

# Neurorehabilitation Updates

Collaborative care, innovative approaches, and research-driven therapies to help patients get back to their lives.



Kennedy Krieger Institute  
UNLOCKING POTENTIAL

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## A Word from the Director

Frank S. Pidcock, MD, Vice President of Rehabilitation at Kennedy Krieger Institute, Director of the Pediatric Rehabilitation Division in the Department of Physical Medicine & Rehabilitation, Johns Hopkins Hospital



In this issue of *Neurorehabilitation Updates*, we take a look at the complex care required to rehabilitate a toddler who sustained brain and spinal cord injuries in a car accident. In addition to movement deficits from injury to the spinal cord, the added complication of a brain injury made rehabilitative care very challenging. A key component of this patient's care was helping her cope with the stress and rigours of separation from family in a hospital setting.

Kennedy Krieger Institute's unique ability to call upon the expertise of a variety of specialists allows us to address the most complicated rehabilitative needs of children at any age. Stacy Suskauer,

MD, Director of Brain Injury Rehabilitation Programs, is a national leader in the field of pediatric brain injury. The International Center for Spinal Cord Injury, led by Cristina Sadowsky, MD, has pioneered the use of activity-based restorative therapies for patients with spinal cord injuries. Suzanne Rybczynski, MD, and Michelle Melicosta, MD, are experts in the care of children with respiratory and other chronic conditions that require rehabilitation in a hospital setting. In addition to physical, occupational, and speech therapies used in a rehabilitation setting, the behavioral psychology, child life, and social work departments have more than 30 years of experience in addressing the emotional and social needs of children who require inpatient rehabilitative care.

Also in this issue, learn how state-of-the-art robotic equipment offers rehabilitation professionals more tools than ever before to help patients build function and independence. Plus you'll find an overview of our latest research findings.

Watch for future issues of *Neurorehabilitation Updates*, in which we will continue to highlight the latest research and treatment options in neurorehabilitation. If you have any questions or would like to learn more about our services, please call our **Physician Referral Line** at **443-923-9403**.

### Rehabilitation Specialty Programs at Kennedy Krieger Institute

Kennedy Krieger Institute has a wide variety of rehabilitation programs to meet the needs of patients at all levels. For a complete listing, please visit [Rehabilitation.KennedyKrieger.org](http://Rehabilitation.KennedyKrieger.org).

#### Pediatric Inpatient Rehabilitation Program

- Brain injury
- Medical rehabilitation
- Pain rehabilitation
- Post-orthopedic surgery
- Spinal cord injury

#### Outpatient Rehabilitation Programs

- Brachial Plexus Clinic
- Brain Injury Programs:
  - Brain Injury Early Assessment
  - Brain Injury Responsiveness Program
  - Interdisciplinary Brain Injury Clinic
  - Neurorehabilitation Concussion Clinic
- Community Rehabilitation Program
- Constraint-induced and Bimanual Therapy Program
- Cranial Cervical Clinic
- Focused Interdisciplinary Therapy Program
- International Center for Spinal Cord Injury
- Limb Differences Clinic
- Orthopedics Clinic
- Pediatric Pain Rehabilitation Clinic
- Phelps Center for Cerebral Palsy and Neurodevelopmental Medicine
- Philip A. Keilty Center for Spina Bifida and Related Conditions
- Physical Medicine and Neurorehabilitation Clinic
- Specialized Transition Program Day Hospital

#### Related Services and Clinics

- Aquatic Therapy Program
- Assistive Technology Clinic
- Audiology Clinic
- Behavioral Psychology Program
- Movement Disorder Clinics
- Neuropsychology Outpatient Clinics
- Nutrition and Weight Management Clinic
- Occupational Therapy Clinic
- Pediatric Psychology Clinic
- Physical Therapy Clinic
- Seating Clinic
- Speech and Language Clinic

## Complex Care for Toddler with Brain and Spinal Cord Injuries



For 3-year-old Sanayah, Kennedy Krieger brought together renowned expertise in both traumatic brain injury and spinal cord injury rehabilitation.

In June, 2015, a car accident left the 2-year-old Sanayah with a severe spinal cord injury, brain hemorrhage, and a concussion. Although her spine was intact, the swelling—and the necrosis of the nerves that followed—left her paralyzed from the chest down. Kennedy Krieger brought together its renowned expertise in both brain injury and spinal cord injury to help Sanayah rehabilitate after her injuries.

Sanayah's case was complex. Not only did she sustain spinal cord and traumatic brain injuries, but she also

experienced respiratory complications. But it was Sanayah's age that was perhaps the most challenging issue. Now 3 years old, she had the stubbornness one would expect of any toddler, and a limited ability to express her emotions or understand her medical situation. Sanayah had undergone significant trauma from the accident itself and the necessary interventions that followed. And it was hard to be separated from her mother, who was recovering from her own injuries in another hospital. Sanayah was understandably anxious, yet it was critical that she participate in the therapies needed for successful rehabilitation.

"Because we have such an excellent interdisciplinary approach, both the behavioral psychology and child life staff worked really closely with Sanayah," says Michelle Melicosta, MD, Sanayah's attending physician on the inpatient unit. Child life therapists helped Sanayah adjust to being in the hospital, while behavioral psychologists taught her, at an age-appropriate level, coping mechanisms she would need moving forward.

Much of Sanayah's rehabilitation was spent undergoing intensive activity-based restorative therapy with functional electrical stimulation, designed to recover function and stimulate recovery of

the nervous system, while maintaining muscle mass and improving strength. "Children like Sanayah have the advantage of plasticity in their spinal cord and central nervous system because they're still growing and developing," explains Janet Dean, pediatric nurse practitioner at Kennedy Krieger's International Center for Spinal Cord Injury. Sanayah's therapies included gait training, weight bearing exercises, and aquatic therapy. Dean says they push their patients harder than other centers might think a child can be pushed—up to five hours of therapy a day. But the experienced therapists are adept at making the hard work of therapy seem like play.

Sanayah now uses a mobile stander and is able to push her own wheelchair, which gives her the ability to explore her world, something that is important for her developing toddler cognition as well as her long-range independence. She has also improved the use of her upper extremities and can perform many activities of daily living independently.

Recovery from an injury like Sanayah's is a marathon, not a sprint. Because of her age, the long-term impact of her traumatic brain injury may not be apparent until she's progressed further in school. But Kennedy Krieger will be there with medical expertise, therapy, and support every moment along the way.



(Left) Occupational therapist Shannon Corbey making the hard work of therapy fun for Sanayah.

(Right) Nurse practitioner Janet Dean checks Sanayah's deep tendon reflexes.



**"Children like Sanayah have the advantage of plasticity in their spinal cord and central nervous system because they're still growing and developing."**

—Janet Dean, pediatric nurse practitioner at Kennedy Krieger's International Center for Spinal Cord Injury

## From Bench to Bedside

*Kennedy Krieger's clinicians and researchers are leaders in the worldwide effort to prevent and treat disorders of the brain, spinal cord, and musculoskeletal system. Our investigators continue to break new ground with innovative imaging technology, investigate critical areas, and develop new treatment models and therapies. Selected recent research includes:*

Altered functional connectivity in children with mild to moderate TBI relates to motor control. Risen SR, Barber AD, Mostofsky SH, Suskauer SJ. *J Pediatr Rehabil Med.* 2015 Dec 1; 8(4):309-19. doi: 10.3233/PRM-150349. PMID: 26684071

Preliminary reliability and validity of a battery for assessing functional skills in children with Sturge-Weber syndrome. Reidy TG, Suskauer SJ, Bachur CD, McCulloch CE, Comi AM. *Childs Nerv Syst.* 2014 Dec; 30(12):2027-36. doi: 10.1007/s00381-014-2573-6. Epub 2014 Oct 26. PMID: 25344741

Neurobehavioral Outcomes in Children After Out-of-Hospital Cardiac Arrest. Slomine BS, Silverstein FS, Christensen JR, Holubkov R, Page K, Dean JM, Moler FW; THAPCA Trial Group. *Pediatrics.* 2016 Mar 3. pii: peds.2015-3412. [Epub ahead of print] PMID: 26940987

Time to Follow Commands and Duration of Posttraumatic Amnesia Predict GOS-E Peds Scores 1 to 2 Years After TBI in Children Requiring Inpatient Rehabilitation. Davis KC, Slomine BS, Salorio CF, Suskauer SJ. *J Head Trauma Rehabil.* 2016 Mar-Apr; 31(2):E39-47. doi: 10.1097/HTR.000000000000159. PMID: 26098263

Prevalence and predictors of affective lability after paediatric traumatic brain injury. Vasa RA, Suskauer SJ, Thorn JM, Kalb L, Grados MA, Slomine BS, Salorio CF, Gerring JP. *Brain Inj.* 2015; 29(7-8):921-8. doi: 10.3109/02699052.2015.1005670. Epub 2015 May 7. PMID: 25950263

Therapeutic hypothermia after out-of-hospital cardiac arrest in children. Moler FW, Silverstein FS, Holubkov R, Slomine BS, Christensen JR, Nadkarni VM, Meert KL, Clark AE, Browning B, Pemberton VL, Page K, Shankaran S, Hutchison JS, Newth CJ, Bennett KS, Berger JT, Topjian A, Pineda JA, Koch JD,

Schleien CL, Dalton HJ, Ofori-Amanfo G, Goodman DM, Fink EL, McQuillen P, Zimmerman JJ, Thomas NJ, van der Jagt EW, Porter MB, Meyer MT, Harrison R, Pham N, Schwarz AJ, Nowak JE, Alten J, Wheeler DS, Bhalala US, Lidsky K, Lloyd E, Mathur M, Shah S, Wu T, Theodorou AA, Sanders RC Jr, Dean JM; THAPCA Trial Investigators. *N Engl J Med.* 2015 May 14; 372(20):1898-908. doi: 10.1056/NEJMoa1411480. Epub 2015 Apr 25. PMID: 25913022

Efficacy outcome selection in the therapeutic hypothermia after pediatric cardiac arrest trials. Holubkov R, Clark AE, Moler FW, Slomine BS, Christensen JR, Silverstein FS, Meert KL, Pollack MM, Dean JM. *Pediatr Crit Care Med.* 2015 Jan; 16(1):1-10. doi: 10.1097/PCC.0000000000000272. PMID: 25268768

Rebecca Martin, OTR/L, OTD; Paige Bourne, DPT; Scott Meyer, PTA; Cristina Sadowsky, MD. (2016, April). *Evaluation of Metabolic Demands of FES-Assisted Exercise in Patients with Chronic Tetraplegia.* Poster session presented at the American Spinal Injury Association Annual Meeting, Philadelphia, PA.

Liza V. McHugh, DPT; Ashley A. Miller, DPT. (2016, April). *Facilitation of Voluntary Motor Activation Utilizing Transcutaneous Electrical Spinal Cord Stimulation in an Individual with Motor-Incomplete Spinal Cord Injury: A Case Report.* Poster session presented at the American Spinal Injury Association Annual Meeting, Philadelphia, PA.

For more information about research, studies, and clinical trials at Kennedy Krieger Institute, please visit [KennedyKrieger.org/Research](http://KennedyKrieger.org/Research).

## Kennedy Krieger Physician Named CARF Surveyor



Melissa Trovato, MD, director of inpatient rehabilitation at Kennedy Krieger Institute, was appointed a CARF surveyor by CARF International in March, 2016. Dr. Trovato has been training under the guidance of CARF's seasoned veteran surveyors for the past year.

Through accreditation, CARF assists service providers in improving the quality of their services, demonstrating value, and meeting internationally recognized organizational and program standards. CARF surveyors are professionals in their fields with primary employment at

CARF-accredited organizations, and are considered to be experts in administrative leadership, service oversight, and optimizing patient outcomes.

**"As a CARF surveyor, I hope to not only share my experience with other similar facilities but also bring their best practices back to Kennedy Krieger and ultimately improve the care for our patients and families."**

—Melissa Trovato, MD, Director of Inpatient Rehabilitation at Kennedy Krieger Institute



Kennedy Krieger Institute

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*The G-EO System™ is robotic technology that allows patients to recover mobility and independence.*

## Robotics: The Future of Rehabilitation

Kennedy Krieger offers patients the latest rehabilitation technologies and equipment, including robotic-assisted devices to improve function, reduce muscle atrophy, and stimulate nerves. Recent advances in understanding of the connections between adaptive neuroplasticity and functional recovery have led to accelerated development of robotic devices that improve rehabilitation outcomes. Robotic devices are used for both occupational and physical therapy, giving our therapists more tools than ever before to help patients build function and independence in both inpatient and outpatient settings.

The benefits of robotic therapy are significant. These sophisticated devices, which can be programmed for each patient, guide the user through repeated, precise movements, providing real-time feedback to patients and therapists, including objective measures relating to position.

Two of the newest robotic devices offered at Kennedy Krieger for people with lower extremity weakness or paralysis are the Ekso™ exoskeleton and the G-EO System™.

- The **Ekso™ exoskeleton** is a powered lower-limb orthosis that enables people to return to standing and walking. In addition, this battery-powered bionic device can be used to supplement our gait training therapies. When at home, the device sends real-time patient performance data to the therapist's mobile device, so adjustments can be made to create the best program.
- The **G-EO System™** allows patients to recover mobility and independence in daily living by performing realistic simulations of activities such as over-ground walking and going up and down stairs. When using the G-EO, therapists are able to provide real-time adjustments in a safe and controlled environment to maximize the benefits of the equipment for each patient.

To learn about additional robotic and state-of-the-art therapy equipment at Kennedy Krieger, visit **Rehabilitation.KennedyKrieger.org**.