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KIENBOECK'S DISEASE TREATED WITH OSTEOTOMY TO LENGTHEN ULNA

By

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The first report of chronic progressive osteochondrosis of the carpal lunate bone was reported by *Kienboeck* in 1910, since when various hypotheses have been put forward to explain the disease and several methods of treatment have been suggested. *Kienboeck*'s conception of the disease as primary necrosis because of a circulatory disorder with secondary fractures has long been refuted, as have other theories such as Axhausen's, which ascribes the necrosis to mycotic embolism. According to the present consensus of opinion, the cause of the condition is a primary compression fracture with interruption of some or all of the blood vessels reaching the lunate bone through its volar and dorsal surfaces. This conception is supported by the work of *Ståhl* (1947). He and others who have studied the physiology and mechanics of the wrist have shown that this bone is acted upon by the majority of local forces arising on movement of the hand and wrist and is therefore exposed to the risk of injury.

Hultén (1928) stressed that the lunate bone faces the articular surface of the radius and the triangular disc, which consist of much softer tissue. A further anatomic feature of importance in the causation of the disease is, according to *Hultén*, shortness of the ulna relative to the radius, so-called minus-variation, which places an abnormal strain and stress on the lunate bone. Of 400 normal wrists, *Hultén* found minus-variation in 23 per cent, no variation, *i.e.*, articular surface of radius and ulna at the same level—in 61 per cent, and relative shortness of the radius relative to the ulna—minus-variation in 16 per cent. Of 23 patients with osteochondrosis of the lunate bone, they found minus variation in 74 per cent, no variation in 26 per cent, and no plus

variants. In a compilation of 338 cases from the literature *Persson* (1945) found minus-variation in 60 per cent, and no variation in 40 per cent and plus variation in none. *Ståhl* has shown that plus variation may sometimes occur, although rarely. Another argument for the fracture theory is that the disease occurs mostly in men and then as a rule in the hand used most, *i.e.*, generally the right one.

TREATMENT (Table 1)

Table 1. Results obtained with different methods of treatment.

	Excision of lunate bone	Lunate bone replaced by prosthesis	Immobilisation in plaster	Elongation ostetomies	
				Literature cases	Personal cases
Number of cases	65	17	293	54	10
Average interval between op. and review (years)	6	4½	10	6	13½
Arthrosis of the wrist (in % of total)	90–100	90–100	80–90	30	20
No significant symptoms (%)	54	53	31	91	100
Symptoms reducing function (%)	12	24	38	6	0
Disabling (%)	34	23	31	4	0

Conservative. The commonest and oldest type of treatment consists of immobilisation in plaster. In a compilation of literature cases *Persson* (1945) found this method to have produced a good result without any significant persistent symptoms in 49, improvement but symptoms in association with heavy work in 57, and poor results or complete loss of function of the wrist in 56. In *Ståhl*'s (1947) series of 142 patients, all pain disappeared in 31, 71 had pain on movement of the wrist, and 13 were obliged to change their occupation, but arthosis deformans of the radio-carpal joint was seen in as many as 94 of 104 examined. Ståhl concluded that when the wrist was immobilised for less than 2 months the result was poor in every second patient, but in only every sixth when the wrist was immobilised for a longer period.

Excision of the lunate bone. According to *Campbell et al.* (1964),

Ståhl (1947) and *Besutti* (1964), the end-results of excision of the lunate bone are poor. *Dornam* (1949) and *Gillespie* (1961), however, reported good results, the latter in 21 of 24 cases, though they, like other authors, invariably observed progressive arthrosis and stiffness of the wrist. The general consensus today is that excision of the lunate bone is a mutilating operation with serious secondary changes in the wrist and that it is therefore no longer justified.

Replacement of lunate bone by an artificial substitute. This operation was performed with success on 1 patient reported by *Danis* (1951). *Agerholm & Goodfellow* (1963) reported 15 cases where the lunate bone was replaced by an acrylic prosthesis: 13 of the patients were satisfied with the result, 8 were symptomfree and 7 had only mild symptoms, but this operation, too, was invariably followed by progressive arthrosis of the wrist.

Osteotomy for lengthening the ulna. In view of Hultén's theory of the abnormal loading of the lunate bone, especially if the ulna is short, Persson described a method for lengthening the ulna distally: the lunate bone is unloaded to promote healing with minimum secondary arthrosis of the wrist. In 1945 Persson described his method and the results obtained in 19 patients operated upon and 5 years later he reported a further 14 cases, in most of which the results were good. *Desenfans* (1953), *Leitner* (1954), *Verbrugge & Verjans* (1963) and *Besutti* (1964) also reported cases treated successfully by this method.

Judging from the literature, then, osteotomy produces satisfactory results more often than other methods available for the treatment of the condition.

PRESENT SERIES (Table 2)

Nine patients with Kienboeck's disease which was bilateral in one of them, were treated with osteotomy of the ulna *ad modum* Persson. Three of the patients were below 20, five were between 20 and 30 and one was above 30 years. One patient was left-handed. He and one patient who was right-handed were operated upon on the left side; the remaining 7, on the right side. One of the patients was a woman, the remaining 8 were men with heavy manual occupations. Four had trauma in their histories. Before the operation 4 of the wrists showed no variation and 6 showed minus variation. There were no plus variants. Seven wrists had been treated for 2–8 months previously with immobilisation but without success. Only 1 of the wrists had produced symptoms for more

Table 2.

Sex	M	F	M	M	M	M		M	M	M	Sum
Side	L	R	R	R	R	R	L	R	R	R	
Follow-up period in years	18	19	19	19	19	17	5	14	4	1½	M = 13½*
Tenderness on palpation	X	X	X	—	X	—	—	X	—	X	6
Intermittent pain	X	X	X	X	X	X	X	X	—	—	8
Heavy occupation	X	X	X	—	X	—	—	X	X	X	7
Wrist stronger than before operation	X	X	X	X	X	X	X	X	—	X	9
Dynamometer in % of contralateral hand	63	45	100	100	27	–	–	100	88	110	M = 79*

* M = Mean

than 1 year. The interval between the operation and the present review was, on the average, 13½ years.

OPERATION TECHNIQUE

The operation was usually performed under plexus or axillary blockade, sometimes in a bloodless field. An incision about 10 cm long was made along the subcutaneous border of the ulna down towards the styloid process of the ulna and the ulna was dissected and exposed subperiosteally. To obtain stability after the osteotomy and a rough surface to promote healing, the bone was cut obliquely with a chisel through a 10 cm premarked line along which a number of holes had been drilled to facilitate the chiselling and to prevent the bone from splitting. The purpose was to secure a plus-variation of 3–4 mm. After the desired increase in length of the bone was calculated, holes were drilled in the radioulnar direction in the distal and proximal fragments respectively, the level between consecutive holes being equal to the distance the bone was to be lengthened (Figure 1). A piece of wire was threaded through the holes and with the aid of a wire-twister desired lengthening could be easily obtained. If the osteotomy is placed in the way illustrated in Figure 1, the distal fragment can be readily gripped with a single-pronged hook and retracted with simultaneous radial deviation of the wrist to facilitate the lengthening still more. According to *Desenfans, Verbrugge* and *Verjans,* the method has fallen into disrepute because of the difficulty in obtaining the desired elongation. They therefore recommend step-osteotomy and the use of a Duchéne plate for fixation. But with this procedure the osteotomy is still more unstable and the presence of the plate on subcutaneous bone retards healing of the skin, a side effect that occurred also in the Verbrugge and Verjans series. But if the above method is applied strictly according to instructions, extension is readily obtained, and good stability can be obtained by the use of 2 supplementary cerclages. The rough, chiselled and bored osteotomy prevents slipping and at the same time promotes healing.

After the operation a dorsal plaster splint is applied from the metacarpo-phalangeal joints to half way up the overarm with the elbow flexed 90° and the hand in midposition between pronation and supination. After about 2 weeks the sutures are drawn and the splint is replaced by a circular plaster, after which the patient may be treated at the out-patient department for 8 weeks after the operation, by which time the osteotomy has usually healed. In the present material the bone

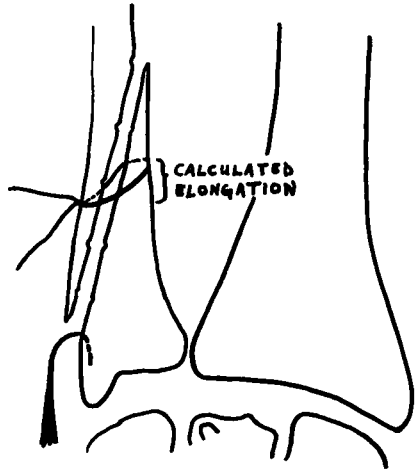

Figure 1. Schematic diagram of operation technique.

was lengthened by 2–3 mm in 3 cases and by 3–4 mm in 7. Six wrists had been immobilised for 2 months, one for 3 months, and three for more than 3 months because of imperfect alignment of the two fractions.

RESULTS

Six patients reported tenderness on palpation (Table 2) and 8 reported intermittent pain, usually in association with a change of the weather or uncommon movement of the hand. But none reported pain during rest. The pain reported was fairly mild and never interfered with the use of the hand. All reported increased strength of the hand after the operation except in 1 case and even there the strength of the operated hand was as much as 88 per cent of that on the unoperated one. The mean strength of operated hands was 79 per cent of that of the contralateral hands (Table 2). In the evaluation of this percentage it should, however, be borne in mind that most of the patients were right-handed and that it was usually the right hand that had been operated upon.

Clinically, the operated hands were all of normal configuration and none of them showed muscular atrophy. Their mobility had invariably improved, with an increase of flexion by, on the average, 50°. The range of flexion was however still somewhat less than that of the contralateral hand, on the average, 10° for volar and dorsal flexion respectively

(Table 3). On the other hand, ulnar and radial deviation as well as pronation and supination were barely affected.

Table 3. Impairment of mobility in degrees compared with range of motion of contralateral wrist.

	0	5	10	15	20	25	30	Mean
Dorsal flexion	3	2	2	1	0	2	0	9
Volar flexion	2	1	4	0	1	1	1	11
Ulnar deviation	2	5	2	0	1	0	0	3
Radial Deviation	8	2						1
Pronation	3	6	1					4
Supination	9	1						1

Roentgenography showed that all the osteotomies had healed normally. In 7 cases the structure of the lunate bone had improved (Table 4) with healing of the fragments and of the cysts (Figures 2–3), in 1 case the structure was unchanged, and in 2 the structure had deterioriated with increase of the cysts in one, with both increase of the cyst and with fragmentation in the other. These changes had no appreciable effect on the function of the hand and the patients were still carrying on with their usual heavy manual occupation. So were the 2 patients who had mild arthrosis of the radio-carpal joints with marginal sclerosis and 1 patient with narrowing of the joint space between the naviculare and

Table 4. Cases arranged in same order as in Table 2.

Increase in length of ulna													
	2–3 mm								X	—	X	2
	4–5 mm	X	X	X	X	X	X	X		—		7
Increase in proximo-distal dimension of lunate bone		0	+	+	+	+	+	+	0	0	0	6
Improvement of structure of lunate bone		+	0	+	+	+	+	+	—	—	+	7
Radio-carpal arthrosis			X			X						2
Arthrosis between navicular and trapezoideum				X								1

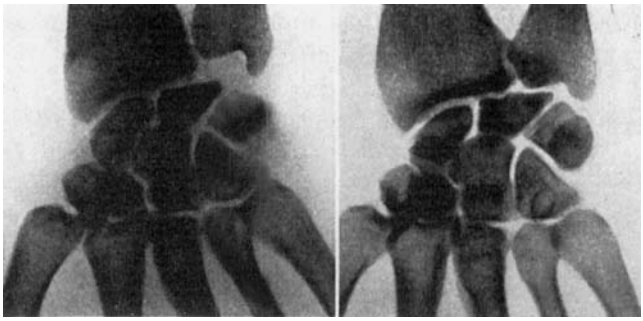

Figure 2. A wrist with Kienboeck's disease immediately before operation (left) and a review 18 years later (to right).

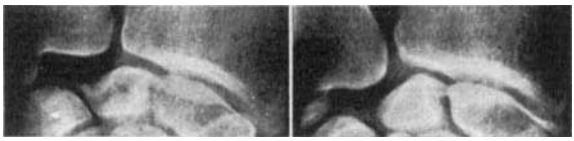

Figure 3. Lunate bone immediately before operation (left) and at review 17 years later (to right). Note the elongation of ulna.

the trapezoideum. Though not arthrotic, the naviculare and the trapezoideum showed sharp edges in 8 wrists and the triquetrum and hamatum in 2. These changes may, perhaps, be ascribed to the changes in the mechanics and loading of the wrist. Restitutio ad integrum was not observed in any of the cases. Neither could complete recovery be expected, for the fractures were not reduced and were thus left to heal in their compressed state. In 6 cases the proximo-distal dimension of the lunate bone had, however, increased in thickness, in 4 it was the same as before the operation, and in none had it become shorter.

All of the patients were very satisfied with the result of the operation. Two who had, however, been obliged to take lighter work, still thought that they could use the hand unhindered. The remaining 7 had returned to their previous heavy work in the woods and on the land.

SUMMARY

Nine patients (10 wrists) with Kienboeck's disease treated with osteotomy for lengthening the ulna *ad modum* Persson are described. The patients were reviewed on the average 13½ years after the operation. The clinical end-results were very good and all the patients were satis-

fied. In none of the cases did roentgenography show such severe arthrosis of the radio-carpal joint as that seen after treatment with other methods.

Judging from published reports and the cases described here, osteotomy is the best available method in the treatment of the condition.

RESUME

Neuf malades (10 poignets) souffrant de la maladie de Kienboeck on été traités par ostéotomie pour allonger le cubitus d'après la méthode Persson. Il est donné une description de ces cas. Les malades ont été réexaminés au bout d'une période moyenne de 13 ans et demi après l'opération. Les résultats finaux cliniques étaient excellents et tous les malades étaient satisfaits. Dans aucun des cas la radiographie ne montra une arthrose grave de l' articulation radio-carpale que l'on rencontre souvent après le traitment par d'autres méthodes.

A en juger des rapports publiés et des cas décrits ici, l'ostéotomie est la meilleure méthode de traitement à disposition dans ces circonstances.

ZUSAMMENFASSUNG

Neun Patienten (10 Handgelenke) mit Kienboeck's Erkrankung, die mittels Osteotomie zur Verlängerung der Ulna *ad modum* Persson behandelt wurden, werden beschrieben. Die Patienten wurden durchschnittlich 13½ Jahre nach der Operation untersucht. Die klinischen Resultate waren sehr gut und alle Patienten waren zufrieden. In keinen der Fälle zeigte die Röntgeuntersuchung so schwere Arthrosen des Radio-carpalgelenkes, als die, welche man nach Behandlung mit anderen Methoden beobachtet.

Gemäss veröffentlichten Berichten und den hier beschriebenen Fällen ist die Osteotomie die am besten anwendbare Methode in der Behandlung dieses Zustandes.

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