

# Surgical management for malignant tumors of the thumb

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## Abstract

**Background** Malignant tumors of the thumb can be treated surgically with either wide local excision with reconstruction or amputation. Local excision of tumors in the thumb and hand often requires closer resection margin than at other sites, and there is also a need for tissue transfer from a donor site for reconstruction. Primary thumb amputation allows local tumor control while avoiding donor-site morbidity, but comes at great functional cost. We conducted this retrospective case review to assess the outcomes of thumb-sparing wide excisions and primary thumb amputations for malignant thumb tumors.

**Methods** We performed a retrospective review of 23 patients who were surgically treated for malignant tumors of the thumb at our center from 1996 to 2005. We reviewed patient demographics, tumor pathology, extent of resection, postoperative margin status, adjuvant therapy, recurrence, and survival. Functional outcomes were scored using the Muscular Skeletal Tumor Society (MSTS) rating system.

**Results** Twenty-three patients underwent definitive surgery: 14 thumb-sparing wide excisions and 9 amputations (five at the interphalangeal joint, three at the metacarpophalangeal joint, and one at the forearm). Median follow-up was 58 months (range, 5–156 months). All patients had negative margins. One patient developed a local tumor recurrence (following below-elbow amputation for a soft tissue sarcoma) while three patients developed distant metastases and died from their disease (two patients had melanomas and one had a soft tissue sarcoma). The median MSTS functional score was 28 (IQR, 27–29) for the entire cohort. Two patients that underwent amputation at the metacarpophalangeal joint without reconstruction had the lowest scores of 11 and 17.

**Conclusion** There was a low incidence of local recurrence and distant metastasis in this study, and these events appeared to be related to the underlying disease rather than the surgery performed. Thumb-sparing wide excision and amputation at the interphalangeal joint both give acceptable functional outcomes, though reconstruction should be strongly considered for patients undergoing amputation at the metacarpophalangeal joint.

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All human studies have been approved by the Institutional Review Board of Memorial Sloan-Kettering Cancer Center.

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Work performed at Memorial Sloan-Kettering Cancer Center.

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## Introduction

The surgical management of malignant thumb tumors presents a significant challenge. Complete excision of these lesions may require the sacrifice of structures critical to thumb function, which in turn significantly affects hand function. Although amputation is a reliable and effective treatment for malignant lesions of the thumb and/or the first ray, it has a significant functional and emotional cost.

Reconstructive options such as index pollicization or toe-to-thumb transfer can improve hand function, should thumb amputation be required [16]. Thumb-sparing resection allows preservation of the thumb, but soft tissue or bone reconstruction may be required, at the risk of donor-site morbidity. Efforts to preserve native tissue during thumb-sparing resections may also result in closer surgical margins.

Complete surgical excision with negative margins is associated with lower local and distant recurrence rates in the bone and soft tissue sarcomas, melanoma, and skin carcinomas—with positive margins associated with poorer long-term survival [2, 10, 14]. Adjuvant radiation and chemotherapy cannot be relied on to compensate for positive margins for soft tissue sarcomas of the hand [2]. As a result, our primary objective of surgical treatment for all malignant tumors is wide excision of the tumor with negative resection margins. We perform amputations for patients in whom thumb-sparing wide resections are not possible.

We conducted this retrospective review of patients with malignant tumors involving the thumb to answer the following questions: (a) Did we achieve negative surgical margins and avoid local tumor recurrence?, (b) How many patients developed distant metastases or died from disease?, and (c) What were the functional outcomes following surgery, measured using the Musculoskeletal Tumor Society (MSTS) scoring system? [3].

## Materials and Methods

This study was conducted after obtaining Institutional Review Board approval. We reviewed the records of all patients who presented to our center between 1996 and 2005 with malignant tumors of the thumb, first ray, first web space, or thenar eminence. Among them, 23 patients who underwent surgical treatment at our center were selected for this study. Data compiled included patient demographics, tumor pathology and characteristics, margin status at the time of surgical resection, and use of adjuvant radiation or chemotherapy. Tumors were staged using the American Joint Committee on Cancer (AJCC) staging system [6]. Patients were followed up till the date of death or latest review. We looked at the local recurrence and distant recurrence rate as well as functional outcome assessed according to the MSTS scoring system [3]. The Musculoskeletal Tumor Society Score is used to assess the outcomes following tumor resection and reconstruction. In the upper extremity, the factors looked at are pain, function, emotional acceptance, hand positioning, dexterity, and lifting ability. Each factor is assigned a value of 0 to 5 and added together, with a final score ranging from 0 to 30.

Functional assessment was recorded when hand function was felt to have stabilized, at a minimum of 5 months from surgery.

Among the 23 patients, 14 were managed with thumb-sparing surgery and nine with amputation. The median age of the 23 patients undergoing surgical treatment was 47 years (range, 10–80 years). Patients undergoing thumb salvage tended to be younger than those undergoing amputation, with median ages of 30.5 years and 56 years, respectively. There were 22 primary tumors and 1 locally recurrent tumor, a low-grade leiomyosarcoma. Diagnoses and stages at presentation included 14 soft tissue sarcomas (four stage I, seven stage II, and three stage III); one bone sarcoma (stage II chondrosarcoma); five subungual melanomas (one stage 0 melanoma in situ, two stage I, and one stage III), one T4b melanoma (patient declined other staging studies); three non-melanomatous cutaneous malignancy, one stage III porocarcinoma with axillary lymph node involvement and two with squamous cell carcinoma (one stage I disease and one stage 0 carcinoma in situ). The reconstructive procedures done for the 14 patients that underwent thumb-sparing resections have been described in a previous publication [9] and included tendon transfers, bone grafts, and flap wound coverage. Of the nine amputations performed, five were at the interphalangeal joint, three at the metacarpophalangeal joint, and one below the elbow. One of the three patients who underwent metacarpophalangeal amputation also underwent staged toe-to-thumb transfer. We performed thumb-sparing surgery for lesions deemed amenable to wide excision based on review of preoperative clinical, pathologic, and radiographic characteristics. MRI imaging was a critical component of preoperative surgical planning. The final determinants of whether wide resection and reconstruction were possible were: (a) wide excision through negative margins could be achieved while retaining a sensate or potentially sensate terminal thumb and (b) the defect following wide excision could be reconstructed using conventional and/or microsurgical techniques. Adjuvant chemotherapy was administered to one patient with stage III melanoma, and radiotherapy administered to four patients with high-grade soft tissue sarcomas. Further details on our patient population are presented in Table 1.

Patients who underwent minor amputations were typically discharged the day of surgery, while those who underwent reconstructive procedures including flaps were kept in the hospital for 5 days according to our institution protocol. Patients were followed up 10 days after surgery, then at 6 weeks, at 3 months, and then every 3 months during the first year, every 4 months for the next 2 years, and every 6 months during the fourth and fifth years. Surveillance for local and distant metastases was disease specific—for example, for patients with soft tissue sarcomas, local recurrence was

**Table 1** Patient characteristics

Patients undergoing thumb-sparing surgery													
Age	Sex	Location	Diagnosis	Presentation	AJCC Stage	Radiotherapy	Chemotherapy	Follow-Up (months)	Local recurrence	Distant metastasis	Status	MSTS score	
17	M	Thumb metacarpal	Chondrosarcoma	Primary	II	No	No	48	No	No	ned	29	
23	M	Thenar	Epithelioid sarcoma	Primary	II	Yes	No	110	No	No	ned	30	
28	M	Thumb P1 dorsum	Epithelioid sarcoma	Primary	II	No	No	58	No	No	ned	29	
12	M	Thumb P1 volar	Epithelioid sarcoma	Primary	II	Yes	No	97	No	No	ned	29	
13	M	Thenar	Epithelioid sarcoma	Primary	II	No	No	64	no	no	ned	30	
80	M	1st web	Synovial sarcoma	Primary	III	Yes	No	32	No	No	ned	27	
30	F	Thenar	Malignant fibrous histiocytoma	Primary	I	No	No	105	No	No	ned	28	
31	F	Thumb P1 dorsum	Malignant fibrous histiocytoma	Primary	II	Yes	No	5	No	No	ned	29	
71	M	1st web	Myxoid liposarcoma	Primary	III	No	No	51	No	Yes	dod	27	
46	F	Thumb P1 volar	Leiomyosarcoma	Recurrence	I	No	No	52	No	No	ned	28	
32	M	Thenar	Fibrosarcoma	Primary	I	No	No	78	No	No	ned	26	
48	M	Thenar	Myofibroblastic tumor	Primary	I	No	No	60	No	No	ned	29	
25	F	Thumb subungual	Melanoma	Primary	0	No	No	53	No	No	ned	29	
50	M	Thumb P1 volar	Squamous cell carcinoma	Primary	0	No	No	35	No	No	doc	30	
Patients undergoing amputation													
Age	Sex	Location	Diagnosis	Presentation	Amputation Level	AJCC Stage	Radiotherapy	Chemotherapy	Follow-Up (months)	Local recurrence	Distant metastasis	Status	MSTS score
56	F	Thumb P1 volar	Epithelioid sarcoma	Primary	MCPJ	II	No	No	95	No	No	ned	11
10	M	Thumb P1 volar	Synovial sarcoma	Primary	MCPJ	II	No	No	156	No	No	ned	29 <sup>a</sup>
47	F	Thenar	Malignant fibrous histiocytoma	Primary	Below elbow	III	No	No	67	Yes	No	ned	NA <sup>b</sup>
55	M	Thumb P2 volar	Porocarcinoma	Primary	IPJ	III	No	No	102	No	No	ned	28
59	M	Thumb P2 volar	Squamous cell carcinoma	Primary	IPJ	I	No	No	52	No	No	ned	28
63	M	Thumb subungual	Melanoma	Primary	IPJ	III	No	Yes	20	No	Yes	dod	28
73	F	Thumb subungual	Melanoma	Primary	MCPJ	T4b, <sup>c</sup>	No	No	22	No	Yes	dod	17
50	F	Thumb subungual	Melanoma	Primary	IPJ	I	No	No	61	No	No	ned	27
59	F	Thumb subungual	Melanoma	Primary	IPJ	I	No	No	45	No	No	ned	27

ned no evidence of disease, awd alive with disease, dod died due to other causes, doc died of disease, P1 proximal phalanx, P2 distal phalanx, IPJ interphalangeal joint, MCPJ metacarpophalangeal joint

<sup>a</sup> Patient underwent staged toe–thumb transfer

<sup>b</sup> Patient not assessed as she underwent a primary below-elbow amputation and second above-elbow amputation following local tumor recurrence

<sup>c</sup> Patient refused staging

assessed with clinical examination at each follow-up visit and yearly MRI scans, while distant recurrence was assessed with chest radiographs done at each visit and a CT scan of the lung performed yearly to identify potential lung metastases. Using the MSTS criteria for functional assessment, we assessed hand function when we believed it had stabilized, at a minimum of 5 months after surgery.

## Results

We achieved negative margins in all patients. The median follow-up for these patients was 58 months (range, 5–156 months). One patient from the amputation group with stage III malignant fibrous histiocytoma developed local recurrence of the tumor 2 months after below-elbow amputation with negative margins. This patient was treated with above-elbow amputation and is alive with no evidence of disease 67 months after initial surgical treatment and 65 months after the second amputation.

Three patients developed distant metastases. One patient with stage III high-grade myxoid liposarcoma who underwent a thumb-preserving resection developed pulmonary metastases 37 months postoperatively and died of disease 52 months after initial surgical excision. Two patients with melanoma who underwent amputations, one at the interphalangeal joint and the other at the metacarpophalangeal joint, were diagnosed with distant metastases at 16 months and 20 months postoperatively, respectively. They died at 20 months and 21 months after amputation.

The median MSTS functional score was 28 (IQR, 27–29) for the entire cohort. The lowest scores of 11 and 17 were seen in two patients who underwent amputation at the metacarpophalangeal joint without reconstruction. One patient that underwent amputation at the metacarpophalangeal joint followed by a staged toe-to-thumb transfer had a score of 29.

## Discussion

We treated 23 patients with malignant tumors of the thumb and were able to achieve negative resection margins for all of them. There was one local recurrence, and three patients developed distant metastases and died of their disease during follow-up. Good function was maintained for all patients except for patients that underwent amputation at the level of the metacarpophalangeal joint without reconstruction.

Limitations of this study include the wide range of tumor types and the small patient cohort. The decision of whether thumb-sparing tumor excision or amputation was done was based on many factors that included tumor type and size; hence the oncologic outcomes like local and distant recurrence between these two groups are not comparable.

The small patient cohort also made it difficult to comment on the ideal operation for each tumor type. However, we feel that despite these limitations, this study shows that thumb-sparing resections are feasible for selected patients with malignant tumors of the thumb.

The highest priority in surgical management of all malignant tumors is achieving complete excision with negative margins [1, 2, 4, 5, 11, 14, 17]. Invasive melanoma was managed most commonly with amputation one joint proximal to the tumor, as recommended by other authors [5, 8, 10, 12, 13], though some authors have reported good results can be achieved with more conservative resections in patients with low Breslow depth tumors [15]. For patients with in situ subungual melanoma and squamous cell carcinoma, we performed wide excision of the entire nail complex with immediate full thickness skin grafting of the defect, preserving the distal phalanx. For patients with soft tissue sarcoma, which include myofibroblastic tumors, the resection was planned based on the MRI findings. Often, we could perform thumb-preserving resections with reconstruction, though in some locally advanced cases, amputation was necessary.

Patients with interphalangeal joint amputation had MSTS scores of 27 or 28 while the two patients with metacarpophalangeal joint amputation without reconstruction had scores of 11 and 17. The patient who underwent a toe–thumb transfer who had a following metacarpophalangeal joint amputation had a far higher score of 29. While the numbers are small, these findings suggest that interphalangeal joint amputation is well tolerated by patients, and amputation at or proximal to the metacarpophalangeal joint is not. Goldner et al. had similar findings in their study on patients with traumatic thumb amputations [7].

In conclusion, thumb-sparing wide excision with good oncologic and acceptable functional outcomes is possible in selected patients with malignant tumors of the thumb. Amputation at the interphalangeal joint gives an acceptable functional outcome as well, though reconstruction with techniques like a toe–thumb transfer or pollicization should be strongly considered for patients undergoing amputation at the metacarpophalangeal joint.

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