Which Surgical Approach Provides Maximum Visualization and Access for Open Reduction and Internal Fixation (ORIF) of Femoral Neck Fractures?

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Introduction

- The most critical component for success in treating displaced femoral neck fractures is reduction
- Open reduction may be required
- Surgical approaches used for open reduction vary based on fracture type and surgeon familiarity with a particular approach

Common Surgical Approaches

- **Smith-Peterson**: direct anterior approach; utilizes the internervous plane between the femoral and superior gluteal nerves
- **Smith-Peterson with Rectus Release**: head of rectus femoris is reflected from the anterior inferior iliac spine to expose the joint capsule
- **Hueter**: utilizes same deep interval as the Smith-Petersen, but the dissection is carried down through the fascial compartment of the tensor fasciae lata, decreasing iatrogenic injury to the lateral femoral cutaneous nerve and avoids need for rectus release
- **Watson-Jones**: anterolateral approach between the tensor fascia lata and gluteus medius

Why Surgical Approach Matters

- Poor visualization of a fracture can lead to:
 - Imperfect reduction and subsequent suboptimal outcomes
 - Unnecessary soft-tissue trauma, increased case-length, and blood loss
 - Neurovascular damage
- The literature currently does not provide detailed anatomical comparisons of the above-mentioned approaches and the anatomical areas of the proximal femur that can be visualized and accessed

Objective

To assess visualization and access to the femoral neck for commonly used surgical approaches to the hip in an effort to guide decision-making for treatment of femoral neck fractures

Methods

- Ten fresh-frozen cadaveric whole-pelvis specimens (n=20 hips)
- Each hip was randomly assigned to one of four different surgical approaches to the hip (n=5 hips/approach)
 - Smith-Peterson (SP)
 - Smith-Peterson with rectus release (SPwR)
 - Watson Jones (WJ)
 - Hueter approach

Computer-Assisted Percent Visualization

- Variation in specimen size was accounted for by marking the skin at several anatomic landmarks prior to the surgical approach to allow for data normalization post-exposure (anterior superior iliac spine, posterior inferior iliac spine, ischial tuberosity, and pubic tubercle) and standard ruler
- After surgical exposure, standardized and calibrated digital images acquired using a camera with a 60-mm lens using clinically relevant retraction and positioning of the hip
- Using ImagePro[®], the area visualized was determined by outlining the area exposed (A_E) and the area defined by the pelvic anatomy marks (A_P) and calculating A_E/A_P to determine percentage area visualized (A_V)

Surgeon Assessment

- After images were acquired, three investigators individually assessed the specimen for surgical visualization and access
- Each investigator determined and recorded their ability to readily **visualize** and then readily **access** (touch/outline with a freer elevator) the following anatomical points:
 - Subcapital femoral neck (superior, anterior and inferior aspects)
 - Basicervical femoral neck (superior, anterior and inferior aspects)
- The number of points **visualized** by each surgeon (S_V) and **accessed** (S_A) were scored and recorded by an independent observer

Statistical Analysis

- Data were compiled and were compared for statistically significance using one-way ANOVA for A_V data
- For S_V and S_A data, scores for anatomic landmarks were combined to compare proportions visualized and accessed for each approach with respect to femoral neck fractures using Fisher's Exact tests.
- Significance level was set at $p \leq 0.05$ and all statistical tests

Results

Figure 1: Percent visualization (A_V), which utilized digital camera images and ImagePro[®] software, for commonly used surgical approaches to the hip. “*” indicates a statistically significant difference.

Figure 2: Anatomical points of the femoral neck that each investigator was to surgically visualize and access post-exposure. *Image from MusculoskeletalKey.*

Figure 3: Smith-Peterson approach with clinically relevant retraction. Subjective and quantitative measures were acquired post-exposure.

Results (cont'd)

Surgeon Visualization of the Femoral Neck

- SP had a significantly ($p=0.029$) higher proportion of visualized anatomic landmarks compared to WJ
- Hueter was not significantly different from any of the others for visualization

Surgeon Access/Outline of the Femoral Neck

- SP and Hueter had a significantly ($p<0.049$) higher proportion of outlined anatomic landmarks compared to SPwR.
- SP and Hueter were not significantly different from WJ

Discussion

- Surgical approach to the hip for ORIF is an ongoing area of debate among orthopedic surgeons.
- While some surgeons may favor a particular approach, adequate exposure and visualization of the femoral neck increases the chance for a successful open reduction when it is required.
- High-quality, subjective and quantitative comparisons among different surgical approaches have been limited in the literature.
- No studies have compared these four commonly used approaches in a single study.
- Our data demonstrated that the Smith-Peterson with and without rectus release, Hueter, and WJ approaches have recognizable and quantifiable differences in their ability to visualize and access the femoral neck.
- The Smith-Peterson approach allowed for the best visualization and access to femoral neck anatomic landmarks from the surgeons perspective, while maintaining excellent percent visualization from the camera and ImagePro[™] analysis – only second to SPwR for this computer assisted method.
- Based on this study the SP approach may provide orthopaedic surgeons the best opportunity to visualize and adequately reduce femoral neck fractures.

Conclusions

The Smith-Peterson approach with or without rectus femoris release provided superior visualization of the femoral neck anatomy compared to Hueter and Watson-Jones approaches. Similarly, the Smith-Peterson approach allowed for optimal surgeon visualization of and access to clinically relevant femoral neck anatomic landmarks compared to other approaches assessed.

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