

# The Non-United and Mal-United Ankle Fracture

## My Approach



4th Foot and Ankle Symposium  
Managing Complications  
in Foot & Ankle Surgery  
UNIKLINIK BALGRIST  
September



Chairman  
Orthopaedic Clinic  
Prof. Beat Hintermann

**KANTONSSPITAL LIESTAL**  
GEMEINSAM FÜR DIE GESUNDHEIT

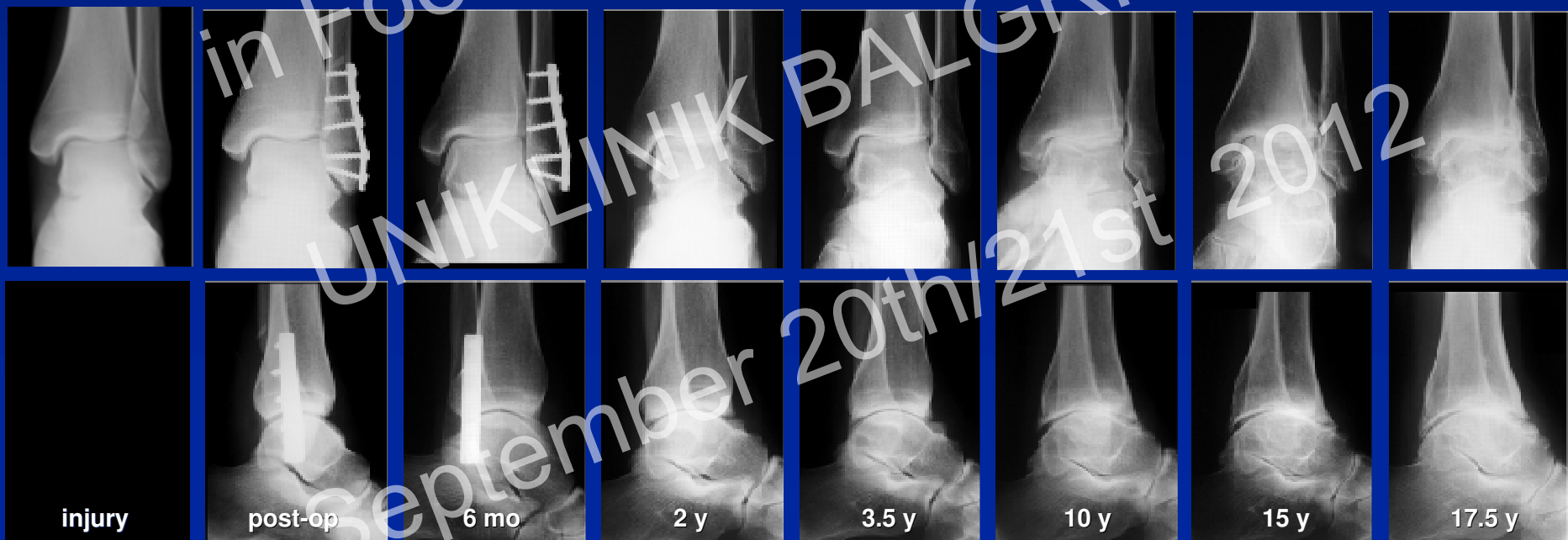
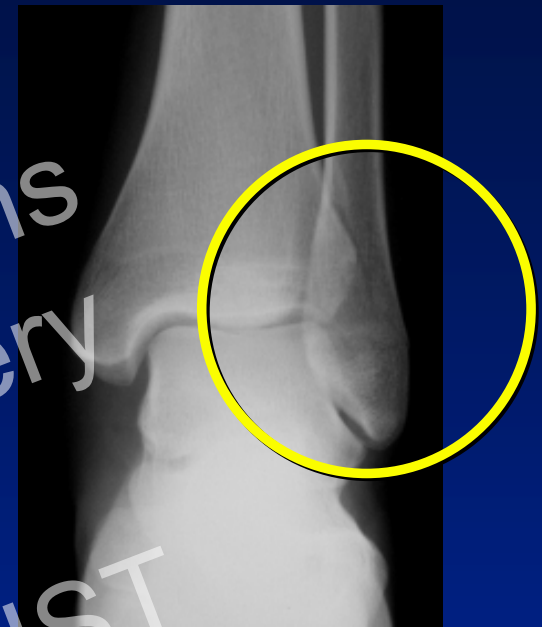
SWITZERLAND

# Correcting Osteotomies after Ankle Fractures

## A Fact ...

Outcome is not always good...

- Ankle fractures
  - usually underestimated
  - no longitudinal studies



# Why does the treatment fail?

## Initial misinterpretation

- extension of the osseous damage
- concomitant injuries of ligaments

## insufficient Reduction

- malposition
- instability

## inadequate fixation

- instability
- Nonunion - Malunion



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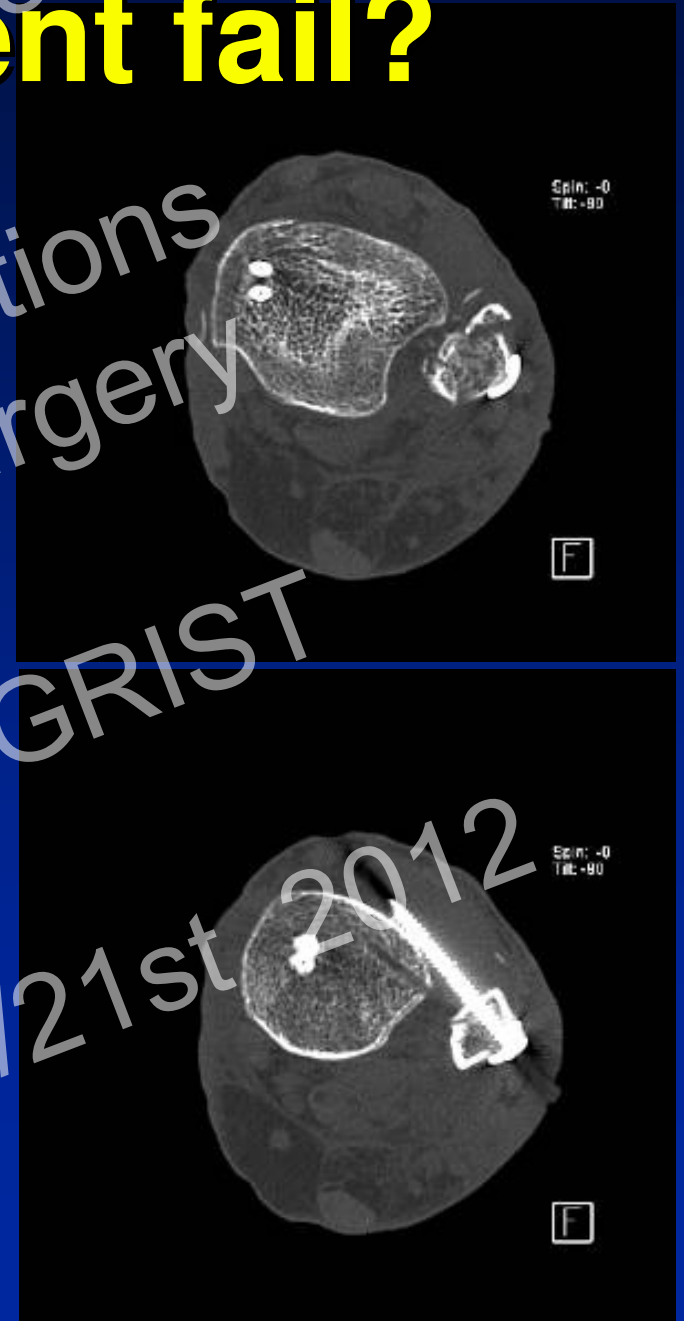
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# Classification

## Short-term complications

- Fracture not healed
- unstable situation

## medium-term complications

- Fracture healed, stable
- no secondary damage

## Long-term complications

- Fracture healed, stable
- secondary damage



1 week



9 months

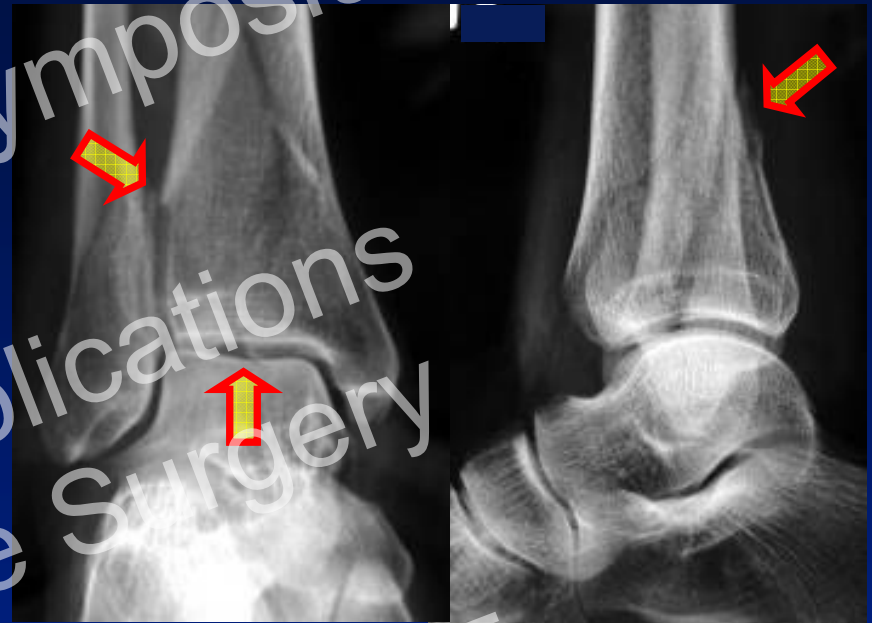
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# Correcting Osteotomies after Ankle Fractures

## Salvage Procedures

### Selected Cases

- Armentarium

- osteotomies
- ligament reconstruction
- tendon transfers

- Other options

- joint debridement
- cartilage repair
- joint distraction
- arthrodeses of distal joints



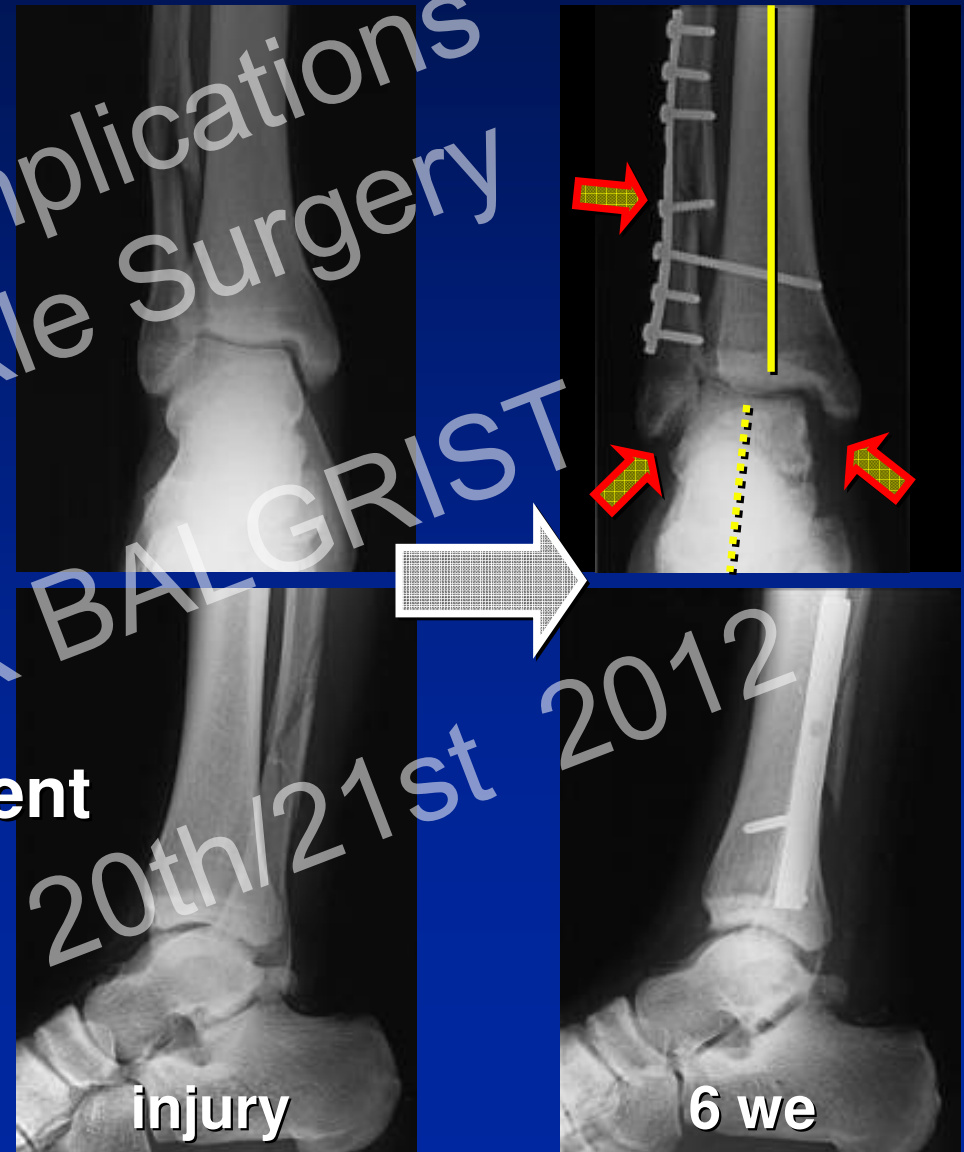
# Correcting Osteotomies after Ankle Fractures

## Early Complications

### Fracture not healed

- Problems

- fibular shortening
- ? fibular malrotation
- tibiofibular diastasis
- lateral dislocation of talus
- valgus tilt of talus
- incompetent deltoid ligament
- ...



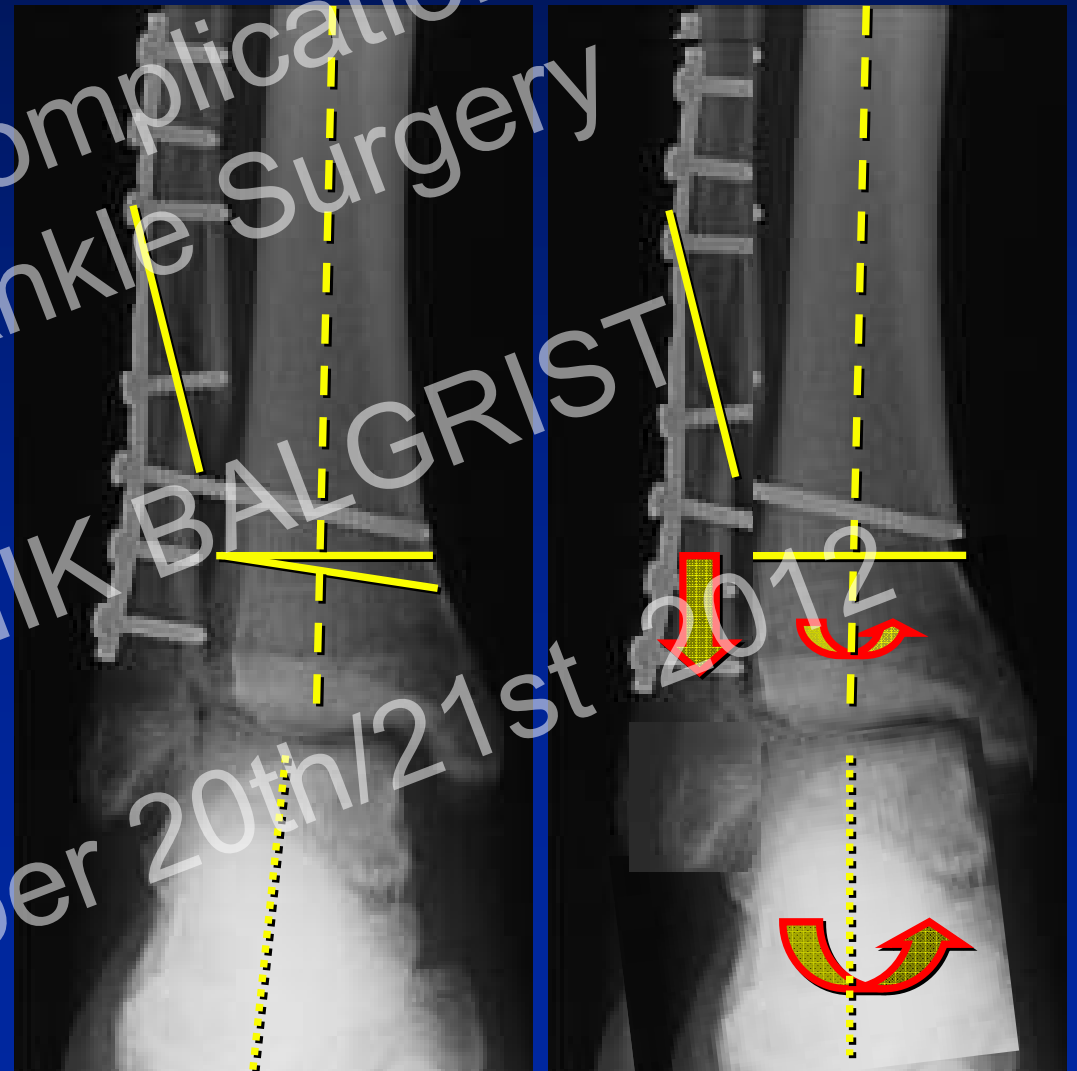
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# Correcting Osteotomies after Ankle Fractures

## Early Complications

### Fracture not healed

- Re-Do ORIF fibula
  - tibiofibular congruency
- Supramalleolar osteotomy
  - realign talus within the mortise
  - normalize syndesmotic load



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications

Fracture healed (?)

Articular structures preserved

f, 44 y

- pronation trauma 14 mo
  - ➔ Weber C-fracture
  - ➔ complex ligament injury
  - ➔ 2 position screws
  - ➔ re-ORIF + 1 position screw 8 we
- persistent pain
- pain, walking distance < 30 min
- PF / DF 35 – 0 – 15°
- instability feeling



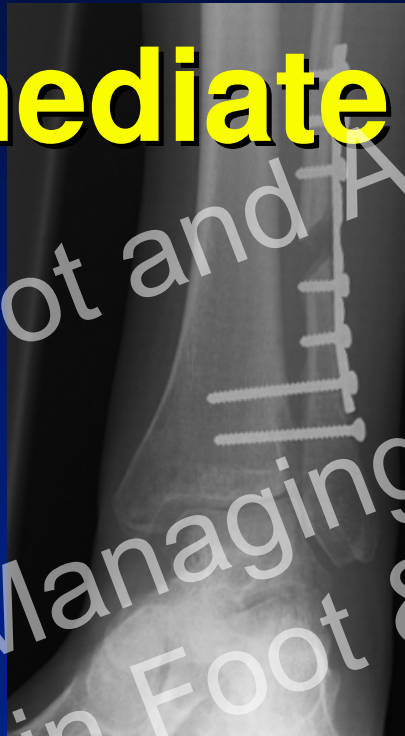
# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



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Complications

After Ankle Fractures

Implications

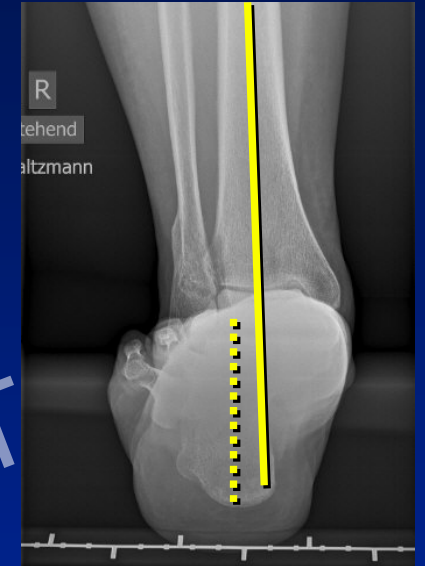
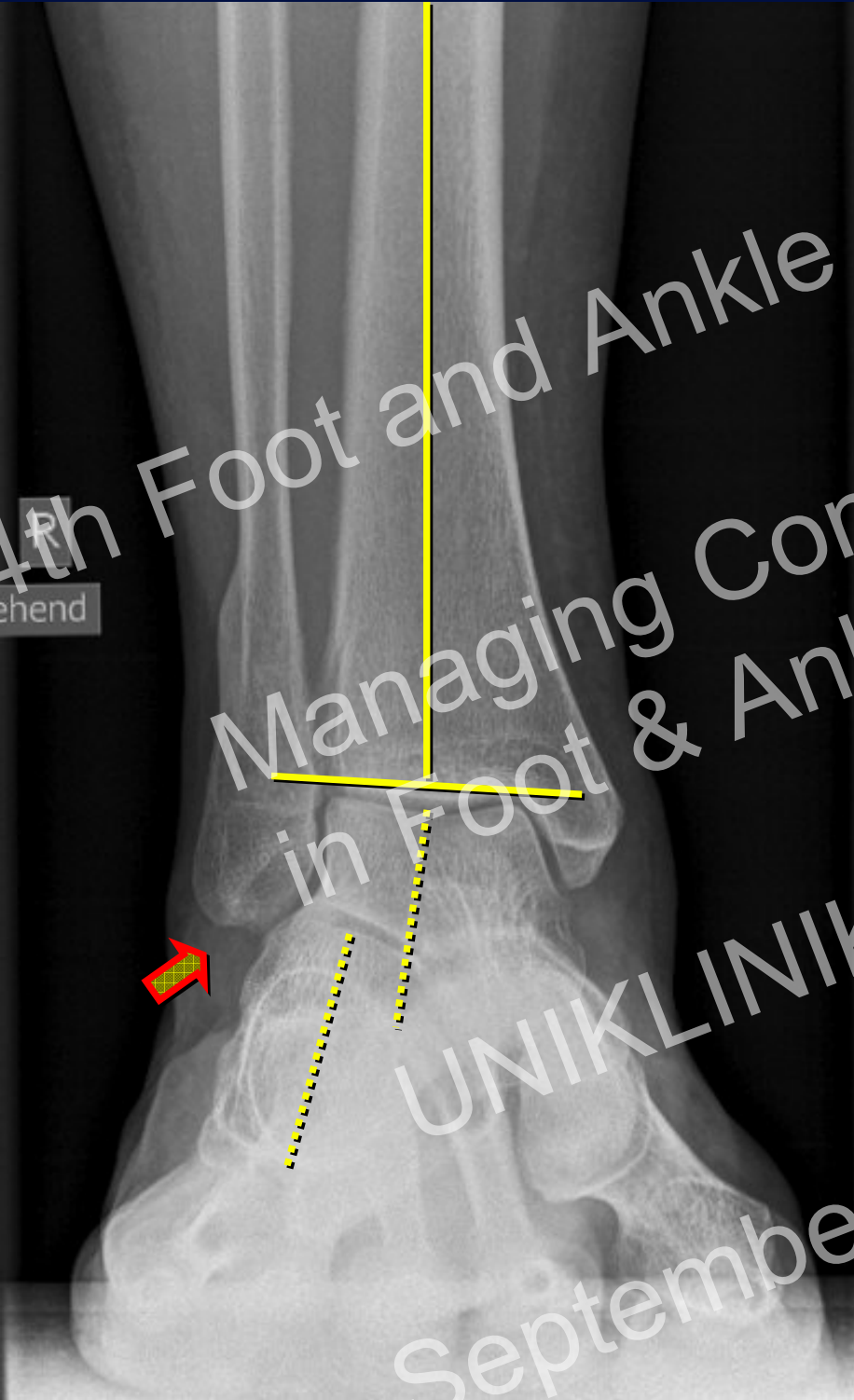
Implications

Fracture

Arth

f, 5

- p
- p
- v
- w
- P
- in



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# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



**After closing wedge osteotomy of tibia**



**After osteotomy and lengthening of fibula**

# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications

Fracture healed

Articular structures preserved/  
incongruency

f, 44 y

- ankle fracture 20 mo  
→ ORIF
- persistent pain
- valgus deformity
- pain, walking distance < 30 min
- PF / DF 35 – 0 – 15°
- proposed arthrodesis



Correcting Osteotomies after Ankle Fractures

# Intermediate Complications

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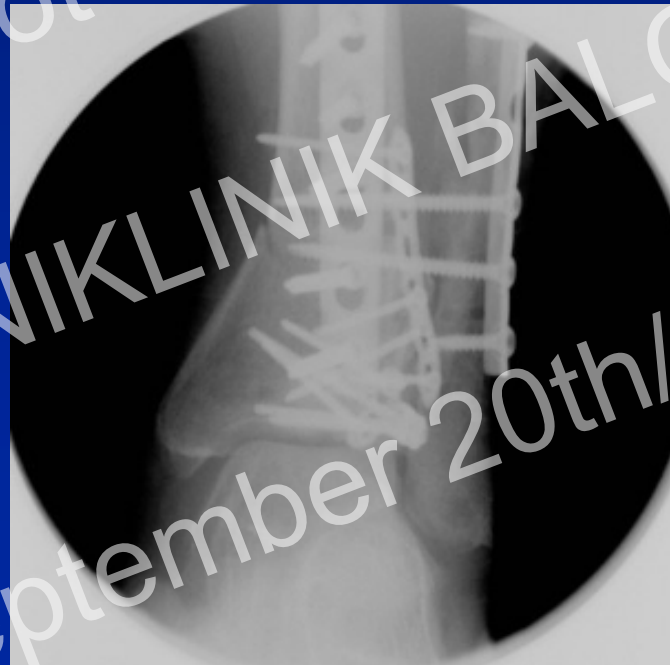


# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications

### Step-by-Step Reconstruction

- Osteotomies
  - fibula
  - tibia



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# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications





# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications

Fracture healed

Articular structures preserved/  
incongruency

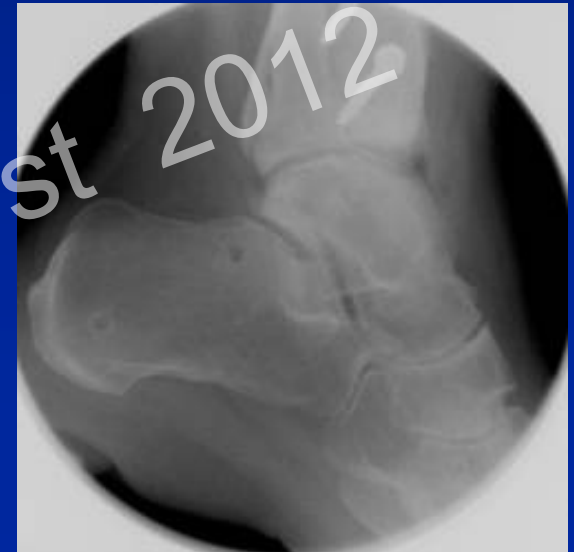
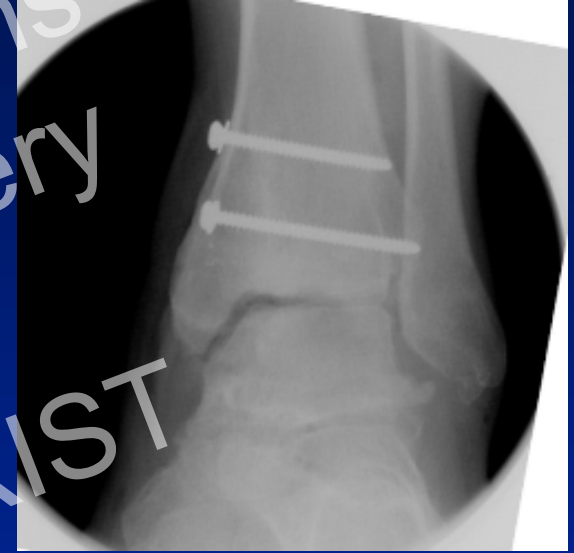
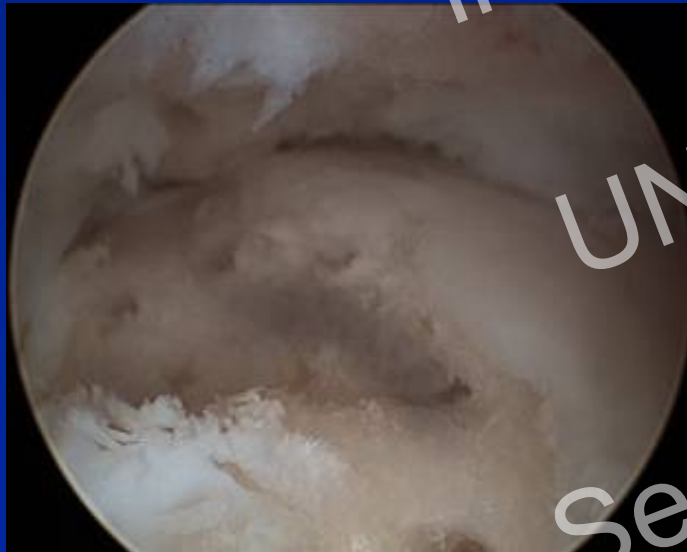
f, 16 y

- ankle fracture 14 mo  
→ ORIF  
4 revision surgeries
- persistent pain  
→ proposed fusion
- pain, walking distance < 30 min
- PF / DF 25 – 3 – 0°
- instability feeling, varus



# Correcting Osteotomies after Ankle Fractures

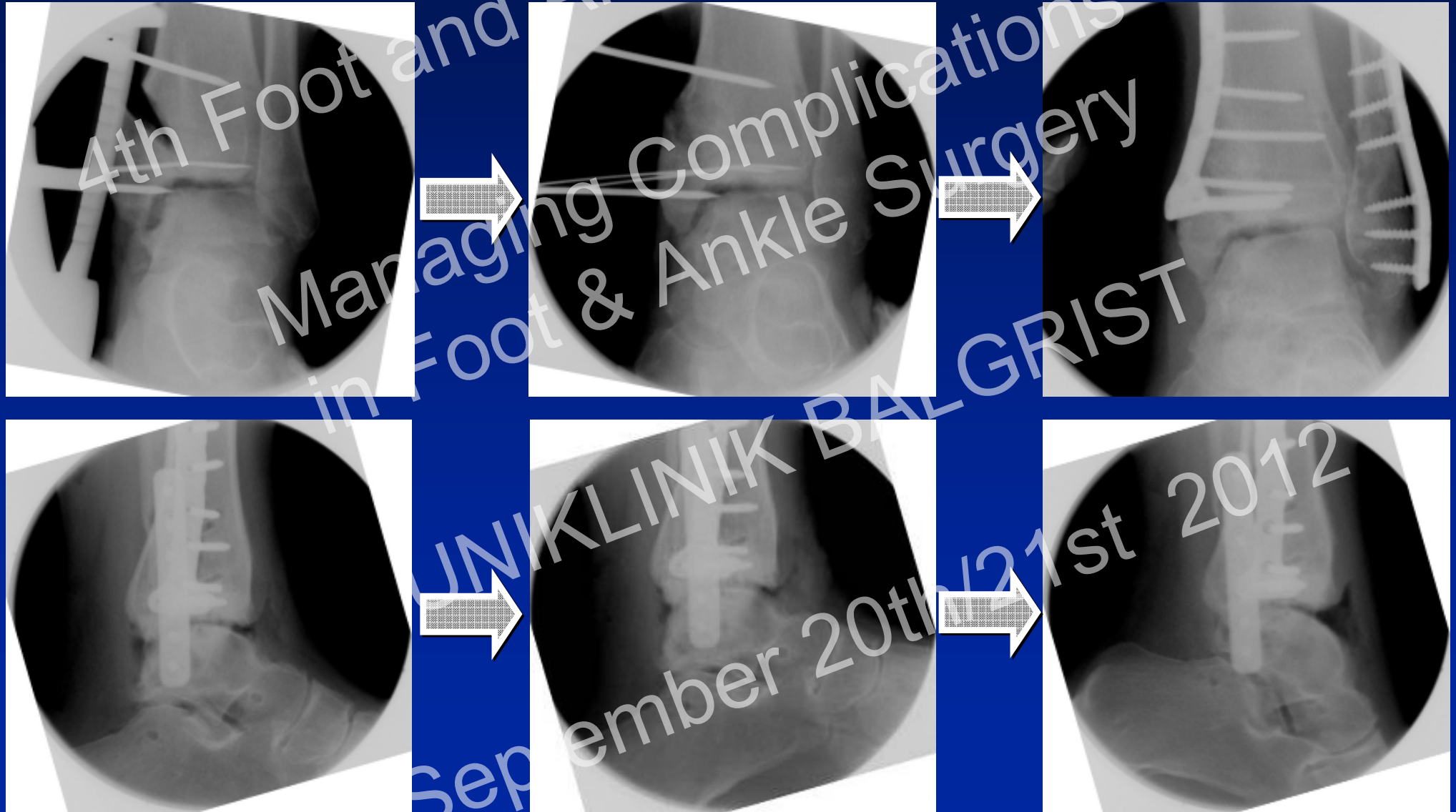
## Intermediate Complications



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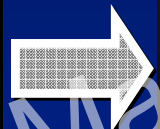
# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



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Thursday, August 12, 2011

Dr. Beat Hintermann  
Liestal, Switzerland

Dear Dr. Hintermann,

I wanted to send you a token of my appreciation for the wonderful work that you did on my ankle on May 18, 2010. I thought a jacket would be perfect for the Swiss weather! Hopefully, you will like the logo-detail that my father's company did.

I wish that I had the words to let you know how very thankful that I am for your skills. The operation really changed the rest of my life. Before I met you, I had very little hope for a happy existence with my ankle. But now, that has all completely changed. In the mornings when I wake, I have only minimal pain. It only takes me a moment to stretch and be able to walk well.

Throughout the day, I have almost no pain. When I do experience pain, I just sit down and give my ankle some time. At night, I never have pain when I fall asleep. Five days a week, regularly, I work out at the gym. I have gained muscle mass in my left calf. For a cardio-workout, I am now able to do the elliptical machine. For the first time in three years, I have been unbelievably happy.

Not a day goes by that I do not stop to think about the amazing work that you did on my ankle. I am in my fourth year of undergraduate curriculum at Auburn University. Currently, I am applying to our Harrison School of Pharmacy at Auburn University (Alabama). *Thank you for giving me my life back!*

Very sincerely yours,

*Kelly Rose Campbell*

*P.S. Enclosed is the personal essay that I wrote for the pharmacy school application.*

ankle Fractures

ications

ations  
urgery

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# Correcting Osteotomies after Ankle Fractures

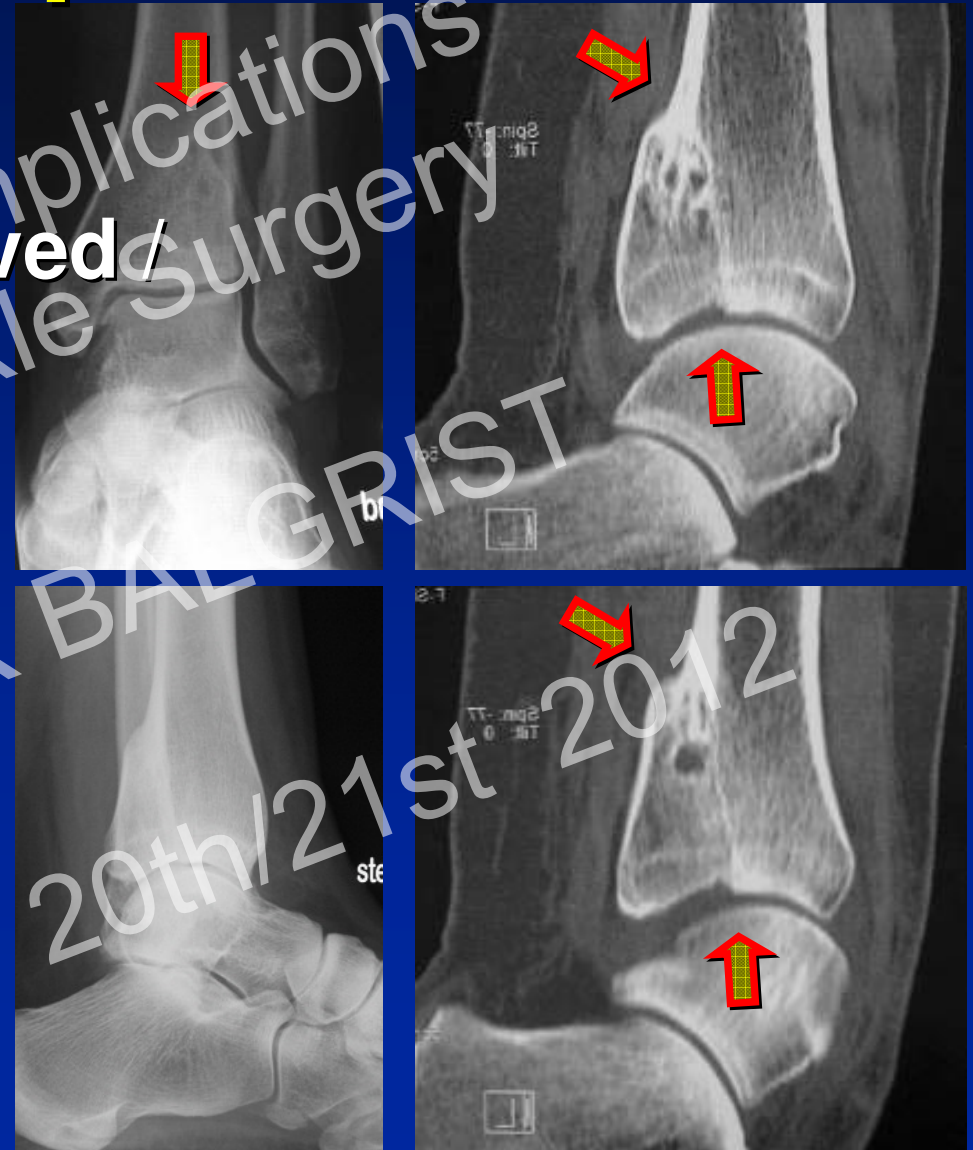
## Intermediate Complications

Fracture healed

Articular structures preserved/  
incongruency

f, 48 y

- ankle fracture 14 mo  
→ ORIF
- persistent pain  
→ IR + arthrotomy after 6 mo  
→ arthrotomy after 11 mo
- pain, walking distance < 30 min
- PF / DF 35 – 0 – 15°
- instability feeling



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications



# Correcting Osteotomies after Ankle Fractures

## Intermediate Complications





# Correcting Osteotomies after Ankle Fractures

## Late Complications

Fracture healed

Articular structures destroyed

f, 42 y

- ankle fracture 9 mo  
→ ORIF
- persistent pain  
→ lateral  
→ dorsiflexion
- pain, walking distance < 20 min
- PF / DF 35 – 0 – 15°
- instability feeling
- bilateral pes planovalgus deformity



# Correcting Osteotomies after Ankle Fractures

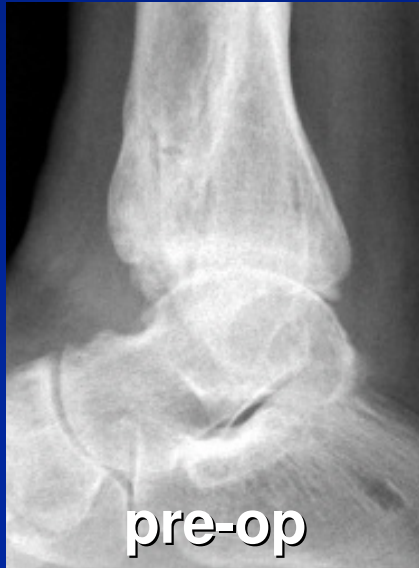
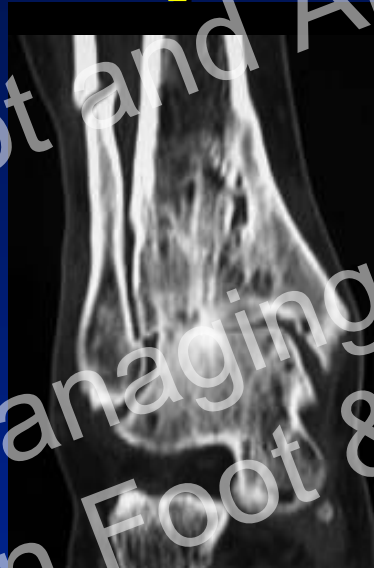
## Late Complications



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# Correcting Osteotomies after Ankle Fractures

## Late Complications



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# Correcting Osteotomies after Ankle Fractures



**intra-op**



**post-op**



**8 we**



**13 we**



**24 we**

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# Correcting Osteotomies after Ankle Fractures



# Correcting Osteotomies after Ankle Fractures

## Late Complications

Fracture healed

Articular structures destroyed

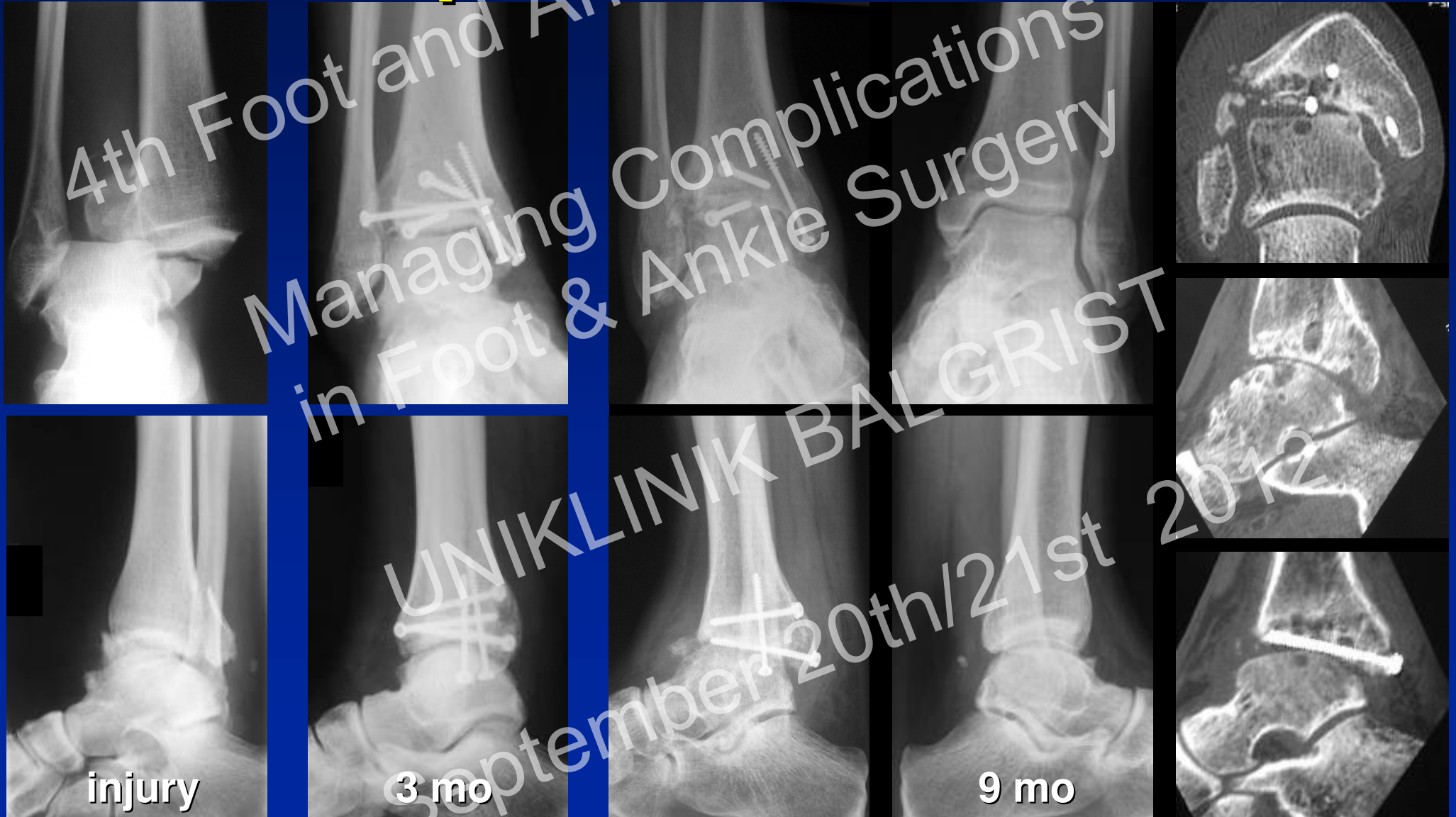
m, 56 y

- ankle fracture 11 mo
  - hangig-glider / high Impact
  - ORIF
- persistent pain
  - osteophytes 8 mo
- pain, walking distance < 15 min
- PF / DF 30 – 0 – 15°
- instability feeling
- high sports demand



# Correcting Osteotomies after Ankle Fractures

## Late Complications



# Correcting Osteotomies after Ankle Fractures

## Late Complications





# Correcting Osteotomies after Ankle Fractures

## Late Complications



# Correcting Osteotomies after Ankle Fractures

## Casuistic

Period from 1995 - 2008

- n = 69      f = 32  
                  m = 37
- age            45 y (21 – 69 y)
- malalignment / malformation
  - valgus            41
  - varus             23
  - extension        3
  - flexion            2
  - rotation          1
  - intraarticular    6



# Correcting Osteotomies after Ankle Fractures

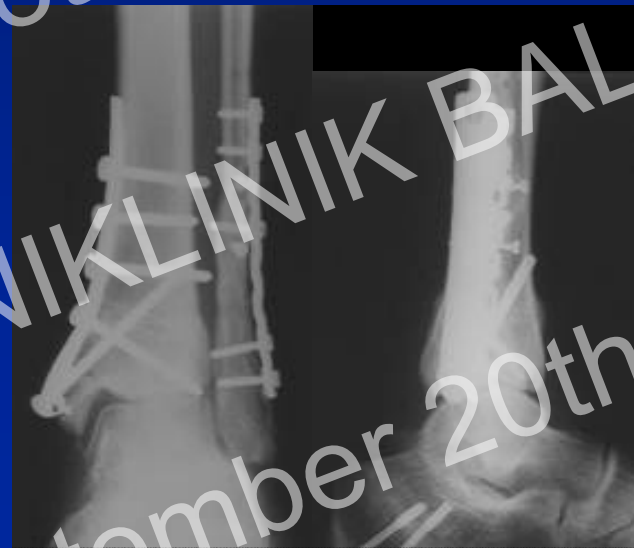
## Complications

(n = 69)

- delayed wound healing 3/4/6/8 weeks 4
- delayed union 15/18/24 weeks 3
- residual hindfoot malalignment 3
- progressive osteoarthritis → TAR 12/26/29 months 3



6 mo after injury / ORIF



12 mo after osteotomy



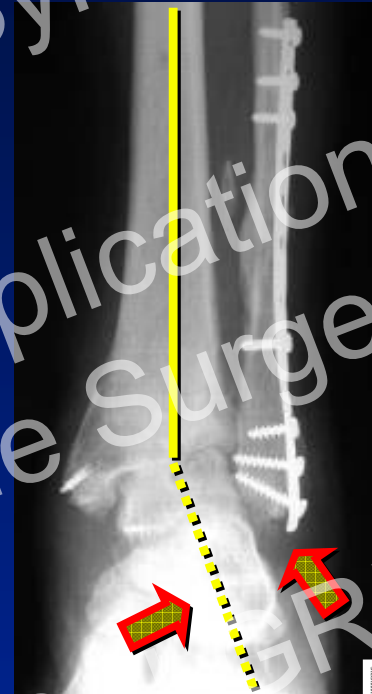
25 mo after osteotomy

# Correcting Osteotomies after Ankle Fractures

## Conclusions

### Operative Correction

- mostly advised
  - as early as possible
  - appropriate diagnostics
  - appropriate planning



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# Correcting Osteotomies after Ankle Fractures

## Conclusions

### Operative Correction

- mostly advised
  - as early as possible
  - appropriate diagnostics
  - appropriate planning
- surgical possibilities
  - re-osteosynthesis
  - osteotomies
  - correction of deformity
  - ligament reconstruction
  - micro fracturing



# Correcting Osteotomies after Ankle Fractures

## Conclusions

Cave !

- use appropriate techniques

m, 28 y

- ankle fracture 22 mo  
→ ORIF
- infection, pain  
→ IR after 8 mo
- walking distance > 3 h
- PF / DF 25 – 0 – 25°
- problems with push-off
- high sports demands



# Correcting Osteotomies after Ankle Fractures

## Cave !

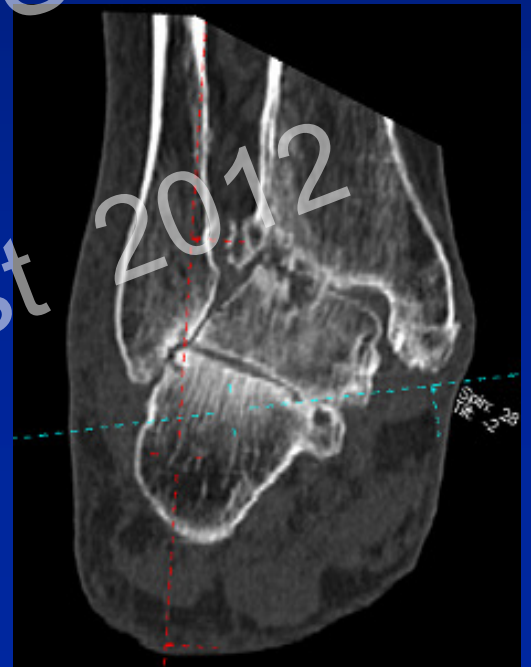
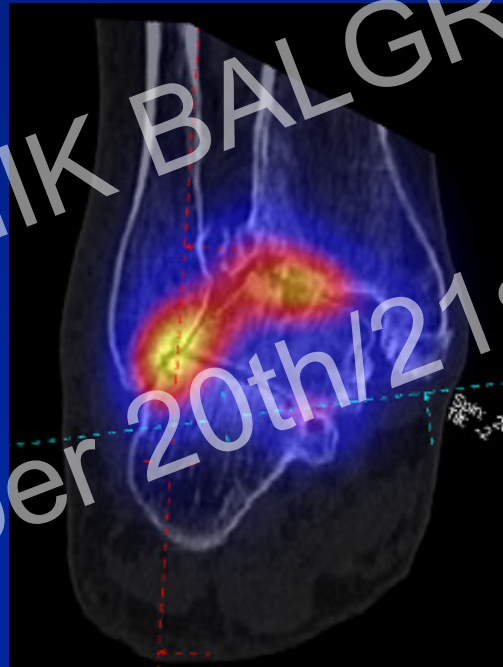


# Correcting Osteotomies after Ankle Fractures

## Conclusions

Where are the limitations ?

- Not determined yet
  - need more experience
- Spect-CT
  - may help



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# Correcting Osteotomies after Ankle Fractures

## Conclusions

Where are the limitations ?

f, 35 y

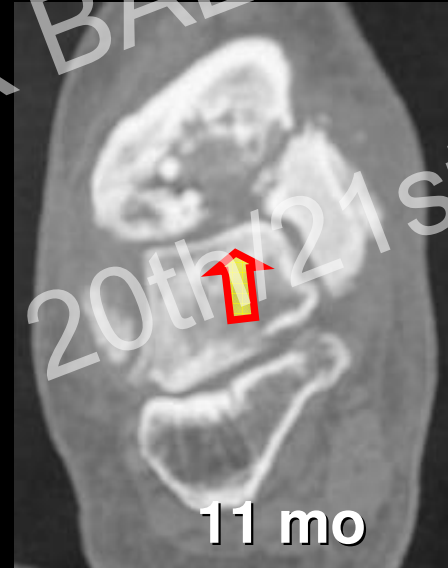
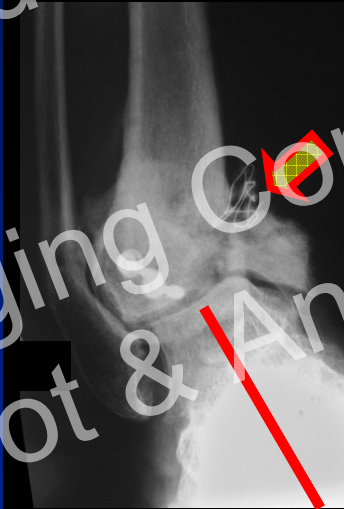
- supination trauma 11 mo
  - external fixator
  - ORIF
  - infection
  - implant removal
  - Gentamycin chain
- varus deformity
- pain
- walking distance < 30 min
- PF / DF 30 – 0 – 10°



# Correcting Osteotomies after Ankle Fractures

## Conclusions

Be Optimistic!



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# Correcting Osteotomies after Ankle Fractures

## Conclusions

Be Optimistic!



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# Correcting Osteotomies after Ankle Fractures

## Conclusions

After 6 Years

- Pain free
- Satisfactory function



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