Commentary

Kienböck's Disease May Be Due to a Wrist-Joint Tamponade

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Kienböck's disease may be due to a mechanism (similar to a muscle compartment syndrome) that reduces the lunate perfusion. Arthrocentesis at an early stage can probably prevent the disease.

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Introduction

The etiology of Kienböck's disease (osteonecrosis of the lunate bone) has been debated for a century now. Kienböck asserted that it was first a nutritional disturbance of the lunate bone followed by a fracture of the weakened bone^[1]. Most studies have focused on anatomical risk factors (such as ulnar variance, radial inclination, and lunate morphology), but the cause of the osteonecrosis is still enigmatic. Current hypotheses include suggestions of localized venous obstruction due to stress microfractures^[2], reduced arterial blood flow to the lunate bone due to an inappropriate wrist position^[3], and intra-osseous venous thrombosis due to an inflammatory disorder^[4]. Hence, it seems justified to call attention to an explanation that seems more consistent with the clinical evidence.

Scaphoid fractures, femoral neck fractures, and Kienböck's disease

Scaphoid fractures and femoral neck fractures are etiologically interesting in this context: partly because they are associated with a high risk of osteonecrosis; and partly because the proximal fragment of a scaphoid fracture, the femoral head of a femoral neck fracture, and the lunate bone all have the characteristics of being drained via capsular veins, which are directly exposed to intraarticular pressure. After an undisplaced scaphoid fracture, an intra-articular pressure of 10 kPa (76 mm Hg) due to hemarthrosis (*wrist-joint tamponade*) was recorded^[5] – more than enough to cause osteonecrosis of the proximal fragment – and arthrocentesis (3 mL blood) in this case brought immediate pain relief. It is well documented that hemarthrosis in the hip joint can cause osteonecrosis of the femoral head because of increased intra-articular pressure (*hip-joint tamponade*) after an undisplaced femoral neck fracture^{[6][7][8]}. By contrast, when the joint capsule ruptures in a displaced femoral neck fracture, no joint tamponade occurs because the intra-articular bleeding is drained.

The fact that Kienböck's disease often (about 50%) has a history of prior trauma to the wrist^[9] but is rare after intercarpal dislocations and fracture-dislocations (none observed in 59 cases)^[10] suggests that, similar to undisplaced femoral neck fractures, Kienböck's disease may result from a wrist-joint tamponade—an effect that does not occur when the joint capsule ruptures. Kienböck's disease has also been associated with several medical disorders (such as rheumatoid arthritis, gout, juvenile idiopathic arthritis), which are likely to have episodes of severe joint effusion^[11]. Thus, at least some of these non-traumatic cases appear to be explained by wrist-joint tamponade.

Conclusions

The proposed mechanism is similar to a muscle compartment syndrome (but is confined by a joint capsule instead of a muscle fascia). A joint tamponade increases the pressure in the capsular veins draining the lunate bone, reduces the arteriovenous pressure gradient, and thus decreases lunate perfusion, which may result in osteonecrosis. After spontaneous revascularization and osteolysis, anatomical risk factors have a mechanical impact on the weakened lunate bone that can subsequently collapse^[12]. Wrist arthrocentesis of a tense joint effusion at an early stage (if given the opportunity, e.g., shortly after a trauma) can probably prevent osteonecrosis, thereby avoiding the development of Kienböck's disease.

References

 [^]Kienböck R. Über traumatische Malazie des Mondbeins und ihre Folgezustände. Entartungsformen un d Kompressionsfrakturen [Concerning traumatic malacia of the lunate and its consequences: joint dege neration and compression]. Fortsch Geb Roentgenstr 1910; 16: 77–103.

- 2. [^]Bain GI, MacLean SB, Yeo CJ, Perilli E, Lichtman DM. The Etiology and Pathogenesis of Kienböck Disea se. J Wrist Surg 2016; 5: 248-54. doi:10.1055/s-0036-1583755
- 3. [△]Kim S, Eichenauer F, Asmus A, Mutze S, Eisenschenk A, Honigmann P. Superselective angiography of t he wrist in patients with Kienböck's disease. BMC Musculoskelet Disord 2019; 20: 143. doi:10.1186/s1289 1-019-2492-5
- 4. [^]Camus EJ, Van Overstraeten L. Kienböck's disease in 2021. Orthop Traumatol Surg Res 2022; 108: 1031
 61. doi:10.1016/j.otsr.2021.103161.
- 5. [^]Mjöberg B. Wrist joint tamponade after scaphoid fracture. A case report. Acta Orthop Scand 1989; 60: 3 71. doi:10.3109/17453678909149298
- 6. [△]Strömqvist B, Nilsson LT, Egund N, Thorngren KG, Wingstrand H. Intracapsular pressures in undisplace d fractures of the femoral neck. J Bone Joint Surg Br 1988; 70: 192-4. doi:10.1302/0301-620X.70B2.3346 286.
- 7. [△]Bonnaire F, Schaefer DJ, Kuner EH. Hemarthrosis and hip joint pressure in femoral neck fractures. Clin Orthop Relat Res. 1998;(353):148-55. doi:10.1097/00003086-199808000-00017.
- 8. [△]Beck M, Siebenrock KA, Affolter B, Nötzli H, Parvizi J, Ganz R. Increased intraarticular pressure reduces blood flow to the femoral head. Clin Orthop Relat Res 2004; (424): 149–52. doi:10.1097/01.blo.0000128 296.28666.35
- 9. [^]Wassef C, Rechter GR, Tatapudi S, Sambhariya V, Pientka WF 2nd. The effect of radial inclination on th e stage of Kienbock disease at the time of initial diagnosis. HAND 2024. Epub ahead of print. doi:10.117 7/15589447231221246
- 10. [^]Russel TB. Inter-carpal dislocations and fracture-dislocations; a review of 59 cases. J Bone Joint Surg B r 1949; 31B: 524-31. PMID: 15397134
- 11. ^ADesy NM, Bernstein M, Harvey EJ, Hazel H. Kienbock's disease and juvenile idiopathic arthritis. McGill J Med 2011; 13: 8–13. PMID: 22363188
- 12. [△]Aspenberg P, Wang JS, Jonsson K, Hagert CG. Experimental osteonecrosis of the lunate. Revascularizati on may cause collapse. J Hand Surg Br 1994; 19: 565–9. doi:10.1016/0266–7681(94)90116–3

Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.