

Wrist Arthroscopy Is Effective for the Diagnosis and Treatment of Chronic Wrist Pain in Pediatric Patients



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Purpose: To determine the outcomes of diagnostic and therapeutic arthroscopy in patients with chronic wrist pain who are younger than 16 years of age. **Methods:** We retrospectively analyzed collected data from medical records of patients who had undergone wrist arthroscopy by the senior author between 2015 and 2017 for longstanding wrist pain and were 16 years old or younger. Findings from preoperative magnetic resonance imaging (MRI) were compared with the intraoperative diagnosis, and midterm results were gathered by a telephone interview. **Results:** Ten patients were included. Eight of 10 patients had undergone conservative therapy before surgery, and 60% had a history of single trauma. In 6 of 10 patients, the arthroscopic diagnosis correlated with the MRI findings. Eight of 10 wrists (80%) showed a tear of the triangular fibrocartilage complex (TFCC). Only 4 of the 8 TFCC tears were correctly identified by 3-Tesla MRI. **Conclusions:** In our study, wrist arthroscopy was an effective tool not only to diagnose but also to treat relevant TFCC lesions both in adolescents and children suffering from persistent wrist pain. A 3-Tesla MRI was neither sensitive nor specific enough to correctly diagnose lesions in small pediatric wrists. **Level of Evidence:** IV, Therapeutic case series.

Wrist arthroscopy is used to diagnose and treat patients with chronic wrist pain.¹ Arthroscopy is used to treat triangular fibrocartilage complex (TFCC) tears.²⁻⁴ As a minimally invasive procedure, it is associated with a low complication rate (5.98%) and a high comfort in recovery.⁵ Reported time intervals from the initial injury to the time of surgery cover up to 9.6 years.⁴ Previous studies revealed that tears of the TFCC causing instability at the distal radial ulnar joint (DRUJ) are the most common injuries in adolescents and children presenting with wrist pain.^{4,6,7} Treating physicians should be aware about these injuries and search for

potential instability, which could favor osteoarthritis when neglected for too long.^{4,8}

Magnetic resonance imaging (MRI) is able to detect joint pathologies in bigger joints, but it is not yet reliable in diagnosing tears of the intrinsic wrist ligaments.⁹ Arthroscopy was shown to be the gold standard in diagnosing abnormalities of this joint.¹⁰⁻¹⁴ Several studies showed controversial findings matching pathomorphologic findings in arthroscopy and MRI in adults, but also in the young. Farr et al.^{15,16} found that only 41.5% of TFCC tears have been correctly identified and classified by MRI, whereas Anderson et al.⁹ reported in a larger patient population that a 3.0-T MRI offers sensitivity of 94%, a specificity of 88%, and an overall accuracy of 91%. A more recent study by Ochman et al.¹⁷ demonstrated a 3.0-T MRI sensitivity of 83% and a specificity of 42% to 63%. Most of these recent studies observed exclusively adult populations. Besides Farr et al., more recently Ramavath et al.² conducted a retrospective study and found that MRI seems to be a likewise helpful tool in diagnosing TFCC lesions in younger patients.

The purpose of this study is to determine the outcomes of diagnostic and therapeutic arthroscopy in patients with chronic wrist pain who are less than 16 years of age. Our hypothesis was that arthroscopy would be superior to MRI in detecting and treating wrist pathology.

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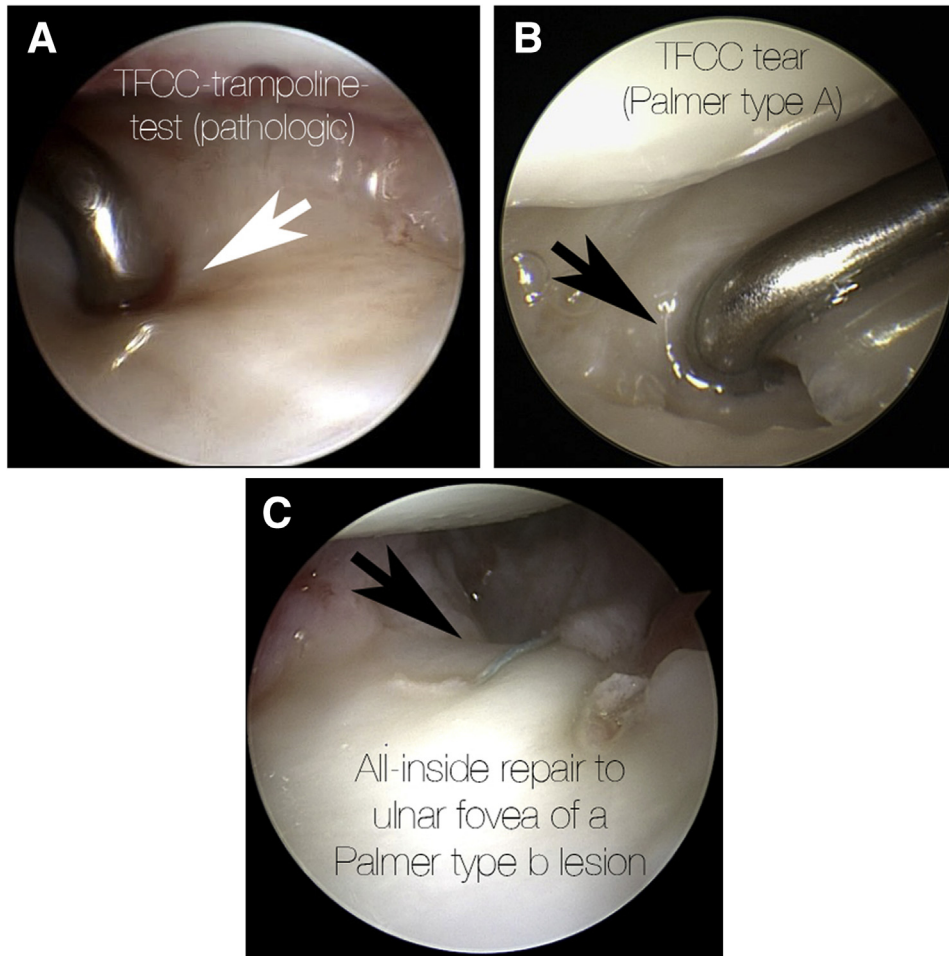


Fig 1. (A) Right wrist: pathologic TFCC trampoline test; (B) right wrist: TFCC Palmer type A tear; (C) Left wrist: all-inside repair to the ulnar fovea of a Palmer type B tear. (TFCC, triangular fibrocartilage complex.).

Methods

This retrospective study was conducted at the hand surgical Department of the University Hospital of Basel. All included patients were treated by the senior author between 2015 and 2017. The study was approved by the local ethics committee. Adolescent patients (age <16 years) presenting to the senior author in a specialized pediatric hand clinic with a documented postoperative follow-up of at least 3 months were included. Patients older than 16 years or patients with less than 3 months of follow-up or successful conservative treatment of wrist pain were excluded from the study. Patients were primarily referred to our department by a family doctor or pediatrician after failed conservative treatment, conducted by an occupational therapist. Before surgery, all patients underwent 3T arthro-MRI to search potential damage to the articulation. Prospectively collected data from MRI and charts of patients were retrospectively reviewed. We only ordered an MRI after conservative treatment failed. A standard wrist examination including TFCC loading tests, DRUJ instability testing, scaphoid shift test,

midcarpal stability evaluation, and range of motion (ROM) active and passive, was conducted and documented in all cases (Fig 1 A-C).

The wrist arthroscopies were performed dry with forearm distraction (Acumed, Hillsboro, OR). Under tourniquet, standard 3/4 and 6R arthroscopy portals were used to access the radiocarpal joint. The joint was reviewed in full to find pathologies. In the ulnar compartment, special attention was given to the TFCC, and lesions were classified according to the Palmer classification using trampoline, suction, and hook test.¹⁸ Midcarpal, palmar, as well as direct foveal portals were used if appropriate.

Lesions of the TFCC and their accompanying injuries were treated as needed, according recommendations by Atzei et al.¹⁹⁻²² Palmer 1b lesions were treated with an all-inside technique using a PushLock anchor from Arthrex (Naples, FL); all other lesions were debrided or sutured to the joint wall. Wellbeing of the patients and their satisfaction after discharge from treatment were assessed according to our institutional protocol including regular check by a skilled ergotherapist and

Table 1. Patient Data and Preoperative Treatment

Patient Number	Sex	Age, y	Conservative Treatment	Days of Conservative Treatment
1	M	16	Yes	91
2	F	11	Yes	71
3	F	13	Yes	64
4	F	15	Yes	69
5	F	14	Yes	440
6	F	16	No	0
7	M	15	Yes	125
8	F	14	Yes	62
9	F	12	No	0
10	F	15	Yes	64

F, female; M, male.

minimum follow-up doctor visits 6 and 12 weeks postoperatively, as well as in a structured telephone interview at study follow-up. Doctor follow-up visits included DRUJ stability testing, TFCC loading tests and evaluation of foveal tenderness and wrist joint movement. Statistical analysis included descriptive methods only due to the low number of cases.

Results

A total of 10 patients met the inclusion criteria. At the time of study initiation, 5 of 10 cases (50%) were already discharged from clinical examinations with a complete pain relief. The others were still under clinical review. The follow-up range of all cases was 3.4 to 15 months. In total, 60% of the patients with wrist pain waited for more than 3 months before presenting to a family doctor or a pediatrician. Six of the 10 patients had wrist pain for more than 6 months before referral to the pediatric hand surgical clinic. The mean age at the time of symptom onset was 13 years, and the mean age at the time of surgery was 14 years (range 11-16 years). Eight of 10 patients had undergone conservative treatment (splints and/or occupational health therapy for strengthening exercises) before surgery, with an average duration of 123 days (~4 months). In total, 60% of the injuries were related to an acute but minor trauma without bony injury (Table 1). Preoperatively, 3 of 10 patients (30%) showed DRUJ instability, 6 patients (60%) showed positive TFCC loading tests, and foveal tenderness was present in 5 patients (50%). One patient (10%) showed significantly reduced range of wrist motion and 1 patient (10%) only slightly reduced wrist motion; in 3 patients (30%), full or near full range of motion was documented. Preoperative documentation regarding range of motion was inconclusive in 5 patients (50%).

In 6 of 10 patients (60%), the pathologic findings during arthroscopy were represented in the MRI findings (Fig 2). Eight of 10 wrists (80%) showed a tear of TFCC, 4 (50%) of which were correctly identified by a 3-Tesla MRI and a dedicated team of pediatric

radiologists. According to Palmer, 5 of 10 TFCC tears were classified as 1B, 2 as 1A, 2 as 1C, and 1 as 1D¹⁸ (Fig 3). Of the 8 patients suffering from a TFCC lesion, only 5 had a remembered history of an acute injury.

Additional pathomorphologic findings besides the TFCC lesions were seen in 5 of the 8 wrists during arthroscopy. Of the 8 cases, only 3 (37.5%) showed an isolated lesion of the TFCC with no other pathomorphologic findings. Three patients showed a synovitis. One patient was additionally diagnosed with ulnar styloid pseudarthrosis and minimal radial malunion, one with a ganglion cyst, and another patient showed a minor lunotriquetral ligament lesion (Table 2).

Conventional radiographs revealed 1 patient with a negative and 1 patient with a positive ulnar variance. Within 3 months postoperatively, 3 of 10 patients reported postoperative minor complications, including persistent hyposensitivity, pain, and one tendinitis.

Nine of 10 patients completed a 5-minute follow-up questionnaire after treatment dismissal; 1 patient was lost to follow-up due to relocation. Three patients reported a total absence of pain since the operation, and 3 complained about remaining movement limitations in their wrists, as "very little" to "little." All patients experienced a subjective reduction of pain compared to the preoperative pain level. On a scale from 1 to 10, where 1 was defined as "not satisfied at all" and 10 as "100% satisfied," the average subjective satisfaction with the outcome of the operation was 8.2. All but 1 patient stated that they would undergo the surgery again if necessary or in case of another similar injury, and four stated that they now wished, retrospectively seen, that the operation had taken place earlier. On clinical examination, DRUJ stability was re-established in all 10 cases (100%) regardless of the preoperative therapeutic delay. Three to 6 months' postoperative TFCC loading test was negative in 8 patients (80%). Two patients had persistent pain and positive TFCC

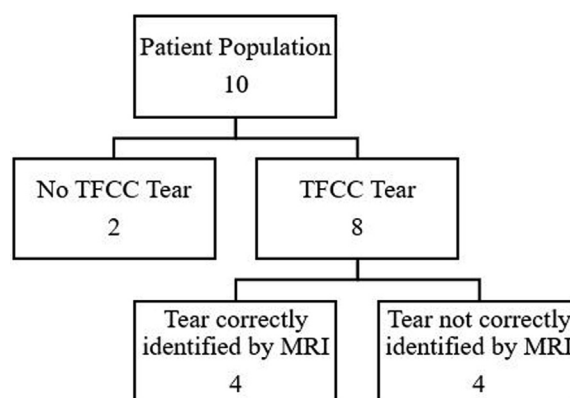


Fig 2. TFCC tears in MRI. (MRI, magnetic resonance imaging; TFCC, triangular fibrocartilage complex.)

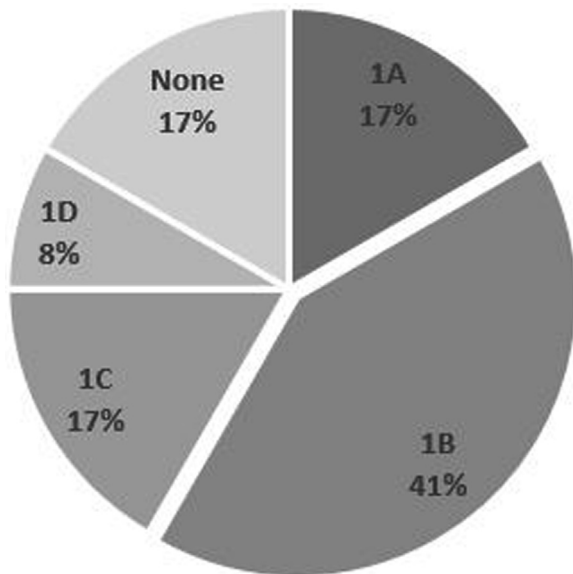


Fig 3. TFCC Injuries found in arthroscopy. (TFCC, triangular fibrocartilage complex.).

loading and needed revision surgery. After 3 months, 8 patients (80%) regained full ROM, and 2 patients showed slightly lowered ROM compared with the contralateral side.

Discussion

The most important finding of this study was that TFCC injuries are the most common cause for ulnar-sided wrist pain in children and adolescents, which confirms current literature^{4,6,15,16} similar to the adult population.²³ As 60% of the observed injuries in our patient population were caused by trauma, physicians should consider the possibility of injury despite sometimes reported mild or unclear trauma mechanism.⁴ Special attention should be paid to female patients presenting with wrist pain during adolescence. Differential diagnosis includes rheumatoid arthritis or osteoarthritis, which is often the case in older patients, or isolated DRUJ instability as a consequence of trauma.

Legault et al.²⁴ observed that female adolescents seem less symptomatic in wrists/hands. However, our study, as well as others, confirms that they do have pathomorphologic findings if the little that is reported is consequently investigated.^{4,24} In our opinion, young patients with persistent wrist pain should be evaluated by arthroscopy to avoid delaying and unsatisfying conservative treatment. This is supported by the results of clinical examination and the telephone interview that we conducted with our patients, which showed that they experienced a relief of pain through surgery, sometimes months after the initial trauma. Even though conservative treatment of chronic wrist pain was proven effective in treating pain provoked by arthritic causes or caused by fractures, the treating physicians should consider the adolescent's subjective pain experience and cancel ineffective conservative treatment methods if they do not lead to substantial improvement.

Wrist arthroscopy is considered the gold standard for further investigation.^{10–14}

Previous MRI studies revealed sensitivity levels between 0.73 and 0.97, specificity levels between 0.6 and 1, and accuracy levels between 0.7 and 0.99.^{25–28} However, these results were not verified in an adolescent-only population yet and should therefore be interpreted with caution. Terry and Waters⁴ showed similar results in a study conducted in 1998, where MRI correctly identified only 5 of 10 TFCC lesions in an adolescent patient population. Farr et al.¹⁵ confirmed this finding in 2012. Therefore, overseeing serious damage in the observed joint and/or prolonged conservative treatment without satisfying recovery, as reported by the majority of our patients, seems likely with MRI.

We acknowledge the important benefit of 3T-MRI in displaying injuries of the human wrist. As Blazar et al.²⁹ showed in 2001, this could have also been influenced by the experience of the observers, as more experienced MRI observers show more accurate interpretation than less experienced ones. All MRIs in our study

Table 2. Patient Data and Detected Pathologies

Patient Number	MRI Findings	Arthroscopy Findings
1	TFCC lesion (1A)	TFCC lesion (1A)
2	Cystic lesion	Ganglion cyst
3	None	TFCC lesion (1B) and pseudarthrosis
4	None	TFCC lesion (1C)
5	Negative ulnar variance	TFCC lesion (1B/1C) and negative ulnar variance
6	None	TFCC lesion (1B) and ganglion cyst and synovitis
7	TFCC lesion (1B) and positive ulnar variance	TFCC lesion (1B) and positive ulnar variance
8	TFCC lesion (1A)	TFCC lesion (1A)
9	Positive ulnar variance	Synovitis and hemorrhage
10	TFCC lesion (1B/1D)	TFCC lesion (1B/1D) and LT demolition

LT, lunotriquetral; MRI, magnetic resonance imaging; TFCC, triangular fibrocartilage complex.

have been interpreted by different examiners of varying degree of expertise. However, all MRIs were evaluated at least by a junior and a senior radiologist.

In our study, the MRI depiction correlated with the intraoperative findings in 6 of 10 examined wrists; however, the MRI scan was not precise enough to identify TFCC lesions and their classification to preoperatively plan the exact surgical procedure. Injuries of the TFCC are often accompanied by other additional pathomorphologic findings that could also contribute to chronic symptoms.^{4,6,15} Surgeons, but also radiologists, should be aware of these findings, and they should be eager to not only ascribe persistent wrist pain to the apparent lesion of the triangular complex, but also to think of other possible injuries that are not commonly shown in MRI.

Limitations

Our small, single-surgeon series with a limited clinical follow-up time cannot provide enough evidence to support guidelines in treatment of wrist pain in adolescents and children, and should be interpreted cautiously in the context of further studies.

Conclusions

In our study wrist arthroscopy seems to be an effective tool not only to diagnose, but also to treat relevant TFCC lesions both in adolescents and children suffering from persistent wrist pain. A 3 tesla MRI was neither sensitive nor specific enough to correctly diagnose lesions in small pediatric wrists.

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