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Comprehensive Analysis of Osteosarcoma Referral Letters: Insights into Medical Collaboration and Diagnostic Practices at Our Hospital

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Abstract

Background/Aim: This study aimed to assess the status of medical collaboration between our hospital and affiliated institutions based on referral letters for patients with osteosarcoma.

Patients and Methods: A single-center retrospective analysis of osteosarcoma referrals was conducted between September 1, 2012, and March 31, 2023. Fourteen patients were included (eight males, six females; mean age=28 years, range=8-74 years) each with a pathologically confirmed diagnosis of a malignant soft-tissue tumor and available referral documentation from previous physicians. Survey parameters included type of referral hospital, geographical area, and medical department of the referral hospital, as well as imaging and blood tests conducted and the corresponding findings.

Results: Patients were referred from various medical institutions: Six from general hospitals, six from clinics, one from a university hospital, and one from a clinic with beds. Most patients (n=10) were from southern Osaka. Among the referrals, 11 patients were referred to orthopedics, two to surgery, and one to pediatrics. Analysis of imaging studies showed eight patients with only radiographs; three patients with radiographs, computed tomography (CT), and magnetic resonance imaging (MRI); one patient with only CT; one patient with only MRI; and one patient with both radiographs and CT. Imaging findings included indications of suspected malignancy in 12 patients and suspected bone tumors in two. Blood tests were conducted in two patients, namely alkaline phosphatase and C-reactive protein, and alkaline phosphatase and lactate dehydrogenase, respectively. Blood tests were not performed in the remaining 12 patients.

Conclusion: Referrals for patients with osteosarcoma at our facility and related facilities were well documented, ensuring informative content and adequate medical coordination.

Keywords: Collaboration, medical coordination, osteosarcoma, patient referrals.

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Table I. *Patient demographics, specialist referrals, and details of diagnostic processes.*

			Referring institution				Imaging			
Sex	Age, years	Site	Source	Region	Specialty	Time to medical examination	Blood sampling	Type	Findings	Symptom description
Male	13	Femur	University hospital	Wakayama	Pediatrics	3 Months	ALP/ LDH	Radiograph, CT, MRI	Malignant	Yes
Female	63	Pelvis	General hospital	Osaka	Orthopedics	1 Month	None	Radiograph, CT	Malignant	No
Male	15	Tibia	Clinic	Osaka	Orthopedics	1 Month	None	Radiograph	Malignant	Yes
Male	8	Humerus	Clinic with beds	Osaka	Orthopedics	2 Months	None	Radiograph	Malignant	Yes
Male	51	Pelvis	General hospital	Osaka	Orthopedics	N/A	None	Radiograph, CT, MRI	Malignant	Yes
Male	14	Femur	General hospital	Osaka	Surgery	1 Month	None	Radiograph	Malignant	Yes
Female	12	Femur	Surgical hospital	Osaka	Surgery	1 Week	None	Radiograph	Tumor	Yes
Female	15	Femur	General hospital	Okinawa	Orthopedics	Day 0	None	Radiograph	Tumor	Yes
Male	51	Humerus	Clinic	Wakayama	Orthopedics	1 Month	None	Radiograph	Malignant	Yes
Male	74	Radius	Clinic	Osaka	Orthopedics	N/A	None	Radiograph	Malignant	Yes
Female	31	Tibia	Clinic	Osaka	Orthopedics	3 Months	None	Radiograph	Tumor	Yes
Male	38	Pelvis	General hospital	Osaka	Orthopedics	2 Weeks	None	CT	Malignant	Yes
Female	27	Pelvis	General hospital	Osaka	Orthopedics	N/A	None	MRI	Malignant	Yes
Female	18	Tibia	Clinic	Wakayama	Orthopedics	3 Months	ALP/ CRP	Radiograph, CT, MRI	Malignant	Yes

ALP: Alkaline phosphatase; CRP: C-reactive protein; CT: computed tomography; LDH: lactate dehydrogenase; MRI: magnetic resonance imaging; N/A: not applicable.

Introduction

Referral forms are crucial for the sharing of patient information (1). Osteosarcoma is a rare type of cancer that requires referral to a specialist, with appropriate medical coordination (2, 3). To our knowledge, no comprehensive studies detailing the contents of referral letters for patients with osteosarcoma have been conducted. This study aimed to analyze the referral letters received at the Orthopedic Department of our hospital for patients with osteosarcoma, and to assess the current status of medical collaboration between our hospital and affiliated institutions.

Patients and Methods

This study was a single-center retrospective analysis. We reviewed the referrals of patients with osteosarcoma that were received at our Orthopedic Department between September 1, 2012, and March 31, 2023. The inclusion criteria were patients with a pathologically confirmed diagnosis of a malignant soft-tissue tumor and available referral documentation from a previous physician. The study included 14 patients, comprising eight males and six females, with a mean age of 28 years (range=8-74 years).

The survey parameters included the type and geographical area of the referring hospital, the referring medical department, types of imaging tests conducted, whether imaging findings were reported and the corresponding details, and whether blood tests were conducted and the corresponding findings.

Results

Table I shows the details of the included patients. Patients were referred from the following medical institutions: six from general hospitals, six from clinics, one from a university hospital, and one from a clinic with beds (Figure 1A). Ten patients were from southern Osaka, three from Wakayama Prefecture, and one from Okinawa Prefecture

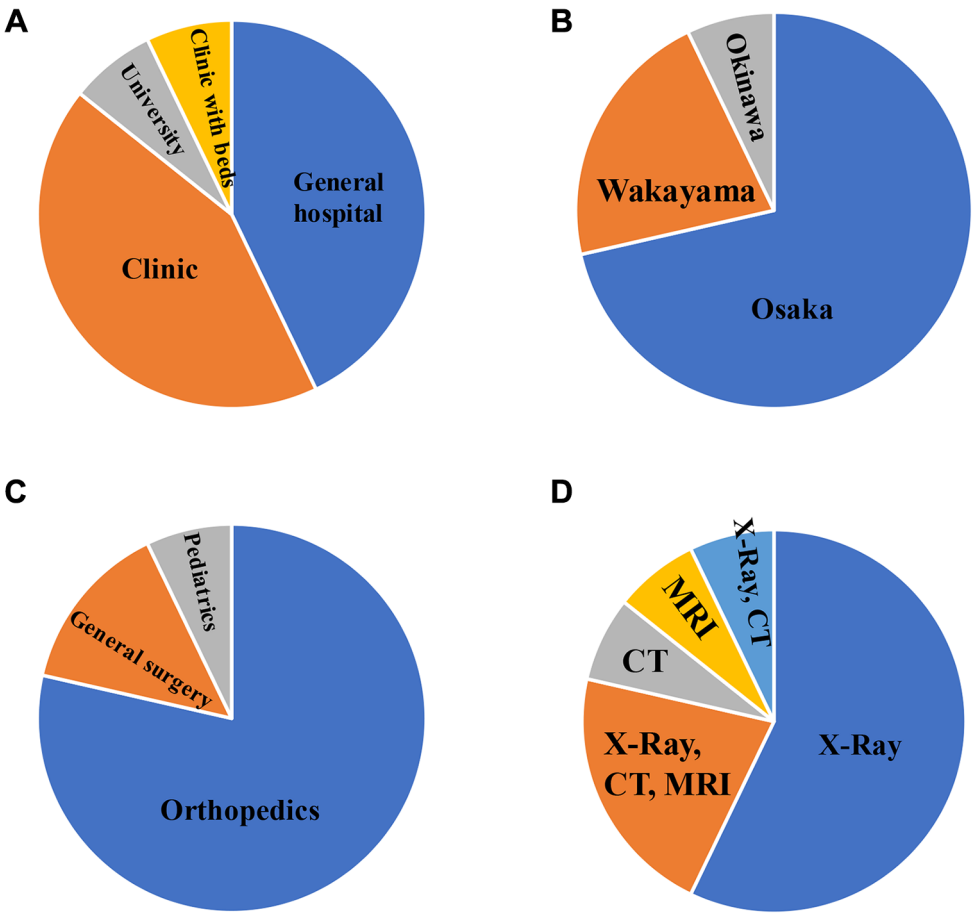

Figure 1. *Characteristics of osteosarcoma referrals: Referring institutions, geographical distribution, medical departments, and imaging studies. A: Pie chart depicting the medical institutions from which referrals were made. The most frequent sources were general hospitals (six patients), followed by clinics (six patients), university hospitals (one patient), and bedside clinics (on patient). B: Pie chart depicting the regions of the referral sources. Most referrals originated from southern Osaka Prefecture (10 patients), followed by Wakayama Prefecture (three patients) and Okinawa (one patient). C: Pie chart depicting the departments from which patients were referred. The most frequent departments were orthopedic (11 patients), followed by surgical (two patients) and pediatric (one patient). D: Pie chart showing the types of imaging studies performed. In descending order of frequency, these were radiographs only (eight patients), radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) (three patients), CT only (one patient), MRI only (one patient), and radiograph and CT (one patient).*

(Figure 1B). Among the referrals, 11 patients were referred to orthopedics, two to surgery, and one to pediatrics (Figure 1C).

The imaging studies performed were as follows: eight patients underwent only radiography; three patients underwent radiography, computed tomography (CT), and magnetic resonance imaging (MRI); one patient underwent only CT; one patient underwent only MRI; and one patient underwent both radiography and CT (Figure 1D).

The interval between symptom awareness and consultation was less than 1 month for seven patients and 2 to 3 months for four patients. The remaining three patients did not specify when they first noticed their symptoms (Figure 2A).

The imaging findings included indications of suspected malignancy, such as periosteal reaction, in 12 patients and suspected bone tumor in two patients (Figure 2B). Blood tests were conducted in two patients, namely alkaline

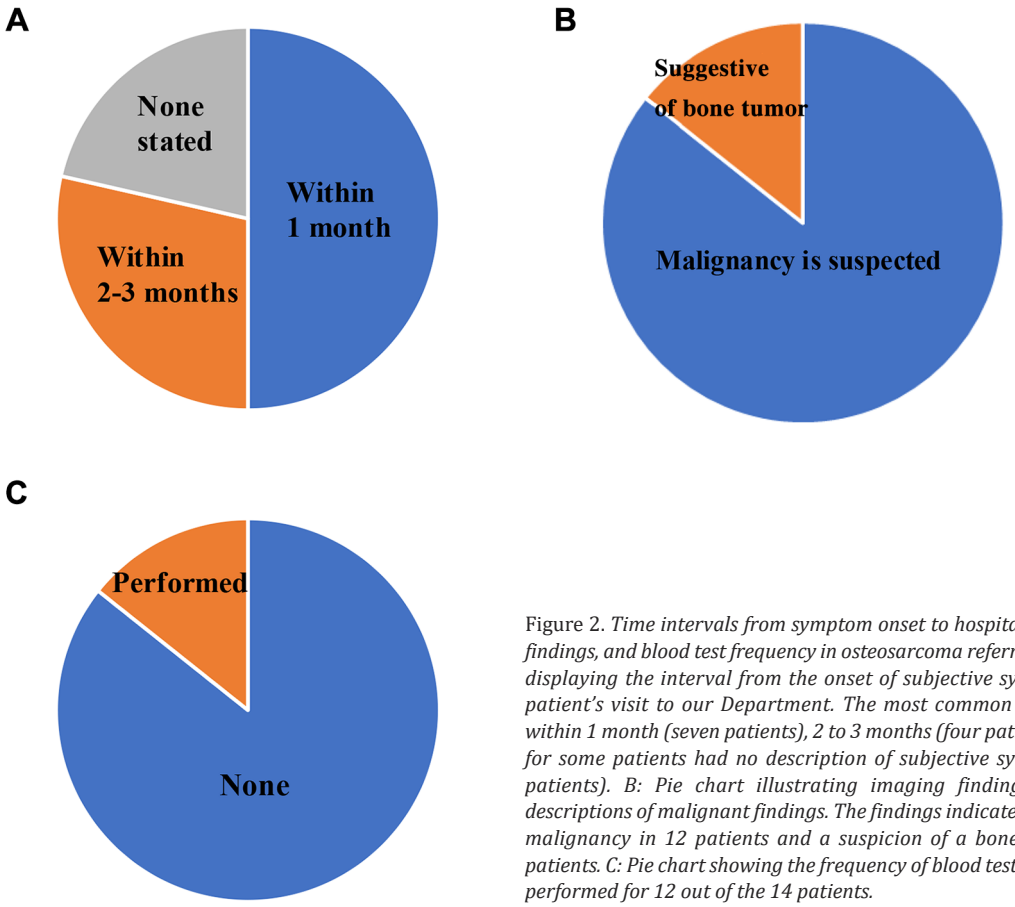

Figure 2. *Time intervals from symptom onset to hospital visit, imaging findings, and blood test frequency in osteosarcoma referrals. A: Pie chart displaying the interval from the onset of subjective symptoms to the patient's visit to our Department. The most common intervals were within 1 month (seven patients), 2 to 3 months (four patients); referrals for some patients had no description of subjective symptoms (three patients). B: Pie chart illustrating imaging findings, specifically, descriptions of malignant findings. The findings indicated a suspicion of malignancy in 12 patients and a suspicion of a bone tumor in two patients. C: Pie chart showing the frequency of blood tests. No tests were performed for 12 out of the 14 patients.*

phosphatase and C-reactive protein, and alkaline phosphatase and lactate dehydrogenase, respectively. Blood tests were not performed for the remaining 12 patients (Figure 2C).

Discussion

Effective management of malignant bone and soft-tissue tumors requires adequate knowledge, specialized training, a multidisciplinary team, and extensive experience (4). To prevent improper management, current clinical practice guidelines recommend that patients with malignant bone and soft-tissue tumors be referred to specialized institutions (5, 6). The annual incidence of osteosarcoma in Japan is relatively low (approximately 200 patients) (4). Therefore, non-specialists have limited exposure to patients with osteosarcoma, only encountering approximately two such patients throughout their careers (7). This limited exposure may impact the ability of clinicians to interpret symptoms and diagnostic findings related to osteosarcoma and make the appropriate referrals to specialists.

As of March 2022, only 199 (0.8%) out of 25,769 orthopedic surgeons in Japan were registered as orthopedic oncologists (4). In general, orthopedic surgeons are more mindful of tumor size than non-orthopedic surgeons, indicating that the Japanese Orthopaedic Association clinical practice guidelines on the management of soft-tissue tumors may be more commonly followed by orthopedic surgeons (4). Family physicians and pediatricians are often the first

clinicians to encounter patients with osteosarcoma (8). Ideally, physicians across all specialties and departments should be familiar with the practice guidelines for managing bone and soft-tissue tumors. In this study, both orthopedic and non-orthopedic surgeons adhered to the noted referral guidelines.

In a study to analyze the prognostic impact of diagnostic delay in osteosarcoma in adults in a Mexican population at a specialized sarcoma center, the median time from the onset of osteosarcoma symptoms to diagnosis was 6 months (range=2-36 months) (9). An incorrect diagnosis can lead to inappropriate resection (10, 11). A delayed diagnosis is associated with a poor prognosis (9) and can result in litigation (12). The present study revealed no such delays in referrals for our patients with osteosarcoma. Additionally, the patients included in the current study were scheduled for and underwent surgery as soon as possible after referral.

According to the 2022 Guidelines for Malignant Bone Tumors, standard radiography is recommended as the primary diagnostic tool for patients with suspected osteosarcoma (13). CT, MRI, and blood tests are considered adjunct diagnostic methods. In the present study, the initial examinations were generally of high quality.

This retrospective single-center study on osteosarcoma referrals has notable limitations, primarily its small sample size (14 patients), narrow geographical focus (mostly southern Osaka), and retrospective design. The research lacks comprehensive outcome data, comparative analysis, and detailed insights into multidisciplinary collaboration. While providing preliminary insights into referral patterns, the study's restricted scope necessitates further large-scale, multi-institutional research to draw definitive conclusions about osteosarcoma referral practices.

In conclusion, the study of osteosarcoma referrals at our facility revealed generally well-documented practices and adequate medical coordination. However, several areas for improvement were identified, including standardizing diagnostic procedures, expanding blood testing, enhancing documentation of symptom onset, promoting a multidisciplinary approach, and addressing geographical disparities in referrals. Recommendations for practice improvement include developing a standardized referral checklist, implementing training sessions for non-specialists, establishing a fast-track referral system, creating a regional specialist network, and conducting regular audits of referral practices. These measures aim to enhance early detection, improve patient outcomes, and foster more efficient medical collaboration in osteosarcoma management.

Conflicts of Interest

The Authors declare no conflicts of interest in relation to this study.

Authors' Contributions

This study was designed by K.H. and S.N. The data acquisition was performed by K.H. S.N., and K.G. The data were analyzed by K.H. and S.N., and the results were critically examined by all Authors. K.H. had a primary role in preparing the manuscript, which was edited by S.N. and K.G. All Authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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