The Kienböck disease and scaphoid fractures

Mariusz Bonczar
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Mariusz Bonczar
Kienböck disease – personal experience

- My special interest for almost 25 years
- Thesis on 60 cases and 8 bilateral
- 8 bilateral – still the biggest series in the literature
- More then 200 surgeries
- Continuing searching the literature
Kienböck disease – objectives

- The latest information on:
  - Etiology
  - Pathomechanism
  - Treatment algorithm
Kienböck disease - etiology
Kienböck disease - etiology

„At risk” patient

„At risk” lunate

„At risk” surroundings
Kienböck disease - etiology

- Young
- Active
- Male??
- Particularly manual labor
- Repetitive stress, micro trauma

„At risk” patient
Kienböck disease- etiology

„At risk” lunate
Zapico type lunate

Type I 32%  Type II 50%  Type III 18%
Zapico type lunate

Type I 32%  
Type II 50%  
Type III 18%
Zapico type lunate

Type I 32% Trabecular pattern weakest
Kienböck disease - etiology

„At risk” surroundings
„At risk” surroundings
„At risk” surroundings

Type I +
„At risk” surroundings

Type I +

Ulna -
„At risk” surroundings

Type I +

Ulna -

Flat radius
"At risk" surroundings

Type I +

Ulna -

Flat radius
„At risk” surroundings
„At risk” surroundings
„At risk” surroundings
External and internal bone micro-architecture in normal and Kienböck's lunates: A whole-bone micro-computed...
Kienböck disease - pathomechanism

3D micro-CT scan

Proximal single layer of subchondral bone – 0.1 mm thick
Kienböck disease - pathomechanism

„At risk” patient

„At risk” lunate

„At risk” surroundings

Stress fracture at the proximal pole
Kienböck disease - pathomechanism
Kienböck disease - pathomechanism

Stress fracture

Impairment of subarticular venous drainage

venous hypertension
Kienböck disease - pathomechanism

- impairment of venous drainage is critical in the development of AVN in the lunate
- stress fracture of proximal pole = localized lunate phenomenon
- obstruction of the vein that accompanies the single volar artery = global hypertension of the lunate
Kienböck disease - treatment algorithm

Patient’s age

Lunate stage – how does the disease affect the lunate?

Classification

Wrist stage – how does the disease affect the wrist?

What can the surgeon offer?

What does the patient want?
Kienböck disease classification

- Lichtman osseous classification
- Schmitt vascular/MRI classification
- Bain cartilage/arthroscopic classification
Lichtman osseous classification
Bone marrow

normal

ischemic
MRI pattern A

partially necrotic
MRI pattern B

completely necrotic
MRI pattern C

Schmitt bone marrow viability in MRI
Bain cartilage/arthroscopic classification

number and location of nonfunctional articular surfaces
Kienböck disease - treatment algorithm

- lunate intact

- immobilization
- unloading procedures
- lunate decompression
- vascularized bone graft

ischemic MRI pattern A
Kienböck disease- treatment algorithm

Lunate compromised = proximal lunate collapse

Lunate reconstruction

- vascularized bone graft
- VBG + radial shortening
- RSL fusion

Partially necrotic MRI pattern B
Kienböck disease - treatment algorithm

lunate unreconstructable = lunate collapse

lunate excision

- PRC
- capitate shortening
- CL fusion
- lunate replacement

completely necrotic MRI pattern C
Kienböck disease - treatment algorithm

wrist compromised

wrist reconstruction
Kienböck disease - treatment algorithm

RC joint compromised

fuse or bypass RL joint

= RSL fusion, SC fusion....
Kienböck disease - treatment algorithm

RC and MC joint compromised

bypass central column

= SC fusion, hemiarthroplasty...
Kienböck disease treatment algorithm

- Wrist not reconstructable

Wrist salvage

- Wrist fusion
- Wrist arthroplasty
- PRC with arthroplasty

MRI pattern C
Kienböck disease treatment algorithm is helpful, but.......
Kienböck disease- treatment algorithm

Patient’s age

lunate stage – how does the disease affect the lunate?

wrist stage – how does the disease affect the wrist?

what can the surgeon offer?

what does the patient want?

is helpful, but.......
Kienböck disease treatment algorithm

is helpful, but........

what does the patient want?

lunate stage – how does the disease affect the lunate?

what can the surgeon offer?

final decision
Kienböck disease - treatment algorithm

Is helpful, but........

What does the patient want?

What can the surgeon offer?

Final decision
Even with some lunate collapse – I always try unloading procedures and/or lunate decompression with vessels implantation
Kienböck disease - some practical points....

- Even with some lunate collapse – I always try unloading procedures and/or lunate decompression with vessels implantation
- When lunate is collapsed – it will stay collapsed even if the pain disappears
Kienböck disease - some practical points....

- Even with some lunate collapse – I always try unloading procedures and/or lunate decompression with vessels implantation
- When lunate is collapsed – it will stay collapsed even if the pain disappears
- Don’t treat the X-rays
- Vessels implantation
- Vascular bone graft
- Planed 3rd surgery because of collapse

Limited ROM BUT NO PAIN !!!!!!
Kienböck disease - some practical points....

- Even with some lunate collapse – I always try unloading procedures and/or lunate decompression with vessels implantation
- When lunate is collapsed – it will stay collapsed even if the pain disappears
- Don’t treat the X-rays
- Sometimes we have to make a tough decisions in spite of any algorithms
- No unloading procedures possible
- Complete collapse
- Very rapid progression
- Constant pain

July

Patient 23 yo

November
Kienböck disease - some practical points....

- Even with some lunate collapse – I always try unloading procedures and/or lunate decompression with vessels implantation
- When lunate is collapsed – it will stay collapsed even if the pain disappears
- Don’t treat the X-rays
- Sometimes we have to make a tough decisions in spite of any algorithms
- I always take an x-ray of other wrist
Scaphoid fractures
When does not unite

Factors predicting non union
scaphoid

- Critical link in the mechanism of the carpus
- Complex shape which allows to participate in the kinematics of the proximal and distal rows
scaphoid
scaphoid
scaphoid
scaphoid
scaphoid

- part of the proximal row *(mobile bones)*
- very strong ligaments attachments
  - no tendon insertions
- mechanical link with distal row *(almost no motion between the bones)*

excessive loading and forces
excessive loading and forces
excessive loading and forces
Mechanism of fracture

more proximal fracture site - more displacement
Suspected scaphoid fracture?

Wait 2 weeks, reexamination and x-ray ??
Repeated X-ray in suspected fracture

- The value of radiographs and bone scintigraphy in suspected scaphoid fracture. A statistical analysis
  

- Suspected scaphoid fractures: can we avoid overkill?
  

Little value in doing the repeated X-ray. Small minority or none of suspected fractures are visible after a period of immobilization
Repeated X-ray in suspected fracture

- Can follow-up radiography for acute scaphoid fracture still be considered a valid investigation?


With poor sensitivity, poor negative predictive value and poor reliability, follow-up radiography *cannot be considered a valid* diagnostic examination for the detection of scaphoid fracture in patients with normal initial radiographs.
Repeated X-ray in suspected fracture

Review of the literature clearly demonstrate the major role that MRI should play in management of clinically suspected scaphoid fracture.
Repeated X-ray in suspected fracture

Clinically Suspicious of Scaphoid Injury

No Fracture, but clinical suspicion

Futura Wrist Splint or Scaphoid Slab

Review in A&E 7 days post injury (mon- Fri, 9-4) Futura Wrist Splint or Scaphoid Slab

No Clinical Suspicion

Manage as soft tissue injury

X-ray

Fracture (#)

Ongoing Clinical Suspicion

MRI 4/7

No #

Clinic FU

# Clinic FU

# Scaphoid Slab
Is there any other possibility?

- Limited access
- Waiting time
- Costs

Better selection of the patients for MRI?
Clinical scaphoid score (CSS) to identify scaphoid fracture with MRI in patients with normal x-ray after a wrist trauma

Torbjørn Hiis Bergh,1,2 Tommy Lindau,2,3 Lars Atle Soldal,1 Soosaippillai V Bernardshaw,1 Mehdi Behzadi,4 Knut Steen,1 Christina Brudvik1,2

Clinical scaphoid score (CSS)

ASB: Tenderness in the anatomical snuffbox (ASB) with the wrist in ulnar deviation.

ST: Tenderness on palpation over the scaphoid tubercle (ST) with the wrist in slight extension.

LC: Pain on the longitudinal compression (LC) of the thumb.

3

2

1

Clinical scaphoid score (CSS)

$CSS \geq 4$ was the only statistically significant ‘cut-off’ value to identify scaphoid fracture defined as occult scaphoid fracture.
Immobilization?
scaphoid fracture

Long arm cast:

Thumb spica cast

Thumb spica splint

Short arm cast:
scaphoid fracture

Figure 35.—Type of plaster cast used for immobilization in fractures of carpal scaphoid bone. Note so-called grasping pose. Note also possible range of motion of metacarpophalangeal joints.
NEED THE THUMB BE IMMOBILISED IN SCAPHOID FRACTURES?

A RANDOMISED PROSPECTIVE TRIAL

NIGEL R. CLAY, JOSEPH J. DIAS, P. S. COSTIGAN, P. J. GREGG, N. J. BARTON

- 292 fractures – spica and Colles cast (with or without thumb)
- Both types of cast were equally well in bone healing
- The scaphoid cast is clearly more inconvenient for the patient and has the further disadvantage
- For fresh, undisplaced fractures of the waist of the scaphoid, the simpler Colles plaster would appear to be equally effective.
2012

Cast Immobilization with and without Immobilization of the Thumb for Nondisplaced Scaphoid Waist Fractures: A Multi-center Randomized Controlled Trial

Level 2 Evidence

- Geert A. Buijze, MD
- J. Carel Goslings, MD, PhD
- Steven Rhemrev, MD
- Alexander Weening, MD
- Bart Van Dijkman, MD
- David C. Ring, MD, PhD
SUMMARY POINTS

- Treatment with a below-elbow cast without immobilization of the thumb results in a higher extent of union on CT at ten weeks.
- There was no difference in arm-specific disability.
- Nondisplaced fractures of the scaphoid waist can be adequately treated in below-elbow cast without immobilization of the thumb.
How to assess displacement?
displacement
(Amadio et al, J Hand Surg 1989)

lateral intrascaphoid angle

No displacement:
< 35º on CT sagittal cuts
displacement
(\textit{Amadio et al, J Hand Surg 1989})

anteroposterior (AP) intrascaphoid angle

\textbf{No displacement:}
\[ \geq 35^\circ \]
Delayed Dx-1 month

1. Cast
2. Percutaneous screw
3. Open screw
Scaphoid - can we predict the heeling?
Scaphoid - can we predict the heeling?

Very difficult
Scaphoid - can we predict the healing?

- Difficult to predict fracture union based on radiographic feature
- More accurate assessment of displacement (CT) may predict the likelihood of union
- Initial poor vascular supply of the proximal fragment?
The lack of correlation between poor proximal vascularity in the acute stage and eventual non-union DOES NOT SUPPORT THE HYPOTHESIS that ischemia of the proximal fragment predisposes to non-union.
Scaphoid - can we predict the heeling?

- Difficult to predict fracture union based on radiographic feature
- More accurate assessment of displacement (CT) may predict the likelihood of union
- Initial poor vascular supply of the proximal fragment...is not a determinant of non-union

If it still difficult to identify fractures with a poor prognosis....

...that better treat them with screw fixation?
Scaphoid - can we predict the heeling?

Further issues that directly influence outcome are:

- delay in diagnosis and treatment
- instability, associated ligament disruption, soft tissue interposition
- adequacy of treatment
Scaphoid - can we predict the heeling?

Further issues that directly influence outcome are:

- Delay in diagnosis and treatment
- Instability, associated ligament disruption, soft tissue interposition
- Adequacy of treatment
Delays and Poor Management of Scaphoid Fractures: Factors Contributing to Nonunion

King Wong, MB BCh, Herbert P. von Schroeder, MD

Purpose Scaphoid fracture nonunion remains prevalent, and it was our purpose to examine the initial care, fracture site, and patient gender and age to determine factors contributing to fracture nonunion.

- No clinical examination
- No initial x-rays
- No adequate immobilization
- No follow up
management decision

- stability
- ease of reduction
- associated ligament disruption
- patient's needs
- technical abilities of surgeon

percutaneous fixation has clearly shifted management from conservative to surgical!
FLEXION (humpback)
FLEXION (humpback)