DISCLOSURE

- Consultant
  - Zimmer
  - Sanofi Biosurgical
- Research Support
  - DePuy Orthopaedics
  - Baxter
- Royalties
  - DePuy Orthopaedics
WHAT REALLY MATTERS IN THA?
What Really Matters in THA

- Component Position
- Stability
- Soft Tissue Balance
  - Limb Length
  - Offset
- Durable Fixation
- Minimal Complications
- Quality Outcomes
- Patient Satisfaction
Traditional Approaches to THA

- Transtrochanteric Approach (Charnley)
  - Trochanteric non-union
- Direct Lateral (Hardinge)
  - Postoperative Limp
- Anterolateral (Watson-Jones)
  - Postoperative Limp
- Posterior Approach
  - Dislocation
Minimally Invasive THA

- Shorter incisions
- Improved cosmesis
- Less Blood Loss
- Less muscle damage
- Less Pain
- Improved LOS
- Quicker recovery
- No compromises
Minimally Invasive THA

- Posterior
- Anterior
- Direct Lateral
- Anterolateral
- 2-Incision

All Except 2-Incision can be adopted gradually, shortening the incision to comfort
Minimally Invasive THA

• Prerequisites
  – Patient Selection
  – Specialized Instruments
    • Retractors
    • Inserters
    • Lighting
    • Reamers
    • Broaches
Early Results of MIS THA

• Larry Dorr—Mini Posterior
  – Improved Pain Relief
  – Improved psychological satisfaction and body image
  – Outpatient THA
Early Results of MIS THA

• Richard Berger—2-Incision Technique
  – Early rehabilitation, same-day discharge, no complications

• Joel Matta—Anterior Approach
  – Excellent results, low complications, rapid recovery
CHALLENGES WITH MIS
Catastrophic Complications of Minimally Invasive Hip Surgery

A Series of Three Cases

By Thomas K. Fehring, MD, and J. Bohannon Mason, MD

Investigation performed at the Charlotte Hip and Knee Center, Charlotte, North Carolina
MIS THA: Early Complications

Severe Symptomatic Heterotopic Ossification and Dislocation: A Complication After Two-Incision Minimally Invasive Total Hip Arthroplasty

Jeffrey S. Feinblatt, MD,* Keith R. Berend, MD,†‡§ and Adolph V. Lombardi Jr, MD, FACS†‡§

Heterotopic Ossification After 2-Incision Total Hip Arthroplasty

B. Sonny Bal, MD. Jason A. Lowe, MD.
Ann E. Gietler, MD, and Thomas J. Aleto, MD
MIS THA: Confounders

• Accelerated Rehabilitation
• Patient Education
• Multimodal Pain Management
• Improved Anesthesia
• Advanced Surgical Techniques
  – Navigation
  – Fluoroscopy
  – Robotics
Conflicts and MIS THA

- Proprietary Techniques
- Proprietary Instruments
- Required Prostheses
- Retain or Attract Cases
  - Advertising

Zimmer MIS TOTAL HIP REPLACEMENT PROCEDURE

- Traditional Incision
  25-30cm
- Zimmer MIS Mini-Incision
  6-8cm
- Zimmer MIS 2-Incision
  4-5cm each
Conflicts and MIS THA

- Proprietary Techniques
- Proprietary Instruments
- Required Prostheses
- Retain or Attract Cases
  - Advertising
Minimal Incision THA

• “With a few exceptions, the published literature on minimal incision hip arthroplasty is retrospective, lacking controls, statistically under-powered, and derived from proceedings, supplements, and invited articles rather than from unsolicited, independently peer-reviewed studies.”

• “...the patient who has undergone THA through smaller incision is no better at > 6 weeks...than the patient who has undergone THA through a standard incision.”

Learning Curve

- Wikipedia

“A learning curve is a relationship of the duration or the degree of effort invested in learning and experience with the resulting progress, considered as an exploratory discovery process.”

"experience curve", "improvement curve", "cost improvement curve", "progress curve", "progress function", "startup curve", and "efficiency curve"
Learning curves in surgical practice

- A—Commencement of training
- B—Independent Competence
  - Temporary performance deterioration due to case mix, over-confidence, lapses in technique or judgment
- C—Small Incremental Improvements
- D—Plateau
- E—Declining performance from aging, negating benefits of experience

Learning Curve

• Primum non nocere (Above all do no harm)
Learning Curve in MIS THA

- 46 DAA vs 46 Standard Posterolateral
  - No Improvement in functional outcome
  - Higher early complication rate
  - No learning benefit after 46 cases
- “...we recommend that hip surgeons should be very careful in changing their daily routine and performing THA through a technique whose benefit has not been proven in the long term and which could cause an increase in complications, especially during the learning-curve phase.”

Learning Curve in MIS THA

• Anterior Approach
• 81 patients
  – 3 groups of 20
  – 1 group of 21
• “Proficiency improved after 40 cases, and was more marked after 60 cases”
• No major complications
• “Surgeons considering this approach should expect a substantial learning period.”

Learning Curve in MIS THA

• Anterior-supine intermuscular approach

• “The authors found the learning curve to be around 40 cases and 6 months in a high-volume joint surgeon’s practice.”

• Cadaver dissections and one-on-one mentoring are recommended when implementing this approach in one’s practice.

Learning Curve in MIS THA

Comparison of Primary Total Hip Replacements Performed with a Standard Incision or a Mini-Incision

BY STEVEN T. WOOLSON, MD, CHRISTOPHER S. MOW, MD, JOSE FERNANDO SYQUIA, MD, JOHN V. LANNIN, MD, AND DAVID J. SCHURMAN, MD

Investigation performed at Stanford University Hospital, Stanford, California

## Learning Curve in MIS THA

<table>
<thead>
<tr>
<th></th>
<th>MIS</th>
<th>STANDARD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIPS</td>
<td>135</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>WEIGHT (BMI)</td>
<td>25</td>
<td>28</td>
<td>0.008</td>
</tr>
<tr>
<td>ASA</td>
<td>1.76</td>
<td>2.14</td>
<td>0.006</td>
</tr>
<tr>
<td>WOUND COMPLICATION</td>
<td>3</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>ACET MALPOSITION</td>
<td>15</td>
<td>13</td>
<td>0.04</td>
</tr>
<tr>
<td>POOR FEMORAL FIT &amp; FILL</td>
<td>13%</td>
<td>0%</td>
<td>0.0036</td>
</tr>
<tr>
<td>SURGICAL TIME</td>
<td>97</td>
<td>105</td>
<td>0.13</td>
</tr>
<tr>
<td>BLOOD LOSS</td>
<td>603</td>
<td>507</td>
<td>0.12</td>
</tr>
<tr>
<td>TRANSFUSION</td>
<td>1.5</td>
<td>1.6</td>
<td>0.49</td>
</tr>
<tr>
<td>LENGTH OF STAY</td>
<td>4</td>
<td>4</td>
<td>0.44</td>
</tr>
<tr>
<td>DISPOSITION</td>
<td>48%</td>
<td>35%</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Learning Curve in MIS THA

- Based on authors’ initial experience
- Failed to confirm positive clinical outcomes
- Further analysis of technique needed before it can be recommended for general use

Learning Curve in MIS THA

- 247 hips, 5 community surgeons
- Double that of innovator
  - Surgical time = 164
  - EBL = 858
- 6 times rate of innovator
  - Major complications (9%)
- “Adequate training is critical to reduce the risk of complications during the learning experience of minimally invasive hip arthroplasty procedures by community practice surgeons.”

Learning Curve in MIS THA

- Zimmer MIS 2-Incision Training
- 159 Surgeons
  - 10 cases each
    - Significant decrease in OR/Fluoro time
    - NO decrease complications
- Learning curve is longer than 10 cases
  - Patient characteristics
  - Surgeon experience

WHAT HAPPENS AFTER THE LEARNING CURVE?
Complication in MIS Surgery

High Complication Rate With Anterior Total Hip Arthroplasties on a Fracture Table

Brian A. Jewett MD, Dennis K. Collis MD

Series of 800 THAs

Table 1. Intraoperative complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trochanteric fracture</td>
<td>19 (2.3%)</td>
</tr>
<tr>
<td>Femoral perforation</td>
<td>3 (0.37%)</td>
</tr>
<tr>
<td>Femur fracture</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>Acetabular fracture</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>Ankle fracture</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 2. Postoperative complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection</td>
<td>7 (0.88%)</td>
</tr>
<tr>
<td>Dislocation</td>
<td>7 (0.88%)</td>
</tr>
<tr>
<td>Wound healing</td>
<td>37 (4.6%)</td>
</tr>
<tr>
<td>Femur fracture</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>Superficial nerve injury</td>
<td>1 (0.12%)</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>14 (1.75%)/2 (0.25%)</td>
</tr>
<tr>
<td>Other medical</td>
<td>24 (3.1%)</td>
</tr>
<tr>
<td>UTI</td>
<td>4</td>
</tr>
<tr>
<td>A-Fib</td>
<td>2</td>
</tr>
<tr>
<td>Delirium</td>
<td>10</td>
</tr>
<tr>
<td>Ileus</td>
<td>2</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2</td>
</tr>
<tr>
<td>MI</td>
<td>1</td>
</tr>
<tr>
<td>CVA</td>
<td>1</td>
</tr>
<tr>
<td>Other CV</td>
<td>0</td>
</tr>
</tbody>
</table>

DVT = deep venous thrombosis; PE = pulmonary embolism; UTI = urinary tract infection; A-Fib = atrial fibrillation; MI = myocardial infarction; CVA = cerebrovascular accident; CV = cerebrovascular.

"Despite potential advantages...surgeons should be aware of the potential complications...associated with this technique."

Scars in MIS THA

• Mini Incision Wounds
  – More rated poor by plastic surgeons
  – More wound healing problems
• 30/31 patients rated pain relief and longevity higher priorities than cosmesis
• Cosmesis may be inferior to standard incision scars due to retraction

Early Failure in MIS THA

Minimal Incision Surgery as a Risk Factor for Early Failure of Total Hip Arthroplasty

Bradley P. Graw MD, Steven T. Woolson MD,
Heather G. Huddleston MD, Stuart B. Goodman MD, PhD,
James I. Huddleston MD

• Retrospective review
• 46 revision THAs
  – Excluded re-revisions and infections
  – No differences in age, gender, BMI
• Most common reasons for revision in MIS THA
  – Intraoperative fracture
  – Femoral loosening
• MIS THA may be risk factor for early revision

<table>
<thead>
<tr>
<th></th>
<th>MIS</th>
<th>NON-MIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15 (33%)</td>
<td>31 (67%)</td>
</tr>
<tr>
<td>MEAN TIME TO REVISION (YRS)</td>
<td>1.4</td>
<td>14.7</td>
</tr>
<tr>
<td>REVISION WITHIN 2 YEARS</td>
<td>12</td>
<td>4</td>
</tr>
</tbody>
</table>

MIS vs Standard Posterior THA

- MIS vs Convetional THA
- No difference in outcomes
  - Infection
  - Nerve Palsy
  - Component malposition
  - Aseptic loosening
  - Dislocation
- MIS patients preferred cosmetic result
- No clinical benefit other than COSMETIC APPEAL

MIS vs Standard Posterior THA

- 219 hips randomized
- Single incision posterior approach
- Blinded during hospital stay
- Standardized protocol
  - Anesthesia
  - Analgesia
  - Postoperative PT

- No benefit in early postop period
  - Transfusion
  - Pain
  - Walking ability
  - LOS
  - Component position
  - Component fixation
  - Functional scores
    - 6 weeks

Minimally Invasive Compared with Traditional Transgluteal Approach for Total Hip Arthroplasty
A Comparative Gait Analysis

By M. Pospischill, MD, A. Kranzl, Mag, B. Attwenger, and K. Knahr, MD

Investigation performed at the Orthopedic Hospital Vienna—Speising, Vienna, Austria

• “With regard to gait kinematics in the early postoperative period (three months), the present study showed no significant benefits for...minimally invasive...approach in comparison with...a standard...approach.”

Functional Outcome after MIS THA

A Randomized, Prospective Study of 3 Minimally Invasive Surgical Approaches in Total Hip Arthroplasty

Comprehensive Gait Analysis

- 24 hips randomized
  - Mini posterior approach
  - Mini anterolateral approach
  - 2-incision approach

- No difference at 6 weeks and 1 year in gait analysis parameters

MIS THA: Incision or Other Factors

Minimally Invasive Hip Arthroplasty: What Role Does Patient Preconditioning Play?

By Aidin Eslam Pour, MD, Javad Parvizi, MD, FRCS, Peter F. Sharkey, MD, William J. Hozack, MD, and Richard H. Rothman, MD, PhD

• Most important factors influencing outcomes
  – Family education
  – Patient preconditioning
  – Pre-emptive analgesia
  – Preop and Postop Rehab acceleration

• Surgical technique may not matter

Single Mini-Incision Total Hip Replacement for the Management of Arthritic Disease of the Hip
A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Mari Imamura, PhD, Niall A. Munro, MD, FRCS(T&Orth), Shihua Zhu, PhD, Cathryn Glazener, PhD,
Cynthia Fraser, MA, James Hutchison, FRCSEd, PhD, and Luke Vale, PhD

Investigation performed at the Health Services Research Unit, University of Aberdeen, Aberdeen, United Kingdom

• Meta Analysis through 3/10
  – RCT and quasi RCT
  – 1857 hips
  – F/u 6 weeks to 3 years

“...no strong evidence either for or against mini-incision compared with standard incision total hip replacement.”

• Small, non-clinically important advantages
  – Less blood loss
  – Shorter OR times
  – Shorter LOS

MIS vs Standard THA

- Systematic review
  - Published and unpublished literature
  - Randomized and non-randomized controlled trials
  - Clinical and radiologic outcomes
- 28 studies
  - 1428 MIS THA
  - 1421 Conventional THA
- Conclusions
  - Significantly increased risk of LFCN palsy (p=0.006)
  - No improvement in any other outcomes

Minimally Invasive THA

- Shorter incisions
- Improved cosmesis
- Less Blood Loss
- Less muscle damage
- Less Pain
- Improved LOS
- Quicker recovery
- No compromises

- YES
- MAYBE NOT
- MAYBE NOT
- MAYBE NOT
- MAYBE
- MAYBE NOT
- MANY
Percutaneously Assisted Total Hip arthroplasty
Minimally Invasive THA

- Mini Incision THA
  - NOT MINIMALLY INVASIVE!!!
- True minimally invasive THA spares:
  - Skin
  - Muscle
  - Tendon
  - Fascia
  - Joint Capsule
PATH THA

• Direct Posterior Approach
  – Incision over Pyriformis
  – Pyriformis release only
PATH THA

• Direct Posterior Approach
  – Incision over Pyriformis
  – Pyriformis release only
PATH THA

• Visualization
  – Headlight

• Access
  – Special retractors
  – Special preparation instruments
  – Special implantation instruments
Portal Guide

• Portal posterior to Femur
PATH THA
PATH THA
PATH THA

- Femoral Preparation
PATH THA

- Intraoperative radiographic evaluation
• Intraoperative radiographic evaluation
Percutaneously Assisted Total Hip Arthroplasty (PATH): A Preliminary Report

By Brad L. Penenberg, MD, W. Seth Bolling, MD, and Michelle Riley, PAC

Economic Impact of MIS THA

The Economic Impact of Minimally Invasive Total Hip Arthroplasty

Paul J. Duwelius, MD,* Hans S. Moller, MD,* Robert L. Burkhart, PA,* Frederick Waller, MD,† YingXing Wu, MD,‡ and Gary L. Grunkemeier, PhD.§

• MIS/ACTIVE PATHWAY
  – LOS: 1.5 Days*
  – Costs: $12.8 K*
  – Complications =

• LIS/PASSIVE PATHWAY
  – LOS: 3.8 Days
  – Costs: $16.7 K
  – Complications =

**COST SAVINGS: 3.9K**

* p < 0.001

MIS THA: Additional Costs
SURGICAL APPROACH IN TOTAL HIP ARTHROPLASTY:

DOES IT REALLY MATTER?

Andrew I. Spitzer, MD
Director
Joint Replacement Center of Excellence
Cedars-Sinai Medical Center

Israel Orthopaedic Association
December, 2012
MIS THA

- Does not improve long term results
- Limited and poor data
- May impact short term results
  - Cosmesis
  - LOS
  - Speed of rehabilitation
- May significantly increase complications (“Learning Curve”)
- Careful adoption
  - Progressive shortening of incision
  - Consider adjunctive imaging
  - Consider truly innovative approaches
  - WAIT FOR DATA
What Really Matters in THA

- Component Position
- Stability
- Soft Tissue Balance
  - Limb Length
  - Offset
- Durable Fixation
- Minimal Complications
- Quality Outcomes
- Patient Satisfaction
Primum Non Nocere
May I never see in the patient anything other than a fellow creature in pain.
THANK YOU!!

תודה רבה!!

1/1/2013

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Patient Outcomes vs Surgical Approach

- Outcomes Measures
  - WOMAC Pain and Function
  - Self Administered Patient Satisfaction Scale for Primary Hip and Knee Arthroplasty
- Posterior approach superior to anterolateral
  - 3.5-7.2%