

MAOA THIRD PLENARY SESSION
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94. Open Fractures and Dislocations of the Talus

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Open fractures and dislocations of the talus are severe injuries which have a high incidence of infection. Some investigators have suggested that partial or total excision of the talus in such cases may decrease the incidence of infection. The purpose of this study was to compare the incidence of infection in open talar fractures and dislocations treated with preservation of the talus to those treated with partial or total talectomy.

A retrospective review was undertaken of open fractures and dislocations of the talus between November 1999 and October 2003. Twenty-four open talar fractures and three open talar dislocations were identified. There were 12 male patients and 15 female patients. Twenty-three injuries were caused by motor vehicle accidents, two by motorcycle accidents, one from a jump from a building, and one from a high velocity gunshot wound. Twelve were Gustilo Type II, 5 were Gustilo Type IIIA, and 10 were Gustilo Type IIIB open injuries. Three-quarters of the fractures were comminuted. Twenty-three (85%) patients had additional injuries. Twenty-four patients were treated initially with internal fixation, two with partial talectomy, and one with complete talectomy. The three patients treated with the partial or total talectomy were all Type III open injuries. Three patients required skin grafts, and three required flaps for closure.

Deep infection occurred in 4 of 27 (15%) patients. All infections were in Type III open injuries treated with internal fixation (4 of 12 or 33%). One of 3 open dislocations and 3 of 24 open fractures became infected. Two of the ten patients with Type IIIB fractures required below knee amputation. One deep infection was treated with delayed talectomy and long-term antibiotics, and one was treated with antibiotics alone. No infection occurred in the three Type III open injuries treated with partial or total talectomy.

Although the number of partial and total talar excisions was small, the data suggest that strong consideration should be given to primary partial or total talectomy in patients with Type IIIB open talar injuries, to reduce the incidence of infection and amputation.

95. Contralateral Meniscus MRI Better Predicts Needed Meniscal Allograft Size than Recipient Tibial X-Ray

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INTRODUCTION: Currently, the needed size of a meniscus for meniscal-allograft-transplantation (MAT) is estimated from recipient tibial plateau radiographs. We have found this method to be frequently inaccurate, often overestimating the needed size, with low inter-observer reliability. In arthritic knees, transplanted menisci usually fail by extrusion: as if oversized. MRI measurement of a patient's contralateral intact meniscus offers a potentially more accurate method to determine ipsilateral meniscal size. This has not been adopted as a sizing method because (1) menisci have been assumed to be bilaterally asymmetric and (2) MRI has been reported to be inaccurate. We hypothesized that (1) menisci are bilaterally symmetric, (2) MRI is accurate, (3) the radiographic method is not consistently accurate, and (4) MRI measurement of the contralateral intact meniscus should be a more consistently accurate method.

METHODS:

Part I. Symmetry: we obtained meniscal size data for 500 left/right pairs of cadaveric knees from Allosource Tissue Bank and calculated the size difference between menisci for each pair.

Part II. Sizing: menisci in ten intact cadaveric knees were measured directly and with MRI. Tibial plateau radiographs were measured to predict the meniscal size.

RESULTS:

Part I: 97% of the menisci had sagittal and frontal dimensions that were within 3 mm of the contralateral meniscus.

Part II: MRI predicted actual meniscal size within 5%, versus 14.5% for radiographs ($p=0.019$).

CONCLUSIONS: MRI measurement of the contralateral meniscus, if intact, better predicts needed meniscal size than radiographs of the recipient tibial plateau. Better sizing may improve MAT results in arthritic knees.

96. Acetabular Outcome Following Hip Hemiarthroplasty in Tumor Patients – Medium to Long-Term Follow-Up

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INTRODUCTION: Hip hemiarthroplasty types are routinely performed on tumor patients with either primary or metastatic disease. Though most patients' hips do well in the short-term, the medium and long-term effects of the prosthesis on the native acetabulum are not known. The purpose of this study is to investigate the clinical and radiographic outcome of the acetabulum following hemiarthroplasty.

METHODS: Our Orthopaedic Oncology database was reviewed to find all adult tumor patients treated with a hemiarthroplasty. The medical records and radiographs of patients with five-year follow-up were reviewed to determine the presence of groin pain, need for pain medication, incidence of further surgical procedures, and migration of the hemiarthroplasty femoral head.

RESULTS: Four hundred ninety-three hemiarthroplasties were performed at our institution for primary or metastatic tumors since 1972. Six hips were converted to a total hip arthroplasty. The subset with five-year follow-up contained 32 patients with a mean age of 43 years and a mean follow up of 11.1 years. Average proximal and medial migration was 3 mm and 2 mm, respectively. Only one patient required occasional hydrocodone. No conversions to a THA were required in this subset of patients.

DISCUSSION: The overall conversion to a THA in the tumor population is quite low. Even patients with medium to long-term follow-up have little or no pain and minimal radiographic changes. Concern over the outcome of the acetabulum and the potential need for conversion to a THA should not preclude treatment of a tumor patient with a hemiarthroplasty.

97. ♦ The Effects of Intra-Articular Hyaluronic Acid Injection on Percentage of Chondrocyte Apoptosis After a Blunt Cartilage Injury in the New Zealand White Rabbit

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Dr. Matlock is the recipient of the Edward D. Henderson, M.D. Physician in Training Award.

BACKGROUND: Articular cartilage has little ability to repair itself after an injury. It is well documented that a blunt cartilage injury leads to chondrocyte apoptosis and that chondrocyte apoptosis may progress to arthrosis. If this progression from injury induced chondrocyte apoptosis to arthrosis could be altered, the significant morbidity associated with post-traumatic arthrosis could be positively affected. The purpose of this study was to determine the effect of intra-articular hyaluronic acid injection on the percent of chondrocyte apoptosis after a blunt cartilage injury in the New Zealand white rabbit.

METHODS: Rabbits received an acute articular cartilage injury to both patellae using a drop tower apparatus. Immediately after the injury, one knee was injected with hyaluronic acid and the other knee was injected with saline, and served as the control. Terminal dUTP nick end labeling staining was used to determine the percentage of apoptotic cells in each group.

RESULTS: The patellae in the injured control group treated with saline showed a chondrocyte apoptosis percentage of 20.2%. Those injured patellae in the group treated with hyaluronic acid had a chondrocyte apoptosis percentage of 4.7%. This difference was statistically significant ($p=0.026$).

CONCLUSIONS: Intra-articular injection with hyaluronic acid after a blunt articular cartilage injury seems to significantly decrease the percentage of apoptotic chondrocytes. Hyaluronic acid may be useful as a chondroprotective agent to alter the natural history of a blunt articular cartilage injury.

98. Pseudarthrosis After Single-Level Laparoscopic, Anterior Lumbar Interbody Fusion Using Threaded Endodowels

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SUMMARY OF BACKGROUND DATA: Recent advances in minimally invasive surgery have made laparoscopic placement of threaded dowels in the lumbar spine feasible with few complications. No large series, however, has addressed the fusion rate of stand-alone, threaded dowels using these techniques.

METHODS: From 1997 to 2004, 49 patients underwent laparoscopic, single-level lumbar interbody fusion with twin, threaded, allograft endodowels and autogenous iliac crest bone graft performed by a single spine surgeon assisted by a general surgeon. All patients had autogenous iliac crest bone graft harvested prior to procedure. Cases requiring intraoperative conversion to open laparotomy were excluded. Patient charts and operative reports were reviewed for comorbidities, preoperative symptoms, intraoperative technique, and postoperative recovery. All plain radiographs, CT scans, and MRI studies were reviewed to assess for successful fusion.

RESULTS: The cohort consisted of 29 females and 20 males with an average age of 37.3 years. Forty-one patients underwent L5-S1 arthrodesis and seven patients isolated L4-5 arthrodesis. Mean follow-up was 21 months. One patient was lost to follow-up postoperatively and excluded. Thirty patients demonstrated solid fusion on plain radiographs by six months postoperatively. Seventeen of 18 with evidence of incomplete fusion on plain radiographs underwent further imaging studies to assess for pseudarthrosis: CT scan (14 patients), MRI (6 patients), or both studies (3 patients). Thirteen CT and three MRI studies demonstrated incomplete fusion. Twelve patients underwent operative exploration via a posterior approach, confirmation of pseudarthrosis, and revision posterior spinal fusion.

DISCUSSION/CONCLUSION: Single-level, laparoscopic, lumbar interbody fusion utilizing threaded allograft endodowels with autogenous iliac crest bone graft is associated with a high rate of pseudarthrosis. Thirty-eight percent of patients in this study demonstrated incomplete fusion on plain radiographs, and 25% had intraoperative confirmation and revision posterior fusion. While these techniques have an acceptably low complication rate, the incidence of pseudarthrosis is unacceptable when compared to open or minimally open anterior approaches.

99. Evaluation of Outcome and the Radiolunate Joint Following Scaphoidectomy and Four-Corner Fusion

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PURPOSE: The effect of four-corner fusion and scaphoidectomy upon the lunate fossa has not been well studied. The purpose of this study was to evaluate our experience with four-corner arthrodesis, looking specifically at the development of radiolunate arthritis and functional outcome.

METHODS: A retrospective review was conducted on all patients who underwent a scaphoidectomy and four-corner arthrodesis between January 1974 and July 2002. The Disabilities of the Arm, Shoulder and Hand, Patient Rated Wrist Exam, and a questionnaire were sent to all surviving patients. Medical records and radiographs were reviewed. Type of fixation, carpal indices, arthritic changes in the radiolunate fossa, and complications were recorded. Statistical significance was set with an alpha \leq to 0.05.

RESULTS: One hundred seventy-seven procedures (170 patients) were reviewed. Average survey follow-up was 9.0 years. The average flexion-extension arc was 56°. Eighty-four percent of patients reported an improvement in pain. Grip strength was reported as the same or better in 61%, and 77% of patients returned to work. The type of fixation (k-wires, staples, circular plate) had no effect on union rate ($p=0.72$). Thirty-eight percent of patients required at least one additional procedure. Progression of radiolunate arthritis was visible in 10.6% of radiographs and 70% of these patients required further surgery, but only one required total wrist arthrodesis. Overall, eight wrists required revision to a total wrist arthrodesis or arthroplasty and six of these occurred within one year.

CONCLUSIONS: Four-corner fusion provides a reliable solution for SLAC and SNAC arthritis with preservation of the radiolunate articulation and wrist function.

100. Quantification of Endogenously Produced Bone Morphogenetic Proteins Following Total Joint Arthroplasty

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BACKGROUND: The knowledge base and clinical applications of the BMP superfamily have increased dramatically over the last several years to include spinal fusion and long bone nonunions. Recent advances include attempts to increase the rate of bony ingrowth for press fit prostheses using recombinant BMPs. The purpose of this study was to quantitatively measure the amounts of BMP-2, -4, and -7 made endogenously over a period of 48 hours in patients receiving either total knee or total hip arthroplasty, and to evaluate any potential correlation with patient demographics.

METHODS: Seventeen patients undergoing either total hip or total knee arthroplasty were studied. Their mean age was 61 years old, with ages ranging from 46 to 76 years old. Seven patients were female and ten were male. Thirteen total knee arthroplasties and four total hip arthroplasties were performed. Drainage tubes were placed at the time of surgery for routine intra-articular postoperative drainage. Fluid from these tubes was collected at 4, 8, 24, and 48 hours. Samples were tested quantitatively for BMP levels with sandwich enzyme-linked immunosorbent assay (ELISA) using commercially available kits. Results were quantified as total BMP present in drainage samples adjusted for volume present.

RESULTS: All patients had BMP 2, 4, and 7 present in the samples collected. The levels of BMP-2 showed a small spike at 4 hours then rose steadily over 48 hours. The levels of BMP-7 peaked between 8 and 24 hours then decreased. The levels of BMP-4 peaked at 4 hours with a second peak at 24 hours, then decreased. The average BMP-2 was 179.29 ng (range 3.28 to 508). The average BMP-7 was 4.32 ng (range .05 to 18.06). The average BMP-4 was 8.06 ng (range 1.11 to 36.34). Patients over the age of 60 had no statistically significant difference in the amount of BMP 2, 4, or 7 recovered compared to patients under 60 ($p=0.204$, 0.595 , and 0.263). There was no statistically significant difference in the amount of BMP 2, 4, or 7 recovered from male versus female patients ($p=0.485$, 0.288 , and 0.189).

CONCLUSIONS: Based on this small sample size, we found significant amounts of BMP-2, BMP-4, and BMP-7 present following total joint arthroplasty. The presence over time is similar to mRNA human and animal studies. There is no difference in the amount of BMP 2, 4, or 7 produced relative to patient age. There is no difference in the levels of BMP 2, 4, or 7 produced relative to sex of the patient.

**101. Activity Following Modern Total Knee Arthroplasty (TKA):
What Are Patients Actually Doing?**

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INTRODUCTION/PURPOSE: TKA has been demonstrated to provide functional improvement for most patients with advanced knee arthritis, but there is little information about patients' actual return to a wide variety of specific activities after TKA. The goal of this study was to determine, in a large population of patients, the functional and athletic activities that patients actually returned to following TKA.

METHODS: We identified 1,630 consecutive patients who underwent primary TKA with a single condylar posterior cruciate substituting implant between 1995 and 2000. These patients were surveyed regarding clinical outcome and activity level. Additionally, patients were queried about actual participation in 40 different athletic activities. Modified Knee Society pain and function scores, and UCLA activity-level ratings were calculated.

RESULTS: 1,206 patients responded (74%). Average age at TKA was 67 (20-91). Average follow-up was 5.7 years (2-10). Average UCLA activity-level rating was 7.1. Average Knee Society function score was 71. Satisfaction with activity level was 91%. 643 patients (53%) responded that their activities were limited by other joints. Patients over 70 years had lower UCLA ratings and Knee Society function scores ($p < 0.0001$) but higher self-assessment of activity versus peers ($p = 0.001$) than those under 70. Men had higher UCLA scores ($p < 0.0001$), Knee Society function scores ($p < 0.0001$), and higher self-assessment of activity level versus peers ($p < 0.0001$) than women. Patients with unilateral TKA who reported they were not limited by other joints had the highest mean UCLA, Knee Society function, and self assessment versus peer scores. 187 patients (16%) reported participating in heavy manual labor or sports deemed "not-recommended" by Knee Society published guidelines.

CONCLUSION: This is the largest study to date documenting patient-reported activity level including athletics following TKA. Men reported higher activity levels than women regardless of age. Of importance, 16% of patients reported participation in heavy manual labor or sports considered "not-recommended" by the Knee Society.

◆ The FDA has not cleared the drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an “off label” use).