

Rehabilitation

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Ahead of the game: A new approach for sports concussion

> BY NEIL JASEY, M.D., AND LORAN VOCATURO, ED.D., ABPP (RP)

MUHAMMAD ALI may always be known as one of the most dynamic boxers in American sports history, but his legacy also is marked by something else: his transformation from elite athlete to Parkinson's patient. Anyone skeptical as to the seriousness of sports-related concussion, also known as mild traumatic brain injury (mTBI), need only consider Ali's decline.

From football to hockey and beyond, athletes who incur repeated head injuries are vulnerable to detrimental and potentially long-term physical, cognitive and behavioral effects. But as the science and practice of rehabilitation medicine continue to advance, Kessler Institute for Rehabilitation and other facilities are generating greater awareness of these conditions through specialized concussion care.

Making the Right Call

The pathway from the playing field to the physician's office is not always a direct one. Athletes who have sustained mTBI may not be aware that medical attention is necessary, because common features, such as headaches, are often minimized or considered "normal" for athletes (see sidebar, page 7). Prompt diagnosis leads to earlier treatment and better outcomes, but unresolved symptoms can linger extensively and produce secondary conditions, including depression, post-concussive syndrome or long-term cognitive deficits.

Treatment involves physical and cognitive rest in which activity and stimulation are greatly restricted, allowing the brain to heal. This highlights another downside of not receiving a timely diagnosis: Without the prescribed rest-and-recovery period, patients may resume activity prematurely, increasing the possibility of reinjury by four- to sixfold. And research shows that repeated concussions are particularly ruthless, possibly leading to serious and potentially irreversible conditions like dementia or even death.

A Different Game Plan

Rehabilitation for mTBI in young athletes can be complex. Teachers and parents are frequently engaged in the treatment plan. For instance, academic accommodations, such as allowing a student to record class lectures rather than take handwritten notes, can be helpful. *(continued on page 7)*



FOCUS ON

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Social justice, high ideals and access to Medicaid



FOR MANY INDIVIDUALS who cannot afford health care and do not have health insurance, the federal-state health insurance program, Medicaid, is vitally important. Federal regulations stipulate minimum requirements with which states must comply to receive their matching funds. Nonetheless, coverage differs substantially among them, notably for rehabilitation services. With benefits ranging from full program support (at or below provider cost) to no inpatient reimbursement whatsoever, many of those needing care—up to 30 percent of some inpatient rehabilitation hospital or unit (IRH/U) populations—are or will become dependent upon Medicaid as their sole source of health coverage.

As state governments struggle with their budgets, many are looking to reduce Medicaid expenditures. The imminent threat to the program's rehabilitation coverage poses particular concerns for those who treat persons with disabilities (PWD).

For most physiatrists, our involvement goes well beyond the standard medical model. Our specialty embraces a belief system that compels us to provide enlightened, quality care to people suffering catastrophic injuries or disabling conditions. We focus on understanding our patients' circumstances in relation to their community—what helps them function, what represents success.

We know that PWDs are a minority; they are underrepresented and quite vulnerable. Although we view them as a population, they seldom see themselves as such. This is understandable, as persons with spinal cord injuries, for example, believe they have little in common with those who have had strokes or amputations. Because PWDs may more easily identify with individuals who have similar limitations, affiliating with condition-specific organizations (for example, the Brain Injury Association of America) may help represent their concerns. But only when communicating through a broader coalition, such as the Consortium for Citizens with Disabilities, can they advocate effectively to protect the safety net that is Medicaid.

PWDs are prominent among Medicaid beneficiaries. Too often, those who are not recipients before being disabled become impoverished by incurred costs and enroll in the Medicaid program. If this assistance disappears or if states impose onerous limitations on eligibility or benefits, our patients will disproportionately suffer the consequences. Many individuals and institutions will be forced to depend even more on charity or uncompensated care. Or, patients simply won't be able to access needed services and will languish at home or residential facilities.

Our awareness of these and other issues compels us to advocate for continued access to care for PWDs. Although this advocacy requires sustained effort, the above insights help to explain our field's activism and the evangelical nature of what we do.

Accordingly, we as providers must do everything possible to protect Medicaid. Advocating for PWDs is a matter of equity and social justice—and is the right thing to do.

Bruce M. Gans, M.D.
Chief Medical Officer

For the right patient, intelligent orthotics offer more natural movement

> BY JEREMIAH D. NIEVES, M.D., AND GEOFFREY HILL, CPO

STATIC KNEE JOINT components of traditional knee-ankle-foot orthoses (KAFOs) have significant drawbacks. They generally require manual adjustment for specific tasks, such as sitting or standing. When the orthosis is locked for ambulation, the user must compensate for restricted knee flexion through inefficient gait patterns such as vaulting, hip hiking and circumduction. This transmits pain and stress to adjacent joints and prevents normal movement of the supporting tissues. Together, these effects increase fatigue and the possibility of lost muscle mass, making continued use challenging.

State-of-the-art “stance-control orthoses” (SCOs) are overcoming such difficulties, offering more natural motions while speeding rehabilitation. These dynamic “smart joint” KAFOs incorporate three categories of design: microprocessor-controlled systems, weight-controlled structures, and gait-activated mechanisms that allow both knee flexion (during the swing phase of walking) and locking (during the stance phase).

The Process

The orthotist works with the referring physician and physical therapists to consider options for a given patient. In most cases, a basic orthosis is tried first. This strategy helps determine whether a more advanced alternative is appropriate for the particular clinical situation.

If a “smart joint” is suitable, a diagnostic version might be used first to hone component and design choices. Then, assuming that the device works as anticipated, dimensions from models rendered



from casts or manual measurements are entered into a computer-aided design and manufacturing system for in-house or external fabrication of a custom-fitted appliance. As rehabilitation progresses, the care team can adjust the orthosis’ settings to optimize its capabilities.

An example is provided in the case of a 40-year-old police officer who suffered a traumatic disk herniation resulting in spastic hemiparesis. To address the weakness in his lower leg, orthotists at Kessler Institute for Rehabilitation first fitted him with a traditional KAFO. Although this brace effectively stabilized his leg, the patient suffered from all the limitations mentioned above. His ability to generate enough momentum of the affected side, along with his otherwise good health, physical and mental fitness,

and motivation to use the device, suggested the suitability of an SCO.

The criteria for an optimal functional outcome led to use of the Sensor Walk® system. In the stance-controlled setting of this KAFO, sensors embedded in the footplate detect when the person is about to step forward (the late-stance phase) and trigger microprocessors to unlock the knee joint. The sensors also identify when relocking is needed, resulting in a more efficient, more natural-looking gait. The flexion-blocking mechanism is activated as required during the gait cycle, providing additional stability. Other settings include continuous lock, free swinging of the joint, and controlled resistance to flexion from sit to stand. A rechargeable battery that lasts for a typical active day powers the device.

A Beneficial Outcome

After one month of using the customized product, the patient had adapted completely, with only minor adjustments and no complications. He retained the muscle mass in his leg and was delighted with the appearance and speed of his gait. He is able to enjoy many outdoor activities, including fishing and hunting.

Some people will not be candidates for SCOs. For example, those who wish to use the Sensor Walk must have sufficient strength in the hip, torso and pelvis to generate momentum on the affected side to swing the leg forward, and have the manual dexterity to lock and unlock the device if the battery fails. With careful patient selection and monitoring, however, these orthoses can offer both short- and long-term benefits throughout rehabilitation.



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Moving forward: Clinical care and research combine to promote ambulation

> Q&A WITH STEVEN KIRSHBLUM, M.D.

THE ABILITY TO MOVE about at will is something that most of us take for granted. For patients who have a spinal cord injury, traumatic brain injury, stroke, multiple sclerosis or other neurological conditions resulting in mobility deficits, simply walking across the room may seem like an impossible feat. Recent advances in the development of locomotor technology, however, are making ambulation more than just a potential goal. Combined efforts of clinicians at Kessler Institute for Rehabilitation and researchers at Kessler Foundation Research Center are trying to turn these patients' dreams into reality.

To better understand the potential of mobility technologies and the ways in which Kessler's clinicians and scientists are teaming up to use such devices in the rehabilitation of individuals with ambulatory deficits, *Focus on Rehabilitation* spoke with Steven Kirshblum, M.D., the medical director of Kessler's West Orange campus and director of Kessler's Spinal Cord Injury Program.

Focus on Rehabilitation: What is meant by the term "mobility technologies"? Can you describe an example currently in use at Kessler?

Steven Kirshblum, M.D.: Mobility technologies refer to assistive devices that aid in ambulation for those with spinal cord and other neurologic injuries causing gait deficits, including balance, strength and overall limitations in walking. While in the past these technologies generally consisted of wheelchairs and orthoses, today we have the addition of robotic therapies, which offer an innovative way to enhance recovery and may significantly improve a patient's ability to function more independently (see sidebar).

At Kessler, one of our newest devices in use is the LokomatPro V6. This body weight-supported, ambulation training

system incorporates an enhanced treadmill to help recover and strengthen gait. Robotic walking devices, such as the LokomatPro V6, offer improvements from the previous model in locomotor training by providing better range of motion and patient-tailored feedback. This in turn allows the system to better mimic the actual environments in which the person will move and supports development of a more symmetrical gait.

Focus: Are there particular outcomes beyond that of ambulation for which

mobility technologies appear particularly beneficial?

Kirshblum: A number of studies have recently shown that locomotor training is of benefit to persons with incomplete spinal cord injury in a number of different domains, including walking itself, physiological parameters and quality of life. As technology continues to improve, this will allow for the study of additional outcome measures as well as consideration for individuals with neurologically complete injuries.

ROBOTICS IN REHABILITATION

Robotic devices such as the LokomatPro V6 represent the novel interface between rehabilitation and biomechanical engineering. Technologies are available for both lower and upper body motor impairments, such as aiding the recovery of arm, hand and finger use following stroke. While safety and efficacy outcomes are of obvious interest in robotic locomotor training, secondary measures, including cardiovascular and metabolic functioning, quality of life, and patient acceptance, are also of increasing concern.

Kessler's use of the LokomatPro V6 attracted recent media attention for its novelty and potential to transform how individuals regain the ability to walk. But other robotic technologies are similarly earning a reputation for potentially revolutionizing the way ambulatory rehabilitation is provided, and one such device is the Exoskeleton Lower Extremity Gait System (eLEGS). Developed by Berkeley Bionics, eLEGS is a lower-extremity exoskeleton, or "wearable robot," that allows patients with neurological injuries resulting in paralysis or lower extremity weakness to stand and walk. The device uses artificial intelligence and sensors placed on the leg muscles to determine and respond to how the person wants to move, allowing the development of a more efficient gait.

Kessler Foundation Research Center is one of 10 sites currently testing eLEGS. Research staff there are working with Kessler Institute for Rehabilitation to assess safety and efficacy and to identify populations thought to be most appropriate for the use of this technology. This includes individuals with spinal cord injury or traumatic brain injury, and also stroke patients.



Collaboration among clinicians and researchers, combined with advanced technologies, enables patients to make significant progress in their rehabilitation.

Focus: Why is integrating research with patient care so important?

Kirshblum: The goal in establishing a partnership between clinical service delivery and research is to develop therapeutic parameters for practice that are empirically based and ultimately will lead to better outcomes. Collaboration between researchers and clinicians, including physicians and therapists, is critical in translating science from the lab to the care setting. We are extremely fortunate to have here at Kessler the research and clinical teams under one roof, with similar goals and motivations. While we as practitioners and scholars benefit from this union, it is ultimately the patients who gain the most from the interventions and knowledge obtained from these studies.

Focus: Can you discuss some specific programs or projects in which Kessler Institute for Rehabilitation and Kessler Foundation Research Center have combined research and clinical efforts to improve care?

Kirshblum: Our Locomotor Training Program is an excellent example of how we have successfully integrated science and clinical evidence with actual practice. The program, which retrains patients with incomplete spinal cord injuries in walking, has been active in collaborating with our research partners over the last few years. This includes participating as a clinical and training

site for the NeuroRecovery Network, which is sponsored by the Christopher and Dana Reeve Foundation and the Centers for Disease Control and Prevention and whose primary investigator is Susie Harkema, Ph.D.

This partnership also allows Kessler clinicians to work closely with Kessler Foundation research staff, most notably Gail Forrest, Ph.D., interim director of the Human Performance and Movement Analysis Laboratory, to study other benefits of locomotor training, including functional activities, bone mineral density and overall quality of life. Data are routinely collected on those enrolled in the program, meaning we can continually study and enhance treatment to optimize rehabilitation.

A similar approach is being used with our application of the LokomatPro. While using the training program clinically to help patients establish a more functional gait, we also will be researching its potential to improve secondary conditions associated with spinal cord injury, such as respiratory and bladder dysfunction and poor circulation. What

we learn from studying these and other outcomes is then integrated into rehabilitation regimens on the clinical side. In this manner, patient care and research go hand in hand, as findings from one area help inform the development and application of technology in the other area.

Focus: How have patients responded to participating in both the research side of ambulatory rehabilitation and the clinical side?

Kirshblum: Acceptance has been quite high. The availability of advanced technology mobility devices is limited, and therefore, understanding their benefits through research is important in order for the field to achieve more widespread use. Because of this, patients are not only grateful for the opportunity to use and benefit from these devices, they are highly motivated to participate in these clinical interventions. In most cases, their enthusiasm results from the progress they have achieved.

Focus: Are there any downsides to individuals in such clinical-research ambulatory rehabilitation programs?

Kirshblum: There are some restrictions for participation in these clinical interventions and trials. While we have focused mostly on the spinal cord population, we will be initiating studies involving other neurological disorders in the near future.

It is important to remember that although technological devices represent an exciting and promising opportunity to improve the lives of patients in ways that weren't possible before, they do not replace the critical aspects of therapy-driven interventions. For instance, the importance of transitioning from body weight-supported gait training to over-ground walking is critical for advancement. The human touch should never be discounted as a key tool in the success of a locomotor program—or any rehabilitation program.



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The peril and promise of accountable care organizations for medical rehabilitation

> BY BRUCE M. GANS, M.D.

THE CENTERS FOR Medicare and Medicaid Services (CMS) recently published its proposed certification criteria for accountable care organizations (ACOs). To the extent that health care providers had high expectations for Medicare's plan, the proposal's details as released in the Federal Register were greeted with collective disappointment from most of the hospital community. One organization announced that more than 90 percent of its surveyed members would not apply to the program as presented.

Frequently cited criticisms of Medicare's plan focus on its overly onerous quality reporting metrics and inherent financial risks—for both upfront costs and retroactively applied gains or losses. To become certified, CMS offered two three-year trial options. One ACO model specifies two initial years of gain-sharing only, followed by a third year with potential gains or losses. The second option offers greater profit potential throughout the trial in exchange for higher risk assumption for all three years. Savings or losses are determined statistically from Medicare's calculations of expected expenditures for the retroactively determined patient population included in the ACO computations.

Impeding Access?

The CMS proposal emphasizes linking primary care physicians with acute care hospitals, anticipating improved care coordination and disease management. But because it does not address post-acute care or any associated quality criteria, rehabilitation providers are concerned about its implications. If primary care dominates the process, and financial factors figure prominently in decision-making, absent reliable outcome data about their use of rehabilitation services, the economics could incentivize physician referrals to less expensive but less appropriate settings. As an unintended

consequence, this could, in effect, impede access to inpatient rehabilitation hospitals/units (IRH/Us).

CMS asserts its proposal preserves patients' rights to choose providers in the fee-for-service program. Yet, our field worries that financially conflicted primary care practitioners may influence individuals toward post-acute providers that benefit their ACO—without their knowledge (or consent). Also, patients may not realize their doctor's limited expertise in directing them to subsequent services. If

that we take the initiative, educating ACOs about our unique value. In the typical primary care Medicare population, patients experience approximately 0.5 percent incidence of rehabilitation hospitalizations annually. Treating these few individuals makes it unlikely that generalists will develop sufficient expertise to make optimal placement decisions. This further demonstrates the value of relying on physiatric consultants to identify those who could benefit from rehabilitation services—and in what

Because the CMS proposal does not address post-acute care or any associated quality criteria, rehabilitation providers are concerned about its implications.

practitioners do not understand the differences among such settings, they may feel justified basing referrals on price. The medically precarious patient could suffer dramatically from these conflicting interests. Beyond the obvious health implications, this shift in access away from rehabilitation hospitals could ultimately jeopardize the viability of IRH/Us.

The enlightened primary care practitioner would consult physiatrists and liaison rehabilitation nurses regarding their patients' post-acute placement. Because these specialists can best evaluate individuals' needs for further medical, nursing and therapeutic services support, their input minimizes the risk of subsequent adverse health effects and maximizes positive outcomes. Ideally, ACOs would approach rehabilitation providers to partner from the outset.

A Time for Action

Unfortunately, the lack of rehabilitation emphasis in Medicare's proposal makes this unlikely. It is imperative then

setting. That IRH/U patients experience substantially fewer rehospitalizations and long-term institutionalizations than those in skilled nursing facilities suggests that incorporating rehabilitation into ACOs is arguably a wise business decision as well as good medicine.

If Medicare's certification requirements are not substantially revised, its trial won't be highly subscribed or have much impact nationwide. Nonetheless, a movement for increased health care coordination is gaining momentum; the hospitals and health systems are pursuing privately insured ACO projects, seeking to grow market share and financial gains. It is essential that our specialty view this as both a threat and an opportunity—and be proactive.

Doing so requires introducing our specialty into ACO developers' mindsets. At this juncture, we must take every opportunity to ensure the viability of IRH/Us, both from a self-serving business standpoint and for continued patient access to our specialized services.

Ahead of the game: A new approach for sports concussion

(continued from page 1)

Children and younger adolescents may not be as articulate as adults in reporting their symptoms, and athletes in general may be reluctant to admit to symptoms, because they either minimize the seriousness or fear that seeking medical treatment will disrupt their play. This makes reliance on other information sources a necessary component of monitoring the patient.

The sporting culture itself is another consideration. Violence and injuries are viewed as an acceptable part of competitive play, and athletes may feel pressure from coaches and teammates to quickly resume activity after injury. Recent research confirms that student athletes are increasingly susceptible to second-impact syndrome, a fatal response to reinjury that occurs while the brain is healing from the initial concussion. Given the subtle nature of the signs of concussion, as well as the potentially life-threatening consequences, education about patient honesty is imperative.

A Team Approach

Kessler's concussion services are helping to set the standard in quality care. A wide range of multidisciplinary specialists work together under one roof, enabling patients to receive coordinated care in a single visit rather than having to return to the clinic on multiple days. The team includes in-house physiatrists, neuropsychologists, physical therapists trained in vestibular rehabilitation, and occupational therapists specializing in ocular recovery.

To promote prevention, Kessler's clinicians consult with area high schools, colleges and universities to raise awareness about head injury safety, including the importance of the ImPACT evaluation system. Athletes who may have sustained a concussion are advised to



A SILENT ADVERSARY

Sports-related concussions constitute the majority of mTBI sustained each year, but their exact incidence is unknown. Within rehabilitation medicine there is a lack of consensus on diagnostic criteria; even defining what is meant by the term "concussion" has changed over the past few years. All of this makes pinpointing the frequency of the condition difficult, and with no universal working definition for diagnosis, mTBI may

go undetected. Compounding the problem is that patients who experience concussions often appear normal, both observationally and on objective assessments such as MRI. In the absence of hard data from brain imaging or blood tests to confirm a concussive injury, clinicians must rely on patient self-report of history and functioning for diagnosis.

The most common functional impairments associated with mTBI include headache, blurry or distorted vision, dizziness, vertigo and balance problems, irritability, sleep disturbance, and mental changes such as concentration and memory decline. A patient may experience these ordinary and often benign symptoms for a variety of reasons besides head trauma. Consequently, individuals can misattribute the cause of their symptoms or dismiss them as unimportant or trivial. This underscores the importance of a multidisciplinary model of care. As in sports, where a unified team rather than a sole player achieves victories, so, too, in medicine can a collaborative network attain greater success than can a lone clinician.

stop play, immediately seek medical evaluation, and restrict activity until cleared by a clinician experienced in treating concussions. Comprehensive neuropsychological testing is provided to those with more extensive injuries or deficits. Recommendations for treatment and accommodations are coordinated with the patient, parents, teachers, coaches and trainers to maximize rehabilitation potential and hasten the return to full, independent functioning. Medical treatment also is provided for

related symptoms, such as fatigue and sleep disturbance.

Kessler's approach to sports concussion care has helped initiate statewide reforms in New Jersey. The clinic assisted Gov. Chris Christie's office in drafting legislation mandating that all New Jersey public schools develop head-injury prevention and response programs. As public awareness of the significance of mTBI grows, Kessler will serve as an exemplar for the treatment—and, more important, the prevention—of these devastating injuries.



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Care for the caregiver is a vital part of a successful rehabilitation approach

> BY KATE BERNARD, MSW, CCM

PROVIDING CARE to chronically ill family members and friends is frequently associated with significant psychological and physical morbidity, as extensive research has demonstrated.

For example, a prospective study of U.S. women published in 2003 in the *American Journal of Preventive Medicine* concluded that caring for a disabled or ill spouse for nine or more hours per week was associated with increased risk of coronary heart disease. Research from 2005 appearing in *Stroke: Journal of the American Heart Association* found depression in about one-third of caregivers of stroke patients during the acute and chronic phases of the illness. Other recent studies have shown that caregivers may experience accelerated telomere erosion.

Caregiver burnout constitutes so serious a public health threat that national organizations such as the American Stroke Association, the Brain Injury Association of America, and the National Institute of Neurological Disorders and Stroke have launched major initiatives targeted at protecting the health of this population.

Encompassing Support

To address these concerns, case managers at Kessler Institute for Rehabilitation

work with those providing care for a family member or loved one to find support programs, education and training resources, and appropriate respite services. Stress management is taught to caregivers both for the sake of their own health and to enable them to effectively implement the patient's discharge plan.

Some of the specific recommendations provided to caregivers include the following:

- Prepare a to-do list prior to patient discharge.
- Focus on staying organized, managing appointments with medical providers, and keeping adequate records.
- Maintain balance throughout day-to-day life: eat right, take a class, go for walks.
- Take time to be with people other than the patient; join a support group or arrange regular visits with friends and relatives.

- Consider adult day care or in-home care for the patient—an opportunity for a third party to provide relief for the caregiver.
- Identify relevant community resources, such as Meals On Wheels or a hairdresser willing to visit the home.
- Access Web-based resources of reputable organizations, for example, the National Spinal Cord Injury Association.
- Consult with therapists about assistive medical devices and accessories.

Conferring with the Team

Kessler provides comprehensive family training prior to discharge to facilitate this caregiver support. Family members, in addition to meeting with the case manager, may confer with the physician, nurses, psychologist, physical, occupational and speech therapists, and other providers to learn more about both patient care and strategies for protecting caregiver health.



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