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Original Research

Reoperation Rate Following Thumb Basal Joint Arthroplasty: A Minimum Follow-Up Period of 5 Years

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Purpose: Thumb basal joint arthroplasty (BJA) performed for thumb basal joint arthritis is associated with high patient satisfaction. However, complications requiring reoperation occur, with a previously reported early reoperation rate (within 2 years) of 1.5%. The purpose of this study was to determine the risk of and reasons for reoperation in the intermediate term, defined as within 5 years of the index surgery.
Methods: All cases of primary thumb BJA performed from 2014 to 2016 at a single private academic center were reviewed. For cases requiring reoperation, data regarding index surgical technique, reason for reoperation, time to reoperation, and reoperation technique were collected. Risk of reoperation (return to the operating room for any reason) and risk of revision arthroplasty (revision surgery for symptomatic subsidence or instability) within 5 years of the index surgery were calculated.
Results: A total of 686 primary thumb BJAs were performed in 637 patients. Risk of reoperation for any reason was 2.0% (14/686), and risk of revision arthroplasty for symptomatic subsidence or instability was 0.6% (4/686) within 5 years of surgery. The mean time between the index surgery and reoperation was 10.3 months (range, 16 days to 4.6 years) for all cases; however, for revision arthroplasty, the mean time was 9.6 months (range, 3.9–14.3 months).
Conclusions: The intermediate term (5 years minimum) rate of reoperation following thumb BJA for any reason was 2%, with only approximately one-fourth of reoperation cases requiring revision arthroplasty for symptomatic subsidence or instability. These data may provide useful information in the counseling of patients considering thumb BJA surgery.
Type of study/level of evidence: Prognostic IV.

Osteoarthritis of the thumb basal joint is among the most common degenerative conditions of the hand and has been reported to affect up to 91% of those >80 years of age.[1–3] There are both modifiable (repetitive use, manual labor, and trauma) and nonmodifiable (increasing age, female sex,[4] and ligamentous laxity; eg, as seen in Ehlers–Danlos syndrome) risk factors for development of thumb basal joint arthritis.[1,2,5–7] Despite the cause, patients may suffer from activity-related pain, weakness with pinch/grasp, and up to a 50% impairment in the affected upper extremity.[1,8] Given the impact of advanced disease, surgical intervention is often pursued in the form of thumb basal joint arthroplasty (BJA), also known as thumb or first carpometacarpal arthroplasty.

There are a number of surgical techniques employed to perform thumb BJA, most including a combination of trapeziectomy and some form of suspensionplasty to support the thumb metacarpal.[9–11] Regardless of technique, outcomes are generally good.[12–16] However, complications requiring reoperation do occur, and given its elective nature, reoperation risk following this procedure is of interest.[17] Previous studies have reported a revision risk ranging from 2.9% to 5%, but the evidence is scarce.[18–22] A retrospective study performed at our center by Graham et al[22] was published in 2019, reporting an early reoperation rate (within 2 years) of 1.5% and an early revision rate of 0.6%.

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Table 1
Demographics, Reoperations, and Revisions by Index Surgical Technique

Index Technique	Joints, n (%)	Age (y), Mean (Range)	Female, n (%)	Reoperations, n (%)	Revisions, n (%)
LRTI	515 (75.1)	62.5 (33–83)	372 (72)	7 (1.4%)	2 (0.4)
SBS	119 (17.3)	61.0 (43–80)	90 (76)	4 (3.4%)	1 (0.8)
Trapeziectomy with pinning	35 (5.1)	59.8 (44–78)	29 (83)	3 (8.6%)	1 (2.9)
Trapeziectomy without pinning	17 (2.5)	62.8 (53–71)	3 (18)	0 (0%)	0 (0)
Total	686 (100)	61.5 (33–83)	494 (72)	14 (2.0%)	4 (0.6)

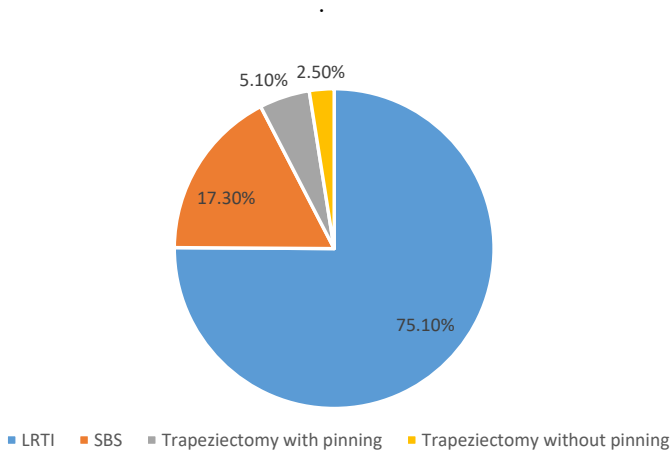

Figure 1. Index surgical technique.

Given the variability in reported risk and limited available data, the purpose of this study was to extend the investigation presented by Graham et al[22] to the intermediate term to determine the risk of and reasons for reoperation within 5 years of the index surgery. It was hypothesized that the risk of reoperation within 5 years of the index surgery would be less than 5%.

Materials and Methods

Study design and setting

Institutional review board approval was secured. The study was organized as a retrospective study including all patients undergoing primary thumb BJA from January 2014 to December 2016 (a 3-year period) at a single private academic center.

Study patients

Patients with a diagnosis of thumb basal joint arthritis who underwent primary thumb BJA from 2014 to 2016 were included in this study. Patients were identified using current procedural terminology codes 25447 (interposition arthroplasty, intercarpal or carpometacarpal joints) or 25210 (carpectomy; one bone). Patients who had undergone thumb BJA surgery prior to 2014 were excluded, and only patients undergoing their first thumb BJA were included. Similarly, patients in which BJA was performed as a secondary operation (eg, after initial open reduction internal fixation for fracture) were excluded. Index thumb BJA surgical techniques included ligament reconstruction and tendon interposition (LRTI), trapeziectomy with suture-button suspensionplasty (SBS) using the Mini TightRope (Arthrex, Inc), trapeziectomy with pinning, and trapeziectomy without pinning.

Data collection and analysis

Baseline demographic information was collected for each patient, including age, sex, laterality, diagnosis, and comorbidities. The medical record was reviewed with attention paid to reoperation following the index procedure. For cases requiring reoperation, data on index surgical technique, reason for reoperation, time to reoperation, and reoperation technique were collected. Risk of reoperation (return to the operating room for any reason) and risk of revision arthroplasty (revision surgery for symptomatic subsidence or instability) within 5 years of the index surgery were calculated. Categorical variables were compared using Fisher's exact tests. All analyses were two-tailed, and significance was set at a P value of $<.05$.

Results

Study patients

A total of 686 primary thumb BJAs were performed in 637 patients by 14 board-certified hand surgeons (A.M.I.) over the 3-year study period, of which 494 (72%) were performed in women and 192 (28%) in men, with a total mean age at time of index surgery of 61.5 ± 9.6 years (range, 33–83 years) (Table 1). The thumb BJA technique consisted of trapeziectomy with LRTI in 515 (75.1%), trapeziectomy with SBS in 119 (17.3%), trapeziectomy with pinning in 35 (5.1%), and trapeziectomy without pinning in 17 (2.5%) (Fig. 1). The mean duration between the index surgery and electronic medical record review was 7.9 ± 0.9 years (range, 6.4–9.7 years).

Risk of reoperation

A total of 14 of 686 (2.0%) primary thumb BJAs underwent reoperation within 5 years of the index surgery (Table 2). The mean duration between the index surgery and reoperation for any reason was 10.3 months (range, 16 days to 4.6 years).

Of the 14 cases undergoing reoperation, four (0.6% of total; 4/686) underwent revision surgery for painful subsidence. Two patients underwent index LRTI and were treated with revision to an SBS construct. One patient underwent index trapeziectomy with pinning and was treated with revision to an SBS construct. Finally, one underwent index SBS and was treated with revision SBS. Mean duration between the index surgery and revision arthroplasty for painful subsidence was 9.6 months (range, 3.9–14.3 months).

Among the other 10 cases requiring reoperation, three cases (21.4%) were complicated by infection/seroma requiring irrigation and debridement (and in one case, removal of hardware with revision SBS), three cases (21.4%) were complicated by persistent pain/neuritis requiring neurolysis, two cases (14.3%) were complicated by retained hardware following trapeziectomy with pinning requiring unplanned removal of hardware, and finally two cases (14.3%) developed symptomatic cysts at the BJA surgical site requiring cyst excision (Fig. 2). The mean duration between the

Table 2
Joints Undergoing Reoperation Following Thumb BJA

Patient ID	Age (y)	Sex	Laterality	Diagnosis	Comorbidities	Index Technique	MCP Procedures	Reason for Reoperation	Time to Reoperation (mo)	Reoperation Technique
1	47	F	L	CMC OA, Eaton III	PE, HTN, HLD, fibromyalgia, previous smoker	LRTI	None	Painful subsidence	12.9	Conversion to SBS
2	64	F	L	CMC OA, Eaton IV	HTN, smoker	Trapeziectomy with pinning	None	Painful subsidence	3.9	Conversion to SBS
3	61	M	R	CMC OA, end stage	CKD, HTN, anxiety, depression, smoker	LRTI	None	Superficial infection	0.5	I&D
4	55	F	R	CMC OA, end stage	HTN, OSA, depression, previous smoker	SBS	None	Seroma	4.2	I&D, removal of hardware, revision SBS
5	68	F	R	CMC OA, severe	Osteoporosis	LRTI	None	Painful subsidence	7.1	Conversion to SBS
6	65	F	L	CMC OA, Eaton III	SLE, Crohn's disease	LRTI	None	Infection	1.1	I&D
7	78	M	L	CMC OA, advanced	HTN, HLD, OSA, previous smoker	Trapeziectomy with pinning	None	Retained symptomatic pin	1.8	Removal of hardware
8	70	F	L	CMC OA, end stage	Asthma, HLD, depression	Trapeziectomy with pinning	None	Retained symptomatic pin	1.8	Removal of hardware
9	61	M	L	CMC OA, advanced	Anxiety	LRTI	None	Radial sensory neuritis	3.9	Radial sensory neurolysis
10	53	F	L	CMC OA, Eaton III	HLD, anxiety, depression, smoker	SBS	None	Painful subsidence	14.3	Revision SBS
11	65	F	R	CMC OA, advanced	CHF, HTN, osteoporosis, smoker	LRTI	None	Ganglion cyst at surgical site	3.7	Excision of cyst
12	76	F	L	CMC OA, advanced	Afib, hypothyroidism, HTN, HLD, osteoporosis	SBS	None	Cyst near surgical site	4.6	Excision of cyst
13	69	F	L	CMC OA, advanced	Heart disease, HTN, HLD, OSA, depression	SBS	Capsulodesis	Persistent pain	55.6	Revision SBS
14	60	F	R	CMC OA, end stage	HLD	LRTI	None	Persistent pain	28.8	Revision LRTI, radial sensory neurolysis

Afib, atrial fibrillation; CHF, congestive heart failure; CKD, chronic kidney disease; CMC OA, carpometacarpal osteoarthritis; F, female; HLD, hyperlipidemia; HTN, hypertension; I&D = irrigation and debridement; L, left; LRTI, ligament reconstruction tendon interposition; M, male; MCP, metacarpophalangeal; OSA, obstructive sleep apnea; PE, pulmonary embolism; R, right; SBS, suture button suspension; SLE, systemic lupus erythematosus.

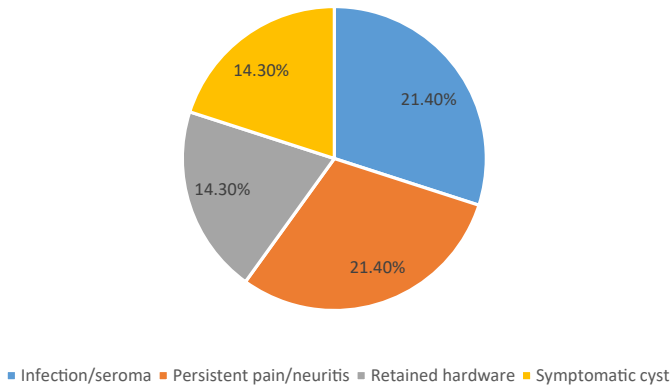

Figure 2. Reasons for reoperation (excluding those undergoing revision arthroplasty secondary to painful subsidence).

index surgery and reoperation for a nonrevision arthroplasty reason was 10.6 months (range, 16 days to 4.6 years).

Risk of reoperation for any reason was 1.4% (7/515) following LRTI, 3.4% (4/119) following SBS, 8.6% (3/35) following trapeziectomy with pinning, and 0% (0/17) following trapeziectomy without pinning. Joints undergoing trapeziectomy with pinning had an increased risk of reoperation when compared to LRTI (8.6% vs 1.4%; $P = .02$); however, no statistically significant differences were found when comparing each of the other groups (LRTI vs SBS, LRTI vs trapeziectomy without pinning, SBS vs trapeziectomy with pinning, SBS vs trapeziectomy without pinning, and trapeziectomy with pinning vs trapeziectomy without pinning; $P > .05$).

The risk of revision arthroplasty for painful subsidence was 0.4% (2/515) following LRTI, 0.8% (1/119) following SBS, 2.9% (1/35) following trapeziectomy with pinning, and 0% (0/17) following trapeziectomy without pinning.

The risk of reoperation for a nonrevision arthroplasty reason was 1.0% (5/515) following LRTI, 2.5% (3/119) following SBS, 5.7% (2/35) following trapeziectomy with pinning, and 0% (0/17) following trapeziectomy without pinning.

Discussion

Osteoarthritis of the thumb basal joint is a common ailment of the hand and can lead to substantial impairment.[1,2,8] Surgical intervention in the form of thumb BJA is effective in reducing pain and restoring function with generally high patient satisfaction.[12–16] Although uncommon, there are instances in which a reoperation or revision BJA may be indicated.[17] The literature is scarce regarding the risk of revision, and reported figures range from 0.6% to 5%.[18–22] The purpose of this study was to expand upon an investigation into early (within 2 years) reoperation risk published by Graham et al[22] in 2019 from this center, to determine the risk of and reasons for reoperation at the intermediate term, defined as within 5 years of index surgery.

The risk of reoperation within 5 years of the index surgery was found to be 2%, while the risk of revision arthroplasty was found to be 0.6%. The risk of reoperation was expectedly higher than that reported by Graham et al[22] in 2019 (1.5% reoperation risk) owing to an increase in time to follow-up but still notably lower than other published reports.[18–22] Megerle et al[18] reported a revision risk of 2.9% at a mean of 2.7 years after the index surgery. Wilkens et al[19] differentiated between revision and reoperation, reporting a revision risk of 2.8% within 5 years and a reoperation risk of 4%. Cooney et al[20] report a 3.8% revision risk, but this figure is questionable as calculating risk from their data set seems to yield a risk of 2.8%, not 3.8%. Mattila et al[21] also investigated the revision risk and report a figure of 5%. Our cohort is unique in that we analyzed patients treated by 14 surgeons, which includes an inherent variability in preference and technique, which may increase the generalizability of our results.

Ligament reconstruction and tendon interposition was by far the most commonly employed technique for index surgery (75%). This was followed by SBS (17.3%), trapeziectomy with pinning (5.1%), and trapeziectomy without pinning (2.5%). The breakdown of surgical techniques is variable between studies (eg, Mattila et al[21] and Cooney et al[20] did not have cases of SBS in their cohorts), which limits the comparison. The risk of reoperation was found to be higher following trapeziectomy with pinning (8.6%) when compared directly to LRTI (1.4%). In the 2019 study, Graham et al[22] found an increased risk of reoperation following trapeziectomy with pinning when compared to both LRTI and SBS ($P < .01$); however, only the former comparison remained statistically significant in this current expanded follow-up study. Interestingly, Wilkens et al[19] found that partial or complete trapeziectomy with interposition alone was associated with an increased risk of reoperation when compared to partial or complete trapeziectomy with interposition and ligament reconstruction or suspensionplasty.

Four joints in our cohort underwent reoperation in the form of revision arthroplasty secondary to painful subsidence: two underwent index LRTI and were treated with revision to an SBS construct; one underwent index trapeziectomy with pinning and was treated with revision to an SBS construct; and one underwent index SBS and was treated with revision SBS. Two joints that underwent index LRTI were complicated by infection requiring irrigation and debridement. In one case treated with index SBS, seroma developed, and this was addressed with irrigation and debridement, removal of hardware, and revision SBS. Two joints treated with index LRTI were complicated by persistent pain; one was treated with simple neurolysis for presumed radial sensory neuritis, and the second underwent revision LRTI + neurolysis. One joint treated with index SBS and simultaneous capsulodesis of the ipsilateral metacarpophalangeal joint was complicated by persistent pain and ultimately treated with revision SBS. Two joints that underwent index trapeziectomy with pinning experienced retained hardware (pin) after attempted pull in the outpatient setting, necessitating reoperation for hardware removal. Finally, two joints, one index LRTI and one index SBS, developed cysts near the BJA surgical site and underwent reoperation for cyst excision.

Papatheodorou et al[23] investigated 32 cases of failed BJA, most secondary to painful subsidence; they found that revision with distraction pinning and soft tissue interposition ± ligament reconstruction resulted in significant reduction in pain and increase in pinch/grip strength. Sadhu et al[24] report significantly worse patient-reported outcomes in patients undergoing revision LRTI compared to patients undergoing primary LRTI. This conclusion is corroborated by Munns et al,[25] reporting that results are expectedly inferior following revision arthroplasty when compared to primary arthroplasty; however, they state that revision arthroplasty can still result in satisfactory long-term outcomes. Renfree et al[26] investigate the salvage of failed BJA in 12 patients and note that multiple procedures owing to recurrent complications were common with an average of 4.5 per patient. Of note, one patient in our cohort treated with index LRTI and revision to SBS construct for painful subsidence (1.1 years after index) experienced recurrent painful subsidence and underwent a second revision arthroplasty in the form of partial trapezoidectomy and revision SBS (1.2 years after first revision, 2.3 years after index). Renfree et al[26] report that most of their patients undergoing multiple revisions were satisfied with their pain relief and function at an average follow-up of 5 years.

This study has several limitations. First, follow-up is limited to the information contained within our electronic medical record. It

is possible that there is a fraction of our cohort that had sought care elsewhere either for a revision surgery or for routine follow-up that was not captured, limiting the ability to review the most up-to-date and accurate information. Second, reliance on current procedural terminology codes for identification of our cohort leaves the possibility of missing patients during the initial query if coding errors existed. Finally, given the infrequency of a positive event (reoperation) in this data set, all statistical analyses performed are limited and likely underpowered to find statistically significant differences if true differences indeed exist (ie, these analyses are prone to type II error).

In conclusion, following the prior study in which Graham et al[22] reported an early (within 2 years) reoperation and revision risk following thumb BJA, an expanded investigation to 5 years after surgery identified a reoperation rate of 2% with a revision risk of 0.6% for instability or painful subsidence. This information adds to the existing literature and may provide surgeons with a useful framework to guide shared decision making with patients considering thumb BJA for symptomatic arthritis.

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