

# ПЛЕЧЕВОЙ СУСТАВ: ПОСЛЕОПЕРАЦИОННАЯ ВИЗУАЛИЗАЦИЯ

К. Вёртлер

Технический университет, Мюнхен, Германия

## SHOULDER: POSTOPERATIVE IMAGING

K. Wörtler

Technische Universität München, Germany

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**Imaging of the Postoperative Shoulder**  
Prerequisites

- Familiarity with surgical procedure (stabilization, rotator cuff repair)
- Normal vs abnormal postoperative findings
- Typical complications
- Knowledge of current symptoms & function
- Plain radiography
  - Bony changes
  - Obvious pathology
  - Metallic implants



• MR Imaging • MR Arthrography • CT Arthrography • CT

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**Anterior Glenohumeral Instability**  
Anatomic Repair

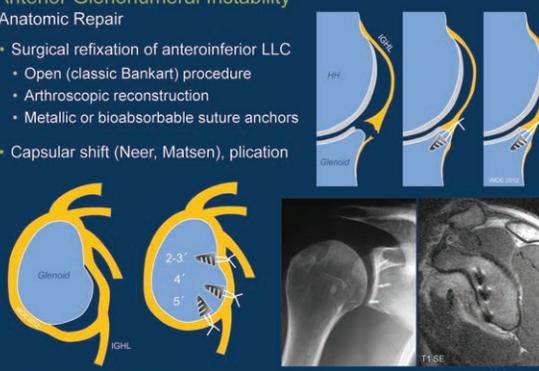
- Surgical refixation of anteroinferior LLC
- Open (classic Bankart) procedure
- Arthroscopic reconstruction
- Metallic or bioabsorbable suture anchors
- Capsular shift (Neer, Matsen), plication



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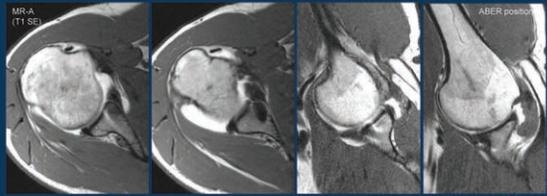
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**Anatomic Shoulder Stabilization**  
Normal Postoperative MR Findings

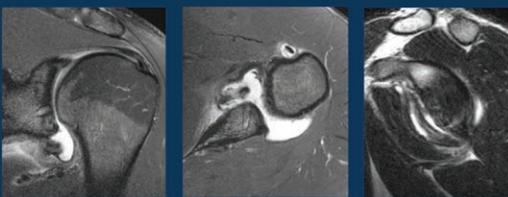
- Plump and/or enlarged glenoid labrum & irregular thickening of IGHL
- Thickened capsule & scar tissue formation (capsular shift, plication)
- Integrity of labro-ligamentous complex
- MR arthrography mandatory
- ABER (abduction & external rotation) position very helpful



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**Anatomic Shoulder Stabilization**  
Recurrent Instability

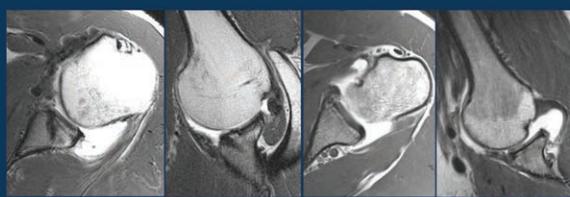
- Labro-ligamentous retear (traumatic redislocation, -subluxation)
- Insufficient capsular reduction
- SLAP lesion
- Osseous glenoid defect (chronic wear), best demonstrated by CT



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Wagner SC et al (2002) Radiology 222:196-203

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MR-A (T1 SE) MR-A (T1 SE) ABER position

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ABER (T1 SE) MR-A (T1 SE) MR-A (T1 SE)

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MR-A (T1 SE)

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**Non-Anatomic Shoulder Stabilization**  
**Overview**

- Most procedures are historical
- Treatment of recurrent anterior instability (failed Bankart repair)
  - Bristow-Latarjet procedure (coracoid transfer)
  - Bone block (J span) procedures (Lange, Resch, Eden-Hybinette)

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T1 SE

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**Rotator Cuff Tear**  
**Surgical Repair**

- Suture of torn rotator cuff tendon(s): tendon to tendon - tendon to bone
- Surgical procedure depends on size of tear
  - Arthroscopic & Mini open repair
  - Open repair (requires acromial detachment of deltoid muscle)
  - Tendon transfer (Latissimus, ISP, SSC)

Transosseous sutures Suture anchors

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**Rotator Cuff Repair**  
Normal Postoperative MR Findings

- Increased SI of repaired tendon(s)
- 90-100 % of repaired tendons
- Partial or (smaller) complete defects
- Clinical symptoms & function ?
- Contrast extravasation at MR arthrography
- MR arthrography rarely helpful

Spielmann AL et al (1999) Radiology 213:705-708  
Zanetti M et al (2000) Skeletal Radiol 29:314-319  
Knudsen HB et al (1999) J Shoulder Elbow Surg 8:242-246

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**Rotator Cuff Repair**  
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- 90-100 % of repaired tendons
- Partial or (smaller) complete defects
- Clinical symptoms & function ?
- Contrast extravasation at MR arthrography
- MR arthrography rarely helpful
- Subacromial fluid
- Subacromial decompression procedures
- Might extend into AC joint

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**Rotator Cuff Repair**  
Retear

- Suture failure or pull-out, anchor pull-out
- Structural failure of repaired tendon(s)
- Muscular degeneration
- MR Imaging (conventional)
- Complete (= transtendinous) tears:
  - Sensitivity 84-86 %
  - Specificity 91-92 %
  - Defects > 1 cm often symptomatic
- Partial tears: meaningless

Owen et al (1993) Radiology 186:443-447  
Magee et al (1997) Am J Roentgenol 168:925-928  
Gawronski et al (1996) J Bone Joint Surg Am 78:1501-1506

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**SSP Tendon Retear**

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**Rotator Cuff Tear**  
Muscle Atrophy & Fatty Degeneration

Grade 0	no fat
Grade 1	streaks of fat
Grade 2	less fat than muscle
Grade 3	equal amounts of fat and muscle
Grade 4	more fat than muscle

*no surgical repair*

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Goutallier (1994) Clin Orthop 304:78-83

**Postoperative Complications**  
Deltoid Dehiscence

- Suture failure following deltoid reinsertion (open rotator cuff repair)
- Interposition of
  - Fluid (acute dehiscence)
  - Fat, scar tissue (chronic dehiscence)

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**Postoperative Complications**  
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- Suture failure following deltoid reinsertion (open rotator cuff repair)
- Interposition of
  - Fluid (acute dehiscence)
  - Fat, scar tissue (chronic dehiscence)
- Atrophy & fatty degeneration of deltoid muscle

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**Postoperative Complications**  
Related to Fixation Devices

- Metallic implants
  - Non-ferromagnetic (titanium)
  - Dislocation, misplacement, protrusion, loosening, fracture
  - Best depicted by CT or CT arthrography

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T1 SE      fs PD TSE      CT

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### Postoperative Complications Related to Fixation Devices

- Bioabsorbable implants
  - Non-radioopaque material (polymers), resorption over months to years
  - Misplacement & dislocation only visible on MR imaging

fs PD TSE      T1 SE      fs PD TSE

MR-A      Suture anchor      Tack

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Major NM, Banks MC (2003) Am J Roentgenol 180:377-380  
Park et al (2009) Am J Sport Med 34:139-144

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T1 SE      fs PD TSE      Histology

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### Postoperative Complications Nerve Injury

- Mechanisms of injury
  - Intraoperative tissue retraction, direct laceration, suture entrapment
- Suprascapular nerve injury
  - Open rotator cuff repair, tumor surgery
  - Denervation of infraspinatus ± supraspinatus muscles

T1 SE      fs PD TSE      Diagram

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### Postoperative Complications Nerve Injury

- Mechanisms of injury
  - Intraoperative tissue retraction, direct laceration, suture entrapment
- Axillary nerve injury
  - Open stabilization, Bristow-Latarjet procedure, open acromioplasty
  - Denervation of deltoid and/or teres minor muscles

MR-A (T1 SE)

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### Postoperative Complications Infection

- Rare complication
  - Septic arthritis, bursitis, periarticular soft tissue infection, osteomyelitis
- Role of MR imaging
  - Define extent of infection
  - Rule out/detect abscess formation & osteomyelitis

T1 SE      fs T1 SE Gd      fs T1 SE Gd

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T1 SE      fs T1 SE Gd      fs T1 SE Gd

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### Postoperative Shoulder Summary - What to learn

- Prerequisites
  - Familiarity with surgical procedure & complications
  - Plain radiograph
  - MRI vs MR arthrography vs CT/CT arthrography
- Shoulder stabilization
  - Clinical data
  - MR arthrography incl. ABER position
- Rotator cuff repair
  - Current symptoms & function
  - Standard MR imaging usually sufficient
  - Report on findings of therapeutic relevance

The "Nuremberg Funnel" (Historical postcard)

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