



AO Foundation

AO Surgery Reference

- Hundreds of surgical procedures
- Evidence and decision making support
- Studies and journal articles
- Graphics, videos, animations, charts
- Easy to use internet-solution

**The comprehensive online reference
in your daily clinical life**



AO Surgery Reference:**For the benefit of residents and surgeons.**

Traumatology today encompasses such a vast wealth of knowledge that no single surgeon can cope with all this information. And daily clinical life hardly leaves any time for academic research.

That's exactly where the AO Surgery Reference steps in: Here you'll find all the specialized knowledge you might need in your daily clinical life, accessible online from any office, library or operating room – wherever there is Internet access.

How to access AO Surgery Reference

Simply go to www.aosurgery.org

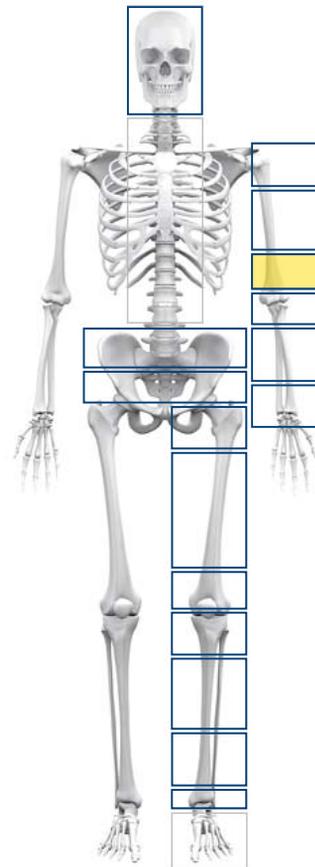
The authors

More than sixty of the world's most renowned surgeons from 20 countries are contributing to this project, making sure that the AO principles are followed while keeping in mind local realities.

**AO Surgery Reference**

To understand the AO Surgery Reference, think of a huge online library where you can find quick answers to clinical questions.

Hundreds of surgical procedures are described in text and images. Approaches and patient positionings are shown, and decision making is supported

**Start page**

On the start page of the AO Surgery Reference you'll see a skeleton. The **anatomical areas** available now are highlighted. New anatomical areas are being added continuously at 2-month intervals.

A click on the anatomical area of your interest will take you directly to a website dedicated exclusively to that anatomical region.

with a huge evidence base containing the literature of the last decade.

You not only find in-depth information in the form of text, graphics and videos, AO Surgery Reference also helps you make the right decisions.

Surgical management process

Go step by step through the process.

The page layout

For better use and understanding the information on each page is structured similarly.

Quickfinder

If you have chosen to go step by step and would like to change the diagnosis, treatment method, or the fixation device while in the process, use the Quickfinder to quickly change your settings without going through the whole process again.

Information

Here, in the middle and largest section of the page, you'll find what is most relevant to know in a particular clinical situation.



Support

On the right-hand side of each screen there are boxes containing links to relevant videos, studies, journal articles and book chapters.

Much of this information can be used in a clinical situation (videos, decision making support). The links collected under "Further reading" lead to more academic material with generally longer texts.

Surgical management process

With the surgical management process there are two ways of finding information:

1. Step by step: Let yourself be guided through the whole surgical management process: Start by selecting a diagnosis. You will then be shown all indication options available for your choice. Then select a method of treatment and a fixation device. You will be guided

through the appropriate patient preparation, approach and surgical procedure.

2. Direct information: Just jump into anything you're interested in. Click on "Approach" to see all approaches, or go to "Reduction and Fixation" to see all available surgical procedures.

Diagnosis
13-C3 Complete articular fracture, multifragmentary



Multifragmentary articular fractures of the distal humerus are classified as 13-C3.

The mechanical properties of the distal humerus are based on a triangle of stability, comprising the medial and lateral columns, and the transverse condylar mass. In C-type fractures, all 3 sides of this triangle must be restored.



13-C3 complete articular

Images taken from Ottavio F, et al. (1998) Atlas of Internal Fixation. Used with kind permission.

AO Foundation

Executive Editor: John Cooney, General Editor: Peter Heul, Authors: Wilfried Böhler, Daniel Weidmann

Distal Humerus

Diagnosis | Classification | Preparation | Approach | Reduction & fixation | Aftercare

Fracture Type	13-A1	13-A2	13-A3
Proximal	13-A1 radial	13-A2 shaft	13-A3 multifragmentary
Partial	13-B1 lateral epiphyseal	13-B2 medial epiphyseal	13-B3 total
Complete	13-C1 single	13-C2 multifragmentary comminuted	13-C3 multifragmentary

AO Surgery Reference
 Online references in AO Surgery Reference

The goal of AO Surgery Reference is to provide an evidence-based, comprehensive, and up-to-date reference for all orthopedic surgeons. AO Surgery Reference can be searched online in the AO Surgery Reference.

Additional information

- Find additional information related to diagnosis in "Evidence", "Decision support" and "Further reading."

Classification

To learn more about a specific fracture, click on the image. In the pop-up window which opens after clicking, the fractures of this classification are then explained in detail.

Diagnosis

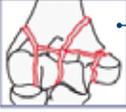
This screen will help with making a good diagnosis based on the Müller/AO classification. Each fracture type is explained in text, drawings and x-rays. Our Evidence summary gives an overview of the epidemiology of these fractures, therapy, and prognosis, as reported in the literature of the past decade.

Having made a selection, the system takes you directly to the next stage.

Indication

13-C3 Operative

print select & proceed



Indications

Adult articular fractures of the distal humerus require open anatomical reduction and stable fixation.

Contraindications

- Noncompliant patient
- Unacceptable surgical risk
- Extreme osteoporosis

Advantages

- Anatomical reduction
- Articular congruity
- Early functional aftertreatment
- Reduced risk of degenerate joint disease

Studies

In order to help you make an evidence-based decision, we have added relevant studies and literature analyses.

Summary of studies
Nonoperative treatments compared to operative treatments

Distal humeral fractures in adults

Study	Year	Level	Design	Outcome	Score	Quality	Conclusion
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative
Standerford et al	2011	III	Retrospective	Union	75	Low	Operative

AO Foundation

Executive Editor: Chris Colton | Associate Editor: Paul M. Sizer
Authors: Winand Grooten, David Erik, David Ring

Distal humerus 13-C3

back to overview

Diagnosis **Indication** Preparation Approach Reduction & Fixation Aftercare

Quickfinder

Fracture: Humeral
Distal
13-C3

Indication: ORP
Fracture technique: ORP

Summary

Show all entries

Treatment Options

1 Nonoperative treatment

Indication
select this option

Operative treatment

Indication
select this option

Method

2 ORP
Open in reduction
Internal fixation

Indication
select this option

Fixation technique

3 Perpendicular plating

Indication
select this option

Parallel plating

Indication
select this option

AO Surgery Reference

Distal humerus in clinical life

Nonoperative treatment compared

Nonoperative vs operative treatments

Cruciate ligaments compared

Further reading

Decision making in distal humerus

Pop up

Clicking on "Information" will open a pop up window for each option, giving you the most important indications at a glance.

Indication

After diagnosing a fracture, three decisions need to be taken:

1. Is surgical treatment required or will nonoperative therapy suffice?
2. Which surgical method is appropriate?
3. Which implant/fixation device should be employed?

The "Indication" page gives help with these questions. For all possible options indications are given along with contraindications, advantages and disadvantages. On the right-hand side of the screen, studies and literature analyses provide a sound basis for evidence-based decision making.

Approach

Transolecranon approach

1  **Incision**
Make a straight incision beginning level with the junction of the middle and distal thirds of, and centered on, the humeral shaft. Some surgeons make a straight incision, whereas others prefer to curve the incision around the olecranon to the radial side. The incision ends over the ulnar olechysis.
An ulnar-based subcutaneous flap is developed.

2  **Ulnar nerve**
The ulnar nerve is identified proximally along the medial border of the triceps. It is then released from the cubital tunnel distally, through the flexor pronator aponeurosis to the level of its first anterior motor branch. Whenever possible, care should be taken to preserve the perineural vessels. A vessel loop is placed around the ulnar nerve, which is protected throughout the entire procedure.

This incision is made over the olecranon. The incision is made over the olecranon. The incision is made over the olecranon.

Approach: Transolecranon approach
Ulnar nerve
The ulnar nerve is identified proximally along the medial border of the triceps. It is then released from the cubital tunnel distally, through the flexor pronator aponeurosis to the level of its first anterior motor branch. Whenever possible, care should be taken to preserve the perineural vessels. A vessel loop is placed around the ulnar nerve, which is protected throughout the entire procedure.

AO Foundation
Executive Editor: Chris Colton | General Editor: Paul de Beer
Authors: Marc Storz | Date: Nov. 2010
Distal humerus 13-C3 ORIF

Diagnosis Indication Preparation **Approach** Reduction & Fixation Aftercare

Triceps-elevating approach
Click image to see the posterior triceps-elevating approach (Brian Morrey) explained step by step.

Posterior triceps-on approach
Click image to view the triceps-on (Alonso-Ulames) approach to the distal humerus.

Transolecranon approach
Click image to see the posterior triceps-on approach (with olecranon osteotomy) step by step.

AO Surgery Reference
Online reference in clinical life

Problems associated with an operation solution can be solved by using a similar and realistic technique for creating and repairing the prosthesis.
Click here to read more.

Videos
Approaches in traumatology: We allow (posterior)

Further reading
Surgical approaches: soft tissue management

Information
Pop-up windows offer more information and better viewing.

Video
Most approaches can also be viewed on video in several formats.

Approach

This section shows all regularly practiced approaches. After having selected a treatment option, the recommended approach for this method is displayed. When no selection has been made, or when the "show all" button is clicked, all recommended approaches to the anatomical segment are shown.

Each approach is explained on a step-by-step basis with enlargeable images.

3 Perpendicular plating Reconstruction of the articular surface

a

Condyral reassembly
Reduce and hold the articular fragments using cannulated screw guide wires.1

Assemble all small fragments covered by cartilage, even if they have no soft tissue connection. A headless screw is often a good choice for fixing some of those fragments.

b

Definitive fixation of articular fragments
Insert a cannulated screw over the guide wire after pre-drilling the pilot hole. Insert a second screw in the same plane as the first. The wire should be removed after the second screw is inserted. The wire should not be left in the joint.

Insert the screw from the lateral to the medial. The screw head does not irritate the ulnar nerve in the planned position of the medial plate.

AO Foundation

Distal Humerus 13-C3 ORIF

Perpendicular plating

- 1 Principles
Stability of the distal humerus is based on a triangle of stability, comprising the medial and lateral columns and the transverse scapular strap. Click image to learn more about the triangle of stability.
- 2 Identification of the bony fragments
Take your time to recognize all bony fragments, and compare them to the images. Click image to see further information on the identification of bony fragments.
- 3 Reconstruction of the articular surface
Click image to see the reconstruction of the articular surface explained step by step.

Reconstruction of the articular surface
Condyral reassembly



Assemble all small fragments covered by cartilage, even if they have no soft tissue connection. A headless screw is often a good choice for fixing some of those fragments.



STREAMING 0:05:27:392

Aftercare
Here you will find statistical data and advice regarding postoperative care.

Information

Pop-up windows show each step of the surgical procedure in full detail.

Video

Many procedures can also be viewed on video, live, or as AO course videos.

Reduction & Fixation

Reduction and Fixation explains the different surgical procedures of treating fractures. When a selection has been made in Indication, the selected procedure is shown here step by step, often augmented by video, animations or additional chapters from AO books.

When no previous selection has been made, all available procedures are shown in a list. All of the procedures

shown here were compiled by teams of renowned AO surgeons who draw from many years of specialized experience, making the "pitfalls and pearls" described useful even to the experienced surgeon.

Quick online reference in clinical life

AO Foundation
Clavadelerstrasse 8
7270 Davos
Switzerland

Phone +41 (0) 81 414 28 01
Fax +41 (0) 81 414 22 80
E-mail foundation@aofoundation.org
Web www.aosurgery.org