

SHORT COMMUNICATION**Foot Metastasis: Review of 38 Cases**Mehrdad Bahrabadi, MD¹; Babak Otoukesh, MD¹; Mehdi Moghtadaei, MD¹; Shayan Hoseinzadeh, MD²; Shayan Amiri, MD³*Research performed at Department of Orthopedic Surgery, Iran University of Medical Sciences, Tehran, Iran**Received: 01 July 2020**Accepted: 13 September 2020***Abstract**

Acrometastases are rare and account for approximately 0.1% of metastases. The most common primary cancer site is the lung, followed by colorectal and genitourinary system.

We searched PubMed (www.pubmed.com), Google scholar (www.scholar.google.com), Science Direct (<http://www.sciencedirect.com>), and Springer (<http://link.springer.com>) databases, using a combination of controlled vocabulary and text word terms and reviewed the last 10 years literature in order to describe demographic trends, anatomical distribution, the most common primary sources of malignancy, and survival rates in the reports of foot metastases.

In conclusion 38 cases were included in this review analysis. Lung and genitourinary system were the most frequent primary sites.

Forefoot was involved in 71% of all metastases to foot either alone or in combination with other areas of the foot. Calcaneus was involved in about 23% of patients either alone or in combination with other foot bones.

Level of evidence: IV

Keywords: Neoplasm metastasis, Neoplasms, Second primary, Survival

Introduction

Although bone is eventually involved in at least 20-30% of patients with metastatic cancers, distal metastases to the elbow and the knee (acrometastasis) are very rare (1, 2). Metastases to the feet are even more scarce with a reported rate of almost half to one-third the rate for hand metastases (2). Their incidence is around 0.01 in cancer patients (3, 4). The most common sources of metastasis to foot are lung (>50%), followed by colorectal and genitourinary systems (5). The rare incidence of foot acrometastases is believed to be due to the lack of red marrow in these bones, a further distance from the primary cancer site, and the valveless paravertebral venous plexuses (Batson's plexuses), which allow retrograde tumor cell embolization through the iliofemoral venous system (6).

Depending on the location and spread of the tumor, amputation may be considered. However, the prognosis is poor with a mean survival time of less than 6 months after diagnosis. If the mass is unrespectable, palliative care with radiation therapy, bisphosphonates, and

chemotherapy is recommended.

In the present study, we have reviewed a 10 years literature in order to describe the demographic trends, anatomical distribution, the most common primary sources of malignancy, and survival rates in the reports of foot metastases published between July 2007 and July 2017.

Materials and Methods

A literature search on metastasis to the foot was performed in July 2017 using PubMed (www.pubmed.com), Google scholar (www.scholar.google.com), Science Direct (<http://www.sciencedirect.com>), and Springer (<http://link.springer.com>) databases. The used keywords included "acrometastasis", "tarsal metastasis", "foot metastasis", and "toe metastasis". Using this search, all relevant articles in English were included for analysis (about 123 articles). All relevant non-English articles were also included for analysis if they revealed the primary tumor, the involved bone, and patients' age and gender through their English abstract or a suggestive

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reference/cross-reference (about 15 articles). When available, the search was restricted to the limitations of human, reviews, case reports, case series, and abstracts. A time-range limit was set between July 2007 and July 2017. Furthermore, all the articles' references and cross-references were checked and, if relevant, were included in the study (about 20 articles). Most of the articles were case reports with limited number of patients; however, the article written by Maheshwary et al. reporting 14 patients had the highest number of patients reported (7).

Results

A total of 38 cases from 10 published articles were included in this review analysis. The mean age of the patients was 59.4 ± 17.3 years (range: 3-88 years). There was a male predominance with 63% in this study.

Twenty patients (52.5%) had known primary malignancy at the time of diagnosis of foot metastasis. In 17 patients (44.5%), foot metastasis was the first manifestation of an occult malignancy. One patient had missing data. Lung and genitourinary system were the most frequent primary sites, each was reported in twelve patients (31.5%) [Table 1].

The duration of local symptoms varied from two weeks to one year (mean 3.2 months), and the symptoms were pain, swelling, and erythema, while, there was no pattern for the time of the diagnosis in our study, whereas the interval between diagnosis of the primary tumor and confirmation of foot metastasis ranged between zero to seven years (mean: 25.5 months).

Forefoot was involved in 71% of all foot metastases either alone or in combination with other areas of the foot. Forefoot alone was involved in 63% of all metastasis to foot, while the most common involved bones in this region were metatarsal with the frequency of 31.5% and among them, the 1st metatarsal was the most common bone. The calcaneus bone was involved in about 23% of patients either alone, or in combination with other foot bones [Table 2; 3]. Right and left feet were involved equally, and no bilateral involvement was seen in those patients.

On plain radiographs, the lesions were mainly lytic in 81.6%. Mixed lytic and sclerotic lesion was seen in one patient; two patients had normal radiographs; and two other patients had missing data on radiographs [Table 4].

Metastasis to foot was mostly from sub diaphragmatic sources like liver, kidney, endometrium, colorectal adenocarcinoma, and genitourinary system (58%) as compared to supradiaphragmatic locations (42%) like lung [Table 5].

Table 1. Primary source of metastasis to foot

Site of primary tumor	Percentages
Lung	31
Breast	7
Colon and GI	22
Kidney and GU	31
Other	9

Table 2. Rate of bone involvement in foot metastasis

Site of involvement	Percentages
Calcaneus	5
Calcaneus and foot bones	16
Other tarsal	16
Metatarsal	33
Toes	29
Metatarsal and toes	3

Table 3. Region of foot, which is involved with metastasis

Region of foot involved	Percentages
Hind foot	17
Midfoot	2
Forefoot	63
Hind-mid foot	15
Hind-forefoot	9
Hind-mid foot	2

The sources of metastasis to the foot in those patients were lung (adenocarcinoma in all cases except one case with squamous cell carcinoma) and genitourinary system (like bladder epithelial cell carcinoma, renal cell carcinoma, and hypernephroma) with equal frequencies. GI tumors (such as colorectal adenocarcinoma) were the third most common source of metastasis to foot.

Other metastases were evident in 23 patients (60.5%) at the time of diagnosis of foot metastasis. No other metastasis was seen in 14 patients (39 %) at the time of diagnosis, while one patient had missing data. The survival of 12 patients was not mentioned in the papers; however, the median survival rate for the remaining 26 patients was 5.8 months (minimum: 2 months and maximum: 1 year).

Table 4. The pattern of bone involvement in foot metastasis

Radiographic pattern	Percentages
Lytic	87
Sclerotic	9
Both	4
Normal	10

Table 5. Source of metastasis to foot in relation to diaphragm

Source of metastasis	Percentages
Supra-diaphragmatic	16
Sub-diaphragmatic	22

Discussion

Acrometastases are more common in the hands, than the feet. The presence of red marrow in hand bones and its absence in foot bones may be a reason for the discrepancy observed in the frequency of metastasis to the hands and feet (8). In a review of 41 renal cell carcinoma acrometastases, 27 (66%) involved the hands, 11 (27%) involved the feet, and 3 (7%) involved both (9). Hand metastases are more frequent in dominant hand. The difference between dominant and non-dominant hand acrometastases may be as a result of increased blood flow in the dominant limb (10).

Metastasis in the foot have reported to have a tendency to involve the hind foot. In a review by Zindrick et al. in 1982 evaluating 72 patients with foot metastasis almost half of the metastases to the foot were observed in talus, and a quarter in calcaneus (5). In another study in 1987 by E Libson et al. on 43 cases tarsal lesions were observed in 73% of metastasis to the foot, and the calcaneus was the only bone involved in 27% (2). In our review, forefoot was involved in 71% of all metastases to foot and fore foot alone was involved in 63% of all metastasis to foot. This is in clear contrast to previous studies.

As with previous studies, we also found that metastases to foot are mostly from sub diaphragmatic sources (58%) as compared to supradiaphragmatic locations (42%). Libson et al. reported that due to the incompetent venous drainage in legs, subdiaphragmatic neoplasms tend to metastasize to foot because of the retrograde spread of tumor from vertebral venous plexus toward legs (2). The sources of metastasis to the foot in our review study were from lung and genitourinary system with equal frequency, while GI tumors were the third most common source of metastasis to foot that is likely similar to the study of Hatrap SJ et al. (3).

Steven J Hatrap et al. reported that proximal locations are most common in the feet: 50% in tarsal bone, 45% in calcaneus, 23% in metatarsal, and 17% in phalanx (3, 4).

Early diagnosis of foot metastasis may be difficult (11). The mean time from diagnosis of the primary lesion to presentation of the foot metastases has been reported to be as late as 172 months (mean: 93) with a delay in correct diagnosis up to 24 months (mean: 6.4). The incidence is highest in the seventh and eight decades of life, with males affected twice as often as females (5). Despite their rarity, foot metastases may be important

because they may be the first manifestation of an occult cancer (up to 53%), while the only or first presentation of metastases may mimic other skeletal disease and result in delayed diagnosis and inappropriate management (3, 5). In addition, manifestation of pain prior to the appearance of a radiographic abnormality may signify the imminent appearance of more widespread metastases (3).

Symptoms of foot metastasis include pain or pain and swelling. When confronting these symptoms, more common benign condition such as gout, rheumatoid arthritis, Paget's disease, ligamentous sprains, infections, or osteoarthritis are the probable differentiations (1, 7, 12-15). These symptoms are often misdiagnosed, leading to delayed treatment. Therefore, a highly suspicious lesion requires early management to rule out acrometastases and allowing early treatment so that the patient's survival and quality of life can be enhanced.

The treatment of foot metastasis is determined by the overall extent of the malignant disease and the severity of the local process and includes biopsy, digital amputation, below knee amputation, above knee amputation, radiation therapy, and in some cases because of advancement of the disease no treatment has been done (3).

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