

# **Fractures of the clavicle: when and how to operate —indications and methods of fixation**

*Jeppe Barckman  
Aarhus University Hospital*

# 42-year-old man, fell off mountain bike

- Displaced fracture of the clavicle
- Neurovascular intact



Operation?

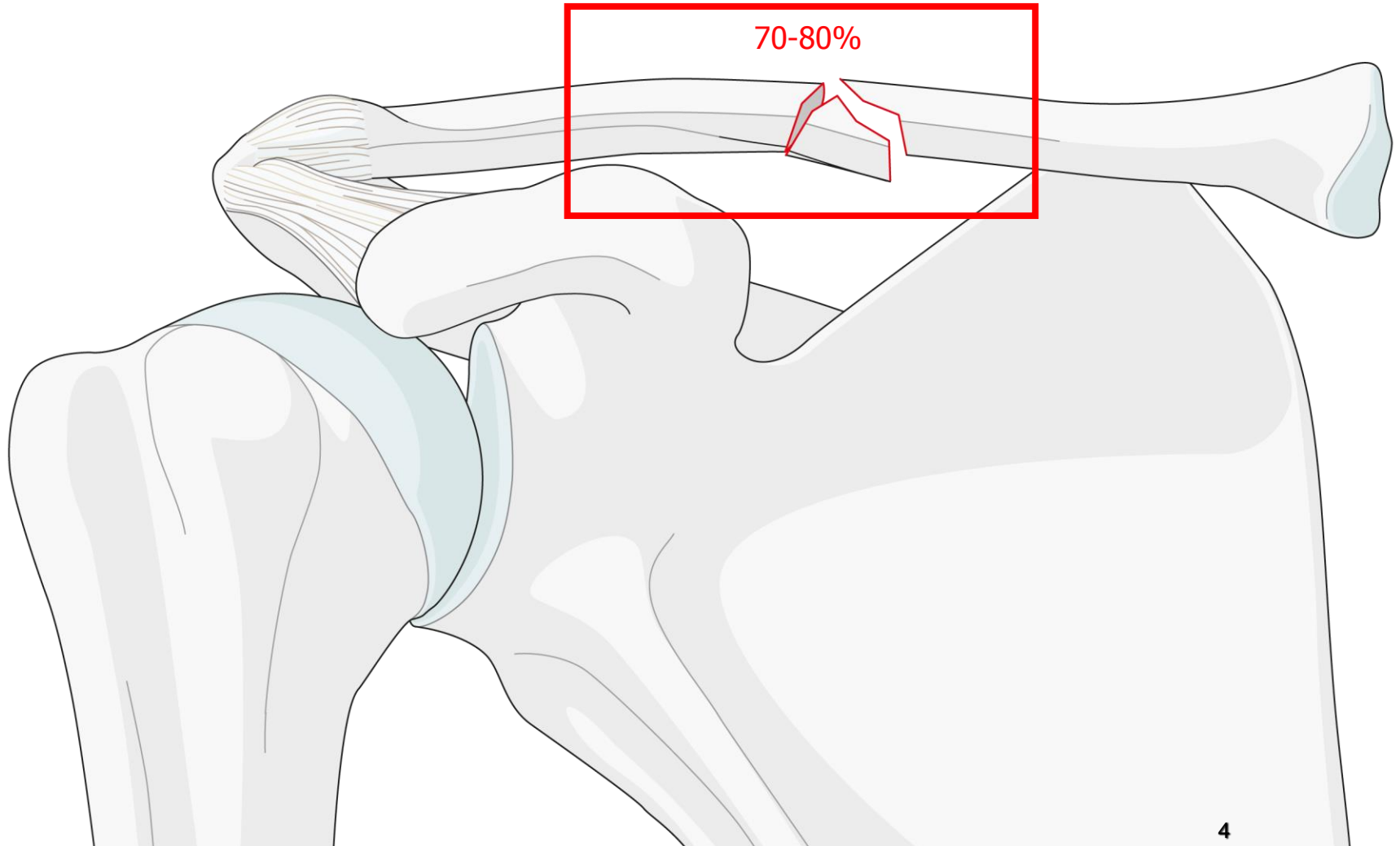
Yes

No

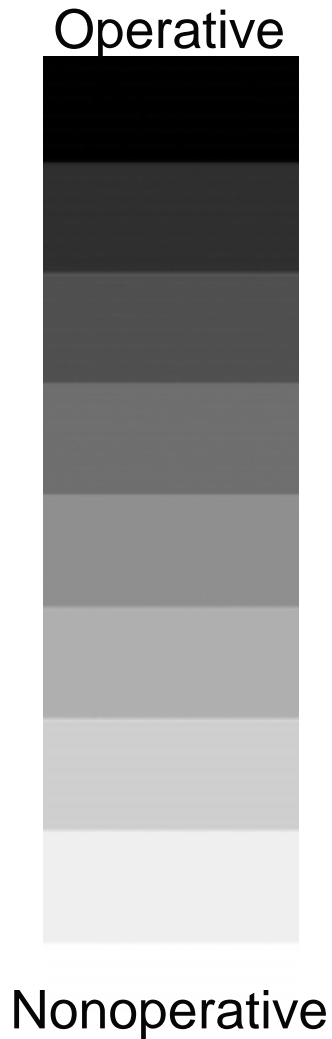
# Learning outcomes

- Discuss indications for operative vs. conservative treatment and the possible complications
- Identify surgical approaches and anatomical structures at risk

# 70–80% are middle third clavicular fractures



# Indication of surgery



- Absolute
  - Open fracture
  - Neurovascular compromise
- Relative
  - Polytrauma
  - “Floating shoulder”
- “Significant displacement”
- Undisplaced fracture



# “Traditional teaching”

- “With surgery, you trade a bump for a scar”
- “Function is normal even following clavicular malunion”
- “All clavicle fractures heal”

# Indications

*J Bone Joint Surg Am.* 2007 Jan;89(1):1-10.

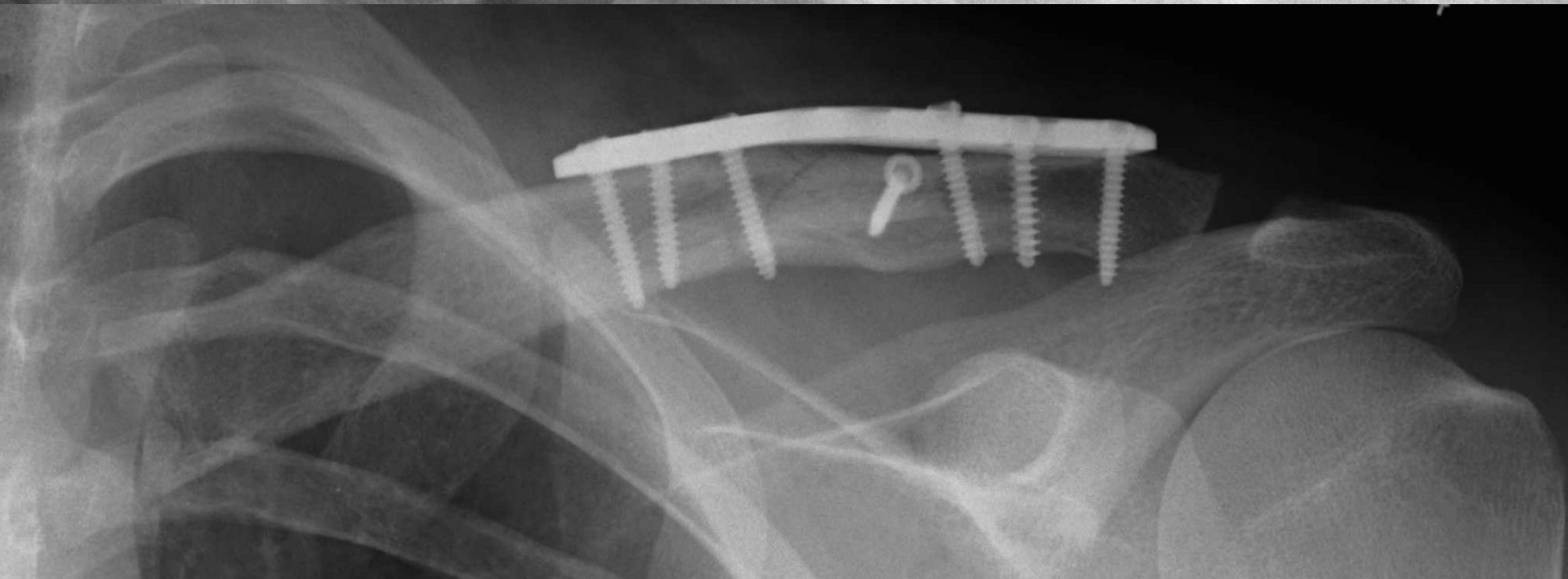
## Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures

$n=13$   
2

A Multicenter, Randomized Clinical Trial

By the Canadian Orthopaedic Trauma Society



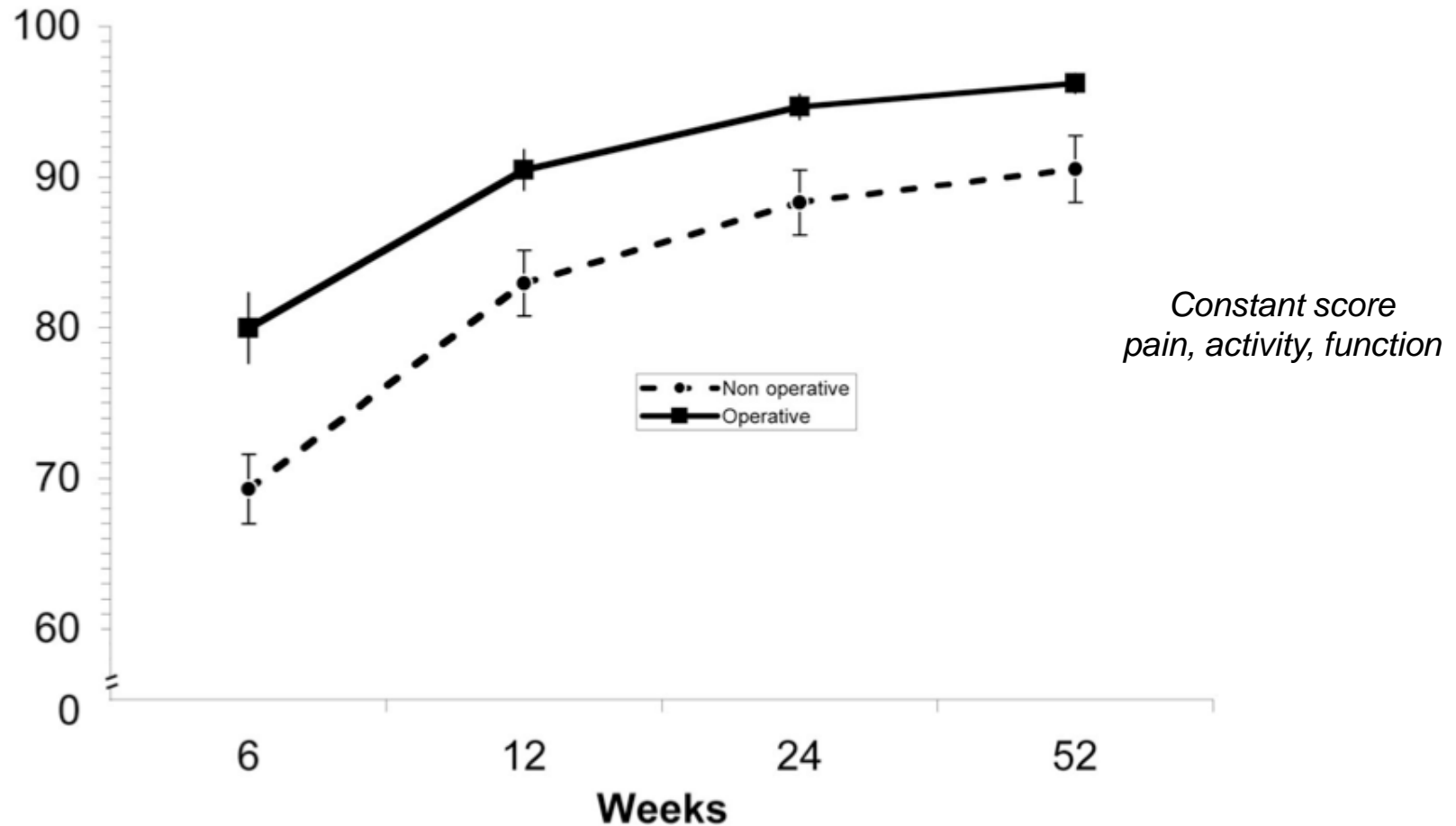




- **Inclusion:** completely displaced (ie, no contact between the principal fragments) middle third clavicle fractures in adults (16–60 years old) with no absolute or relative indications.
- Nonoperative: **sling**
- Operative: open reduction internal fixation (ORIF) using **small fragment plates and screws**
- Outcome: Constant Shoulder Score, DASH scores collected at 6 weeks, 3 months, 6 months, 12 months, and 2 years

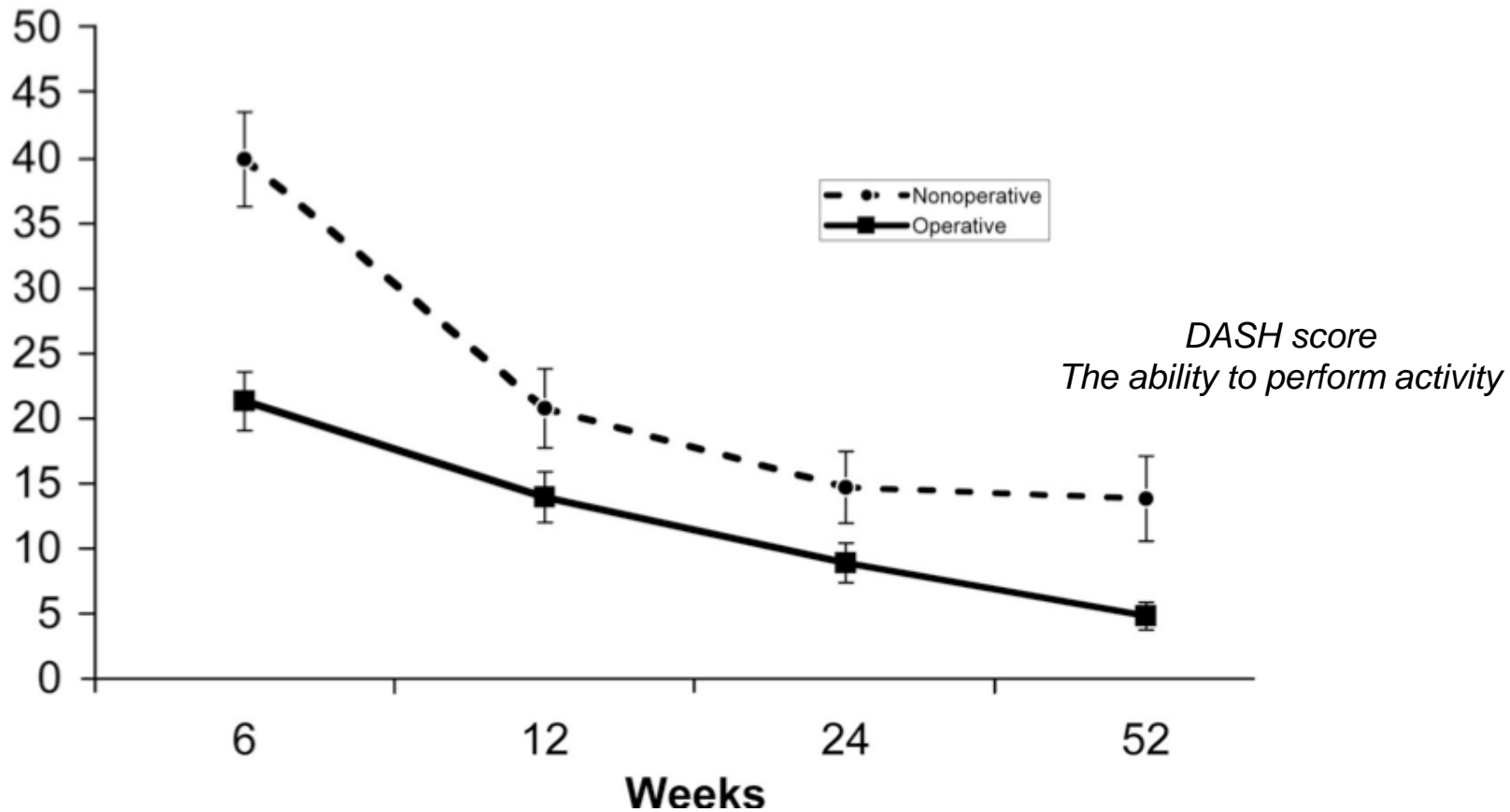
# Constant Shoulder Score

Canadian Orthopaedic Trauma Society



# DASH scores

Canadian Orthopaedic Trauma Society



# Study conclusions

Canadian Orthopaedic Trauma Society

- Data supports early operative plate fixation of completely displaced midshaft clavicle fractures in young active individuals
- Nonoperative treatment of midshaft clavicular fractures should be reconsidered

# KKR DK 2012

(Godkendt DOS 2014)

## Short clinical guideline

### Klavikelfrakstur – Korte Kliniske retningslinjer

#### Behandling

Den optimale behandling er meget omdiskuteret. Historisk er konservativ behandling den foretrukne da klaviklen som udgangspunkt har et stort helingspotentiale. Operativ behandling er mange steder foretrukket ved dislocerede frakturer, men aktuelt forligger der ikke videnskabelig evidens der taler for bedre resultater efter operativ behandling.

Ved følgende forhold er der oftest indikation for operativ behandling:

- Åbne frakturer
- Truet hud
- Påvirkede neurovaskulære forhold
- Samtidig fraktur af collum scapula (floating shoulder)

Open fractures  
Risk of skin perforation  
Neurovascular compromise  
Floating shoulder

Ellers **kan** de forskellige klavikelfrakturer behandles efter følgende algoritme:

Laterale		Udisloceret: <b>Slynge behandling</b>
		Disloceret: Er sjældne og forekommer ofte hos ældre. Disse synes kun at have få symptomer ved non-union hvorfor primær behandlingen er <b>slynge</b> . Hos yngre patienter (specielt hvis frakturen er intraartikulær) kan operation overvejes.
Midtskafte		Udisloceret (uanset vinkling): <b>Slynge behandling.</b>
		Disloceret (>1 knoglesbredde med og uden flere fragmenter) : <b>Omdiskuteret men slynge behandling er at foretrække.</b> Undersøgelser viser at der er signifikant let bedre resultater (funktionelt og smertemæssigt) i den første tid efter operationen sammenlignet med slynge behandling, men resultaterne synes at udlignes med tiden (ca. 1-2 år.)
Mediale		Udisloceret / disloceret Ses yderst sjældent. Oftest er frakturen disloceret og ekstraartikulær. <b>Slynge behandling</b> er foretrukket. Hvis frakturen trykker i mediastinum skal lukket reponering forsøges. Hvis det ikke lykkes skal pt åbent reponeres på OP.

Udarbejdet maj 2012 af:

Ilja Ban<sup>1</sup>, Carsten Moss<sup>2</sup>, Michael Brix<sup>3</sup>

<sup>1</sup>Ortopædkirurgisk afdeling, Hvidovre Hospital. <sup>2</sup>Ortopædkirurgisk afdeling, Regionshospitalet Randers. <sup>3</sup>Ortopædkirurgisk afdeling, Odense Universitets Hospital.

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### Conclusion

All midshaft clavicle fractures can be treated conservatively if there is not absolute indication

		Disloceret (>1 knoglesbredde med og uden flere fragmenter) :  <b>Omdiskuteret men slynge behandling er at foretrække.</b> Undersøgelser viser at der er signifikant let bedre resultater (funktionelt og smertemæssigt) i den første tid efter operationen sammenlignet med slynge behandling, men resultaterne synes at udlignes med tiden (ca. 1-2 år.)
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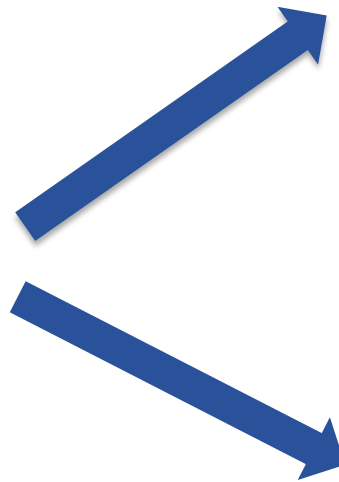
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# What are the issues? If conservative treatment?



Nonunion



Malunion

# Can we predict who will suffer nonunion?

Robinson CM, Court-Brown CM, McQueen MM, et al. Estimating the risk of nonunion following nonoperative treatment of a clavicular fracture. *J Bone Joint Surg Am*. 2004 Jul;86-A(7):1359–1365.

- Calculated probability of a nonunion at 24 weeks after a clavicular shaft fractures, based on age, sex, comminution, and displacement\*

Probability of a Nonunion								
Age (yr)	Not Displaced, Not Comminuted		Displaced, Not Comminuted		Comminuted, Not Displaced		Displaced and Comminuted	
	Males	Females	Males	Females	Males	Females	Males	Females
20	<1%	2%	8%	16%	2%	7%	18%	30%
30	<1%	3%	10%	20%	4%	9%	20%	35%
40	1%	5%	13%	26%	5%	12%	25%	38%
50	2%	6%	18%	28%	6%	13%	29%	40%
60	2%	7%	19%	30%	8%	15%	31%	44%
70	4%	10%	21%	37%	9%	18%	35%	49%

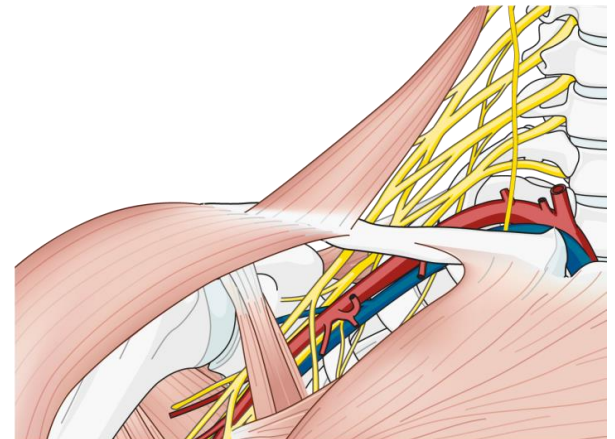
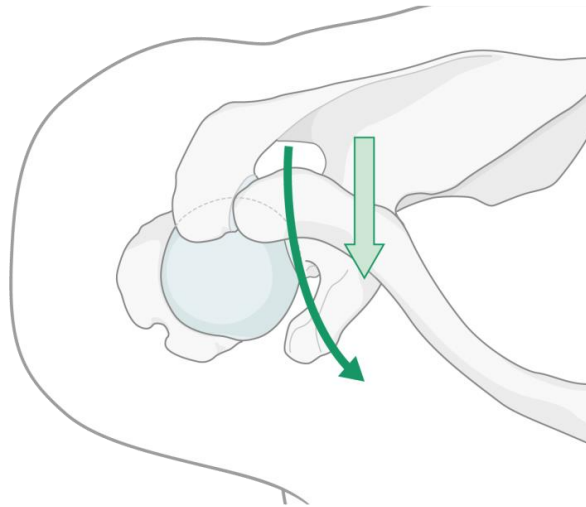
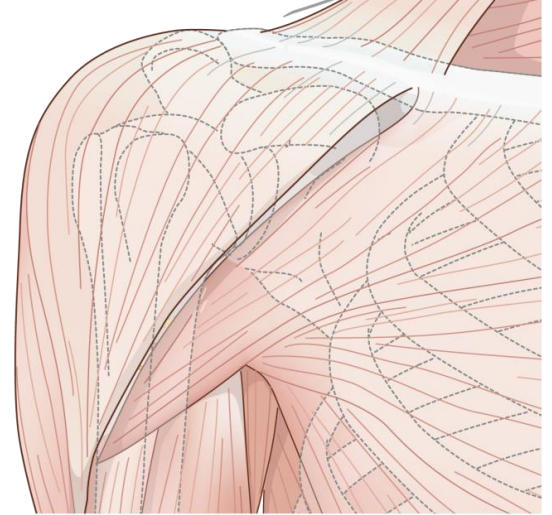
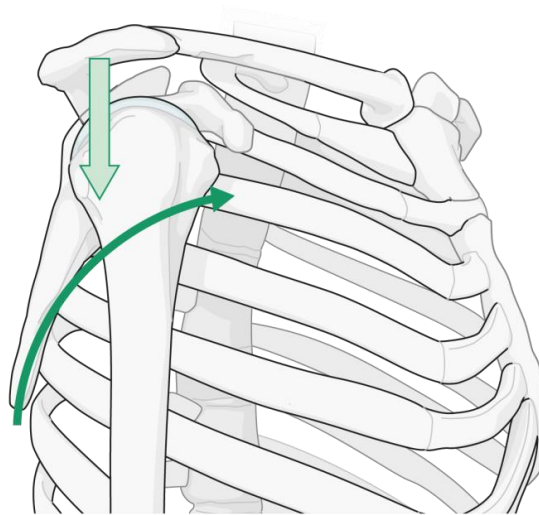
\*The values are based on studies including a total of 581 fractures<sup>9,125</sup>.



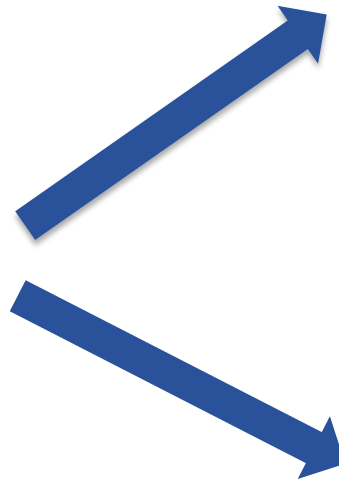
# Is this malunion a problem?



# Clavicular malunion



# What are the issues? If conservative treatment?



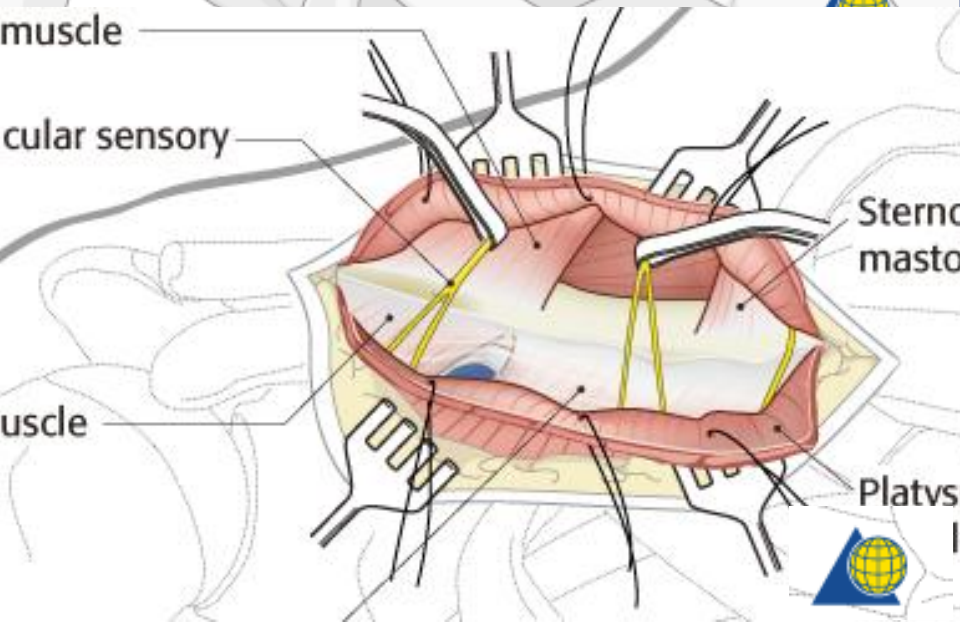
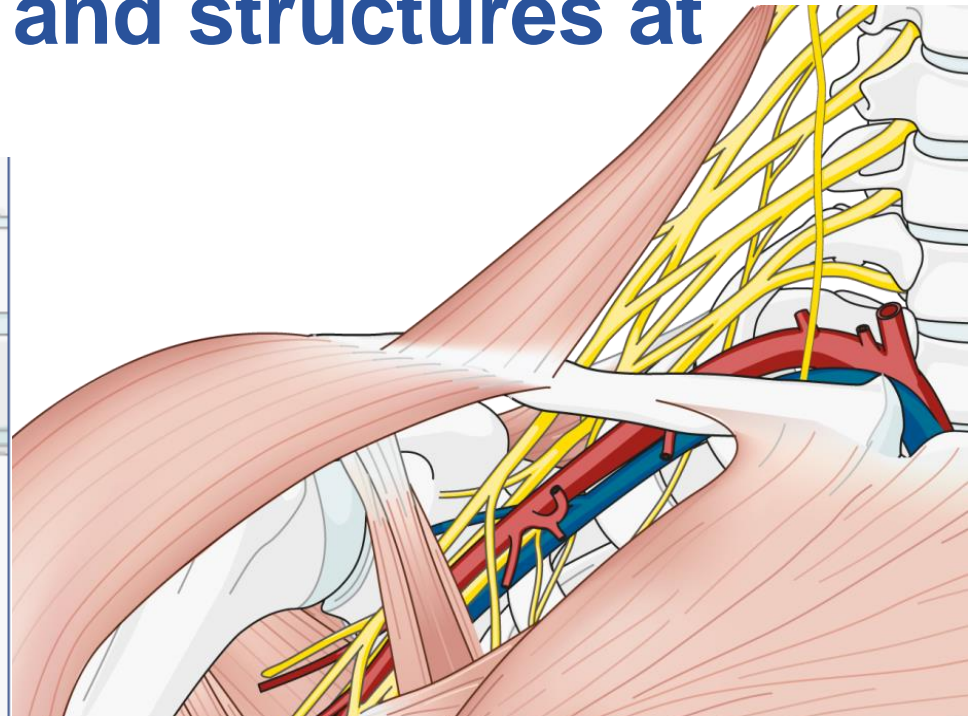
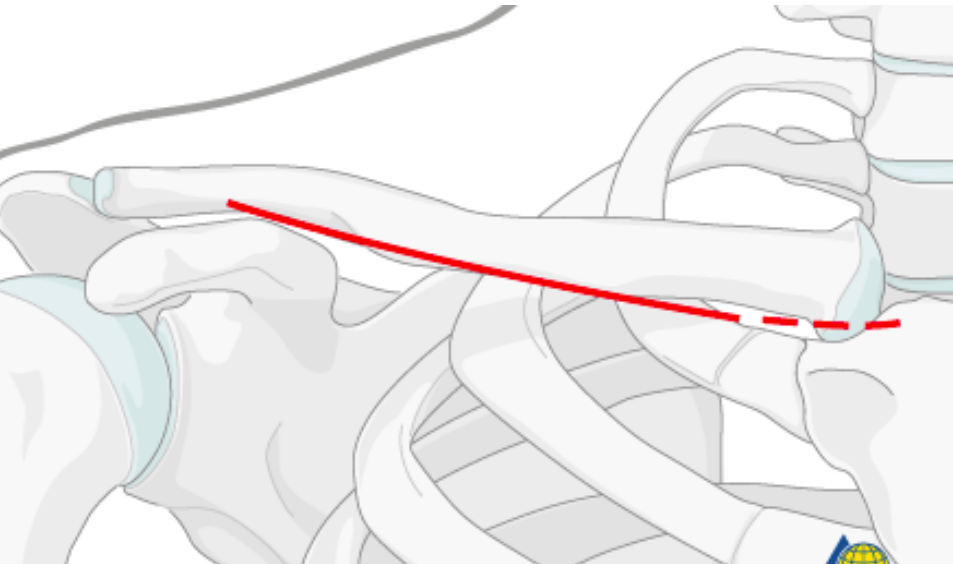
Nonunion



Malunion



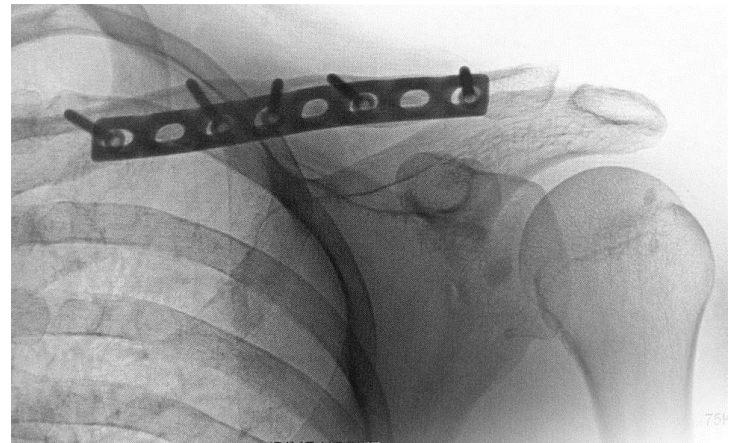
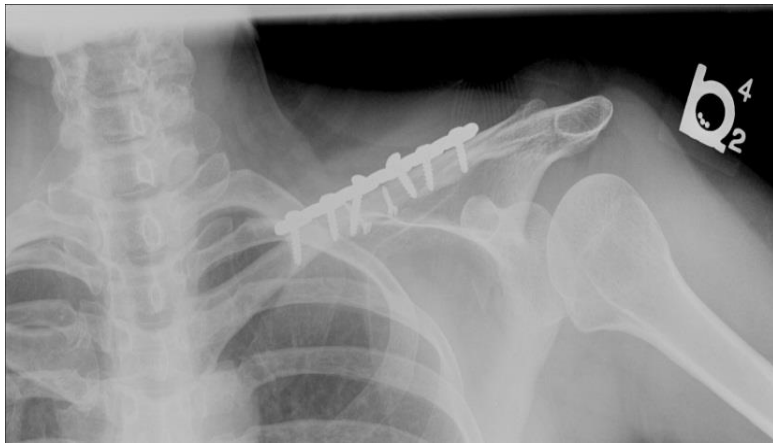
# Technique: approach and structures at risk



# What implants?

- No difference in functional outcome

Houwert RM, Wijdicks FJ, Steins Bisschop C, et al. Plate fixation versus intramedullary fixation for displaced mid-shaft clavicle fractures: a systematic review. *Int Orthop*. 2012 Mar;36(3):579–585



# Nail versus plate?

## ORIGINAL ARTICLE

### Elastic stable intramedullary nailing of midclavicular fractures in athletes

A Jubel, J Andermahr, H Bergmann, A Prokop, K E Rehm

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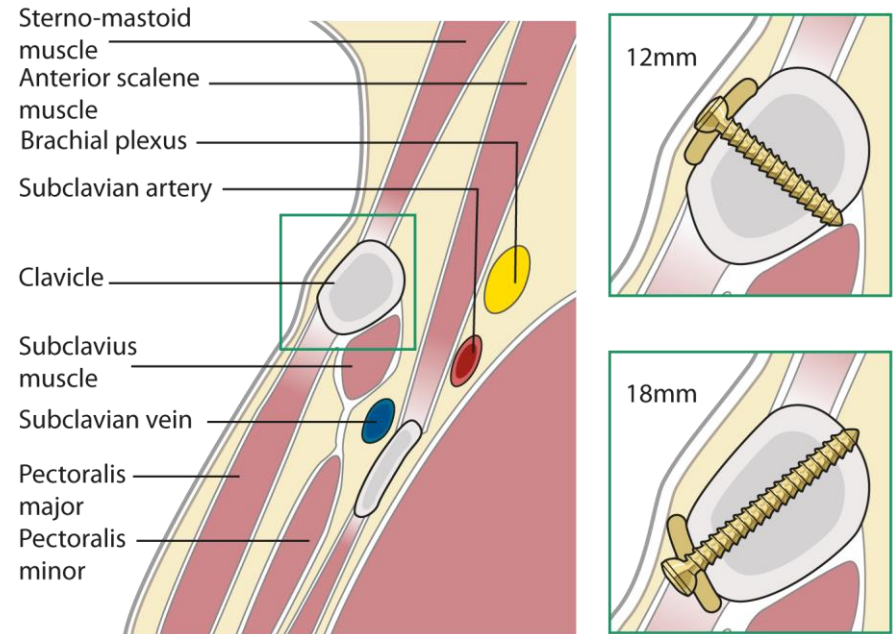
*Br J Sports Med* 2003;**37**:480–484





# Other considerations

- Type of plate
- Position of plate
- Hardware removal



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Operation?

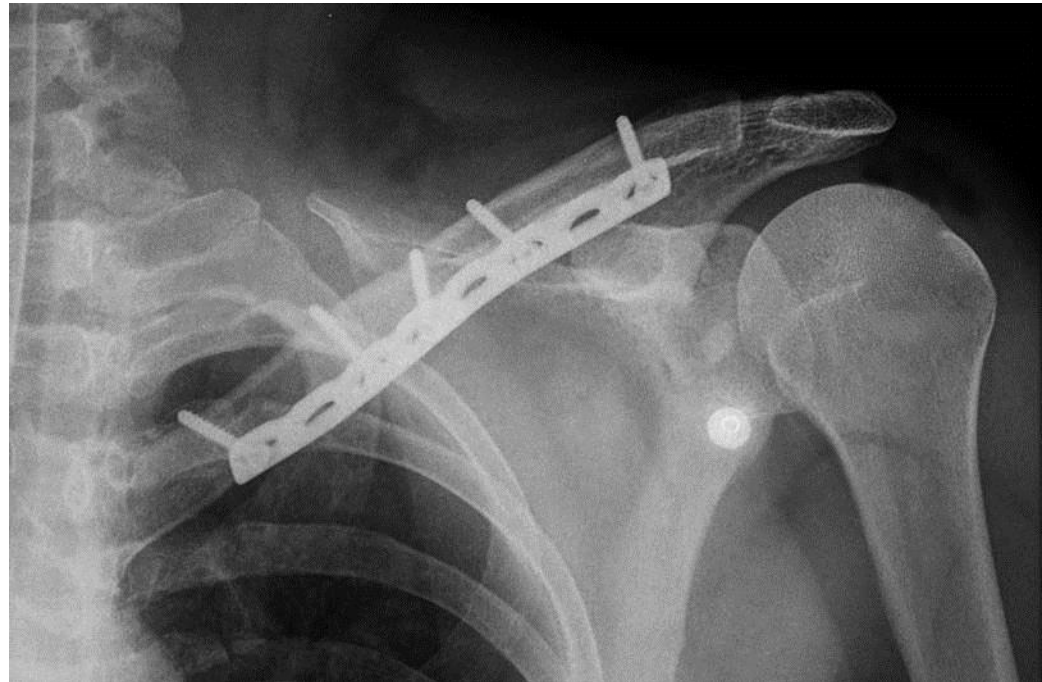
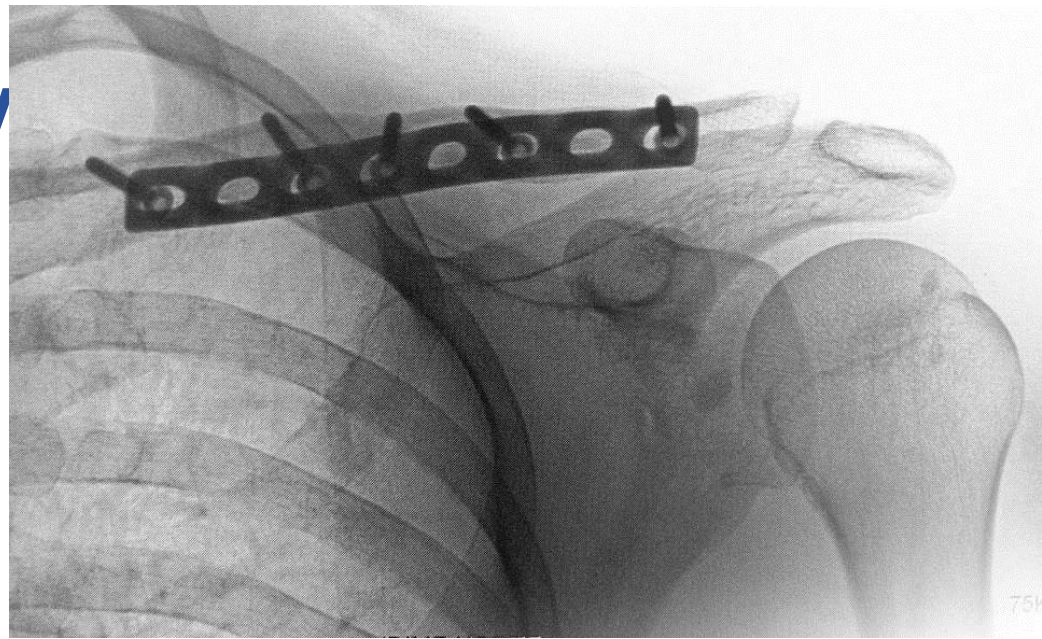
Yes

No





# Postoperative x-ray





# Summary

- In displaced clavicle fractures there is some evidence (RCT) that operative treatment have better patient oriented outcomes.
- Nonunion and malunion may have significant morbidity.
- Nonoperative therapy remains an appropriate option, but requires monitoring and patient compliance.

