal Cord Injury System (NNJSCIS), which consists of Kessler Institute for Rehabilitation, Kessler Medical Rehabilitation and Research Education Corporation (KMRREC) and University of Medicine and Dentistry of New Jersey-University Hospital, has received a five-year grant

from the National Institute on Disability and Rehabilitation Research to develop protocols for the prevention of pneumonia in this patient population.

Innovative device may provide increased benefits

As one of only 14 model systems in the country for the research and treatment of SCI, the NNJSCIS will test the efficacy of the use of oximetry with manual and mechanical assisted cough (O-MMAC). This innovative technique has been shown to be effective in preventing pneumonia in individuals with other neuromuscular diseases that impair the ability to cough.

In patients with SCI, impaired cough is a result of inspiratory and

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Focus on

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**“Prove It!”**• *Bruce M. Gans, M.D.*

Evidence-based medicine has been a controversial topic for years. Certainly, good clinical evidence is essential for informed decision making, but “evidence” isn’t a substitute for sound clinical judgment. In 2003, a satire in *The Lancet* noted that only anecdotal evidence supports the use of parachutes to prevent gravity-induced trauma. The authors urged the zealous advocates of evidence-based medicine to enroll in a placebo-controlled trial and provide proof that parachutes work.

An exclusive focus on evidence-based medicine isn’t in our patients’ best interests. Payers often ask us to provide scientific evidence to justify clinical practices that have been shown to be effective through many years of implementation but have not been validated by clinical trials. They increasingly use the “lack of evidence” argument to deny access to care or to restrict payments, asserting that the “evidence” does not prove that rehabilitation hospitals provide care superior to that available in less intensive (and less expensive) settings. All too often, we hear the flawed argument that the absence of evidence proves that an intervention is ineffective. This trend may accelerate with new pay-for-performance programs.

Still, payers do not adhere to evidence-based standards. In its revised 75 percent rule, the Centers for Medicare and Medicaid Services (CMS) carved out limited new diagnostic categories for joint replacement patients—but provided no supporting evidence. Fiscal intermediaries do not use evidence for local coverage determinations (LCDs). However, Medicare requires us to provide evidence to refute these arbitrary decisions! Current rules make it impossible for us to gather the evidence we need: The CMS denied the National Institutes of Health’s request for a waiver program so that hospitals could conduct randomized clinical trials without jeopardizing their standing on the 75 percent criterion. The CMS has also refused to convene an expert consensus panel to establish evidence-based standards for coverage policy.

We need to expose the lack of logic behind the “no proof means no effectiveness” argument used by payers. Research to validate our programs is vital. The American Medical Rehabilitation Providers Association, in conjunction with leading hospital providers, has established a multimillion-dollar fund to stimulate research on patient placement issues.

The American Academy of Physical Medicine and Rehabilitation has produced expert consensus standards to address medical appropriateness criteria. Those standards are being used to assess the accuracy of LCDs and other admission decision tools. Additionally, our professional organizations and societies have stepped up efforts to secure more federal research funding and to pressure the CMS for needed waivers.

As we move forward, we must embrace compelling evidence. But we also have to balance the call for rigorous proof with real-world factors—functional benefit, cost constraints, ethical concerns and common sense.

If I ever take up skydiving, I, for one, won’t wait for randomized trial results before donning a parachute.

Robotics bring new treatments for stroke rehabilitation

♦ Uri S. Adler, M.D.

New robotic systems and devices are changing the world of stroke rehabilitation. Recent advances in technology include upper-body therapy systems for motor re-education and/or improvement in muscle tone and range of motion. Lower-extremity “exoskeletons” help patients relearn how to walk.

Many devices are based on one principle: Continual repetition of active and engaged motion results in cortical reorganization, a process through which neural pathways can be retrained.

These new treatment tools can be used by diverse patient groups. If a patient has no motor function, his or her affected limb is moved passively. If an individual has partial mobility, movement is initiated or guided by the device.

Restoring upper-extremity function

Increasingly, robotic technology is being evaluated and incorporated as a component of comprehensive rehabilitation programs. New devices include the Reo™ Therapy System (Motorika Ltd.), a neuromuscular retraining system for stroke patients designed to improve shoulder and elbow function. Under evaluation at Kessler Institute for Rehabilitation and other sites, the technology is used by patients who have function, as well as by those who do not. It can automatically maneuver the arm, allow the patient to control the movement or assist the individual in making fluid repetitive motions.

To initiate assisted treatment, the therapist programs the unit to carry out specific arm movements at designated speeds and for a certain number of repetitions. The device is

attached to the patient’s arm via a wrist/hand brace. A ball handle assists the patient in following movement patterns that appear on a computer screen, much like operating a joystick or computer mouse. The guided repetitive motion is therefore combined with visual interaction on the computer screen. The unit measures and records each session’s progress.

Inpatients generally use the Reo daily; outpatients use the system dur-



Robotic devices are being used to help patients at all stages of stroke recovery.

ing their regular regimens of two or three sessions a week.

Repetitive exercise is also accomplished using devices such as the InMotion² Shoulder-Elbow Robot® (Interactive Motion Technologies, Inc.). It uses video games to help patients engage in specific movements, assisting the individual in moving his or her hand toward a target on the monitor. These activities increase motor abilities and reduce pain in the paretic arm. Other devices in trials or in use at rehabilitation centers assist with more complex hand functions and sweeping arm movements.

Assisting in complex lower-extremity movements

Robotics have also improved treatment for patients with motor impairments in the lower extremities. In traditional systems, an overhead harness supports the patient during exercise on a treadmill while therapists maneuver the individual’s legs through repetitive walking motions.

The innovative Lokomat® (Swiss Federal Institute of Technology) hugs the patient’s body like an exoskeleton and controls the walking movement, allowing for a more consistent and precise motion than was previously available. The Lokomat also sets hip and knee joint movements electronically to achieve correct stepping and walking motions. Sensors in the motor-driven joints indicate the amount of effort generated by the patient. The device lessens the manual labor needed for therapy, allowing longer training sessions with more repetitions.

Innovations for targeted treatment

Robotic devices offer new options to improve outcomes for a wide range of patients, from those without muscle function to individuals who are achieving full recovery. By targeting specific areas of the body, they allow for the precise repetition and controlled movements. Because of the great potential offered by these treatments, it’s likely that an ever-increasing array of new robotic products to aid in stroke rehabilitation will be introduced.

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Improving outcomes after amputation

♦ An interview with Bruce A. Pomeranz, M.D.

Increasingly, issues associated with amputation are in the spotlight. Media profiles of military veterans often describe the challenges and successes of rehabilitation after traumatic amputation. Public attention also focuses on the prevalence of diabetes and obesity, which are often associated with vascular disease and a higher risk of amputation.

Thanks to advances in treatment and innovative prosthetic design, patients who experience traumatic or nontraumatic amputations can attain levels of physical function unheard of 10 years ago.

Bruce A. Pomeranz, M.D., medical director of Kessler Institute for Rehabilitation, spoke with *Focus on Rehabilitation* about strategies to meet the needs of individuals after amputation.

Has recent media coverage changed how people perceive amputations?

The publicity about military veterans' return to normal function shows us that, after amputation, individuals can live normally with jobs, families and hobbies. The public sees that amputation is a physical, psychological and emotional challenge that can be overcome with training and treatment.

How does amputation associated with traumatic injury or disease progression affect individuals?

Traumatic amputation often results in total shock and a complete change in self-image. Someone with a chronic illness who needs amputation may have a long history of complications and functional decline. Although anyone

experiencing amputation feels a real loss, chronically ill individuals may see it as a definitive resolution to long-term problems; in essence, a new beginning with new potential.

How do physicians deal with the complex medical issues?

As rehabilitation providers, we develop treatment plans that manage medical problems and the accompanying functional challenges. We want to help patients regain their skills and abilities so that, whenever possible, they can return to what they used to do.

If some functional goals can't be realized, we try to identify other ways to build on the patient's skills and interests. We certainly don't want the patient to give up or "settle" for less than achieving full potential. At Kessler, where the rehabilitation team includes specialists in amputation, we work with the patient and his or her family to meet specific individual needs.

When should rehabilitation begin?

If the rehabilitation team is involved before or shortly after surgery, subsequent problems and complications may be prevented. For example, individuals often develop knee or hip flexion contractures that may go unnoticed. When the patient begins to use a prosthesis, flexion contracture may limit use of the device for maximum benefit. In some cases, muscle fibers contract and tighten so much that the patient can't regain complete function. It's much more challenging to correct this problem than to prevent it.

For people who have had lower-extremity amputations, it's also



Dr. Pomeranz counsels a patient at Kessler.

essential to monitor and treat the remaining limb. Clinicians need to note that, in patients with vascular disease, the loss of one limb suggests increased risk of amputation of the other. For example, the pressure on the heel created by prolonged bed rest may lead to skin ulceration. We use a variety of footwear and strategies to prevent this.

Patients also need to be alert to safety issues. Many people who have leg amputations experience phantom sensations. They may get up in the middle of the night and, "forgetting" that they no longer have a leg, be injured in a fall. Patient education and practical strategies, such as placing the walker or other assistive device in an accessible place, to help avoid injury.

What advances affect outcomes?

Today, prostheses are more comfortable and functional than in the past. From a manufacturing perspective, new computer technology enables us to precisely reproduce the patient's residual limb when fabricating the prosthetic socket. This creates a much better fit than we used to be able to obtain.



Careers in rehabilitation: Choices and opportunities

♦ *Matthew Shatzer, D.O.*

Gel liners made from silicone and urethane distribute the limb's weight across the socket, reducing the pressure and the shear forces that can cause discomfort and skin breakdown. Lightweight, strong and durable carbon fiber is used to make prostheses and allow the devices to be tailored to patients' levels of activity.

Additionally, skilled clinicians use visual aids, video and photographic techniques and verbal and written instructions to train individuals in the use of their prostheses. We teach patients about limb care and how to maintain their prosthesis.

What role does the patient's family and support system play?

We involve family and caregivers in patients' training and rehabilitation: Technology can't take the place of personal participation. Rehabilitation after an amputation must be a partnership including the patient and his or her support network, family, friends, physicians, prosthetists and therapists. The technology creates the potential, but only people can turn that promise into reality.

Support groups help patients adjust to their new lives. The Amputee Coalition of America, a nonprofit consumer education organization, has initiated training and certification of "peer visitors," individuals with amputations who have successfully returned to active lives. Several peer visitors have been certified at Kessler and now help coach patients who have had recent amputations.

Bruce A. Pomeranz, M.D., is medical director of Kessler Institute for Rehabilitation. He can be reached at bpomeranz@kesslerrehab.com.

Every year, approximately 350 new physiatrists begin their careers and make critical professional decisions—where to practice, whether to subspecialize and what practice setting to pursue.

A 1999 Lewin Group report forecasted a decade of significant growth in the South but fewer opportunities in the Northeast and Great Lakes region. The publication assessed 12 specialties and predicted solid growth for industrial rehabilitation, primary care for the disabled, alternative complementary medicine, outpatient musculoskeletal care, chronic pain management and episodic principal care. A 2001 report by Ogle et al. suggests that growth within our field will be matched by increasing demand for the next decade.

Selecting a practice setting

Statistics aside, career decisions are often dictated by professional preferences. Acute care and acute rehabilitation facilities generally present physiatrists with pathologies and clinically complex cases that are seldom seen in private practice or subacute care settings.

For the doctor who wants shorter, more predictable work hours—for example, an individual who balances career with family or childcare responsibilities—a private office-based practice or a consulting job in a subacute facility may be the best fit. In these settings, the physician generally sets the schedule (and can switch hours with colleagues if necessary), can avoid weekend and evening hours, and faces fewer demands such as patient calls and emergencies.

The clinical emphasis at in-

patient acute care facilities centers on diagnosis, determining the level of injury and prognosis and beginning a rehabilitation program. Practitioners typically work with cases involving spinal cord injury, brain trauma and stroke.

Rehabilitation center resources

In the rehabilitation setting, the physiatrist works with the patient and the interdisciplinary rehabilitation team to set functional goals and develop a program to meet them. In this long-term partnership, the practitioner plays a key role. For instance, the complex and critical care given to a spinal cord injury patient on a ventilator will have a profound, lasting effect on that patient—and on the doctor.

Physicians have the opportunity to combine new ideas with emerging technologies to develop evidence-based therapy protocols.

Physiatrists interested in research and publishing are more likely to appreciate large rehabilitation facilities that have research departments and patient populations that are sufficiently large to permit clinical trials. With many residents and students, these settings also offer opportunities for teaching.

By carefully evaluating the opportunities and responsibilities associated with each practice setting, clinicians entering the field can select the best path for long-term career growth and a lifestyle that meets the individual's needs.

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Global collaboration: The future of PM&R

♦ Bruce M. Gans, M.D.

As this issue goes to press, I am preparing to speak at a world conference on technology and rehabilitation in Brazil. Next year, I will attend an international conference in China.

These trips remind me that our field, like so many others, has become a global enterprise. Medical rehabilitation was largely invented within the U.S. health care system, an outgrowth of our vast resources, technological advances and concern for veterans disabled in both World Wars.

Still, early pioneers in the field, such as Henry Kessler, M.D., and Howard Rusk, M.D., had a global vision for the future of rehabilitative medicine that is being realized today. They paved the way for international efforts by training physicians from other countries who then adapted interventions developed by American physicians for use in other cultures and delivery systems. Today, physiatrists in the United States—once the world’s teachers—are now partners in an international culture of excellence.

What does the global practice of physiatry mean to clinicians and patients in the United States? To provide quality care for the individuals we treat, we’ve developed increased cultural sensitivity and take into account cultural, ethnic and religious factors that may affect treatment and outcomes.

In terms of professional development, the globalization of our specialty means that American physiatrists can learn a great deal from our colleagues in other countries. These physicians may work within health care delivery sys-

tems that differ greatly from that used in the United States. Very few nations allow market forces to drive health care to the extent that our system does.

Other countries, therefore, may offer valuable lessons in how to fund rehabilitation and advance civil rights advocacy efforts—sparks first ignited in the United States that have spread throughout the industrialized world.

Additionally, we need to remember that, today, we are not competing with physicians in other countries—we must work with them as collaborators. We may need to look beyond our

Today, international research dominates the rehabilitation literature.

borders for advanced research. More than half of the rehabilitation science published in the nation’s leading peer-reviewed journals is authored by international researchers.

Although some American physiatrists may assume differently, we are no longer the world leader in our approach to rehabilitation or in our research efforts. New technological interventions that improve outcomes for our patients often come from other countries; promising investigations in stem cell research are conducted in such countries as China and Israel.

We should not bemoan the fact that we have slipped from first place. We all benefit from the worldwide pursuit of excellence we see today. We need to focus our efforts on keeping up with the

worldwide state of the art and take advantage of international efforts.

How can we make use of the gains made by colleagues abroad? First, we can increase our participation—both as individuals and as organizations—in international meetings and professional associations. Instead of viewing professional travel as unnecessary, time-consuming junkets, we must realize that our participation is essential if we are to increase our expertise and enhance the value of our programs.

Second, we should establish and maintain a communication network with international colleagues and their facilities. We should host global experts as visitors to our programs. Third, we can educate ourselves through reading journals from other countries, such as the *International Journal of Rehabilitation Research*. Furthermore, we must support the efforts of our colleagues in other countries who are actively advancing the civil rights of patients with disabilities.

Finally, and perhaps most important, we need to avoid the chauvinistic stance that discounts innovations that are not “made in the USA.” While we should be proud of the role that American physiatry has played worldwide, we also need to accept that it is now our turn to import new ideas and approaches. If we continue to overlook advances being made far from home, we will only limit the care we can provide to our own patients.

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Research to reduce pneumonia in spinal cord injury patients

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expiratory muscle paralysis, and it predisposes the individual to bronchial mucus congestion, lung collapse and pneumonia. In a neurologically intact patient, the cough peak flow (CPF) is between 300 and 700 L/min. In individuals with SCI, the unassisted CPF value can range from approximately 200 to 300 L/min. Maximum unassisted flows below 300 L/min have been shown by co-primary study investigator John Bach, M.D., to carry a high risk of pneumonia and respiratory failure in other populations of patients with respiratory muscle weakness. Moreover, interventions using muscle aids have been shown to improve CPF and cough, thereby reducing rates of pneumonia, hospitalization and death among these patient populations.

Study design to evaluate O-MMAC

Tests of the efficacy of these aids are crucial for developing protocols to reduce pneumonia risk in patients with SCI. Research will therefore compare two modes of treatment for improving at-home respiratory management.

A single-blind, randomized controlled study will begin this fall and enroll approximately 200 patients with chronic SCI with a CPF of less than 300 L/min.

Both groups will receive pneumococcal and influenza vaccines. Additionally, all study participants will be given a manual of procedures, a videotape and a CD that describes how and when to use the equipment.

The control group will use

oximetry with an incentive spirometry device. The treatment group will self-administer O-MMAC. Individuals in this group will use a pulse oximeter to measure oxygen saturation. Sudden decreases in oxygen saturation levels are almost always caused by airway mucus accumulations.

To clear the airway, a mechanical in-exsufflator device (Cough-Assist™) will aid coughing by



David Tulskey, Ph.D. (left), director of NNJSCIS, and Steven Kirshblum, M.D., project co-director, hope to improve respiratory management of patients with spinal cord injury through the services and research available at Kessler.

expanding the lungs, then quickly reversing the pressure to rapidly empty them. This combination technique works to facilitate expulsion of secretions and improve alveolar ventilation.

Enrolled patients will be asked to monitor their oxygen saturation. If any problems arise with their normal breathing or signs of respiratory tract infection develop, patients will be asked to check and record their oxygen saturation. If cough develops, the treatment group will use mechanical cough techniques to assist in removing secretions.

The control group will monitor oxygen levels during upper respiratory tract infections and record the duration of time when levels are 95 percent or below.

Participants will be followed for 36 months, with pulmonary function and maximum insufflation capacity testing performed at six, 12, 24 and 36 months. Monthly phone calls will record patient experiences.

Primary outcomes to be measured are reduction in the incidence of community-acquired pneumonia and severe respiratory infections requiring antibiotics. The number of hospitalizations due to a primary diagnosis of respiratory complications is also a primary outcome measure. Secondary measures will include the duration of illness and hospitalizations, as well as the impact of these on quality of life and community participation. Quality-of-life measures will be monitored using various tools.

With this important clinical study, researchers expect to show that the improved at-home respiratory management protocol will be significantly more effective for preventing pneumonia and related hospitalizations among high-risk persons with SCI. It is believed that the study will lead to improved respiratory management guidelines and more effective care for individuals with SCI.

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Diagnosis and management of concomitant brain and spinal cord injuries

♦ Jonathan Fellus, M.D.

It has been estimated that between 40 percent and 60 percent of individuals with spinal cord injury (SCI) experience concomitant traumatic brain injury (TBI). Both conditions require prompt treatment, but rehabilitation protocols for patients with each condition differ. The medical literature is rich in studies that demonstrate diagnosis of concomitant SCI and TBI injuries; however, significantly less has been published concerning strategies to manage dual-diagnosis patients. These persons require a careful balance of treatment modalities and are, therefore, best managed by a rehabilitation team that includes specialists in both SCI and TBI.

Challenges of dual diagnosis

In itself, the presence of an SCI should trigger a high level of suspicion for TBI, particularly in patients involved in high-speed motor vehicle accidents. Dual diagnosis is also likely in other patients with injuries to the cervical spinal cord; the higher the anatomic site of the SCI, the more likely a TBI.

Symptoms of TBI and SCI may be difficult to differentiate. Both are associated with sleep disorders, pain, depression and inappropriate

emotional responses. In addition, agitation, an early sign of TBI, may be difficult to assess until verbal tests can be administered.

Treatment for SCI and TBI

Accurate diagnosis allows clinicians to manage symptoms that may include pain from SCI and both spasticity and seizure from TBI by selecting medications that do not aggravate coexisting conditions or increase the risk of adverse events. For example, clonidine or diazepam may ease symptoms of SCI, but they may exacerbate brain injury. Autonomic dysreflexia can result from either TBI or SCI, but the treatment differs based on the diagnosis. Similarly, deep vein thrombosis in SCI patients may be treated with anticoagulation therapy, which is contraindicated early in the course of treatment for patients with cerebral bleeding.

Rehabilitation protocols must be specific for SCI/TBI patients. A dual-diagnosis patient is often in a state of anterograde amnesia. Cognitive changes may be difficult to detect in tracheotomized SCI patients, pending extensive verbal testing as part of a neuropsychological battery. Both the rehabilitation team and the individual's family and

support network need to extend considerable patience. A dual-diagnosis patient usually participates less actively and with less motivation. Conditions in the rehabilitation setting may influence recovery. For example, SCI/TBI patients often benefit from low stimulation levels.

The rehabilitation team must also be alert to problems that emerge later in the recovery process, such as subdural hematoma, hydrocephalus or seizures resulting from TBI. Neurologic declines and diminished motor function or balance may occur. Patients with SCI may experience similar symptoms resulting from different underlying conditions. Both TBI and SCI may cause spasticity and other movement disorders, although manifestations may differ somewhat.

Clearly, early diagnosis and appropriate treatment of patients with TBI and SCI are critical. A multidisciplinary rehabilitation team with experts in both fields offers patients the greatest opportunity to achieve the best outcomes.

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