



2011 Annual Meeting of the American Academy of Orthopaedic Surgeons

Selected Abstracts by Residents at the University of Pennsylvania

February 15-19, 2011

San Diego, California



PAPER NO. 279

Recurrent Median Nerve Neurectomy in Prevention of Intrinsic Spastic Thumb-in-Palm Deformity

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The goal of this study was to investigate the efficacy of recurrent median nerve neurectomy, done at the time of superficialis-to-profundus (STP) tendon transfer in concert with an ulnar motor nerve neurectomy, in the prevention of an intrinsic thumb-in-palm (TIP) deformity caused by spastic thenar muscles. We retrospectively evaluated a consecutive series of 23 patients, with upper motor neuron syndrome, who underwent a STP transfer performed by a single surgeon at our institution. Group I included 11 consecutive patients who underwent an STP, ulnar nerve motor branch neurectomy and wrist arthrodesis. Group II included 12 consecutive patients who underwent the same procedures with the addition of a neurectomy of the recurrent median nerve. We examined outcomes including development of a post-operative intrinsic TIP deformity, resolution of hygiene issues and the need for additional surgery to correct the remaining deformities. Patients were followed for an average of 16.1 months. In Group I, 45.5% developed an intrinsic TIP deformity compared to 16.7% in Group II. Hygiene related issues resolved in 72.7% of patients in Group I and 83.3% of patients in Group II. In the seven patients with post-operative intrinsic TIP deformity (five in Group I and two in Group II), five elected to have additional surgery. Two of the seven patients declined additional surgery because their deformities were mild and their hygiene issues had resolved. Recurrent median nerve neurectomy appears a useful adjunct to STP with ulnar motor branch neurectomy and wrist fusion in the prevention of an intrinsic TIP deformity in the non-functional hand.

PAPER NO. 285

Immobilization in Supination Following Surgical Treatment of Galeazzi Fractures: Is it Necessary?

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The goal of this study was to investigate whether immobilization in supination is necessary to prevent recurrent distal radio-ulnar joint (DRUJ) instability in patients with Galeazzi fracture-dislocations whose DRUJ stabilizes immediately following operative fixation of the radius. We performed a retrospective chart review of 13 consecutive patients who were immobilized in either supination or a neutral position following surgical treatment of a Galeazzi fracture-dislocation in which the DRUJ was noted to be

stable immediately after fixation of the radius. Group I consisted of seven patients who were immobilized in supination for a period of four weeks, while Group II, six patients immobilized in neutral for two weeks. Patients were followed for an average of 18 weeks post-operatively. No significant difference was noted between the two groups with respect to age, medical co-morbidities, hand dominance or worker's compensation status. None of the patients in either group demonstrated DRUJ instability during the follow up period or required additional surgeries. At final follow up, patients in the two groups had comparable forearm pronation and supination ($p=0.93$). This study demonstrates that there is no clear benefit from immobilizing patients in supination for Galeazzi fracture-dislocations who demonstrate a stable DRUJ following operative fixation of the radius. Limited immobilization for two weeks in neutral does not appear to predispose these patients to post-op DRUJ instability.

PAPER NO. 453

Level of Evidence of Presentations at American Academy of Orthopaedic Surgery Annual Meetings

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The American Academy of Orthopaedic Surgery (AAOS) Annual Meeting is a major international forum for scientific exchange and education. The AAOS Program Committee works continuously to improve the scientific quality of material presented at this meeting each year. One measure of quality is the level of evidence on which each study is based. The purpose of this study is to evaluate the level of evidence of papers and posters presented at the 2004, 2007 and 2010 AAOS Annual Meetings. Abstracts obtained from the AAOS Annual Meeting Proceedings from 2004 (290 papers and 466 posters), 2007 (525 papers and 541 posters) and 2010 (720 papers and 569 posters) were analyzed by three reviewers. The level of evidence of each presentation was determined based on the evaluation system adopted by the AAOS. The results were subdivided according to orthopaedic subspecialty and type of presentation (paper vs. poster). With each successive year, there was a substantial increase in the percentage of Level I studies (2.9% in 2004, 5.1% in 2007, 7.2% in 2010), Level II studies (18% in 2004, 23% in 2007, 29% in 2010) and Level III studies (26% in 2004, 29% in 2007, 33% in 2010), with a concomitant decrease in the percentage of Level IV studies (54% in 2004, 43% in 2007, 31% in 2010). These trends were consistent across all orthopaedic subspecialties and in both the paper and poster subgroups. In 2010, Level I studies comprised 8.8% of papers and 5.2% of posters and Level II studies comprised 31% of papers and 26% of posters. Among subspecialty categories in 2010, Hand and Wrist had the

largest percentage of Level I studies (9.7%) and Foot and Ankle had the smallest percentage of Level I studies (4.5%). The level of evidence of studies presented at the AAOS Annual Meeting is steadily increasing - a mark of continual improvement in the quality of the scientific program.

PAPER NO. 627

Tendon Lengthenings in Spastic Hemiparetics with Intact Motor Control and Shoulder Contractures

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Patients with spastic hemiparesis after upper motor neuron (UMN) injury often exhibit limited active shoulder movement. Limitation in movement is secondary to tendon contractures, abnormal patterns of muscle activation and spasticity. Limited movement interferes with active and passive functions and is often painful. We evaluated outcomes of shoulder tendon lengthenings in patients with spasticity and some preservation of volitional control. A consecutive series of adults with spastic hemiparesis from UMN injury (23 post-stroke and 11 post-traumatic brain injury) and limited active and passive shoulder movement with preserved volitional motor control who underwent shoulder tendon lengthenings were evaluated. Active function, passive motion, spasticity, pain and satisfaction were considered pre- and post-operatively. There were 15 males and 19 females with a mean age of 44.1 years. Mean follow up was 12.2 months. Twenty-seven (87%) patients noted improved active motor control at follow up. The mean Modified Ashworth spasticity score was 2.4 preoperatively compared to 1.9 postoperatively ($p = 0.001$). After surgery, passive extension, flexion, abduction and external rotation improved from 65%, 47%, 54% and 32% to 89%, 73%, 69% and 64%, respectively compared to the normal contralateral side ($p < 0.01$). Ninety-four percent (15/16) of patients with preoperative pain had improved pain relief postoperatively with 14 (88%) being pain-free. Thirty-one (92%) were satisfied with the outcome of surgery. Shoulder tendon lengthenings to relieve contractures can be an effective means of pain relief, improved motion, enhanced active motor control and decreased spasticity in patients with spastic hemiparesis from UMN injury.

PAPER NO. 613

Comparison of Synthetic Osteochondral Grafting and Remplissage for Engaging Hill Sachs Lesions

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This study compares outcomes between patients who underwent either arthroscopic synthetic osteochondral substitute grafting or Remplissage procedure for recurrent shoulder instability with an engaging Hill Sachs lesion. We reviewed consecutive patients

who underwent the Remplissage procedure ($n = 20$) or synthetic osteochondral implantation ($n = 19$) by the senior author. All patients had 'engaging' Hill Sachs lesions with or without the presence of an 'inverted pear' glenoid. Patient centered outcomes and recurrence rates were reviewed. Twenty patients were treated with the Remplissage procedure, and 19 were treated with synthetic grafting. Average follow up was 24 months (range nine to 45 months). There were three post-operative recurrences in the Remplissage group, and six in the graft group ($p = 0.18$). Nineteen Remplissage patients had moderate to severe Hill Sachs defects (larger than 2 cm long/0.3 cm deep) compared to seven patients in the grafting group. Average Western Ontario Shoulder Instability (WOSI) score for the Remplissage group was 75.5, and 65.5 for osteochondral graft group ($p = 0.192$). Although not statistically significant, the Remplissage patient group outscored the graft patient group when matched for larger lesions (WOSI score 74.7 vs 50.4, $p = 0.08$). Controlling for age, gender, lesion size and difference in follow up, we found that the Remplissage group reported significantly better WOSI scores ($p = 0.016$). This study demonstrates potential advantages of the Remplissage technique in both rate of recurrence and functional outcome scores when compared to the osteochondral synthetic grafting technique in patients with recurrent anterior shoulder instability, in the presence of a humeral head defect. No significant range of motion deficits were noted with Remplissage.

POSTER NO. P122

Porous Tantalum Patellar Components in Revision Total Knee Arthroplasty: Minimum 5-Year Follow-Up

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Revision total knee arthroplasty (TKA) can be complicated by severe patellar bone loss, which makes the use of standard cemented patellar components unfeasible. Porous tantalum (PT) patellar components have been designed to allow patellar resurfacing in this setting. The purpose of this study is to evaluate the mid-term outcomes of porous tantalum patellar components used in revision total knee arthroplasty. We reviewed 23 revision TKAs in which a PT component was used to resurface the residual patella due to bone loss. There were six males and 17 females (average age 61.9 years). The PT shell was secured to host bone/tissue using non-absorbable sutures, and a three-peg polyethylene component was cemented onto the shell. Outcomes were measured using the Knee Society and Oxford knee scores. Radiographs were evaluated for component loosening. All patients were followed for a minimum of five years with an average follow up of 7.7 years (range 5.0 - 10.1 years). At last follow up, the Knee Society scores for pain and function averaged 82.7 and 33.3 respectively, while the mean Oxford knee score was 32.6. Mild to no anterior knee pain was reported in 67% of patients, moderate pain in 22% and severe pain in 11%. Four patients underwent revision surgery

(two loosening, one fracture, one infection). Aseptic failures were associated with avascular patellar bone and failure of ingrowth when the PT shell was fixed to soft tissue alone. Survivorship at an average of 92 months was 82.6%. Porous tantalum patellar components can be good alternatives in cases where patellar bone loss precludes the use of a traditional component. Failures in this series were associated with severely thinned and/or avascular patellar bone that did not provide ingrowth into the porous tantalum. In these situations, other options for patellar management should be considered.

POSTER NO. P276

Surgical Treatment of Painful Glenohumeral Subluxation in Hemiparetic Patients: Biceps Suspension

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Patients with upper motor neuron (UMN) injury can suffer painful inferior glenohumeral subluxation. If a patient's symptoms are relieved by manual reduction of the subluxation, the pain is considered mechanical and potentially amenable to surgical reduction. The purpose of this study was to describe our surgical technique and to report outcomes of the biceps suspension procedure for achieving joint reduction and relieving pain. This was a retrospective case series of 11 consecutive hemiplegic patients with painful glenohumeral subluxation who underwent surgical reduction with a biceps suspension procedure. Seven patients additionally underwent a shoulder release for contractures. Preoperative and postoperative variables included assessment of pain, physical examination, radiographs and satisfaction. Mean follow up was 3.2 years (2.0-5.8). Average age was 46.9 years. All patients had pain with passive range for motion (ROM) preoperatively compared to only one patient postoperatively ($p < 0.001$). Mean postoperative VAS for pain was 1.45, and all had improved pain postoperatively. All patients had a sulcus sign preoperatively compared to three patients postoperatively ($p < 0.001$). When analyzing the seven patients who underwent a shoulder release, there were improvements in extension ($p = 0.009$), flexion ($p = 0.030$), abduction ($p = 0.040$) and external rotation ($p = 0.043$). Ten patients were satisfied with the surgical outcome. Postoperatively, 10 patients had improved glenohumeral position and nine had complete reduction. Biceps suspension can provide pain relief in patients with painful shoulder subluxation after UMN injury. Shoulder release can improve passive ROM in patients with spasticity.

PAPER NO. 325

Performance after ACL Reconstruction in Womens National Basketball Association Athletes

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Anterior cruciate ligament (ACL) tears are more common in female compared to male athletes. Performance outcomes and attrition rates associated with this injury/surgery in Women's

National Basketball Association (WNBA) athletes are unclear. The purpose of this study was to compare athletes who underwent ACL reconstruction with preinjury and with matched controls to determine differences in performance. A retrospective review of 18 WNBA players who underwent ACL reconstruction between 1998 and 2008 was conducted. Performance data for two seasons preceding and following the index surgery were collected. Data were obtained from 36 matched controls. Within-group and between-group comparisons were performed to assess significance of changes in athletic performance between the pre- and post-index seasons, and the odds ratio of return to play following surgery. Twenty-two percent (4 of 18) of WNBA athletes who underwent ACL reconstruction never returned to play in the WNBA. Within-group comparisons revealed that shooting percentage ($p = 0.04$) and steals per 40 minutes of play ($p = 0.03$) were reduced postoperatively. No other performance variables were significantly different in absolute terms or per 40 minutes of play. Changes in these performance variables from the pre-index to post-index seasons were not significantly different from those of the control group. Cases had lower odds of remaining in the WNBA after the index year when compared to controls (OR 0.7, $p = 0.72$). After ACL reconstruction, 22% of athletes did not return to a sanctioned game. For those returning, performance decreased in several categories, although the changes were not statistically significant relative to the comparison group.

POSTER NO. P308

Shoulder Tenotomies To Improve Motion And Relieve Pain In Patients With Spastic Hemiparesis

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Patients with spastic hemiparesis after upper motor neuron (UMN) injury commonly develop shoulder adduction and internal rotation contractures. The contractures are often painful, cause skin maceration, impair axillary hygiene and predispose to spiral fractures of the humerus. The purpose of this study was to evaluate outcome of shoulder tenotomies in treating spastic contractures in patients who do not have active motor function. A consecutive series of adults with spastic hemiparesis from UMN injury, shoulder adduction and internal rotation contractures and no active movement, who underwent shoulder tenotomies, were evaluated. Pain, passive motion and satisfaction were considered pre- and post-operatively. There were 10 males and 26 females with an average age of 52 years at the time of surgery. Average follow up was 14.3 months. Preoperatively, all patients had limited passive motion which interfered with passive functions. Nineteen patients had pain. After surgery, passive extension, flexion, abduction and external rotation improved from 50%, 27%, 27% and 1% to 85%, 70%, 66% and 56%, respectively compared to the normal contralateral side ($p < 0.001$). All patients with preoperative pain had improved pain relief at follow up with 18 (95%) being pain

free. Thirty-five (97%) were satisfied with the outcome of surgery. Age, gender, etiology and chronicity of UMN injury were not associated with improvement in motion. Shoulder tenotomy to relieve spastic contractures resulting from UMN injury can be an effective means of pain relief and improved passive range of motion in patients with no active motor function.

PAPER NO. 726

IVC Filter Placement in Orthopaedic Trauma Patients: Clinical Judgement or Clinical Guidelines?

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Indications for inferior vena cava (IVC) filter placement in polytrauma patients are debated and often performed via clinical management guidelines (CMG). The goals of our study were to determine how often CMG were followed versus how often clinical judgement (CJ) was used, to determine the effectiveness of each method, and to define factors leading to filter placement outside of CMG. A retrospective review of our institution's trauma database of blunt orthopaedic trauma patients admitted from 1997 to 2007 was performed. CMG dictates very high risk patients receive IVC filters. CMG IVC filter patients were compared to CJ IVC filters and control subjects. Data were analyzed by univariate and multivariate statistics. The overall prevalence of thromboembolic disease in 4,279 blunt trauma patients was 6.8%. A total of 603 received IVC filters. Some 47.5% of patients had IVC filters placed via CMG versus 52.5% by CJ. The prevalence of thromboembolism in CMG patients was 28.6%, compared to 52.4% in CJ patients. The sensitivity of CMG for patients at risk was 25.2%, and the specificity was 95.4%, compared to 68.3% and 96.5% for CJ. Older age ($p < 0.001$) and higher injury severity ($p < 0.001$) were risk factors for receiving an IVC filter by CJ. Over 50% of patients receiving filters did not meet CMG criteria. Patients who received IVC filters via CJ had significantly higher risk of thromboembolic disease. In addition, CJ provided a substantial adjunct to CMG. Even in the setting of CMG, clinicians should exercise experience and judgement in IVC filter placement after blunt orthopaedic trauma.

POSTER NO. P464

Locked Plating versus Intramedullary Nailing of Periprosthetic Femur Fractures after TKA

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Periprosthetic femur fractures after total knee arthroplasty (TKA) are an ever-growing challenge. Previous series compared intramedullary fixation with conventional plating, revealing no significant differences in outcomes. Improved plating technologies have since developed. This series compares

locked plating to intramedullary fixation in these fractures. A multi-center retrospective review of 68 post-TKA periprosthetic fractures was conducted. Inclusion criteria included intramedullary device or locked plate treatment with complete radiographic and clinical records. Exclusion criteria included conventional plating or incomplete records. Need for revision, time to weightbearing and union time were assessed. Radiographic union rates between the groups were compared at six, 12, 24 and 36 weeks postoperatively using Fisher's exact test. Locked plating patients had longer operative times (161 minutes vs. 111 minutes; $p = 0.01$) and greater need for blood transfusion ($p < 0.01$). At 24 weeks post-operatively, locked plating showed a greater percentage of radiographically united patients (24/28; 85.7%) than intramedullary nailing (25/40; 62.5%) ($p = 0.05$). This difference was even more pronounced at 36 weeks postoperatively (26/28; 92.9% vs 26/40; 65%) ($p < 0.01$). Mean time to full weightbearing was similar for both groups (11.6 weeks vs. 10.9 weeks). Intramedullary nail treatment trended towards increased revision rates compared to locking plates (18 vs 6; $p = 0.07$). Patients treated with locked plating had a greater rate of union and less need for revision surgery than patients managed with an intramedullary device in periprosthetic femur fractures after TKA. Consideration needs to be given to modern plating techniques in this increasingly prevalent injury pattern.

POSTER NO. P518 ALTERNATE PAPER

Outcomes Of Arthroscopic Release After Proximal Humerus Fixation

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Pre-contoured locked plating of proximal humerus fracture is commonly used in treating proximal humerus fractures. Biomechanically, the treatment allows early mobilization. However, post-traumatic stiffness and functional disability remains problematic. Forty-three patients were treated with plating of humerus fractures by a single surgeon over a three-year period. Surgical and demographic factors associated with post-fixation adhesive capsulitis were assessed. When indicated, patients underwent a circumferential arthroscopic capsular release. Pre and post release function, range of motion and functional outcome were assessed. Nine patients underwent an arthroscopic shoulder release after fixation with a locked, pre-contoured plate with a mean follow up of 35 months (11-59) after surgical release. The mean patient age was 56 (24-79). The mean time from fixation to contracture release was 257 days (100- 602). Mean patient follow up from date of fracture to final follow up was 34.9 months (11-59), with an average follow of 32 months (five-55) after capsular release. The predominant factor associated with need for contracture release was female gender (seven of nine patients). There were no cases of avascular necrosis and one case of varus malreduction in the entire cohort. Prior to arthroscopic release, mean forward elevation (FE), abduction and external rotation (ER) was 111°, 78° and 32° respectively. At final follow up, after

CR, mean FE, abduction and ER increased by 43° ($P < 0.001$), 28° ($P < 0.05$) and 29° ($p < 0.01$) respectively. The mean DASH score at final follow up was 23. Arthroscopic capsular release reliably improves the range of motion after locked plating of proximal humerus fractures.

PAPER NO. 219

Economic Analysis of Surgical Pelvic and Acetabular Fracture Treatment at a Level 1 Trauma Center

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Surgical treatment of pelvic/acetabular fractures may be financially beneficial to a health system. However, hospital charges and collections likely surpass those of the orthopaedic trauma surgeon responsible for managing the injury. A retrospective review was performed of all operatively managed pelvic and acetabular injuries over two years in a health system that did not provide this service previously. Hospital contribution margin (CM) and profit were calculated. Factors impacting CM and profit were analyzed. Metrics were compared to other surgical services within the health system. Hospital charges and collections were compared to the orthopaedic surgeon's charges and collections. Sixty-five patients were included. The average hospital CM for surgical pelvic/acetabular patients was +\$18,188/patient, greater than the majority of surgical services. However, calculated hospital profit was -\$14,279/patient. The length of stay and indirect costs were highest in the pelvic/acetabular surgical patients, which negatively affected calculated profit. Shorter length of stay and worker's compensation insurance significantly increased hospital profits, while higher diagnosis related group (DRG) and Medicare severity diagnosis related groups (MSDRG) weights (measures of patient illness/injury severity) significantly increased CM. Hospital charges/collections far outweighed orthopaedic surgeon professional fee charges/collections (50 fold and 30 fold, respectively). Surgically managing pelvic/acetabular injuries can have a profound impact on CM for a hospital. The hospital collections for the treatment of these patients are in excess of the direct costs by \$18,188/patient; therefore the hospital does benefit significantly. Indirect costs, which the surgeon has no con-

trol over and are somewhat arbitrarily set, are high in this population. Hospital charges/collections far outweigh the surgeon's. When advocating for the necessary resources to treat pelvic/acetabular fractures, surgeons should be aware of the hospital's financial position.

POSTER NO. P173

Total Knee Arthroplasty in Patients Under Forty: A Cautionary Tale

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In recent years, advancements in prosthesis design and materials have promised increased longevity of knee implants. Furthermore, while there has also been a trend towards offering total knee arthroplasty (TKA) in younger, more active individuals with knee arthrosis, data regarding outcomes in these very patients is limited. The purpose of this study was to evaluate the outcomes of modern primary cemented total knee arthroplasty in patients younger than 40 years of age. Between 2002 and 2005, 23 patients (30 knees) younger than 40 years of age underwent total knee arthroplasty at our institution. There were 13 men and 10 women with an average age of 32.1 years. The etiology was osteoarthritis/post-traumatic in 13 (57%), avascular necrosis in four, hemophilic arthropathy in four, juvenile rheumatoid arthritis in one and septic arthritis in one. All knees were performed with cruciate-substituting, cemented implants. Clinical outcomes were evaluated using the Oxford knee scores, and radiographs were reviewed for signs of loosening. All patients were followed for a minimum of two years. The mean follow up was 4.8 years. At last follow up, the mean Oxford knee score was 34.2 (19- 48). Seven knees (23%) in six patients required revision: three knees for infection (10%), two knees for aseptic loosening (7%), one knee for patellar instability (3%) and one knee for periprosthetic fracture (3%). The five-year survivorship for patients with TKA under age 40 was 77%. Our results show increased complications and failure rate after total knee arthroplasty in this patient population. Implant survivorship in this series is lower compared to previously published series for primary total knee arthroplasty under the age of 55. Patients undergoing total knee arthroplasty under the age of 40 should be cautioned of the higher risk of failure and complications.