

Avoiding Unplanned Resections of Wrist Sarcomas: An Algorithm for Evaluating Dorsal Wrist Masses

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Abstract

Ganglion cysts, soft-tissue masses that commonly occur about the wrist, are often excised without imaging or biopsy. In this article, we report a series of incompletely excised soft-tissue sarcomas about the wrist and offer an algorithm for their evaluation.

We describe a series of 4 consecutive patients who each presented after incomplete resection of a soft-tissue sarcoma mistakenly diagnosed as a ganglion cyst. We also retrospectively review the cases of 7 patients with incompletely excised sarcomas of the wrist.

Three of the 4 patients with sarcomas mistaken for ganglion cysts did not have prior magnetic resonance imaging (MRI), 3 of the 4 did not have an attempted aspiration, and all 4 did not have transillumination. Common atypical characteristics included ulna-based lesions (3/4), symptoms for less than 6 months (3/4), and no appreciable fluctuation in size (3/4). Functional outcomes for all patients were poor because of multiple surgical procedures, re-excisions requiring flaps, and need for additional adjuvant therapies.

Dorsal wrist masses with atypical characteristics should be approached with caution. Transillumination and aspiration are 2 accessible, cost-efficient methods for evaluating these masses. If either test is abnormal, an MRI should be performed.

Ganglion cysts are the most common dorsal wrist mass, accounting for about 60% of all tumors of the hand and wrist.¹⁻³ They most commonly occur on the radial side of the wrist, and dorsal cysts usually originate from the scapholunate interosseous ligament.⁴ Given their prevalence and the rarity of malignant tumors near the wrist, dorsal

wrist ganglion cysts are often excised without biopsy, magnetic resonance imaging (MRI), or any standard workup. However, not all soft-tissue masses about the wrist are ganglion cysts. Less common dorsal wrist masses are venous malformations, benign lipomas, and malignant soft-tissue sarcomas (STSs). STSs are rare (~1:100,000 patients) but highly malignant neoplasms.^{5,6}

The disproportionately high incidence of dorsal wrist ganglion cysts relative to the rare malignant tumors of the extremity has led to a wide array of pre-resection evaluation techniques. Transillumination of ganglion cysts during physical examination can confirm their cystic nature.⁷ Aspiration with a large-bore needle can also distinguish a cystic lesion from a solid tumor and, when performed with lidocaine and corticosteroids, can provide temporary relief, though the recurrence rate is high.⁸ Routine MRI for all dorsal wrist masses seems excessive and cost inefficient. Ultrasonography is another means of evaluating wrist masses,⁹ but its routine use in evaluation of dorsal ganglion cysts is not well established.

Unplanned primary excision of an STS of the extremity complicates treatment of the tumor. Incomplete excision makes re-excision to obtain negative margins more difficult, and re-excision is often best performed by specialty-trained surgical oncologists. Unplanned, incomplete excision contaminates the surgical field and may result in additional loss of soft-tissue and function during re-excision.¹⁰ In addition, as unplanned excision violates the tumor capsule and spreads malignant cells along the different layers of tissue, eradication of all tumor cells becomes more difficult, and subjects the patient to more aggressive surgical and postoperative treatment. This is particularly important in the hand and wrist, where so many important structures are concentrated in a small cross-sectional area. A single planned resection, therefore, can result in better function and outcomes for the patient than an unplanned excision can.¹¹

We reviewed the characteristics of a series of 4 patients who presented to a tertiary-care facility within 6 months after undergoing unplanned excision of an STS that had been incorrectly diagnosed as a dorsal ganglion cyst. We also reviewed another series of 7 patients for long-term outcomes of incomplete excision of an STS of the wrist. In addition, we reviewed the

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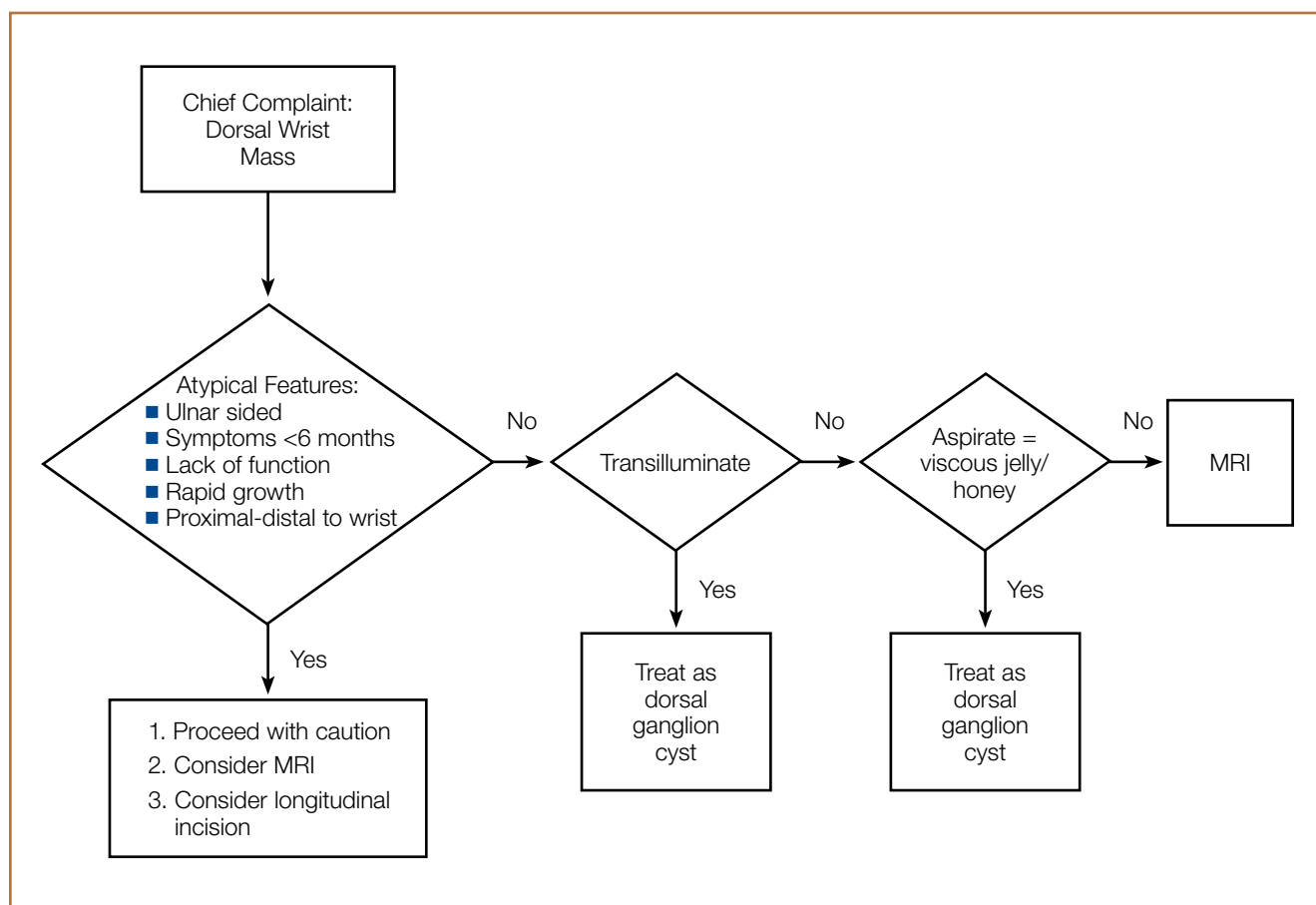


Figure 1. Flowchart of purposed algorithm of diagnostic steps (diamonds) and treatment recommendations (rectangles) for patients presenting with a dorsal wrist mass.

literature and developed a diagnostic and treatment algorithm that can be used to guide evaluation of dorsal wrist masses, specifically those presenting with atypical characteristics.

Materials and Methods

We obtained institutional review board approval but did not require informed consent because this study was a de-identified review of medical records. We retrospectively reviewed medical records of 2 series of patients who presented to a tertiary-care center after incomplete excision of an STS of the wrist.

The 4 patients in the first series presented within 6 months after incomplete excision of an STS mistaken for a dorsal wrist ganglion cyst. Follow-up had been short-term. The medical records and operative reports were searched to answer several questions about preoperative workup, operative technique, and tumor characteristics. We wanted to determine if any noticeable trends in these tumors were incorrectly identified as dorsal ganglion cysts. The strikingly high number of incompletely excised STSs mistaken for dorsal ganglion cysts at a single institution over a short period was one of the driving forces behind this study.

The 7 patients in the second series were identified by retrospectively reviewing a prospective database of soft-tissue

sarcomas collected between January 2001 and December 2004, a period chosen to allow for long-term (5-year minimum) follow-up. Identified patients had an STS of the wrist re-excised after incomplete excision. We wanted to further define outcomes and prognostic information. All patients were treated at a single institution and were followed longitudinally by a specialty-trained musculoskeletal oncologist. Long-term outcomes, including local recurrence, distant metastasis, and death caused by sarcoma, were measured.

All 11 patients were referred after incomplete excision by a surgeon not specifically trained in treating sarcomas. Ten of the patients underwent complete surgical re-excision with intraoperative pathology consultation to confirm negative margins and diagnosis, and the eleventh patient was treated with radiation therapy alone. Adjuvant radiation therapy and chemotherapy were administered to each patient at the discretion of the multidisciplinary oncology team and consistent with current standards of care.

We collected demographics, tumor characteristics, and outcomes data from retrospective review of medical records. Tumor characteristics included size, depth (superficial, deep), histologic grade (low, intermediate, high), and subtype. Cancer staging was also performed per the guidelines recommended

by the American Joint Committee on Cancer.¹² In addition, times between index operation and re-excision were collected.

Results

Table I lists the data for the 4 patients in the first series. These patients' tumors had several characteristics in common. Three of the 4 tumors were on the ulnar side of the dorsal wrist. Three of the 4 patients had symptoms for less than 6 months and did not describe a fluctuating course; 1 wrist mass was present for 1.5 years and fluctuated in size. None of the surgeons tested the mass for transillumination. One of the 4 masses was aspirated in clinic, and the aspirate was reported as bloody and was not sent to pathology. Only in 1 of the 4 masses did the physician order an MRI before excision, and in that patient, the radiology report identified the mass as a dorsal ganglion cyst. Three of the 4 masses were evaluated by fellowship-trained hand surgeons.

Pathology for the 4 incomplete resections revealed positive margins. Mean tumor size was 3.5 cm (range, 2.4 cm–5.8 cm). Two masses were resected through transverse incision and 2 through longitudinal incision. After incomplete resection, 3 patients underwent reoperation to remove gross residual disease (the fourth underwent extensive adjuvant radiation therapy and chemotherapy). Of these 3 patients, 2 underwent re-resection and required radial pedicle flap coverage of the defect left by the operation; the third underwent transradial amputation. Three of the 4 tumors were intermediate grade, and the fourth was high grade. In addition, 3 masses were histologically classified as synovial sarcomas, and the fourth as an undifferentiated pleomorphic sarcoma.

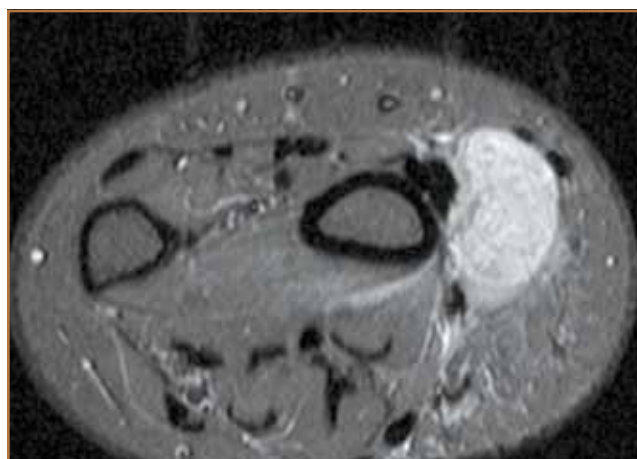


Figure 2. Axial T2-weighted magnetic resonance imaging of wrist mass that proved to be a sarcoma.

Table II lists the data for the 7 patients in the second series. Mean tumor size was 5 cm (range, 2–8 cm). Five of the 7 tumors were deep to the fascia; 2 were superficial. Four patients had grade III tumors, and 3 had grade II tumors. Residual disease, microscopic or macroscopic disease at time of re-excision, was present in 5 of the 7 patients.

These 7 patients had poor outcomes. Two patients developed distant metastasis, which was detected before definitive resection in 1 case, and 5.1 years after definitive resection in the other case. The patient with metastasis before definitive resection had to undergo below-elbow amputation, and died

Table I. Demographics of Patients Who Had Unplanned Resections of Sarcomas Mistaken for Ganglion Cysts (Series 1 Patients)*

Pt	Age, y	Sex	Clinical History	Side	Aspiration	Preoperative MRI	Incision	Pathology	Margins	Definitive Treatment	Required Flap
1	21	F	1.5-y history of pain and swelling in dominant wrist after injury	Ulnar	No	Yes	Transverse	Synovial sarcoma	Positive	Chemotherapy/radiation therapy	N/A
2	16	M	4-mo history of slow-growing mass in dominant dorsal wrist	Ulnar	No	No	Longitudinal	Synovial sarcoma	Positive	Re-excision	Yes
3	16	M	5-mo history of pain and slow-growing mass in nondominant dorsal wrist	Radial	No	No	Transverse	Synovial sarcoma	Positive	Re-excision	Yes
4	75	M	4-mo history of slow-growing asymptomatic mass in nondominant dorsal wrist	Ulnar	Bloody	No	Longitudinal	Undifferentiated pleomorphic sarcoma	Positive	Amputation	No (transradial amputation)

Abbreviation: MRI, magnetic resonance imaging.

*Transillumination—not attempted.

Table II. Long-Term (2000–2004) Outcomes of Unplanned Resections of Sarcomas About the Wrist (Series 2 Patients)

Variable	n
Patients	
Total	7
Sex	
Male	4
Female	3
Median age, y	68
Sarcomas	
Mean size, cm	5
Depth	
Superficial	2
Deep	5
Histologic grade	
I	0
II	3
III	4
American Joint Committee on Cancer stage	
I	0
II	5
III	0
IV	2
Residual disease	
Yes	5
No	2
Histologic type, %	
Fibrosarcoma	1
Malignant fibrous histiocytoma	4
Synovial sarcoma	1
Rhabdomyosarcoma	1
Undifferentiated pleomorphic sarcoma	0
Treatments and Outcomes	
Radiation therapy	
Yes	4
No	3
Chemotherapy	
Yes	1
No	6
Local recurrence	
Yes	1
No	6
Distant metastasis	
Yes	2
No	5
Survival status	
Alive	5
Died of sarcoma	1
Died of other causes	1

of the sarcoma 2.4 years after diagnosis. In 1 patient, local recurrence was detected about 10 months after definitive resection. Apart from the death caused by sarcoma, all patients were either alive (n = 5) or died of a complication unrelated to sarcoma (n = 1).

Discussion

Ganglion cysts account for 50% to 70% of all masses about the hand and wrist^{13,14} and are a common source of dorsal wrist pain.¹⁵ The most reliable treatment for dorsal wrist ganglion cysts is surgical resection of the cyst down to the wrist capsule.^{1,3,4} Because of their high incidence, these masses are often excised without any standardized workup. Sarcomas of the extremity are rare, particularly when compared with benign masses.¹⁷ Patients with sarcoma of the extremity often undergo incomplete excision by non-specialty-trained surgeons, with rates ranging from 14% to 53%.^{5,16-19} Surgical resection of sarcomas without proper planning often creates positive margins and complicates treatment of these tumors. When the tumor is not resected en bloc, malignant cells contaminate the layers of tissue around the neoplasm. Re-resection of a contaminated tumor bed results in additional loss of healthy tissue.²⁰⁻²² A larger resection in the wrist is particularly debilitating, as many important structures pass through a small cross-sectional area. In our series, the 3 patients treated with reoperation required either a flap for soft-tissue coverage or an amputation.

In comparison, planned excision of an STS about the wrist can allow the limb to be salvaged and maximal function to be preserved.²³⁻²⁵ Unplanned excision of a sarcoma can delay use of adjuvant chemotherapy or radiation until after definitive re-resection of the tumor bed.^{5,26} In addition, compared with patients with adequate margins, patients who undergo re-excision after incomplete excision require higher doses of radiation.²⁷ Radiation therapy for the hand has been associated with edema, fibrosis, impaired range of motion (ROM), and other complications.²⁸

Sarcomas of the upper extremity have a better prognosis than sarcomas of the lower extremity,²⁹ and sarcomas of the hand and wrist have a particularly high survival rate.³⁰ This is likely because tumors of the upper extremity are detected earlier, as the upper extremity has less fat and greater fine motor requirements. For this reason, both benign-space-occupying lesions and malignant tumors are common presenting complaints for surgeons to evaluate.

Our proposed algorithm for evaluating dorsal wrist masses is outlined in **Figure 1**. We created this algorithm to help surgeons avoid treating malignant tumors thought to be dorsal ganglion cysts.

Perhaps the most rapid and cost-efficient method of evaluating a dorsal ganglion cyst is to transilluminate the mass with a small light in a dark room. Transillumination can distinguish a cyst from a solid mass. However, many factors (eg, body habitus, skin pigmentation, cyst depth) can obscure the ability of a cyst to transilluminate. Furthermore, myxoid sarcomas may have a high proportion of water, which can give an equivocal result on transillumination.

If transillumination is inconclusive, aspiration of dorsal ganglion cysts can be both diagnostic and therapeutic. The content of wrist ganglion cysts is classically described as a viscous liquid that resembles honey or jelly. Rates of recurrence of ganglion cysts after single aspiration are very high, above 50% in some studies.³¹⁻³³ Some have thought that injection of corticosteroid or hyaluronidase after aspiration decreases the rate of recurrence, but the reported success of these adjuvant therapies varies.^{32,34-36} To avoid spreading malignant cells, only consider injection of these agents after typical ganglion cyst contents have been confirmed. Experience with fine-needle aspiration of sarcomas has demonstrated that aspiration alone poses very low risk of sarcoma cell spread.³⁷

We recommend obtaining an MRI when wrist masses have atypical features or when transillumination and aspiration are inconclusive. MRI can provide much information about the contents, inflammation, and extent of soft-tissue masses.^{38,39} MRI has been shown to be superior to CT in evaluating soft-tissue tumors.⁴⁰ **Figure 2** is an example of an MRI of a wrist mass that proved to be a synovial sarcoma.

Although plain radiographs are often recommended for the initial workup for soft-tissue masses,⁴¹ their yield in the workup of dorsal wrist ganglions is low.⁴² However, many practitioners use plain radiographs as part of the initial evaluation, and mineralization of the lesion that is being evaluated should raise suspicion that it is not a ganglion cyst. The success of ultrasonography in diagnosing wrist ganglions has varied.^{43,44}

Clinicians should give special consideration to wrist masses that follow a course atypical of a ganglion cyst. In our series, the common characteristics of sarcomas mistaken for dorsal ganglion cysts were ulna-side lesions, symptoms for less than 6 months, and lack of fluctuation in mass size. This algorithm should not be used when treating masses proximal or distal to the wrist joint. When a mass has more than 1 atypical feature, it may be prudent to proceed straight to MRI without attempting aspiration.

Larger masses, or masses with irregular shapes, should raise suspicion as well. Although ganglions can present with a bilobed appearance from being split by an extensor tendon, firm irregular masses should be treated as atypical ganglions, as described. Another physical examination finding of concern is limited ROM or tendon excursion about the hand and wrist. Ganglion cysts rarely invade tendons, whereas more aggressive sarcomas have been found adhering to tendons. However, it should be noted that dorsal wrist ganglions can limit wrist ROM because of pain and without invading tendons.

For excision of atypical ganglion cysts, consider a longitudinal incision. Dorsal ganglion cysts are often resected by means of a transverse incision or an arthroscopic approach.^{14,45} A transverse incision is primarily used to reduce scarring and contractures, as the Langer lines run roughly transversely around the wrist.⁴⁵ However, transverse incisions complicate re-excision of a contaminated tumor bed. Because most structures in the hand run longitudinally at the wrist and are concentrated in a small cross-sectional area, a transverse incision

often contaminates more compartments. Further, although arthroscopic excision is increasingly being used in the treatment of ganglion cysts, it should not be used for suspected tumors. It creates a smaller incision superficially, but the pressurized environment it creates around malignant cells is unfavorable, and direct visualization to ensure complete removal of the tumor is preferred. A longitudinal incision should be considered for any dorsal wrist mass with atypical features or for any situation in which the diagnosis is not entirely clear.

Any mass found to be a malignant tumor should be immediately referred to a specialist trained in managing malignant tumors of the extremity. If a biopsy becomes necessary, it is advantageous that the surgeon who performs the definitive resection determines the method and site of biopsy. Early referral to a specialty clinic and excision of the tumor in a single, planned procedure remains the preferred method of treatment for sarcomas of the extremity.^{17,46,47}

Dorsal wrist masses are common. It is important to have a consistent way of evaluating these masses in order to avoid unplanned excision of soft-tissue sarcomas. Transillumination and aspiration are 2 rapid, easily accessible interventions that can be used to establish the diagnosis of dorsal wrist ganglion in clinic. If suspicion persists, MRI can be effectively used to confirm the diagnosis. The goal is to decrease the incidence and minimize the collateral damage of unplanned excisions of soft-tissue sarcomas about the wrist.

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This paper will be judged for the Resident Writer's Award.
