How did you become involved in researching the impact of exercise on quality of life for severely burned children?

While I was completing a postdoctoral research position at the Mayo Clinic in Rochester, Minnesota, I responded to a call for an exercise physiologist and faculty member at the University of Texas Medical Branch/Shriners Hospital for Children (SHC) – Galveston, Texas. The role was to direct a wellness and exercise centre for burned children, which is part of a Burn Centre grant under the direction of burn surgeon, Dr David N Herndon, MD (see p39).

What are the limitations of the current care approach for severely burned children?

The standard of care for the rehabilitation of severely burned children is typically to discharge the patient from the hospital, with a written set of instructions for physical and occupational therapy activities at home, in an unsupervised environment. This rehabilitative practice has been suboptimal and has not had a significant impact on the persistent and extensive skeletal muscle catabolism and weakness characteristic of severe burns.

As a result, patients manifest low aerobic exercise capacity, as well as reduced muscle strength and muscle mass even a year after their incident.

What are the benefits of the Exercise in Burned Children programme?

This 12-week structured and supervised exercise programme started as a clinical research proposal, and is implemented (originally at six months post-burn) at hospital discharge. The aim is to determine its physiological and quality-of-life effect in burned children. It is clear from other acute medical illnesses that implementing an exercise programme improves clinical outcomes and quality of life. Similarly, exercise programmes implemented at hospital discharge in burned children should have the advantage of increasing motivation and compliance with the rehabilitation process.

Furthermore, exercise has been reported to decrease the number of operative procedures to release major joint contractures, and we strongly believe that early education on exercise-induced benefits is of vital importance to the long-term physical and psychosocial health of these severely burned children. To date, exercise in children has been shown to increase muscle mass, bone mass, peak aerobic capacity and muscle strength, and improve quality of life significantly more than the current standard of care.

Could you expand upon your work that sits within the Community Based Exercise Program (COMBEX)?

The term COMBEX is used to describe our studies that to date have focused on a rehabilitation initiative using exercise that is carried out in our hospital. That means that if a patient is not from Galveston, they have to be away from their homes for a minimum of 12 weeks. If we can demonstrate that a similar exercise programme (COMBEX) can also be safely and effectively carried out at local community gyms or fitness facilities, this would be of great benefit to patients with burns.

We are currently conducting these studies in adults through a grant funded by the Department of Defense, and in children under a National Institute for Child Health and Development grant. We plan on publishing our results in 2014.

Have there been any significant challenges that you have had to overcome?

A great challenge is ensuring that all research carried out by us has the potential to directly help patients. Each question and objective should be clinically important and beneficial to the patient.

Another challenge is trying to stay positive when working with each patient. Some patients are children, and their circumstances can sometimes bring about sadness. However, this quickly disappears when you see how positive, hard-working and happy spirited these children are, in spite of such great tragedy. It really teaches us a lesson in humility, perseverance and personal strength.

Has funding been an issue for your work?

The amount of money available for funding from federal agencies has decreased. The way that many reviewers of grants look at research has changed and this has made it very difficult to receive support for life-changing investigations such as those carried out at SHC – Galveston.

Where would you like to direct your efforts in the future?

We hope to explore how nutritional support and exercise combine to improve clinical outcomes for the burn population. We are also studying and expanding our work to investigate the long-term benefits of such exercise programmes, as well as exercise during acute burn care.
WHEN MORE THAN a third of the human body is severely burned, recovery can be a long and painful process, persisting for more than a year or longer if a patient remains inactive. The body goes into a hypermetabolic and catabolic state which leads to increased expenditure of energy and excessive breakdown of protein and fat stores, causing the patient to experience muscle wasting and lose lean body mass. In addition, there are numerous other complications associated with hypermetabolic activity. Tachycardia, which refers to a fast or irregular heart rate, is one such condition that prolongs patients’ rehabilitation and return to full health. To date, treatment options for severe burns remain expensive and in desperate need of improvement.

Now, researchers based at the University of Texas Medical Branch at Galveston and at Shriners Hospital for Children (SHC) – Galveston are employing a multipronged approach, developing and delivering therapeutic strategies for patients with severe burns. The team is led by Dr David N Herndon (see p39), Chief of Staff and burn surgeon at SHC – Galveston, where a multipronged project is being carried out to improve clinical outcomes, alleviating hypermetabolic and hypercatabolic states. Dr Oscar Suman leads exercise-related studies and projects, whereas Herndon leads drug studies. Patient participants take part in both strands, thus collaboration is the central tenet of the investigation.

LOWERING ENERGY EXPENDITURE

After a serious burn, the level of catecholamines in the body increases tenfold. Previous research has shown that these molecules are the primary mediators in the post-burn response, and Suman and colleagues have been testing the theory that reducing catecholamines in the bodies of people with severe burns will shorten patients’ recovery times.

Other studies have indicated that blocking the beta adrenergic receptors which catecholamines act on after a severe burn can decrease energy expenditure and tachycardia, as well as mortality rates. These discoveries have led the University...
OBJECTIVES

- To assess the effect of exercise on mental health and physical functioning, along with its effects on the amelioration of the burn-induced catabolic response
- To improve clinical outcomes for burn patients and other hypermetabolic and hypercatabolic states
- To advance understanding of burn-induced tissue-specific signalling pathways, alterations in clinical indices such as insulin resistance, body composition, scarring, and protein and hormonal bio-signatures

KEY COLLABORATORS

David N Herndon, MD; Celeste C Finnerty, PhD; Walter Meyer, MD; Fujo Suzuki, PhD; Csaba Szabo, MD; Elisabeth Borsheim, PhD; Labros Sidossis, PhD; Kris Jennings, Shriners Hospital for Children – Galveston, Texas

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DR OSCAR E SUMAN received his PhD in Exercise Physiology from the University of Wisconsin-Madison. In 2000, he was appointed Instructor in the Department of Surgery at UTMB and as Director of the Children’s Wellness Center at Shriners Hospital. In 2010, he was promoted to Full Professor with Tenure. Suman holds the Leon Hess Professorship for Burn Injuries Research, and in 2009 received the Presidential Early Career Award for Scientists and Engineers (PECASE).

BUILDING MUSCLE MASS

Suman and colleagues are employing a multifaceted approach to treating burns, and their investigations into complementary treatments are taking place at the Children’s Wellness Center at SHC – Galveston, a facility designed and equipped with exercise equipment for study participants. The team is looking into the impact of exercise on children as an additional therapeutic approach.

The Wellness Center has been successful in putting more than 140 patients through a 12-week exercise programme. The programme, which begins as soon as patients are discharged from hospital, has so far been applied to children aged six to 18 years. The exercise project has assessed not only the physical effects of exercise but also mental health associated with the burn response.

The researchers used a combination of measures to test muscle function and subsequent improvement: isokinetic muscle strength was assessed and peak oxygen consumption measures were taken as a reflection of aerobic capacity or fitness. Initiated with the aim of increasing muscle mass, and improving function, strength and overall performance in patients, the programme has surpassed its original goals, leading to a decrease in surgical interventions, increased aerobic capacity and improved quality of life.

Suman has received the prestigious US Presidential Early Career Award for Scientists and Engineers for his innovative approach and community service and public outreach research, which has led to a five-year grant that will enable him to continue to search for the optimum burns treatment.

WIDE-RANGING IMPLICATIONS

The University of Texas scientists have shared their results with their peers, giving presentations and joining symposia to discuss the various ways to effectively treat severe burns. They will continue to accrue data and plan to obtain further information on patients’ physical and nutritional activities this year. They hope that this combined treatments approach will lead to a better understanding of the signalling pathways linked to burn response, and ultimately improved therapeutic interventions.

These experimental and successful treatment methods will continue at SHC – Galveston under the watchful eyes of Herndon and Suman. As Suman explains: “Successful rehabilitation programmes need to optimise cardiovascular, pulmonary and muscle endurance, strength and function; a need that the Children’s Wellness Center fulfils.”