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Original Article

ROLE OF CAPITATE SHORTENING IN ULNA MINUS VARIANCE KIENBÖCK'S DISEASE

Yasser Osman(*), Al Ameer Farrag, Hassan Noaman **&** Ahmed Sleem,

Orthopedic and Traumatology dept., Faculty of Medicine, Sohag Univ., Sohag, Egypt

E-mail: yasserothman@gmail.com

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Abstract

Background: *Kienbock's disease is characterised by lunate avascular osteonecrosis. The genesis of this illness is still unclear and a subject of controversy. This study aimed assesses the role of capitate shortening in ulna minus variation in the treatment of Kienböck's disease.* ***Methods:*** *This descriptive study was performed on 20 cases aged from 18 to 65 years old, both sexes, suffering from wrist pain, stages II and III and ulna minus. All cases underwent to history taking, clinical evaluation, routine laboratory investigations and radiological evaluation [Wrist Plain X-ray (AP/lateral), computed Tomography and MRI].* ***Results****: VAS score and DASH score were significantly improved postoperative than preoperative (P value <0.001). There was no significant relationship of the function status with occupation and Lichtman stage.* ***Conclusion:*** *During an average 18-month follow-up, patients diagnosed with ulna minus variance Kienbock's disease experienced notable improvements in wrist function and pain reduction with capitate shortening osteotomy as determined by VAS, range of motion, grasp strength, Cooney score, and DASH evaluations. There was no significant relationship of the function status with occupation and Lichtman stage.*

Keywords: *Capitate Shortening, Ulna Minus Variance, Kienböck's Disease.*

1. Introduction

Kienbock's disease is characterized by lunate avascular osteonecrosis. The cause of this sickness is still unclear and a subject of controversy. Nonetheless, it is possible to identify variables that typically influence the likelihood of occurrence. Anatomical risk factors include of the lunate and distal radius shape, ulnar variation, lunate covering by radius, blood supply, intraosseous pressure that is high, and venous stasis [1]. Despite the fact that negative ulna variance, local osseous architecture, and lunar morphology all elevated the risk of Kienbock disease, several investigations were unable to establish this correlation [2]. The first appearance of Kienbock disease may manifest with a range of symptoms, however discomfort confined to the radiolunate facet, reduced range of motion, edoema, and weakness in the afflicted hand are the most common manifestations. Pain often manifests gradually, is frequently associated with physical activity, and may persist for prolonged durations prior to its manifestation [3]. In addition to being the primary imaging modality used to evaluate Kienbock disease, radiography may also be employed to exclude alternative pathological states, including fractures and arthrosis. According to Lichtman and colleagues, the illness may be categorized into four phases using plain radiography. This categorization has the most therapeutic value

since it assists in choosing the most suitable therapy and is thus the most dependable and repeatable [4]. Although all treatments for Kienbock's illness are non-invasive and range from conservative to surgical, none of them are considered gold standards. The therapy protocol is determined by clinical and radiological symptoms. The prevailing radiological classification used to delineate Kienbock's illness is the Lichtman scale. Goldfarb and colleagues introduced an enhanced Lichtman scale in 2003 [5]. The purpose of this research was to evaluate the role of capitate shortening in ulna minus variation in the treatment of Kienböck's disease.

2. Patients and methods

This descriptive study was performed on 20 cases with wrist pain. The study was done from November 2022 to June 2024 after approval from the Ethical Committee Sohag University Hospitals, Sohag, Egypt. An informed written consent was taken from the cases.

1) *Inclusion criteria* were cases aged from 18 to 65 years old, both sexes, suffering from wrist pain, stages II and III and ulna minus.

2) *Exclusion criteria* were teens, serious medical condition, stage I and IV and sever osteoporosis.

3) *All studied cases underwent the following*: history taking, clinical evaluation, routine laboratory investigations and radiological evaluation [Wrist Plain X-ray (AP/lateral), computed Tomography (CT) and MRI]. Cases remains for 24 hours postoperatively until release throughout this time, monitor the cases for neurovascular complications and edoema with broad-spectrum antibiotics. Follow up of cases at two weeks postoperatively one month, three months, six months, one years and 1.5 years.

2.1. *Surgical technique*

Capitate Shortening: During the surgery, Block anaesthesia was administered. A 3-centimeter longitudinal dorsal incision was performed while under tourniquet control, crossing across the capitate. By retracting the extensor tendons of the fourth compartment, the midcarpal joint capsule was revealed. The proximal joint surface of the capitate was exposed by the use of a longitudinal dorsal incision through the capsule of the midcarpal joint and the distal portion of the dorsal intercarpal ligament on the capitate. The case is supine with this arm elevated on a hand operating table. Prior to the tourniquet, a pre-operative antibiotic was administered during anaesthetic induction. Utilized was a pneumatically measured tourniquet. Embryo sterilisation and drapery were initiated. Separation between 2nd and 3rd compartments of extensor tendons, osteotomy & shortening 2.5 mm of capitate, compression by Herpert screw.

2.2. *Postoperative evaluation*

Clinical evaluation by using (Modified Mayo Wrist Score), each patient is assessed regarding wrist pain, work status, range of motion (ROM), grip strength. Radiological evaluation: X-rays anterior-posterior and lateral views to assess healing (union) and deformity.

2.3. *Statistical analysis*

Statistical analysis was performed with SPSS version 26. (IBM Inc., Armonk, NY, USA). The Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of the data. In order to depict quantitative parametric variables, the mean and standard deviation were used (SD). Presentation of qualitative data analysis in the form of frequencies and percentages (percent). A P value with two tails equal to or less than 0.05 was considered to be suggestive of statistical significance.

3. Results

Table (1) shows demographic data, comorbidities, occupation, operated side and disease characteristics of the cases. Table (2) shows preoperative VAS score, follow

up duration, MMWS and Time to return to work (months) of the cases. VAS score and DASH score were significantly improved postoperative than preoperative (P value <0. 001), tab. (3). There was no significant relationship of the function status with occupation and Lichtman stage, tab. (4).

Table (1) Demographic data, comorbidities, occupation, operated side and disease characteristics of the cases

		Patients (n=20)
Age (years)		39.25 ± 8.56
BMI (kg/m^2)		27.78 ± 4.87
Sex	Male	10 (50%)
	Female	10 (50%)
Dominant hand	Left	6 (30%)
	Right	14 (70%)
Comorbidities	DM	2 (10%)
	HTN	1 (5%)
	Smoking	4 (20%)
Occupation	Manual worker	7 (35%)
	Housekeeper	5 (25%)
	Mason	4 (20%)
	Teacher	2 (10%)
	Engineer	0 (0%)
	Farmer	2 (10%)
Operated side	Left	8 (40%)
	Right	12 (60%)
Disease characteristics		
Ulnar variance		-1.45 ± 0.51
Lichtman stage	II	7 (35%)
	IIIA	7 (35%)
	IIIB	6 (30%)

Data are represented as mean ± SD or freque-ncy (%). BMI: Body mass index, HTN: hypertension, DM: diabetes mellitus.

Table (2) Preoperative VAS score, follow up duration, MMWS and Time to return to work (months) of the cases

		Patients (n=20)
Preoperative VAS score		8.4 ± 0.68
Follow up duration (years)		3.23 ± 0.51
Modified Mayo Wrist Score	Pain (VAS score)	2.8 ± 0.77
	Wrist ROM	147.25 ± 17.13
	Grip strength (kg)	30.25 ± 9.89
	Cooney wrist function score	81.25 ± 3.58
	Fair	2 (10%)
	Good	17 (85%)
	Excellent	1 (5%)
Time to return to work (months)		3.6 ± 1.05

Data are represented as mean ± SD or frequency (%). VAS: visual analogue scale, ROM: range of motion.

Table (3) VAS score and DASH score of the cases

		Patients (n=20)
VAS score	Preoperative	8.4 ± 0.68
	Postoperative	2.8 ± 0.77
DASH score	Preoperative	65.68 ± 5.44
	Postoperative	25.46 ± 6.21
P		<0.001*

*Data are presented as mean ± SD. *: significant p value, P value between preoperative and postoperative. VAS: visual analogue scale, DASH: Disabilities of Arm, Shoulder, and Hand.*

Table (4) Relationship of the function status with occupation and Lichtman stage in the cases

		Fair (n=1)	Good (n=17)	Excellent (n=2)	P
Occupation	**Manual worker**	1 (50%)	6 (35.3%)	0 (0%)	0.178
	Housekeeper	0 (0%)	5 (29.4%)	0 (0%)	
	Mason	1 (50%)	3 (17.6%)	0 (0%)	
	Teacher	0 (0%)	1 (5.9%)	1 (100%)	
	Farmer	0 (0%)	2 (11.8%)	0 (0%)	
Lichtman stage	**II**	0 (0%)	6 (35.3%)	1 (100%)	0.565
	IIIA	1 (50%)	6 (35.3%)	0 (0%)	
	IIIB	1 (50%)	5 (29.4%)	0 (0%)	

Data are presented as frequency (%).

Case 1: Female pt 35 yrs. old, house wife, Rt hand, Stage 3b, fig. (1).

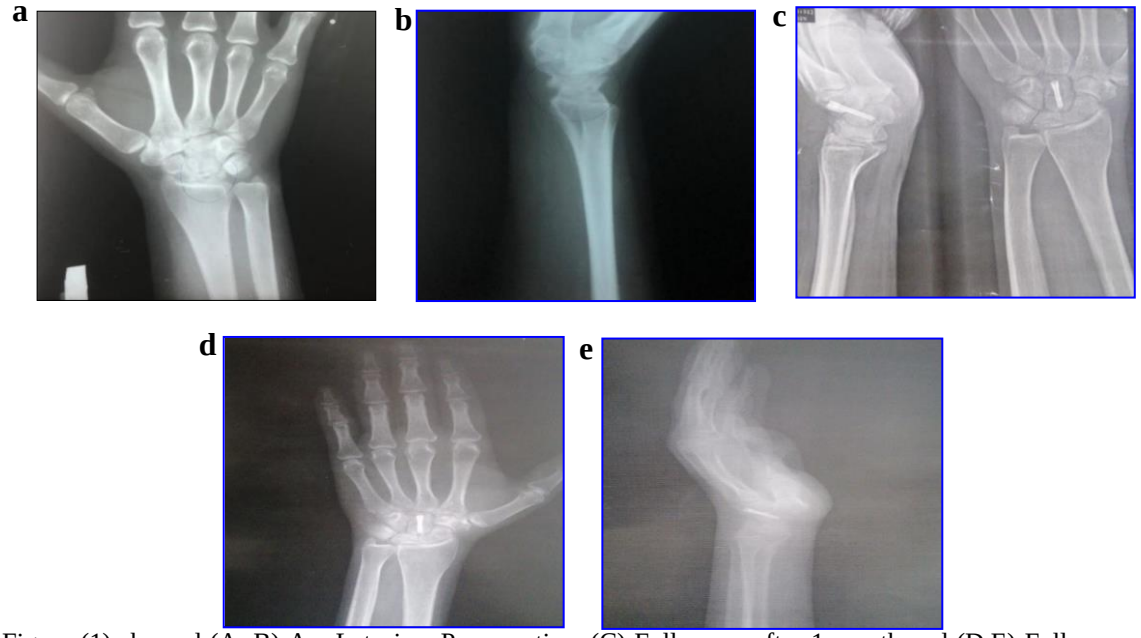

Figure (1) showed (A, B) Ap, Lat view Preoperative, (C) Follow up after 1 month and (D,E) Follow up after 1 year.

4. Discussion

In the present work, the average age of the cases was 39.25 ± 8.56 years, average BMI was 27.78 ± 4.87 kg/m^2, and the ratio of men to women was 1:1. The dominant hand was the right hand that represented 14 (70%). Atiyya et al. included a total of 17 consecutive cases in the initial phases of Kienbock's illness. Cases ranged in age from 17 to 52 years, with an average of 31 years. Of the 17 cases, 3 were women and 14 were men. Nine were at stage IIIA, while eight were in stage II [6]. Al-Ashhab et al. assessed the efficacy of union with the third metacarpal bone at its base and distal capitate shortening in the treatment of Kienbock's illness with neutral ulnar variance. In terms of gender, fourteen cases (70 %) identified as female, whereas six cases (30 %) identified as male. The age of the cases varied from 20 to 37 years, with an average of 26.1 years. The dominant hand of sixteen individuals was impacted (80 %) [2]. In the present work, the most of patients were manual worker 7 (35%). Operated side was left in 8 (40%) of patients and in right in 12 (60%) of patients. The mean Ulnar variance was -1.45 ± 0.51. Al-Ashhab et al., reported that the average period of symptoms was twenty-four months (range: 8-30m.). A total of sixteen cases were engaged in strenuous physical labour, while four cases had office-based employment [2]. Mazhar et al. assessed 52 cases of stage II or III Kienböck's disease,

12 cases in the radial shortening group, and 17 cases persisted until the research's conclusion. The capitate shortening group had a mean value of -0.28 mm (10 cases with positive and 7 cases with negative ulnar variance) [7]. Our work noted that Lichtman stage II and IIIA were found in 7 (35%) of patients and stage IIIB was found in 6 (30%) of patients. The research undertaken by Fouly et al. Who discovered that 8 of 12 cases were 66.7% were identified as having Lichtman stage II Kienbock's illness, while four were categorized as stage IIIA (33.3 %) [8]. According to the current work, the average preoperative VAS score was 8.4 ± 0.68. Mean follow up duration was 3.23 ± 0.51 years. In agreement with our study, partial capitate shortening was done by Citlak et al. on seven individuals who presented with Kienbock's illness in its early stages. It was observed that the average VAS preoperatively was 8.2 (range: 7-10). The average duration of follow-up for these cases was 38 months, with a range of 15-46 months [9]. Furthermore, Gay et al. retrospectively study of 11 cases. All individuals had Kienbock illness in its mildest form. They reported that the mean preoperative VAS score was 6.0 [10]. In the present study, according to Modified Mayo Wrist Score, mean Pain (VAS score) was 2.8 ± 0.77, mean wrist ROM was 147.25 ± 17.13, mean grip strength was 30.25 ± 9.89 kg and mean Cooney wrist function score was 81.25 ± 3.58. Cooney wrist function score was fair in 2 (10%), good in 17 (85%), and excellent in 1 (5%) of patients. Fouly et al. demonstrated that mean pain was 11.3 ± 6.8, mean ROM 16.3 ± 2.3, mean grip strength was 15.4 ± 1.4 The mean final post-operative modified Mayo wrist score was 87.5 ± 6.6 points, with a range of 80 to 100 points [8]. Our findings showed that the average period to return to work was 3.6 ± 1.05 months. Citlak et al. concluded that the range of return to work was 1.5-12 months, with a mean of 5.5 months [9]. VAS score and DASH score were significantly improved postoperative than preoperative (P value <0.001). Hegazy et al. reported evident improvements in the average postoperative pain for cases with stage II disease, whereas incomplete pain relief was known for the majority of cases (six cases) with stage IIIA disease. All of these cases received analgesics, while the remaining four cases required additional surgery [11]. The long-term prognosis of 36 cases who had radial shortening osteotomy for the treatment of Lichtman Stage IIIA Kienbock illness was evaluated in retrospective research conducted by Luegmair et al. Their study stated a DASH score of 12 in a 12-year follow-up [12]. In our study, there was no significant relationship of the function status with occupation and Lichtman stage. Mazhar et al. discovered no association between radiographic and clinical observations, but wrist mobility and grip strength were restricted in some individuals with a better radiologic stage [7].

5. Conclusion

In conclusion, during an average 18-month follow-up, patients diagnosed with ulna minus variance Kienbock's disease experienced notable improvements in wrist function and pain reduction with capitate shortening osteotomy as determined by VAS, range of motion, grasp strength, Cooney score, and DASH evaluations. There was no significant relationship of the function status with occupation and Lichtman stage.

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