The Incidence of Arthroplasty After Initial Arthroscopy for Trapeziometacarpal Arthrosis

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Abstract

Background: It remains unclear how many patients undergo secondary surgery after initial arthroscopy for trapeziometacarpal (TMC) arthrosis. We studied the factors related to secondary TMC arthroplasty after TMC arthroscopy. We also examined secondary questions of: (1) what percentage of patients underwent secondary TMC arthroplasty; and (2) how much time elapsed from initial arthroscopy to arthroplasty. **Methods:** In this retrospective study, we included all adult patients who were treated with arthroscopy of the TMC joint at 2 level I hospitals and affiliates. Factors were assessed for their independent association with secondary TMC arthroplasty using bivariate and multivariable analyses. **Results:** Fourteen of 84 (17%) thumbs underwent secondary TMC arthroplasty an average of 11 months after the initial arthroscopy. Synovectomy alone and smoking tobacco were independently associated with secondary TMC arthroplasty when compared with arthroscopic (partial) trapeziectomy with additional tendon interposition or allograft. **Conclusions:** This study demonstrated that 1 in 6 thumbs underwent secondary TMC arthroplasty, an average of 11 months after the initial arthroscopy. Coupling arthroscopy with partial trapeziectomy, interposition, or extension osteotomy may be a preferable strategy to isolated synovectomy. In addition, smoking tobacco is associated with inferior outcomes regardless of surgical procedure.

Keywords: arthroplasty, arthroscopy, reoperation, risk factors, trapeziometacarpal arthrosis

Introduction

There is an interest in treating mild stages of trapeziometacarpal (TMC) arthrosis arthroscopically. Arthroscopic management may offer the potential benefit of earlier recovery when compared with an open approach.⁴ Various techniques include arthroscopic debridement, arthroscopic debridement with partial trapeziectomy, or arthroscopic debridement with interposition. Recent studies reported significant improvements in pain scores and thumb function^{2, 6, 9}; however, it remains unclear how durable these results are and how often patients undergo secondary TMC surgery after treatment with arthroscopy.

From this context, we studied the factors related to secondary TMC arthroplasty after TMC arthroscopy. We also examined secondary questions: of (1) what percentage of patients underwent secondary TMC arthroplasty; and (2) in patients who underwent secondary reconstruction, how much time elapsed from initial arthroscopy to arthroplasty.

Materials and Methods

Study Population

Our institutional review board approved this retrospective study of a Research Patient Data Registry which

spans 2 level I hospitals and affiliates in a single metropolitan area, between 2000 and 2015. We used International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes and Current Procedural Terminology (CPT) codes to identify all patients who had an arthroscopy of the wrist, hand, or finger. We used the following codes: 80.23, 80.24, 80.73, 80.74, 80.83, 80.84, 29840, 29844, and 29999. All patients older than 18 years who were treated with arthroscopy of the TMC joint were identified. After manual medical record review, 90 patients who underwent therapeutic arthroscopy for TMC arthrosis were identified. We excluded 2 patients with posttraumatic TMC osteoarthritis, 2 patients in which the arthroscopy was converted to arthroplasty intraoperatively, and 5 patients who underwent TMC arthroscopy within 1 year of the data collection. A total of 84 hands in 81 patients were

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available for analysis with a median follow-up of 56 months (interquartile range [IQR]: 36-125 months).

Response and Explanatory Variables

Our primary outcome was whether or not TMC arthroplasty was performed after arthroscopy. The indication for secondary TMC arthroplasty was identified. We used medical record review and text search to obtain explanatory variables: age, sex, race, marital status, smoking history, medical comorbidity (diabetes mellitus type 1, rheumatoid arthritis), insurance status, involvement of the dominant hand, radiographic stage, prior treatment (eg, splint, corticosteroid injection), type of arthroscopic intervention, surgeon, and any other procedure on the same side (eg, trigger thumb release, cyst excision thumb, triangular fibrocartilage complex repair, scaphotrapezotrapezoidal debridement, De Quervain release, or carpal tunnel release); 15 were performed at the same time as the arthroscopy; 3 patients had earlier De Quervain or carpal tunnel release within 3 months before the arthroscopy.

Insurance status was classified as private or public, including patients with Medicare- or Medicaid-type insurance. An attending hand surgeon graded available radiographs using the Eaton classification system.⁵

For the initial arthroscopy, 3 different types of intervention were performed: (1) synovectomy alone (16 thumbs); (2) synovectomy combined with partial trapeziectomy (30 thumbs); and (3) partial trapeziectomy with additional tendon interposition or allograft (38 thumbs). Partial trapeziectomy included resection of the distal part of the trapezium. Out of the 38 patients with additional tendon interposition or allograft, the palmaris longus tendon was used in 18 patients, the flexor carpi radialis in 5 patients, and in 15 patients a GraftJacket or AlloDerm was utilized. A total of 4 surgeons performed the TMC arthroscopies. Decision for initial procedure was mainly based on surgeons' preference.

Statistical Analysis

Continuous data were presented as means with ranges and categorical data as frequencies with percentages. We performed bivariate analysis using a 2-sided Fisher exact test for dichotomous and categorical variables and an unpaired Student *t* test for continuous variables. All variables with a *P* value <.10 were entered into a multivariable logistic regression analysis to assess whether factors were independently associated with later TMC arthroplasty. We calculated odds ratios (ORs) with 95% confidence intervals (CIs). Statistical analyses were performed using Stata 13.0. A 2-sided *P* value of <.05 was considered statistically significant.

Patient Characteristics

Our study population consisted of 60 women (71%) and 24 men with a median (IQR) age of 55 (48-66) years. Most

patients were white (79%), and had Eaton grade II or III TMC arthrosis (71%).

Indication for arthroscopy was based on the patient and surgeon's discretion. Basically, it was offered if patients were refractory to nonoperative treatment (injections/splint). In 2 cases, arthroscopy of the TMC joint was performed in addition to an already scheduled arthroscopy for triangular fibrocartilage complex repair or scaphotrapezotrapezoidal debridement. Two patients underwent intraoperative conversion from arthroscopy to open CMC arthroplasty and were excluded from this study.

Results

Fourteen of 84 thumbs (17%) underwent secondary TMC arthroplasty. The secondary TMC arthroplasty was performed an average of 11 months (range: 2-36) after the initial arthroscopy, mostly because of ongoing pain (Table 1). In 12 of 14 patients (86%), complete trapeziectomy with ligament reconstruction and tendon interposition was performed; the remaining 2 patients had either complete trapeziectomy alone or an additional allograft interposition. Surgeons described operative findings of: 22 patients (26%) with mild chondrosis, 23 (27%) moderate chondrosis, 34 (40%) severe chondrosis, and 5 patients (6%) had no description available in the operative note. Of note, operative records described more wear on the trapezium compared with the metacarpal base (*n* = 23; 27%).

In bivariate analysis, type of arthroscopic intervention and smoking tobacco were associated with patients undergoing secondary TMC arthroplasty (Table 2). After controlling for possible confounders using multivariable logistic regression analysis, we found that patients who had synovectomy alone were more likely to have secondary TMC arthroplasty than patients who had arthroscopic trapeziectomy with additional tendon interposition or allograft (OR: 6.5; 95% CI: 1.2-34; standard error: 5.5; *P* = .027). Patients who smoke had a higher likelihood of undergoing a secondary TMC arthroplasty (OR: 4.2; 95% CI: 1.1-16; standard error: 2.8; *P* = .031; Table 3).

Discussion

The purpose of our study was to determine the percentage of thumbs that undergo secondary TMC arthroplasty after initial arthroscopy as treatment for TMC arthrosis, and to identify factors associated with secondary TMC arthroplasty. We found a 17% incidence of secondary TMC arthroplasty performed an average of 11 months after the initial arthroscopy. Synovectomy alone and smoking tobacco were independently associated with secondary TMC arthroplasty when compared with arthroscopic trapeziectomy with additional tendon interposition or allograft.

This study should be interpreted in the context of its limitations and strengths. First, database study differs from

Table 1. Reasons for Arthroplasty After Trapeziometacarpal Arthroscopy (n = 14).

Sex, age	Eaton stage	Initial arthroscopy	Reason for arthroplasty	Months to arthroplasty
Male, 37	^a	Synovectomy	Ongoing pain	3
Male, 71	III	Synovectomy	Ongoing pain	19
Female, 66	IV	Synovectomy	Ongoing pain	2
Female, 46	^a	Synovectomy	Ongoing pain	6
Male, 71	^a	Synovectomy	Ongoing pain	14
Female, 66	^a	Synovectomy/trapeziectomy	Ongoing pain	36
Female, 56	III	Synovectomy/trapeziectomy	Ongoing pain	9
Male, 63	II	Synovectomy/trapeziectomy	Ongoing pain	3
Female, 68	II	Synovectomy/trapeziectomy	Ongoing pain	25
Female, 69	II	Synovectomy/trapeziectomy	Ongoing pain	8
Female, 43	II	Synovectomy/trapeziectomy	Ongoing pain	5
Female, 51	II	Additional tendon/allograft interposition	Extruded graft	8
Male, 43	III	Additional tendon/allograft interposition	Ongoing pain; weak pinch	6
Female, 71	II	Additional tendon/allograft interposition	Ongoing pain	10

^aNo radiograph available for grading the trapeziometacarpal arthrosis.

other studies in that follow-up can either be defined as date of first treatment until last follow-up or defined as date of first treatment until the end of the database inquiry. True follow-up lies somewhere in between, as some patients might undergo secondary TMC arthroplasty at a different institution after arthroscopy. In this study, we noted no incidences where a patient underwent arthroscopy at one institution and switched to the other institution, which suggests this did not occur frequently. Second, we only had 62 radiographs available of the 84 included patients (74%). Some radiographs were only described in the medical records as the TMC arthrosis being mild, moderate, or severe. Some radiographs were performed using in-office fluoroscopy. Because of this, a subset of radiographs might not have been saved at that time during the visit or could have been graded on radiographs taken at an outside hospital. From the notes, we could not know which classification was used by the surgeon, making it difficult to determine radiographic staging as this was reported variably. Therefore, we chose to only include the stage if we had the actual radiograph available. This limitation may substantially affect the power of the study to evaluate the association between the Eaton stage and likelihood of secondary TMC arthroplasty. Third, indication for surgery was heterogeneous in our cohort. Some surgeons performed arthroscopy for patients with more severe arthrosis, while others limited arthroscopy for patients with mild arthritis.

Our secondary TMC arthroplasty incidence after initial arthroscopy for TMC arthrosis (17%) is difficult to compare directly with the existing literature, because other studies used different types of arthroscopic interventions and inclusion criteria (eg, Eaton stage), as well as often a small number of included patients and short follow-up. A number of studies report no complications and/or reoperations after

arthroscopic treatment of TMC arthritis.^{1,4,6,7} However, Pereira et al¹¹ showed less optimistic long-term results: 6 of 14 patients (43%) underwent secondary TMC arthroplasty after arthroscopic tendon interposition.

We used arthroscopy with tendon interposition as our reference standard. Our study was not structured to examine whether or not arthroscopy delays TMC arthroplasty or accelerates progression toward TMC arthroplasty compared with nonoperative treatments such as splinting or injection. It is clear that the rate of second surgery after TMC arthroscopy is higher than after TMC arthroplasty ranging from 2.8% to 4%.^{3,8,14}

Our data showed that among those who went on to open arthroplasty, the average time between surgeries was 11 months, mainly due to ongoing pain. Three of 14 patients (21%) even had the secondary arthroplasty within 3 months after the initial arthroscopy. Also, 10 out of 14 secondary surgeries (71%) were within the first postarthroscopic year (Table 1).

We observed a higher likelihood of secondary arthroplasty after arthroscopic synovectomy alone. During the study interval, it appears that the highest volume surgeon changed practice from arthroscopic synovectomy alone to partial trapeziectomy and tendon interposition. The second and third highest volume surgeons performed arthroscopic partial trapeziectomy and tendon interposition.

Furia⁶ compared patients with Eaton stage I and II treated with arthroscopic debridement and synovectomy with nonoperatively treated patients, and reported secondary surgical intervention in none of the arthroscopic treated patients. However, in our study, none of the secondary arthroplasties were performed among patients with Eaton stage I TMC arthritis within the follow-up period. Our study supports the concept TMC arthroscopy may be more

Table 2. Bivariate Analyses—Factors Associated With Undergoing Secondary Arthroplasty (n = 84).

Parameter	Arthroplasty		P value
	No (n = 70, 83%)	Yes (n = 14, 17%)	
Age, mean (SD), y	55 (12)	59 (12)	.29
Sex, n (%)			.53
Men	19 (27)	5 (36)	
Women	51 (73)	9 (64)	
Race, n (%)			.28
White	54 (77)	13 (93)	
Nonwhite	16 (23)	1 (7)	
Marital status, n (%)			.99
Married	44 (63)	9 (64)	
Not married	26 (37)	5 (36)	
Smoking history, n (%)			.076
Yes	29 (41)	10 (71)	
No	41 (59)	4 (29)	
Comorbidity, n (%)			.53
Yes	3 (4)	1 (7)	
No	67 (96)	13 (93)	
Insurance, n (%) ^a			.55
Private	28 (40)	4 (29)	
Public	42 (60)	10 (71)	
Dominant hand involved, n (%)			.74
Yes	28 (40)	6 (43)	
No	30 (43)	7 (50)	
Unknown	12 (17)	1 (7)	
Radiographic stage, n (%) ^b			.20
Eaton stage I	11 (22)	0 (0)	
Eaton stage II	15 (29)	6 (60)	
Eaton stage III	20 (38)	3 (30)	
Eaton stage IV	6 (12)	1 (10)	
Prior treatment, n (%)			.51
Yes	53 (76)	12 (86)	
No	17 (24)	2 (14)	
Initial arthroscopy, n (%)			.076
Synovectomy alone	11 (16)	5 (36)	
Synovectomy combined with trapeziectomy	24 (34)	6 (43)	
Additional tendon interposition or allograft	35 (50)	3 (21)	
Surgeon, n (%)			.17
1	38 (54)	10 (71)	
2	19 (27)	1 (7)	
3	12 (17)	2 (14)	
4	1 (1)	1 (7)	
Procedure on the same side, n (%)			.72
Yes	16 (23)	2 (14)	
No	54 (77)	12 (86)	

Note. SD = standard deviation.

^aPublic insurance defined as Medicare and Medicaid.

^bRadiographic stage was analyzed for a subset of patients (n = 62; 74%).

appropriate for patients with earlier stages of arthritis; however, we are unable to discern with our data whether TMC arthroscopy with or without interposition in patients

with early arthritis provides benefit to the patients compared with nonoperative means of treatment. In addition, it may be that patients who underwent CMC arthroscopy for

Table 3. Multivariable Analysis—Factors Independently Associated With Undergoing Secondary Arthroplasty (n = 84).^a

Parameter	Odds ratio	SE	95% CI	P value
Initial arthroscopy				
Synovectomy alone	6.5	5.5	1.2-34	.027
Synovectomy combined with trapeziectomy	3.4	2.6	0.74-16	.12
Additional tendon interposition or allograft	Reference			
Smoking history	4.2	2.8	1.1-16	.031

Note. SE = standard error; CI = confidence interval.

^aArea under the receiver operating characteristic curve = 0.72; pseudo R^2 = 0.13.

Eaton I changes did not progress to open arthroplasty because this was not offered as their surgeon felt the chondrosis was not advanced enough to warrant arthroplasty.

Smoking tobacco seems to negatively affect outcomes of arthroscopy. This is consistent with prior studies that describe smoking as a factor for poor outcome after arthroscopy for knee arthrosis.¹² This may also reflect an association of smoking with less effective coping skills¹³ and might also play a role in which patients do well with perceived outcome and the decision to pursue a second surgery.

An interesting observation in our data is that a large number of operative notes describe the trapezial side of the TMC joint affected more often than the metacarpal base (n = 23; 27%). This finding may be useful in the interpretation of biomechanical data. If chondral wear is asymmetric at the time of arthroscopy, it may help clarify which patients may benefit from a metacarpal extension osteotomy, because this shifts forces to the intact dorsal articular cartilage.¹⁰

This study demonstrated that 1 in 6 thumbs will undergo secondary TMC arthroplasty after arthroscopy for TMC arthrosis, usually within a year after arthroscopy. Finally, regardless of arthroscopic technique, patients who smoke tobacco may be at higher risk of secondary surgery. Isolated arthroscopic synovectomy demonstrates a modest benefit, and coupling arthroscopy with partial trapeziectomy, interposition, or a metacarpal extension osteotomy may be advantageous, but this needs further study.

Authors' Note

The work was performed at the Department of Orthopedic Surgery, Hand and Upper Extremity Service, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts, USA.

Ethical Approval

The institutional review board of our institution approved this study under protocol #2009P001019/MGH.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Statement of Informed Consent

The institutional review board granted a waiver of informed consent.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: SCW, FLV, and AN certify that they have no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article. NC is a consultant for Miami Device Solutions (Miami, Florida).

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