

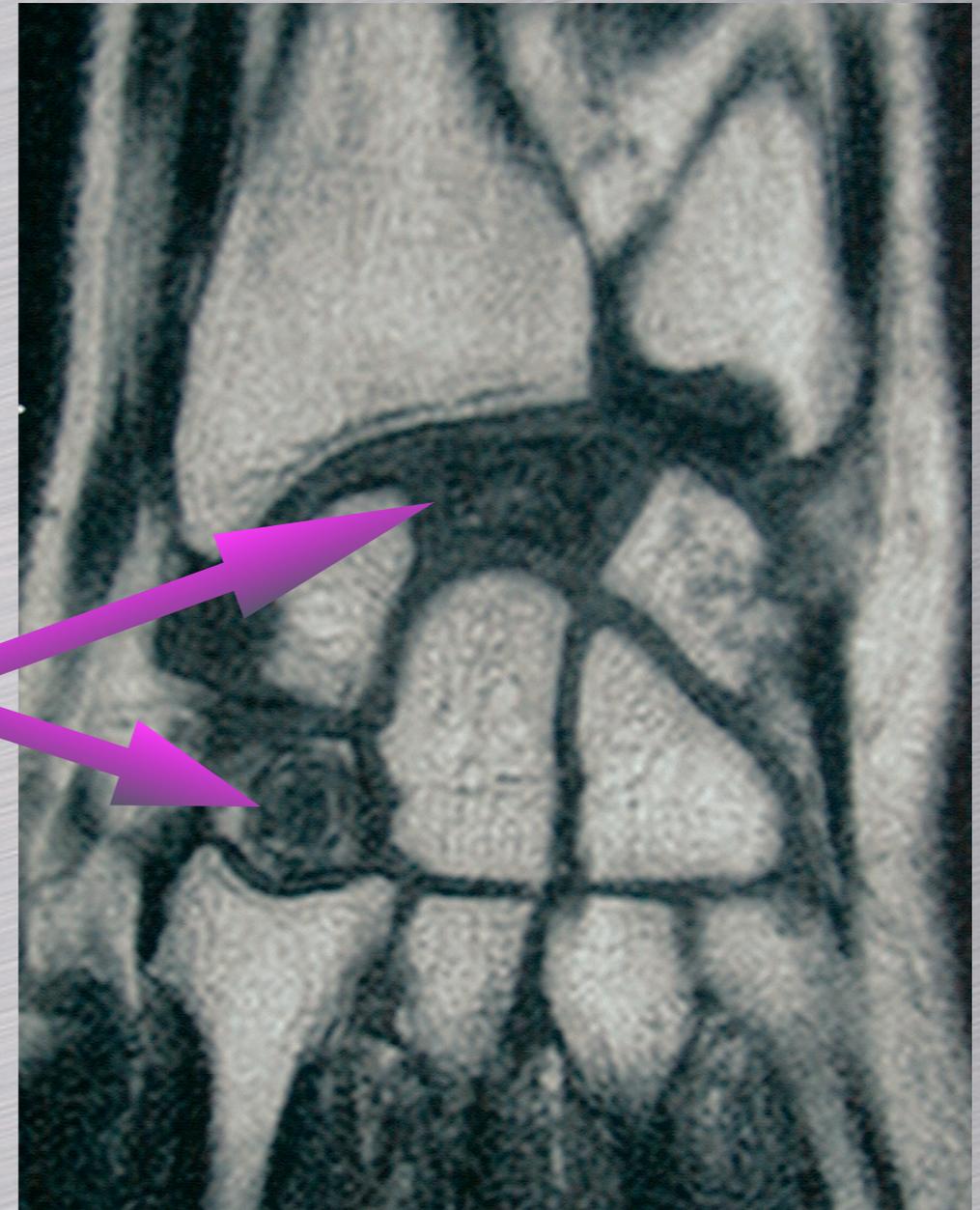
Avascular necrosis of carpal bones

Christian Dumontier

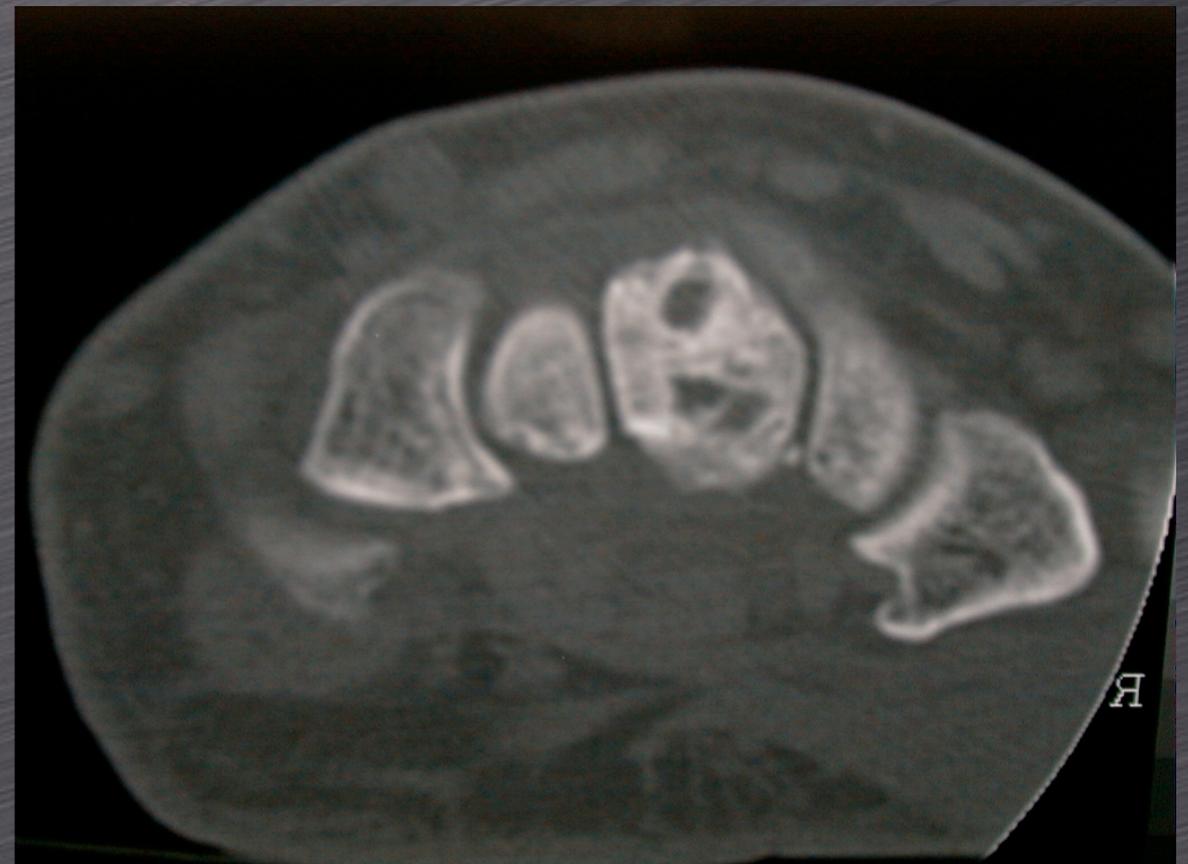
Institut de la Main & Hôpital Saint Antoine,
Paris

Avascular necrosis

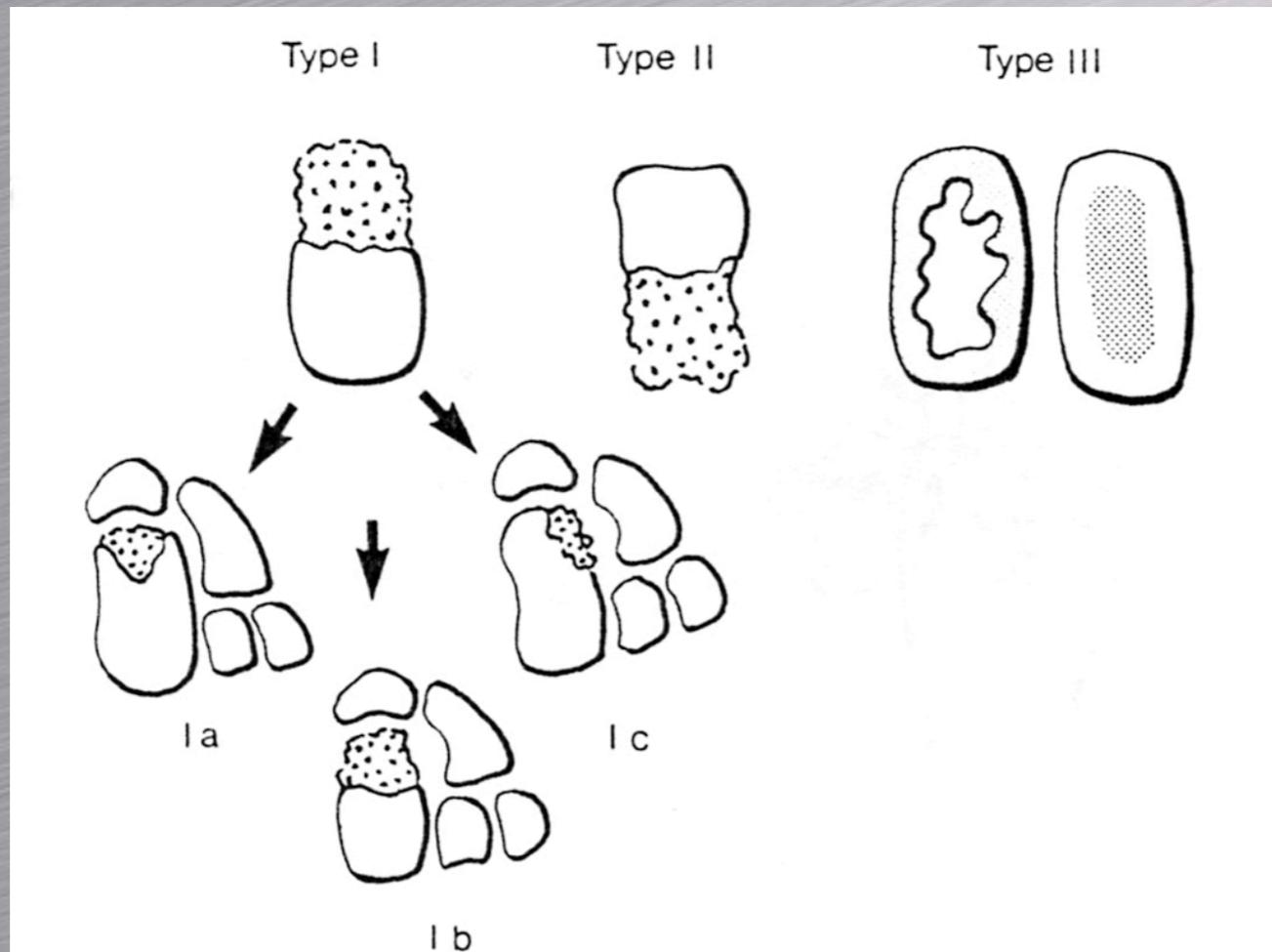
- Rare diseases
- Etiology, evolution and treatment remain unclear
- All carpal bones can be involved
- Kienböck's disease is the most frequent AVN



AVN of the capitatum



- Three types have been reported
 - Proximal type (2/3 cases)
 - Body type (2 reported cases)
 - Global type (1/3 of cases)



Preiser's disease



Avascular Necrosis of the Scaphoid without previous fracture or non-union

Thanks to Dominique Leviet and Thierry Dubert

Preiser's

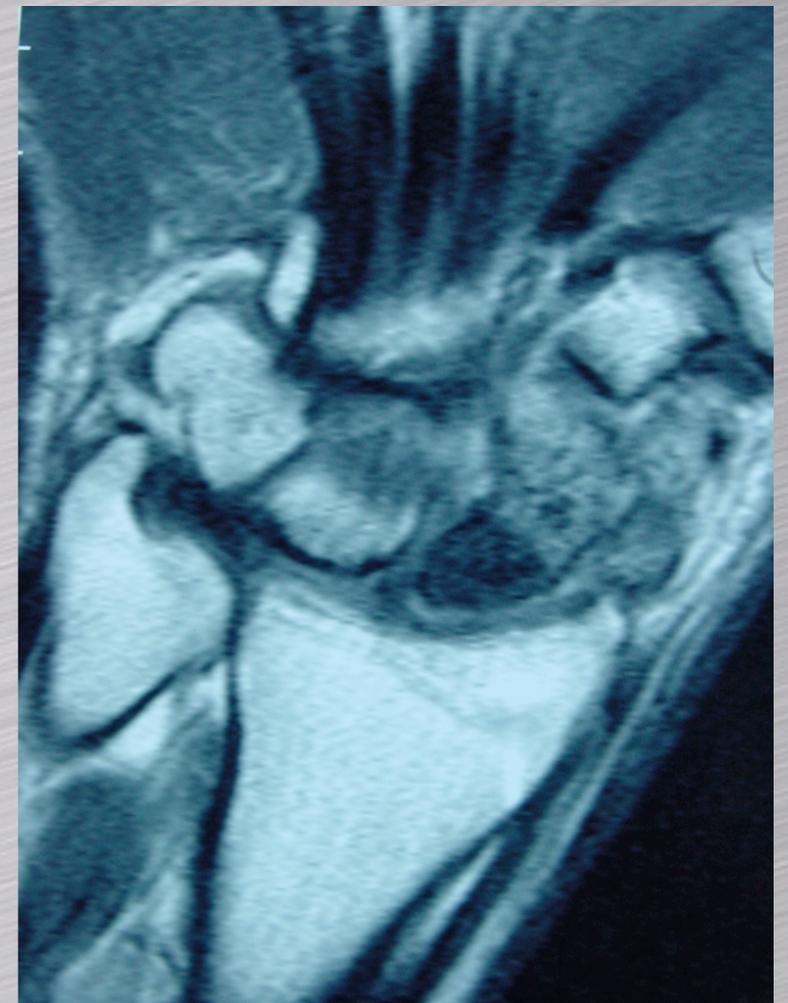
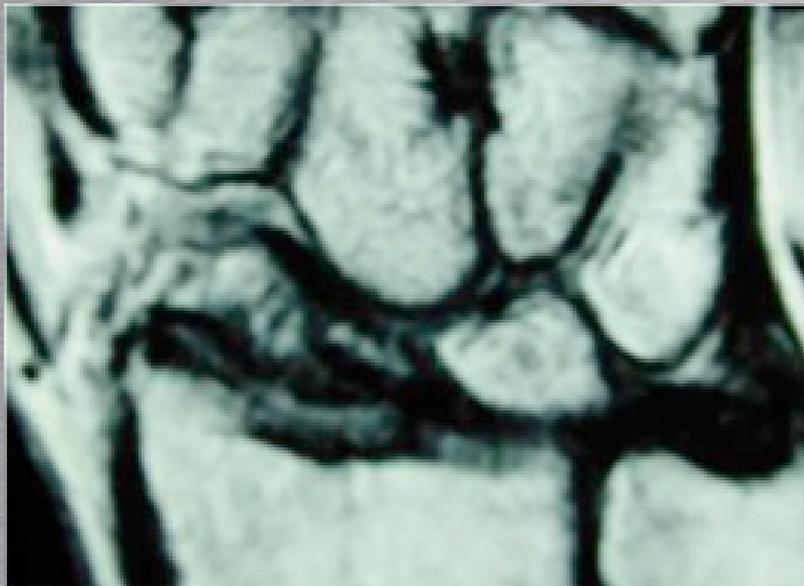


- Preiser reported 5 cases in 1910
(that were in fact necrosis after scaphoid fracture)
- About 150 cases reported in the literature
 - No known risk factors
 - No specific radiographic signs
 - Many treatments have been used

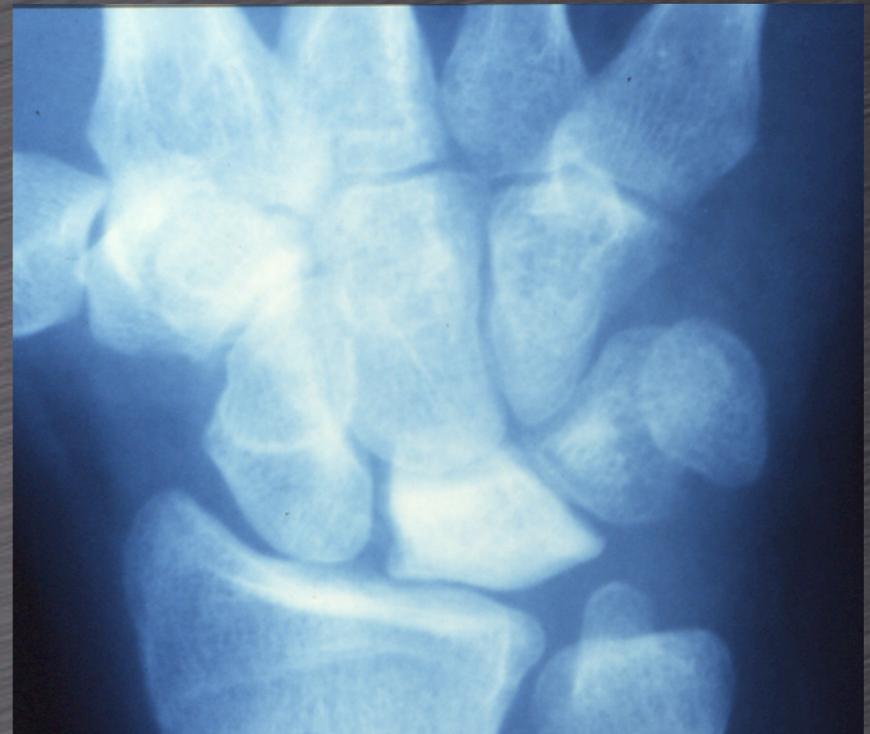


Preiser's disease

- Sclerosis, increased density, erosion or fragmentation, collapse or cysts
- 2 patterns described with MRI
 - Diffuse ischemia and necrosis
 - Partial or focal ischemia



Kienböck's disease



*über traumatische Malazie des Mondbeis und ihre
Folgesustände: Entartungsformen und Kompressions-
fracturen -Fortschr. Geb. Röntgen 1910, 16; 77-115*

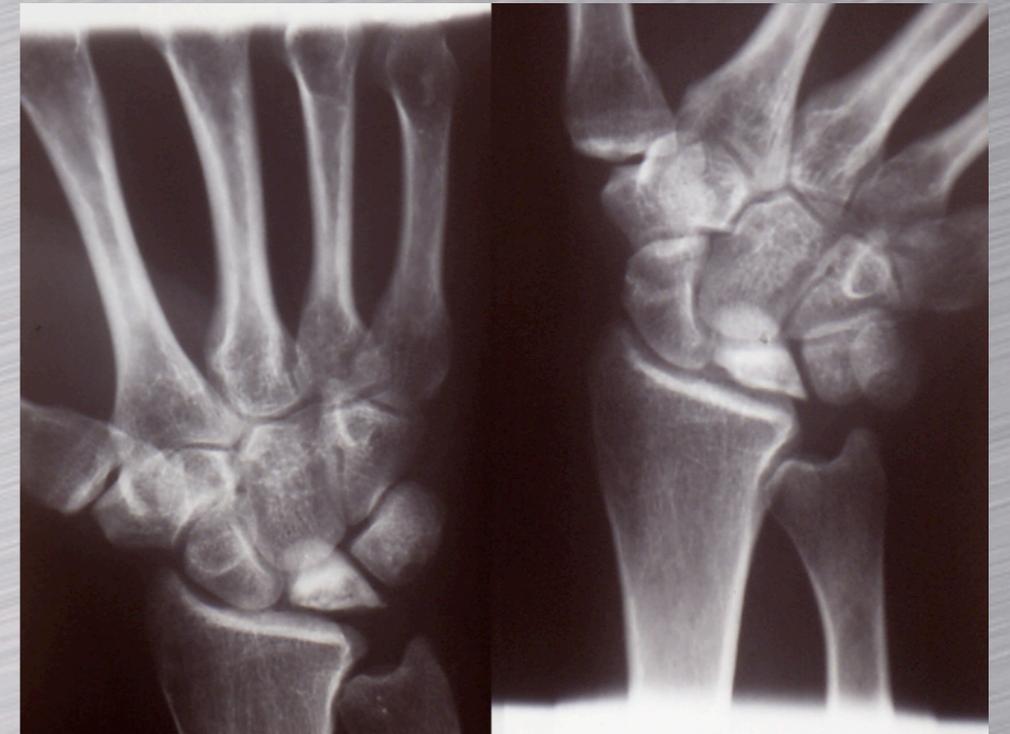
Etiology is unknown

- Abnormalities in loading repartition on the lunate
- Paucity of lunate's vascularisation

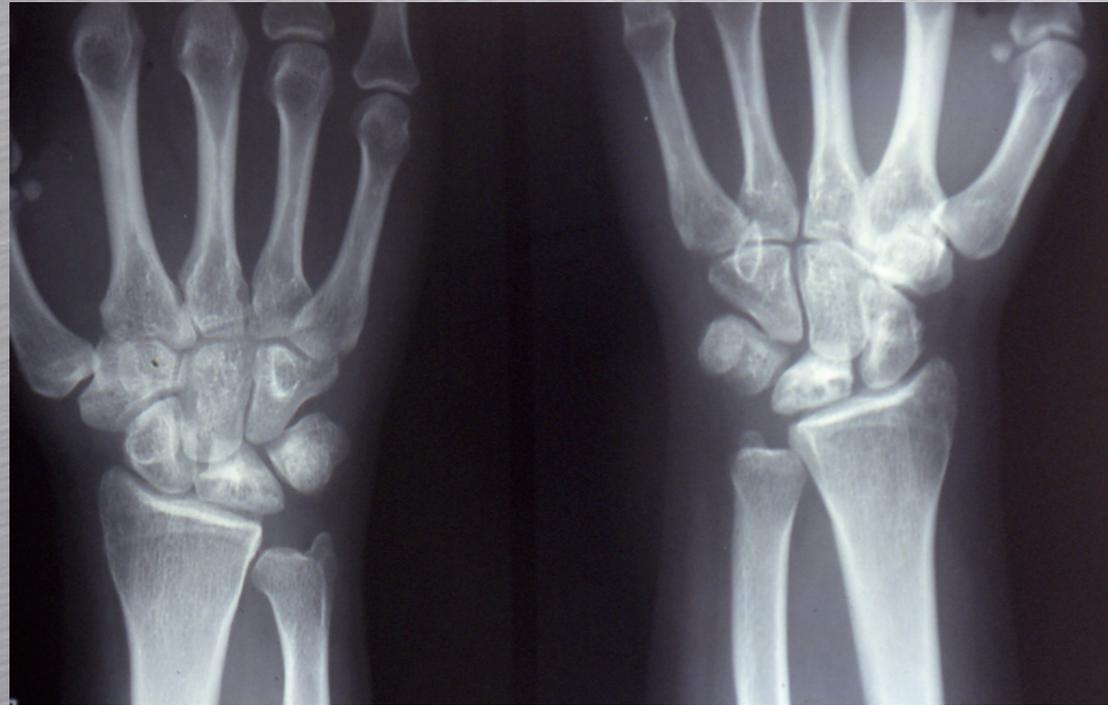
High frequency of lunate fractures:
cause or consequence ?

Loading imbalance

- Short ulna may increase shearing forces on the lunate
- Limited coverage of the lunate
- Variations in shape of the lunate
- Horizontalisation of the lunate facet

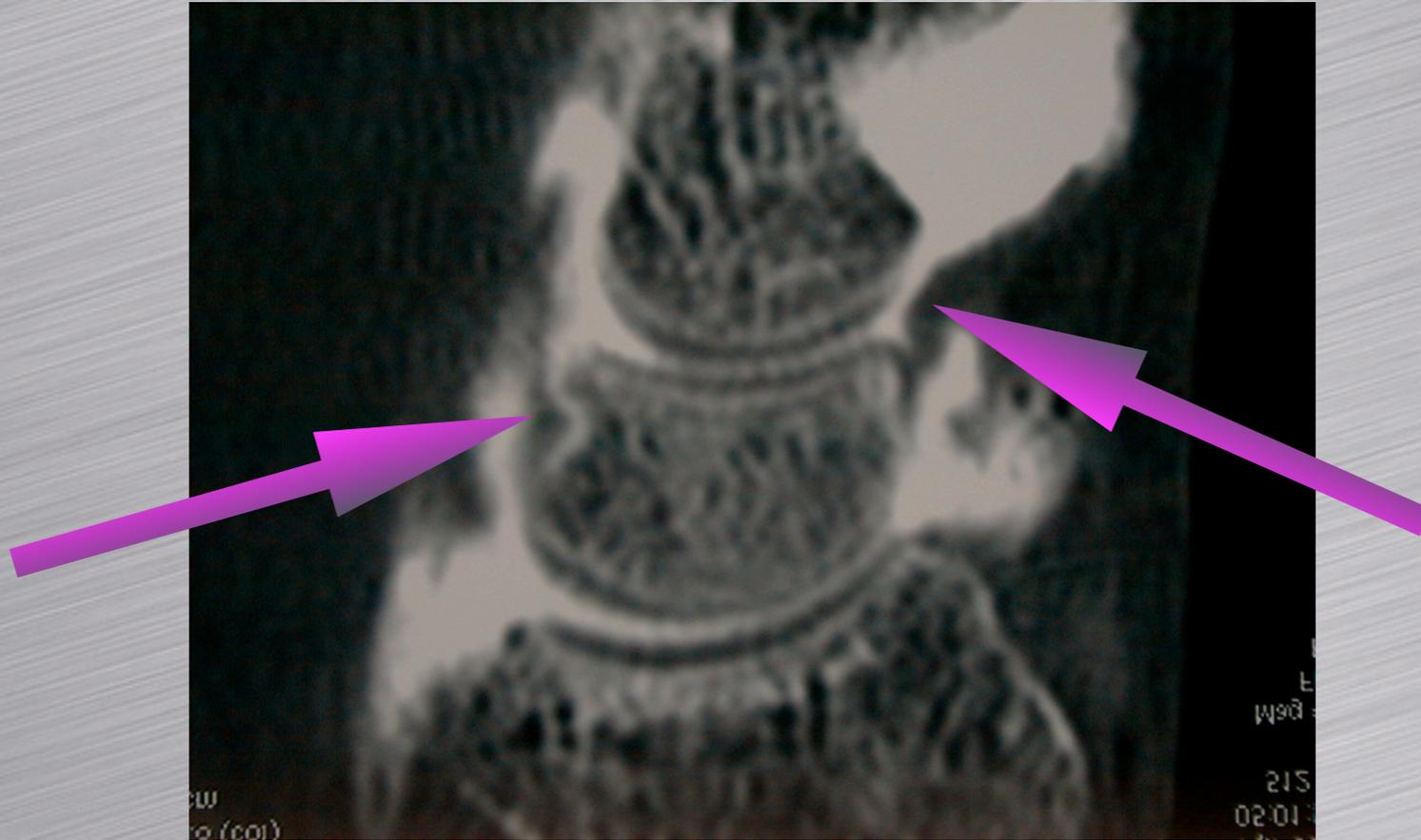


Limits of the loading theory



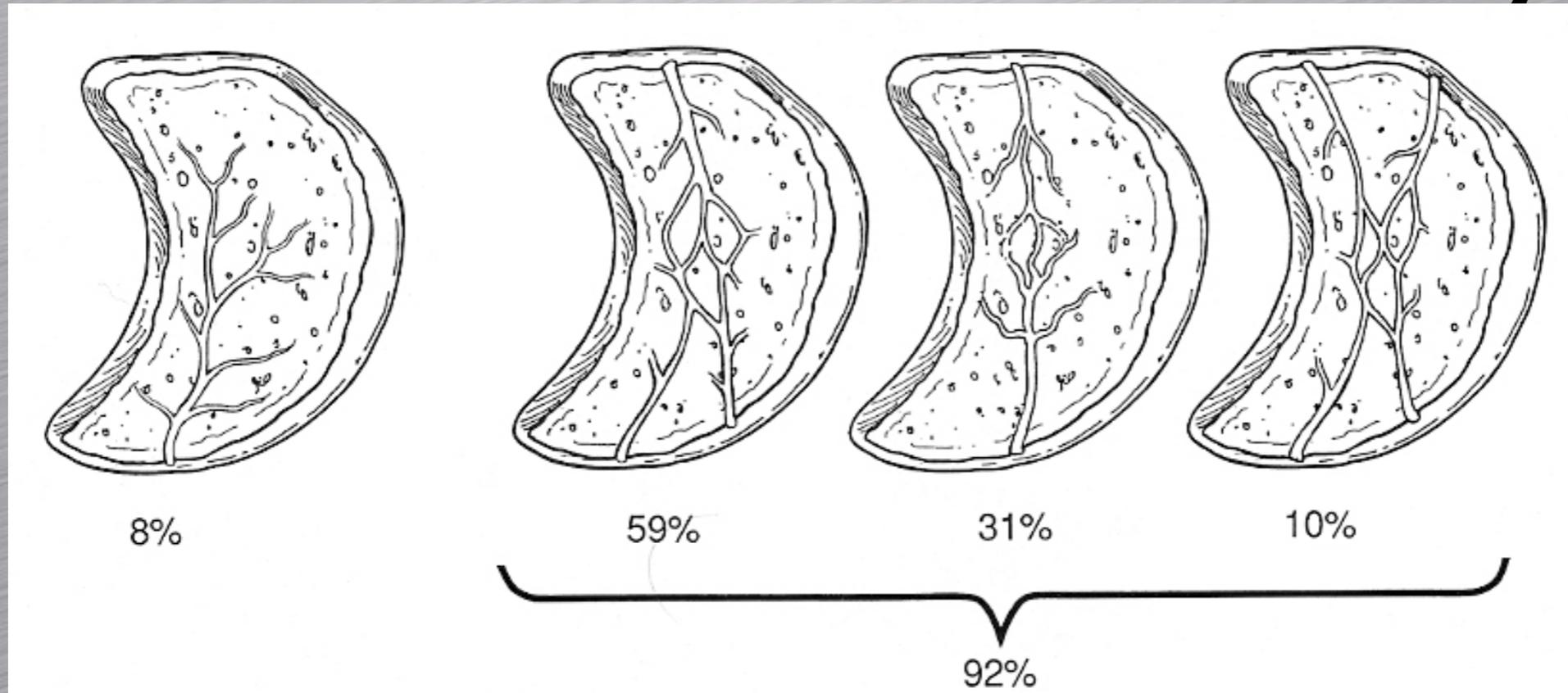
- Short ulna is bilateral, Kienböck's is unilateral
- 40% of Kienböck's do not have a short ulna
- Short ulna = thick TFCC

The vascular theory



- Lee (1963) outlined the limited number of vessels entering the lunatae

The vascular theory



- However Gelberman (1981) has shown that the intra-osseous circulation was “adequate” in most lunate
- Only 50% of lunate necrosis reported after lunate dislocation

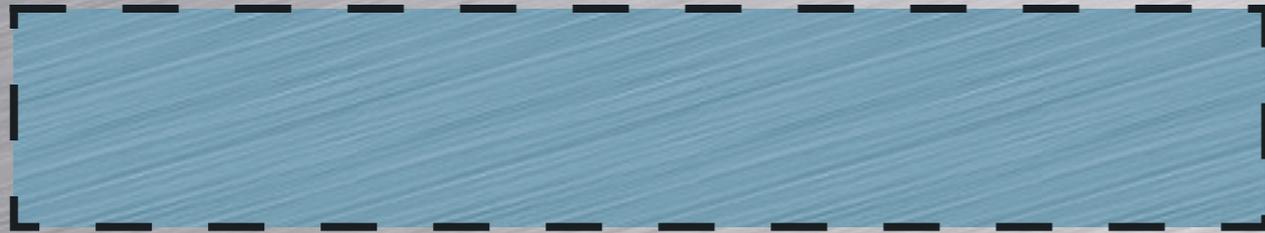
The vascular theory

- The subchondral bone is the less irrigated part
- Others have postulated a insufficient venous drainage leading to arterial hyperpressure



Other risk-factors ?

- Traumatism



- Young adults, 20-30 yrs (8-75 yrs)
- Male / female ratio = 2/1
- Dominant side
- Manual workers
- High frequency of lunate fractures



- “A single or repeated traumas lead to shearing forces that may interrupt the vascular flow of the lunate in at-risk individuals”

Clinical signs are not specific

- Dorsal wrist pain
- Dorsal synovitis
- Loss of grip strength
- Limited wrist motion
- Late stages: Median nerve compression, flexor tendons rupture,...

Diagnosis of Kienböck's disease relies on the imaging techniques

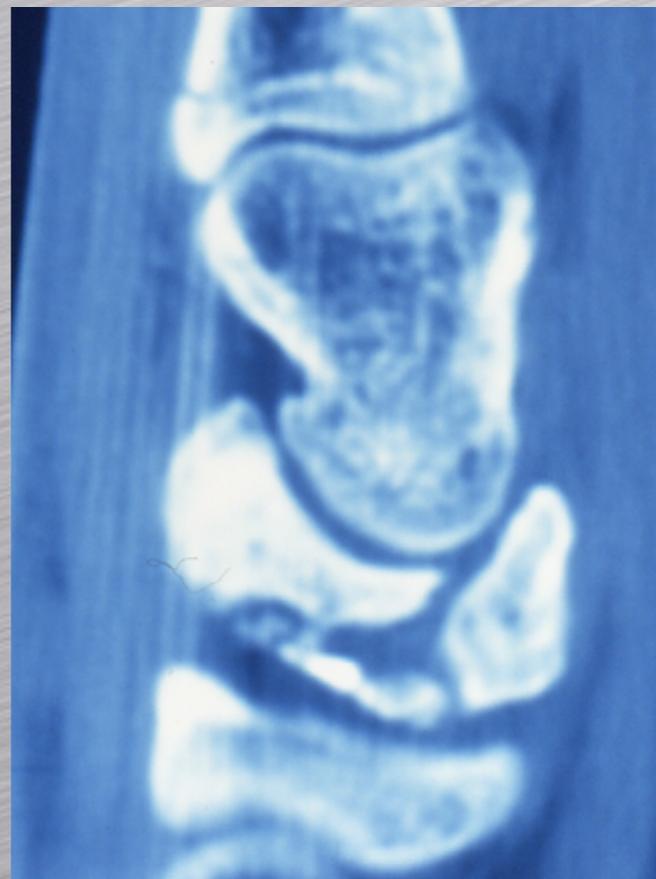
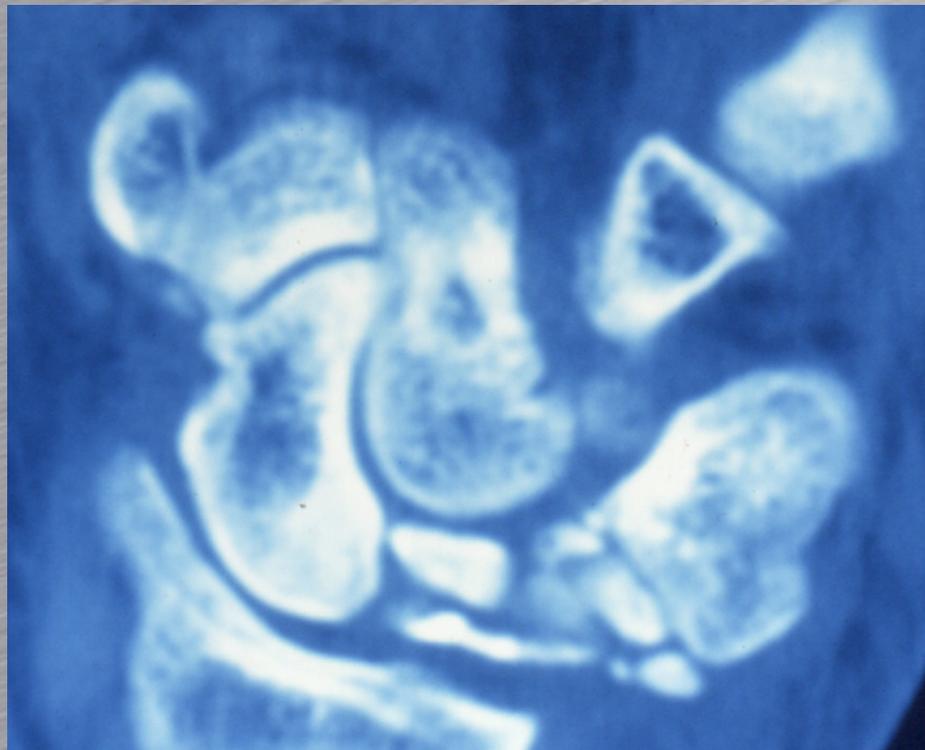
- Staging of the disease depends of the radiographs
- Proposed treatments depend on the radiological staging

Imaging techniques

- Standard AP and Lateral views

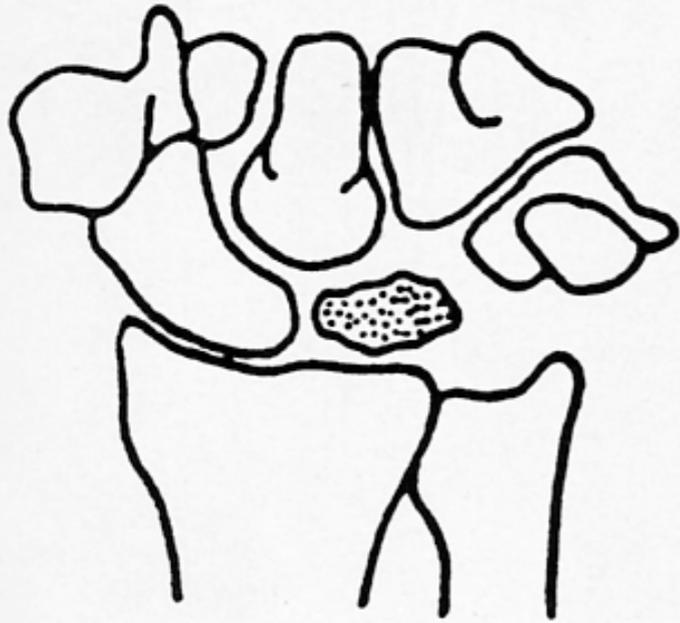


- Bone scintigraphy
- CT-scan
- MRI +++



Classifications

(Stahl, Decoulx, Lichtman, Buechler)



III A



III B



IV

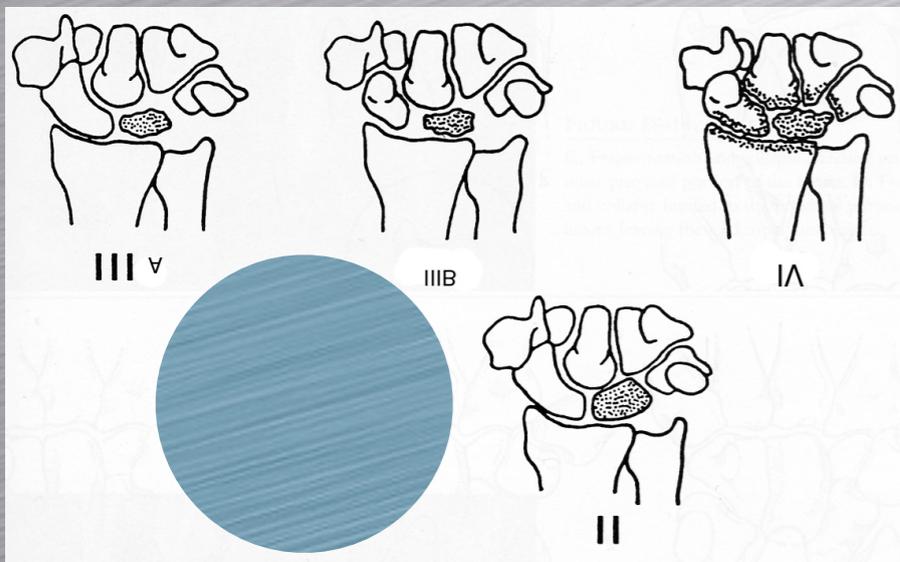


I



II

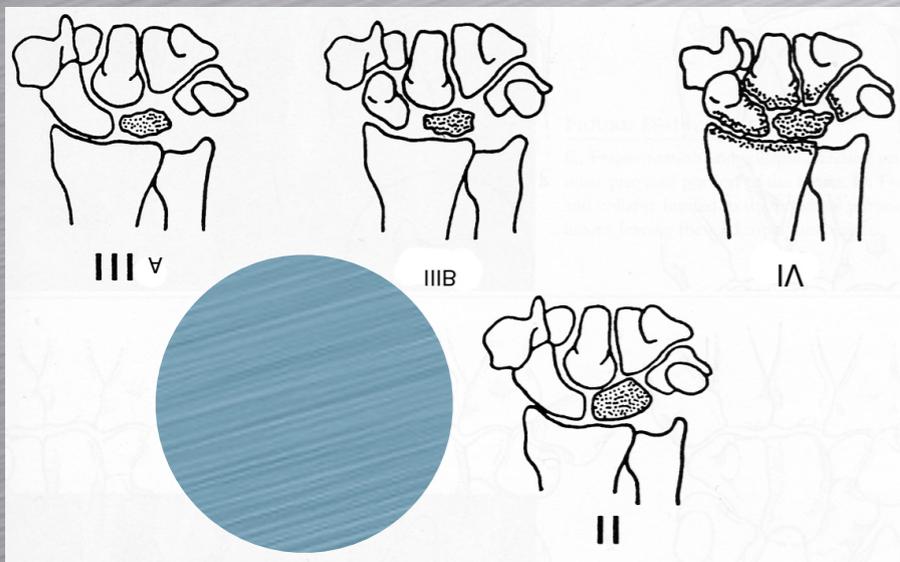
Stage I



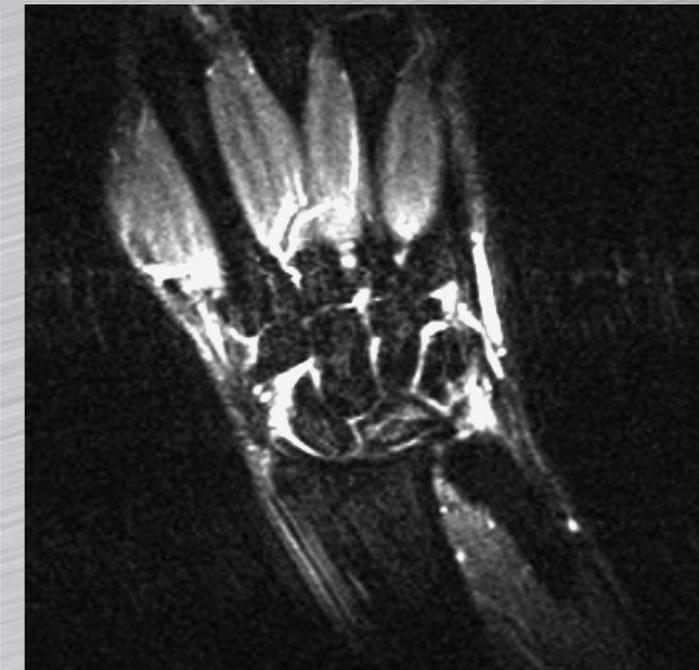
- Normal radiographs
 - (a fracture line may be present)
- Positive bone scan
- Positive MRI

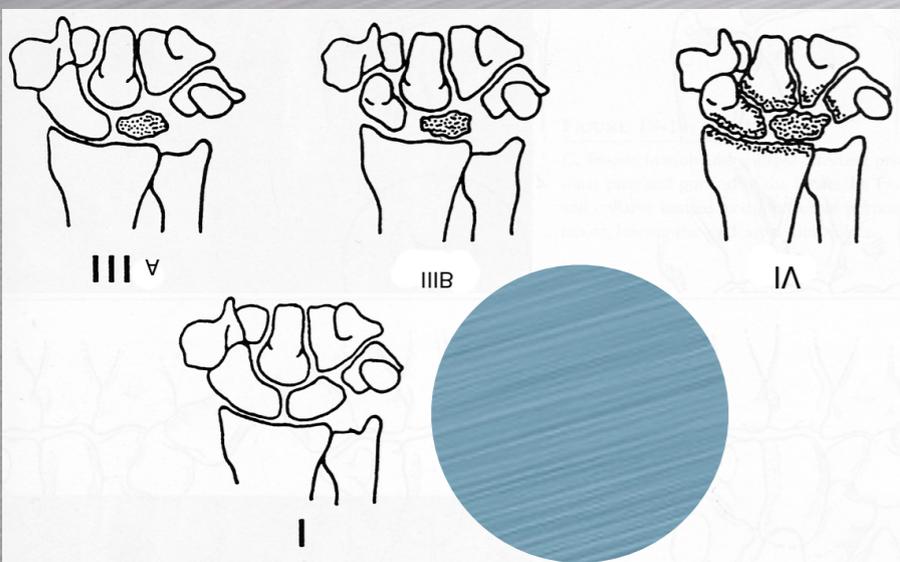


Stage I



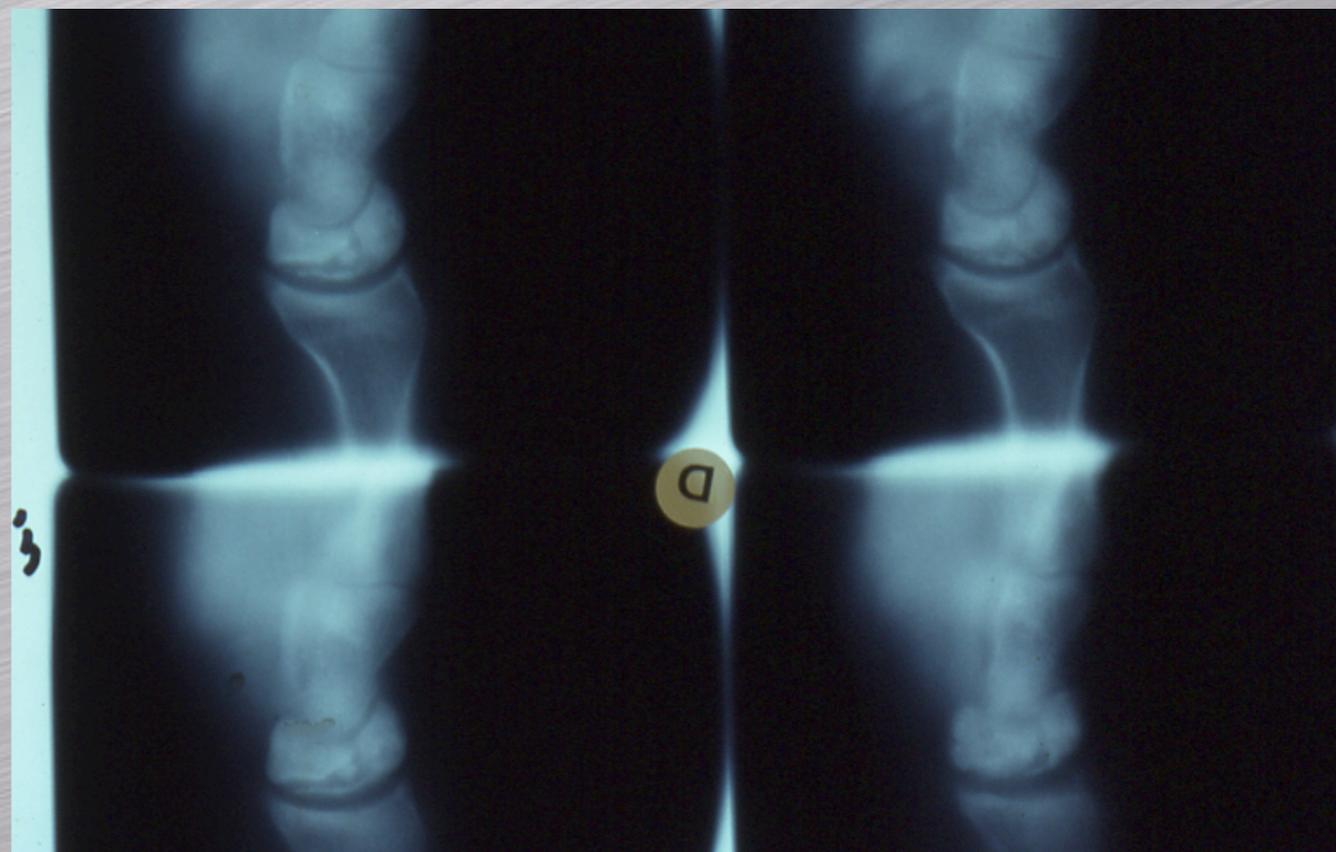
- Hypo-signal T1
- Hypo-signal T2
- Enhancement of the T2 signal with gadolinium injection is interpreted as a potential for revascularisation





Stage II

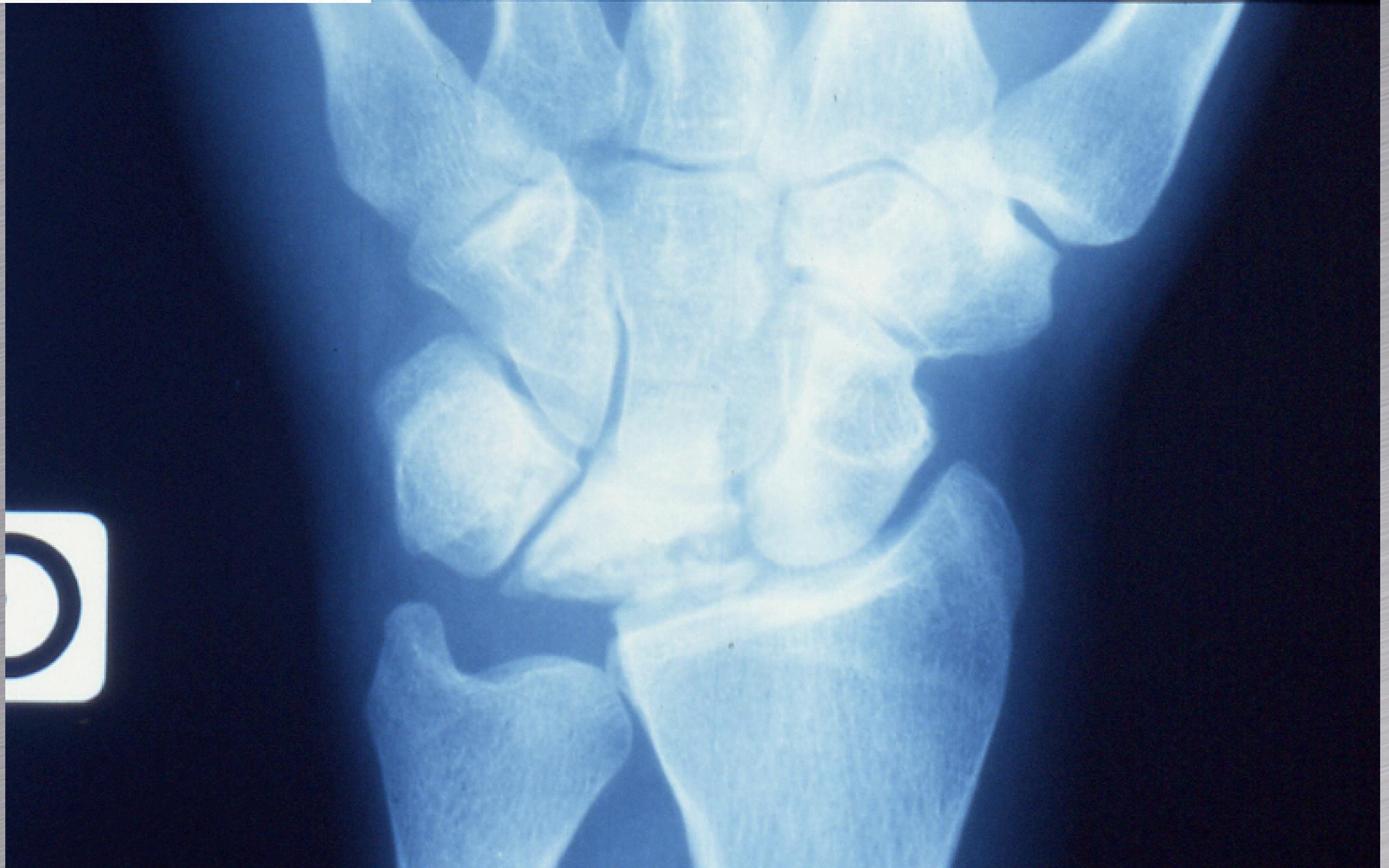
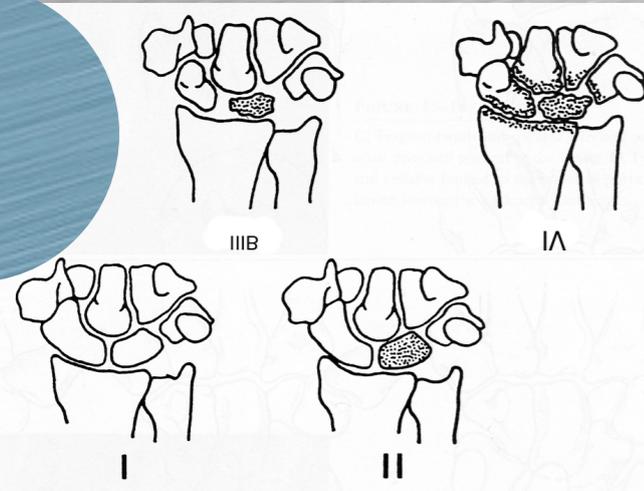
- Condensation of the lunate which shape is normal



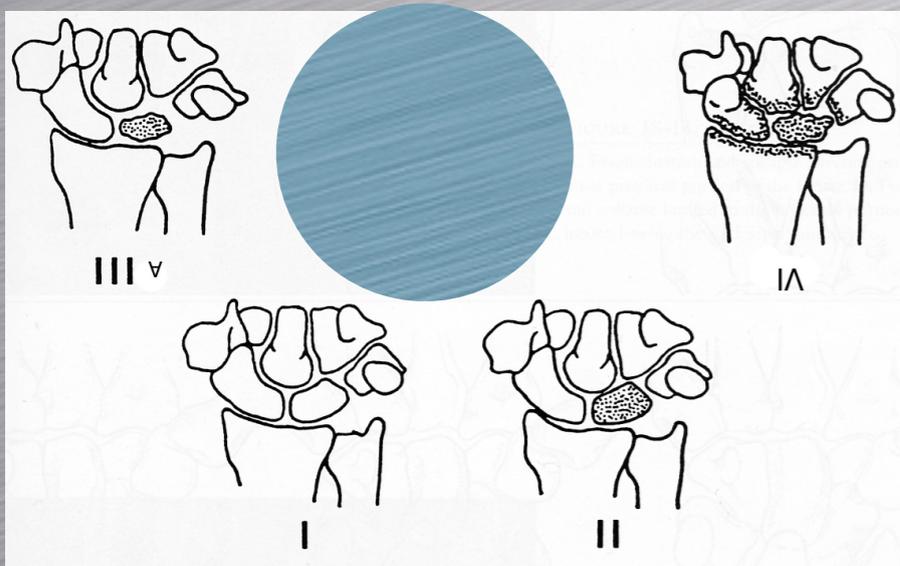
- in stage III, the lunate has collapsed and lengthen in both plane



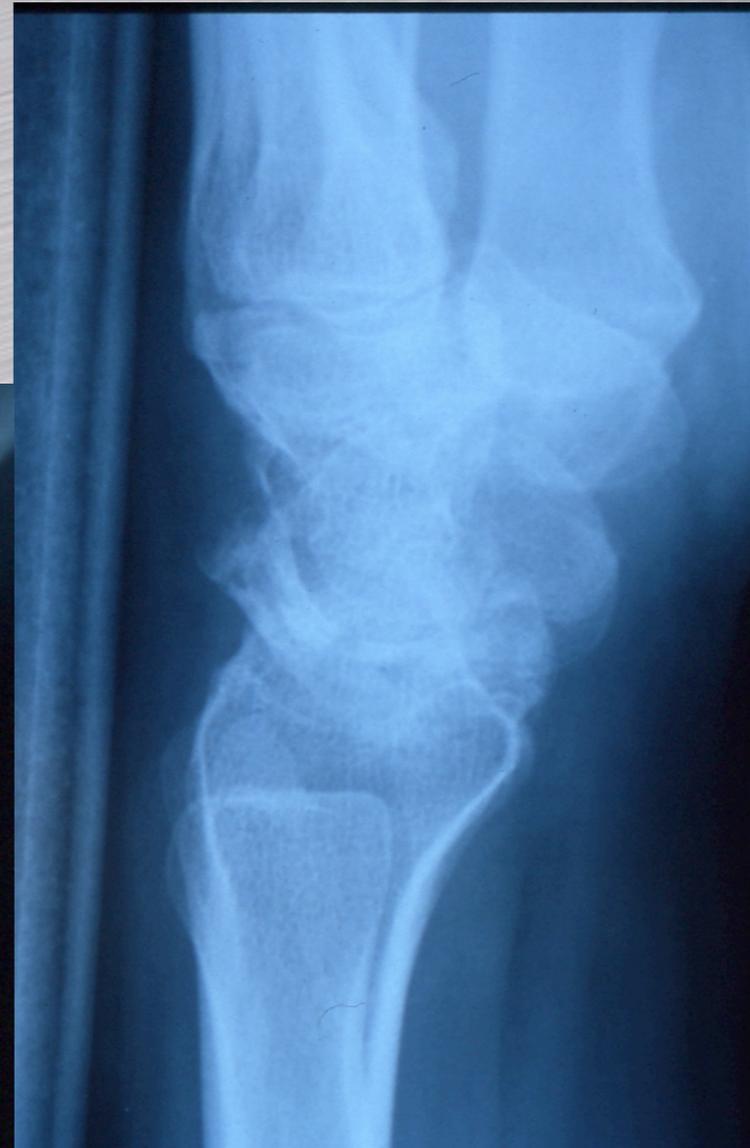
Stage IIIa



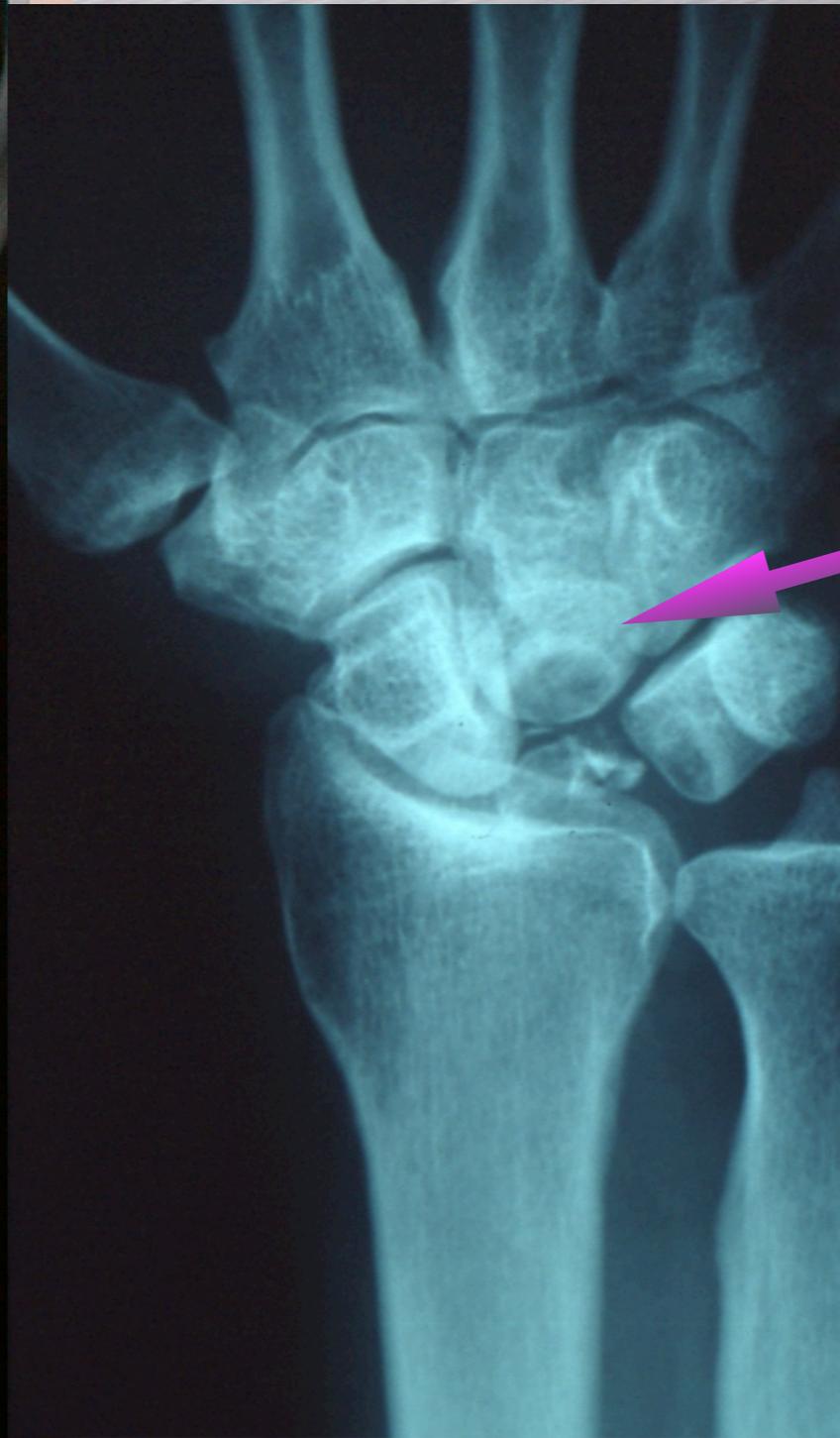
Stage IIIb



- Carpal collapse
- The scaphoid flexes
- Disorganization of the carpus



Stage IV



What can I say to my Kienböck's patients ?

- I don't know exactly why you have this disease (*I have some explanations to give to you*)
- I don't know how many people have the same disease (*incidence is unknown*)
- I don't know how your wrist will evolve without treatment (*Evolution is unpredictable*)

What can I say to my Kienböck's patients ?

- Saffar postulated from 80 cases in building workers followed-up between 10 to 30 years that it takes 5 years to change from one stage to the other



Various Kienböck's ?

- Buechler: 148 patients with MRI, bone scan, CT-scan and plain X-rays
- 4 groups
 - Idiopathic 121



Various Kienböck's ?

- Buechler: 148 patients with MRI, bone scan, CT-scan and plain X-rays
- 4 groups
 - Idiopathic 121
 - Post- fracture 7



72 years old lady with previous Colles' fracture

Various Kienböck's ?

- Büechler: 148 patients with MRI, bone scan, CT-scan and plain X-rays
- 4 groups
 - Idiopathic 121
 - Post- fracture 7
 - Cystic 11
 - Post-perilunate dislocation 9



Treatment(s)

- Abstention / Conservative TTT (+/- distraction)
- Revascularisation (several techniques)
- Ulna lengthening
- Radius shortening / Re-orientation of the radius
- Implants / Intra-carpal osteotomy
- Partial arthrodesis
- 1st row resection / denervation / wrist arthrodesis

Can I do nothing ?

Abstention / conservative TTT

- 70% were improved with 7 yrs FU (Beckenbaugh)
- 77% (24 pts) were pain-free at 18 yrs FU (Kristensen)
- 77% (16 pts) were pain-free at 20 yrs FU (Evans)
- *Opposite to that, Axelson reported 18 failures out of 23 patients*



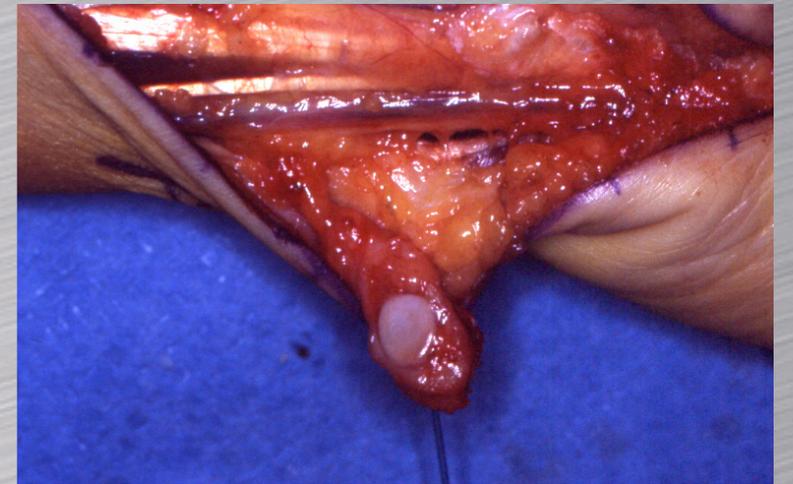
Stage I & II

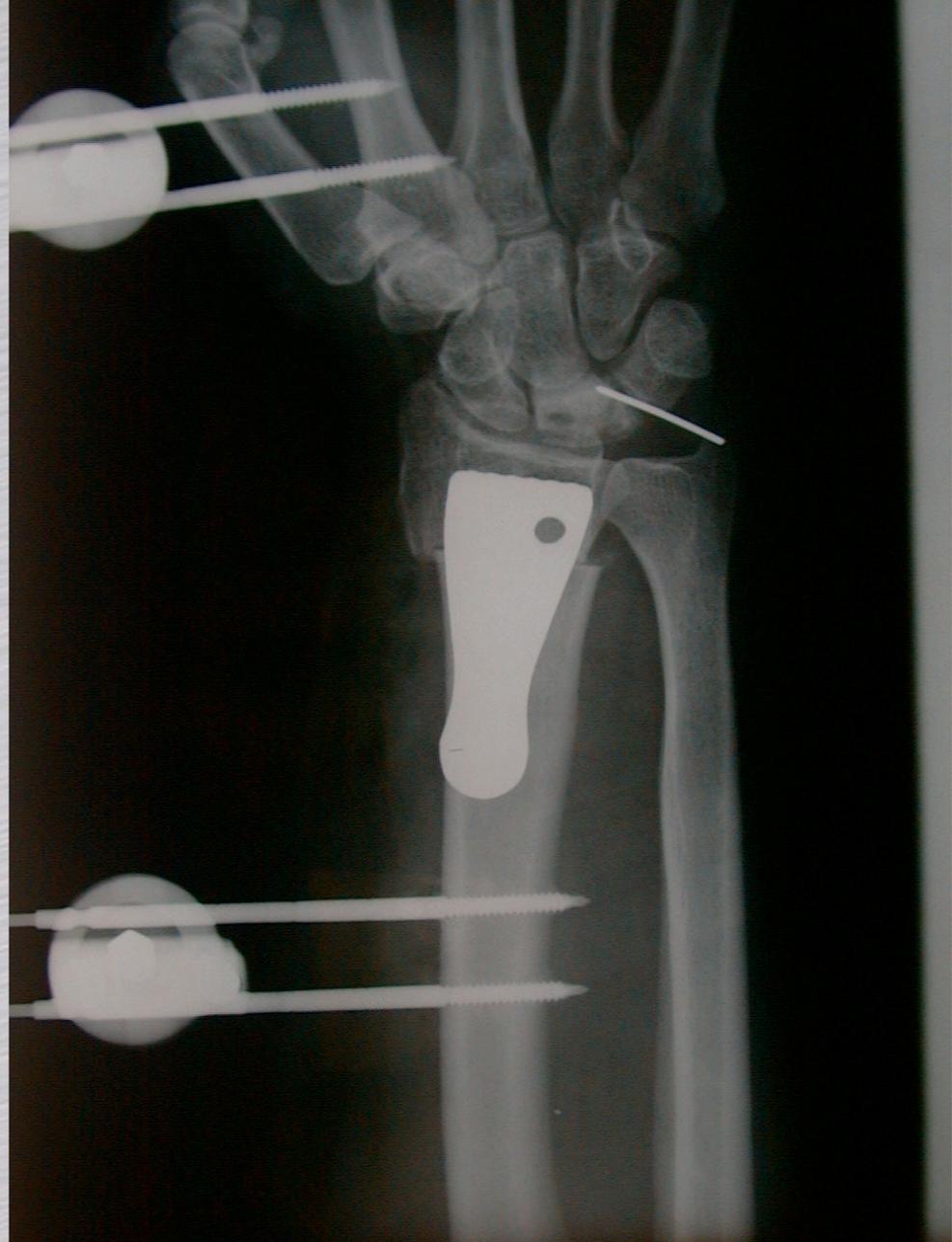
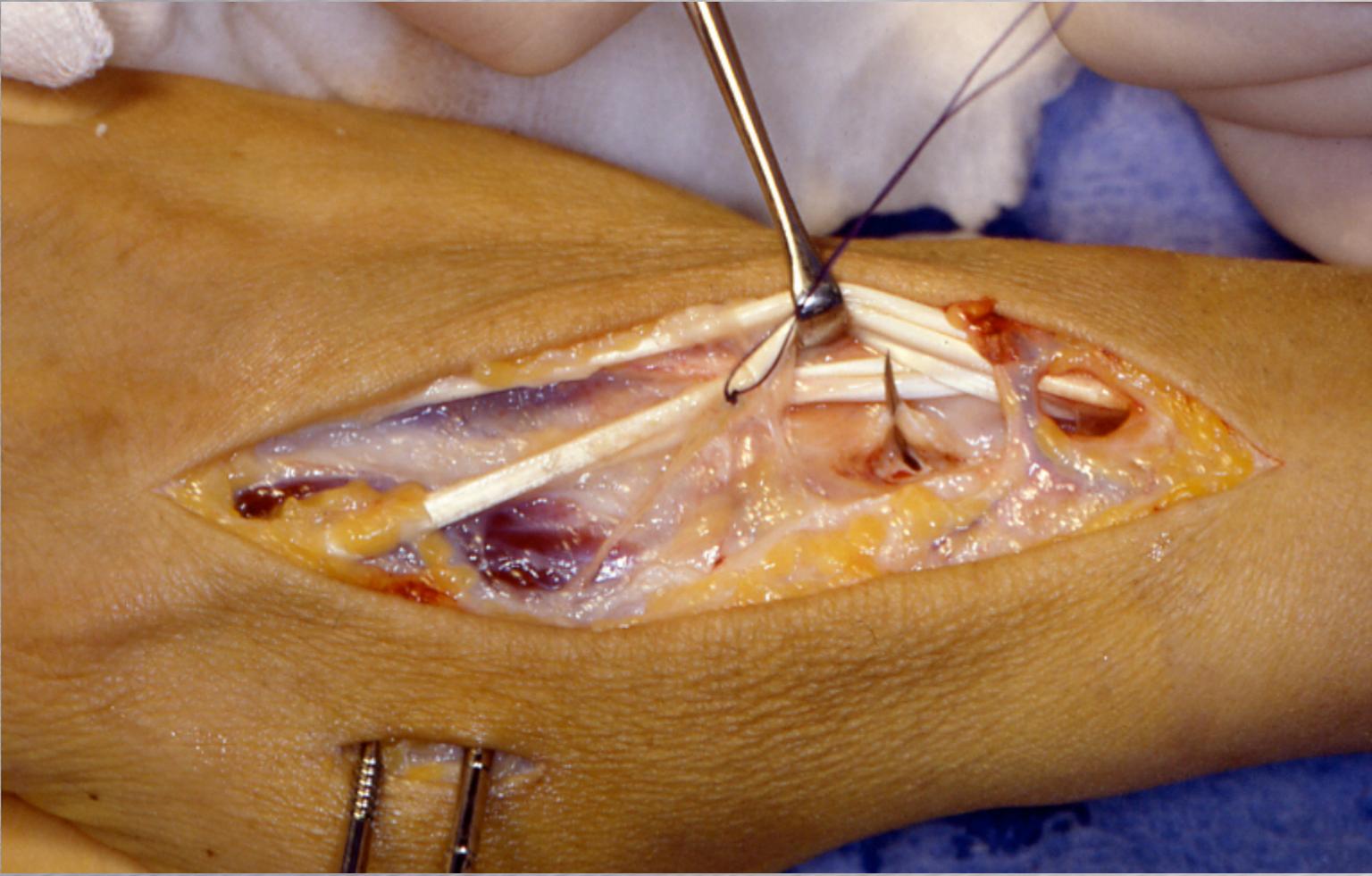
- Revascularisation
- Unloading procedure

*Lunate fractures are not a contra-indication
as the cartilage shell is usually intact
and can be re-modelled*

Revascularisation

- Necrotic bone removal
- Vascularisation supplied by:
 - Pedicled pisiforme (Beck)
 - Dorsal intermetacarpal pedicle (Hori, Tamai)
 - Vascularised bone grafts (Zaidenberg, Kuhlman)
- Very often, Re-vascularisation is combined with loading procedures





Unloading procedures

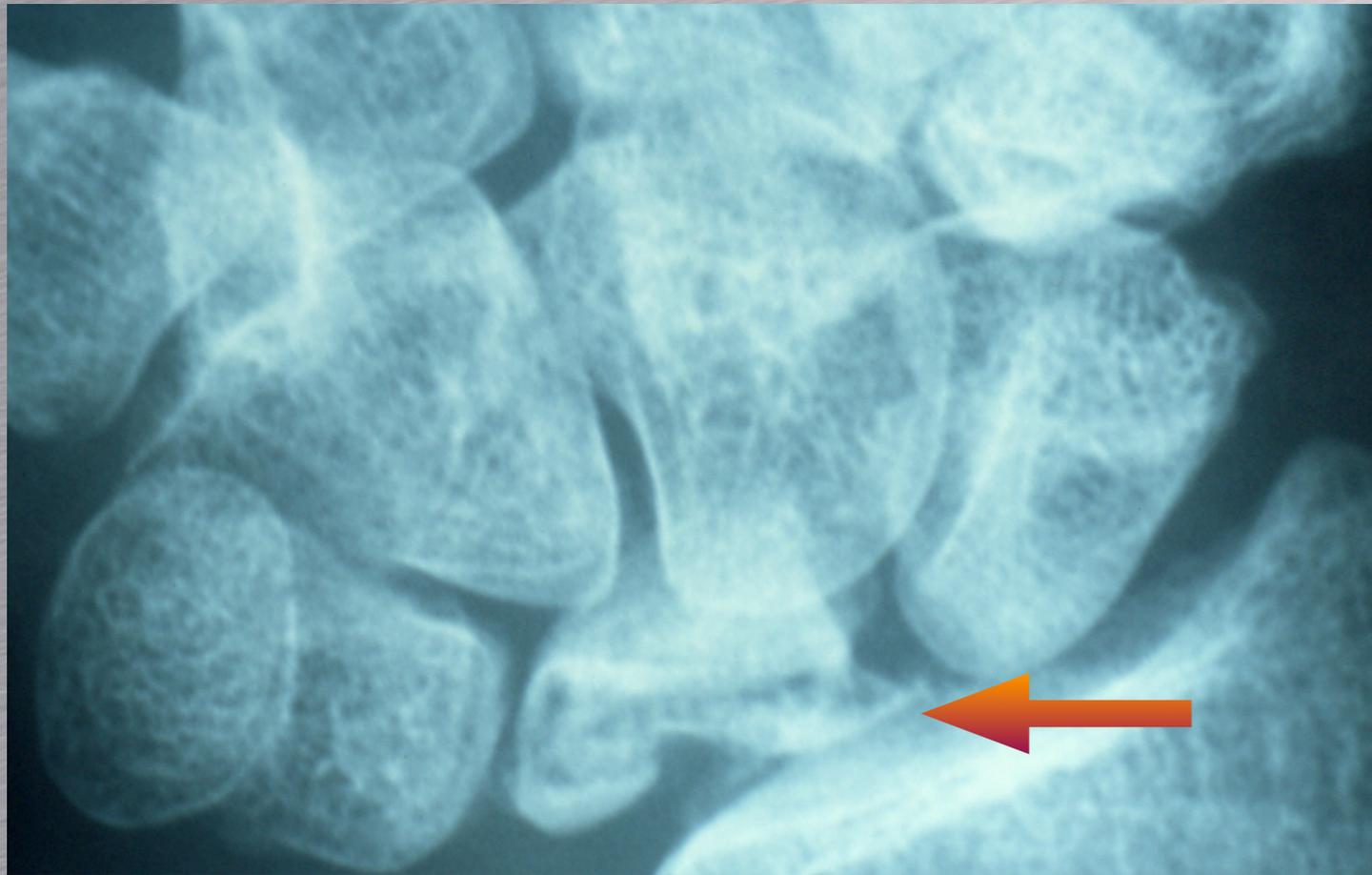
- Radial shortening, ulna lengthening (20% of non-union) and lateral wedge opening of the radius diminish the loads on the lunate
- Variations of 1 mm modify the pressure by 20%
- Excessive shortening is responsible for DRUJ complications
- 70% to 100% good results have been reported at 10 yrs FU



Clinical results at 3 yrs FU with radiological aggravation



Lunate revascularisation after radius shortening



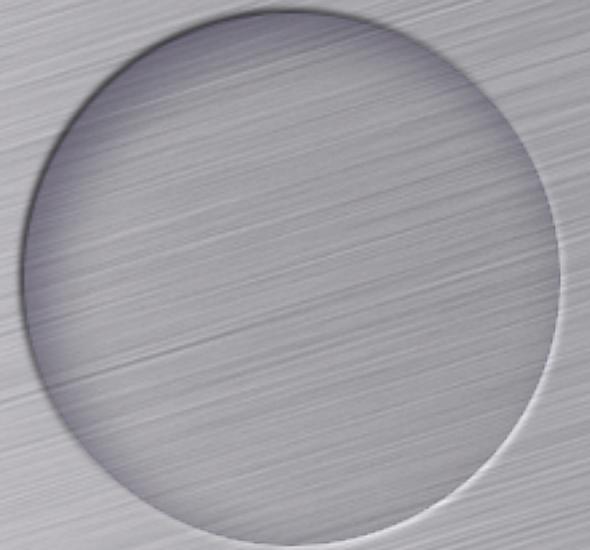
If ulna 0 or + ?

- Wedge osteotomy
 - Lateral Opening (Palmer)
 - 10° Closing wedge osteotomy (Watanabe)
- Ulna + radius shortening ?
- Capitate shortening



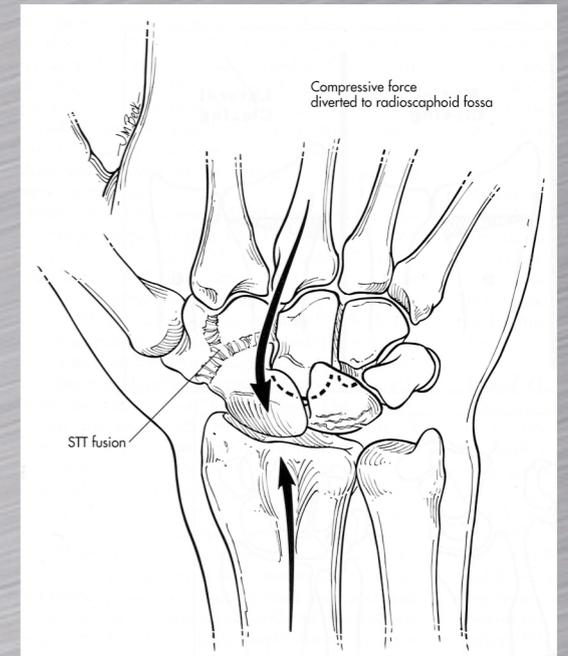
Stage IIIa

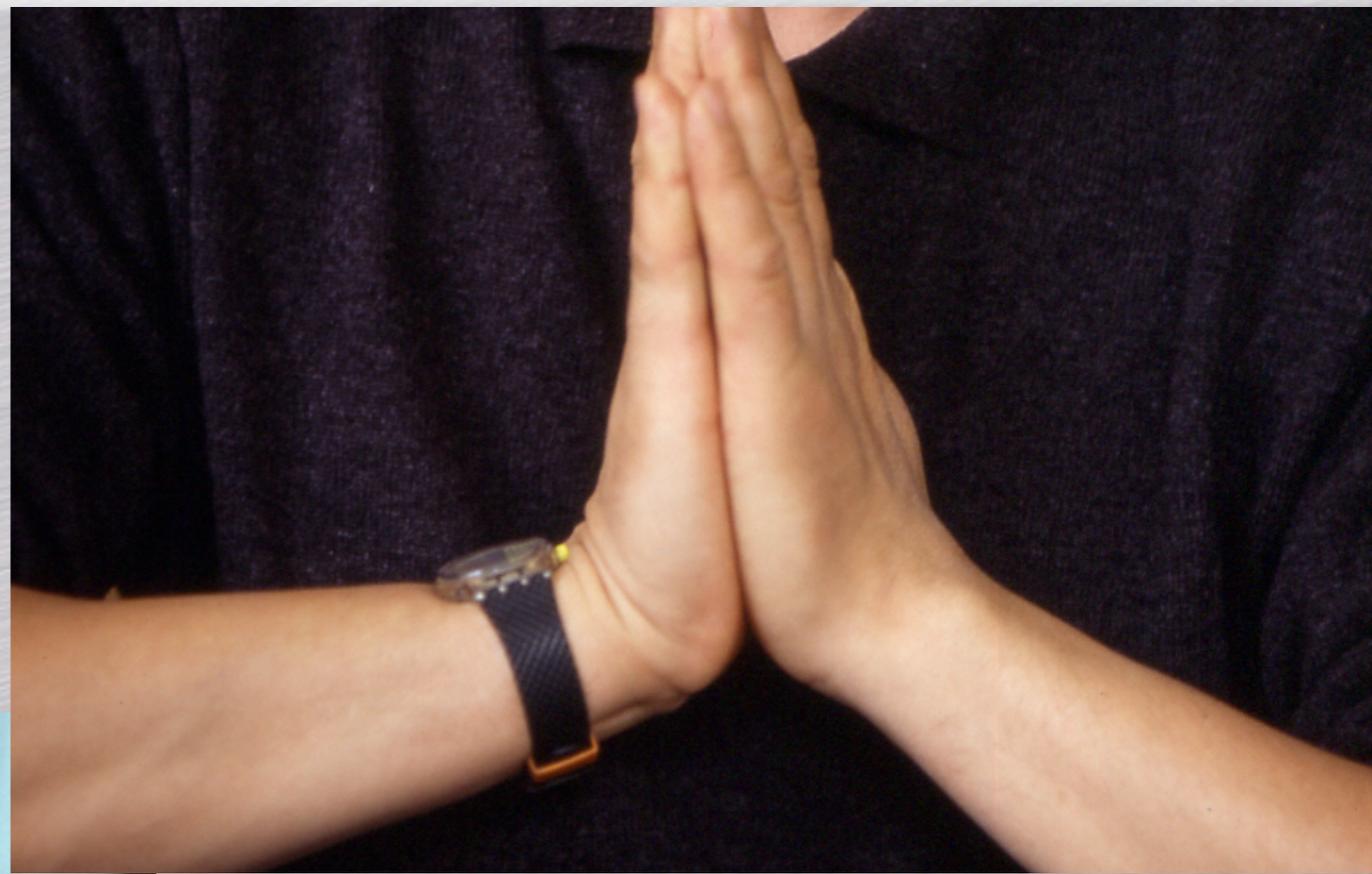
- Unloading procedures
 - + Revascularisation if the lunate is not too fragmented
- Partial arthrodesis
- First row resection



Partial arthrodesis

- STT and SC fusion unload the capitate but increase load to the scaphoid facet of the radius
- Stiffen the wrist and may deteriorate with time

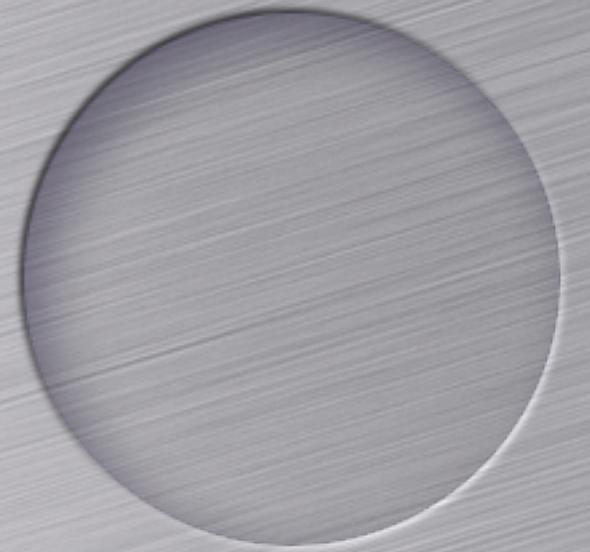




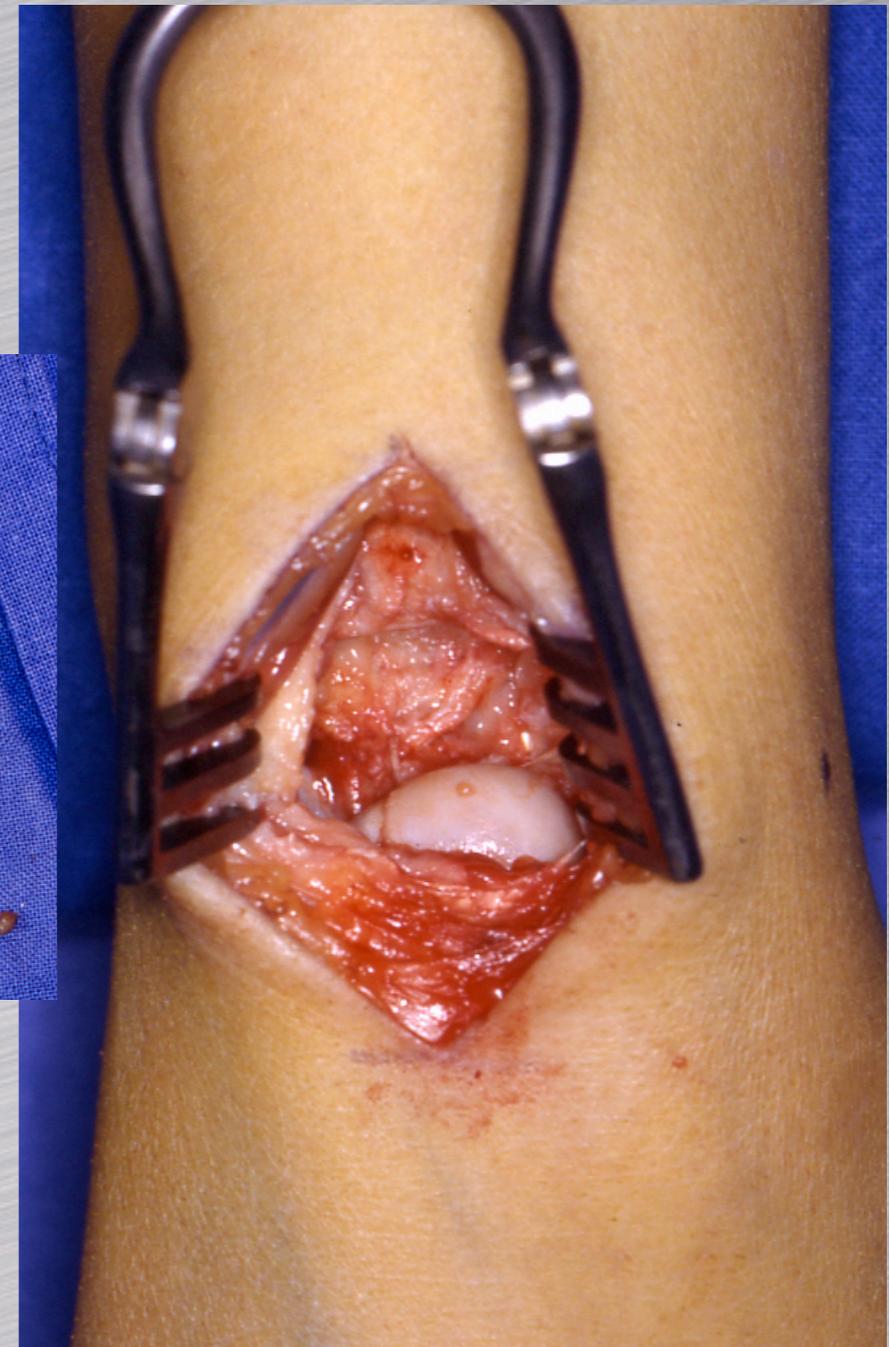
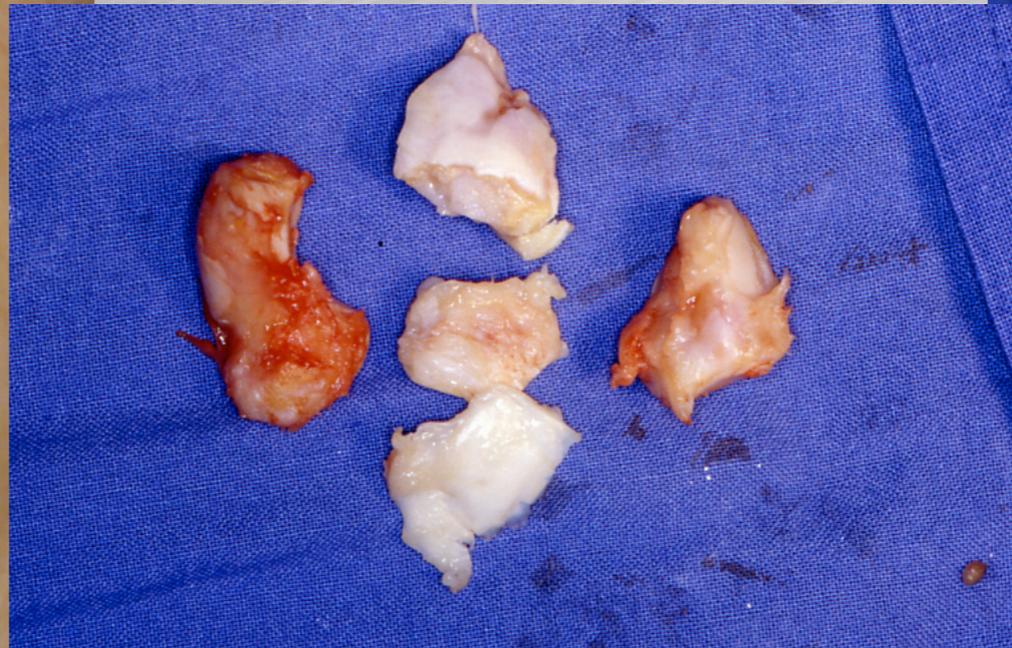
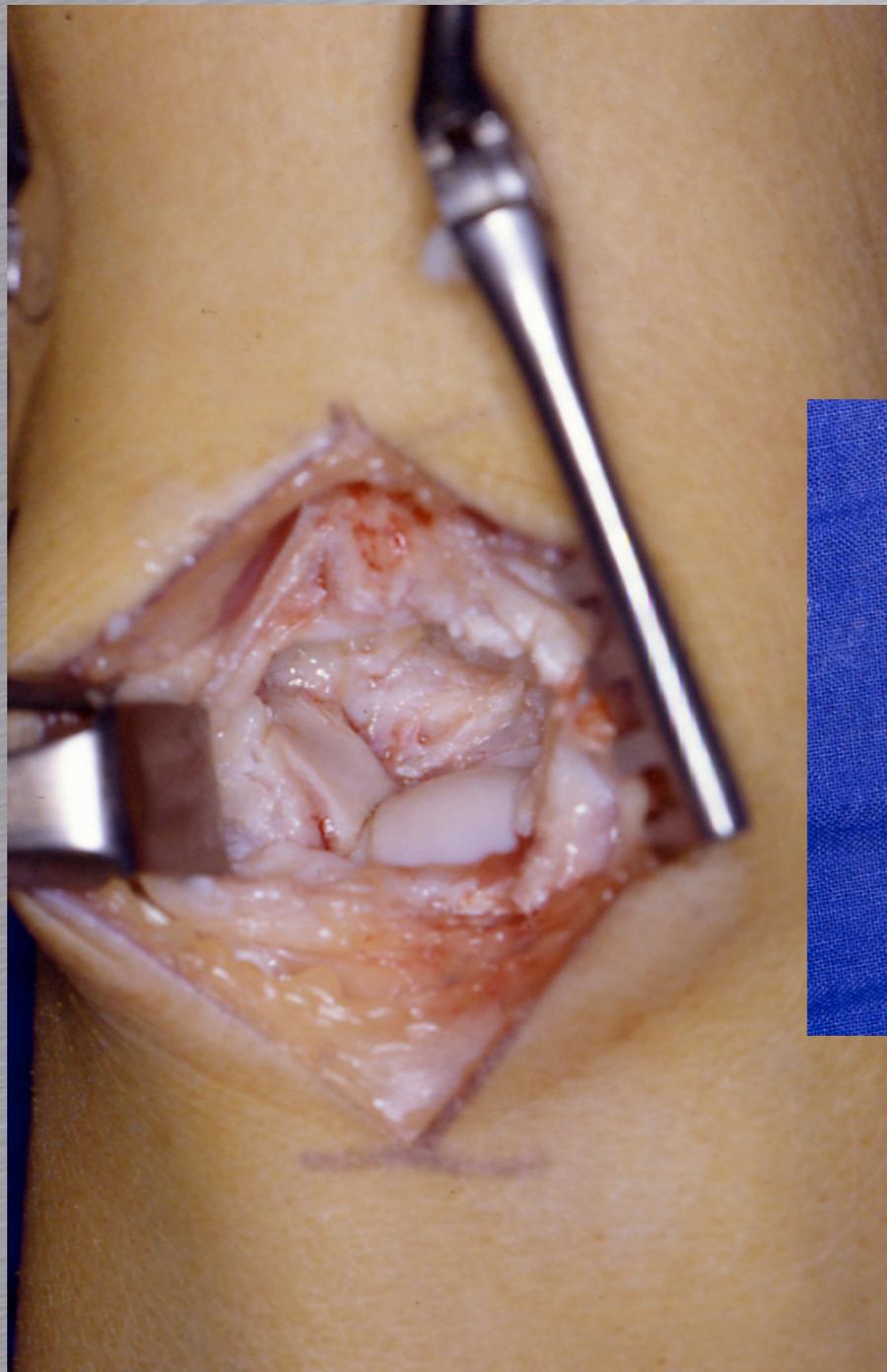
With or without
preservation of the
lunate

Stage IIIb

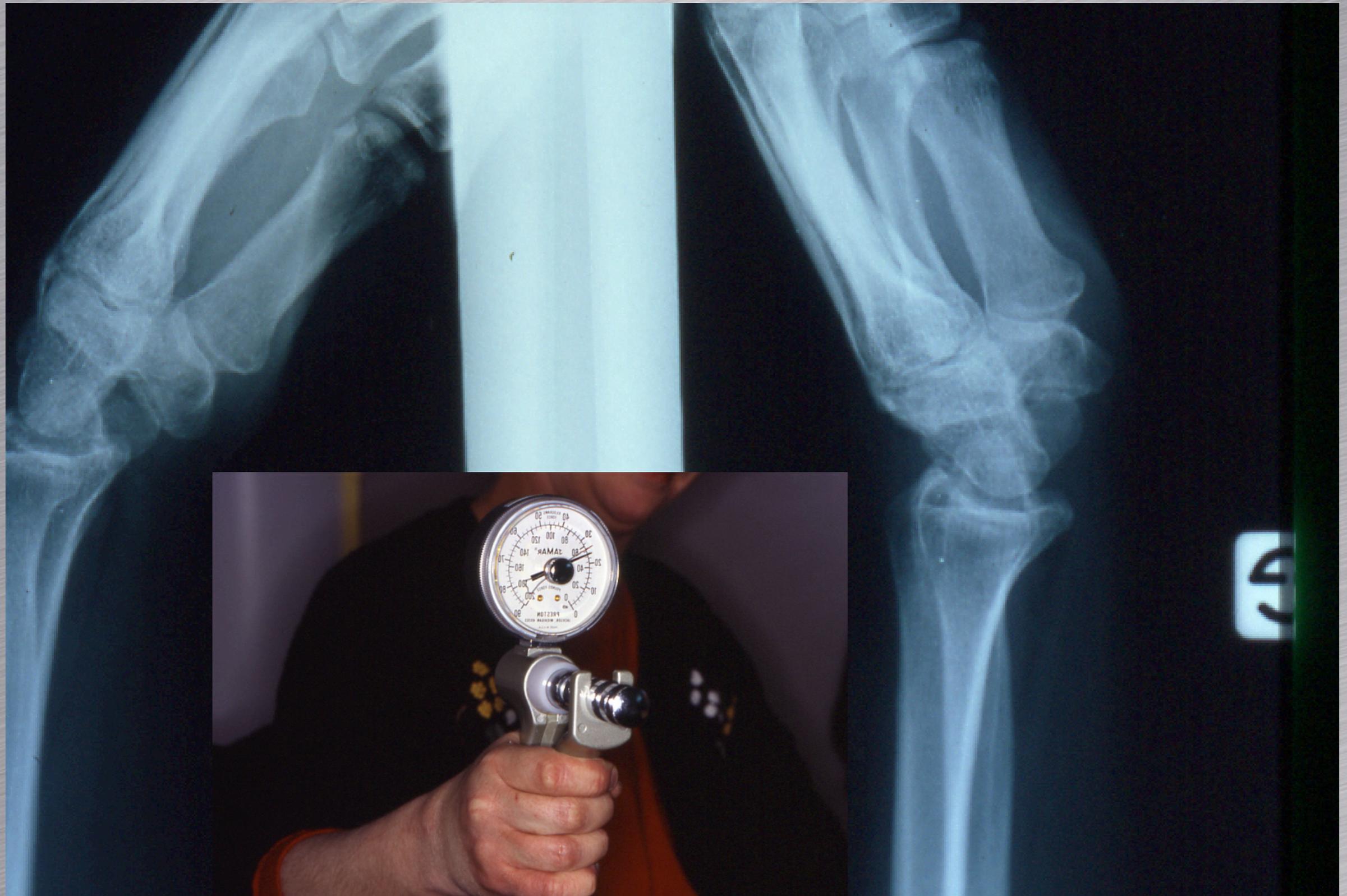
- Unloading procedures ?
- Partial arthrodesis
- First row resection (+/-)
- Lunate implants are no longer used



First row resection

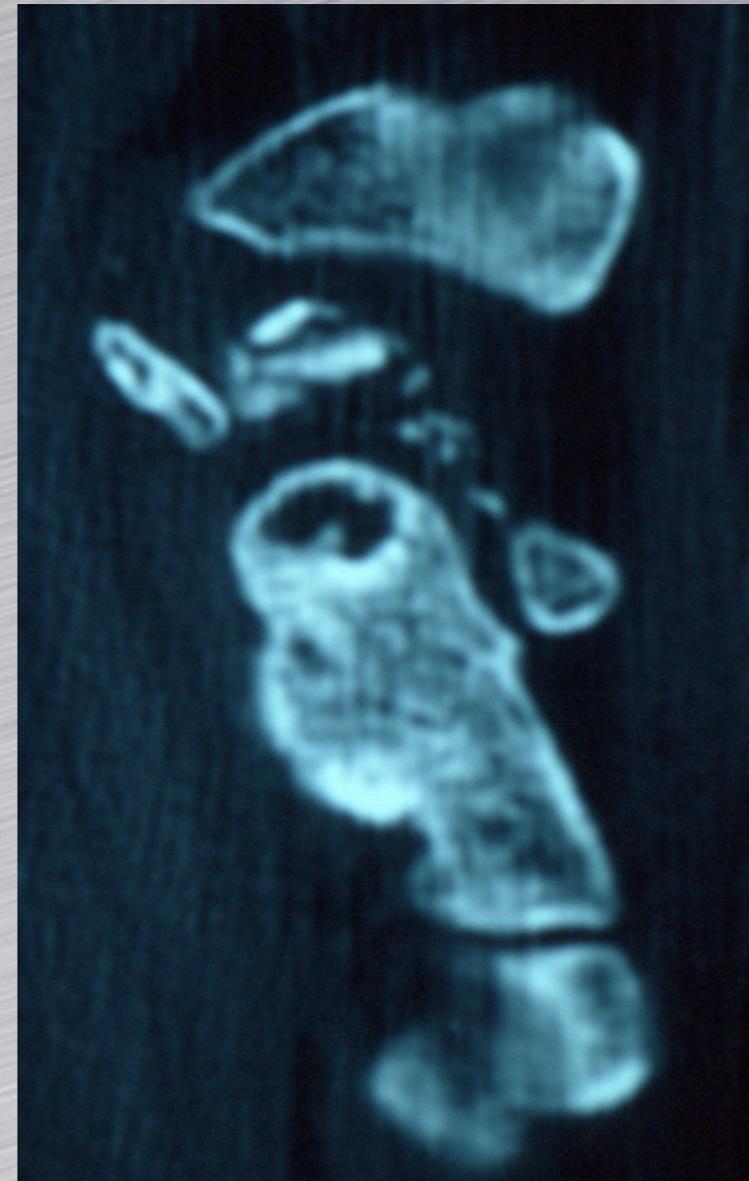


First row resection

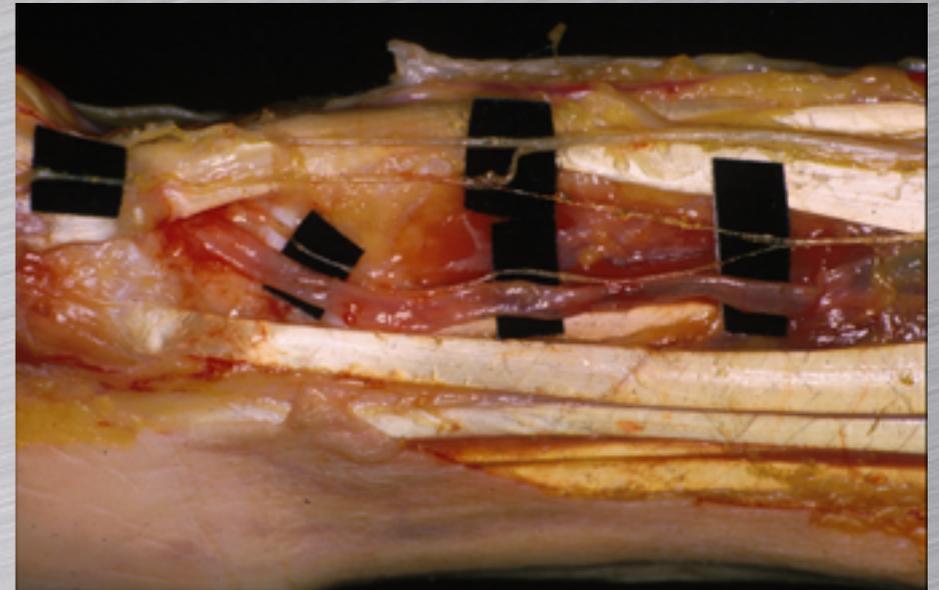
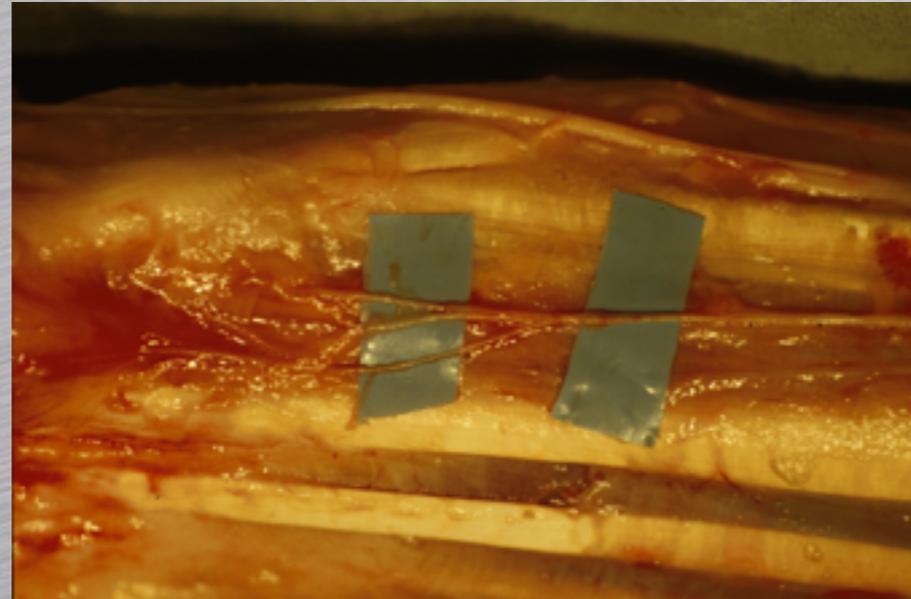


Stage IV

- Wrist denervation
- Wrist arthrodesis



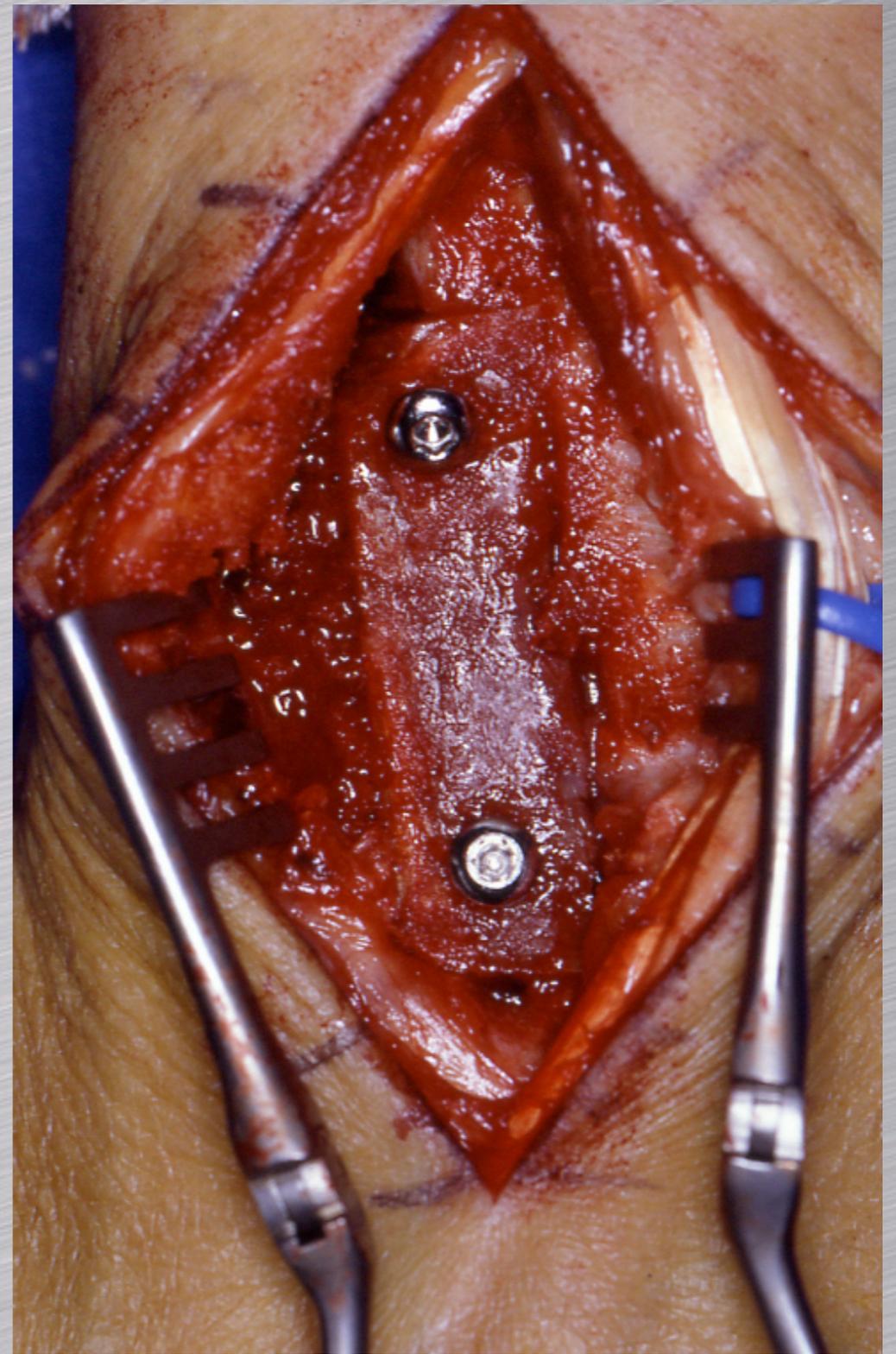
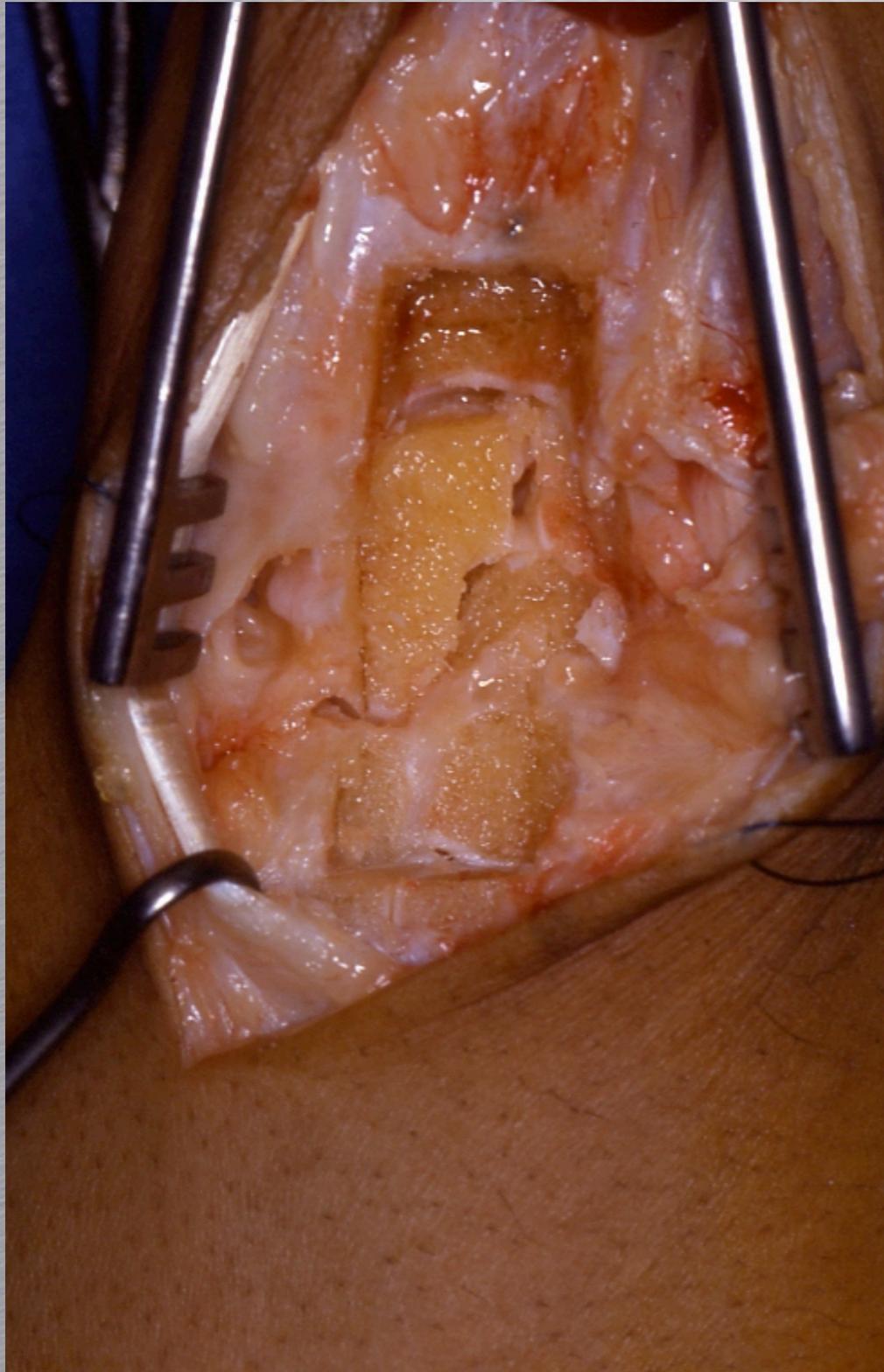
Denervation



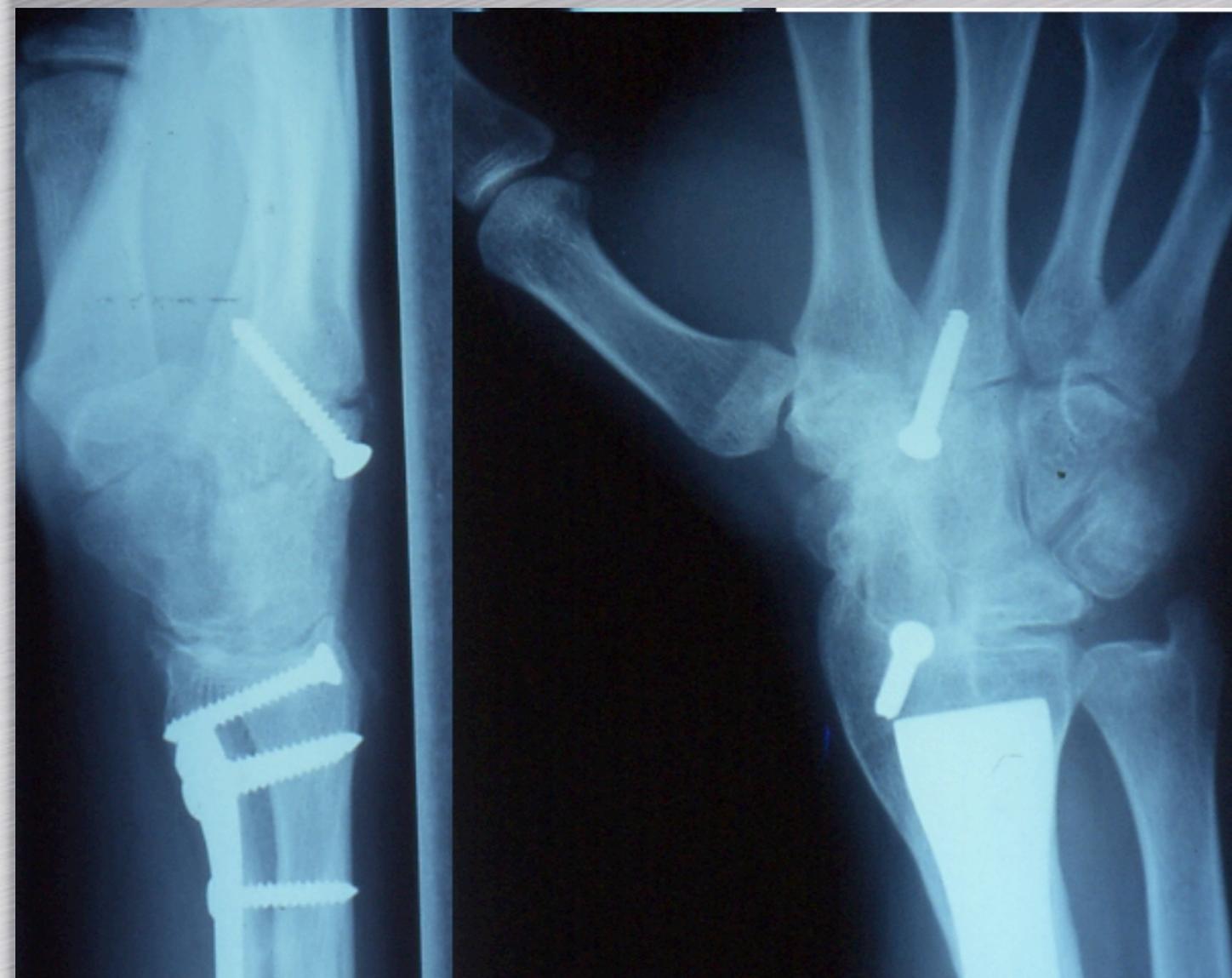
Results of denervation (German society)

Indications	n	Good results
Post-traumatic arthritis	73	71,3%
Articular fracture	76	53,3%
Kienböck's disease	33	75,8%
Fracture-dislocation	9	66,7%
Primitive arthritis	10	70,0%
Pain of unknown origin	24	70,8%
Misceallenous	17	70,6%

Wrist arthrodesis

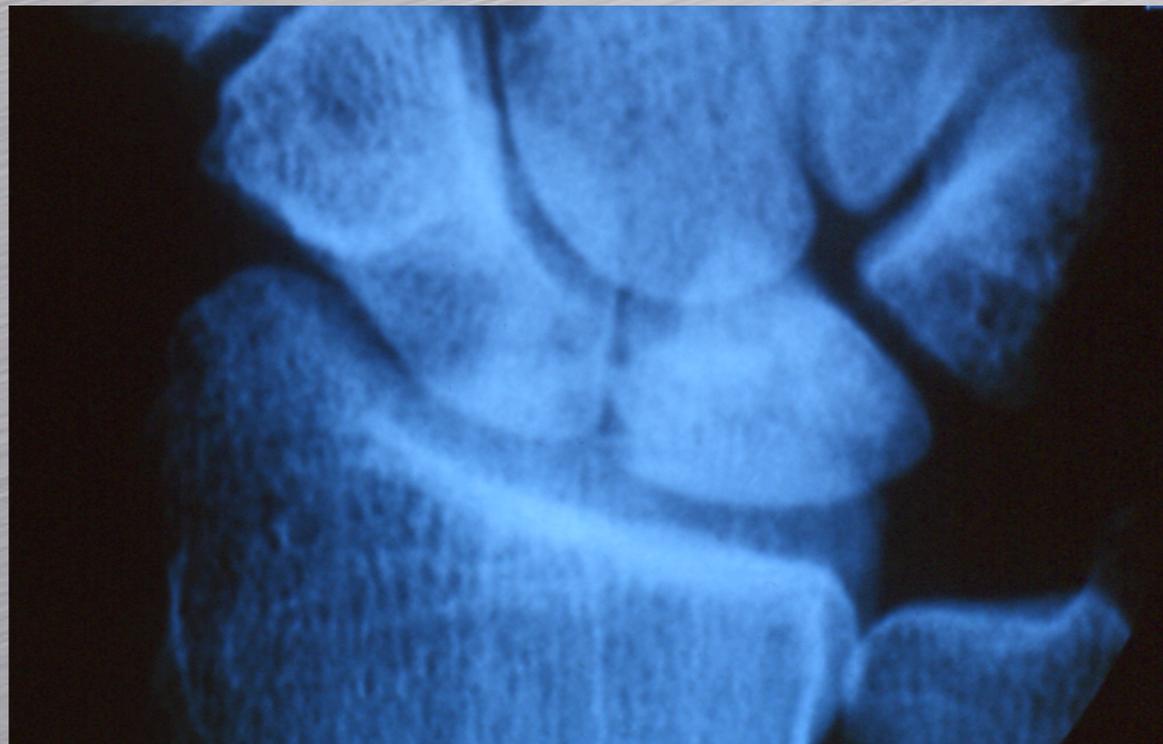


Wrist arthrodesis



Kienböck's fashions ?

- It could be beneficial to treat patients at an early stage when the lunate has still its normal shape and may, perhaps, be re-vascularised with unloading procedures +/- VBGs



**Thank you for
your attention**