Piedmont Orthopedic Society

Abstracts 2002

2002 MY RECOLLECTIONS OF THE EARLY DUKE EDUCATIONAL PROGRAM IN ORTHOPAEDICS, **John Adams, M.D.***, M.P.H., 804 Bay Avenue, Lewes, DE

This meeting is a 50/50 meeting for me, as I was Chief Resident at Duke 50 years ago.

My awareness of the Duke Orthopaedic Program began when Lenox D. Baker visited the 49th General Hospital in Tokyo where I was stationed as a medical officer on the orthopaedic service in the United States Army. After Dr. Baker had been there for a few days, he offered me a position on the Duke Residency Program to begin July 1, 1949. Prior to my entering the program, I learned even more about Duke from Dean Wilburt Davison when he visited the 49th General Hospital as a Pediatric consultant.

In 1949, J. Leonard Goldner was the Chief resident, six residents of the total program were assigned to Duke. There were two residents on the public service, one on the private service, and one at Lincoln Hospital which was in Durham but away from Duke. One resident was assigned to basic science, which was a six month rotation on either Anatomy or Pathology. At that time, Dr. Baker was the only full time faculty on orthopaedics and Dr. Beverly Raney was half time. Dr. Everett Bugg who had a private practice in Durham was part time faculty as other residents were assigned to the city hospital Watts and to Lincoln Hospital.

At Duke, we did surgery three days a week, running two rooms simultaneously. There were outpatient clinics every day, we were on call every other night, and we had patient rounds each morning at 6:00 a.m. and teaching rounds three times a week including Sunday. All clinic notes had to be written or dictated before the resident left the hospital.

Other residents during this period were E. E. Bleck, Don Eyler, Ralph Coonrad, Paul Thompson, Les Meyer, Rick Wrenn, Jim Funk, and Gary Hough. My second six month rotation was on General Pathology under Dr. Wiley Forbus, a master in General Pathology. This rotation was unique and valuable to my education. I completed my year rotation at the Private Diagnostic Clinic and Lincoln Hospital and on January 1, 1950 began a twelve month rotation away from Duke at the North Carolina Orthopaedic Hospital (NCOH) in Gastonia, North Carolina, which is twenty miles from Charlotte. Dr. William Roberts was the Chief Surgeon, there were approximately 150 patients, and the common diagnoses at that time were osteomyelitis, poliomyelitis, tuberculosis, acute and chronic burns, and congenital anomalies. At that time, streptomycin had not yet been introduced for the treatment of tuberculosis and the Salk vaccine had not been completely

developed. In 1950, practically all patients who had scoliosis in North Carolina were treated through NCOH. Most patients treated for scoliosis remained in the hospital for a year and required inpatient schooling and special nursing care. There was one operating day each week with several patients being completed. Large outpatient clinics were held each day. An outlying clinic was attended once each month in Goldsboro, North Carolina, which was approximately 200 miles from Gastonia, 80 miles from Durham, and 80 miles from the Eastern Coast of North Carolina. At this clinic, approximately 100 patients, new and follow-up, would be seen in order to provide follow-up for patients from Eastern North Carolina. At that clinic, Dr. Goldner would attend from Duke and treat the patients with clubfeet. The average clinic had about twenty patients with cast changes. This is where he was introduced to the complex problem of clubfeet from which he developed his practical approach.

Operative treatment of patients at Gastonia was an "eye opener". All anesthesia was given by a nurse anesthetist. Several hundred scoliosis patients had been operated upon by Dr. Roberts during the several years that he had been there, and there had been no intubation and no blood transfusions. The mortality rate was zero. Operative cases seldom lasted more then one hour. A triple arthrodesis, for example, took approximately twenty minutes, there was no internal fixation, and the foot was molded and held in a long leg cast. Dr. Roberts was an expert surgeon, worked rapidly in the operating room, and made all of his decisions before the operation began.

I was Chief Resident at Duke beginning July 1, 1951. This was the same year that the North Carolina Cerebral Palsy Hospital opened. Lenox Baker was the Medical Director and he had been working toward developing this unit for several years. Duke gave the land and the State built the hospital. During that first year, there was a meeting of the American Academy for Cerebral Palsy. The topics on the program were classification of cerebral palsy; diagnosis and treatment, which included discussions about bracing, surgery, physical therapy, and combinations of these modalities.

Len Goldner had joined the full time faculty as of July 1, 1950 and at the Cerebral Palsy meeting, he presented several patients who had upper extremity problems that he had treated surgically. Winthrop Phelps, the national authority on the subject, was there and he expressed his surprise at the "aggressive approach to children with cerebral palsy who had upper extremity problems". It was his policy to wait until they were full grown to even consider surgical treatment. New energy, new ideas, and new results were evident during that meeting.

During my year as Chief Resident, I was introduced to our first full time anesthesiologist and observed the formation of a residency training program by Dr. Ronald Stephens who was Chief of the Division of Anesthesiology. The time interval between cases elongated, but the clinical and research information improved.

There were many incidents that punctuated my Duke experience such as: (1) when the orthopaedic service acquired its first Chick Fracture Table. Dr. Baker was

attached to the old Hawley Table. More than one time he would kick the new Chick Table as he walked by it.

Sub-capital fractures of the hip in elderly patients were treated in the sub-basement Radiology room where the portable x-rays could be taken quickly. There was no fluoroscope in the operating room. In the Radiology Department, at that time, the resuscitation equipment was minimal. The set up for holding the patient was limited by the way the AP and the lateral x-ray was taken. We usually positioned the fractured extremity in such a way that the first year resident would put traction on the extremity and sit under the drapes while the procedure was being done. Dr. Goldner was instrumental in eliminating that undesirable location for this procedure.

Our clinical experiences and our basic science rotation were augmented by outreach clinics held in county health departments throughout the State. On a regular basis, each resident would attend outlying clinics where children and adults could be seen in follow-up and in consultation. Local referring physicians and public health nurses directed patients to the "orthopaedic clinics" for advice and treatment by the orthopaedic consultant from Duke. In this way, the residents experienced graduated responsibility and learned how to communicate with referring individuals. Also, the experience of talking to a patient from a rural community surrounded by several members of the family was somewhat different than the protected environment of Duke Hospital.

All in all, during my Duke residency, I was associated with enthusiastic colleagues and a teaching staff that had no equal. The faculty members gave the necessary time and effort to encourage residents, to work with them on clinical and laboratory projects, and to provide them with useful role models. Duke was one of the stellar teaching programs even at that time. Education for the residents has increased both clinically and in the research laboratory and the current residents are outstanding. There is great pride in knowing that I was part of and associated with the Duke Orthopaedic Residency Program during its formative years.

* Professor and Chairman Emeritus, Department of Orthopaedic Surgery, Washington Medical Center

2002 HOOK OF THE HAMATE FRACTURES IN COMPETITIVE GOLFERS: RESULTS OF TREATMENT, Julian M. Aldridge, M.D., Duke University Medical Center, Durham, North Carolina We present seven competitive golfers with an isolated fracture of the hook of the hamate. All seven patients were treated with excision of the fractured hook of the hamate, with complete resolution of their pain, and a return to their previous level of play. For this group of patients, with a history of hitting in excess of 200 golf balls per day in addition to 18 holes of golf, it is reasonable to consider this fracture pattern the result of an overuse or repetitive motion injury. Regardless of etiology, prompt diagnosis and treatment with excision of the

fractured hook of the hamate bone is safe and reliably allows competitive golfers to return to their pre-injury level of competition.

2002 REVISION ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING A REHARVESTED IPSILATERAL PATELLA TENDON, Colosimo, AJ; Heidt, R.S. Jr.; Traub, JA; Carlonas, RL; University Sports Medicine Center, Cincinnati, Ohio

The patellar tendon remains the most popular graft for anterior cruciate ligament (ACL) reconstruction and has been proven to be the strongest substitute. From 1991 to 1998, we performed revision ACL reconstruction using the reharvested central third of the ipsilateral patellar tendon in 15 patients. Adequate follow-up was obtained on 13 of these 15 patients. The results in these 13 patients (mean age, 27.2 yr) were reviewed. At an average postoperative follow-up of 39.4 months (range 24 – 65), 11 patients had good or excellent results while 2 patients had fair results. Clinical examination revealed an average Tegner knee score of 5.8 (range, 3 to 9) and an average Lysholm knee score of 77.6 (range, 61 to 98). Postoperative KT-1000 arthrometer results showed an average side-to-side difference of 1.92 (range, -2.0 to 4.0). No patient demonstrated any loss of range of motion and only one reported patellofemoral problems. These favorable results demonstrate that, with appropriate patient selection, the use of a reharvested central third patellar tendon is a viable option for revision of a failed ACL reconstruction.

2002 A RETROSPECTIVE STUDY OF PERCUTANEOUS HEEL CORD REPAIRS, Andrew Bullington, John Xerogeanes, M.D., Lamar Fleming, M.D., Emory University School of Medicine, Atlanta, Georgia

Ruptures of the Achilles tendon may be managed by three different methods: open repair, percutaneous repair, non-operative management. Through the years, it has been shown that percutaneous repairs have as good or better results than open repairs. The complications of percutaneous repairs are minimal and the two-year results are similar to those of open repair. The design of this study was to have the patients fill out subjective questionnaires dealing with satisfaction with the procedure, and their postoperative function, strength and comfort. The circumference of the calves was measured to see if return of muscle size has occurred and to evaluate the complications. During the last ten years, twenty-five individuals have undergone percutaneous repairs with an average follow-up of two years. There have been no long term complications, all have healed, and all have gone back to their previous recreational activities. Two sequelae occurred at one year. The nylon that was used in initial patients caused a stitch irritation and had to be removed under a

local anesthesia. The suture we are now using is Maxon zero sized. The rehabilitation program: the patients are placed in a splint for seven to ten days then placed in an Vacoachil splint at 30° of plantar flexion. After two weeks, this was reduced to 15°. At six weeks post-op, the foot was placed at 0°. At two weeks, the patient removed the brace for active exercise; primarily plantar flexion without resistance. At six weeks, when they are walking full weight bearing, they can start concentric exercises. At three months, the individual can do eccentric exercises; at six months they may return to athletic activities such as running and jumping. No re-ruptures occurred and no one has been unable to return to their previous recreational activities. We think this is a promising alternative to a closed- or open repair for those individuals who are not high-performance athletes. An important advantage is to avoid a long skin incision.

2002 RESULTS OF ANTERIOR DUAL ROD INSTRUMENTATION FOR SINGLE MAJOR CURVE SPINE DEFORMITY SURGERY, R.W. Gaines, Jr., M.D., Columbia Orthopaedic Group, Columbia, Missouri

· The outcome of the first 10 patients operated by a single surgeon by a new instrumentation with KASS (Kaneda Anterior Spine System) was assessed.

· The average follow-up was 4.0 years (mean 3.6) following the operative correction. There was follow-up on every patient.

· Average preoperative curve was 52º.

· Average correction was 37.9º (73% correction).

· The sagittal plane was corrected toward normal in every patient.

· No interbody spacers or grafts were used in any patient.

· Bone-on-bone interbody apposition was achieved during each patient's surgery.

· The average number of vertebrae instrumented was 4.7 (mean4.5), which was half the levels of standard posterior instrumentation.

· Average operative time was 4 ½ hours and average blood loss was 850 cc.

- There were no serious complications.

- All patients wore a postoperative TLSO until radiographic interbody healing was evident.

Fusion occurred at an average of 2 ½ months.

2002 SYMPOSIUM ABOUT THE 50th ANNIVERSARY (PHASE I) OF THE PIEDMONT ORTHOPEDIC SOCIETY, J. Leonard Goldner, M.D., James B. Duke Professor and Chairman Emeritus, Orthopaedic Surgery, Duke University Medical Center; Executive Secretary Piedmont Orthopedic Society

The Piedmont Orthopedic Society had its 50th Anniversary (Phase I) in Durham, North Carolina at Duke University Medical Center on May 14, 2002. The meeting was split between Durham and Bermuda. During the initial segment of the meeting in Durham, several individuals were recognized as contributors to the Piedmont Orthopedic Society; foremost among them was Mrs. J. Leonard Goldner who was awarded an Honorary Professorship in the organization. Her dedication to the members and to the development of the Society during the past fifty years was recognized by the membership as being a critical aspect of the interest that the members maintained not only in each other but in the Society as a whole.

During the first segment of the Duke meeting on May 14, there was an orthopaedic symposium that included information about the history of the Piedmont Orthopedic Society, the early educational program of Duke residents, and the contributions by several members of the Society who had been involved for as long as fifty years and as short a time as two years.

VIGNETTE OF THE HISTORY OF THE PIEDMONT ORTHOPEDIC SOCIETY

In 1950, J. Leonard Goldner, Walter Hoyt, Jr., Jack C. Hughston, and Ned Shutkin agreed that the members of the Duke Orthopaedic and Affiliated Training Program should continue to correspond, communicate as a group, and to establish cooperative orthopaedic studies among institutions beginning then and in the future. Furthermore, from the Society would originate a Piedmont Orthopedic Foundation sponsored by the members with the interest from the endowment being returned to residents in training at Duke for pilot orthopaedic research projects. The Society was incorporated in 1951 in Tennessee by Don Eyler; the Foundation was incorporated in Charlotte, North Carolina by Wayne

Lee. The requirement for membership by physicians or scientists was to spend at least one year on the Duke Orthopaedic Educational Program and to continue to be active in clinical or research orthopaedics. The initial number of members was approximately forty and the current membership is approximately 500. The first meeting was held in Durham at Duke in 1953, the second meeting was in Nashville, Tennessee in 1954 with Don Eyler as Chairman, the third meeting was in Winston-Salem, North Carolina in 1955 with Cabell Young as Chairman, and the fourth meeting at Sea Island, Georgia with Jack Hughston as Chairman. Every other year, from that time on, the meeting was held at Sea Island, Georgia with new Chairmen being selected each year and an elected Executive Committee. The Piedmont Orthopedic Foundation also had an Executive Committee and a Secretary/Treasurer. The first research grant from the Foundation was awarded to Donald Ferlic in 1963.

The Piedmont Orthopedic Foundation has awarded approximately 107 grants since the Foundation was formed. The average amount of each grant was $5,000. Numerous publications, exhibits, presentations, and additional projects resulted from these awards.

The structure of the Piedmont Orthopedic Society and the Foundation have enlarged and changed in keeping with changing times since the origin of each organization. The Annual meeting each May continues with new Chairmen for each meeting; there is a Mid-Year meeting held at the same time as the meeting of the American Academy of Orthopaedic Surgeons. The Foundation meets during the Annual meeting in May. The business of the Foundation is carried on during the year by mail, telephone conference, and by the officers of the Foundation who have changed approximately every five years.

When you begin a project, establish an organization, or formulate a society with common goals you never know where the end will be. Several things happened during the past fifty years as the organization matured.

1. Organizational memory was kept alive.

2. Personal friendships grew, developed, and became more meaningful and mature as time passed.

3. The role model was passed to the younger members of the organization. As the young become mature, the requirements of the older members diminish. The energy and enthusiasm of the younger members results in new goals, ideas, and accomplishments.

The Piedmont was selected as the name of the Society and the Foundation because it represented the location of Duke and the Affiliated Programs at the foothills at the base of the mountain, which describes Central North Carolina, which is geographically a Piedmont area.

2002 TECHNICAL ERRORS: AN ANALYSIS OF MALUNIONS AND NONUNIONS, John A. Dorizas, MD, Robert Morgan, BS, Catherine Petty, BS, Langdon A. Hartsock, MD, FACS, Department of Orthopaedic Surgery, Medical University of South Carolina, Charleston, South Carolina Mal-unions and non-unions of the skeleton result in increased morbidity and cost to patients. We analyzed 41 mal-unions and 82 non-unions treated by a single surgeon in our attempt to determine the underlying cause of the malunion or nonunion. This study indicated that in patients with mal-union there was a problem 58.5% of the time in understanding the severity or stability of the fracture on preoperative radiograph. The study showed that technical errors preoperatively and intraoperatively most frequently led to a mal-union. Incorrect choice of implant or incorrect use of the implant was common. Patient non-compliance was an infrequent cause of mal-union or non-union. Incidence of mal-union and non-union can be decreased by careful preoperative analysis of the injury and adequate preoperative planning to make certain that the proper implant is used to stabilize the fracture. Fractures that are complex or seen infrequently may need referral to centers where specialized equipment and expertise are available.

2002 TYPE III ODONTOID FRACTURES WITH DISTRACTION: AN UNSTABLE INJURY, John Kirkpatrick, M.D., Todd Sheils, M.D., and Steven Theiss, M.D., Division of Orthopaedic Surgery, Spine Surgery, The University of Alabama at Birmingham

Introduction: Type III odontoid fractures are typically felt to be stable injuries and heal without surgical intervention. Type III injuries presenting with distraction have vertical instability and represent a specific injury requiring aggressive surgical intervention. The purpose of this study was to review three cases and raise awareness of this unusual injury.

Methods: Three patients with acute traumatic Type III odontoid fractures and associated vertical instability were treated between 1998 and

2000. All three patients presented with vertical displacement of the odontoid on initial radiograph. Clinical records and imaging studies were reviewed.

Results: Upon presentation, each Type III odontoid fracture extended into one or both facet joint and had at least 5 mm of vertical displacement on CT scan and/ or radiographs. Each was initially treated with halo vest immobilization without traction. Reduction was lost in each case due to continued vertical instability. Two cases were noted to have dynamic instability with respiration when the fracture was viewed under fluoroscopy. All cases were noted to have posterior C1-C2 capsule and ligament disruption. One patient presented with a dense brachial plexus palsy and one had incomplete quadriplegia with cranial nerve VI palsy. The third patient was initially neurologically intact but became quadriplegic after reduction was lost in the halo vest. Hemodynamic and hematologic instability prevented acute surgical management in the face of progressive deficit. Definitive treatment consisted of Brooks C1-C2 sublaminar wiring with halo immobilization, C1-C2 transarticular screws with halo, and staged C1-C2 transarticular screws with wiring and halo.

Discussion: Skeletal traction for reduction and halo immobilization is standard treatment for Type III odontoid fractures. In a vertically unstable Type III odontoid fracture, this treatment is likely to have unfavorable results. Obvious vertical displacement should alert one to vertical instability. Vertically unstable Type III odontoid fractures should be suspected when any distraction of the odontoid fragment or posterior elements is noted in high energy trauma. When present, early surgical stabilization with internal fixation should be performed. We favor transarticular screws to assist in and maintain reduction of the fracture.

2002 INDICATIONS FOR SURGERY IN THE UPPER EXTREMITY IN CEREBRAL PALSY, Koman, LA. Wake Forest University School of Medicine, Winston-Salem, NC

Cerebral palsy affects 700,000 to 800,000 children and adults in the United States, with 80% of hemiplegic and quadriplegic limbs being significantly affected. Patients may be compromised by spasticity, movement disorders, and problems with sensibility. Movement disorders are a relative contraindication to soft tissue procedures. Although the predominant pattern of deformity is one of shoulder internal rotation, elbow flexion, forearm

pronation, wrist flexion, finger flexion and thumb-in-palm, variant patterns exist and produce difficulties.

Patients can be assessed by a variety of methods including classic classifications (eg, Green & Banks; Hoffer). In addition, tests which assess a function such as the Melbourn or the Quest, are available. Tests of dexterity include the Jebson Pickup. Assessment should include all of these aspects as well as electromyography in selected patients. Using these guidelines, a variety of soft tissue and bony procedures can improve 10 to 20 percent of patients with upper extremity involvement.

2002 ANIMATED 3D CARPAL MOTION, Michael Sandow, Sam Papas, Michael Kerylidis Royal Adelaide Hospital and Wakefield Orthopaedic Clinic Adelaide

Using software from *True Life Anatomy* (www.rubamas.com) the motion of the carpus can be demonstrated in a clinically applicable format to aid anatomical understanding, diagnosis and reconstructive planning. By obtaining 3D CT scans of the normal and abnormal wrist in various positions of coronal and sagittal deviation, and then creating motion sequences using a step frame animation technique, the dynamic relationships between the various carpal bones can be demonstrated, ligamentous constraints inferred, and pathological and reconstructive options evaluated. The surgeon can view and manipulate the carpus in an interactive graphics environment to facilitate preoperative planning and assist in patient explanation.

2002 DORSAL PERCUTANEOUS INTERNAL FIXATION OF SCAPHOID FRACTURES AND SELECTED NONUNIONS VIA AN ARTHROSCOPIC ASSISTED APPROACH", Joseph F. Slade, III, MD

The dorsal percutaneous technique for repair of scaphoid fractures and selected nonunions with cannulated headless compression screw allows the early return of hand function with a high union rate. A 10-year review of papers (meta-analysis) reporting on percutaneous fixation of "stable" scaphoid fractures using headless compression screws identified 214 acute fractures treated percutaneously that resulted in a 100% healing rate. There were 39 fractures with either fibrous unions or with late presentation treated percutaneously with rigid fixation. All 39 fractures healed without open bone graft. The only complications reported in these papers was the implantation of 4 screws that were too long (complication rate of 1.5%).

The key to this procedure is accurate placement of a guide wire in a reduced scaphoid fracture along its central axis. 0.045 inch guide wire which is introduced percutaneously into the proximal pole of the scaphoid and driven from dorsal to volar. 0.062 inch K-wires joysticks are used to reduce the fracture. A hand-held Standard Acutrak cannulated reamer is placed over the guide wire and the scaphoid is reamed to within the distal cortex. The correct screw length is obtained by subtracting 4mm from the actual scaphoid length. Two parallel guidewires are used to obtain scaphoid length. At the conclusion of surgery, a removable splint is applied and a strengthening program is started. Heavy lifting and contact sports are restricted until CT confirms healing by bridging callous and clinically the patients are non-tender. We have treated over 50 scaphoid fractures with 100% union as confirmed with CT scan. These include stable, unstable and displaced scaphoid fractures rigidly repaired using this dorsal percutaneous method without complication. In addition we have treated fibrous unions and scaphoid fractures which have presented with percutaneous rigid fixation alone without bone graft. These have all also healed, but slower than those fractures treated acutely.

2002 UPDATE OF THE SEVERITY, ANATOMICAL, TOPOGRAPHIC, TYPE (S.A.T.T.) CLASSIFICATION AND MANAGEMENT OF OPEN HAND INJURIES, Panayotis N. Soucacos, M.D., FACS, John Kostas, M.D., Anastasios Korompillias, M.D., Marios Vekris, M.D., Alexandros Beris, M.D., Department of Orthopaedic Surgery, University of Ioannina, School of Medicine, Ioannina 451 10, Greece Open hand injuries are complex injuries which require technical expertise in both skeletal and soft tissue reconstruction. The initial treatment of open hand injuries is of great importance, and prognosis for full functional recovery following open hand injuries is dependent upon recognition of the presence and extent of damage to the various tissue components. An updated classification system (S.A.T.T.) for open hand injuries has been proposed which allows for a more effective management of these complex injuries by assisting the surgeon in recognizing the extent of damage to the various tissues. The classification system is based on: (S) severity of the injury (viability of the involved parts); (A) anatomical localization (isolated vs extended); (T) topography (volar or dorsal); (T) the type of injury (sharp vs crush-avulsed). The initial aim is to save tissues which otherwise can not “wait” for other anatomical management. Afterwards, the other parameters are taken into account, to direct the correct management of the injury and ensure good function. Trauma to the vascular system may produce vascular impairment that may result in loss of the segment or skin necrosis and is of primary concern to the hand surgeon. Most nonviable injuries due to the nature of their vascular impairment, require time-consuming procedures for the restoration of an adequate blood supply. These must be done under brachial plexus block with an experienced anesthesiologist. Stable bone fixation is also a key procedure and is necessary to create a skeletal framework for early motion and function. In general, sharp lacerations have a better prognosis compared to crush injuries. They are less demanding in both primary reconstruction and secondary procedures, such as free flaps, nerves, tendon or venous grafts. Even though clean cut injuries are less severe than crush injuries, when they occur

in zone II they are demanding regarding fine microsurgical techniques in suturing tendons and digital nerves. The bottom line in the management of open hand injuries is to first ensure that the damaged part is viable, and then do to the necessary procedures to make it functional. Most patients with open hand injuries and particularly those with crush injuries require secondary procedures. These may include reconstructive procedures to restore anatomical elements when primary reconstruction was contraindicated such as with flexor tendon rupture in zone II, digital nerves or to treat complications secondary to the severity of the initial injury, such as tendon adhesions, bone pseudoarthrosis, or infection.

2002 LARGE SKELETAL DEFECTS OF THE UPPER EXTERMITY: APPLICATION OF FREE VASCULARIZED FIBULAR GRAFTS,

Panayotis N. Soucacos, M.D., FACS, Haralampos Zalavras, M.D., Anastasios Korompillias, M.D., Marios Vekris, M.D., Alexandros Beris, M.D., Department of Orthopaedic Surgery, University of Ioannina, School of Medicine, Ioannina 451 10, Greece Large skeletal defects of the upper extremity constitute a serious clinical problem related to the functional ability and viability of the affected limb. Free microvascular bone transfers are used to cover large bony defects from a variety of factors which cannot be bridged by conventional techniques. In contrast to nonvascularized bone grafts, the blood supply is preserved with vascularized grafts by the anastomosis the feeding artery of the graft to a host artery. Thus, the graft does not undergo necrosis and revascularization by the surrounding vasculature. The fibula is one of the most frequently used donor bones for free vascularized bone transfers. Because of its size and configuration it lends well to reconstruction of long bones. The feeding peroneal vessels to the fibular graft are not cut until the recipient site is ready. Once ready, the graft is then transferred and the arteries and veins are anastomosed using standard microsurgical technique. Angiography and scanning are done 3 to 5 days postoperatively in order to check patency of the vessels and viability of the free fibular bone graft. The use of vascularized fibular grafts is particularly useful in treating large skeletal defects of the upper extremity. Thirty-two patients (22M, 10F) with large skeletal defects were treated with free vascularized fibular grafts in the lower extremity and 11 patients (8M, 2F) in the upper extremity. The defects involved the forearm in 8 patients (10 bones: radius 7 patients, and ulnar 3 patients) and the humerus in 3 patients. The average length of the defect was 10 cm (6-18 cm). The etiology of the defects included trauma (8), malignant neoplasms (2), and congenital pseudarthrosis (1). The fibula was transferred as an osseous flap in 10 cases and as a composite flap (soleus) in 1 case. At a mean follow-up of 4 years (range 1-10 yrs), 88% of the patients showed excellent graft heal, with union of 14 of the 16 junctions sites at 3 months (2.4-4 mo). Nonunion was observed at 2 junction sites which was attributed to the severity of the injury, unstable fixation and refusal for further treatment. No intraoperative complications, stress fractures and donor site morbidity was observed. There was 1 infection 4 years postop. The functional outcome was excellent in 9 patients (80%), good in 1 patient (10%) (despite nonunion of the junction site), and poor in 1 patient (10%). The results indicate that large skeletal defects in the upper extremity can be reconstructed

with the free vascularized fibular grafts with satisfactory results, even in the presence of poor vascularity of the surrounding soft tissue envelope or infection, which would compromise alternative methods. The success of the free vascularized fibula is related to its unique vascularity, morphology and composition of the graft. The application of the free vascularized fibular graft is technically demanding, requiring meticulous microsurgical technique. None-the-less it can provide a useful solution to the difficult problem of large skeletal defects.

2002 CONGENITAL LONGITUDINAL DEFICIENCY OF THE TIBIA, David A. Spiegel, M.D., Randall T. Loder, M.D., and Robin C. Crandall, M.D., Shriner's Hospital for Children/Twin Cities, Minneapolis, MN

This retrospective clinical and radiographic review involves 15 patients (19 limbs). Clinical findings include a rigid equinovarus foot, knee instability and flexion contracture, and limb length inequality. Coexisting musculoskeletal problems were identified in 8/15 patients, including 5 with congenital hand deformities. Patients with complete absence were treated by knee disarticulation, and those with a distal diastasis underwent Syme amputation. Those with an intact proximal tibia underwent foot ablation and tibio-fibular synostosis, +/- proximal fibular epiphysiodesis or resection of the proximal fibula. Fibular prominence (+/- limb varus) may interfere with prosthetic fitting. Either removal or epiphysiodesis of the proximal fibula, while maintaining knee alignment in neutral to slight valgus, may prevent this problem.

2002 THE EARLY GRACILIS FLAP FOR FUNCTIONAL RECONSTRUCTION OF THE UPPER EXTREMITY, Milan Stevanovic, LAC + USC Medical Center, University of Southern California, Los Angeles

Purpose: Brachial plexus and severe upper extremity injuries have a devastating effect on the patient's function. Reconstruction of the upper extremity remains a challenging problem and microneurovascular muscle transfer has been utilized to restore upper extremity function. Several muscles have been used including the rectus femoris and the latissimus dorsi. We present our experience with transfer of the free gracilis muscle flap.

Material and methods: Reconstruction of the upper extremity with the gracilis free muscle flap was undertaken in 12 patients. Loss of function was secondary to brachial plexus injury in 6 patients, traumatic muscle loss in 5 patients, and tumor excision in one patient. The free gracilis flap was used for restoration of elbow flexion in 6 patients, finger flexion in 4, and finger extension in 2 patients. Follow-up ranged from 1 to 15 years (mean 5 years). Muscle power grade 4 or greater was considered excellent, grade 3 to 4 was considered good, and less than 3 poor.

Results: All flaps survived (100%). The free gracilis flap resulted in good or excellent finger flexion or extension in all 6 patients. Five of 6 patients had an excellent and one had a good outcome. Elbow flexion was achieved in 5 cases with grade 4 power in 2 cases and grade 3 in 3 cases. No function was restored in one case. Overall functional outcome was considered excellent in 5 of 12 cases (42%), good in 6 of 12 cases (50%), and poor in one case (8%).

Conclusions: Microneurovascular transfer of the gracilis is useful for reconstruction of the upper extremity, particularly for restoration of finger flexion and extension. It is a challenging problem to restore thumb flexion separately with a single muscle transfer. Excellent finger motion can be accomplished and good restoration of elbow flexion can be achieved. Optimal muscle resting length, and strong and appropriately located origin and insertion are factors of paramount importance for an excellent functional outcome.

2002 THE MORBIDITY AND MORTALITY OF SIMULTANEOUS BILATERAL, STAGED BILATERAL, AND UNILATERAL TOTAL KNEE ARTHROPLASTY

Cary Tanner MD, Vincent Pellegrini, MD and Marlene Smith, RN

Factors associated with the morbidity and mortality of total knee arthroplasty (TKA) were studied. Outcome data was obtained for 479 consecutive patients who underwent 618 procedures from 1998 to 2001. 114 patients underwent simultaneous bilateral TKA, 25 patients underwent staged bilateral TKA, and 340 patients underwent unilateral TKA.

All of the significant differences between the groups occurred within the first few post-operative weeks. No significant differences between any of the groups were found in those patients with fewer than three medical comorbidities. In patients with three or more comorbidities, those undergoing simultaneous bilateral TKA were more likely to sustain complications with potential long term consequences compared to those undergoing two unilateral total knee replacements. Age over 70, independent of comorbidites, was associated with an increased risk of severe complication and death only in the bilateral TKA group.

Body mass index, the surgeon's experience with TKA, the sex of the patient, the type of anesthesia, and the type of comorbidity, were not found to influence the outcomes between groups.

When the costs associated with complications are accounted for, the potential cost benefit of simultaneous bilateral TKA may be less than previously estimated.

2002 THIRTY-YEAR FOLLOW-UP OF ISOLATED ANTERIOR CRUCIATE LIGAMENT INJURIES: LONG-TERM RESULTS OF TREATMENT WITH PRIMARY REPAIR

, Dean C. Taylor, MD, LTC, MC, USA, Matthew Posner, BS, CPT, FA, USA, Walton W. Curl, MD, COL, USAR, John A. Feagin, MD, COL (ret), USA, Keller Army Community Hospital**,** Division of Orthopaedic Surgery, West Point, New York 10996, 914-938-4821, FAX: 914-938-6806

Over 25 years ago Feagin and Curl reported on the diagnosis and treatment of isolated ACL tears. The purpose of this study is to provide long-term follow-up of this group of patients.

METHODS: This is a retrospective, observational study of arthrotomies performed between 1964 and 1970 for isolated ACL tears. The original 64 patients studied were identified and thirty-four patients were contacted for follow-up. Two patients are deceased. The average age at the time of the ACL repair was 20 years, and the average time to follow-up from the index procedure was 34 years. Outcome measures included subsequent operations, Lysholm scores, KOOS scores, IKDC scores and SANE ratings.

RESULTS: Twenty patients (59%) had subsequent operations to the same knee, and 8 of 34 had operations to address persistent instability of the knee. The average Lysholm score was 70.1, average SANE score 68.9, and average KOOS score 68.8. IKDC subjective ratings were 6 normal, 12 near normal, 7 abnormal and 9 severely abnormal. IKDC symptoms ratings were 8 normal, 9 near normal, 10 abnormal and 7 severely abnormal. The average Tegner Activity Score was 3.8.

DISCUSSION: In this group of patients, surgical treatment of isolated ACL tears, consisting of primary repair in most cases, resulted in good functional results at two years; however, the results deteriorated by 5 years. The data, with more than 30-year follow-up, demonstrate that even with decreased activity demands, the majority of these patients continue to have significant knee symptoms; however, a significant number of patients have had good long-term results.

2002 USE OF THE RADIAL FOREARM FREE FLAP FOR COVERAGE OF POSTOPERATIVE LATERAL HEEL WOUNDS STATUS POST ORIF OF THE CALCANEUS

, E. Bruce Toby, M.D.; Greg A. Horton, M.D.; Jody T. Jachna, M.D., Section of Orthopedic Surgery University of Kansas Medical Center, Kansas City, Kansas

Introduction: The purpose of this study is to describe a unique application of the radial forearm free flap for coverage of lateral heel wounds frequently seen complicating open reduction and internal fixation (ORIF) of the calcaneus.

Methods: Seven lateral heel wounds status-post ORIF of calcaneal fractures were covered with radial forearm free flaps using a technique involving passage of the pedicle of the laterally placed flap anterior to the achilles tendon to the posterior tibial artery for end to side anastomosis.

Results: All flaps survived with good functional and cosmetic results.

Conclusions: Flap application using this technique provides quick, reliable coverage of heel wounds with several advantages.

2002 ANTERIOR ELBOW RELEASE FOR FLEXION AND EXTENSION CONTRACTURES, J.M. Aldridge, III, T.A. Atkins, E. Gunneson, J.R. Urbaniak **Background**: There are many causes of diminished elbow range of motion; trauma, muscle imbalance, burns, osteoarthritis, inflammatory arthritis, hemophilia, and sepsis. When nonoperative techniques (supervised physical therapy and dynamic splinting) fail to increase elbow arc of motion, surgical intervention may be necessary. The purpose of this study was to report the outcome of surgical correction of elbow flexion and extension contractures through an anterior release. In addition we evaluated the efficacy of continuous passive motion in the immediate post-operative period.

Methods: We retrospectively reviewed the outcomes of 106 patients who had anterior elbow release for flexion and extension contractures due to several different causes from July 1975 through June 2001. Post-operatively, 62 of the 87 patients were treated with continuous passive motion, while the other 25 were treated with splinting in extension. The average duration of follow-up was 23 months (range 6-120months). The average patient age was 34 years (range 13-66years). We evaluated the outcomes using pre and postoperative radiographs, and pre and post-operative active elbow range of motion. This measurement was recorded by the same surgeon (JRU) using the same large goniometer (47cm.)

Results: The mean preoperative extension was 52 degrees, which improved to 21 degrees post-operatively. Mean flexion increased from 111 degrees to 117 degrees. The mean total arc of motion for the group increased 38 degrees (from 59 to 97 degrees). The total arc of motion for the patients treated with CPM increased 41 degrees while the total arc of motion for those treated with extension splinting increased 27 degrees. There were 15 complications in 14 patients (16%). The majority of these were related to temporary traction neuropathies (ulnar nerve 5, radial nerve 3, superficial radial nerve 2, posterior interosseous nerve 1, lateral antebrachial cutaneous nerve 1). There were two infections (one superficial, one deep) both of which resolved with oral antibiotics, irrigation, and debridement.

Conclusion: We concluded that release of pathologically thickened anterior elbow capsule through an anterior incision for correction of diminished elbow range of motion

is a safe and effective technique. Furthermore, the utilization of continuous passive motion during the postoperative period increases total arc of motion when compared to splinting alone.

2002 PIEDMONT SOCIETY SURVEY: ACUTE JOINT SEPSIS,

David C. Urquia, M.D., Mechanicsville, Virginia

Survey forms were mailed to all active physician members of the Duke Orthopaedic Piedmont Society, recording their collective experience with the diagnosis and treatment of acute bacterial (non-T.B.) sepsis in selected major joints in adults and children. Experience with arthroscopy reviewed. Experience with percutaneous pigtail catheters reviewed.

A total of 37 surgeons responded. The survey contained General Practice Data, and Clinical Examples. The Data was as follows:

1. Referral to Radiology for diagnostic procedures on suspected joint infections: Never – 35% Rarely - 30%
Occas - 30% Freq.- 5%.

2. Referral to Radiology for therapeutic procedures on suspected joint infections : Yes - 22% No - 78%.

3. Preferred treatment for:

Knee (adult): Arthroscopic I&D (94% of respondents)

Hip (adult): Open Arthrotomy (84%)

Hip (peds): Open Arthrotomy (94%)

Ankle (adult): Arthroscopic (68%), Arthrotomy (26%)

Shoulder (adult): Arthroscopic (58%), Arthrotomy (39%)

GC: Antibiotics alone (51%), Open arthrotomy (49%)

General Observations and Conclusions:

1. Referral to Radiology for diagnostic and/or therapeutic procedures was not the norm for this group of surgeons.

2. Arthroscopic drainage procedures widespread for multiple joints, except in adult and pediatric hip cases.

3. Very limited experience with percutaneous catheters in this group, and not recommended for pediatric hip patients.

4. Multiple aspiration technique for treatment not recommended.

5. Principles of early diagnosis and aggressive surgical treatment supported.

2002 BONE COMPACTION: A TECHNIQUE DESIGNED TO IMPROVE PRIMARY STABILITY OF A HIP STEM, Thomas Parker Vail, Jay West, Richard Glisson, Farshid Guilak, Duke University Medical Center, Division of Orthopaedic Surgery, Durham, North Carolina 27710 A critical factor in the performance of the stem is the technique of implantation. There are three basic ways to prepare bone for an implant: broaching, milling, and compacting. The extent to which the broach compacts or cuts bone depends upon the design of the teeth of the broach. The technique of bone compaction creates a space in the medullary cavity by radially displacing bone. A series of experiments were performed with the objective of determining how the method of bone preparation affects bone-implant contact and bone implant attachment strength using a cementless implant. In Part 1, a conical implant with a 3 degree taper was implanted into a cadaveric femur using one of three (n=5) techniques of bone preparation. The proximal femur was then sectioned with the implant in place. Sections were scanned into NIH V1.54, to quantify the amount of implant-bone contact. The techniques were compared using a one-way ANOVA and Tukey's studentized range test. In part 2, a transverse cylindrical cavity was created above the lateral condyle of a rabbit using one of three techniques (n=12). A hydroxyapatite-coated titanium implant was inserted. Twelve weeks later, the peak pull-out forces were determined and subjected to ANOVA and Neuman-Keuls tests. The cadaveric study demonstrated a significant difference in bone contact between bone compaction and broaching (p=0.03). Bone compaction resulted in 54.25% bone-implant contact, reaming 42.16%, and broaching 37.29%. The rabbit study revealed a trend in pullout strength between compaction (547.0 N), broaching (498.1 N), and milling (444.7 N), but no statistical difference. Thus, bone compaction increased bone-implant contact by trabecular displacement in cadaveric femora, and did not compromise implant pullout strength in an animal model of bone ongrowth.

2002 The Effects of Varus Tibial Alignment on Proximal Tibial Surface Strain in Total Knee Arthroplasty: The Posteromedial Hot Spot, Gregory V. Green, MD[1], Keith R. Berend, MD[1], Michael E. Berend, MD[2], Richard R. Glisson, BS[1], and Thomas P. Vail, MD[1,] 1. Duke University Medical Center, Division of Orthopaedic Surgery, Durham, North Carolina, 2. Center for Hip and Knee Surgery, Mooresville, Indiana Varus tibial alignment in total knee arthroplasty (TKA) is associated with loosening and failure. This study aims to

determine the effect of varus tibial alignment on proximal tibial strain in a human cadaver model. The proximal one-third of seven paired fresh frozen cadaveric tibiae had photo-elastic coating applied. The right tibiae were cut in neutral alignment, and the left cut in five degrees of varus. The tibial components were cemented and loaded 3x body weight with varying medial to lateral load. Surface microstrain was calculated from the birefringent pattern of the photoelastic coating using previously validated techniques. There was statistically increased strain concentration, termed a "hot spot," in the posteromedial quadrant of the proximal tibia in varus-cut bones ($p<0.05$). In neutral alignment, the strain was nearly equal on the medial and lateral sides of the tibia. The increased strain observed in the medial proximal tibiae with varus alignment helps elucidate the mechanism of increased failure of a total knee arthroplasty inserted in varus alignment. When cut in varus, the tibia demonstrated consistently increased medial strain, even with lateralization of the axial load. Neutral alignment may have a protective effect by uniformly dispersing proximal tibial strain.

2002 STRUT/CAGE GRAFTING AFTER CERVICAL CORPECTOMY

CORPECTOMY, Kenneth E. Wood, MD, Sam Chewning, MD, Jennifer Gannon, PA-C, Piedmont Healthcare, Statesville, North Carolina

This study is a preliminary report of a new technique for interbody fusion and fixation following corpectomy of the cervical spine. It is a retrospective review of eleven (11) cases of severe cervical disk disease.

The objectives are to show the efficacy and safety of the use of a titanium mesh cage filled with local autograft bone taken from the corpectomy as a strut to bridge the appropriate end-plates. The strut grafting is followed by anterior cervical plate and screws.

Studies have shown that the use of a fibular or iliac strut graft accompanied by anterior plate and screw fixation is an appropriate fixation technique following cervical corpectomy. In addition it has been recognized there are potential donor site problems with the use of very large iliac crest bone grafts, and there are some contouring challenges with the use of large structural allografts. In favor of titanium cage use, Clemme and Polly as well as Brantigan and Lowery have shown that osteosynthesis and bone remodeling occur within titanium cages.

Eleven patients with an average age of 54.5 years underwent corpectomy and strut/cage grafting. The average follow up is 8.1 months. Diagnoses include multi-level spondylosis, myelopathy, subluxation and stenosis. It is stressed that the use of strut/cage grafting is not recommended for the routine disk herniation or single-level spondylosis.

Indications include severe multi-level cervical disk disease, cervical deformity, cervicovertebral tumors and cervical myelopathy requiring corpectomy. Several illustrative cases are shown with pre- and post-op studies. Results include excellent –

eight (8); improved – three (3); poor – zero (0). Complications: Arrhythmias – One (1). Infections – Zero (0). Hematoma – Zero (0). Deaths – Zero (0).

In conclusion, titanium strut/cage grafting after cervical corpectomy accompanied by anterior plate and screws in this preliminary study is shown to be a safe procedure which is successful in a small group of patients with early follow up of 8.1 months. This procedure reflects a safe way to use allograft and avoid bone grafting and contouring problems associated with very large iliac crest grafts and allografts. This procedure is not recommended for routine disk herniations and single-level spondylosis.