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Arthroscopic Management of Triangular Fibrocartilage Complex (TFCC) Injuries

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Abstract

Background: Triangular fibrocartilage complex (TFCC) injury is major cause of ulnar side wrist pain. It can lead to distal radio ulnar joint instability.

Aim of the work: was to examine the efficacy of arthroscopic management of the TFCC injuries, and assess the functional outcome of this procedure.

Patients and Methods: Twenty patients with torn TFCC underwent arthroscopic management. Five patients had central TFCC tears to which arthroscopic debridement was done. Five patients had superficial peripheral TFCC tears to which arthroscopic reattachment to the capsule was done. Ten patients had deep foveal TFCC tears with DRUJ instability to which arthroscopic assisted foveal reattachment by suture anchor was done. All patients were assessed before and after surgery (at follow-up) by Visual Analogue Scale (VAS) for pain, the Disability of the Arm, Shoulder and Hand (DASH) score, the Modified Mayo Wrist Score (MMWS), and the incidence of complications.

Results: Twenty patients were available for follow-up at a mean of 12.9 months.

VAS improved from a mean of 6 to a mean of 1.3 ($p<0.001$). The DASH score improved from a mean of 28.2 to a mean of 5.8 ($P < 0.001$). MMWS improved from a mean of 66.3 to a mean of 88.5 ($p<0.001$).

Conclusion: Arthroscopic management of TFCC tears has shown to reach good results according with different TFCC lesions and improvement in pain and function. However, the current study is limited by absence of conservative or open control group for comparison and the relatively short follow-up period.

Key words: Ulnar sided wrist pain, TFCC lesions, Arthroscopy of the wrist.

Introduction:

The term of triangular fibrocartilage complex (TFCC) describes the close anatomic and functional relationships of the soft-tissue structures in the ulnar side of the wrist [(1).]

The triangular fibrocartilage complex (TFCC) consists of six parts. The fibrocartilage articular disc; The dorsal and palmar radioulnar ligaments: These ligaments tighten up during prono-supination to prevent instability at the extremes of motion; The ulnolunate and ulnotriquetral ligaments, the extensor carpi ulnaris (ECU) tendon subsheath, the ulnar collateral ligament and the meniscus homologue [(2,3)].

This complex allows smooth motion of the wrist and forearm, distributes load between the ulna and ulnar carpus, and stabilizes the ulnocarpal joint as well as the distal radioulnar joint (DRUJ) [(2)].

Palmar classified the TFCC lesions to traumatic (type 1) and degenerative (type 2). Type 1 is further classified according to the tear location to 1A: central tear, 1B: Periphral ulnar tear, 1C: ulnocarpal ligament tear, and 1D: radial side tear [(1, 4, 5)]. Overlap can occur so both traumatic and degenerative tears can be seen during arthroscopy in the same wrist [(6)]. Type 1B has been further sub classified by Atzei et al [(7)] to five classes: Atzei 1:distal component tear, Atzei 2:proximal and distal components tear, Atzei 3: proximal component tear, Atzei 4:Poor healing capacity, and Atzei 5:DRUJ arthritis .

Patients with a TFCC injury usually experience ulnar side wrist pain or discomfort particularly during powerful rotatory hand movement, like opening a closed jar or pushing down a doorknob [(4,8)].

Fovea sign, axial ulnar compression stress test and DRUJ stability

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test (ballotment test) are the main tests to confirm the diagnosis [8-10].

X ray is the first imaging modality to determine the ulnar variance, distal radio-ulnar diastasis, fractures and osteoarthritis [4, 11].

MRI: the sensitivity, specificity, and accuracy of this type of analysis have been reported to vary widely [12]. To increase the efficacy of TFCC lesions detection high field MR scanner, dedicated wrist coil and MR arthrography could be used [13]. However, MRI may be useful to exclude associated pathologies of the ulnar compartment [8].

Wrist arthroscopy is the ‘‘gold standard’’ in diagnosis of TFCC injuries. It allows an accurate assessment of the TFCC; lesions can be described precisely regarding its location, size, extension (proximal and distal component), Degenerative changes that may or may not be contributing to a patient’s complaints [8,14].

Treatment of TFCC traumatic injuries should start by conservative treatment including long arm splints or elastic bandages, and analgesics. Many patients experience relief of symptoms with such conservative treatment. When the response to conservative treatment is poor, surgical treatment should be considered [15].

The aim of this study was to examine the efficacy of arthroscopic management of the TFCC injuries, and to assess the functional outcome of this procedure.

Patients and Methods:

This study included twenty patients diagnosed with torn TFCC who underwent arthroscopic management in Al Azhar University Hospitals in Egypt, Humanitas Research Institute, and Rimini Hand Center in Italy. Approval of the ethical committee and a written informed consent from all the subjects were obtained. This study was conducted between May 2015 to August 2018.

Inclusion criteria were skeletally mature patients with ulnar side wrist pain after failure of conservative treatment in alleviation of patient's symptoms for 3 months. Exclusion criteria were skeletally immature patients, wrist deformities and wrist arthritis.

There were 16 male (16 wrists, 80%) and 4 female (4 wrists, 20%). The average patient age at the time of surgery was 33.9 years (range: 19–57 years). Eight patients (40%) were manual workers, 8 patients (40%) were employed, 2 patients (10%) were students 1 patient (5%) was housewife, and 1 patient (5%) was not working at the time of surgery. Fourteen (70%) of the 20 wrists involved the dominant arm. Time between trauma and intervention averaged 8.9 months (range: 3-24 months).

The predominant symptoms were ulnar side pain that increased with grasping and rotation. Pain was graded by visual analogue scale (VAS) during exertion from 0 to 10. Disability of the Arm, Shoulder and Hand (DASH) questioner was done using the translated Arabic or Italian version.

Patients consistently had positive foveal sign and ulnocarpal stress test. DRUJ ballottement test was done and repeated later under anesthesia that revealed positivity in 10 patients. Assessment according to Modified Mayo Wrist Score MMWS was done. MMWS consists of subjective parameters (pain and return to work) and objective parameters (range of motion and grip strength as compared to the normal side).

A neutral rotation postero-anterior radiograph showed 16 wrists with ulna neutral and 3 wrists with ulna minus and 1 wrist with ulna positive. MRI was done for all patients to confirm the TFCC lesion but mainly to exclude other associated disorders of the wrist.

Twenty patients were followed up regularly. The shortest follow-up period was 6 months and the longest was 36 months with a mean of 12.9 months. Patients' assessment included Visual Analog Scale (VAS) during exertion, the Disability of the Arm, Shoulder, and Hand (DASH)score, the modified Mayo wrist score (MMWS) , return to activity, and the incidence of complication.

Surgical Technique:

Wrist arthroscopy was carried out under a brachial plexus block or general anesthesia and exsanguination with an upper limb tourniquet inflated. Vertical traction

using finger traps on the index and middle fingers with approximately 3-5 kg of counterweight traction was applied. Either dry or wet arthroscopy was done. Standard portals were established and a 2.7 mm 30° scope or 1.9 mm 30° wide-angle scope was inserted into the wrist. Systematic radio-carpal evaluation beginning from radial to ulnar. We inspect for synovitis and the cartilage status. With the arthroscope in the 3/4 portal and a probe in the 6R portal appreciate the radial insertion of the TFCC, the central disk, ulnar attachments, the superficial palmar and dorsal radioulnar ligament, the prestyloid recess, and the pisotriquetral joint, the 'trampoline test' was done to assess the tension in the TFCC and the 'hook test' to assess the deep foveal insertion of deep palmar and dorsal radioulnar ligament. Mid-carpal arthroscopy was carried out through the radial and ulnar midcarpal portals, to exclude concomitant intrinsic ligament lesions.

All TFCC tears were classified according to Palmer's classification and Atzei classification. Whenever a central pattern was confirmed by arthroscopy, debridement was done (Fig. 1).

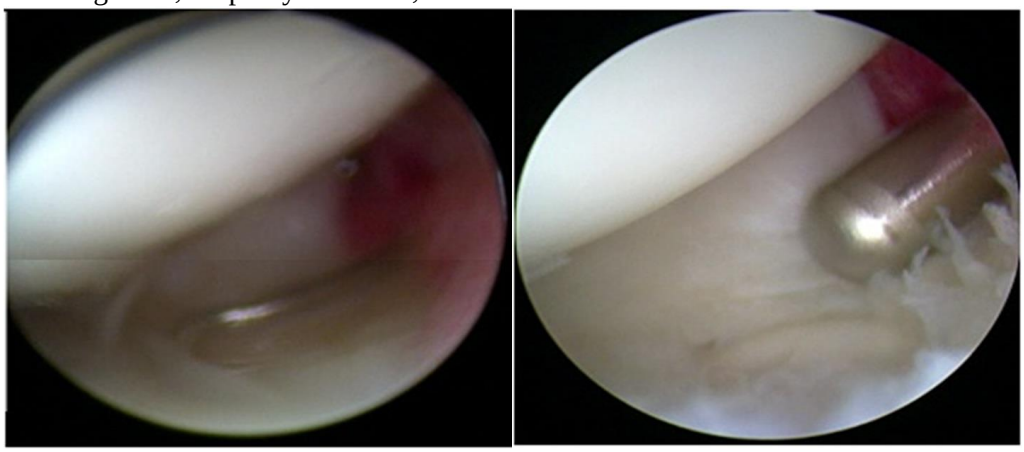


Fig. 1: shows arthroscopic debridement of type 1 A tear. (A)Demonstrates the arthroscopic appearance of a type 1A TFCC tear in a right wrist viewed from 3–4 portal with a hook probe through the 6R Portal to define the extent and margins of the tear. (B)An arthroscopic shaver is used to debride the unstable flaps of the tear back to stable edges

Whenever a peripheral distal tear pattern (Palmar 1B) (Atzei 1) was confirmed by arthroscopy, it was treated by repair of the avulsed superficial part of the TFCC to the capsule by outside in technique using one or more suture (Fig. 2). Foveal detachment tears (Palmar 1B) (Atzei 2 and 3) were treated by arthroscopic assisted foveal reattachment using 2.0 or 2.7 mm anchor (Smith & nephew) inserted in the fovea through direct foveal portal after debridement of the fibrous tissue in the fovea. The anchor inserted in the fovea has 4 strands allowing for making two reattaching sutures through the dorsal and palmar radio ulnar ligaments in an outside-in technique (Fig. 3).

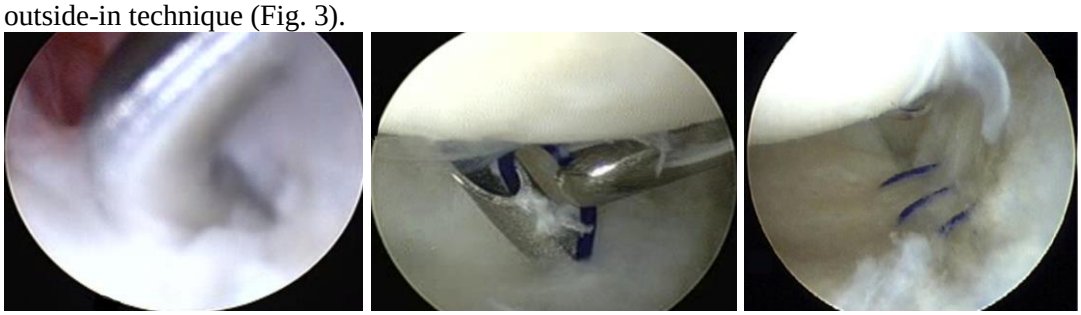


Fig2 .: Peripheral superficial TFCC tear treated by reattachment of TFCC to the capsule through outside in technique. (A)After slight debridement of torn TFCC tissue probing of the tear. (B) First suture passed via the DRU distal radio ulnar portal through the capsule and the TFCC and the suture is retrieved through 6R. (C) Three mattress sutures placed through the articular disk and the ulnar capsule.

Fig. 3: Arthroscopic-assisted suture anchor reattachment of the TFCC in patients with traumatic TFCC foveal avulsion (A) Scope in 3–4 portal, skin incision was done in the ulnar side of the wrist palmar to the ECU tendon. Suture anchor introduction into the fovea through the DF portal after roughening of the fovea by a curette. (B, C) Each suture was passed through each branch (palmar and dorsal) of the distal radio-ulnar ligament under arthroscopic control and retrieved through the 6U portal (D) Application of suture knot after release of traction. Sutures were knotted with the arm in a neutral position after release of wrist traction. (E)Two months post-operative x ray.

Postoperatively, the wrists were placed in an above elbow splint for 4 weeks with the elbow in 90-degree flexion and the forearm in slight supination.

Short arm splint was applied for an additional 4 weeks allowing prono-supination without resistance. Muscle strengthening exercises against resistance

were added from ninth week. Sporting activities were allowed only after 6 months.

Statistical analysis was performed using the Student's paired t-test to compare between the preoperative and postoperative variables with the statistical significance set at $P < 0.05$. Statistical analysis was performed with IBM SPSS version 24.

Results

Five patients had central TFCC tears (Palmar 1A), 5 patients had superficial ulnar tear (Palmar 1B Atzei 1) while 10 patients had foveal TFCC tear (Palmar 1B, Atzei 2 and 3) (Fig. 4).

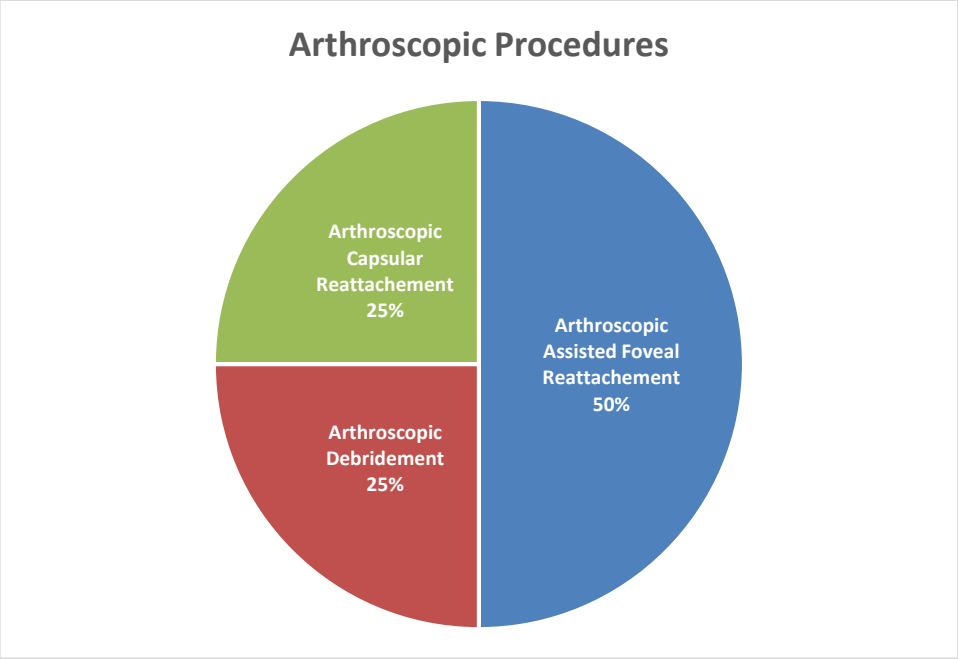
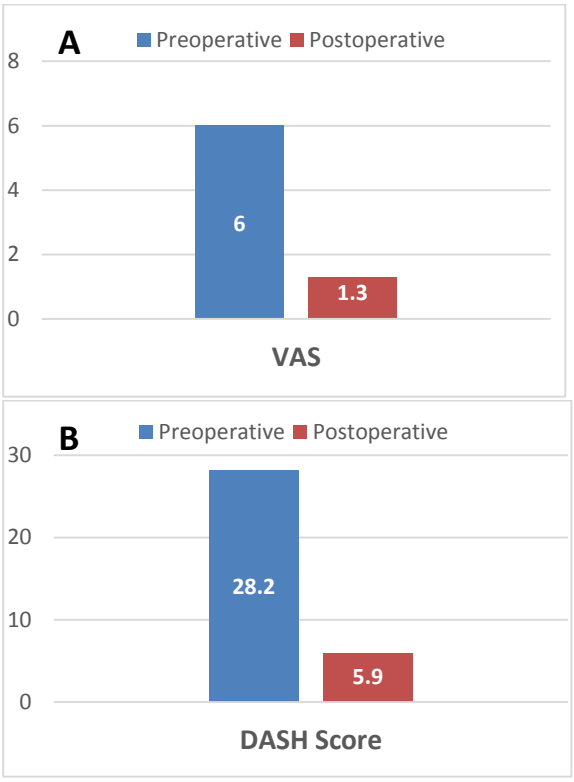


Fig. 4: Pie chart showing percentage of arthroscopic procedures done for treatment of different types of tears.

At an average follow up of 12.9 months (range, 6-36 months) all patients were reviewed. A highly statistically significant improvement ($P < 0.001$) was identified comparing preoperative with postoperative VAS for pain (Fig. 5A). The mean score for pain improved from 6 (range, 2–9) to 1.3 (range, 0–4). Evaluation of functional outcomes with the DASH score also revealed statistically significant improvement ($P < 0.001$). The mean preoperative score was 28.2 (range, 7.5–77.6), while the mean postoperative score was 5.9 (range, 0–14.2) (Fig. 5B).

The mean MMWS was improved significantly ($p< 0.001$) from 66.3 (range 35–85) preoperatively to 88.5 (range, 70–100) postoperatively (fig 5C). Eighteen of 20 (90%) patients returned to their activity at full capacity. Two patients (10%) had moderate pain during strenuous activity.



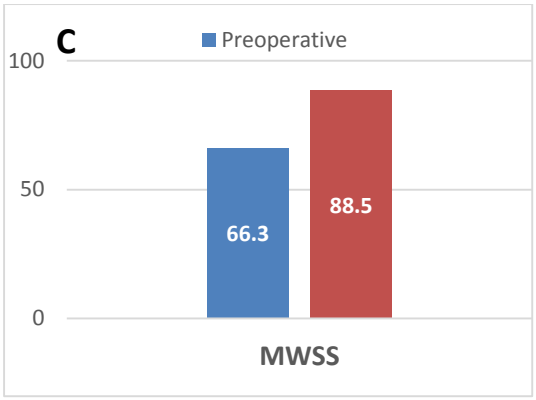


Fig. 5: The graphs show improvement of Visual Analogue Scale (VAS), Disability of the Arm, Shoulder and Hand (DASH) score and Modified Mayo Wrist Score (MMWS).

No significant associations were observed between age, gender, time between trauma and intervention, and outcome (P > 0.05). Two complications were reported: the first one was cut of the suture at the anchor eyelet during knot application. The second complication was temporal dorsal branch of ulnar nerve (DBUN) neurapraxia that resolved within 3 months.

Discussion

TFCC injuries are common, especially in an active population. TFCC injury is recognized as a major cause of ulnar-sided wrist pain. When non-operative modalities fail to resolve symptoms associated with this injury, surgical management is indicated. A number of open, arthroscopic-assisted, and arthroscopic techniques have been described [16]. The current prospective clinical trial study reports the short-term results of arthroscopic management of TFCC injuries. Our cohort of patients comprised of 20 consecutive patients who had traumatic TFCC injury. Five patients had central 1A lesion treated by debridement , five patients had peripheral injury superficial tear with intact foveal attachment (Atzei 1) were treated by capsular reattachment, and ten patients had peripheral injury with foveal detachment (Atzei 2 and 3) were treated by anchor foveal reattachment.

The overall functional outcome of the patients improved after surgery as echoed by the postoperative improvement of VAS, DASH and MMWS.

Pain during exertion express by VAS decreased from mean of 6 to a mean of 1.3. The Disability of the Arm, Shoulder, and Hand (DASH) score reported by the patients showed improvement from higher disability scores with a mean of 28.2 to lower scores with a mean of 5.9. The mean difference was 22.3 points. According to the study of Franchignoni et al 2014 Minimal clinically important difference (MCID) for the DASH score was10.83 points [17].

The modified (MMWS) improved from a mean of 66.3 that was defined satisfactory to a mean of 88.5 that was defined good. Postoperative scores of 12 patients were excellent (90-100), seven were good (80-89) and one patient was satisfactory (65-79). All patients returned to their activity at full capacity except two patients were able to return to a previous job with limited activity due to moderate pain.

No major complications were documented in this series. Two complications were reported: the first one was rupture of the suture at the anchor eyelet during Knot application and was managed by insertion of a second anchor through an open palmar approach; another patient suffered temporal dorsal branch of ulnar nerve (DBUN) neurapraxia which resolved spontaneously within 3 months.

Several series have shown good results of arthroscopic management of different types of TFCC tears.

Luchetti et al. [18] compared between open and arthroscopic-assisted foveal triangular fibrocartilage complex repair for post-traumatic distal radio-ulnar joint instability. The arthroscopic group had 25 patients , average follow-up was 31 months, VAS improved from a mean of 7 to a mean of 3, DASH improved from a mean of 39 to a mean of 16 and MMWS improved from a mean of 47 to a mean of 81.He reported one case of recurrent instability due to suture rupture with radio-ulnar ligament detachment as proved by second arthroscopy.

Sung et al . [19] studied arthroscopic-assisted repair of triangular fibrocartilage complex foveal avulsion in

distal radioulnar joint injury in 12 cases using transosseus suture in 6 patients and suture anchor in the other 6 patients. After a mean follow up of 19 months they show VAS improvement from a mean of 5.3 to a mean of 1.7 and DASH score improvement from a mean of 48.9 to a mean of 24.6. All patients were able to return to their jobs but two patients had persistent moderate pain.

Bayoumy et al. [(15)] studied 37 patients with Palmer 1B TFCC tear without instability and underwent arthroscopic outside-in repair with vertical mattress suture. Average follow-up was 11.1 months. He reported improvement of the VAS from a mean of 7.6 to a mean of 2.9. DASH score revealed improvement from a mean of 29.9 to a mean of 10.2. MMWS improved from a mean of 62.1 to a mean of 91.2.

He reported two complications: one patient had dorsal ulnar nerve neurapraxia, and the other one had weakness in extension of little finger (extensor digiti minimi irritation). Both of them resolved with non-operative treatment.

Our study seems to confirm the results of the previous papers. An accurate classification of TFCC and DRUJ injuries is necessary. Many mixed results of older series may be due to lack of precise diagnosis or treatment of foveal avulsion lesion associated with DRUJ instability [(20)].

To conclude, arthroscopic management of TFCC tears has shown good results regarding detection and classification of TFCC tears with improvement in pain and function. Our study is limited by the absence of randomly assigned control group managed either conservatively or by open surgery; therefore, no definitive statement on treatment differences can be made. The second limitation is the relative short follow-up period and a longer follow-up period is necessary for better evaluation of the functional outcome.

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