

Suture Button Suspensionplasty is Cost Effective for Management of Thumb Carpometacarpal Joint Arthritis: A Cost-Utility Markov Model-Based Analysis

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INTRODUCTION:

Thumb carpometacarpal (CMC) arthritis is a common and disabling condition that significantly impairs hand function and quality of life. Treatment options range from conservative approaches, such as activity modification, orthotic use, anti-inflammatory medications, and corticosteroid injections, to surgical interventions when conservative measures fail. Among surgical methods, trapeziectomy—removing the degenerative trapezium—is most commonly performed, often combined with ligament reconstruction and tendon interposition (LRTI) to address issues like metacarpal subsidence and improve pinch strength. Although evidence hasn't consistently shown superior outcomes for LRTI over isolated trapeziectomy, many surgeons still prefer the combined approach. Recently, a newer technique called suture button suspensionplasty (SBS) has emerged as an alternative, allowing surgeons to avoid tendon harvest and its associated morbidity. SBS offers advantages such as shorter surgical times, less invasiveness, and comparable clinical results to LRTI, along with benefits like avoiding Kirschner wires and faster recovery.

Despite the clinical promise of SBS, concerns remain about its higher implant costs relative to LRTI. While multiple studies compare patient-reported outcomes between the two procedures, no research has thoroughly evaluated their cost differences. Given the increasing focus on value-based care in orthopedics and an aging population, an evidence-based cost-utility analysis is needed to guide treatment decisions and optimize healthcare resource allocation. This study aims to employ Markov modeling to compare the cost-effectiveness of three treatment options for symptomatic CMC arthritis: conservative management with corticosteroid injections, LRTI, and SBS. We hypothesized that SBS would be less cost-effective than LRTI, but that both surgical procedures will be more cost-effective than conservative therapy.

METHODS:

The present study employed a Markov decision tree to evaluate the cost-effectiveness of three treatment strategies for symptomatic thumb carpometacarpal (CMC) joint arthritis including LRTI, SBS, and CSI. Model assumptions, including health utility values for LRTI, suspensionplasty, CSI injections, revision surgery, and symptomatic CMC arthritis were derived from previously published studies and are summarized in Table 1. Direct costs featured in the model, including physician fees, anesthesia fees, facility fees, patient consults, hand therapy costs, and implant costs were determined using Medicare reimbursement rates from the Centers for Medicare Services, and implant costs were provided by the manufacturer through the senior author's institution. The primary outcome measures in this study were total costs and quality-adjusted life years (QALYs) associated with each treatment cohort. In addition, incremental cost-effectiveness ratios (ICERs) were calculated to determine the cost of gaining an additional year of life at full functioning (i.e., dollars per QALY), which were then compared to the standard willingness-to-pay (WTP) threshold of \$50,000. Markov models were constructed using TreeAge Pro.

RESULTS:

The total costs over the 10-year study period of LRTI, SBS, and non-operative management with CSIs were \$6,074, \$5,053, and \$3,071, respectively. The total effectiveness of each strategy, measured in cumulative QALYs, was 6.85 for LRTI, 7.06 for SBS, and 5.53 for non-operative management with CSIs. Thus, non-operative management was the least costly, and SBS was the most effective. Moreover, LRTI demonstrated higher costs but lower total effectiveness than SBS, rendering SBS dominant over LRTI.

To evaluate the cost-effectiveness of operative versus non-operative management of CMC arthritis, the incremental cost and effectiveness of LRTI and SBS were calculated relative to CSIs. Next, to generate the ICER of each surgical treatment modality, the incremental cost was divided by the incremental effectiveness, yielding ICERs of \$2,275/QALY for LRTI and \$1,295/QALY for SBS. As such, both LRTI and SBS are cost effective relative to non-operative management, as their ICERs fell significantly below the willingness-to-pay threshold of \$50,000/QALY. Given that SBS dominates LRTI, these results collectively reveal SBS to be the most cost-effective treatment strategy for CMC arthritis in this model.

DISCUSSION AND CONCLUSION: SBS is an increasingly popular surgery for CMC joint arthritis that is cost-effective. Despite historical trends in treatment which favored LRTI, this study reveals that SBS is dominant over LRTI across the 10-year study period due to its reduced cost and increased effectiveness. Furthermore, this study demonstrates that the increased cost of surgery is justifiable when evaluating relative improvements in quality of life compared to non-operative management. Despite these findings, non-operative management with CSIs should remain the first-line treatment of CMC arthritis given the benefits of avoiding surgery when it is not needed. Future research should aim to better define the health utility of SBS as it becomes a more popular surgical technique in the treatment of CMC arthritis.

Table 1A. Markov model diagram depicting assumptions of treatment pathways

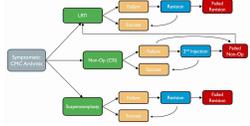


Table 1B. Literature supporting direct inputs for model

Variable	Value	Source
Transition Probabilities		
LIFT failure	2.5% by 2 years; 5.0% by 10 years	Cooney et al.; Mattila and Werts
Success/failure/failure	2.5% by 2 years; 5.0% by 10 years	Cooney et al.; Mattila and Werts
1st CSI revision to 2nd CSI injection	\$8.9% by 1 year	Ostergaard et al.
Conversion from CSI injection(s) to LIFT	10.0% by 1 year; 32.0% by 5 years; 42.8% by 10 years	Ostergaard et al.
Revision surgery	20% in 10 years	Shaw et al.
Costs		
LIFT	\$5,723.76	
Success/failure	\$4,703.53	
CSI injection	\$377.10	Medicare and CMS; see Table 2
Revision surgery	\$7,021.64	
Health utilities		
Successful LIFT	0.768	Lowe et al.
Successful success/failure	0.820	Hatchek et al.
Successful CSI injection	0.578	Fonse et al.; Kutz et al.; Manoglu et al.
Successful revision surgery	0.694	Hatchek et al.; Lowe et al.
Symptomatic CMC arthritis	0.578	Hatchek et al.; Lowe et al.

Abbreviations: LIFT, ligament reconstruction tendon interposition; CSI, corticosteroid injection; CMC, carpometacarpal.