

C. Chillemi
M. Marinelli
P. Raffaelli
A. Gigante

Kienböck's disease with negative ulnar variance: surgical treatment with ulnar lengthening

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C. Chillemi (✉)
Orthopedics and Trauma Surgery Clinic
Via F. Faggiana 34, I-04100 Latina, Italy
Tel.: +39-0773-651308
Fax: +39-0773-418261
E-mail: c_chillemi@libero.it

M. Marinelli • P. Raffaelli • A. Gigante
Orthopaedics Clinic
University of Ancona, Ancona, Italy

Abstract The aim of the study was to analyse the results of surgical treatment of ulnar lengthening in patients with negative ulnar variance and Kienböck's disease. We report 5 case treated from 1994 to 1998. We evaluated pain, range of motion, functional disability and the progression of the disease by radiologically assessing the lunate and the ulnar variance. The minimum follow-up was 3–5 years. The patients treated by ulnar lengthening had no pain and obtained a good range of motion.

No ulnar nonunions were reported and only one patient had residual ulna minus variant at follow-up examination. We recommend an ulnar lengthening procedure for patients with negative ulnar variance and Kienböck's disease.

Key words Kienböck • Lengthening • Ulna • Variance

Introduction

Ulnar variance (UV) refers to the length of the distal ulna relative to the distal radius as determined on a wrist roentgenogram [1]. When the ulnar length differs by less than 1 mm from the radius, this condition is termed as neutral UV or ulna zero [2]. Negative ulnar variance means relative shortening of the ulna with respect to the radius, whereas positive ulnar variance refers to relative ulnar lengthening [3, 4]. Measurements of UV are influenced by the rotational state of the forearm, wrist deviation, and X-ray beam incidence angle [1, 4, 5], so that to evaluate the UV the "zero-position" exposure is recommended (shoulder abducted to 90° and elbow flexed at 90°, with neutral position of the forearm and the hand aligned with the forearm axis) [1].

Negative UV has been associated with different painful wrist conditions such as carpal ligamentous instabilities [3] and avascular necrosis of the lunate bone or lunatomalacia as first described by Kienböck [6–8]. About the latter, as recently pointed out [9], the negative UV seems to be a predisposing rather than a causative factor, so that the relative short-

ness of the ulna has a secondary influence on a primary necrotic lunate bone [10, 11]. According to this theory, the association between shortness of the ulna and Kienböck's disease may be related to deformation of the necrotic lunate bone by the relatively elongated radius. This theory is able to explain the success of surgery when obtaining a neutral UV (by lengthening the ulna or shortening the radius), if performed before advanced lunate fragmentation and collapse has occurred [12].

The aim of the present study was to analyse the results of ulnar lengthening in patients with Kienböck's disease.

Patients and methods

Five patients (6 procedures, 1 bilateral case) with Kienböck's disease were selected for this study. The diagnosis was based on clinical symptoms and signs and confirmed by radiography and magnetic resonance imaging. All the patients gave their informed consent.

Ulnar lengthening was performed under general anesthesia with a pneumatic tourniquet applied to the patients arm. A longitudinal

incision was made over the medial border of the distal portion of the ulna. The extensor carpi ulnaris and flexor carpi ulnaris were reflected, so that the distal one-third of the ulna was exposed subperiosteally. A Z-osteotomy was made with a power saw and the satisfactory distraction was obtained by using a laminar spreader. Osteosynthesis was performed with a plate with four or more holes that was placed over the exposed ulna, without bone graft.

After closing the wound, a palm-to-elbow plaster cast was applied and was left for at least 8 weeks. The follow-up included clinical and radiological examinations.

Results

We performed ulnar lengthening in 6 patients with Kienböck's disease (Table 1, Figs. 1, 2). All patients were seen for follow-up examination; the minimum follow-up was

3–5 years. The patients were asked to rate the overall results on a visual analog scale of 0 to 10, in which a score of 0 represented no improvement at all and 10 was an excellent result. The average score was 8.5 points.

At the time of the last follow-up visit, 4 patients stated that they had achieved complete relief of pain and 1 infrequent discomfort, so that, in this case, it was planned to remove the plate. All patients returned to their previous occupations. Average postoperative immobilisation was 56 days (range, 55–80). Postoperative wrist range of motion was available in all patients: range of motion had increased in all.

The average motions at follow-up, expressed as percentages of the motion on the uninvolved side (only for five patients), were 80% for dorsiflexion, 70% for palmar flexion, 90% for radial deviation and 50% for ulnar deviation. A full range of pronation and supination remained in all patients excepted one.

Table 1 Preoperative clinical characteristics of 5 patients with Kienböck's disease and negative ulnar variance (UV)

Subject	Age, years	Sex	Affected hand	Dominant side	UV, mm	Stage of Kienböck's disease
Case 1	17	Male	Left	Right	- 3.0	1
Case 2	18	Male	Right	Left	- 2.0	1
Case 3	18	Male	Left	Right	- 3.0	2
Case 4	20	Female	Bilateral	Right	-3.0 (right) -2.0 (left)	2 (right) 1 (left)
Case 5	20	Male	Right	Right	- 4.0	2



Fig. 1a, b Pre-operative anteroposterior (a) and lateral (b) radiograms of the left hand of a 20-year-old woman with Kienböck's disease. Ulnar variance is -4.0 mm



Fig. 2a, b Postoperative anteroposterior (a) and lateral (b) radiographs of the left hand of the patient in Figs. 1 and 2. The ulna variance has been corrected



Fig. 3a, b Anteroposterior (a) and lateral (b) radiographs of the left hand of the patient shown in the previous figures, 2 years after surgery

Table 2 Postoperative radiological findings in 5 patients treated with ulnar lengthening

Subject	UV, mm	Stage of Kienböck's disease	Healing period, days
Case 1	0	1	60
Case 2	+0.5	1	75
Case 3	0	1	55
Case 4	0 (right) +0.5 (left)	1 (right) 2 (left)	65 (right) 60 (left)
Case 5	-0.5	2	80

UV, ulnar variance

No patient but one was found to have a residual negative ulna variance at follow-up radiological examination (Table 2). All but one had been corrected to a neutral or positive ulnar variance at the time of surgery. No ulnar nonunions were reported. All ulnar osteotomies healed without a secondary operative procedure. Evidence of consolidation and healing within the lunate was observed on X-ray examination (Figs. 3, 4).

Discussion

Many authors found an association between Kienböck's disease and the ulna minus variant (i.e. when the distal articular surface of the radius extends beyond that of the ulna) [5, 8, 10, 12–14]. Since little has been published about the treatment of Kienböck's disease, there are no standards against which our

results can be compared [15]. Many procedures have been used in the treatment of Kienböck's disease: conservative management, radial shortening, ulnar lengthening, excision of the lunate, dorsal flap arthroplasty, and ceramic or polymeric silicone (Silastic) replacement arthroplasty [12, 16]. Some authors felt that the logical therapeutic approach to Kienböck's disease was to correct the unfavourable concentration on the lunate [12, 17]. Those authors who reported about conservative treatment have found that it is ineffective or suitable only for the acute phase of the disease [18] or as an initially conservative therapy in the early stage of the disease [15].

Radial shortening procedures have been described as a treatment for Kienböck's disease by several authors. Theoretically, their aim is to reduce the compressive forces by shortening the muscles crossing the carpus [8]. Trail et al. [19] reported good results in radial shortening and they found it superior to ulnar lengthening in that there were fewer problems with bone unions. On the contrary, Armistead et al. [8] reported that nonunion and malunion of the radius may pose a complication if stable fixation is not obtained; finally, another disadvantage is that dissection to expose the radius involves more soft tissue structures than, for example, ulna lengthening.

Ulnar lengthening is an accepted and well-established procedure mainly used for decompression of the lunate in Kienböck's disease [8]. In our series we obtained good relief from pain and restoration of the normal range of motion. The radiological findings show no progression of the necrosis of the lunate and no nonunion. Good consolidation can be obtained because the length of the Z-osteotomy along the axial plane allows good contact between the two parts of the bone when the distal one is brought forward before osteosynthesis.

The number of cases is too small for us to draw a clear conclusion, but we believe that our data suggest that ulnar lengthening should be recommended for patients with negative ulnar variance and Kienböck's disease.

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