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Outcome of Ulnar Shortening Darrach's Osteotomy for Malunion of Distal End Radius Fracture with Positive Ulnar Variance- A Prospective Study

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Key word

Distal radius fractures, abnormal radio-ulnar variation, ulnar variance, degenerative abnormalities

Abstract

Distal radius fractures that don't heal properly often cause radial lengthening as the primary deformity, along with abnormal radio-ulnar variation. Instability of the distal radioulnar joint and lesions of the "triangular fibrocartilage complex" (TFCC) are common complications. A person with a radio-ulnar variation has a shorter distance between their distal ulnar radius corner and their ulnar head's most distal portion of the dome. If the ulnar variance is positive, then the distal ulnar dome is farther distal than the distal ulnar corner of a radius. Because of the loading that happens between both the ulnar carpus and the ulnar head, this positive variation may lead to discomfort on the ulnar side of the wrist, limited ulnar deviation & rotation of the forearm, and the development of degenerative abnormalities.

1. Introduction

"Distal radius fractures are a common injury treated by the emergency room's orthopaedic specialists. In children, distal radius fractures account for around 25% of all fractures, while in the elderly, they may account for up to 18%."[1] There is a plethora of resources for treating these wounds.[2] Distal ending radius fractures are surgically treated with Kirshner wire fixation or open reductions internal fixation plus plating. Reduction and casting are

common nonoperative treatments. Malunion occurs in 11% of patients despite surgical intervention and 23% of cases without surgery.[3] Distal radius fractures that don't heal properly often cause radial lengthening as the primary deformity, along with abnormal radio-ulnar variation. Instability of the distal radioulnar joint and lesions of the "triangular fibrocartilage complex" (TFCC) are common complications (DRUJ). A person with a radio-ulnar variation has a shorter distance between their distal ulnar radius corner and their ulnar head's most distal portion of the dome. If the ulnar variance is positive, then the distal ulnar dome is farther distal than the distal ulnar corner of a radius.[4] (Fig. 1).

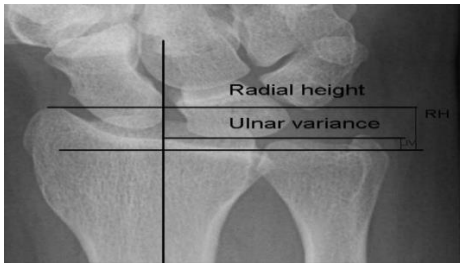

Fig. 1 - Radio-ulnar variance.

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Because of the loading that happens between both the ulnar carpus and the ulnar head, this positive variation may lead to discomfort on the ulnar side of the wrist, limited ulnar deviation & rotation of the forearm, and the development of degenerative abnormalities. "Degenerative rips of the TFCC, chondromalacia of a ulnar head, lunate, or triquetrum, attenuation or tears of triquetrolunate ligament, and ulnocarpal osteoarthritis result from ulnar head impaction on the carpus." When the TFCC is torn or avulsed, the ligaments that support the DRUJ are no longer stable. Further laxity may result from injury to the joint's secondary stabilizers, such as "the capsular ligaments, ligament sheath of a extensor carpi ulnaris, its interosseous membrane, or the pronator quadratus." [5]

Before deciding on a surgical course of treatment, "it is crucial to conduct a comprehensive clinical and radiological evaluation with an emphasis on the patient's desired functional need. Correctional radial lengthening & ulnar shortening osteotomies, Darrach's treatment distal ulnar resection, hemi-resection, interpositional arthroplasty, Sauve-Kapandji surgery, and distal radioulnar hip replacements are only few of the surgical therapeutic possibilities.[6] Anatomical relationships between the distal ulna and the radius may be restored with corrective osteotomy, however this technique can be technically challenging". [7, 8] Yet, in other instances when radial angulation is modest, such a process is unneeded. For this reason, "ulnar shortening osteotomy" (USO) has replaced previous methods of treating positive ulnar variation. [9, 10] For malunited distal radius fractures with significant ulnar variance presenting severe ulnar sided wrist discomfort, we provide a case series of 20 patients treated with ulnar shortening osteotomy using the Darrach operation.

2. Objective

The purpose of this research was to see whether ulnar shortening osteotomy helped patients having malunited distal radius fractures with wrist discomfort and function.

3. Material and methods

After receiving necessary ethical clearance, researchers from the "Krishna Institute of Medical Sciences in Karad" conducted a prospective study. After obtaining the appropriate consents, forty (40) individuals with malunited proximal end radius fracture and positive ulnar variation were recruited for the investigation. "Patients with rheumatoid arthritis, low demand patients, and patients with osteoarthritis of the distal radioulnar joint were also included in the study, as were patients between the ages of 50 and 70 who had previously suffered a distal radius fracture and displayed with clinical signs showing ulnar-sided wrist pain as well as a radiological positive ulnar variance."

Patients below the age of 18 were not permitted to participate. Steyers and Blair's method was used to quantify the ulnar variance. [11] In line with previous research, we did not include malunions with volar & dorsal angles of more than 20 degrees.[12–15] Radial osteotomy was thus considered necessary for abnormalities over this threshold. A detailed history was taken regarding their level of satisfaction after the operation and production of pain during activities of daily living. Clinical examination was carried out. Range of motion of various movements at the operated wrist was measured in degrees and compared to the preoperative measurements taken from the charts. Clinical outcome was graded using Modified Gartland and Werley criteria. Patients were also assessed for the presence of complications.

Pathoanatomy and Indications for Surgery-

"The force over distal ulna and the dorsal force intensity over the distal radius both rise with dorsal tilt."

Reduced radial inclination shifts the carpal tunnel, which in turn modifies the angle of a flexor tendons, reducing the mechanical advantage of the flexors and leading to diminished grip strength & fatigue.

Decreased DRUJ space raises the likelihood of DRUJ arthrosis by causing changes in transfer of load, DRUJ discomfort, and reduced forearm rotation.

Adaptive ventral intercalated segment instability may emerge from the ensuing shifts in position (DISI)

Operativeprocedure-

A supraclavicular block was used to induce general anesthesia in the patient. "Excision of distal 1-2 cm of ulna (just proximal to the sigmoid notch) - the least amount of bone is excised which is sufficient to restore full motion; ulnar styloid process avulsion - longitudinal incision is created over proximal ulna over medial side we value to retain the attachments of a TFCC to the carpi approach distal ulna thru the interval between the ECU and FCU If indeed the ECU is volarly subluxated, it ought to be relocated as well as anchored distally over the carpus; - bevel whatever sharp edges, cutting off dorsal ulna to protect the ECU tendon; - remnants of the TFCC have been opposed to the wrist capsule as well as the radius; - remnants of a wrist capsule have been anchored to the distal ulna."

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Periosteum is closed in longitudinal manner.
Layered closure is done.

Post-operative Management

- Post-op : Long arm splintwithforearm in neutral × 3 weeks-NWB > 21bs
- 3 Weeks Post-op-Transition to removableMuenster or long arm brace-May removebrace to begin ROM of forearm, wrist, and elbow-NWB > 21bs
- 6 Weeks Post-op
- May discontinue brace-May begingentlestrengthening, continue ROM-Weightbearing as tolerated12 Weeks Post-op

Patient may resume activités without restriction

Fig.2- Skin incision

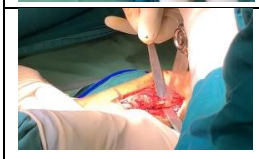

Fig 3- interval between FCU and FCR

Fig 4- Ulnar Osteotomy

Fig 5- Wound closure

4. Results

Patients' mean ages were 60 years old (range, 50–70 years). There were 12 male patients and 8 female patients. There were 20 wrist operations. The majority (13 out of 20) had dominant wrists. The median amount of time between the first fracture and treatment was 30 months. On average, patients were followed up with for 24 months. Eighteen out of twenty patients' wrists had positive patient feedback. Of the original 15 patients, 19 were back at work. Of of the five retired patients, four are now performing at or above their pre-injury levels. Twenty wrists were completely pain-free a year after surgery, whereas six wrists experienced discomfort only during very strenuous or atypical activities. It hurt to sleep or rest. The findings were broken down as follows (Fig. 6): 4 outstanding, 11 good, 4 fair, and 2 bad using the revised Gartland & Werley criteria for functional status. (Fig. 7)

Items	Point
Residual deformity (0–3 points)	
Prominent ulnar styloid	1
Palmar tilt deformity	2
Radial deviation deformity	2 or 3
Subjective evaluation (0–6 points)	
Excellent: no pain, disability, or limitation of motion	0
Good: occasional pain, some limitation of motion, and weakness of wrist	2
Fair: pain, limitation of motion	4
Poor: pain, activities markedly restricted	6
Objective evaluation (0–5 points)	
Loss of extension (<45°)	5
Loss of ulnar deviation (<15°)	3
Loss of supination (<50°)	2
Loss of flexion (<30°)	1
Loss of radial deviation (<15°)	1
Loss of circumduction	1
Pain in distal radioulnar joint	1
Grip strength: 60% or less than on the opposite side	1
Loss of pronation	2
Complications (0–5 points)	
Arthritic change	
Minimum	1
Minimum with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
Nerve complications (median nerve)	1 or 3
Poor finger function due to cast	1 or 2
Final results	
Excellent	0–2
Good	3–8
Fair	9–20
Poor	≥21

Fig. 6- Modified Gartland and Werley criteria for functional outcome

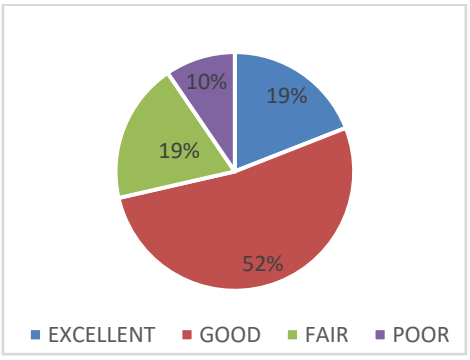

Fig. 7 - Functional outcome as per Gartland and Werly criteria

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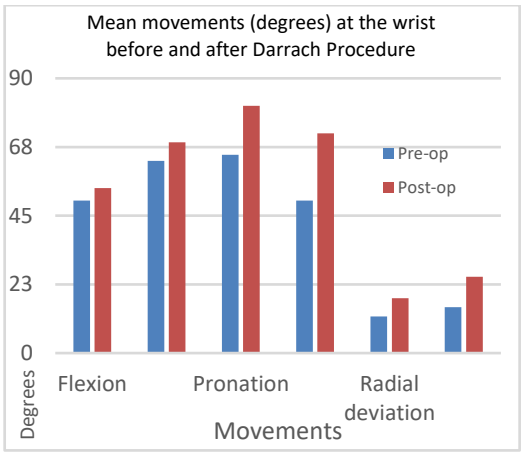

Fig 8 – Mean range of motion(in degrees) at the wrist joint before and after Darrach's procedure.

Two patients had wrist instability and one carpal tunnel syndrome.

5. Discussion

A distal radius fracture may significantly reduce functional results. Radioulnar joint incongruity causes supination and pronation difficulties. Ulnar impaction syndrome occurs when the ulna becomes abnormally long as a result of a healed radius's shortening. Pain on the ulnar side of the wrist is often due to ulnar impaction syndrome. Surgical ulnar shortening is a common method of treating this condition. The Darrach technique has been shown to be effective in several studies, with patients reporting better mobility, less discomfort, and no worsening of handicap. [16-20] After the Darrach surgery, the average ultimate range of motion for the wrist was 85 degrees in pronation and 78 degrees in supination, and 41 degrees in flexion and 45 degrees in extension, according to a recent research by Grawe B et al. [21] Our results are quite close to that study.By means of the modified Gartland and Werley score preoperatively twenty-four out of thirty-one wrists were rated poor and seven fair in a study by Goo Hyun Baek et al.[20] Postoperatively, the score improved so that twenty-four wrists were rated excellent; five, good; one, fair; and one, poor. Our study is consistent with this study. Our findings corroborate those of a previous research in which ulnar shortening was used to treat ulnar impaction syndrome in 23 wrists belonging to 22 patients (average age, 37 years). [22]

After a mean of 33 months of follow-up, 16 of the 17 patients who reported having excellent subjective pain alleviation also had satisfactory overall outcomes. Tatebe Masahiro is his study showed satisfactory outcomes with ulnar shortening.[23] The average range of flexion–extension increased from 82% to 93%. This study's findings are similar to ours. Our findings corroborate those of McKee and Richards, who found that 19 out of 23 patients were pleased with the outcome of the treatment. [24]

There were certain caveats to our research. The lack of a control group and the relatively modest size of the sample size make it difficult to draw firm conclusions. A prospective comparative study with a larger patient group might enhance the outcomes. We have, however, shared our early findings; "an supplementary study is essential to compare our technique with other standard techniques in a prospective fashion with authenticated scoring systems to assess results."

6. Conclusion

Based on our findings, Darrach's excision of the distal ulna should be considered the therapy of choice in aptients having rheumatoid arthritis & low demand patients who suffer from impaction syndrome. In particular, this Darrach surgery helped our patients significantly improve their wrist motion. Pain was uncommon and over all patient satisfaction and functional outcome was good.

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