

Kappa Delta, OREF winners honored today

The winners of the 2007 Kappa Delta Awards and the Orthopaedic Research and Education Foundation (OREF) Clinical Research Award will be recognized today during the Opening Ceremonies of the AAOS Annual Meeting.

The 2007 Kappa Delta Young Investigator Award is Constance R. Chu, MD, who outlined her career in “Integrating Bench to Operating Room: Journey of a Clinician-Scientist.”

Recipients of the Kappa Delta Ann Doner Vaughan Award are David L. Butler, PhD, Natalia Juncosa- Melvin, PhD, Gregory P. Boivin, DVM, Marc T. Galloway, MD, Jason T. Shearn, PhD, Cynthia Gooch, BS, and Hani Awad, PhD, for their research on “Functional Tissue Engineering for Tendon Repair: A Multidisciplinary Strategy using Mesenchymal Stem Cells, Bioscaffolds and Mechanical Stimulation.”

Winners of Kappa Delta’s 2007 Elizabeth Winston Lanier Award are Martha L. Gray, PhD, and coauthors Deborah Burstein, PhD, Young-Jo Kim

MD, PhD, and Alice Maroudas, PhD, for their paper on “Magnetic Resonance Imaging of Cartilage Glycosaminoglycan: Basic Principles, Imaging Technique, and Clinical Applications.”

The work of Christian Gerber, MD,

FRCSEd(hon) on “Rotator Cuff Disease: From Scientific Understanding to Patient Care” will be honored with the 2007 OREF Clinical Research Award.

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Christian Gerber, MD, FRCSEd(hon) (right, front) will receive the 2007 OREF Clinical Research Award for his work on “Rotator Cuff Disease: From Scientific Understanding to Patient Care.” (see complete story, page 32)

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History of awards

During their Golden Anniversary commemoration in 1947, Kappa Delta Sorority established the annual Kappa Delta Research Fellowship in Orthopaedics. Over the years, the award has grown from one recipient paper and \$1,000 stipend to three recipient papers, each receiving an

award of \$20,000. Since 1950, Kappa Delta has given nearly \$1.1 million in support of orthopaedic research through these awards.

The OREF is the only independent, surgeon-driven organization supporting research in the musculoskeletal area. The Board of Trustees presented the first Clinical Research Award and accompanying \$20,000 stipend in 1994. The award is given to encourage clinical research in orthopaedics.

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Clinical evaluation of rotator cuff repairs

The first of Dr. Gerber's studies in this area evaluated the results of repair of massive tears of the rotator cuff. As he says, the purpose was "to apply the biomechanically superior techniques of rotator cuff repair, as determined *in vitro* in our previous studies, to patients and determine if they are efficacious *in vivo*."

The prospective study followed 29 patients with massive rotator cuff tears consisting of at least two tendons for a minimum of two years. All tears were repaired with number 3 braided nonabsorbable sutures with a modified Mason-Allen stitch, secured to the bone via transosseous passage of the sutures, which were then tied over a small augmentation plate.

After repair, patients experienced an improvement in forward flexion and average abduction, as well as a reduction in pain and an increase in the ability to participate in activities of daily living. Radiographs, however, demonstrated a retear rate of 34 percent, "considerably lower than the 50 percent to 70 percent failure rate reported in previous studies of repair with comparable tears." Patients who had a retear had improved from their preoperative condition but less so than those with a successful repair.

Another study evaluated patients' clinical outcome after structural failure of rotator cuff repairs. Of 20 patients with structural failures, 17 patients were either very satisfied or satisfied with their clinical results. If the goal of treatment is optimal function recover, writes Dr. Gerber, "MR imaging of repair failure and therefore potential rerupture should not be a contraindication to attempted repair."

The team's 2006 study of the structural changes in the musculotendinous units after open repair of a single tendon tear found that "while patients clinically had significant subjective and objective improvements, successful repair was not associated with a decrease in muscle atrophy and was associated with increased fatty infiltration of the muscle."

Salvage surgeries

Because "some massive tears are so large that they are not amenable to repair," Dr. Gerber writes, "we pioneered the latissimus dorsi tendon transfer as a salvage surgery for irreparable rotator cuff repairs." A preliminary report in 1988 had introduced the procedure, and a 1992 study established it—via surgical application to 16 patients who were followed for an average of 33 months—as an effective surgical approach to irreparable cuff tears.

The team concluded that "in cases with good subscapularis function but irreparable defects of the external rotator tendons, restoration of approximately 80 percent of normal shoulder function was obtained, indicating that latissimus dorsi transfer is a safe and valuable alternative for the treatment of massive posterosuperior rotator cuff tears."

Results of a 2006 study of 67 patients "with 69 irreparable tears of at least two tendons were treated with latissimus dorsi tendon transfer and followed for an average of 53 months" reconfirmed the efficacy of the surgery, provided the subscapularis is intact.

Dr. Gerber's team has also reviewed patient results for those receiving the Delta III inverse total shoulder arthroplasty to treat pseudoparalysis associated with irreparable rotator cuff dysfunction. The team followed 58 patients with the prostheses for an average of 38 months. They confirmed that the prosthesis had the potential to "improve the condition of patients with severe shoulder dysfunction, and that while complications were frequent with both primary and revision surgery, they rarely affected the final outcome."

Dr. Gerber's research has been supported by grants from the Swiss National Science Foundation, Vontobel Foundation, Resortho Foundation, Balgrist Foundation, and University of Zurich. He has no commercial interests in the results of his work and has not received money or anything of value from commercial sources.

OREF recognizes research on rotator cuff disease

By Sally Chapralis

The award-winning paper presents 20 years of research on rotator cuff disease by Dr. Gerber and his colleagues

Christian Gerber, MD, FRCSEd (hon), has received the 2007 Orthopaedic Research and Education Foundation (OREF) Clinical Research Award for his manuscript on “Rotator Cuff Disease: From Scientific Understanding to Patient Care.” Dr. Gerber is a professor and chairman of the department of orthopaedic surgery at the University of Zurich, Switzerland, and an international member of the AAOS and the American Shoulder and Elbow Surgeons.

The award-winning paper presents 20 years of research on rotator cuff disease by Dr. Gerber and his colleagues. Their studies have examined the anatomic criteria predisposing to rotator cuff disease, the possibilities of diagnosis by clinical examination and imaging and the pathophysiology of muscular changes after rotator cuff tear and repair. The author has introduced these findings into the current clinical practice of management of rotator cuff surgery. These studies have directed research toward the entire muscle-tendon-bone unit, rather than to the tendon alone, and have led to new surgical procedures for treatment of rotator cuff tearing.

Dr. Gerber’s research on rotator cuff disease encompasses several areas, including anatomic descriptions, clinical diagnosis, radiographic diagnosis, causes of rotator cuff repair failure from mechanical and biologic perspectives, clinical evaluations of rotator cuff repairs, and salvage surgeries for irreparable rotator cuff tears.

In the area of isolated subscapularis tendon tears, for example, Dr. Gerber not only described these injuries, but his contributions to the development of the “lift-off test” and the “belly press test” have allowed surgeons to reliably diagnose these tears and to have guidelines regarding their reparability and their repair.

His studies on the mechanical properties of sutures, tendon grasping techniques and anchoring the tendon to bone have resulted in new tendon-to-bone repair techniques. After being validated in both experimental animals and humans, these techniques have established the current standard of reference for rotator cuff repair.

To address tears beyond repair, Dr. Gerber’s team introduced the concept of tendon transfers into shoulder surgery. He pioneered the latissimus dorsi tendon transfer as a salvage procedure for the treatment of irreparable posterolateral tears.

Anatomic descriptions

Dr. Gerber’s anatomic studies, delineated “the relationship between rotator cuff tears and glenoid orientation, but also between rotator cuff tear and lateral overhang of the acromion.” Dr. Gerber’s team “identified an association between rotator cuff tear and the orientation of the glenoid relative to the axis of the supraspinatus fossa and concluded that greater glenoid retroversion is predictive of an anterior cuff injury whereas greater anteversion is predictive of a posterior cuff injury and that rotator cuff tearing was associated with a wide lateral extension of the acromion.”

Clinical diagnosis

The team’s study of isolated tears of the tendon of the subscapularis muscle was the first to describe the lift-off test as a “reliable way to diagnose or exclude subscapularis insufficiency...as a source of a patient’s pain.” Dr. Gerber’s study also concluded that “while other case reports noted an instability episode with a subsequent subscapularis tear, no patients in this series report instability but rather a forceful adduction or hyperextension of an adducted arm as the traumatic mechanism.”



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Another study focused on isolated ruptures of the subscapularis tendon. This study, the first to evaluate the clinical outcome of surgical repair, introduced the diagnostic belly-press test. A patient with a subscapularis insufficiency is unable to forcibly press his palm to his abdomen and keep his elbow anterior to his abdomen or to actively internally rotate his arm to maintain the press against his abdomen. This study also demonstrated that open subscapularis repair is an effective treatment for this condition.

Radiographic diagnosis

Three studies addressed the diagnostic effectiveness of magnetic resonance (MR) imaging techniques. MR arthrography was found to be accurate for detecting lesions of the subscapularis; MR spectroscopy was established as useful in quantifying fatty infiltration of rotator cuff musculature; and MR imaging after rotator repair almost always showed subacromial bursitis-like findings. Small retears or residual

defects, however, were not necessarily associated with symptoms.

Mechanical causes for rotator cuff repair failure

Dr. Gerber’s six studies in this area tested and improved potentially “weak mechanical links in the rotator cuff repair construction,” ranging from “anchor pullout, anchor strength, effect of eyelet, strength and type of suture, to type of suture fixation of the tendon.”

One study, for example, addressed the influence of test temperature and test speed on the mechanical strength of absorbable suture anchors. The results of this study showed that “testing implants at room temperature can falsely improve results by a factor of 50, and that it is mandatory to test absorbable implants at body temperature, preferably at slower speeds.”

Biologic causes for rotator cuff repair failure

After reviewing problematic mechanical links in rotator cuff repair, the team looked at biologic sources of failure, such as osteopenia of the humeral head, the tissue ramifications of delayed cuff repair, the assessment of fatty infiltration, and the biomechanical manifestations of this infiltration.

Recognizing the importance of bone quality for the secure fixation of tendon to bone, Dr. Gerber examined the association of osteopenia of the humeral head with full-thickness rotator cuff tears. This study compared the bone density of cadaveric humeral heads with a full-thickness rotator cuff tear to those without a tear, using microcomputed tomography. Specimens with a tear had reduced cancellous bone and higher bone density under the articular surface compared to the greater tuberosity, leading to a recommendation that surgeons place sutures or anchors subcortically or under the articular surface.

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