

LONG-TERM RESULTS OF RADIAL SHORTENING FOR KIENBÖCK'S DISEASE

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The long-term evaluation (mean 4.5 years) of radial shortening in 17 patients with Kienböck's disease demonstrated an improvement in pain, but no patients are painfree, and mobility and force are restricted respectively to 69.5% and 72% of the contralateral side. Radiographically, further evolution of the lunatomalacia could not be prevented. The possibility of creating distal radioulnar joint dysfunction and/or ulnar impaction requires in our view a reconsideration of these leveling techniques in the treatment of Kienböck's disease.

Keywords: Kienböck's disease; radial shortening; evaluation; BTE; distal radioulnar joint.

Mots-clés: maladie de Kienböck; raccourcissement du radius; évaluation; articulation radio-cubitale inférieure.

INTRODUCTION

Hultén in 1928 (15) associated Kienböck's disease with ulnar minus variance, and in 1950 Persson (24) and others (13, 28) advocated leveling procedures of the forearm bones as the standard procedure in the treatment of Kienböck's disease. The results of these procedures are generally good in a high percentage of the reported series (1, 2, 3, 4, 9, 19, 23, 25, 26, 27, 30).

However recent reports (6, 8, 16, 17, 21) have questioned again the importance of the ulnar variance (UV). Förstner (10, 11), Tolat (29) and De Smet (7) have noted a difference in sigmoid notch morphology and/or orientation related to the UV with possible hazardous effects on the distal radioulnar joint (DRUJ) of changing the

length of one of the forearm bones. The clinical effect of this was also noticed by Nakamura *et al.* (20).

The aim of this study was to determine the effect of radial shortening for Kienböck's disease on the symptoms, on the wrist function, and on the radiological evolution of the lunate.

MATERIAL AND METHODS

Seventeen patients (11 males, 6 females), mean age 37 years, could be retrieved. The mean follow-up was 4.5 years (range 1 to 7 years). Except for one, all had a follow-up of at least 2.5 years.

All patients had radiographs at final follow-up; 14 were seen clinically. The Cooney score (5) was used to evaluate the wrist function. The grip was tested with a Jamar dynamometer. The same 14 patients were also tested with a Baltimore Testing Equipment (BTE) work simulator to evaluate more precisely forces during pronation, supination, wrist flexion, wrist extension and grip force. The contralateral side was used for comparison. Unfortunately pain ratings, mobility and force measurements preoperatively were lacking or incomplete.

On the x rays the UV was measured, the lunate was staged according to Lichtman *et al.* (Table I) and the carpal height measured according to Nattras *et al.* (carpal height divided by capital height) (22) (fig. 1).

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Table I. — Lichtman stages of lunatomalacia

I	No change visible in the lunate
II	Sclerosis of the lunate
III	Sclerosis with fragmentation or collapse of the lunate
IV	Stage III combined with degenerative changes

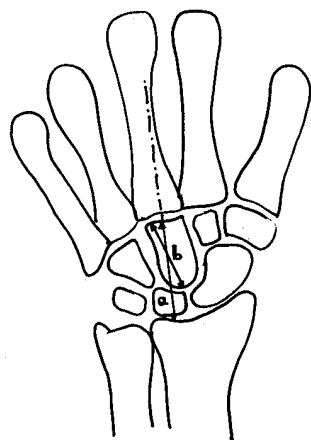


Fig. 1. — Nattras-index = a/b (normal value : 1.57). a) The distance between the base of the third metacarpal and the distal cortical margin of the radius, along the extension of the longitudinal axis of the third ; b) length of the capitate.

RESULTS

1) Subjective results

No patients were completely relieved of pain, 9 occasionally had mild pain, while 5 declared having moderate pain. None had continuous and/or severe pain.

2) Objective results

Mobility was restricted, especially pronation and ulnar deviation (fig. 2) to respectively 59 and 60% of the opposite side.

Grip force measured with the Jamar dynamometer demonstrated a reduction (fig. 3) to 75% of the opposite side. More detailed analysis of the forces, determined with the BTE work simulator, confirmed the reduction to 76% of the global grip force, but also a reduced force of wrist extension (56%), flexion (67%), supination (64%) and pronation (73%) (fig. 4).

Mobility

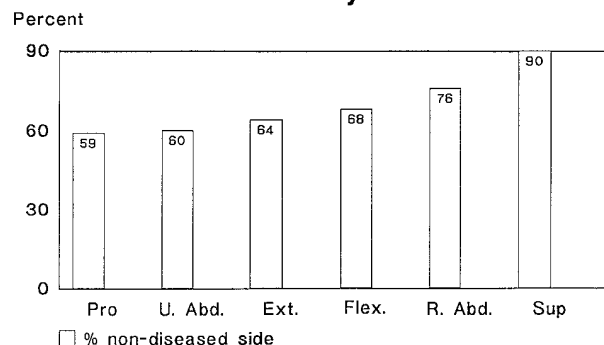


Fig. 2. — Mobility of the wrist (compared to the contralateral side).

Jamar (Grip force)

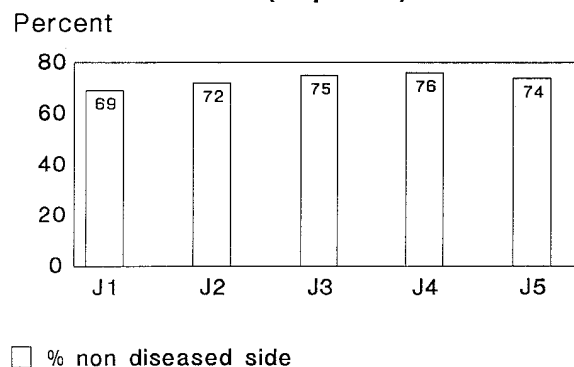


Fig. 3. — Grip force (compared to the contralateral side). J1 to J5 indicates the width of the Jamar dynamometer (J1 minimal opening, J5 maximal opening).

Force (BTE)

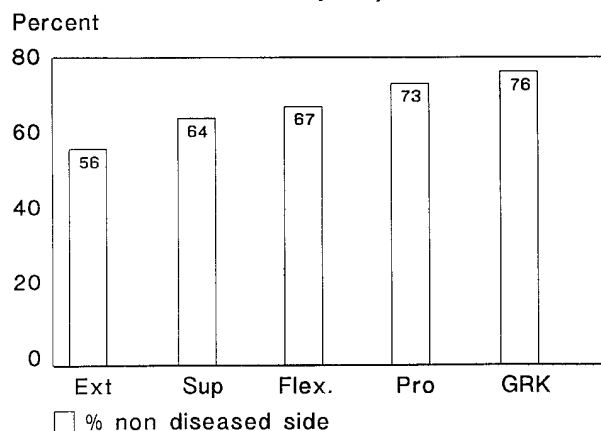


Fig. 4. — Wrist force (measured with BTE work simulator and compared to contralateral side).

The cumulative scoring according to Cooney *et al.* was poor (less than 65 points) for 4 wrists, and satisfactory (65 to 80 points) for 10 wrists.

3) Radiographic results

The objective of leveling the DRUJ was obtained with a marked increase of the ulnar variance (mean -0.588 intraoperatively to a mean of + 1.509 postoperatively) (fig. 5).

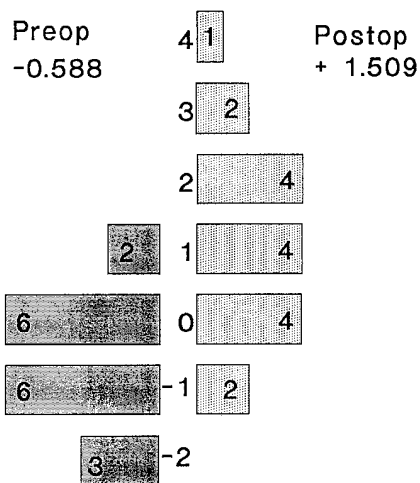


Fig. 5. — Ulnar variance : preoperatively and postoperatively.

Despite this outcome, the leveling did not prevent further progressive deterioration of the lunate (fig. 6) in 16 cases. Only one lunate had a better staging postoperatively (from stage III to stage II).

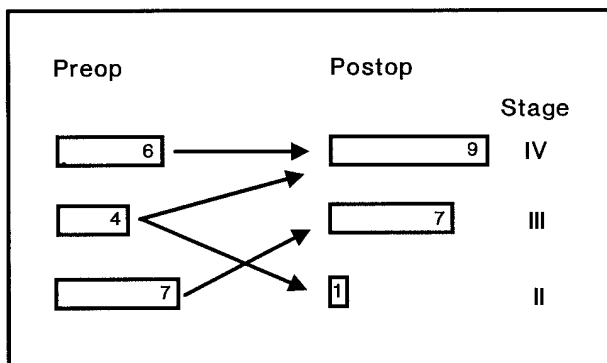


Fig. 6. — Stage of lunate involvement (Ståhl-classification).

The carpal height ratio as calculated by the Nattras coefficient (normal = 1.57) (22) decreased slightly from 1.45 preoperatively to 1.40 postoperatively, but this difference was not significant (fig. 7). Radiographic signs of DRUJ osteoarthritis and/or ulnar impaction syndrome (12) were seen in 9 cases.

DISCUSSION

The good results (1-4, 9, 19, 23, 25, 26, 27, 30) reported for radial shortening and ulnar lengthening in Kienböck's disease are in contrast to the continuous search for other (surgical) solutions.

Although all patients had an improvement in their pain, none was completely pain free, and mobility and force were restricted. According to the (severe) evaluation system of Cooney *et al.* (5), we found a satisfactory outcome in 10 cases and an unsatisfactory one in 4 cases. Compared with some other series (2, 3, 19, 30) (table II) our results concerning mobility and strength are equivalent to and even better than others, except for extension and certainly pronation.

Another possible threat which has only been poorly documented is the iatrogenically induced incongruence of the DRUJ and/or the increased ulnar length with secondary ulnar impaction. To our knowledge only Nakamura mentioned this possibility (21).

Förstner (10, 11) described 3 types of sigmoid notches of the radius depending on the ulnar length. Tolat *et al.* (30) and De Smet and Fabry (7) noticed a different orientation of this sigmoid notch, also in relationship with the ulnar length.

From these observations it is clear that changing the length of the ulna can induce incongruence or impingement in the DRUJ. Even in the «cylindrical» sigmoid notches where there is no risk of incongruence, increased ulnar length is a major contribution to the ulnar impaction syndrome with degenerative changes of the TFCC, the lunate and the ulnar head (12) (fig. 7).

However, before questioning radial shortening as such, a critical analysis of indications, technique and results is required.

In these cases it is obvious that in 2 wrists with an ulnar variance of + 1 mm, radial shortening

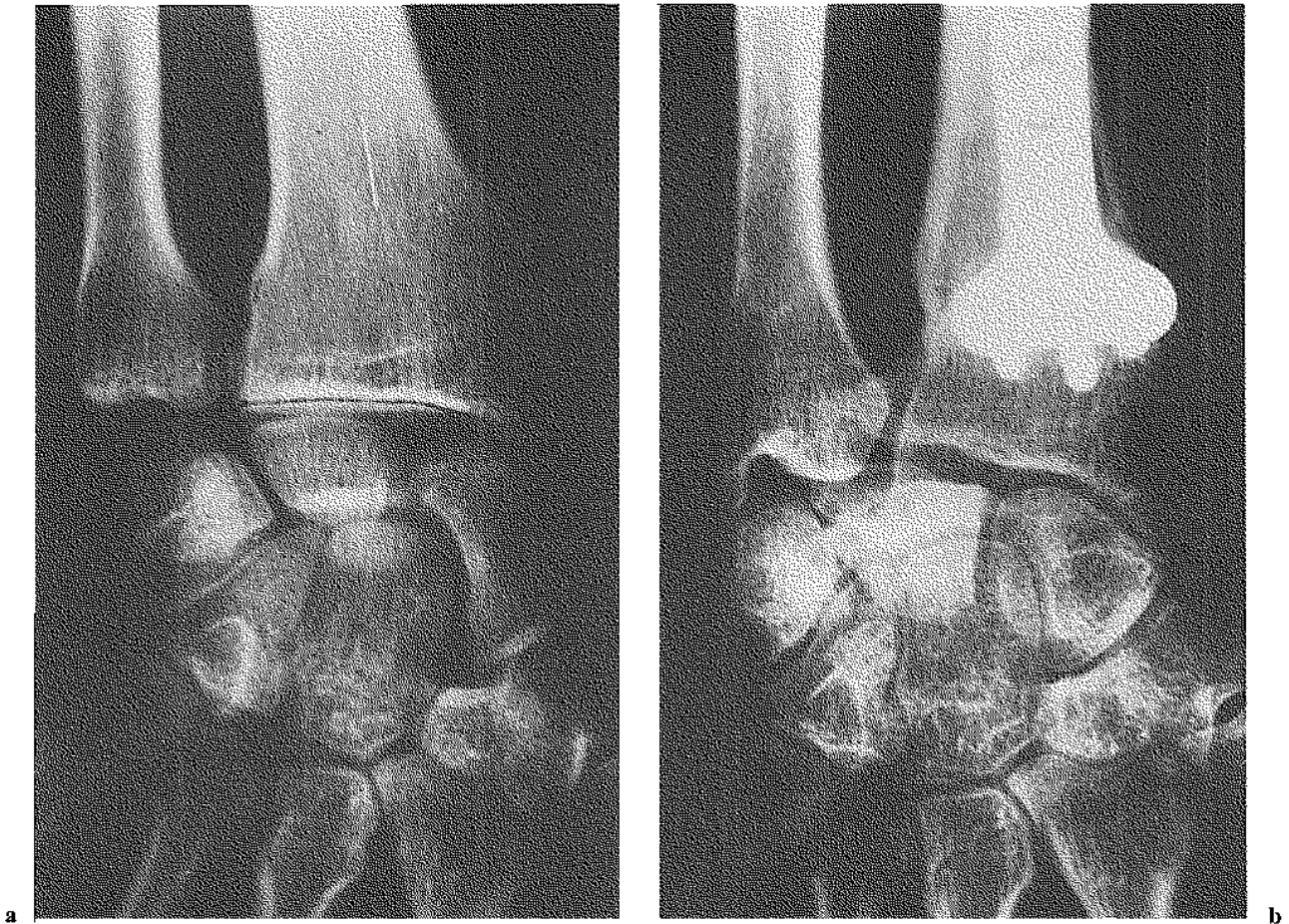


Fig. 7. — Involvement of the DRUJ and ulnar impaction after excessive radial shortening.

Table II. — Comparison of results following radial shortening in Kienböck's disease (percent of normal side)

	Present Study	Axelsson (3)	Armistead <i>et al.</i> (2)		Weiss <i>et al.</i> (30)		Nakamura <i>et al.</i> (19)	
			Pre	Postop.	Pre	Postop.	Pre	Postop.
Extension	64	73	81	84	60	81	45	52
Flexion	68	65	62	70	61	77	40	50
Radial deviation	76	87	59	86	56	70		
Ulnar deviation	60	67	62	53	56	80		
Pronation	59	92	100	100	—	—		
Supination	90	90	100	100	—	—		
Strength	75	68	53	70	53	86	62	88

was performed and that in 7 cases excessive shortening was obtained. The experimental work of Axelson (3) has demonstrated how excessive radial shortening influences forearm rotation.

The 2 cases with excessive radial shortening reported by Nakamura *et al.* (20) had similar mobility restrictions as seen in this series : one had impaired pronation ; one impaired ulnar abduction.

This series supports the conclusions of previous authors (18, 20) that radial shortening is not indicated when the ulnar variance preoperatively is + 1 mm. The resulting + 1.59 mm is probably caused by excessive radial shortening, compared with - 0.1 mm obtained by Nakamura *et al.* (19). This could explain the observed impaired pronation and ulnar abduction, and the ulnar impaction syndrome seen in 9 cases.

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SAMENVATTING

L. DE SMET, K. VERELLEN, K. D'HOORE, C. BUELLENS, R. LYSSENS, G. FABRY. Radiusverkorting voor ziekte van Kienböck. Longterm resultaten.

Na een gemiddelde follow-up van 4.5 jaar zagen wij 17 patiënten terug. Alhoewel er pijnverbetering optrad, was geen van allen pijnvrij. Bewegelijkheid en grijpkracht waren gereduceerd tot resp. 69.5% en 72%. Verdere evolutie van de lunatomalacie kon niet worden voorkomen en ulnaire overdruk trad op bij 9 patiënten.

RÉSUMÉ

L. DE SMET, K. VERELLEN, K. D'HOORE, C. BUELLENS, R. LYSSENS, G. FABRY. Résultats à long terme des raccourcissements du radius pour maladie de Kienböck.

Nous avons revu avec un recul moyen de 4.5 ans 17 patients qui avaient subi un raccourcissement du radius pour maladie de Kienböck. Tous ont une amélioration de la douleur, mais aucun n'est sans douleur. La mobilité et la force de préhension restent réduites, à 69.5% et 72% respectivement par rapport au côté opposé. L'évolution ne peut pas être arrêtée et un conflit cubital se voit chez 9 patients.