

**DIVISION OF ORTHOPEDIC SURGERY
UNIVERSITY OF OTTAWA**

H. K. UHTHOFF ANNUAL RESEARCH DAY

THURSDAY, APRIL 24, 2014

**THE OTTAWA HOSPITAL – GENERAL CAMPUS
MAIN AUDITORIUM**

VISITING PROFESSOR

***Perry L. Schoenecker, MD
Professor of Orthopedic Surgery
Washington University School of Medicine
St. Louis, Missouri***



We are pleased to welcome

Perry L. Schoenecker, MD

as the 2014 H. K. Uthoff Visiting Professor

Dr. Schoenecker received his medical degree from the University of Wisconsin in 1968, completed his internship in 1969 at Parkland Memorial Hospital in Dallas, Texas and in 1970-71 was Assistant Resident in General Surgery at Strong Memorial Hospital in Rochester, New York. He completed his orthopedic surgery residency in 1975 at Washington University School of Medicine in St. Louis, Missouri. Dr. Schoenecker served as Interim Chairman and Program Director of the Division of Orthopedic Surgery at Washington University School of Medicine in 1980-1983. In 1995, Dr. Schoenecker became a full Professor of Orthopedic Surgery at Washington University. He has been Acting Surgeon in Chief in Pediatric Orthopedics at St. Louis Children's Hospital from 1991-1996, and again in 1999 to the present. Dr. Schoenecker has been the Chief of Staff at Shriners Hospital in St. Louis from 1977 to the present.

In 1995, 1998 and 2010, Dr. Schoenecker received the Palma Chironis Award for Excellence in Teaching presented by the Department of Orthopedic Surgery at Washington University School of Medicine. In 1999 and 2009, he received the Jerome J. Gilden, M.D. Distinguished Physician Award (in appreciation for commitment, skill and passion for patient care) presented by the Department of Orthopedic Surgery, Washington University School of Medicine. He was recognized as the Outstanding Teacher of the Year at the University Kansas School of Medicine, Wichita in 2010 and in February 2012 he received the Distinguished Clinician Award from the Washington University School of Medicine.

Dr. Schoenecker is an active member of the Pediatric Orthopedic Society of North America (past President in 2006-2007, Board of Directors 2005-2010) and the American Academy of Orthopedic Surgeons. Dr. Schoenecker travels extensively both nationally and internationally sharing knowledge in Europe, South Africa, South America and all of Asia. His interests include the reconstructive surgical treatment of hip, lower extremity and foot deformities and trauma.

Dr. Schoenecker's CV contains 155 articles (52 pertinent to hip pathology in patients of all ages) in peer reviewed journals and 18 book chapters.

**RESIDENT RESEARCH REQUIREMENTS
THE DIVISION OF ORTHOPEDIC SURGERY
UNIVERSITY OF OTTAWA**

- 1. All residents must participate in a minimum of two research projects during their residency.**
- 2. Research plan and protocol is presented to the Research Visiting Professor in November.**
- 3. Preliminary results are presented to the Division of Orthopedic Surgery Research Committee in early April.**
- 4. The final paper is presented at the H.K. Uthoff Research Day in April.**
- 5. Papers are chosen for submission to Collins Day in May.**
- 6. Two completed manuscripts must be written in style of the Journal of Bone and Joint Surgery and submitted to the Chairman of the Resident Research Committee, one by the end of the PGY-3 year and one by the end of the PGY-4 year.**

RESIDENTS/FELLOWS

DIVISION OF ORTHOPEDIC SURGERY

2013-2014

PGY-5

**Dr. Natasha Holder
Dr. Bradley Meulenkamp
Dr. Marie-France Rancourt
Dr. Cai Wadden
Dr. Geoffrey Wilkin**

PGY-2

**Dr. Mitchel Armstrong
Dr. Aaron Frombach
Dr. John Morellato
Dr. Caleb Netting
Dr. Shawn Verma**

PGY-4

**Dr. Gillian Bayley
Dr. Kelly Hynes
Dr. Matthew MacEwan
Dr. Ian MacNiven
Dr. Travis Marion
Dr. Scott McGuffin
Dr. Markian Pahuta**

PGY-1

**Dr. Andrew Bodrogi
Dr. Paul Jamieson
Dr. Bogdan Matache
Dr. Kevin Rasuli
Dr. Akshay Seth
Dr. Andrew Stewart**

PGY-3

**Dr. Christopher Dowding
Dr. Heathcliff D'Sa
Dr. Adrian Huang
Dr. Brian Le
Dr. Andrew Tice
Dr. Kristi Wood**

FELLOWS

**Dr. Helen Anwander
Dr. Abdullah Arab
Dr. Randa Berdusco
Dr. Derek Butterwick
Dr. Philippe Hugo Champagne
Dr. Luca Gala
Dr. Christopher Kennedy
Dr. Sadegh Saberi
Dr. Pascale Thibaudeau**

DIVISION OF ORTHOPEDIC SURGERY

RESIDENCY TRAINING COMMITTEE

2013 – 2014

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Dr. Andrew Tice**

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ACKNOWLEDGEMENTS

**The Division of Orthopedic Surgery greatly acknowledges the support of the
H. K. Uthoff Research Day by the following companies:**

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PROGRAM

- 0800 **Opening Remarks**
Dr. Joel Werier, Director of the Orthopedic Surgery Residency Training Program,
University of Ottawa
- 0805 **Welcome/Introduction of Dr. Perry L. Schoenecker**
Dr. Baxter Willis, Division of Orthopedic Surgery, University of Ottawa
- 0810 **Presentation by Dr. Perry L. Schoenecker, Visiting Professor**
- 0830 **Discussion**

SESSION I

MODERATOR: Dr. Ken Kontio

- 0840 **1. Smoking Cessation Intervention within the Fracture Clinic: A Prospective Double Cohort**
Dr. Travis Marion, PGY-4
- 0847 **Discussion**
- 0850 **2. Gait Dynamics for Level and Inclined Surfaces: Comparison between TKA Patients and Healthy Control**
Sarah Reynolds, Graduate Student, School of Human Kinetics, University of Ottawa
- 0857 **Discussion**
- 0900 **3. Complex, Unstable Fractures of the Intertrochanteric Region of the Femur – A Retrospective Chart Review**
Dr. Christopher Kennedy, Clinical Fellow
- 0907 **Discussion**
- 0910 **4. Biomechanical Evaluation of Two Suturing Techniques for Distal Biceps Tendon Rupture Repair**
Dr. Ian MacNiven, PGY-4
- 0917 **Discussion**
- 0920 **5. Clinical and Radiographic Analysis of the Gap Restoration Acetabular Cup in Total Hip Arthroplasty**
Dr. Ian MacNiven, PGY-4
- 0927 **Discussion**
- 0930 **6. Is the Contralateral Hip at Risk in Patients with Unilateral Symptomatic Cam FAI? A Quantitative Cartilage T1p MRI Study**
Dr. Scott McGuffin, PGY-4
- 0937 **Discussion**

SESSION II

MODERATOR: Dr. Louis Lawton

- 0940 7. **Correlation between Physical Examination and Questionnaires with Anatomical Parameters of Cam FAI**
K. C. Geoffrey Ng, Graduate Student, Department of Mechanical Engineering, University of Ottawa
- 0947 Discussion
- Refreshment Break and Exhibits, Royal Room
- 1030 8. **Natural History of Lateral Femoral Cutaneous Nerve (LFCN) Neuropraxia after Anterior Approach Total Hip Arthroplasty: A 5 Year Follow-Up**
Dr. Luca Gala, Clinical Fellow
- 1037 Discussion
- 1040 9. **Cam lesions of hip: A static or dynamic deformity?**
Dr. Luca Gala, Clinical Fellow
- 1047 Discussion
- 1050 10. **The Cost Effectiveness of Outpatient versus Standard Inpatient Total Knee Arthroplasty**
Dr. Adrian Huang PGY-3
- 1057 Discussion
- 1100 11. **Should Magnetic Resonance Imaging for Tumours of the Musculoskeletal System be Performed in a Sarcoma-Designated Healthcare Centre?**
Dr. Heathcliff D'Sa, PGY-3
- 1107 Discussion
- 1110 12. **Validation of Short-Term Functional Outcomes after Joint Replacement**
Dr. Kristi Wood, PGY-3
- 1117 Discussion
- 1120 13. **Does Subscapularis Strength Return to Normal Following Shoulder Arthroplasty?**
Dr. Kristi Wood, PGY-3
- 1127 Discussion
- 1130 14. **Correlation between Anatomical Parameters of Cam FAI and Muscle Activity during Squatting**
Giulia Mantovani, Graduate Student, School of Human Kinetics, University of Ottawa
- 1137 Discussion
- 1140 15. **The Effect of Distal End Point on Coronal Plane Deformity in Antegrade Nailing of Sub-Isthmic Femoral Shaft Fractures**
Dr. Derek Butterwick, Clinical Fellow
- 1147 Discussion
- Lunch and Exhibits, Royal Room

SESSION III

MODERATOR: Dr. Robert Feibel

- 1315 **The Effect of Timing in Delayed Repair of Supraspinatus Disruptions – An Experimental Study in Rabbits**
Dr. Hans K. Uthoff
- 1325 **Discussion**
- 1329 **Presentation by Dr. Perry L. Schoenecker, Visiting Professor**
- 1349 **Discussion**
- 1359 **16. Predictors of Success in Peri-Acetabular Osteotomy (PAO) Surgery**
Dr. Christopher Dowding, PGY-3
- 1406 **Discussion**
- 1409 **17. Synergism amongst a Focal Adhesion Kinase Inhibitor (PF-562,271) and Candidate Chemotherapeutic**
Drugs for the Treatment of Bone Metastases
Dr. Christopher Dowding, PGY-3
- 1416 **Discussion**
- 1419 **18. Working towards Benchmarks in Orthopedic Room Efficiency for Joint Replacement Surgery in an**
Academic Centre
Dr. Aaron Frombach, PGY-2
- 1426 **Discussion**
- 1429 **19. Vertebral Fractures in the 3 Year Period Following Steroid Initiation among Children with Chronic**
Illnesses
Dr. Leanne M. Ward
Research Chair in Pediatric Bone Health and Associate Professor, University of Ottawa
Pediatric Endocrinologist, Children’s Hospital of Eastern Ontario
- 1436 **Discussion**
- Refreshment Break, Auditorium**

SESSION IV

MODERATOR: Dr. Braden Gammon

**1500 20. Safety and Efficiency of Outpatient Orthopedic Surgery: Distal Radius, Proximal Humerus and Ankle Fractures
Dr. Kevin Rasuli, PGY-1**

1507 Discussion

**1510 21. To Dislocate or Not...Early Supracapsular Percutaneously Assisted Total Hip (SuperPATH[®]) Arthroplasty Outcomes Compared with Percutaneously Assisted Total Hip (PATH[®]) and a Direct Lateral Approach
Dr. Kevin Rasuli, PGY-1**

1517 Discussion

**1520 22. Immunophenotypic Analysis of Peripheral Blood Lymphocytes in Patients with Failed Metal-on-Metal Hip Implants Associated with a Pseudotumor
Dr. Isabelle Catelas, Associate Professor and Canada Research Chair, Department of Mechanical Engineering, Department of Surgery, Department of Biochemistry, Microbiology and Immunology**

1527 Discussion

**1530 Closing Remarks
Dr. Peter Lapner, Director of Research, Division of Orthopedic Surgery, University of Ottawa**

ABSTRACTS

1. SMOKING CESSATION INTERVENTION WITHIN THE FRACURE CLINIC: A PROSPECTIVE DOUBLE COHORT

Travis Marion, MD¹, Andrew Pipe, C.M., M.D., LL.D. (Hon), D.Sc. (Hon)²,
Franco Momoli, PhD³, Steve Papp, MD, FRCSC¹, Allan Liew, MD, FRCSC¹, Joel Werier, MD, FRCSC¹

¹University of Ottawa, Division of Orthopaedics

²University of Ottawa Heart Institute, Division of Prevention and Rehabilitation

³University of Ottawa

Introduction

Tobacco use is the leading preventable cause of death contributing to more than 5 million estimated deaths per year globally. Complications due to smoking, from an Orthopaedic perspective are well established. The acute fracture clinic is a unique, high volume environment whereby previously healthy patients are faced with the impact of disability and have an impetus to abstain for the benefit of fracture outcomes. We hypothesize that The Ottawa Hospital fracture clinic will serve as an effective environment to employ primary prevention smoking cessation interventions.

Methods

A multi-surgeon, single centre, prospective quasi-experiment with the objective to compare the smoking cessation rates between patients who have sustained a fracture and use tobacco, that have received the standard of Orthopaedic care to those that have additionally received the Modified Ottawa Model for Smoking Cessation (mOMSC). The primary outcome is long-term smoking cessation. Secondary outcomes include SF36v2, and rates of non-union, delayed union, infection, and revision surgical intervention.

Results

Pilot data reveals that between March 2013 and August 2013 inclusive, 525 new orthopaedic trauma patient consults or post operative patients who have sustained a fracture presented to one of three Orthopaedic Surgeon Fracture Clinics. 115 of which (21.9%) regularly use tobacco. 60.7% were male and average age of patient using tobacco was 41.2%, average pack years was 22.08, and average number of cigarettes used per day was 10.33. Cessation rates after receiving the standard of care was 14 of 115 patients (12.17%).

Discussion

A high proportion of young, tobacco users, without smoking related comorbidities present to the Fracture Clinic on a regular basis. This represents a population that is traditionally regarded as unattainable from cessation interventions. Their cessation rate after Orthopaedic standard of care is 12.17%. An effective evidence based, smoking cessation program is necessary to reduce the incidence of complications associated with fracture and surgical healing, and achieve greater long-term cessation rates.

2. GAIT DYNAMICS FOR LEVEL AND INCLINED SURFACES: COMPARISON BETWEEN TKA PATIENTS AND HEALTHY CONTROLS

Sarah Reynolds, MSc¹ | Mario Lamontagne, PhD^{1,2} | Geoffrey Dervin MD MSc FRCSC³

¹ School of Human Kinetics, University of Ottawa

² Department of Mechanical Engineering, University of Ottawa

³ Division of Orthopaedic Surgery, University of Ottawa

Introduction

Total knee arthroplasty (TKA) has been shown to significantly improve gait dynamics for individuals suffering from severe osteoarthritis. However, previous research has limited gait analysis for TKA patients to level surfaces. Gait analysis among young, healthy individuals has shown that lower limb mechanics change as individuals move from level to inclined walking surfaces, with the most pronounced changes occurring at the knee joint. The purpose of this study was to compare gait patterns between TKA patients and controls during both level and inclined tasks.

Methods

Sixteen participants were recruited from the local hospital for the TKA group. Inclusion criteria dictated that participants be between 50-75 years of age, with a BMI ≤ 35 kg/m², having undergone unilateral TKA for severe knee osteoarthritis within the past 6-12 months (mean=11 \pm 5 months). Control participants (n=16) were recruited from the local community. Motion analysis was conducted using 10 Vicon MX cameras; inclined walking trials were performed on a 4 metre ramp set at a 9° (12.5%) incline. Ground reaction forces were calculated using 2 force plates embedded within the respective walkway; kinetic measures were calculated using an inverse dynamics approach. Participant performed 5 trials for each walking task. Trials were analyzed and time normalized (for consecutive heel strikes) in a customized Matlab software; statistical analysis was conducted using SPSS 21.0 software. One-way ANOVAs were conducted to compare peak kinematic and kinetic values across groups (TKA vs. Control), with an $\alpha=0.05$.

Results

For each of the walking tasks, TKA participants exhibited significantly reduced knee flexion angles in both the early stance (10-30%) and swing (62-100%) of the gait cycle, along with reduced knee power knee throughout the gait cycle. No significant differences were observed for hip kinematics or kinetics.

During each of the gait tasks TKA patients experienced reduced extension moments during early stance; however this only reached statistical significance during level (p=0.049) and downhill (p=0.01) walking. In contrast, uphill walking produced significantly different peak knee extension moments (p=0.018) between the TKA and control groups in late stance/pre-swing (40-60% of gait cycle), as TKA participants exhibited peak extension moments of 0.1 \pm 0.08 N*m/kg, compared to controls (mean=-0.4 \pm 0.4 N*m/kg).

Discussion

It is of interest to note that despite these aforementioned differences between the TKA and control groups, all of the participants exhibited similar adaptations to their gait patterns when adjusting between level and inclined walking. This includes increased hip and knee flexion angles and extension moments, as well as significantly greater power generation at the hip. During downhill walking, both groups experienced reduced flexion angles and extension moments at the hip, while the knee had significantly greater flexion angles and extension moments, allowing for greater power absorption, compared to level walking.

Consistent differences in knee power and flexion angles throughout both level and inclined walking tasks suggests that these discrepancies may be part of an adapted gait pattern that patients have developed, either as a continuation of pre-operative gait patterns or due to post-operative outcomes (i.e. pain, reduced muscle activation, flexion contractures). Due to the more demanding nature of inclined walking tasks, it was anticipated that a greater number of discrepancies would be observed between TKA and control groups during these tasks, compared to level walking; however, this was not the case. Overall, level walking produced the greatest differences between the groups, with discrepancies in knee flexion/extension angles and moments, as well as reduced peak power generation and absorption at the knee throughout the gait cycle. It is possible that inclined gait tasks had fewer differences between the groups because the more demanding nature of the task reduced variability or required greater muscle activation, which may have compensated for other differences in gait mechanics (such as those observed in level walking). This information warrants further research to examine the role of muscle activation and strength during these dynamic tasks, and how they impact gait patterns during level and inclined walking. The similar adaptations among both groups between level and inclined walking tasks suggests that TKA patients maintain similar movement patterns to healthy controls; however, they are unable to reach similar peak values throughout the movement, compared to their healthy counterparts.

3. COMPLEX, UNSTABLE FRACTURES OF THE INTERTROCHANTERIC REGION OF THE FEMUR – A RETROSPECTIVE CHART REVIEW

Christopher Kennedy, MD, Steve Papp, MD, FRCSC
Allan Liew, MD, FRCSC, Wade Gofton, MD, MEd, FRCSC

Division of Orthopedic Surgery, University of Ottawa

Introduction

The most unstable intertrochanteric (IT) fracture types are classified by the Orthopedic Trauma Association (OTA) as 31-A3 fractures, including reverse obliquity type fractures. There has been very little published on the fixation of these fractures specifically, and even less since the mainstream, use of intramedullary (IM) nails. A retrospective chart review from August 2007 to January 2012 was performed at our institution and 51 31-A3 fractures were identified. Seventeen fractures did not meet inclusion criteria leaving 34 fractures for the study. The objectives of the study were to assess these fractures for fixation type, re-operation rates and non-union rates.

Methods

Thirty (88%) fractures were treated with an IM device and the remainder were treated with either total hip arthroplasty (1) or fixed angled plating (3).

Results

Nine fractures (26%) required a second surgery. Seven (21%) IM nails required re-operation; 4 (12%) for nonunion, 1 for post-traumatic arthritis, 1 for mal-rotation and 1 for hardware removal. The fractures that failed to unite had a mean Medial Neck Shaft Angle (MNSA) of 120° and a mean Medial Proximal Femoral Angle (MPFA) of 76.7°. The MNSA and MPFA measurements for united fractures were 127.3° and 84.5°, respectively.

Conclusions

These findings suggest that a failure of fixation of 12% with IM nails for 31-A3 fractures is a significant improvement over the published value of 32% for fixed angled plates. As well, anatomic reduction at the time of fixation is a key variable in the successful outcome of these fractures.

4. BIOMECHANICAL EVALUATION OF TWO SUTURING TECHNIQUES FOR DISTAL BICEPS TENDON RUPTURE REPAIR

Ian MacNiven, MD, Hakim Louati, BSc,
J Pollock, MD, MSc, FRCSC, Steve Papp, MD, FRCSC

Division of Orthopaedic Surgery, University of Ottawa

Purpose

Surgical repair of the torn distal biceps tendon must have good resistance and should restore the tendon footprint with a strong biomechanical profile that avoids strangulation. The biomechanical performance and gap formation of suture repair using two surgical techniques comparing the modified Krakow to the reduction knot technique of distal biceps tendon repair was evaluated.

Methods

Nine matched pairs of cadaveric elbows were acquired and randomly assigned to the reduction knot or Krakow repair group. In each specimen the biceps tendon was isolated and lifted off the tuberosity, anatomic repair to the radial tuberosity was then completed using 2 Linvatec 2.9mm suture anchors loaded with number 2 HIFI suture. The Group 1 repair consisted of a reduction knot suturing technique, and in Group 2 the repair was completed with a modified Krakow repair. The radius was then potted, the bicep tendon cryogenically clamped and the construct was preconditioned. The repair was then cycled at 75N and 125N with a 90° force vector for 50 cycles, followed by loading to failure. The strength, stiffness, gap formation and mode of failure were analyzed for each construct.

Results

The Group 1 cohort of the reduction knot technique demonstrated significantly less gapping following cycling at both 75N and 125N. While the reduction knot repaired tendon remained in direct contact with the insertion, the modified Krakow repaired tendon completely lifted off the insertion by the end of the cycling protocol. The reduction knot technique repairs were not significantly stiffer than the modified Krakow repairs. The load to failure between groups was also not statistically significant. The primary mode of failure in both groups was through suture rupture.

Conclusions

The reduction knot technique demonstrated significantly less gap formation, during cycling. Both repairs allowed for immediate cycling and did not fail throughout physiological testing. Using a suture anchor repair allows for immediate range of motion under physiologic loads in cadaveric samples, and the reduction knot technique decreases gap formation which may lead to improved surgical repair and recovery time.

5. CLINICAL AND RADIOGRAPHIC ANALYSIS OF THE GAP RESTORATION ACETABULAR CUP IN TOTAL HIP ARTHROPLASTY

Ian MacNiven, MD, Joel Werier, MD, FRCSC, Robert J. Feibel, MD, FRCSC,
Wade Gofton, MD, MEd, FRCSC, Paul E. Beaulé, MD, FRCSC

Division of Orthopaedic Surgery, University of Ottawa

Purpose

In complicated primary and revision total hip arthroplasty various surgical technique options are available. This study evaluates the radiological and clinical performance of the Legacy Stryker GAP cup for acetabular reconstruction.

Methods

Forty five patients who underwent primary or revision total hip arthroplasty with a GAP cup acetabular reconstruction from December 2005 until December 2013 were included. Radiographic analysis of the impact of GAP cup positioning on bone graft resorption, migration and failure of fixation was completed. The Paprosky classification of acetabular bony defect was analysed. Functional outcomes and complications were assessed with the SF-12 and WOMAC scores.

Results

Descriptive data (mean, standard deviation, range) will be generated from cup inclination from the standard post-operative radiograph view assessed by the primary investigator. The Paprosky classification of acetabular bone loss will be defined, the cup migration will be compared to immediate post operative X-rays and loosening will be analyzed by radiographical lucency. The functional outcomes and complications will be assessed with the SF-12 and WOMAC scores.

Conclusions

By reviewing our patient cohort who underwent acetabular reconstruction with the Restoration GAP cup identification of the indications, complications, and functional outcomes will be completed. Furthermore the effect of the acetabular cup positioning on bone resorption, migration and failure of fixation will be elucidated and will provide a basis for optimization of surgical technique and may provide validation of the GAP cup use in THA.

6. IS THE CONTRALATERAL HIP AT RISK IN PATIENTS WITH UNILATERAL SYMPTOMATIC CAM FAI? A QUANTITATIVE CARTILAGE T1ρ MRI STUDY

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Kawan S. Rakhra, MD, FRCPC², Paul E. Beaulé, MD, FRCSC¹

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Background

Cam-type femoroacetabular impingement (FAI) is likely the most common cause of early labral and cartilaginous damage in the nondysplastic hip as well as a major cause of hip arthritis. T1ρ (rho) MRI is a technique that has recently been shown to identify hyaline cartilage degeneration via its sensitivity to change in the cartilage extracellular matrix.

Objective

To (1) quantify regional variations in the T1ρ MRI relaxation times in the weight-bearing cartilage of hips with cam-type femoroacetabular impingement and (2) evaluate for a difference in T1ρ profile between symptomatic and asymptomatic cam-FAI hips in the same patient.

Methods

18 patients (16M; 2F; mean age 37.3 years) with bilateral cam-type femoroacetabular impingement undergoing osteochondroplasty for unilateral hip pain were prospectively recruited. Preoperatively, they underwent 1.5T T1ρ MRI of the symptomatic hip. Patients subsequently received a 1.5T T1ρ MRI of the contralateral, asymptomatic hip at an average of 75.7 days following their surgical procedure. The weight-bearing hyaline cartilage bilayer of the acetabulum and femoral head was evaluated on 7 sagittal images, and each image further segmented into four zones: anterior (I), anterosuperior (II), posterosuperior (III) and posterior (IV). The mean T1ρ relaxation value was calculated for each sagittal slice and each zone. The weight-bearing area was also divided into four quadrants (anterolateral, anteromedial, posterolateral and posteromedial) and the mean T1ρ relaxation value calculated for each quadrant.

Results

With selective combinations of slices and zones to subdivide the weight-bearing area into quadrants, the symptomatic hips had higher relaxation times (lower cartilage proteoglycan content) in three of four quadrants when compared to asymptomatic hips (AL 31.4 vs 29.4; AM 33.5 vs 32.2; PL 31.2 vs 31.4; PM 32.5 vs 31.8), however this difference did not reach statistical significance. In general, the T1ρ relaxation times of the various slices and zones in both symptomatic and asymptomatic hips, the T1ρ MRI relaxation times trended towards lower relaxation times in the anterior zones and lateral slices.

Conclusions

The T1 ρ MRI profile of hyaline cartilage is not significantly different between symptomatic and asymptomatic hips with cam-type femoroacetabular impingement. Additionally, the pattern of regional variation in T1 ρ relaxation time seen in this patient cohort is similar to previous findings from our group in healthy volunteers with normal hip morphology.

7. CORRELATION BETWEEN PHYSICAL EXAMINATION AND QUESTIONNAIRES WITH ANATOMICAL PARAMETERS OF CAM FAI

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Kevin D. Dwyer, MSc² | Paul E. Beaulé, MD FRCSC³

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³ Division of Orthopaedic Surgery, University of Ottawa

Introduction

Presence of the cam deformity can lead to mechanical impingement of the hip, demonstrating clinical signs of femoroacetabular impingement (FAI) and imposing elevated stresses at the articulating surfaces. The alpha angle, which defines the severity of the cam deformity, may not be enough to distinguish between symptomatic and asymptomatic hips with the cam deformity. In efforts to understand predictive outcome measures that help characterize the symptomology of cam FAI, the purpose was to examine the associations between anatomical hip joint parameters of cam FAI with physical examinations and pain scores.

Methods

Thirty-eight male participants were included and diagnosed as either: symptomatic FAI (sFAI – cam deformity with symptoms), asymptomatic femoroacetabular deformity (aFAD – cam deformity without symptoms), or control (CON–no deformity, no symptoms). Each participant's CT data was acquired, blinded, and measured for axial alpha angle, radial alpha angle, anterior femoral head-neck offset, femoral neck-shaft angle, medial proximal femoral angle, femoral version, and acetabular version. Each participant underwent a physical examination – hip flexion, internal rotation, external rotation, straight-leg raises, sit-and-reach flexibility – and completed the WOMAC and HOOS pain questionnaires.

Results

Between groups, sFAI demonstrated significantly smaller hip flexion ($p = 0.039$), external rotation ($p = 0.005$), and noticeably reduced internal rotation and straight-leg raises, in comparison with CON. The sFAI group also had significantly lower pain scores (HOOS = $63.8 \pm 20.9\%$, WOMAC = $70.4 \pm 21.5\%$; $p < 0.001$), in comparison with aFAD and CON. Associating the physical examinations with the pain scores, HOOS correlated significantly with femoral neck-shaft angle ($r = 0.491$, $p = 0.002$) and femoral head-neck offset ($r = 0.344$, $p = 0.034$); and negatively with femoral version ($r = -0.327$, $p = 0.045$) and acetabular version ($r = -0.362$, $p = 0.026$); whereas WOMAC correlated significantly with just femoral neck-shaft angle ($r = 0.418$, $p = 0.009$). Axial alpha angle, radial alpha angle, and medial proximal femoral angle showed no correlations with pain questionnaires ($-0.199 \leq r \leq 0.199$). Associating the physical examinations with anatomical parameters (Table 1), hip flexion correlated with femoral head-neck offset ($r = 0.487$, $p = 0.005$) and negatively with axial alpha angle ($r = -0.348$, $p = 0.045$), radial alpha angle ($r = -0.335$, $p = 0.049$), and acetabular version ($r = -0.388$, $p = 0.031$). External rotation correlated negatively with radial alpha angle ($r = -0.386$, $p = 0.02$) and acetabular version ($r = -0.333$, $p = 0.047$). Femoral neck-shaft angle, medial proximal femoral angle, and femoral version showed no correlations with physical examinations ($-0.287 \leq r \leq 0.297$).

Conclusions

The strongest correlations between HOOS and WOMAC were with femoral neck-shaft angle. Interestingly, no correlations were found between either pain questionnaires with either alpha angle, suggesting that pain due to mechanical impingement is not adequate enough to assess the presence and severity of the cam deformity. Strong correlations were found between hip flexion and femoral head-neck offset, both alpha angles, and acetabular version; also, between external rotation and radial angle and acetabular version. The flexibility test demonstrated that FAI symptoms were not influenced by other lower back or hamstring problems. The cause of FAI may not be limited to the cam deformity, as defined by the alpha angles, but attributed to other anatomical and functional parameters. The additional parameters suggest that the presence of the cam lesion can remain undetected for a while, leading to degenerative changes in the subchondral bone, until damage to the labrum presents symptoms of pain.

Table 1: Pearson correlation coefficients between physical examination and anatomical parameters

Physical Examinations	Radiographic Parameters						
	Axial alpha angle	Radial alpha angle	Femoral neck-shaft angle	Medial proximal femoral angle	Femoral head-neck offset	Femoral version	Acetabular version
Hip Flexion	-0.348 *	-0.335 *	0.227	0.080	0.487 **	-0.316	-0.388 *
Internal Rotation	-0.142	-0.137	0.282	0.115	0.267	0.074	-0.184
External Rotation	-0.287	-0.386 *	0.176	0.044	0.293	-0.249	-0.333 *
Straight-Leg Raise	0.012	0.010	0.297	0.094	0.123	-0.199	-0.010
Stand-and-Reach Flexibility	0.134	0.243	-0.229	-0.165	-0.140	0.064	0.001

** significant at $p < 0.01$, two-tailed

* significant at $p < 0.05$, two-tailed

8. NATURAL HISTORY OF LATERAL FEMORAL CUTANEOUS NERVE (LFCN) NEUROPRAXIA AFTER ANTERIOR APPROACH TOTAL HIP ARTHROPLASTY: A FIVE YEAR FOLLOW-UP

Luca Gala, MD, Paul R. Kim, MD, FRCSC, Paul E. Beaulé, MD, FRCSC

Division of Orthopaedic Surgery, University of Ottawa

Purpose

Incidence of lateral femoral cutaneous nerve (LFCN) neuropraxia after anterior approach total hip arthroplasty has been reported to occur in over 50% of patients. Although in the vast majority of cases there has been no functional impact it is unknown if symptoms worsen or diminish over time. The aim of this study was to examine the natural history LFCN neuropraxia in previously reported cohort of individuals after anterior approach total hip arthroplasty.

Methods

143 consecutive patients underwent direct anterior hip approach (DAA) between September 2006 and February 2009 of which 107 had been identified with LFCN neuropraxia. These 107 symptomatic patients (39 THA; 68 HR; 44 Female & 63 male; mean age 55.4 (38.4-88.8)), were provided a self-reported questionnaire for sensory deficits associated with LFCN as well as severity of symptoms on visual analogue scale (VAS). These were done both at initial assessment and latest follow-up.

Results

Sixty of the 107 patients (56%) had completed their questionnaires with a mean follow-up of 5.4 years (24 THA; 36 HR). Twenty-two percent (13 of 60: 8 men & 5 women) had complete resolution of their symptoms of which 9 were HR and 4 THR . Of the 47 patients (78%) still reporting symptoms of LFCN neuropraxia, the mean score on VAS decreased from 2.32 (SD:2.11) to 1.74 (SD:1.99). No limit in activities was reported for 90% (54 out of the 60). Of the 6 patients with limited activity they reported a mean VAS score of 4.4 (SD: 3.6 range of 0-8.4).

Conclusions

While LFCN neuropraxia is a common complication following direct anterior approach total hip replacement, almost a quarter of patients will have complete resolution of symptoms and the majority will have a decrease in their symptomatology. LFCN neuropraxia following DAA hip arthroplasty rarely leads to functional limitations.

9. CAM LESIONS OF HIP: A STATIC OR DYNAMIC DEFORMITY?

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Purpose

Cam-type impingement refers to alterations in the osseous contour at the level of the femoral head-neck interface leading to abnormal contact between the acetabulum and the femur during range of motion of the hip resulting in femoral acetabular impingement (FAI). In our institutions' earlier study in 2010, two-hundred asymptomatic patients were investigated with magnetic resonance imaging (MRI) for the prevalence of cam-type morphology, defined as an alpha angle $> 50.5^\circ$. Based on this study, we reported a prevalence of cam-type lesions in 14% of our asymptomatic volunteers. However, little is known as to the natural history of the cam deformity, specifically as to whether there is any change in the deformity over time. Therefore the purpose of this study is to radiographically determine whether Cam lesions of the hip are a static or dynamic deformity over time.

Methods

This study is a direct follow up to *Prevalence of Cam-Type Femoroacetabular Impingement Morphology in Asymptomatic Volunteers* by Hack et al in 2010, which took 200 asymptomatic volunteers and used a magnetic resonance imaging (MRI) machine to image each of their hips (for a total of 400 hips) to assess for a cam-type femoral deformity. An alpha angle $> 50.5^\circ$ was considered elevated and thus positive for cam-type morphology.

From this cohort of 200 patients, 22 were prospectively selected for further follow-up to assess for changes in alpha angle. Of these 22 patients, 10 had a confirmed cam lesion (alpha $> 50.5^\circ$) in at least one of the evaluated views in one or both hips (Cam Positive Group). The remaining 12 patients were selected as a control group as they had alpha angles below 50.5° therefore, no evidence of a cam lesion in either hip by MRI (Cam Negative Group).

A repeat MRI or CT scan was then performed. Alpha angles were re-evaluated for these repeat scans by an MSK radiologist using the oblique axial 3:00 and radial 1:30 reformatted views. The findings were then compared to the original MRI findings to identify any difference in alpha angle using a paired t-test evaluation, with clinical significance set as $p < 0.05$.

Results

Of the 22 initially selected patients, 17 were able to be re-contacted to undergo their repeat imaging. This included 7 patients from the Cam Positive Group and 10 patients from the control, Cam Negative Group. The average time to repeat scan was 3.8 years. The cohort consisted of 14 males and 3 females, with 7 patients having a repeat MRI and 10 patients having a CT scan for their repeat images.

Both groups (cam negative and positive) showed no significant change in alpha angle from their initial MRIs to the current repeat scans at either the 3 or 1'30 position. The findings for the repeat alpha angles from the Cam Negative control group are also unchanged from the previous imaging. Finally, when the entire follow-up cohort is combined, it too shows no change in alpha angle or subsequent cam size from the original to follow-up imaging studies.

Conclusion

Neither the previously identified patients with a cam-type lesion, nor the control group without a cam lesion demonstrated any identifiable change in alpha angle over approximately a 3.8 year time period. Consequently, screening at time of skeletal of maturity would be an efficient means of identifying individuals with this deformity.

10. THE COST EFFECTIVENESS OF OUTPATIENT VERSUS STANDARD INPATIENT TOTAL KNEE ARTHROPLASTY

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Purpose

The purpose of this study is to compare the cost-effectiveness of outpatient versus the standard inpatient total knee arthroplasty (TKA).

Methods

Seventeen outpatient primary TKA cases and their respective inpatient matches from a single surgeon practice were included in this pilot study. All data was collected prospectively. Outpatient TKA cases were discharged on the day of surgery, while control TKA cases followed a standard clinical pathway. Financial cost data was obtained from the hospital finance department from the fiscal years 2011-2013. Case costs were determined in a standardized fashion according to the Ontario Case Costing Initiative principles and compared on a year-to-year basis. Clinical data included pre and post-operative WOMAC scores and a documentation of complications. Cost-effectiveness analysis included a comparison of direct and indirect hospital costs and clinical markers of comparison, including pre and post-operative WOMAC scores and complications.

Results

The outpatient TKA cohort yielded an average of 53% cost-savings compared to the inpatient cohort. There were no readmissions or other adverse consequences in the outpatient cohort. Clinical knee scores were similar between the two groups.

Conclusion

The results suggest that an outpatient TKA program is cost-effective, allowing for significant cost-savings without degrading clinical outcomes of patients. Given Ontario's new funding scheme for total knee and hip arthroplasty, it has become more important to perform these surgeries cost-effectively. This corroborates evidence from the American population that a carefully selected cohort of patients perform well on both cost minimization and clinical outcome bases, suggesting that outpatient TKA is a viable and cost-effective option.

11. SHOULD MAGNETIC RESONANCE IMAGING FOR TUMOURS OF THE MUSCULOSKELETAL SYSTEM BE PERFORMED IN A SARCOMA-DESIGNATED HEALTHCARE CENTRE?

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Purpose

The objectives of this study are to evaluate the concordance of MRIs of musculoskeletal lesions reported outside of a high volume sarcoma centre with expert second opinion reports and to evaluate the accuracy of reporting technical details, descriptive and interpretive characteristics.

Methods

A retrospective review identified 521 consecutive surgical referrals to a multi-disciplinary sarcoma centre from July 2007 to June 2011. Two hundred and fifty one patients (117 females; 134 males) presented with an MRI performed in a referring institution. An adjudication panel of 4 MSK-trained radiologists and one orthopedic oncologist evaluated all diagnostic-imaging studies independently. Four categories were assessed: 1) technical details, 2) descriptive characteristics, 3) interpretative characteristics, and 4) global impression; the latter two areas were graded on a 1-5 scale. Interpreters were blinded to reporting institution and pathology diagnosis. Disagreement was resolved through consensus opinion, and percent agreement was recorded (93%). Exclusion criteria included MRIs lacking a report, imaging of a previously resected tumour bed, known metastatic lesions as well as incidental findings.

Results

83 of 251 MRI reports (33%) showed discordance between the initial report and secondary interpretation. The discrepancies observed were inadequate tumour descriptors in up to 38%; one in three reports did not discuss proximity to neurovascular structures or presence of heterogeneity when it was indicated. Presence and characterization of edema, an important characteristic for surgical planning, was missing in 24% of reports. Discordance in differential diagnoses occurred in 30% of reports, and inappropriate recommendations were made in 15%. Technical sequencing errors occurred in 5 to 43% of studies, which limited the quality of interpretation or required repeat scans for contrast enhancement. Major discriminators, defined as having the capacity to alter clinical care, were identified by the clinician in 69% of inaccurate MRI reports.

Conclusions

This study identified a significant proportion of discordance in MRI interpretation between referring centres and sarcoma-designated units. Our findings suggest that more accurate reporting for suspected musculoskeletal neoplasia may be achieved by disseminated guidelines and synoptic reporting, or by collaboration with a centre with expertise in musculoskeletal neoplasia.

12. VALIDATION OF SHORT-TERM FUNCTIONAL OUTCOMES AFTER JOINT REPLACEMENT

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Introduction

There is a lack of validated measure of short-term outcome after hip and knee replacement. Two performance measures have been suggested: Timed Up and Go (TUG) and Iowa Level of Assistance Scale (ILOA). The reliability of both tests has been previously demonstrated in the arthroplasty population.

Objectives

To further assess the psychometric properties of TUG and ILOA

Methods

Patients undergoing hip and knee replacement were assessed using the TUG and ILOA. Outcomes were assessed: before surgery, post-operatively day 1-3 and 2 and 6 weeks. The psychometric characteristics assessed were: proportion able to complete the test, floor and ceiling effects, responsiveness with effect sizes, and correlation between performance measures.

Results

43 and 38 patients undergoing knee and hip replacement were recruited respectively. All patients were able to complete all tasks before surgery and two/six weeks after. Seventeen percent of patients were not able to complete the tasks one day after surgery, while only one and two patients were not able two and three days after respectively. The ILOA demonstrated floor effects before surgery, and 2/6 weeks after, while the TUG did not demonstrate any floor or ceiling effects for all periods. Effect sizes were high (>0.80) for all periods for the TUG, but only in the days following surgery for the ILOA. The ILOA was moderately to highly correlated with the TUG before surgery and days after (Pearson r .67 to .79), but less in the weeks after (Pearson r .07 to .37).

Conclusions

Both the ILOA and TUG measure the same construct but the TUG appears more responsive, is more quickly administered and requires less training than the ILOA. Both tests were less useful post-operative day 1, due to many patients unable to do the tasks. The TUG appears to be a promising short-term outcome measure after joint replacement.

13. DOES SUBSCAPULARIS STRENGTH RETURN TO NORMAL FOLLOWING SHOULDER ARTHROPLASTY?

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Investigations performed at the Division of Orthopedic Surgery,
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Background

During shoulder arthroplasty, the subscapularis tendon is released and repaired. Whether subscapularis strength subsequently returns to normal is not well understood.

Objective

To determine whether subscapularis strength normalizes following shoulder replacement and whether any preoperative factors predict the return of strength following surgery.

Methods

Sixty-four patients underwent unilateral shoulder arthroplasty. Subscapularis strength was compared between the surgical and contralateral (normal) limbs at baseline (preoperatively) and follow-up. Independent variables were assessed for their effect on final subscapularis strength, including sex, age, dominant side surgery, preoperative strength, preoperative external rotation, and subscapularis management technique.

Results

Subscapularis strength significantly improved from baseline (mean 3.4 kg [SD 2.3]) to 24 months follow-up (mean 4.6 kg [SD 2.5]) ($p = 0.0007$). The mean change ratio at 24 months from baseline strength was 1.19 (SD 2.23, $p=0.0007$). The normal side was significantly stronger than the operative side at all time points ($p < 0.0001$). The operative side mean strength ratio was 0.54 (SD 0.28) of normal at baseline, and 0.70 (SD 0.24) at 24 months. Defining normal strength as $\pm 15\%$, 15% of patients were normal at baseline up to 22% at 24 months. Multivariable regression analysis did not demonstrate any correlation ($p>0.05$) between the independent variables studied and final subscapularis strength.

Discussion

Although significant strength improvement from baseline was observed at 2 years following shoulder arthroplasty, subscapularis strength returned to normal in only a minority of patients. Potential prognostic variables associated with final subscapularis strength remain elusive.

14. CORRELATION BETWEEN ANATOMICAL PARAMETERS OF CAM FAI AND MUSCLE ACTIVITY DURING SQUATTING

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Introduction

Femoroacetabular Impingement (FAI) is an anatomical deformity of the hip, associated with groin pain and reduced hip range of motion. Alpha angle is considered a predictor of FAI, and used to discriminate between normal and symptomatic population. However, other anatomical parameters, such as femoral neck-shaft angle or acetabular and femoral version, carry important information to discriminate between groups. FAI patients experience reduced hip range of motion during everyday activities such as walking and squatting. Whether the anatomical deformity or a different muscle recruitment pattern is responsible for the reduced pelvic mobility is not clear, yet. The purpose of this study was to investigate electromyography (EMG) of major hip muscles during squatting and correlate muscle activity alterations to FAI anatomical features.

Methods

Twenty-five male participants were included from a larger cohort: 8 unilateral symptomatic FAI (sFAI); 8 unilateral asymptomatic FAI (aFAI) with deformity but no pain; and 9 healthy control participants (CON) matched for age and body mass index. Participants performed maximum depth squats in a standardized position, while monitored by motion analysis cameras, force-plates and electromyography. EMG probes were placed on the affected leg for the following muscles: gluteus maximus (GMax), gluteus medius (GMed), biceps femoris, semitendinosus, tensor fasciae latae and rectus femoris (RF). Integrated EMG (IEMG) was calculated from the linear envelopes for the ascending squat phase to estimate net muscle activation. Radial and axial alpha angles, femoral neck-shaft angles, and acetabular and femoral versions (FV) were calculated from computer tomography scans. The correlation between the anatomical parameters and the IEMG was therefore estimated with the Pearson's correlation coefficient (R).

Results

The average IEMG were not significantly different among the three groups. However, sFAI and aFAI had a tendency to overactivate RF muscle (25% and 5% increase respectively) respect to CON, while GMax was underactivated (32% and 27% decrease respectively). The Pearson's R was statistically significant (95% confidence) for correlation between GMed and FV (R= -0.42). All the other anatomical features were not strongly or significantly correlated to IEMG of the hip muscles.

Discussion

When the femur is anteverted, GMed moment arm increases for hip flexion/extension movements. This explains the negative correlation of GMed IEMG with FV, in fact, if the moment arm increases, the muscle needs less activation to develop equal net joint moment.

Even if not statistically significant, the differences in net muscle activation for GMax and RF may partially explain the reduced pelvic mobility found in FAI patients; the pelvis is less reclined during ascent because GMax contributes less to the hip extension and RF has to compensate by extending the knee.

Musculoskeletal models can clarify this issue by estimating muscle forces and hip moment of forces; therefore, future investigations are warranted that involves hip load estimations.

15. THE EFFECT OF DISTAL END POINT ON CORONAL PLANE DEFORMITY IN ANTEGRADE NAILING OF SUB-ISTHMIC FEMORAL SHAFT FRACTURES

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Introduction

Basic science literature states that the anatomic axis of the femoral shaft exits the distal femur approximately 5-10 mm medial to the apex of the femoral notch on an AP X-ray. We hypothesized that sub-isthmic femur fractures nailed with a distal end point at this location would have a more anatomic coronal plane alignment in comparison to those nails ending medial or lateral to this point. Furthermore, we hypothesize that nails ending medial to this point should create a valgus deformity at the fracture site, while those ending lateral to the apex will create a varus deformity with dose-response relationship existing between deviation from the recommended end point and the degree of malalignment.

Methods

We performed a retrospective review of 40 sub-isthmic femoral shaft fractures treated with reamed antegrade centromedullary nails at our center from 2007-2012.

Results

The following measurements were observed: fracture site coronal plane alignment, distance from nail tip to apex of the notch, and distance of the tip of the nail from the medial cortex at the level of the physeal scar in comparison to the width of the femur at this level.

Conclusion

Our findings show that distal end point may be a factor in coronal plane malalignment.

16. PREDICTORS OF SUCCESS IN PERI-ACETABULAR OSTEOTOMY (PAO) SURGERY

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Purpose

The purpose of this study was to examine the clinical outcome of patients suffering with hip dysplasia treated with a Periacetabular Osteotomy (PAO) at one center looking at predictors of poor outcome and overall survivorship.

Methods

Data was prospectively collected on 67 patients (72 hips) who underwent a PAO. Mean age was 31.65 years (range 14.46-53.65), mean BMI was 25.74 (range 17-31-40.77). Data collected included: Tonnis grade (median 0, range 0-2), Tonnis angle (mean 18.02 degrees, range 0-55), minimum joint space width (mean 5.56 mm, range 1-45) center-edge angle (mean: 14.6) and alpha angle (mean 52.54 degrees, range 29-82). Clinical outcome measures including the Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC], the UCLA Activity Scale, and the 12-Item Short Form Health Survey [SF-12] were collected preoperatively and yearly at a minimum one year postoperatively.

Results

The overall WOMAC score improved from 53.9 to 74.4 ($p < .01$). SF-12 Physical and Mental improved from 37.2 to 44.9 ($p < 0.01$) and from 45.29 to 48 ($p = .21$), respectively. UCLA activity score improved from 5.3 to 6.6 ($p < .01$). The mean post operative CE Angle improved significantly to 29.5° (10.7 – 49) as well as the Tonnis angle to 9.6° (-5 to 13) ($p = .001$). Only 14.5% of patients had an alpha greater than 50.5 post-operatively.

Hip survivorship at 5 years was 94.1%. Pre-op alpha angle was associated with lower WOMAC score ($p = .04$). There was one re-operation for excision of HO at 2.15 yrs and one patient with a femoral nerve palsy that fully recovered at one year.

Conclusion

Overall survivorship for the PAO at five years is comparable to other clinical series with overall functional scores improving significantly. A greater alpha pre-operatively was associated with a poorer outcome.

17. SYNERGISM AMONGST A FOCAL ADHESION KINASE INHIBITOR (PF-562,271) AND CANDIDATE CHEMOTHERAPEUTIC DRUGS FOR THE TREATMENT OF BONE METASTASES

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Purpose

A wide array of chemotherapeutic agents is in use for the treatment of primary malignancies. There are currently no such drugs in wide use for the treatment of bone metastases. It is not well understood why drugs that are efficacious against primary malignancies are ineffective against boney metastases from those same primary tumours. Our goal is to identify and investigate the use of drugs which may have a synergistic toxic effect on boney metastases.

Methods

Using a large drug library and cell lines derived from primary breast cancer cells, hundreds of drugs were screened for efficacy alone and combination with PF-562,271 - an ATP-competitive inhibitor of focal adhesion kinase (FAK), an important regulator of integrin signaling pathways. Drug combinations that seemed to have a synergistic toxic effect on the breast cells were identified and this synergistic effect was validated on a breast cancer cell line using varying concentrations of each drug alone and in combination. Using previously generated drug library data involving a lung cancer cell line the same approach was applied. Candidate drugs were then tested on samples of lung and breast tumours obtained via the Ottawa Tumour Bank.

Results

Several drugs were identified that may have a synergistic toxic effect on bone metastases samples, however, more samples are required for validation.

Discussion

FAK inhibition is currently being investigated as a means of treating metastatic tumours. Our research question is whether or not the combination of PF-562,271 with another drug may increase its toxicity towards boney metastases, and if so it may lead to further research into the use of these drug combinations to treat patients with metastatic tumors to bone.

18. WORKING TOWARDS BENCHMARKS IN ORTHOPEDIC ROOM EFFICIENCY FOR JOINT REPLACEMENT SURGERY IN AN ACADEMIC CENTRE

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Introduction

We reviewed our current success rate with 4-joint rooms to define benchmarks for success. From May 2012 to Oct 2012, forty-nine 4-joint rooms were reviewed for a total of 196 joint surgeries. Each surgery time was divided into the following components: Anesthetic time; Positioning time; Procedure time; Emergence time (from end of closure to patient leaving the room) and Turnover time. Success was defined as 4 joint cases being completed within the standard hour shift worked by many employees in our operating room. Most of these time components emerged as significant predictors of success. Targeted interventions can be taken to maximize operating room efficiency and increase the likelihood of completing four joints per day within the allotted time period.

Objectives

One of the difficulties in achieving and maintaining OR efficiencies is the lack of benchmarks/standards to which surgeons, nurses, anesthesiologists and administrators can refer to in regards to their individual and overall performance. The introduction of 4-joint rooms to meet provincial targets for wait times represented a major change in clinical practice, providing an opportunity to optimize patient care within the same OR time allotment (07:30-15:30). The purpose of this study is to review our current success rate with 4-joint rooms and to define benchmarks for success.

Methods

From May 2012 to Oct 2012, forty-nine 4-joint rooms were reviewed for a total of 196 joint surgeries. These were performed by five surgeons, 2 of which were fellowship trained in joint arthroplasty. There were 27 anesthesiologists with a median of 2 days (8 or less cases performed in 4-joint rooms) and 4 with at least 3 days or 12 attempted cases. Using prospectively collected data from the Surgical Information Management System (SIMS) operating room manager, each surgery time was divided into the following components: Anesthetic time; Positioning time; Procedure time; Emergence time (from end of closure to patient leaving the room) and Turnover time. Success was defined as 4 joint cases being completed within the allotted time.

Results

Of the 49 days, 24 (49%) were successful. Only 2 surgeons had a greater than 50% success rate. Significant ($p < .05$) predictors of success were: Anesthetic time (Odds Ratio:0.9), Positioning (Odds ratio: 0.92), Procedure time (Odds ratio:0.94) and Emergence time (Odds ratio:0.76). Turnover time approached significance at p value of 0.06. Using the Kaplan-Meier survival curves, we estimated benchmarks for each temporal component that correspond to the success rate of 80%. These benchmarks were: Anesthetic < 10 minutes, positioning < 14 minutes, procedure < 70 minutes and emergence < 5 minutes. Finally a turnover time of < 17 minutes was required.

Conclusion

Based on these findings targeted interventions can be taken to maximize operating room efficiency and increase the likelihood of completing four joints per day within the allotted time period.

19. VERTEBRAL FRACTURES IN THE 3 YEAR PERIOD FOLLOWING STEROID INITIATION AMONG CHILDREN WITH CHRONIC ILLNESSES

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Objectives

To describe the pattern and frequency of incident vertebral fractures (VF) in glucocorticoid (GC)-treated children and to determine the clinical factors at baseline that are associated with incident VF.

Methods

In children with leukemia, rheumatic disorders and nephrotic syndrome, VF were assessed prospectively each year following GC initiation for 3 years, according to the Genant semi-quantitative method. An incident VF was defined as a new fracture in a previously normal vertebral body or worsening of an existing fracture. The 3-year cumulative VF incidence rate was then calculated. Multivariable Poisson regression was used to examine associations between the 3-year total number of incident VF and clinical factors *at baseline*, including diagnosis, age, gender, pubertal stage, height and body mass index (BMI) Z-scores, calcium and vitamin D intake, physical activity, back pain, and lumbar spine (LS) bone mass density (BMD) Z-score. In addition, prevalent VF (at baseline) as well as cumulative GC exposure and the number of days in receipt of GC until the baseline visit were also assessed for their relationship with 3-year, incident VF.

Results

404 children were enrolled at a median age of 6.2 years, range 1-17; 50% boys; 188 (46%) had leukemia, 136 (34%) rheumatic conditions, and 80 (20%) nephrotic syndrome. The baseline study visit occurred at a median of 18 days following steroid initiation (inter-quartile range 11-24 days). Forty-four (11%) children had VF at baseline, while 134 incident VF were detected in 55 children over the 3 years. Overall, 17% of children (95% CI 13-22) had at least one incident VF over the 3 years. The proportions of children with incident VF were as follows: Leukemia: 24% (95% CI 16-32); rheumatic disorders: 13% (95% CI 6-19); nephrotic syndrome 9% (95% CI 1-17). The annual proportion of children with incident VF peaked at 12 months and declined thereafter ($p=0.04$). Among those with incident VF, 24/55 children (44%) had 1 or more moderate or severe fracture. Most of the VF were new fractures in previously normal vertebral bodies (86%), compared to worsening of existing VF. In Poisson multivariable modeling assessing *baseline* clinical factors, the following were associated with higher, 3-year VF incident rates: the presence of VF at baseline (incidence Rate Ratio (RR) 6.3, 95% CI 3.2-12.4), female gender (RR 1.8; 95% CI 1.0-3.3), pre-pubertal status (RR 2.1; 95% CI 0.8-5.4), and lower BMD Z-scores (RR 1.4; 95% CI 1.1-1.7). Underlying diagnosis and back pain at baseline were highly correlated with these significant factors, while the other factors at baseline were not significantly associated with incident VF.

Conclusions

Within 3 years of steroid initiation, 17% of children had incident VF. VF incidence peaked at 12 months, and almost half of the VF were moderate or severe. Of the factors measured *at baseline*, prevalent VF was most strongly associated with incident VF over the ensuing 3 years. Female gender, pre-pubertal status and low BMD at baseline were also associated with 3-year incident VF (for every 1 standard deviation reduction in spine BMD Z-score, there was a 40% increased incident VF risk).

20. SAFETY AND EFFICIENCY OF OUTPATIENT ORTHOPEDIC SURGERY: DISTAL RADIUS, PROXIMAL HUMERUS AND ANKLE FRACTURES

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Purpose

Since the 1970s, there has been a significant shift from inpatient to outpatient surgery across the specialties. However, there remains a paucity of evidence in the literature regarding the safety of outpatient surgery. In this retrospective review we have chosen to report on the results of our experience with three of the most common fractures treated in the outpatient setting: open reduction internal fixation of ankle, wrist and proximal humerus fractures.

Methods

We included all patients who underwent one of these three aforementioned procedures at The Ottawa Hospital between January 1st, 2012 and December 31st, 2012 inclusively. A total of 307 procedures were reviewed, including 187 ankles, 98 wrists, and 22 proximal humeri.

Results

The unanticipated post-operative admission rate was 1.6%. The average length of stay of an unanticipated admission was 3 days; no admissions were secondary to peri-operative complications. The overall infection rate was 2.3%. There were 3 deep and 4 superficial infections; all were post ankle open reduction internal fixation.

Conclusion

Outpatient orthopaedic surgery is a safe and effective way of treating ankle, wrist and proximal humerus fractures.

21. TO DISLOCATE OR NOT.... EARLY SUPRACAPSULAR PERCUTANEOUSLY ASSISTED TOTAL HIP (SuperPATH[®]) ARTHROPLASTY OUTCOMES COMPARED WITH PERCUTANEOUSLY ASSISTED TOTAL HIP (PATH[®]) AND A DIRECT LATERAL APPROACH

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Objectives

The purpose of this study was to review the early outcomes of the Supracapsular Percutaneously Assisted Total Hip Arthroplasty (SuperPATH[®]). This group is compared to an early group of Percutaneously assisted Total hip Arthroplasty (PATH[®]) and matched group of traditional direct lateral (DL) Hip Arthroplasty patients to determine if there was a difference in operative time, length of stay, component alignment or complications. A secondary objective was to determine the learning curve for the minimally invasive PATH[®] and SuperPATH[®] techniques.

Methods

The first twenty-five consecutive patients undergoing SuperPATH[®] total hip arthroplasty were compared with the first 50 fifty consecutive PATH[®] patients and 50 matched conventional DL THA patients performed by a single surgeon. Analysis of variance (ANOVA) was used to compare patient demographics, change in Hemoglobin (hgb), component alignment, and hospital length of stay (LOS) between techniques. The order of surgery and OR time was tested using correlation coefficient for each surgery type.

Results

The three patient cohorts were found to be similar with respect to age, BMI and ASA classification. There was a trend to a smaller operative Hgb change and significantly fewer transfusions with the minimally invasive techniques (PATH[®] and SuperPATH[®]). Early operative times were longer for the minimally invasive groups, with a reduction in OR times (learning curve) present until approximately case 40 for PATH and persisting at case 25 for SuperPATH[®]. After the steep portion of the learning curve PATH cases took approximately 10 minutes longer and SuperPATH[®] 5 minutes longer than a traditional DL approach. There was a significant effect (<0.0001) with LOS and approach (DL=5d, PATH[®]=3d, SuperPATH[®]=2d) and need for inpatient rehabilitation (DL=36%, PATH[®]=12%, SuperPATH[®] 4%). Acetabular inclination was significantly lower (5-8°) and anteversion significantly higher (3°) in the PATH[®] and SuperPATH[®] groups. Two patients in the PATH[®] group and one in the SuperPATH[®] group required extension to a formal posterior approach. Complication rates between groups were found to be similar.

Conclusion

This study demonstrates that similar to PATH[®], the minimally invasive SuperPATH[®] technique is associated with a lower transfusion rate, shorter length of stay, and reduced need for inpatient rehabilitation, without an increase in complication rate when compared to a DL approach. The SuperPATH[®], which avoids surgical dislocation of the hip, is a safe technique that takes on average 5 min less than a PATH[®] and allows for discharge within 48 hours for this surgeon

22. IMMUNOPHENOTYPIC ANALYSIS OF PERIPHERAL BLOOD LYMPHOCYTES IN PATIENTS WITH FAILED METAL-ON-METAL HIP IMPLANTS ASSOCIATED WITH A PSEUDOTUMOR

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Background

The increasing number of reports of early adverse tissue reactions, including pseudotumors, has raised major concerns with metal-on-metal (MM) hip implants. Although the pathomechanisms of pseudotumors remain largely unknown, the presence of lymphocyte aggregates suggests the presence of a hypersensitivity reaction. The objective of this study was to compare the proportions of lymphocyte subpopulations in peripheral blood from patients with failed metal-on-metal (MM) hip implants with and without a pseudotumor and from patients with well-functioning MM hip implants.

Methods

Peripheral blood mononuclear cells were isolated from heparinized peripheral blood samples from consenting patients: 6 with failed MM hip implants with a pseudotumor (58.4 ± 13.6 years old, mean time to failure: 3.3 ± 0.8 years), 18 with failed MM hip implants without a pseudotumor (54.4 ± 10.3 years old, mean time to failure: 3.4 ± 1.7 years), and 24 with well-functioning MM hip implants at >5 years (58.2 ± 11.6 years old; mean time of implantation: 6.1 ± 1.0 years). Lymphocyte subpopulations were analyzed by flow cytometry after cell staining with specific surface and intracellular cytokine markers.

Results

Results showed lower proportions of memory T-helper (Th) and memory T-cytotoxic (Tc) cells, as well as type 1 T-cells (particularly Th cells) in patients with failed implants with a pseudotumor. This suggests a lower number of these cells circulating systemically in this group of patients, which could reflect a sequestration of these cells in periprosthetic tissues (i.e., at the local site of the adverse reaction). This, however, remains to be confirmed with absolute cell counts.

Conclusion

Results suggest the presence of a type-IV hypersensitivity reaction in patients with failed MM hip implants associated with a pseudotumor. Immunophenotypic differences between these patients and other MM patients could potentially become diagnostic markers for the detection of this type of adverse tissue reaction. Nevertheless, group sizes, particularly the pseudotumor group, need to be increased to confirm the observed immunophenotypic differences, and results should be correlated to histological analysis of periprosthetic tissues.