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Abstracts 2003

2003 IMPROVED QUADRICEPS RECOVERY TIME IN TOTAL KNEE ARTHROPLASTY - A MINOR INCISIONAL ADJUSTMENT, George S. E. Aitken, M.D., Duke Orthopaedics of Person County, Roxboro, NC

Healthcare is under continued pressure to shorten inpatient admission time. Adjusting the surgical approach for Total Knee Arthroplasty to an incision medial to the Quadriceps tendon does shorten the recovery of straight leg raising (SLR) ability. In 75 patients undergoing total knee arthroplasty (TKA) SLR was reached on average in less than 3 days [range 1-7].

This incision compared to a traditional Quadriceps splitting surgical approach has shortened our patients' recovery of motor control in the operated extremity without affecting outcome. This allows for earlier discharge of the patient from the hospital.

2003 LATERAL PARAPATELLAR APPROACH FOR VALGUS TOTAL KNEE ARTHROPLASTY, Frank V. Aluisio, M.D., Greensboro Orthopaedic Center, Greensboro, NC Primary total knee arthroplasty in the valgus knee is a challenging and controversial subject. There is no consensus concerning the most effective way to do lateral soft tissue release in order to balance the knee. The complication rate from a medial approach for the valgus knee arthroplasty is higher than that noted for a varus knee. The surgeons objecting to the lateral approach indicate that wound complications and disruption of the extensor mechanism are more likely through that approach than the medial incision. This study assesses the utility and safety of the lateral parapatellar approach for valgus total knee arthroplasty.

The lateral parapatellar approach was used in 26 knees (23 patients) out of a total of 216 primary total knee arthroplasties (12%). The mean pre-operative radiographic valgus deformity was 18.3 degrees (range 12-30 degrees), and 8 knees had a greater than 20 degree deformity. All cases were performed by the same surgeon using a posterior stabilized femoral component with a fixed bearing tibial component in 13 knees and a mobile bearing in 13 knees. All inserts were posterior stabilized and no additional constraint was necessary. The mean patient age was 68.7 years (39-85 years). The mean tourniquet time was 63 minutes (47-84 minutes) and mean operative time 76 minutes (60-100 minutes).

This technique was successful in correcting the deformities to a mean of 5 degrees valgus (range 4-9 degrees). The mean correction was 13 degrees per knee and maximum correction in any knee was 26 degrees. There was one asymptomatic deep venous thrombosis (DVT), one non-fatal pulmonary embolus and 3 urinary tract infections. There were no cases of wound drainage, breakdown or infection and no peroneal nerve palsies. There were also no extensor mechanism complications. Range of motion improved dramatically from pre-operative mean of 109.8 degrees flexion to post-operative mean of 129.6 degrees flexion (range 108-134 degrees). Similarly extension improved from a mean 5 degree contracture to a mean 1.7 degree contracture. No closed

manipulations were necessary.

The mean follow-up is 19.2 months and the results have not deteriorated with time. There have been no instances of recurrent valgus deformity as have been reported when using the medial parapatellar approach in valgus knees. Most importantly, there were no wound or extensor mechanism complications. The lateral parapatellar approach proved to be a safe and effective means of addressing the complex valgus total knee arthroplasty.

2003 AVOIDING COMPLICATIONS & MANAGING RISK: THE PIEDMONT SURVEY, David E. Attarian, Duke Medical Center, Durham, NC The current social and medical/ legal economic climates place significant stress on practicing orthopaedic surgeons. Medical mistakes are cited as the 8th leading cause of death (up to 98,000/ year); the JCAHO and government are aggressively promoting patient safety initiatives given the perceived under-reporting of complications and mistakes by physicians and hospitals. The malpractice crisis has also caused great angst with skyrocketing premiums, physician work stoppages, and a lottery mentality for jury awards. A survey was sent to all members of the Piedmont Orthopedic Society requesting information on how individual surgeons avoid complications and manage risk. Eleven percent (40) provided detailed responses; 65% of the respondents were in private practice and 50% described themselves as subspecialists. The average time in practice was 22 years (range 1 to 40). The categories for avoiding complications were: 88% specific protocols, e.g. antibiotics, DVT prophylaxis, drain; 63% preoperative planning; 48% be compulsive/attention to detail/follow routine; 28% limit or refer complex cases; 23% wrong site surgery protocol; 23% avoid fatigue/maintain healthy lifestyle; 20% excellent history and physical; 20% obtain consultation; 15% avoid cutting-edge techniques; and 13% do only what you do well. The results for managing risk were: 75% excellent ethical interpersonal relations (Golden Rule); 68% detailed documentation and informed consent; 18% check on outpatients postop day #1; 15% emphasize conservative care; 13% follow complications closely; 13% disengage from problem patients and substandard physicians/peers; and 10% avoid criticism of others. This survey, although the response was limited, confirms other polls showing that experienced orthopaedic surgeons take specific steps to avoid complications and manage risk. Many surgeons are modifying their practices to limit services as well as patient access**.**

2003 BIOMECHANICAL AND CLINICAL IMPLICATIONS OF TIBIAL COMPONENT ALIGNMENT IN TOTAL KNEE ARTHROPLASTY, Michael E. Berend, MD, Duke University Medical Center, Orthopaedic Laboratory, Durham, NC; Center for Hip and Knee Surgery, Mooresville, IN The aim of the study was to do a combined biomechanical and clinical study examining the effects of varus tibial alignment on survival of a total knee arthroplasty. For the biomechanical testing, fourteen paired fresh frozen cadaver tibiae had photoelastic coating applied. Right tibiae were cut in neutral alignment and left tibiae were cut in 5° of varus. Components were cemented and loaded with 3 times body weight. There was a statistically significant

increased hot spot of concentrated strain in the posterior medial compartment of the proximal tibia in varus cut bones. In neutral alignment, the strain was nearly equal medially and laterally. This increased strain pattern may help explain the mechanism of failure rates in total knee arthroplasty inserted in varus alignment. Neutral alignment may have a protective effect. The clinical portion of this study examined the failure mechanisms of a non-modular metal-backed cemented tibial component of the AGC design (Biome). Three thousand one hundred and ninety total knee replacements were reviewed and 40 tibial components have been revised (1.3%) for four distinct failure mechanisms. Nineteen were revised for medial bone collapse, 13 for ligamentous imbalance, 6 for progressive radiolucencies and 2 for pain. Factors associated with medial tibial bone collapse were tibial component alignment of greater than 3.9° of varus, increased body mass index of greater than 33.7 and overall varus limb alignment. No knees were revised for polyethylene wear or osteolysis. The mechanism of medial bone collapse may be related to medialtibial edge overload as determined in the biomechanical study. This study helps emphasize the importance of component alignment for long term survival of a total knee arthroplasty.

2003 THE RELATIONSHIP BETWEEN FEMORAL BONE LOSS AND OUTCOME WITH A MODULAR REVISION HIP STEM, Michael Bolognesi, M.D., Philip Clifford, M.D, Thomas Parker Vail, M.D., Duke University Medical Center, Durham, NC Modular hip arthroplasty stems have been used extensively in revision surgery to treat both mild and severe cases of bone loss. The purpose of this study was to analyze the clinical and radiographic performance of a modular revision hip system when applied to a consecutive cohort of patients with a range of proximal bone loss. Fifty-three cementless femoral revisions were performed on an unselected, consecutive series of fifty-two patients between 1992 and 1997. Type I (n=3), II (n=24), IIIA (n=13), and IIIB (n=3) bone defects of the proximal femur were included. Minimum follow-up of two years was required for inclusion in the study. Average follow-up was 3.9 years (range 2-7.5 years). Forty-two of the forty-three patients had adequate radiographs for review. Massive proximal femoral replacement allografts were excluded, but strut, segmental, and cancellous grafting procedures were included in this study. Two of the forty-three femoral stems (4.6%, one Type II and one type IIIB defect) required re-revision due to aseptic loosening. Radiographic evidence of bone ingrowth was noted in 39 (91%) of the stems. Stable fibrous ingrowth was seen in three stems (7%, all type III defects) and definite radiographic loosening was seen in one stem (type II defect). Femoral component survivorship was 95% for the entire group using revision as an endpoint. The performance of the SROM modular hip stem was excellent in all patients with Type I and II defects (26/27, 96% not revised and 26/27, 96% bone ingrowth). Inferior results were seen with Type III proximal femoral defects (15/16, 94% not revised and 13/16, 81% bone ingrowth). Key words: hip revision, modular stem.

2003 TOPOGRAPHY IMPLICATIONS FOR ORTHOPEDIC IMPLANTS, E.J. Harvey, S.A. Hacking, M. Tanzer, J.J. Krygier, J.D. Bobyn , Jo Miller Orthopaedic Research Laboratory, Division of Orthopaedics, Departments of Surgery and Biomedical Engineering, McGill University, Montreal, Quebec, Canada The positive effect of hydroxyapatite (HA) coatings on osseointegration has been attributed to their chemistry and their ability to increase the concentration of calcium and phosphate in the microenvironment immediately adjacent to the implant. Recent work by this group has illustrated that the relative contribution from the traditional pathway of surface chemistry may be overstated. The topographies of so-called "bioactive" surfaces are more important than previously thought. The purpose of this study was to illustrate the relative contributions of surface chemistry and topography to the bone forming tissue response to implants in general. A canine femoral intramedullary implant model from this laboratory compared the osseous response to identical commercially pure Ti implants that were either polished, grit blasted, plasma sprayed with HA or plasma sprayed with HA and masked with a very thin layer of Ti using plasma vapor deposition (PVD). The Ti-Mask isolated the chemistry of the underlying HA layer without changing its surface topography. At 12 weeks the bone-implant specimens were prepared for undecalcified thin section histology and serial transverse sections were quantified with backscattered scanning electron microscopy for the percentage of bone apposition to the implant surface. Bone apposition averaged 3% for the polished implants and 23% for the grit blasted implants ($p<0.001$, paired Student's t test). Bone apposition to the HA-coated implants averaged 74% while bone apposition to the Ti-Mask implants averaged 59% ($p<0.001$, paired Student's t test). Therefore, 80% of the bone forming response to bioactive implant surfaces was from microtopography alone. The implications of this finding are wide ranging. It means that many previous experimental and clinical studies citing the positive effects of HA coatings have to be critically reviewed and reconsidered with a new perspective. It also means that future studies of this type have to maintain absolute control over topography and morphology if implant chemistry is to be evaluated for its bone response in an implant model or surgical scenario. It will no longer suffice to "approximately" match surfaces for topography – this variable must now be eliminated in study design, not just casually addressed. In addition to these considerations are the practical issues relating to the manufacturing techniques of different implant surfaces and their relative cost, reliability, and benefit to osseointegration. Advantage may well be gained in the future by more deeply exploring and developing simple and cost-effective methods for surface texturing of orthopaedic implants that utilize the principles elucidated in this study. This finding is fundamental to implant design and has profound implications with respect to basic research and our understanding of the parameters governing osseointegration.

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2003 CLOSED, FLEXIBLE INTRAMEDULLARY NAILING OF UNSTABLE PEDIATRIC FOREARM FRACTURES, Anastasios D. Kanellopoulos, M.D., Department of Pediatric Orthopaedics, KAT Accident Hospital, Athens, Greece

The results of the conservative treatment of unstable pediatric both bone forearm fractures can be disappointing mainly due to loss of forearm rotation. Angular malunion greater than 20° can lead to 30° loss of forearm rotation. The "forgiving" effect of remodelling is to be inadequate for malunited proximal forearm fractures or fractures with radio-ulnar angulation in the frontal plane. Fortunately, unstable fracture patterns account for less than 4% of all both bone forearm fractures and surgical treatment is usually advised. This study is focusing on the surgical treatment and the final functional status of pediatric patients with both bone forearm fractures who underwent intramedullary stabilization with elastic, titanium nails.

We reviewed the medical records and the X-ray folders of 23 children with 23 both bone forearm fractures admitted to the Pediatric Orthopaedics Department between February 2000 and January 2001 due to unstable both bone forearm fractures. There were 14 males and 9 females with a mean age of 10 years (8-14 years). Nine fractures were type I open according to the Gustilo and Andersen classification. The injury was usually caused by fall from a height or secondary to a MVA. The indications for operative fixation included the presence of an unstable fracture pattern, inability to maintain reduction and secondary loss of reduction. Failure to restore angulation to less than 10 degrees in patients older than 8 years, fracture translation and narrowing of the inter-osseous space were considered indications for surgery. Further indications for surgical treatment included all displaced fractures of the proximal third of radius, fractures with significant fracture site comminution and loss of reduction within one week. All open fractures were taken to the operating room for thorough irrigation and debridement and fracture stability was assessed intra-operatively. Under general anesthesia, the fracture was reduced and percutaneous intramedullary nailing followed using flexible titanium alloy nails (Ti6Al4V alloy, ECMES nail™, De Puy International Ltd., Leeds, UK). Closed reduction and percutaneous insertion of the nails was possible in 12 patients. Limited exposure of the fracture site was necessary in 11 patients, including the patients with an open fracture where irrigation and debridement of the fracture site was mandatory. The functional outcome was assessed based upon the system advocated by Price et al. Complications were classified as major or minor according to the criteria set by Luhmann et al.

The average hospital stay of the patients was 2 days (1-4 days) and the mean follow up was 27 months (25-36 months). There were no significant intra-operative or post-operative complications although five minor ones were accounted for. Four patients complained of paraesthesiae at the base of the thumb that completely resolved within 3 months and one developed a stitch abscess that resolved with p.o. antibiotics. According to Price et al. all patients were considered having an excellent or good functional result.

This study concluded, as many others do, that should surgical treatment of an unstable both bone forearm fracture in a pediatric patient be indicated, intramedullary fixation with titanium nails is dependable.

2003 NANDROLONE DECANOATE AND LOAD INCREASE REMODELING AND STRENGTH IN HUMAN SUPRASPINATUS BIOARTIFICIAL TENDONS, **Spero G. Karas, *M.D., Ioannis K. Triantafillopoulos, *M.D., Melissa Maloney, †B.E., William E. Garrett, Jr., *M.D., Ph.D., Albert J. Banes, *†Ph.D., *Department of Orthopaedic Surgery, University of North Carolina School of Medicine, †Flexcell International Corporation, Hillsborough, NC** **Background**: No controlled laboratory studies document the effect of anabolic steroids on human rotator cuff tendons.

Study design: Controlled laboratory study.

Hypothesis: Anabolic steroid administration enhances matrix remodeling and improves the biomechanical properties of bioartificially engineered human supraspinatus tendons (BATs).

Methods: BATs were treated either with nandrolone decanoate (NLS group, n=18), stretching (LNS group, n=18), or both (LS group, n=18). A control group received no treatment (NLNS group, n=18). BAT's contractility was assessed by daily scanning, cytoskeletal organization by staining, matrix metalloproteinase-3 (MMP-3) levels by ELISA assay, and biomechanical properties by load-to-failure testing.

Results: The LS group showed greatest contractility and the best-organized actin cytoskeleton when compared to the other groups. On the second and third day of treatment, MMP-3 levels in the LS group were significantly greater than those of the NLNS group and greater than NLS and LNS groups. The biomechanical properties in the LS group were significantly improved when compared to NLNS and NLS groups and greater than those in the LNS group.

Conclusions: Nandrolone decanoate and load acted synergistically to increase matrix remodeling and biomechanical properties of BATs.

Clinical Relevance: Carefully prescribed and monitored anabolic steroids may have an important adjunct role in postoperative healing and rehabilitation of repaired rotator cuff tendons.

Acknowledgments: NIH AR38121

References:

1.Tsuzaki M, et al: *J Orth Res*, in press, 2002.

2.Miles JW, et al: *JBJS* 74-A: 411-422, 1992.

3.Garvin J, et al: *Trans of 48th ORS*, 27: 2002**.**

2003 THROWING FATIGUE AND SCAPULAR KINEMATICS: IMPLICATIONS FOR INJURY IN OVERHEAD ATHLETES, **Spero G. Karas, M.D., Jamie R. Birkelo, M.S., Darin Padua, Ph.D., Kevin Guskiewicz, Ph.D., Shoulder Service and Department of Exercise and Sports Science, UNC Chapel Hill, NC** INTRODUCTION: The angular velocity generated by the shoulder during overhead throwing makes it susceptible to injury. Overuse and repetitive microtrauma have also been implicated in glenohumeral failure in the overhead athlete. The purpose of this study is to evaluate scapulothoracic kinematics before and after a bout of prolonged overhead throwing. We will attempt to relate our findings to injury mechanism and prevention.

METHODS: Thirteen healthy, collegiate pitchers were assessed for changes in periscapular muscle strength and scapular kinematics after a mock baseball game consisting of fifteen pitches per inning over five innings. Motion at the scapulothoracic articulation was tracked with a computerized electromagnetic system with six degrees of freedom before and after the throwing protocol. A manual dynamometer was utilized to evaluate pre and post game strength. A repeated measures ANOVA was used to discern significant differences with an alpha level set at .05.

RESULTS: After the prolonged overhead throwing protocol, there were statistically significant differences in global periscapular muscle strength (scapular protractors, retractors, and depressors). With the arm moving from the abducted and externally rotated position into maximum internal rotation, kinematic analysis revealed significantly decreased scapular protraction ($p=.035$) and acromial cephalad rotation ($p=.031$) following the throwing protocol.

CONCLUSIONS: Prolonged, overhead throwing activity adversely affected periscapular muscle strength and scapular kinematics in our study. We postulate that decreased scapular protraction during follow-through decreases the arc of motion for arm deceleration- thus placing abnormal eccentric load on the biceps, labrum, and posterior rotator cuff. Decreased acromial cephalad rotation also decreases the size of the subacromial space and increases the risk of outlet impingement on the rotator cuff. Knowledge of these phenomena will enable better selective strengthening about the shoulder girdle and help us understand the pathomechanics of shoulder injuries in throwers**.**

2003 NON-OPERATIVE TREATMENT OF THE FROZEN SHOULDER, Keith Kenter, M.D. and M. Jane Craig, R.N., University of Cincinnati Medical Center, Cincinnati, OH

Purpose: Frozen shoulder or adhesive capsulitis is a painful and progressive loss of both active and passive range of motion without any known intrinsic cause. The natural history and histological stages have been described to help explain the pathogenesis. There have been conflicting reports evaluating the effects of intra-articular corticosteroid injections in the treatment to improve the natural history. We report our non-operative experience with the use of glenohumeral corticosteroid injections in patients diagnosed with adhesive capsulitis of the shoulder**.**

Methods: 129 consecutive patients with a diagnosis of frozen shoulder were followed from 1997-2002. A detailed physical examination in both the erect and supine position documented range of motion. A visual analogue scale (VAS) was used to document pain. All patients underwent a glenohumeral injection with 40 mg DepoMedrol and 9 cc 1% plain lidocaine at the time of initial presentation and at monthly follow-up with the following criteria:

1. No improvement in pain of 2 VAS levels
2. No improvement in erect abduction or forward flexion of 20^{o}

or

3. No improvement in erect or supine IR or ER of 10º.

A maximum of 3 injections was used. Patients were followed until complete resolution of symptoms or if surgical intervention was needed. Successful treatment was considered if there was complete resolution of pain, full function, and patient satisfaction. Initial and follow-up ASES and HSS L'Insalata scores were recorded.

Results: Thirty-one patients were lost to follow-up leaving 98 patients to be evaluated. There were 69 females with average age of 40.7 years and 29 males with average age of 53.2 years. Overall success was 71.4% (71% females, 72.4% males). Successful treatment occurred at 4.15 months in females and 4.5 months in males. 85.7% of both female and male patients recovered with 1 or 2 injections. Poor prognostic indicators were Diabetes Mellitus, absent physiotherapy, workman's compensation, post-operative stiffness cases, dominant arm, and stage 3 cases. Average ASES scores were 41.8 at presentation and 92.7 at resolution and **HSS** L'Insalata scores were 52.5 at presentation and 91.0 at resolution. There were no complications with our technique.

Conclusions: Glenohumeral corticosteroid injections for the patient with adhesive capsulitis are considered to be safe and an effective method of treatment for resolution of pain and improvement in functional range of motion. We recommend glenohumeral corticosteroid injections at the time of presentation and with close follow-up for frozen shoulder as part of the initial treatment regime. We have suggested an algorithm for the timing of intra-articular injections based on pain and objective range of motion.

2003 CERVICAL SPINE INJURY AND RESTRAINT SYSTEM USE IN MOTOR VEHICLE COLLISIONS, B. Claytor, P.A. MacLennan, G. McGwin Jr., L.W. Rue, J.S. Kirkpatrick, Departments of Surgery and Epidemiology and the Center for Injury Sciences, University of Alabama at Birmingham, Birmingham, AL

Context- Motor vehicle collision (MVC) related cervical spine injury is a severe and often permanently disabling injury. Although advances in automobile crashworthiness have reduced both fatalities and some severe injuries, the impact of varying occupant restraint systems (seatbelts and airbags) on cervical spine injury is unknown.

Objective- To investigate the relationship between the occurrence of cervical spine injury and occupant restraint systems among front seat occupants involved in frontal MVCs.

Design, Setting, and Patients- A case-control study among subjects obtained from the 1995 to 2001 National Automotive Sampling System (NASS). Cases were identified based on having sustained a cervical spine injury of ≥ 2 on the Abbreviated Injury Scale, 1990 Revision.

Results- Approximately half (44.7%) of 8,412 cases of cervical spine injury were unrestrained occupants while belted only, airbag only and both restraint systems represented 38.2%, 8.8% and 8.4% of cases respectively. Overall, the combined use of

airbag and seatbelt had the greatest protective effect, relative to unrestrained occupants, with an odds ratio (OR) of 0.19 and a 95% confidence interval (CI) of 0.12 to 0.30. Use of a seatbelt only also had a protective effect (OR=0.40, 95% CI=0.23 to 0.70). Occupant use of an airbag only neither increased nor decreased the risk of cervical spine injuries relative to unrestrained occupants (OR=1.02, 95% CI=0.57 to 2.13).

Conclusions- The results of this study suggest that there is an increase in overall protection against cervical spine injury by combining airbag and seatbelt restraint systems relative to seatbelt alone.

2003 COMPLEX REGIONAL PAIN SYNDROME AND DISTAL RADIUS FRACTURES: INTERMEDIATE-TERM FOLLOW-UP, Gamal A. Elsaidi, D.O.; L. Andrew Koman, M.D.; Martha Holden, A.A.S.; Beth P Smith, PhD; Thomas L. Smith, Ph.D.; and Jefferson R. Dudelston, B.S., Wake Forest University School of Medicine, Winston-Salem, NC

Purpose: Study aims were to evaluate the impact of complex regional pain syndrome after distal radius fracture (DRF) on function and health-related quality of life (HRQL) and to correlate outcome after therapeutic interventions.

Materials and methods: A retrospective review was conducted on 28 patients (24 women and 4 men) diagnosed with complex regional pain syndrome following distal radius fracture between 1991 and 2000 as diagnosed by a hand surgeon. Mean age at injury was 52.9 (Range: 29-74). Initial fracture management included closed reduction (n=24), open reduction (n=4), external fixation (n=6), open reduction and internal fixation (n=1), and percutaneous pinning (n=5). Sixteen patients had casts. After initial management, 21 patients underwent subsequent surgeries which included wrist fusion, ulna resection, iliac crest bone graft, wrist arthroscope, plate ORIF, repeat external fixation, Darrach procedure, shoulder arthroscope, and intrinsics release. The average time from injury to CRPS diagnosis was 186 days.Treatment of CRPS included autonomic nerve blocks [stellate block (n=5), epidural block (n=2), axillary block (n=1), and infraclavicular brachial plexus block (n=2)]; hand therapy with active and passive range of motion (n=28) and contrast baths (n=28); median nerve decompression (n=7), and oral medications (n=28). Three outcome measures (clinical assessment, standardized validated HRQL instruments, and thermoregulatory testing) were compared between initial diagnosis and after five years of treatment. Statistical analysis included one and two-way analysis of variance (ANOVA).

Results: Health-related quality of life instruments: The Levine symptom and functional status scales showed a statistically significant improvement at the 5-year follow up examination when compared to initial examination for both symptom ($p=0.003$) and function status ($p=0.001$). The McCabe cold sensitivity severity scale showed no statistically significant improvement at follow up exam. The McGill pain questionnaire showed a statistically significant difference between the initial exam & follow up exam ($p=0.048$). The Wake Forest University symptom rating scale showed a

statistically significant difference between initial exam and follow up exam in pain ($p=0.014$), weakness ($p=0.001$), and stiffness ($p=0.001$) with no statistically significant difference in numbness and cold intolerance between the initial exam and follow up exam. At follow-up exam, when study population's DASH scores were compared to DASH scores of 36 control subjects (individuals with history of distal radius fractures without CRPS diagnosis), a statistically significant difference between our study group and the control group was found ($p=0.002$).

Thermoregulatory testing: There was no statistically significant difference ($p>0.05$) in laser Doppler fluxmetry, or digital temperatures between initial exam and follow up exam. This indicates no significant improvement in these parameters.

Clinical examination findings at CRPS diagnosis and follow-up exam correlated well with the other outcome measures.

Conclusions: At a mean follow up of five years after initial exam (mean 6.6 years post-injury), Compared with uncomplicated DRF, patients with CRPS treated with current protocols demonstrate a significantly diminished function and HRQL and may be impacted positively by active intervention with diminished pain, improved strength, and decreased stiffness; however, numbness and cold intolerance may persist resulting in residual disability in spite of active and vigorous intervention.

2003 LIMITED OPEN INCISION AND DRAINAGE FOR PYOGENIC FLEXOR TENOSYNOVITIS, Douglas H. Murray, M.D., Atlanta Medical Center; Gary M. Lourie, M.D., The Hand Treatment Center, Atlanta, GA

INTRODUCTION: Surgical irrigation and debridement with intravenous antibiotics remain the cornerstone of treatment for pyogenic flexor tenosynovitis. Inadequate treatment can lead to tendon necrosis with limitation of function, loss of motion, and pain. Rarely cases that are diagnosed within 48 hours respond to intravenous antibiotics alone. Historically, wide incisions that close secondarily have been the recommended treatment. These extensive incisions often result in stiffness and extended morbidity in terms of return to work, gain in strength, and function. Catheter irrigation systems allow limited incisions with more rapid healing and potential decrease in stiffness with fewer wound problems. The catheter systems however have not been universally accepted due to many practice problems including: fluid leakage form the wounds or drains, soft tissue occlusion of the drain, early loss of drain postoperatively, delay of therapy until system is removed, and severe pain with catheter irrigation. This study reports a new incision that maintains the benefits of the limited incision but does not have the inherent difficulties associated with the catheter systems. This study evaluated effectiveness of 4 limited midline volar incisions left open for wound care to assess healing, range of motion, and return to pre-injury functional levels. A cadaveric study is included to assess the adequacy of tendon sheath decompression.

MATERIALS AND METHODS: Seven patients with clinical evidence of septic flexor tenosynovitis were treated with a limited incision for open irrigation and drainage of the flexor tendon sheath. The sheath was exposed using a limited technique, employing 4 volar-midline skin incisions over the distal palm, proximal phalanx, mid-phalanx, and distal phalanx taking care not to cross the digital creases. Through these incisions the sheath is exposed protecting the A2 and A4 pulleys. A pediatric feeding tube is threaded through each incision into the sheath where vigorous irrigation with bacitracin solution is performed. Once the sheath is adequately drained, the wounds were packed open with bacitracin solution-soaked gauze and the hand splinted in the functional position.

Postoperatively on day one, daily whirlpool therapy is instituted with repacking of the wounds, institution of range of motion, and functional splint wear. This was continued for 10-14 days with intravenous antibiotics continued on average of 2-3 weeks followed by p.o. antibiotics.

In the cadaveric part of the study, a limited open incision technique was performed on 8 digits from 2 cadaveric hands. Longitudinal volar midline incisions x4 were made over the tendon sheath avoiding the digital creases. The tendon was exposed by longitudinally opening the sheath at the A1, C1, A3, C2, C3 and A5 pulleys leaving the A2 and A4 annular pulleys intact. After exposure, the skin was completely removed to allow inspection of the tendon sheath.

RESULTS: All seven patients were followed for approximately 1 year. 6 of 7 patients revealed complete closure of wounds within 3 weeks after surgical drainage. 6 of 7 patients gained full composite flexion being able to flex to the distal palmar crease of the involved digit by time of wound closure, approximately 3 weeks, range 18 to 27 days. The 7th patient demonstrated continued limited motion lacking approximately 3.5 cm. of flexion to the distal palmar crease, but did have preexisting degenerative arthritis involving both the PIP and DIP joint. No complications were noted in the previous 6 patients; specifically no contracture, neurovascular injury, bowstringing, or prolonged healing. None of the patients have required additional procedures up to this point.

Dissection of the cadaveric digits revealed that the A2 and A4 pulleys were preserved with complete exposure. Exposure of the remaining tendon sheath was complete in all digits with the limited open incision. In 2 of the digits, approximately 25% of A4 had been incised proximally. The A2 pulley was preserved in all of the cadaveric digits.

CONCLUSION: Pyogenic flexor tenosynovitis can lead to devastating hand morbidity. While surgical debridement is recommended, no single technique has gained universal support. The cadaveric study conforms that adequate debridement can be successfully achieved with 4 limited longitudinal incisions. Care must be taken not to cross the digital creases. Further, the incision of the tendon sheath in the distal half of the middle phalangeal wound can violate the 4th proximal annular pulley and requires careful attention. The clinical cases demonstrate adequate debridement achieved without

violating the A2 and A4 pulley with expedient wound closure, regaining of full range of motion, and a few soft tissue complications. This limited open incision technique allows successful debridement of the sheath while maintaining the benefits of the limited incision technique without the difficulties inherent to their catheter systems.

2003 RADIAL-ULNAR SYNOSTOSIS AFTER THE TWO-INCISION BICEPS REPAIR: A STANDARDIZED TREATMENT PROTOCOL, Dean Sotereanos, M.D., Pittsburgh, PA

Radial ulnar synostosis is the most common complication of the two-incision biceps repair. Thus far, only one study in the literature has described this complication and treatment. Between 1992 and 2000, 8 patients with radioulnar synostosis after a two-incision biceps repair were evaluated and treated with a mean age of 38 (range 29-47) years old. The mean time between tendon repair and resection of the synostosis was 8 (6-18) months. The average follow-up was a 27 (range 13-36) months. An average pronation-supination arc of 27 ^{o} (range 0 ^{o} – 70 ^{o}) was noted preoperatively. Postoperatively all patients underwent post-operative radiotherapy in two divided doses for a total of 700 rads. At an average follow-up of 27 months, it was noted that the rotation arc of the forearm improved to 155 ^{o} (range 140 ^{o} - 170 ^{o}) with an average gain of 128 degrees. The strength of supination was 80% (range 70% - 90%) of the contralateral limb. Seven of the eight patients had no pain after activities of daily living or work. One had mild pain after prolonged activity. No radiographic or clinical evidence of synostosis recurrence was noted at final follow-up.

The posterolateral incision was extended and the interval between the extensor digitorum communis and the extensor carpi radialis brevis is developed to expose the supinator muscle. The posterior interosseous nerve is identified and protected. The synostosis is subperiosteally exposed through a separate interval, from the ulna to the radius. After resection, bone wax is applied over bleeding surfaces, the wound is irrigated and the tourniquet is released to obtain excellent hemostasis. A drain is placed for 24 hours.

2003 PEDIATRIC ORTHOPAEDIC PROBLEMS IN THE DEVELOPING WORLD, David A. Spiegel, M.D., Shriners Hospital for Children, Minneapolis, MN

The sequelae of musculoskeletal infections represent an important cause of disability in developing countries, especially as many cases present at later stages of involvement. Chronic osteomyelitis is usually due to untreated acute hematogenous osteomyelitis. Treatment includes aggressive debridement of all infected/devitalized tissue, and antibiotics as an adjunct to surgery. Related concerns include dead space management, treatment of segmental bone loss and/or angular deformity, and addressing limb length inequality. Sequestrectomy should be delayed until a sufficient involucrum has formed, and bone loss may be managed by conventional grafting, open cancellous grafting for

subcutaneous bones (Papineau), or bone transport if the resources are available. External fixation may facilitate grafting procedures. For extensive loss of the tibial diaphysis, transfer of the ipsilateral fibula may be successful.

Musculoskeletal manifestations of tuberculosis include arthritis, osteomyelitis, and spondylitis. With adequate compliance, current chemotherapeutic protocols should successfully eradicate more than 90% of cases of osteoarticular tuberculosis. Surgery serves as an adjunct to chemotherapy. Articular involvement begins with a proliferation of synovial granulation tissue, which is followed by marginal erosions, and ultimately destruction of the joint. Early diagnosis is essential as outcome depends upon the degree of involvement at presentation. In addition to chemotherapy, splinting and early motion help prevent contractures. Surgical indications include biopsy for diagnosis, synovectomy/debridement (controversial), and salvage procedures including resection arthroplasty (hip), arthrodesis, osteotomy, and total joint arthroplasty.

Skeletal tuberculosis most commonly presents as a lytic lesion with a sclerotic rim, but may also have an aggressive appearance (periosteal reaction, small sequestra). Uncommon forms include *cystic* (no sclerotic rim, children, diverse sites, may be multicystic), *disseminated* (compromised host, appendicular in children, skull/axial in adults), *closed multiple tubercular diaphysitis* (very rare, children, swelling in forearms and legs with diaphyseal thickening and sclerosis), and *tubercular rheumatism* (Poncet's disease, multiple effusions). Skeletal lesions may invade neighboring joints, and may cross the physis. Sinuses are common, and up to 50% of these may be superinfected by bacteria.

The disease focus in tuberculous spondylitis (Pott's disease) is usually within the vertebral bodies, and chemotherapy is the mainstay of treatment. Neurologic deficits may occur during the active phase (abscess, granulation tissue, sequestra) or the healed phase (transverse ridge of bone at the apex, dural fibrosis). A subset of patients will develop a significant kyphosis (» 5% > 60°) despite treatment, and risk factors include age (children), thoracic involvement, multiple levels of involvement, and greater initial loss of vertebral height. The indications for surgery remain controversial, and include establishing the diagnosis, decompressing the neural elements, preventing the development of significant deformities in those at risk, and shortening the duration of symptoms. Surgical approaches include anterior (most common), posterior (laminectomy for isolated posterior or intradural disease), and anterior and posterior (significant kyphosis, high risk of significant kyphosis). In patients unable to tolerate an anterior approach to the spine, costotransversectomy allows drainage of abscesses, while the lateral extrapleural approach allows decompression of the spinal cord and grafting. Instrumentation is not contraindicated in mycobacterial infections.

2003 THE MORBIDITY AND MORTALITY OF SIMULTANEOUS BILATERAL, STAGED BILATERAL, AND UNILATERAL TOTAL KNEE

ARTHROPLASTY, Cary Tanner, M.D., Vincent Pellegrini, M.D. and Marlene Smith, R.N., Fresno, CA

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 comorbidities, 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.

2003 RECONSTRUCTION AND REPAIR OF THE MEDIAL COLLATERAL LIGAMENT COMPLEX OF THE KNEE FOR ISOLATED CHRONIC MEDIAL INSTABILITY: A PRELIMINARY REPORT, Dean Taylor, M.D. and Keith Lonergan, M.D., West Point, New York

Recent recommendations for the management of medial collateral ligament (MCL) sprains have emphasized nonoperative treatment. Over the last 6 years we have noted that some patients treated nonoperatively have persistent pain and/or instability of the knee. The purpose of this study was to evaluate the results of the late treatment of these patients who have chronic medial collateral ligament injuries.

METHODS: This is a retrospective, observational study. All patients had isolated MCL injuries and underwent an operation for complaints of pain and/or instability. The operations included anatomic repair of the superficial and deep portions of the MCL and of the posterior oblique ligament. Additionally, the semitendinosis tendon was used to reinforce and protect the repair. The study group includes nine patients operated on between 1997 and 2002. Eight were male. Average age was 25 (18-40). The average time from injury to operation was 18months. Eight patients had follow-up evaluations at an average of 36 months (6-56); one patient was only one month postop. Patients' follow-up evaluations included physical examination measures, radiographs, and

isokinetic strength testing. We used the Lysholm and SANE outcome measures, and assessed activity level on the Tegner scale**.**

RESULTS: All patients were able to return to their preoperative level of activity. Postoperative surveys and physical examinations were performed. All eight patients demonstrated less valgus laxity at follow-up with five Grade I and three Grade 0. The average Single Assessment Numeric Evaluation (SANE) rating was 87 (range 70-100), average Lysholm score was 87 (range 81-95), and average Tegner activity score was 7 (range 4-9). The IKDC results were 2 normal, 5 nearly normal, and 1 slightly abnormal. All individuals regained their preoperative range of motion and had a negative Swain Test. One individual developed stiffness and underwent a manipulation under anesthesia without further sequelae. Three of four individuals who had the double limb grafts developed problems with the screw and spiked washer on the femoral epicondyle and requested hardware removal.

DISCUSSION: This is a preliminary report of our experience in surgically treating isolated chronic MCL injuries. The study should bring out two interesting points for discussion: (1) Do some isolated MCL sprains need surgical treatment acutely, and if so, which ones?, and (2) What is the best treatment for persistent symptoms following an MCL sprain? Nonoperative? Repair/reconstruction? Trephination of the ligament from inside the joint? "Microperforation" from outside the joint?

2003 PIEDMONT ORTHOPAEDIC SOCIETY SCIENTIFIC COMMITTEE REPORTS FROM MEMBERSHIP – TWO SURVEYS, David Urquia, M.D., Richmond, Virginia

Two individual surveys were available to Society members through direct mailings and through official website. These results were summarized and presented to the membership.

Survey 1 : Sports Recommendations for Total Knee Patients, and Cervical Fusion Patients. (50 respondents)

#1 *Unilateral TKA* : 100% for biking, swimming, fishing, golf.

82% for hunting

49% for hiking, tennis

31% for skiing

11% jogging

#2 *Bilateral TKA* : 100% for biking, swimming, fishing

95% for golf

80% for hunting

37% for tennis, hiking

24% for skiing

7% for racquetball, jogging

#3 *Cervical Fusion* (single level ACDF):

50% of respondents approved of contact

sports.

Survey 2 : Emergency Room Coverage for Unassigned Orthopaedic Surgeons (63 Respondents)

90% of MD's under age of 56 still taking Call.

19% of respondents anticipating *retirement* prior to age 60.

Vast majority of surgeons in *academic* practices rarely went to ER's themselves to see patients.

A trend toward full-time Orthopaedic *Tramatologists*, but mainly at the major academic medical centers, rarely at private hospital.

A trend toward private hospitals paying daily cash *stipends* for Orthopaedic coverage of their ER's.

2003 MUSCULOSKELETAL TUMORS, AN INTERACTIVE CLINICAL, RADIOLOGY AND PATHOLOGY CD-ROM TEXTBOOK, William G. Ward, Carol A. Boles, Scott Kilpatrick, Marcus Duda, Wake Forest University School of Medicine, Winston-Salem, NC

Purpose: The authors developed a case-based, interactive computerized program to teach and assess the musculoskeletal pathology knowledge of orthopaedic surgeons, pathologists and radiologists. Cases were chosen to illustrate basic entities, with emphasis on the clinical presentation, image interpretation, histology interpretation, diagnosis establishment and treatment knowledge. Evolving technology allowed creation of a CME ready, commercially viable educational program particularly aimed at orthopaedic surgeons.

Introduction: This clinical-radiological-histological interactive training program was developed as an outgrowth from a regional musculoskeletal pathology course that was taught by the combined faculties of Duke University, Wake Forest University School of Medicine, University of North Carolina School of Medicine, the Charlotte Orthopaedic training program, Medical University of South Carolina, and Emory University faculty. This clinical radiologic histologic interactive training activity evolved from a case based program utilizing 5 x 7 black and white radiographic image copies and actual glass slide histology microscopic examinations, into a highly sophisticated, yet easy to use interactive program that allows the learner to view 200 cases of musculoskeletal tumors and tumor-like conditions that require correlation of clinical, radiographic and histologic material to illustrate basic teaching points of musculoskeletal pathology and musculoskeletal tumor management. The activity was designed to allow the reader to perform his own interpretations with annotated interpretations provided that can be viewed or hidden from view depending on the viewer's preference. These cases may be selected randomly or they may be selected on the base of diagnosis, anatomic area, imaging modality, patient age grouping, tissue type (bone versus soft tissue) and benign versus malignant. The learner objectives are as follows:

1. The learner should be better able to recognize and describe the clinical presentation, the laboratory findings and the radiographic findings of basic musculoskeletal ongoing and related disease processes.
2. The learner should be able to discuss the basic evaluation and proper management of patients presenting with problems suggestive of a bone or soft tissue tumor, including the appropriate clinical, laboratory and radiographic work-up.
3. The learner should be able to understand the pathophysiology as a more common encounter bone and soft tissue tumors. This knowledge will enable him/her to properly classify these patients and their problems, properly interpret and analyze the clinical/radiographic and pathologic findings and formulate a diagnostic work-up and treatment plan.
4. The learner should be better able to select and prescribe the appropriate therapies of both benign and malignant bone and soft tissue tumors including chemotherapy, radiation therapy and limb salvage surgical techniques.
5. The learner should be able to judge or measure his/her knowledge by the built in, self evaluation quiz mechanism in a clinical based context that simulates clinical practice.

References are provided, but not all inclusive, but include references utilized by the authors during their preparation of the program and/or references utilized by the authors during their training and references believed by the authors to be useful to students. The content also reflects the input of the many mentors the authors had over the years, whose teaching are reflected in this work, but whom may not be formally acknowledged.

Method: From over 2000 cases performed by the primary surgeon, 200 classic cases were selected. Each case presented at least one unique teaching point that the senior author felt was quite instructive for the orthopaedic learner as well as the pathology and radiology learner. The images were captured with state-of-the-art imaging technology.

Each case presents with a brief clinical history followed by thumbnails of the radiographic and histologic images allowing the user to complete the interactive quiz for the radiologic and the final clinical radiologic histologic diagnosis.

Treatment Discussion: This is provided along with an interpretation of each of the studies, allowing the user to fully assess their knowledge.

Results: The CD-ROM has been utilized by the author at his own institution and residents who have used the program have raved about its ability to prepare them for both clinical practice and for board examinations. It was well received at the Piedmont Orthopaedic Society and presented in his interactive format as well as at other venues.

Conclusion: This interactive educational activity is designed to meet the need of busy practitioners allowing them to review these topics in a concise case based format facilitates retention as opposed to the rather dry encyclopedic format of most musculoskeletal pathology. Interactive nature maintains the clinician's interest. The educational activity is eligible for a maximum of 16.5 hours of Category 1 CME credit as defined on the author's website, Innovativecognition.com from which additional descriptive information as well as potential ordering information is available.

2003 CONGENITAL CLUBFOOT – 52 YEARS EXPERIENCE: STUDIES EMPHASIZING TREATMENT AND OUTCOMES BASED ON SEVERITY RATINGS

J. Leonard Goldner, M.D., Robert D. Fitch, M.D., Duke University Medical Center, Durham, NC

From 1946 to 1952 I used the Kite method for management of idiopathic clubfeet. During that time, clubfeet were separated into idiopathic and teratologic based on both severity and the presence of other systemic deficiencies. The method included: (1) pre-treatment attempts to rate severity; (2) frequent change of above knee plaster casts attempting to diminish forefoot adduction, cavus, hindfoot internal rotation and inversion; malposition of the talus in the ankle mortise, and equinus related to triceps surae contracture and contracture of the posterior tibiotalar calcaneal capsule.

Other pathologic lesions treated were contracture of the posterior tibial, flexor digitorum longus, and flexor hallucis longus muscles. The toe extensors were usually physiologic, the peroneal muscles were frequently weak, and the contracted anterior tibial muscle supinated and adducted the forefoot and secondarily the hindfoot. Lateral up and down radiographs established the degree of static equinus. Social, economic, and logistical reasons, resulted in cast changes every two to four weeks. Maximum improvement from cast treatment was attempted for 6 to 12 months.

A large number of patients were incompletely corrected and better management was necessary. With cast treatment and/or Denis-Browne splints, “rocker bottom” was seen frequently. Those patients who improved temporarily with cast treatment were in the minimal to mild category of severity. About 25% of the entire group of clubfeet that I treated from 1950 through 1955 maintained correction for two years. Half of those

patients, however, recurred and required surgery eventually. Approximately 85% of the referred patients from 1950 through 1960 required progressive surgical treatment to maintain painless weightbearing feet. As progressive surgical management was being developed, the procedures done included heelcord lengthening, posterior release of tibiotalar capsule, lengthening of the posterior tibial, flexor hallucis longus, and flexor digitorum longus tendons as well as arthrotomy of the talonavicular joint. By 1960, the approach was to the posterior, medial, plantar, and lateral aspects of the foot and the four-quadrant release, excluding the subtalar joint and including transfer of the anterior tibial tendon to the dorsum of the first metatarsal, had been developed. In this prospective study, at least 90% of the moderate-severe and severe feet were aligned by removing a wedge from the cuboid bone and adding that to an open osteotomy of the first cuneiform.

During this same period, a severity classification was established: 1-5/60 positional; 5-10/60 minimal; 10-20/60 mild; 20-40/60 moderate; 40/60 severe; 60/60 very severe (teratologic). Of the newborn infants referred, approximately 50% responded to monthly cast changes for six months. These feet were classified as positional or minimal. They occasionally required a heelcord lengthening and posterior tibiotalar capsulotomy.

The remaining feet showed progressive severity and the surgical procedure done was based on severity. In 1968, a prospective study of four-quadrant release was initiated after the feet had been classified according to severity. Those prospective patients (1968-1984) with a 20-35 year outcome (1968-2003) are currently being analyzed. The preliminary results show that patients in the mild and moderate categories, who had progressive surgery, had satisfactory functional and relatively painless feet until they were, at least, 25 years old. Those with severe and very severe feet had intermittent pain during adolescence and subsequently, based on incongruity of articular surfaces between talus and navicular and other tarsal defects with or without musculotendinous imbalance.

We have concluded that surgical treatment, per se, was not the cause of foot pain. Asymmetrical incongruity of talonavicular and tarsometatarsal joints accounted for some degree of discomfort. A “ball and socket” ankle joint occurred in several patients but these feet were not always painful. “Ball and socket” ankle joints frequently developed when the range of talocalcaneal motion was severely limited. The outcomes of similar cohorts were measured. Patients that required triple arthrodesis by the time they were 20 years old were all in the severe and very severe categories. Five percent of the severe cohorts required triple arthrodesis.

Until feet in similar cohorts of severity are compared with each other, the current statistical information related to clubfeet outcome studies are invalid. It is inappropriate to compare the outcome of a mild foot with that of a severe foot.

2003 ACETABULUM FRACTURES: MUSC EXPERIENCE

Langdon A. Hartsock, MD, FACS, Medical University of South Carolina, Charleston, SC

Introduction: Acetabulum fractures (AF) are uncommon injuries. This study documents a single surgeon's experience in a single institution.

Materials and Methods: All AF operative cases of the author from October 1997 to April 2000 were included in this retrospective review of charts, radiographs, and

outpatient records. All patients had pre-operative AP pelvis and Judet radiographs and a CT scan of the pelvis. Fractures were classified according to Letournel. Surgery was performed under general anesthesia with skeletal traction, cell saver, C-arm, and radiolucent table. Fractures were repaired with 3.5mm screws and reconstruction plates. All fractures were treated through Kocher-Langenbeck, ilioinguinal, extended iliofemoral, or combined Kocher-Langenbeck and iliofemoral approaches. Only the extended iliofemoral approach received prophylaxis against heterotopic bone (HO). Post-operatively patients were allowed full range of motion, but stayed touch down weight bearing (WB) for six weeks followed by partial WB for another six weeks. All patients had AP pelvis and Judet radiographs at the end of the procedure, and AP pelvis x-ray and follow-up exam at 6 weeks, 12 weeks, 6 mos, 1 year and 2 years post op.

Results: There were 69 male and 34 female patients (total of 103). The average age was 37 (range 13-85). MVCs were the cause of 65 fractures; 38 occurred from motorcycle accidents, falls, industrial accidents, bicycle and pedestrian accidents. There were 42 elementary fractures and 54 associated fractures. Seven fractures were unclassified. In the elementary group there were 21 posterior wall, 12 transverse, 5 posterior column, and 4 anterior column fractures. In the associated group there were 14 both column fractures, 20 transverse with posterior wall, 11 T-type, 7 posterior column/posterior wall and 2 anterior column/posterior hemitransverse fractures. There were 61 Kocher-Langenbeck approaches, 14 ilioinguinal approaches, 14 combined approaches, and 4 extended iliofemoral approaches. Follow-up on all patients was challenging with 69% at 6 weeks, 52% at 12 weeks, 39% at 6 mos, 20% at 1 year and 12% at 2 years. There were two acute revisions: one for an intraarticular screw and one for a loose bone fragment. There were 5 post-op nerve palsies involving the peroneal nerve. There were no deep infections and 2 superficial infections which required treatment in the OR. There were 2 documented PEs. Four patients had Grade 4 HO and all underwent excision. There were no nonunions and one case of AVN. By 2002, 5.8% of cases had been converted to total hip. The average conversion occurred at 14 mos post op. These included 3 transverse fractures, 1 both column, and 2 posterior wall fractures.

Discussion: The demographics of this series are similar to others reported in the literature. Our series differs from Matta by having more elementary types, fewer extended approaches and more combined approaches. There was a low conversion to THA by 2002. Acetabulum fractures can be successfully treated after careful analysis of the fracture by radiography and CT, expert use of a variety of surgical approaches and reduction strategies, and careful postoperative care.

2003 THE PLACE OF OSTEOTOMY IN THE TREATMENT OF KNEE INSTABILITY, Peter J. Fowler, M.D., University of Western Ontario, London, Ontario, Canada

The goal of HTO in instabilities, arthrosis and cartilage and meniscal saving procedures is to correct or overcorrect the mechanical axis. Pre-operative radiographs include standing hip-to-ankle views to target the weight-bearing axis and lateral views to assess posterior tibial slope. It is important to keep in mind that

increasing the posterior tibial slope will aggravate an ACL deficit, but help a PCL deficit. As well, the location of erosions and wear patterns will vary depending on the knee's stability, whether it is ACL or PCL deficient and on the status of the meniscii. With an intact ACL there is anteromedial arthrosis, while in ACL deficiency posteromedial arthrosis is frequently seen. It is important to tailor the osteotomy to the pathology.

The author's preferred technique of HTO is opening wedge with Puddu plate fixation. The advantages of opening over closing wedge osteotomy are that the proximal tibio-fibular joint and the peroneal nerve are avoided; a two plane (sagittal/ coronal) osteotomy is easier to create and requires one cut only; the osteotomy is made most often at the site of the deformity; it is easier to do small corrections; the anterior compartment of leg not violated; the collateral structures are tensioned and finally, the osteotomy is a stable construct. The main disadvantage is that most often a graft and a longer period of rehabilitation are required.

A clinical and radiographic review of 22 opening wedge high tibial osteotomies in 20 patients with chronic posterior or posterolateral instability was carried out at our centre. Knee stability was significantly improved in 60% of cases, somewhat improved in 35% and unchanged in 5%. All 20 patients would undergo the procedure again. Alignment was altered a mean of 4° valgus and posterior tibial slope was increased a mean of 7°. We concluded that good functional and radiographic results can be achieved with biplanar corrections.

Osteotomy may be combined with soft tissue surgery. However, correction of alignment should be the first order of business and may be the only surgical intervention required. If deemed necessary, soft tissue procedures can be done at a later date. Overcorrection of alignment should not be the goal in patients with instability alone. Osteotomies about the knee can be either femoral or tibial and opening or closing, depending on surgeon preference and experience.