The case:

A 71-year-old woman was admitted for a presumed right thumb felon refractory to incision and drainage in the emergency department and several days of antibiotics. She also reported neck pain and recent onset of right arm weakness.

Figure: Gross appearance of the right thumb at presentation (A) and posteroanterior right hand radiograph (B).

Your diagnosis?

For answer see page 964
Diagnosis: Acrometastasis of the Thumb

CPT K. Aaron Shaw, DO; MAJ Todd P. Balog, MD; MAJ (P) Jason A. Grassbaugh, MD

Answer to Radiologic Case Study
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An inpatient orthopedics consultation was requested for a 71-year-old woman with a presumed right thumb felon that had been incised and drained in the emergency department 1 week earlier. Despite the incision and draining and empirical treatment with clindamycin, she had worsening erythema and swelling of her thumb. In addition, she reported several months of neck pain with recent onset of right arm weakness and paresthesias. Her medical history included a persistent cough and a large lung mass diagnosed as a lipid pneumonia via bronchoscopy. On admission, her antibiotic regimen had been broadened for presumed disseminated infection, and orthopedics was asked to assume management of her thumb. The neurosurgery service was consulted for management of her cervical spine.

The patient was afebrile and had stable vital signs. Her thumb was swollen and mildly erythematous, with packing in place (Figure 1A). White blood cell count was 7.2×10^3/µL and C-reactive protein was 24.2 mg/L, with an erythrocyte sedimentation rate of 67 mm/hr. Radiographs of her hand showed a lytic process of the distal phalanx of the thumb with cortical disruption (Figure 1B). Radiographs of her cervical spine showed collapse of her fourth cervical vertebra (Figure 2A). This was further evaluated with magnetic resonance imaging (MRI) (Figure 2B) and reported to be osteomyelitis.

A repeat bedside incision and drainage was initially performed, but no improvement occurred. A metastatic process was suspected, despite the presumed benign nature of the lung mass. The patient underwent formal incision and drainage with biopsy. Intraoperatively, complete absence of the distal phalanx was noted. Firm, expansile, purple tissue had replaced the phalanx. This was confirmed on intraoperative mini C-arm radiographic imaging (Figure 3A).

Cultures and intraoperative tissues were obtained, and a general debulking procedure was performed. An antibiotic-impregnated cement spacer was placed to fill this void until confirmation of a metastatic process. A second, definitive procedure was planned.
The pathology report indicated the biopsy specimen was adenocarcinoma of unknown primary origin (Figure 3B). An intralesional revision amputation was performed at the level of the interphalangeal joint to preserve length and function. Radiation-oncology was then consulted for postoperative radiation to this region. In addition, the patient experienced a similar rapid collapse of her C4 and C5 vertebra and underwent corpectomy and fusion. Despite medical efforts, the patient died of pulmonary complications of her adenocarcinoma 2 months later.

**Etiology**

Neoplasms of the hand are a large, diverse group of cellular growths that can be subdivided into primary and secondary lesions. Primary lesions include both benign and malignant neoplasms with cutaneous, soft tissue, or bony origins.\(^1\)\(^2\) Benign lesions are significantly more prevalent with ganglion cysts and enchondromas, the most common lesions of soft tissue and bony origin, respectively.\(^2\) Secondary neoplasms consist of metastatic lesions, termed acrometastases when involving the hand.\(^3\)

Acrometastases are a rare clinical entity, composing only 0.1% of all metastatic lesions.\(^4\) In a review of 257 reported cases of acrometastases, Flynn et al.\(^5\) found that most were primary lung carcinoma metastases, with a preponderance for the distal phalanx.\(^5\) The middle finger was involved in 26% of the cases, followed by the thumb in 21%. Seventy-four percent of cases presented as a solitary lesion, most commonly affecting the right hand, and cases occurred 1.8 times more often in men than in women.

The mechanism of metastasis to the hand remains a topic of some debate. The seeding mechanism of metastasis was first proposed by Paget.\(^6\) In 1923, Joll\(^7\) proposed the concept of trauma-induced acrometastasis, hypothesizing that repetitive trauma may degrade the surrounding tissues, providing a nidus for tumor emboli to colonize the skeletal tissue. After discovering the predominance of acrometastases to the dominant hand, Healey et al.\(^8\) hypothesized that an increase in vascularity was involved. More recent literature suggests that the development of metastasis is most dependent on the burden of circulating tumor cells.\(^9\)

**Presentation and Diagnosis**

Acrometastases are commonly described as erythematous, warm, and swollen digits.\(^10\) The typical patient presents with insidious onset of pain and swelling,\(^11\) often receiving an initial diagnosis of a felon, osteomyelitis, or gout.\(^3\)\(^5\)\(^10\) Radiographically, these lesions are osteolytic. Magnetic resonance imaging can be valuable to document the extent of the soft tissue involvement.\(^10\) Biopsy and cultures are required to ascertain the correct diagnosis.\(^12\) It is not unusual for the patient to initially present to an orthopedic surgeon for acrometastases. Once the diagnosis has been reached, an appropriate oncologic referral should be made and a systematic survey for disseminated metastatic disease conducted.

The presence of acrometastases indicates a poor prognosis, with a mean patient survival time of 6 months.\(^3\)\(^4\)\(^10\)\(^11\) However, survival is directly related to the nature of the primary malignancy and the efficacy of available treatment, not to the presence of acrometastases.\(^3\) Local treatment primarily consists of excision of the involved bone.\(^5\) For small lesions involving the distal phalanx, amputation with clear oncologic margins is adequate for pain relief and local disease control.\(^10\) If an adequate local excision would likely result in a nonfunctional hand, then consideration should be given to a ray resection. For more proximal lesions, local resection can be performed and radiation therapy administered with good results.\(^5\) Radiation therapy alone may be indicated for small proximal lesions and in those patients who either have a short life expectancy or are not good candidates for surgery.

In the current case, the patient underwent a 2-stage procedure, beginning with local biopsy and placement of an antibiotic spacer into the osseous defect and followed by a revision amputation after formal diagnosis. This ap-
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approach was selected to facilitate definitive diagnosis of the lesion and allow declaration of dorsal soft tissue vascularity that appeared compromised. Following the initial tumor debulking, the patient experienced a significant decrease in the swelling of her thumb, with resultant improvement in the vascularity of the digit. By staging her procedures and allowing the vascular status of her thumb to declare, the authors were better able to assess the overall condition of the soft tissue. This allowed the authors to retain the maximum thumb length during the subsequent revision amputation. Because an intralosional margin was required to maintain functional length, adjuvant radiation therapy was added to address any remaining tumor burden.

The rationale for the intralosional margin was to attempt to maximize the functionality of the hand postoperatively. The thumb is the keystone to the normal functionality of the hand. Its function in opposition enables key grips that differentiate the human hand from that of other humanoid species and is vital to daily human life. As such, the necessity to preserve as much length, and thus functionality, of the thumb was recognized to optimize the patient’s self-reliance during the ensuing treatment and rehabilitation period.

CONCLUSION

Acrometastases are rare. Although they commonly simulate a local infection, a high clinical index of suspicion, incorporating key elements of the patient’s history, can prevent a delay in diagnosis and allow early intervention. When the thumb is affected, efforts should be made to maximize the functionality of the hand.

REFERENCES