Fixation Recommendations in 2013: Plating

Steven A. Olson, MD
Professor, Dept Orthopaedic Surgery
Duke University School of Medicine

Current Recommendations

Plate Fixation for OTA / AO 41A fractures

- 41A1
- 41A2 injuries with an intact lateral cortical wall

OTA / AO Fracture Compendium
Hip Fracture Fixation

Traditional Approaches to Fixation

Intertrochanteric Fractures
Anatomic alignment - Implants that allow controlled collapse

Femoral Neck Fractures
Anatomic alignment – Implants that use axial compression

What Are the Fixation Problems?

Intertrochanteric Fx:
Screw cut-out – loss of fixation
Malreduction – leg length disc., abductor weakness

Femoral Neck Fx:
AVN, Non-union
Shortening of femoral neck (malunion)

Factors That Impact Outcome

Patient Factors:
Pre-Injury Function
Osteoporosis

Treatment Factors:
Quality of reduction
Placement of fixation
Choice of fixation

Position at union

Ziowodzi et al JBJS (Br) 2008

Baumgaertner et al JBJS (Am) 1995
Biomechanical Investigations

In the 80's and early 90's investigations focus on parameters of controlled collapse

Screw sliding as a function of side-plate angle

Medial calcar strain as a function of reduction


These early biomechanical investigations reported usual variables - stiffness & strain, etc

Ultimate failure mechanisms did not reproduce screw cut-out as seen clinically

Beginning in 1995 clinical observation linked rotational displacement of an intertrochanteric fracture with screw cut-out.

Lustenberger et al Unfallchirurg 1995
Gottfried et al CORR 2004
Moroni et al CORR 2004
Observation Confirmed with Biomechanics

Sommers et al. J Ortho Trauma 2004

Lateral Wall

Lateral wall structure is an important factor as well

Palm et al. JBJS (Am) 2007

The clinical effect of loss of the lateral wall on the femoral shaft is to allow the proximal fragment to have both lateral migration and rotational displacement

Implant Classification

Impaction Devices: Blade plate, Jewett nail

Compression Devices: SHS, Medhoff, IMHS, Gamma nail, etc

Reconstruction Devices: 2 screws without linear compression

Linear Compression: 2 screws with linear compression (PCP)

Compression Devices with Lateral wall buttress options: ?

Locking Plates: ?

Lateral Buttress Plate

Clinical series suggest use of a lateral buttress plate to restore the lateral wall improves fixation.

Gupta et al. International Orthopaedics 2010

Little biomechanical data to evaluate effects of lateral buttress plate with SHS on proximal fragment rotation or stability

Bong et al. J Trauma 2004

PCP vs SHS

Clinically there appears to be a benefit to use of the percutaneous compression plate

Ma et al. Meta-Analysis. Injury 2012

PCP vs SHS

Rotationally Stable Implants

Koenigsee Implants, Allendorf, Germany

Knobe et al J Ortho Trauma 2012

The use of locking screws in the side plate of a DHS significantly increases cycles to failure compared to non-locking screws

Dylan et al Injury 2008

Figure 3 Mean number of cycles to failure with 95% confidence interval.

Locking Plates

110 patients – good results in intertrochanteric fx's

Zha et al Injury 2011
Locking Plates – Not a Panacea

Catastrophic Failure After Open Reduction Internal Fixation of Femoral Neck Fractures With a Novel Locking Plate Implant

Berkes et al. J Ortho Trauma 2012

Increasing Use of IMN Fixation

SHS vs IMN use in Board Examinees 1999-06

Anglen, Weinstein JBI S 2008

Not Just an American Issue!

Yli-Kyyny et al. Injury 2012
Is There Still a Role for Plates?

No study to date looking at stable intertrochanteric fractures has shown superior results of IMN fixation over SHS fixation!

Meta-analysis Bhandari, et al. JOT 2009

Many studies of OTA/AO 41A2 fractures also have equivalent results

Why Use Plate Fixation?

Equivalence with IMN Fixation

Cost of SHS is much less than IMN fixation

Evolving rotationally stable plates may alter the cost arguments

Potential adverse consequences of IMN fixation???

Conversion of Failed Hip Fx Fixation to THR

Femoral Neck 83
Intertrochanteric 71

Complication rates comparable to revision arthroplasty or complex THR

Mortazavi et al J Arthroplasty 2012

| Table 1. Comparison of Different Pelvisper Fixation Between the Neck Salvage and Intersubchameric Salvage Groups |
|-----------------------------------------------|-----------------------------------------------|
|                     | Neck Salvage (113 hips) | Intersubchameric Salvage (72 hips) |
| Operation time (hrs) | 96                       | 126                          |
| Intertrochanteric loss (yes only) | 50%                      | 40%                          |
| Allogenic blood transfusions | 1.3                      | 2.4                          |
| Femoral neck osteotomy | 0                        | 15                           |
| Osteotomy (n,%): &Estreil (n,%): | 0                        | 15                           |
| Calve replacement (n,%): | 0                        | 7                            |
| Femoral head (n,%): | 28                       | 54                           |
| Complication (n,%): &Postoperative complications | 22 (26%) | 24 (24%) |
| Mortality (n,%): | 13 (15%) | 18 (25%) |
Summary

Plate Fixation for intertrochanteric fractures continues to have a role in 2013. OTA/AO 41A1, 41A2

Constructs that have rotational stability as well as linear compression are of increasing interest

Biomechanical testing is an imperfect science – we do see added value, but the link between benchtop and the bedside is limited.

Thank You!