CHAPTER **12**

Management of a Recurrent Metastatic Renal Cell Carcinoma to the Foot With Medial Column Reconstruction: A Case Study

H. Thomas Temple, MD
Mohanad Eltahir, DPM
Jannah F. Bacchus, DPM
Thomas Merrill, DPM

INTRODUCTION

Renal cell carcinoma (RCC) comprises about 3% of all adult malignancies and frequently metastasizes to bone (1-3). There are reportedly 200,000 new cases with 100,000 deaths per year (4). RCC most commonly affects individuals between the ages of 55 and 80 years, with a median age of 64 years at diagnosis and men are affected twice as frequently as women (4).

Metastases have been observed in 35-40% of patients, with 25-30% of RCC patients presenting with metastatic disease at initial diagnosis (5,6). These metastases are common in the adrenal gland, bone, brain, liver, lung (Table 1). Metastases in general are uncommon in the foot and ankle accounting for fewer than 3% of all osseous metastases (7,8). Osseous metastases occur in 30-45% of patients with RCC (3,9,10), with 0.1% occurring in the hands or feet (9,11-13). In general, metastatic RCC occurs within 3.0 ± 5.4 years from initial discovery and treatment (6). Upon removing an individual RCC tumor, 20-40% will reoccur (14). RCC is the fourth most common cancer to metastasize to the bone following lung, breast, and prostate cancer (10). Acrometastasis to the foot in particular, is predictably accomplished through hematogenous spread (13). Bone metastases are known to be associated with a more aggressive type of disease, and become more common in advanced stages of RCC, impacting quality of life by leading to skeletal related-events (4,10,12). The symptoms include pain, palpable mass, enlarging digit, mechanical dysfunction, pathologic fractures, spinal cord compression, and sequelae of hypercalcemia (10,13).

Treatment options for metastatic RCC (mRCC) include radiation therapy, chemotherapy, immunotherapy, embolization techniques, and bisphosphonates while up to one-third of patients receive orthopedic surgery (4,9-11,13,15). Surgical options include local curetting and tumor excision, which has a local recurrence between 20-40% (14). Amputation is a cancer palliative option in select patients (13). Surgery is currently the principle form of treatment of mRCC in association with radiotherapy, which by itself is palliative (9,10,13). RCC is often resistant to radiation therapy and chemotherapy further underscoring the value of surgery (15).

Survival depends on staging and to a lesser extent, tumor grade. Approximately 50% of patients presenting with metastasis within the first year die; the 5-year survival rate is only 10%. Patients presenting with a solitary bone metastasis from RCC are reported to have a 5-year survival rate between 35% and 60%, compared to poor survival in patients with multiple osseous metastases (15).

Radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) are often employed to determine tumor size and extent (15). MRI is preferred in evaluating tumor metastases in the hand and foot offering better delineation of intra- and extra-osseous tumor extent (13). Needle biopsy is the preferred method of diagnosis whereas open biopsy may result in increased risk of pathologic fracture and tumor contamination of adjacent normal tissue (13,15) (Table 1).

In this case report, a 60-year-old man was diagnosed with renal cell carcinoma that metastasized to his bladder, lung, and eventually to his right medial cuneiform. The foot metastasis occurred after a traumatic event to his

Table 1. Cancer type and main sites of metastasis (7).

Cancer Type	Main sites of metastasis
Bladder	Bone, liver, lung
Breast	Bone, brain, liver, lung
Colorectal	Liver, lung, peritoneum
Kidney	Adrenal gland, bone, brain, liver, lung
Lung	Adrenal gland, bone, brain, liver, other lung
Melanoma	Bone, brain, liver, lung, skin/muscle
Ovary	Liver, lung, peritoneum
Pancreas	Liver, lung, peritoneum
Prostate	Adrenal gland, bone, liver, lung
Stomach	Liver, lung, peritoneum

right medial foot. The overall purpose of this article is to highlight this unusual and aggressive treatment for a patient with a recurrent metastatic tumor to the foot.

CASE REPORT

A 60-year-old man presented with micro hematuria and back pain of a 2–year duration. A renal ultrasound and MRI were performed, and demonstrated a mass in the left kidney. The patient underwent a left laparoscopic partial nephrectomy for a tumor measuring 9 cm. The initial tumor stage was 3A. The Fuhrman Grade was 2/4 and analysis of the tumor revealed positive surgical margins, signifying the need for further intervention.

Two months following partial nephrectomy of the left kidney, the patient experienced gross hematuria. Subsequent cystoscopy revealed multifocal papillary lesions consistent with urothelial cell carcinoma. The patient was then scheduled for a transurethral resection of a bladder tumor (TURBT). The pathology was consistent with a high grade carcinoma in situ, stage pTa versus T1 (16).

Two months after this procedure a second TURBT was recommended as well as application of Bacillus of Calmette-Guerin (BCG) therapy. The patient refused treatment at that time. A CT chest image 3 months later, showed pulmonary nodules, which were suspicious for metastases. A second TURBT was performed 6 months after the first TURBT, with subsequent pathology demonstrating recurrent tumor and muscular invasion. The patient then underwent 6 BCG treatments and was surveyed by cystoscopy every 3 months. Three years after the initial diagnosis, cystoscopy washings were negative for tumor, however a chest CT scan showed pulmonary nodules increasing in size and number.

Three years after the diagnosis of RCC, the patient sustained a twisting injury of his right foot resulting in constant pain that was exacerbated by activity. In addition, the patient had increasing swelling over the medial aspect of his foot for approximately 1 year. For the pain and discomfort, he underwent cortisone injections and custom orthotics without relief of his symptoms.

Anterior-posterior, lateral, and oblique radiographs of the right foot were obtained demonstrating a destructive radiolucent lesion with poorly defined margins involving the right medial cuneiform (Figure 1). A subsequent MRI showed a 2.9-cm hyperintense signal abnormality on T2 pulse weighted sequences (Figure 2). On physical examination, a mass was palpable and was pulsatile on the medial arch of the right foot. Surgery was discussed and planned for excision of the medial cuneiform, fusion of the first metatarsal and navicular, bicortical bone allograft, and splint placement to the right foot (Figure 2).

First Surgical Procedure

Under general anesthesia, a 10-cm longitudinal incision was made over the medial aspect of the mid-foot. The lesion was excised intralesionally and the bone margins were burred. The tissue was submitted for histopathology and revealed adenocarcinoma with clear cell features consistent with RCC. The medial cuneiform, proximal bone and cartilage of the first metatarsal, and portion of the navicular that articulates with the first cuneiform were removed. A fibular bicortical allograft was placed in the void, and good fit was confirmed

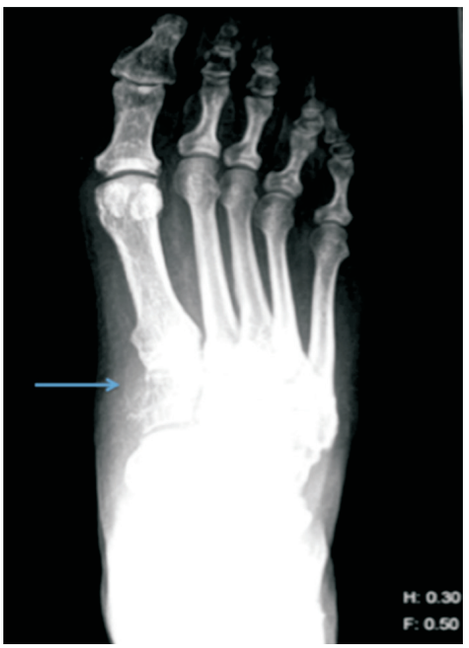

Figure 1. Lytic lesion (blue arrow) located about the right medial cuneiform medially. Metastatic renal cell carcinoma to the foot.

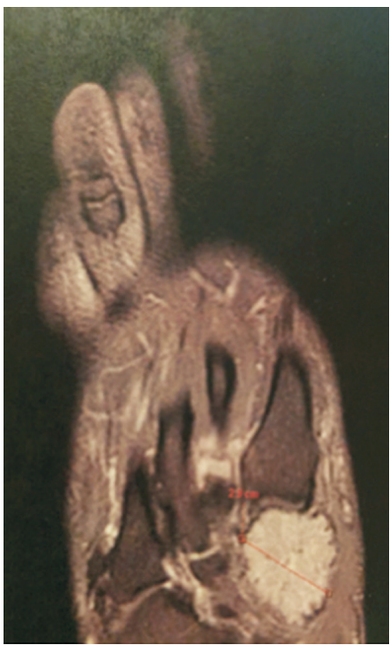

Figure 2. Note the high signal intensity about the medial cuneiform. The right foot tumor measures 2.9cm (red line).

with fluoroscopy. Fixation was achieved with a 7-hole plate and screws (Figure 3). Micronized cortical bone allograft was used to fill the voids between the bicortical allograft. The patient was then admitted to the hospital for pain control and later released with a CAM walker and instructed to be nonweight-bearing on the affected limb (Figure 3).

The patient's postoperative course was uncomplicated and by 10 weeks, the surgical site was completely healed and he was ambulating without assistive devices and had no pain or discomfort. The radiographs taken at this visit showed adequate alignment and healing to the fusion and graft site. Thirteen months after excision of the medial cuneiform, radiographs demonstrated a recurrent radiolucent lesion in the surgical area (Figure 4).

Second Surgical Procedure

The patient then underwent re-excision of the tumor through the same incision. Extended curetting and burring was performed. Liquid nitrogen was then applied to the defect, with 2 freeze-thaw cycles employed. A structural graft was then placed over the medial midfoot, and micronized graft was placed (Figure 4).

His immediate postoperative course was uncomplicated, but after 2 months, he presented to the emergency room for initial onset of redness and swelling for the past 2 days. The patient was admitted to the hospital, cultures were obtained, and antibiotics were started. He then underwent radical intraoperative debridement. Although his postoperative course was uncomplicated he died 2.5 months later from

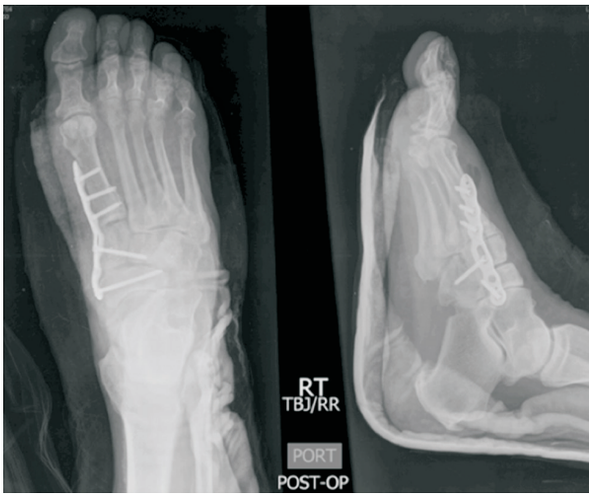

Figure 3. Nonweight-bearing postoperative radiographs (Anteroposterior on the left, Lateral on the right) of the foot directly following the patient's first RCC metastasis to the medial cuneiform excision, fusion and allograft placement. Note the hardware in adequate alignment.

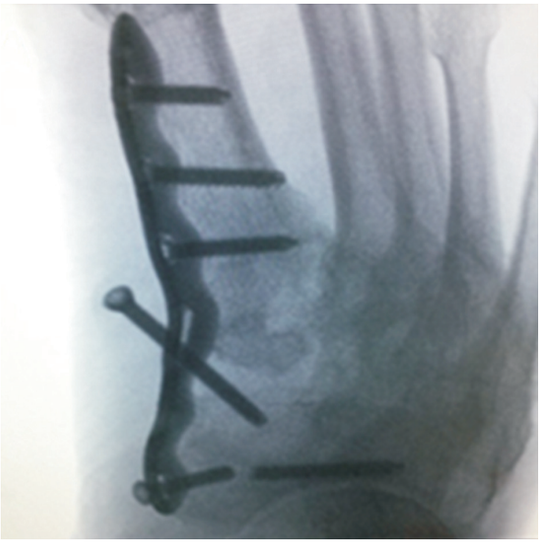

Figure 4A. Preoperative radiograph prior to hardware removal and placement in procedure II.

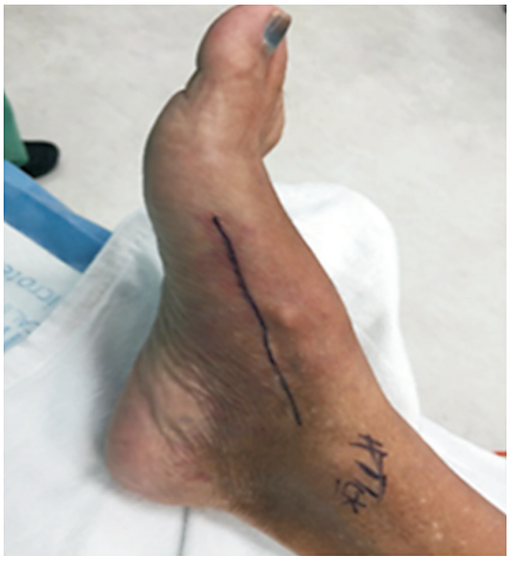

Figure 4B. Incision planning using marking pen.

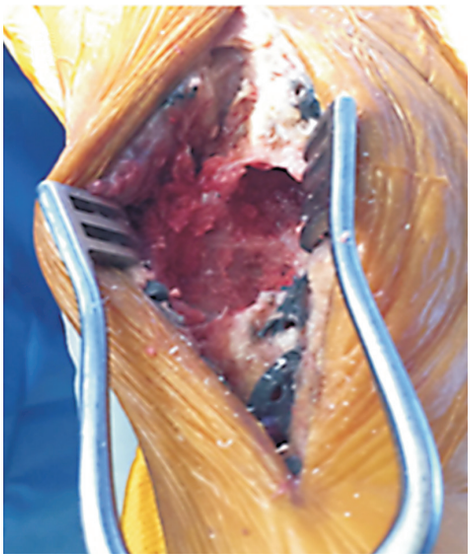

Figure 4C. Curettage of tumor area; medial cuneiform void noted.

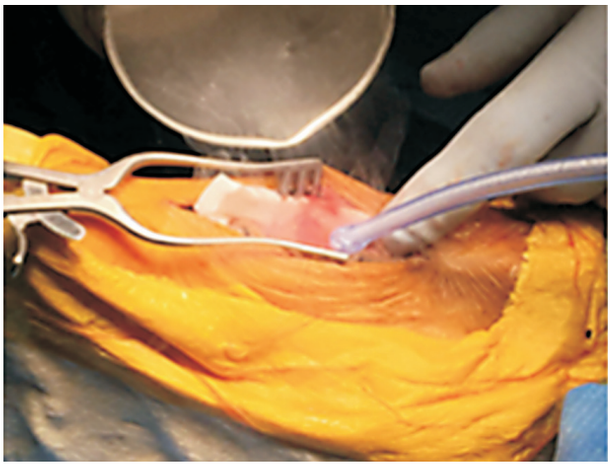

Figure 4D. Liquid nitrogen used to abolish tumor cells from floor of post tumor region.

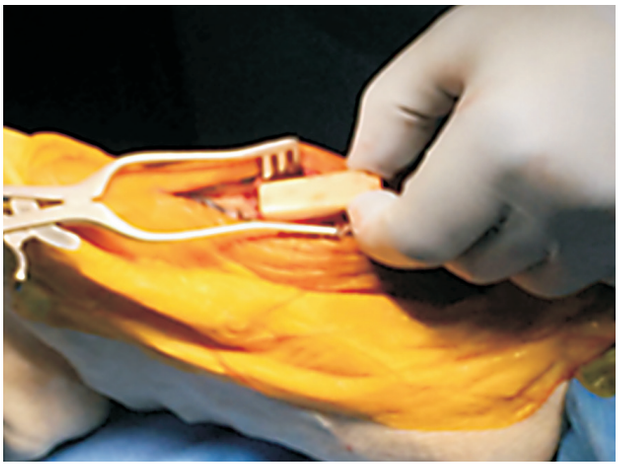

Figure 4E. Fibular bicortical bone allograft placement into defect area.

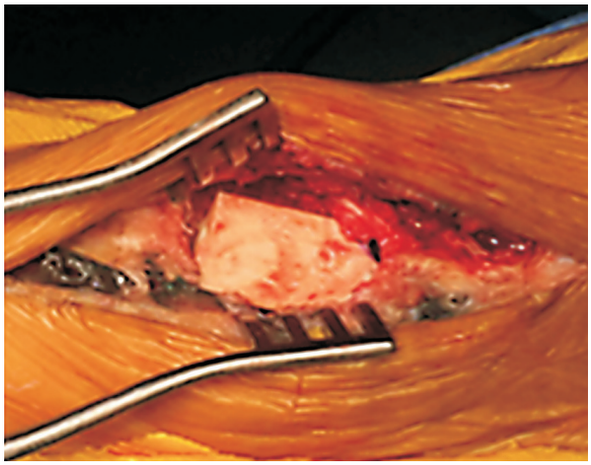

Figure 4F. Proper alignment of fibular bicortical bone allograft.

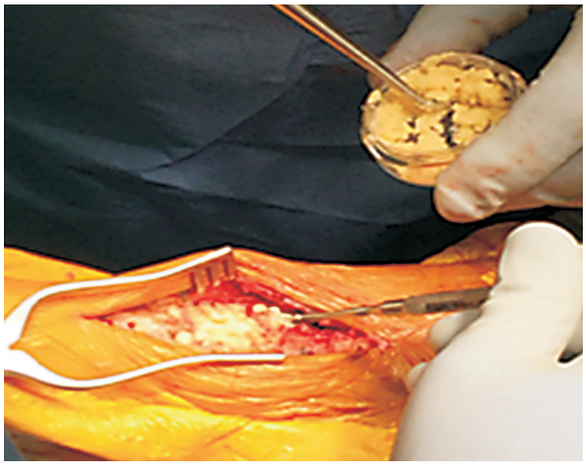

Figure 4G. Bone chips with stem cells placed over allograft.

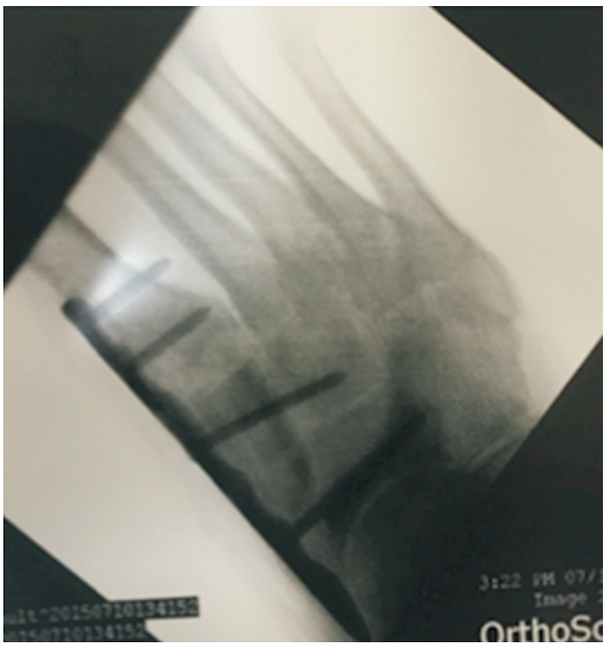

Figure 4H. Postoperative radiograph showing correct placement of 7 hole Stryker place and screws for fixation.

complications of systemic metastatic disease. A bone scan taken 2 months before his death, showed multiple areas of increased uptake of varying size throughout his shoulders, spine, lungs, bladder, hips, right greater trochanter of his femur, and foot (Figure 5).

DISCUSSION

In a similar case report, by Perdona et al, a 72-year-old man presented with a painful and progressively enlarging right hallux lesion. The symptoms began after trauma to his affected digit. A biopsy sample showed histologic changes that were consistent with a carcinoma with prominent nucleoli and vacuolated cytoplasm. Immunohistochemical staining for epithelial membrane antigen and cytokeratin were positive and consistent with mRCC. The patient received a radical nephrectomy and amputation of the affected right hallux simultaneously, followed by immunotherapy. After 12 months the patient was free of disease (11).

Another similar case reported by Yadav et al, described a 55-year-old man who reported pain and swelling of his right

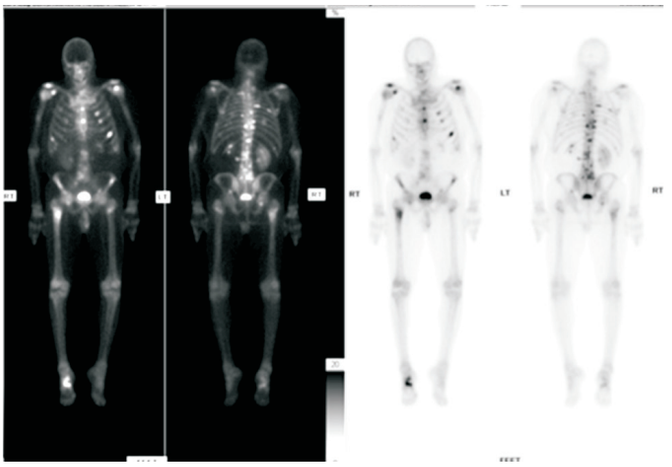

Figure 5. Hot spot on isotope bone scan demonstrates areas of renal cell carcinoma metastasis 2 months prior to death; with the right foot hot spot evident after having 3 procedures to maintain normal ambulation and tumor growth removal.

foot. The patient had no other systemic or musculoskeletal complaints aside from the foot pain and swelling representing the first and only clinical manifestation of disease. Unlike the other cases, there was no antecedent trauma to the affected foot (13).

Although metastases to the foot are rare, RCC should be considered in the differential diagnosis for older patients presenting with destructive lesions in the bones of the foot. It is interesting to note concomitant trauma to the foot around the time of diagnosis of this condition but more likely than not, is incidental as suggested by Ewing and his notion of "traumatic determinism" (11,17).

The techniques utilized for the surgical removal of the mRCC tumor to the foot in this case were chosen to best suit the patient's needs of alleviating pain and restoring function. Intralesional curetting was employed to remove all gross disease while liquid nitrogen was used to extend the tumor margin. The structural allograft, in this case, freeze-dried fibula, provided structural support for the medial column supplemented with micronized bone graft and osteoprogenitor cells (Viagraft, Vivex Biomedial) to promote healing. Plate and screw fixation were adequate to stabilize the construct and promote osseous healing. This strategy has been employed by the authors in similar cases to achieve local tumor control, relieve pain and restore independent function.

In conclusion, although this patient had a poor prognosis from the onset of diagnosis, the index procedures were not without complications, including local recurrence and infection; maintaining normal foot function was important in improving his quality of life by allowing him to ambulate independently without assistive devices. It has been reported that the inability to ambulate significantly reduces patient quality of life (18). Overall, this was an attempt to salvage the patient's right foot, reduce his pain, and restore ambulation. Osseous metastases from RCC represent a challenging clinical problem and requires a multidisciplinary approach for overall patient management and careful surgical planning.

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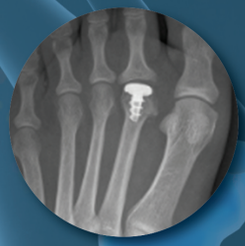

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