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Research paper

Clinical characteristics and risk factors analysis of lung metastasis from benign giant cell tumor of bone☆

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A B S T R A C T

Pulmonary metastasis of benign giant cell tumor of bone is very rare, and its biological behavior is difficult to predict. In the present study, we analyzed the clinical characteristics of and related risk factors for pulmonary metastasis from this tumor. Forty-six patients with lung metastasis were analyzed. In total, 60.9% of the primary tumors were located around the knee joint. The Campanacci stage of all tumors was stage 3. Surgery of the primary tumor included curettage in 37 patients, resection in 8, and amputation in 1. Local recurrence after the primary surgery occurred in 34 patients. The recurrence rate, Campanacci stage, and surgical method were significant risk factors for lung metastasis. The median postoperative metastasis times in the lower limbs, upper limbs, and axial skeleton were 20.1, 7.9, and 1.4 months, respectively ($p = 0.010$). The median metastasis times in patients with and without recurrence were 13.7 and 43.2 months, respectively ($p = 0.018$). Eighteen patients had unilateral metastasis and 28 had bilateral metastasis. Most lesions ($n = 38$) were located in the peripheral lung. Nineteen patients received treatment, and 12 of them underwent tumor resection. The 5-year overall survival rate was 94.4%. This study showed that local recurrence, a high Campanacci stage, and curettage were possible high-risk factors for pulmonary metastasis. The primary lesion site and local recurrence may be related to the metastasis time. The survival rate of patients with pulmonary metastasis was high.

1. Introduction

Giant cell tumor of bone (GCTB) is an invasive benign bone tumor consisting of proliferative mononuclear cells and osteoclast-like multinucleated giant cells. It has the tendency to relapse. GCTB accounts for 4–5% of primary bone tumors. The incidence of lung metastasis in patients with GCTB is about 1–9% [1–5]. Viswanathan et al. [3] reported that two mechanisms are related to lung metastasis: a self-limiting process of transformation and vascular transfer. Because both lung tissue and GCTB tissue have a rich blood supply, the tumor cells may invade the interstitium and destroy the vessel walls, facilitating hematogenous metastasis to the lung.

Studies and reports of lung metastasis of GCTB are rare because of the low incidence of lung metastasis. The biological behavior and clinical features of GCTB are difficult to predict [6,7]. Some researchers have attempted to analyze related clinical factors of lung metastasis, such as age, sex, primary tumor site, tumor stage, primary tumor treatment, and recurrence. However, the numbers of patients were small, and different results were reported among the studies. High-level evidence from large-sample data is lacking. Therefore, the present study focused on a large number of patients with lung metastasis in a single center. The purpose was to elucidate the clinical characteristics and risk factors for pulmonary metastasis of GCTB.

2. Materials and methods

2.1. General characteristics

This study was a retrospective clinical case analysis. All cases were from the clinical database of our center. The inclusion criteria were a pathological diagnosis of benign GCTB, lung metastasis as confirmed by pathology or computed tomography (CT) (lesion diameter of > 1 cm and dynamically increasing), and no evidence of any other tumor. According to the above conditions, 46 patients were enrolled in this study from January 1983 to February 2014 (Table 1). The following possible risk variables were analyzed: sex and age of patient, tumor location, Campanacci stage, treatment of the primary tumor [8], and number of local recurrences. The following metastatic characteristics were reviewed: duration of time from initial treatment of primary lesion to diagnosis of metastasis and number and location of metastases.

☆ This work was performed at the department of Orthopedic Oncology Surgery, Beijing Ji Shui Tan Hospital, Peking University, Beijing, People's Republic of China.

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Table 1
Profile of patients with lung metastasis of GCTB.

Case	Gender	Age	Location of Primary lesion	Campanacci stage	Treatment of Primary lesion	No. of Local Recurrences	Interval from Treatment of Primary lesion to Diagnosis of Metastasis (Month)	No. of metastasis	Location of Metastasis
1	Female	22	Distal femur	3	Curettage and cementation	1	16.7	2	Bilateral lung
2	Male	20	Distal radial	3	Curettage and grafting	2	0	> 10	Bilateral lung
3	Male	30	Proximal tibia	3	Amputation	0	0	1	Unilateral lung
4	Female	17	Proximal humerus	3	Curettage and grafting	1	51.1	1	Unilateral lung
5	Male	24	Proximal tibia	3	Curettage and cementation	2	35.5	2	Bilateral lung
6	Male	29	Distal femur	3	Curettage and cementation	2	42.4	> 10	Bilateral lung
7	Female	37	Proximal femur	3	Resection	2	334.5	1	Unilateral lung
8	Male	48	Proximal tibia	3	Curettage and grafting	2	91.6	1	Unilateral lung
9	Male	44	Proximal tibia	3	Curettage and cementation	2	65.7	4	Bilateral lung
10	Male	30	Distal femur	3	Curettage and cementation	0	21	4	Bilateral lung
11	Female	24	Distal femur	3	Curettage and grafting	2	51.8	5	Bilateral lung
12	Female	40	Proximal femur	3	Curettage and grafting	1	13.7	1	Unilateral lung
13	Male	38	Distal radius	3	Curettage and cementation	1	6	1	Unilateral lung
14	Female	58	Ischium	3	Resection	0	0	2	Bilateral lung
15	Female	31	Distal femur	3	Resection	0	3.1	1	
16	Female	29	Distal femur	3	Curettage and cementation	1	89.5	> 10	Bilateral lung
17	Male	27	Proximal tibia	3	Curettage and cementation	1	18	9	Bilateral lung
18	Male	21	Distal femur	3	Curettage and cementation	1	6.1	2	Unilateral lung
19	Female	53	Proximal tibia	3	Curettage and grafting	1	107.8	1	Unilateral lung
20	Male	42	Proximal femur	3	Curettage and cementation	0	0	2	Unilateral lung
21	Female	34	Distal radius	3	Curettage and grafting	1	7.9	> 10	Bilateral lung
22	Male	23	Distal femur	3	Curettage and grafting	1	32	1	Unilateral lung
23	Male	39	Distal femur	3	Curettage and cementation	1	0	2	Unilateral lung
24	Female	30	T12 vertebra	3	Curettage and cementation	0	0	> 10	Bilateral lung
25	Male	26	Proximal femur	3	Resection	1	3.2	> 10	Bilateral lung
26	Female	61	Proximal tibia	3	Curettage and grafting	1	20.1	1	Unilateral lung
27	Male	32	Proximal humerus	3	Resection	2	154.9	1	Unilateral lung
28	Female	28	Distal femur	3	Curettage and grafting	0	0	4	Bilateral lung
29	Female	25	Distal radius	3	Curettage and cementation	2	0	> 10	Bilateral lung
30	Male	28	Distal radius	3	Curettage and grafting	2	13.7	> 10	Unilateral lung
31	Female	33	Proximal femur	3	Curettage and grafting	2	21.8	8	Bilateral lung
32	Female	33	Proximal tibia	3	Curettage and grafting	1	105.1	7	Bilateral lung
33	Male	32	Distal femur	3	Curettage and grafting	1	23.3	10	Bilateral lung
34	Male	36	Distal femur	3	Curettage and grafting	1	6	10	Bilateral lung
35	Male	45	Sacrum	3	Curettage alone	1	4.2	1	Unilateral lung
36	Female	58	Distal femur	3	Resection	0	12.2	6	Bilateral lung
37	Male	25	Proximal femur	3	Resection	0	48	3	Bilateral lung
38	Male	25	Distal femur	3	Curettage and grafting	1	7	3	Bilateral lung
39	Male	29	Proximal humerus	3	Curettage and grafting	0	15	> 10	Bilateral lung
40	Male	21	Proximal tibia	3	Curettage and grafting	0	0	> 10	Bilateral lung
41	Female	19	Proximal femur	3	Curettage and cementation	0	26.8	2	Unilateral lung
42	Male	38	Proximal tibia	3	Curettage and grafting	1	69.9	2	Unilateral lung
43	Male	33	Distal femur	3	Curettage and cementation	1	0	> 10	Bilateral lung
44	Male	26	Distal femur	3	Curettage and grafting	1	17.2	> 10	Bilateral lung
45	Female	32	Proximal tibia	3	Curettage and cementation	1	24	> 10	Bilateral lung
46	Male	26	Distal femur	3	Resection	1	8	> 10	Bilateral lung