



ABSTRACTS PRESENTED AT THE  
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**MECHANICAL TESTING OF A NOVEL ACL RECONSTRUCTION TECHNIQUE WITH APERTURE FIXATION AND CIRCUMFERENTIAL INGROWTH**, Kyle P. Kokko, MD, PhD, Philip R. Coker, BS, William R. Barfield, PhD, John DesJardins, PhD, Joseph J. Calandra, MD, Medical University of South Carolina, Charleston, South Carolina

**Introduction:** Interference screws are the gold standard for bone-tendon-bone graft (BTB) fixation during ACL reconstruction and are commonly used for soft tissue grafts. This study compares a novel ACL fixation technique and instruments to this standard.

**Methods:** Common bone tunnels were created in 10 immature porcine femurs and tibias. A novel ACL reconstruction technique was used to secure these grafts using a specialized #5 suture. Novel instrumentation guides the creation of transosseous bone tunnels at specific angles and spacing allowing multiple sites of graft fixation. Load to failure testing was conducted using a materials testing system and specially fabricated fixation jigs. The jigs directed the pull force collinear to the bone graft tunnel being tested.

**Results:** The mean failure for the BTB graphs occurred at  $606 \pm 141$  N and  $386 \pm 90$  N for the femur and tibia respectively. The mean failure for the soft tissue graphs were  $482 \pm 83$  N and  $465 \pm 108$  N for the femur and tibia respectively.

**Discussion and Conclusion:** Our results indicate that ACL fixation in an immature porcine model using our novel ACL fixation technique equals or surpasses published ACL fixation strengths using interference screws in human and animal cadaveric models. In addition to the fixation strengths demonstrated herein, the implied benefits of our method include aperture fixation and circumferential healing of the graft (soft tissue or BTB) on both the tibial and femoral side of the ACL reconstruction.

**CONGENITAL PSEUDARTHROSIS OF THE TIBIA: LONG-TERM FOLLOW-UP OF TREATMENT BY A SINGLE SURGEON,** Robert D. Fitch, MD, Nickolaos

Rigopoulos, MD, Tyler Watters, MD, Richard C. Mather III, MD, Duke University Medical Center, Durham, North Carolina

**Background:** Congenital pseudarthrosis is a rare disorder of sporadic incidence. The goal of surgical management is to correct the deformity and to achieve union. This goal can be difficult to achieve and maintain. Amputation is a frequent outcome. The purpose of the present study was to review the outcome of surgical management of congenital pseudarthrosis of the tibia performed by a single surgeon. We analyzed the surgical procedures performed and whether a union was achieved at the final follow-up.

**Methods:** The present study consisted of 15 patients identified with at least 5 years of follow-up. The average follow-up of these patients was 9.2 years (5-26). Mean age at follow-up was 15.6 years. We recorded the number and types of surgical procedures performed. We identified re-fractures or persistent pseudarthrosis and if union was accomplished at final follow-up.

**Results:** 46% of patients had surgery prior to treatment at our institution. The average number of procedures per patient was 3.5 with a range of 0-6. 80% of patients required more than 1 surgical procedure. There was a 93% union rate at final follow-up. 53% of patients had a re-fracture and 88% of those were at a site remote from the original pseudarthrosis. Surgical procedures included a Williams intramedullary rod iliac crest bone grafting in 10 patients, free vascularized fibular graft in 4, circular external fixator in 8, iliac crest bone grafting and plating in 3. No patients required amputation. The final procedure leading to union involved intramedullary rodding and iliac crest bone grafting in 67%.

**Conclusion:** Williams intramedullary rodding with iliac crest bone graft was the work horse in this series in difficult and straightforward cases. Intramedullary rodding encouraged coronal and sagittal alignment and provides long-term internal support. Intramedullary nailing with iliac crest bone grafting is a suitable initial treatment. Re-fractures are frequent and multiple procedures are expected. Ultimate union however can be achieved.

**EFFECT OF IMPLANTATION TYPE ON INSTRUMENTATION FRACTURE RATE IN THORACIC, THORACOLUMBAR AND LUMBAR SPINAL FUSIONS,**

Lloyd A. Hey, MD,MS; Brittany A. Harris, MSPAS, PAC; Jennifer F. Chapman, MMS, PAC; Rachel A. Robinson, MSHS, PAC; Charlotte Rastas; Emily Fulmer, BA, The Hey Clinic, Raleigh, North Carolina

**Summary:** Changing the type of spinal implants used from titanium rods with fixed-head screws to cobalt chrome rods with variable-angle screws, a newer product, was found to have no significant effect on post-surgical implant fracture rates.

**Introduction:** A major complication of spinal fusion surgery involving instrumentation is the fracture of implants, typically requiring revision surgery. This retrospective study of spinal fusion cases compares fracture rates of two types of instrumentation.

**Methods:** The medical records of 210 consecutive adult patients with thoracic, thoracolumbar or lumbar posterior spinal fusions in 2005 and 2008 were reviewed for post-surgical instrumentation fractures. Cases from 2005 involved titanium instrumentation whereas cases from 2008 used cobalt chrome implants. Data was analyzed using a Chi square test.

**Results:** Fracture rates were 2.84% and 4.30% in 2005 and 2008, respectively; the difference between these rates is not statistically significant.

**Conclusion:** There is no significant difference in post-surgical instrumentation fracture rates when comparing titanium and cobalt chrome implants.

**ADDING THORACIC FUSION LEVELS IN LENKE 5 CURVES - RISKS AND BENEFITS,**

Lark RK, Yaszay B, Bastrom T, Newton PO, Duke University Medical Center, Durham, North Carolina

**Summary:** A matched comparison of Lenke type 5 curves demonstrated fusing the thoracic curve resulted in reduced thoracic kyphosis and flexibility with only slightly improved coronal correction.

**Introduction:** The Lenke classification suggests a limited thoracolumbar fusion for type 5 curves, although many experienced AIS surgeons fuse the thoracic curve. The purpose of this study was to determine the risks and potential benefits of non-selective vs. selective fusion in a matched set of Lenke 5 curves.

**Methods:** Prospectively collected cases from a multi-center database were analyzed. Lenke 5 AIS patients were divided into two groups (109 selective: only TL/L curve fused and 41 non-

selective: both TL/L and Th curves fused). Patients were then matched based on pre-op radiographic and clinical measures. Two year post-op radiographic and clinical outcomes were compared utilizing ANOVA with bonferonni correction ( $p < 0.008$ ).

**Results:** Twenty-nine matched pairs (58 pts) of Lenke 5 curves were available. There was no pre-op difference between groups in age, thoracic or lumbar Cobb angle, curve flexibility, thoracic kyphosis, clinical trunk flexibility, or SRS scores. Post-op, patients in the non-selective group exhibited greater coronal correction for thoracic ( $22^\circ$  vs  $12^\circ$ ) and lumbar ( $19^\circ$  vs  $13^\circ$ ) curves. However, the longer fusions had significantly less thoracic kyphosis ( $27^\circ$  vs  $18^\circ$ ), truncal side bending (14 vs 10 cm), and rotational flexibility ( $53^\circ$  vs  $42^\circ$ ). There was no difference in clinical balance or SRS-22 scores.

**Conclusions:** AIS surgeons attempt to achieve balanced correction with the fewest motion segments fused. Our data suggests that fusion of the thoracic curve in primary thoracolumbar scoliosis may improve coronal correction, but at the cost of decreased thoracic kyphosis and clinical flexibility at 2 years post-op.

### **Radiographic Markers of the Hip Joint Until Skeletal Maturity:**

**How Do They Evolve?**, Lark RK, Moor M, Ziebarth K, Tannast M, Hosalkar H, Duke University Medical Center, Durham, North Carolina

**Purpose:** Our understanding of hip joint morphology and its contribution to various hip disorders including impingement has rapidly evolved in the last decade. While continuing to draw information from the adult pelvis and acetabulum, we recognized the distinct lack of information in the skeletally immature. This information is important to bridge the gap and alert the clinician when normal transitions into the abnormal. We hypothesize there exists a predictable gender-based pattern of development of specific radiographic landmarks in the immature pelvis and acetabulum that can help decide the maturity, congruity, version and orientation.

**Methods:** Antero-posterior and frog lateral standardized radiographs of the male and female pelvis were reviewed in one year increments from age one to 16 in otherwise healthy subjects. Specific anatomic landmarks including: sacro-coccygeal (SC) joint, pubic symphysis, cranial lateral

acetabular edge, medial end of sclerotic zone, lowest point of acetabular margin, teardrop, extent of anterior/posterior rims, sphericity of femoral head, and degree of development of the ischial spines, were documented. Data was systematically reviewed to determine the pattern of appearance of these landmarks with respect to chronologic age.

**Results:** Radiographs from 80 males and 80 females ages 1-16 years were reviewed. The SC joint, pubic-symphysis, edges of the acetabulum, and teardrop were easily visualized in all age groups. The iliac spines developed from a subtle bump around age 5, to a more pronounced structure around age 10, and finally took on its adult appearance at age 12 in females and 14 in males. The anterior and posterior wall began to ossify at age 8 in females and age 10 in males. The wall could not be completely visualized until age 10 in females and 12 in males. We have categorized the extent of visualization in different age groups. These were more prominent initially at the superolateral and inferomedial edge of the acetabulum and slowly ossified towards the tri-radiate cartilage. The pattern of development in the femoral head begins as an eccentric sphericity of the capital physis that eventually models into a spherical head neck junction with normal offset around age 10 in both males and females. All landmarks with the exception of the ischial spines were more easily visible on the frog lateral radiographs.

**Conclusions:** Radiographic landmarks related to development in the immature pelvis and acetabuli seem to follow a gender-based predictable pattern. While more radiographic analyses will certainly add power to this study, initial observations will help us better understand the pathoanatomy of hip disorders related to maturity, congruity, version and orientation.

**Significance:** Our study demonstrates the normal radiographic development of the immature pelvis and acetabulum that will be useful in clinicians/researchers understanding of the development of pathologic hip disorders.

**EXTENSOR POLLICIS LONGUS RUPTURES IN DISTAL RADIUS FRACTURES- A CLINICAL AND CADAVERIC STUDY WITH A NEW THERAPEUTIC**

**INTERVENTION**, Gary Lourie, MD, The Hand and Upper Extremity Center of Georgia, Atlanta, Georgia

**Hypothesis:** EPL ruptures have been described with distal radius fractures, treatment usually late reconstruction. This study reviews the characteristic radiographic findings seen along with important physical findings. A cadaveric model is described to explain this clinical scenario along with introduction of a possible new therapeutic intervention that may decrease the morbidity seen.

**Methods:** Radiographs of 19 patients with distal radius fractures and EPL ruptures (established or impending) were reviewed for anatomic findings including location of fracture and presence of intraarticular involvement. A cadaveric model (6 forearms) with a nondisplaced distal radius was created and hypaque dye injected into the fracture site. Pressure measurements were taken from the third dorsal compartment before and after injection. Aspiration was performed with an 18 gauge needle and final pressure measurements recorded. Utilizing this data 4 patients seen with this presentation were confirmed with physical findings and underwent therapeutic aspiration of the third compartment with results assessed.

**Results:** Eleven radiographs were reviewed- all patterns were nondisplaced, usually transverse and within 2.5cm of the radial styloid. Over 50% had intraarticular involvement and in each case (100%) the line exited thru the scapho-lunate facet. In the cadaveric model initial third compartment pressures avg 0.77mmhg, increased to 25.5 mmhg after hypaque injection, and fell to 1.61 mmhg after simulated therapeutic aspiration. Four patients seen with characteristic radiographic findings, along with pain on resisted EPL function underwent prophylactic aspiration just ulnar to Lister's tubercle with complete sustained relief of pain and improvement in EPL function. All aspirations yielded readily available hematoma avg approx 2cc. None went on to rupture.

**Summary Points:**

- 1) Patients seen with nondisplaced extraarticular or intraarticular radius fractures seen within 2.5 cm of the styloid or extension into the scapho-lunate facet should be evaluated for EPL function and pain on resistance.
- 2) If present then the possibility of impending rupture should be discussed.
- 3) Aspiration just ulnar to Lister's tubercle may decompress the unyielding third compartment and protect the EPL from

resulting in rupture and avoidance of need for late reconstruction.

**ILIOLUMBAR FIXATION IN SPINAL SURGERY. A BIOMECHANICAL CADAVERIC STUDY COMPARING MODIFIED ILIAC AND S2 ALAR ILIAC (SAI) SCREW**

**TECHNIQUES**, Chase Corn, MD, Colin Crosby, MD, Jesse Even, MD, Clinton Devin, MD, Gregory Mencio, MD, Vanderbilt, Nashville, Tennessee

**Study Design**: Cadaveric comparison of pull-out strengths of two pelvic fixation techniques used for lumbo-sacral stabilization: "modified" anatomic iliac screws and sacroalar-iliac (SAI) screws.

**Objective**: This study describes and compares the biomechanical strength of two techniques of lumbopelvic fixation that provide low-profile, in-line fixation without the necessity of additional incisions or soft tissue dissection: "modified anatomic" iliac screws as described by Vaccarro et al and S2 alar-iliac screws , as described by Sponseller et al.

**Summary of Background Data**: Ideal pelvic fixation remains a challenge for spine surgeons. Current techniques have been associated with high rates of lumbo-sacral pseudarthrosis, failure of fixation and instrumentation complication (prominence or skin breakdown). Newer techniques have been devised that allow for placement of screws into the ilium across the lumbosacral pivot point to improve biomechanical stability.

**Methods**: Embalmed cadaveric specimens (n=7) were utilized. Standard iliac screws and SAI screws were placed in-situ on opposite sides of each specimen, alternating between right and left for each type of fixation used. The pelvi were then harvested, hemisectioned and potted for biomechanical testing with a servohydraulic machine (MTS 858 Bionox). Loading the screws at a rate of 5 mm/minute, pull out strength (or ultimate load to failure) was then measured in Newtons.

**Results**: Mean pull-out strength for anatomically-referenced iliac screws and SAI screws were 576 N (SD- 185) and 933 N (SD- 440), respectively (see Figure 1). A significant difference was found between the two groups (p=0.026). Construct profile was slightly lower for the SAI screws. There were no significant cortical breaches with either technique. There was no significant difference in fluoroscopy time used for each

fixation technique ( $p > 0.05$ ).

**Conclusions:** In this cadaveric biomechanical study with 14 hemipelvi we showed that the mean pull out strength of iliac screws was 576N and sacral alar-iliac screws was 933N. SAI screws are approximately 60% stronger in pull out strength than iliac screws with no statistical difference in fluoroscopy time, and should be considered for implementation in challenging situation where lumbopelvic fusion is critical.

**MORTALITY AND PERIOPERATIVE COMPLICATIONS AFTER UNICOMPARTMENTAL KNEE ARTHROPLASTY,** Michael J. Morris, M.D., Ryan Molli, D.O., Keith R. Berend, M.D., Adolph V. Lombardi, M.D., Joint Implant Surgeons, New Albany, Ohio

**Background:** Unicompartmental knee arthroplasty (UKA) has been increasingly utilized over the past decade secondary to favorable reports of better range of motion, higher activity levels, and increased patient satisfaction compared with total knee arthroplasty (TKA). The purpose of this study was to determine the mortality and perioperative complication rate for patients undergoing UKA in a high-volume arthroplasty practice.

**Methods:** One thousand consecutive unicompartmental knee arthroplasties (UKA) in eight hundred and twenty-eight patients were retrospectively reviewed. Of these, 967 (96.7%) were medial UKA and 33 (3.3%) were lateral UKA. A retrospective database review of hospital and office charts was performed to evaluate the 90-day perioperative complication and mortality rates. Clinical outcomes on all patients were known for the study period.

**Results:** There were zero deaths during the study period. Twelve percent of the surgeries were complicated by variances within the ninety day postoperative period. There was one deep venous thrombosis (0.1%) and no pulmonary emboli. Cardiovascular complications were infrequent. Three patients had a myocardial infarction (0.31%), one developed congestive heart failure (0.1%), one angina (0.1%), and three had arrhythmias (0.31%). Secondary procedures were performed in fifteen patients during the follow-up period. Seven of these procedures were manipulations under anesthesia for arthrofibrosis, one was an arthroscopic removal of retained cement, one arthroscopic removal of a drain, one repeat wound closure after a dehiscence

secondary to a fall, one open reduction internal fixation for a supracondylar femur fracture, three irrigation and debridement procedures for an aseptic hematoma, and one radical debridement with later successful conversion to a total knee arthroplasty for a periprosthetic infection.

**Conclusion:** This study supports the notion that UKA is a safe procedure that is associated with a low rate of mortality and serious post-operative complications. Comparatively, UKA has less morbidity and mortality to TKA in the ninety day postoperative period.

**Level of Evidence:** Therapeutic Level III.

**THE STABILIZING EFFECT OF THE DISTAL INTEROSSEOUS MEMBRANE ON THE DISTAL RADIOULNAR JOINT IN ULNAR SHORTENING PROCEDURE:**

**A BIOMECHANICAL STUDY,** Sayuri Arimitsu, M.D., Hisao Moritomo, M.D., Takashi Kitamura, M.D., Lawrence J. Berglund, B.S., Kristin D. Zhao, M.A., Kai-Nan An, Ph.D., Marco Rizzo, M.D., Mayo Clinic, Rochester, Minnesota

**Background:** The importance of the stabilizing effect of the distal interosseous membrane (dIOM) on the distal radioulnar joint (DRUJ) has been described, especially in patients with a distal oblique bundle (DOB). The purpose of this study is to evaluate DRUJ stability following ulnar shortening and quantify longitudinal stiffness of ulnar shortening between an osteotomy carried out proximal and distal to the ulnar attachment of dIOM and between forearms with and without a DOB.

**Methods:** Ten fresh frozen cadavers were used. A transverse osteotomy and ulnar shortening as performed proximal (proximal shortening) and distal (distal shortening) to the ulnar attachment of the dIOM. DRUJ laxity was evaluated as the volar and dorsal displacements of the radius relative to the fixed ulna with 20 N of applied force. Testing was performed under controlled shortening at 1 mm intervals to 4 mm in neutral forearm alignment, 60° pronation, and 60° supination. Stiffness of ulnar shortening was quantified as the slope of load-displacement curve obtained by displacing the distal ulnar segment proximally utilizing a vertical uniaxial load frame.

**Results:** In proximal shortening, a significantly greater DRUJ stability was obtained with only 1mm shortening compared with the control, while distal shortening demonstrated significant improvement in DRUJ stability only after 4 mm or more shortening in all rotational positions. A significantly greater DRUJ stability was achieved with proximal shortening compared with distal, and in specimens with DOB versus without DOB. The

longitudinal stiffness of ulnar shortening was significantly greater in proximal shortening than distal. The stiffness in proximal shortening was not affected by the condition of the dIOM with and without DOB.

**Conclusions:** Ulnar shortening with osteotomy carried out proximal to the attachment of the dIOM had a favorable effect on DRUJ stability compared with distal, especially in the condition with a DOB.

**Clinical Relevance:** We found a DRUJ stabilizing effect by increasing tension of the dIOM in ulnar shortening.

**LOCAL PEDICLES OF THE HAND AND DIGITS,** Sigurd Sandzen, MD, Vero Beach, Florida

**Purpose:** Though these techniques include pedicle advances (e.g. Moberg, Kutler, and Attasoy-Kutz-Kleinert procedures) and numerous others, the most readily adaptive are the palmar and dorsal cross finger grafts. Digital joints must be supple and with no evidence of arthritis.

**Methods:** The palmar pedicle may be located thenar, mid-palmar or hypothenar in location, but there should be no stress on the pedicle base. The graft can be completely detached in 12 to 14 days post application, and multiple grafts can be applied simultaneously. These grafts provide excellent resurfacing for any digital tip amputation with exposed bone and are particularly suited to maintain complete functional digital length. The donor site is not resurfaced: both the McCash open method in severe Dupuytren's release in the palm, and drainage of large palmar abscesses have proved this tenet. The dorsal cross finger method pedicle offers greater versatility particularly after flexion contracture release, but the donor site must be resurfaced.

**Results:** Both these grafts offer excellent coverage maintaining complete functional digital length in the appropriate patient and may be preferred in reconstruction.

**Conclusions:** These grafts should be used sparingly both to treat acute injuries and reconstruction.

**Rationale for Continued Minimally Invasive Shoulder Surgery for Impingement Syndrome with Acromioclavicular Arthritis, Biceps Tendonitis, and Rotator Cuff Tear,** John W. Shaffer, M.D.,

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In this retrospective review of 330 patients treated by surgery from January 1, 2005 through December 31, 2010, patients had acromion osteophytes, acromioclavicular arthritis, rotator cuff tears, and biceps tendonitis. Patients in this study were over 40, and findings were linked to aging. Diagnosis was established by history of patient symptoms, physical examination with trigger points, impingement on provocation, and decreased muscle strength. All patients had biplanar shoulder xrays, and MRI imaging.

The surgical method used on all patients was a **mini-open repair** with a 4 to 6 cm incision. The incision was longer if the rotator cuff tear was large or if the patient's chest wall was oversized. The key to the mini-open repair was to avoid injury to deltoid muscle fibers by **deltoid recession**. The deltoid origin from distal clavicle and acromion was recessed using electrosurgery. There was no damage to deltoid muscle fibers, and with closure, the deltoid fascia was repaired anatomically at the end of the procedure. Prolonged immobilization for deltoid healing was not required. There was no adverse effect on shoulder forward flexion or arm elevation. The deltoid recession permitted an excellent view of the AC joint, anterior acromion after coracoacromial ligament release, and an excellent view of the entire rotator cuff and long head of the biceps.

The study dealt with surgery treatment results for patients treated by one surgeon from 1/1/2005 through 12/31/2010. There were **330 patients**: 327 had acromioplasty; 256 had distal clavicle resection; 209 had rotator cuff repair; and 75 had biceps tenodesis. Only two patients saw another physician for long term follow up of the postoperative shoulder: one patient had reverse total shoulder replacement 3 years postoperative; and one patient received a cortisone injection into the postoperative subacromial space 18 months later.

Patients have been very pleased in the postoperative period by their pain relief and their upgraded shoulder function.

Postoperative sequelae numbering 24 included:

Developed AC Symptoms	2 patients
Frozen Shoulder needed manipulation	1 patient

Massive Cuff Retear after Surgery	2 patients
Required Pain Mgt. for pre-existing addiction	1 patient
Developed postoperative biceps tendonitis	4 patients
Postoperative brachial plexitis	1 patient
Persistent weakness after 6 months postoperative	1 patient
Diagnosed massive cuff re-tear with arthritis	1 patient
Repaired Cuff developed arthropathy and needed reverse total shoulder arthroplasty	4 patients
Rotator Cuff tear in a patient treated only with acromioplasty and distal clavicle excision	1 patient
Developed repaired cuff tendonitis 18 months postoperative	1 patient
Frozen shoulder responded without manipulation	2 patients
Needed biceps tenodesis 2 years postoperative	1 patient
Had SLAP lesion requiring repair 14 months postoperative acromioplasty and distal clavicle excision	1 patient
Recurrent shoulder pain 8 months postoperative after acromioplasty improved after additional PT	1 patient

***Minimal invasive shoulder surgery for impingement syndrome has been verified in this series of 330 patients treated by one surgeon from 1/1/2005 to 12/31/2010.***

**ELBOW CONTRACTURE SURGERY: ROUTINE ULNAR NERVE TRANSPOSITION OR NOT?**, Sotereanos DG; Williams BG; Venouziou AI, Baratz ME, Allegheny General Hospital, Pittsburgh, Pennsylvania

**HYPOTHESIS:** Prophylactic release of the ulnar nerve in patients undergoing capsular release for significant loss of elbow flexion has been recommended, although there is limited data to support this claim. Our hypothesis was that more severely limited preoperative flexion and extension would be associated

with a higher incidence of postoperative ulnar nerve symptoms in patients undergoing capsular release.

**METHODS:** A retrospective review of patients undergoing open and arthroscopic elbow capsular release for elbow stiffness between 2003 and 2010 was conducted. The ulnar nerve was decompressed in situ or transposed if the patient had preoperative ulnar nerve symptoms or a positive Tinel's test. Preoperative and postoperative range of motion was measured using a goniometer. The incidence of preoperative and postoperative ulnar nerve symptoms was noted. Statistical analysis was made using a paired *t*-test, with a  $\chi^2$  test for non-parametric data.

**RESULTS:** 164 patients underwent elbow capsular release (45 arthroscopic, 110 open, 9 combined). Mean elbow extension improved from 39.2° to 18.5° ( $p < 0.0001$ ), and mean elbow flexion improved from 110.5° to 126.5° ( $p < 0.011$ ), with a mean improvement in the arc of motion of 36.7°. Perioperative complications included one hematoma and one infection, both of which were treated with surgical debridement. One patient undergoing an ulnar nerve decompression (UND) had a partial transection of the nerve that was repaired, and this patient was excluded from the calculations.

Of the 101 without preoperative ulnar nerve symptoms, 14 underwent UND. None of these 14 patients developed postoperative ulnar nerve symptoms, whereas 7/87 patients (8.1%) who did not undergo UND developed postoperative ulnar nerve symptoms ( $p = .27$ ). Five of these patients with persistent symptoms eventually underwent UND, (three as part of another procedure on the same elbow). Patients without preoperative symptoms had a higher rate of developing postoperative symptoms if they had preoperative flexion  $\leq 100^\circ$  (15.2%) compared to those with preoperative flexion  $> 100^\circ$  (3.6%,  $p = 0.047$ ). There was no association between preoperative extension and postoperative symptoms.

**CONCLUSIONS:** The overall rate of ulnar nerve symptoms following elbow contracture release is low, and only two patients underwent reoperation specifically for UND. Release of the ulnar nerve is indicated in patients with preoperative ulnar nerve symptoms or a positive Tinel's test. There was a higher rate of ulnar nerve symptoms in patients with more severe contractures ( $\leq 100$  degrees of preoperative flexion), and

prophylactic decompression of the ulnar nerve may be indicated in these patients.

**GRAFT SIZE AND PATIENT AGE ARE PREDICTORS OF EARLY REVISION FOLLOWING ACL RECONSTRUCTION WITH HAMSTRING AUTOGRAFT**, Robert A.

Magnussen, John Todd Lawrence, Ryenn L. West, Alison P. Toth, Dean C. Taylor, William E. Garrett, Duke University Medical Center, Durham, North Carolina

**Introduction:** Hamstring autografts are frequently used for successful anterior cruciate ligament reconstruction. Commonly used 4-strand grafts average about 8 mm in diameter but significant variation among patients has been noted. The ultimate failure load of smaller grafts is lower in biomechanical studies. Failure rates for ACL reconstruction are between 5 and 20% in most series and may be higher in younger patient populations. We hypothesize that decreased hamstring autograft size and decreased patient age are predictors of early graft failure and revision.

**Methods:** Two hundred fifty-six of 338 consecutive patients (75.7%) undergoing primary ACL reconstruction with hamstring autograft were retrospectively evaluated. Graft size, patient sex, and patient age at the time of ACL reconstruction were recorded from medical records along with whether each patient underwent revision ACL reconstruction during the follow-up period.

**Results:** The 256 patients included 136 males (53.1%) and ranged in age from 11 to 52 years (mean, 25.0 years). Average follow-up was 14 months (range, 6 to 47 months). Revision ACL reconstruction was required in 18 of 256 patients (7.0%) at a mean of 12 months following surgery (range, 3 to 31 months). Revision was required in 1 of 58 patients (1.7%) with grafts greater than 8mm in diameter, 9 of 139 patients (6.5%) with 7.5 or 8 mm grafts, and 8 of 59 patients (13.6%) with grafts 7 mm or less in diameter ( $p = 0.049$ ). One revision was required in the 137 patients age 20 and older (0.7%), but 17 revisions were required in the 119 patients under 20 (14.3%) ( $p < 0.0001$ ). Most failures (16 of 18) were noted to occur in patients under age 20 with grafts 8mm in diameter or less. The revision rate in this population was 16.4% (16 of 97 patients). Multiple logistical regression revealed decreased age at reconstruction ( $OR = 1.25$ ;

95% CI = 1.07-1.45; p = 0.004) and decreased graft size (OR = 2.35; 95% CI = 1.07-5.14; p = 0.032) to be associated with significantly increased risk of revision. Female gender was not an independent predictor of graft failure when patient age and graft size were taken into account (OR = 1.40; 95% CI = 0.48-4.04; p = 0.53).

**Conclusions:** Decreased hamstring autograft size and decreased patient age are predictors of early graft failure and revision. Use of hamstring autografts 8mm in diameter or less in patients under age 20 is associated with a relatively high early revision rate.

**REPORT OF THE PIEDMONT ORTHOPAEDIC SOCIETY SCIENTIFIC COMMITTEE,**

David C. Urquia, M.D., Augusta Orthopaedic Associates, Augusta, Maine

Summary data of two on-line national surveys of Duke University Orthopaedic faculty and alumni was presented.

The Survey #1 topics involved issues of professionalism in emergency musculoskeletal medicine (E.D.), with 132 respondents.

The Survey #2 topic was an analysis of advanced radiology in Emergency Department setting for traumatic and non-traumatic musculoskeletal conditions, with 91 respondents.

Majority opinions from these surveys included the following :

76% of respondents felt there was still an obligation for E.D. coverage by all Orthopaedic Surgeons, although 80% would drop their E.D. coverage if given the option.

61% of respondents believe it ethical to have contractual relationships with commercial medical vendors

Other topics dealt with ethical issues involved in the transfer or acceptance of E.D. patients, and the perception of new professional attitudes among Resident surgeons in training towards E.D. and unassigned general patients.

The majority of respondents felt there is an excessive ordering of CT and MRI scans in the E.D. for routine musculoskeletal conditions.

A significant percentage of the respondents were unaware of the recommended diagnostic protocols for screening potential spine trauma patients in the E.D.

**NAVIGATED PLACEMENT OF ILIAC BOLTS: DESCRIPTION OF A NEW TECHNIQUE,** Ken E Wood, MD, Ben J Garrido, MD, Lake Norman

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**BACKGROUND CONTEXT:** Image-navigation has improved the safety and ability to perform complex spinal procedures where visibility is not optimal or anatomical deformity is present. Numerous published studies have demonstrated its effectiveness in improved pedicle screw placement in complex multiplanar deformities. Studies have also demonstrated image-navigation technology versatility; however, stabilization of the lumbo-pelvic junction with navigated iliac bolt fixation has not been reported.

**PURPOSE:** To describe an innovative, versatile application of image-navigation technology in spine surgery. We examine the safety, accuracy and effectiveness of navigated iliac bolt placement while minimizing challenges associated with current techniques.

**STUDY DESIGN:** Case series.

**METHODS:** Five patients requiring lumbo-pelvic fixation have undergone navigated iliac bolt placement using Medtronic Stealth Station Treon (Medtronic Inc., Littleton, MA, USA) in conjunction with the O-ARM (Medtronic Inc.) (Medtronic O-Arm). A right percutaneous posterior superior iliac spine (PSIS) reference frame was placed at the superior, lateral margin of the PSIS and bilateral iliac bolts were placed using both the anatomic and traditional surgical techniques. Indications have included revision lumbosacral pseudoarthrosis cases, lumbopelvic fixation for sacral U-type fractures and degenerative deformity multilevel fusions. Post-placement, intra-operative imaging CT with the O-ARM was obtained to confirm position of the iliac bolts.

**RESULTS:** Ten iliac bolts were successfully placed in five patients. Intra-operative CT demonstrated ideal iliac bolt-bone placement projecting within 2 cm of the sciatic notch, between pelvic tables. With image-navigation, both anatomic and traditional iliac bolt placement techniques were performed with less surgical exposure, no radiation exposure and complete accuracy using image-navigation technique with a percutaneous reference frame. The percutaneous reference frame placed in the superior, lateral PSIS did not cause any interference with our navigated trajectory or bolt placement.

**CONCLUSIONS:** Image-navigated iliac fixation allows for safe and accurate placement of bilateral iliac bolts without PSIS percutaneous reference frame interference. Image guidance eliminates fluoroscopic radiation exposure, extensive soft tissue dissection and facilitates both traditional and anatomic iliac bolt placement techniques.

**KEY WORDS:** Image guidance, navigation, lumbo-pelvic fixation, computed-assisted surgery.