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Treatment of Pathologic Fracture of Humerus with Internal Fixation, Abrasion of the Lytic Lesion and Cement Infusion; A Case Report and Literature Review

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Abstract

Introduction: The skeleton is the most common target of metastatic disease, after lungs and liver. Humerus is the third most common location for a bone metastasis. Pathologic fractures occur as a response to the compromised physiology of the bones, which has as a result poor mechanical properties due to the underlying lesion.

Methods and Materials: A 59year-old woman with diagnosed and under treatment lung cancer arrived at the outpatient orthopaedic clinic due to chronic pain (three weeks) and inability to lift her right arm. The onset of pain was gradual. Radiological tests showed a fracture in the proximal third of the humerus and a lytic lesion.

Results: The patient was treated with internal fixation with a locking plate, broad abrasion and ablation of the lytic lesion and cement infusion. The patient was mobilized without limitations, other than avoidance of loading, post-operatively.

Conclusion: Pathological fractures are a common complication of bone metastases. Life expectancy in patients with bone metastases has been extended due to the progress in chemotherapy, radiotherapy, and other oncological therapies. At pathological fractures of the humeral shaft, the abrasion of the lytic lesion and the infusion of cement, after internal fixation, creates a more stable fixation of the fracture and gives the patient a better quality of life being able to use the arm. According to current bibliography, the use of PMMA limits the spread of cancer cells.

Keywords: Pathologic Fracture, Internal Fixation, Cement Infusion

Abbreviations

IM intramedullary, PMMA polymethylmethacrylate

Introduction

An estimated 1.9 million people was diagnosed with cancer in 2022. More than half of these diagnoses will involve cancers that metastasize to bone, the most common being breast, prostate, lung, renal, and thyroid carcinomas [1]. In general, after the lungs and liver, the skeleton is the most common target for metastatic disease. The spine, pelvis, proximal femur and proximal humerus are the most frequent sites for metastasis [2]. Pathological fractures are a growing concern in the field of musculoskeletal oncology. Their incidence is increasing, primarily due to improved diagnostic and therapeutic methods leading to increased survival. Pathological fractures due to bone metastases in the long bones are most commonly located in the femur, tibia and humerus [3,4]. The most common types of primary focus are lung cancer and renal cell cancer, often without manifestation from the primary focus [5,6].

Pathologic fractures occur in response to altered bone physiology, resulting in compromised mechanical properties owing to an underlying lesion. The root cause can be either benign or malignant, primary or secondary. These entities require different treatments, and the consequences of a missed diagnosis can be devastating; therefore, proper evaluation of the lesion is essential before surgery. Although the differential diagnosis includes bone sarcomas, tumor-like conditions, metastases, benign bone tumors and lymphoproliferative diseases, the most common cause of pathologic fracture is a metastasis [7,10]. Metastatic disease to the shoulder girdle is a challenging problem because of the potential for pain, pathologic fracture, and loss of function of that limb. Management of the bone disease centers around palliation, prevention of further complications and the preservation of residual function.

Case Report

A 59 year-old woman with diagnosed and under treatment lung cancer arrived at the outpatient orthopaedic clinic due to chronic

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pain (three weeks) and inability to lift her right arm. The onset of pain was gradual. The radiological tests showed a fracture in the proximal 1/3 of the humerus and a lytic lesion. The patient was treated with internal fixation with a locking plate, broad abrasion and ablation of the lytic lesion, cement infusion and placement of dried bone chips. The aim of injecting the cement inside the humeral shaft was, in addition to further stabilizing the reduction, to reduce the possibility of cancer cell spreading and to fill the bone deficit due to the lytic lesion [12]. Quinn et al in their article on the contemporary management of metastatic bone disease suggest that smaller lesions should be treated with internal fixation with plate and polymethylmethacrylate (PMMA) [13]. In another study of 672 operated skeletal metastases, it was found that the en bloc resection of a metastases did not increase the average of life expectancy [14]. Biopsies were taken during the procedure for histopathological examination of material. (Figures 1-13). The patient was mobilized the next daywithout arm loading and had no local recurrence six months after. During the first post-surgical reassessments (week 4, week 8, week 24) the patient had no local spread. But, nine months after the surgery, the patient had a local recurrence with a new lytic lesion on the distal third of the humeral shaft, and also multiple metastatic locations, such as brain, liver and sternum.



Figure 1: Lytic lesion of proximal third of humerus.



Figure 2: Interal fixation before abrasion of lesion (1).



Figure 3: Fluoroscopic check of placement of the plate with C-arm.



Figure 4: Interal fixation before abrasion of lesion (2).

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Figure 5: Interal fixation before abrasion of lesion (3).



Figure 6: Interal fixation before abrasion of lesion (4).



Figure 7: Abrasion of the lytic lesion (1).



Figure 8: Abrasion of the lytic lesion(2).

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Figure 9: Cement infusion.



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Figure 11: Lytic Lesion of Humerus (f).



Figure 10: Internal fixation, abrasion of lytic lesion and cement infusion.



Figure 12: Lytic Lesion of Humerus (p).

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Figure 13: Post operative x-ray: Internal fixation, abrasion of lytic lesion and cement infusion

Discussion

Pathological fractures of the long bones are a common complication of bone metastases. Life expectancy of patients with bone metastases has increased due to advances in chemotherapy, radiotherapy, and other oncological treatments. Appropriate treatment has not yet been standardized, although the literature describes surgical treatment to stabilize the fracture and improve expected life expectancy [15]. Orthopedic cement placement combined with wide abrasion of the bone metastasis has been described as a treatment method [16], but needs further investigation. In addition to internal fixation with locking plate and screws, intramedullary nailing has been described as a treatment for pathological long bone fractures due to bone metastases from advanced cancer [17]. In patients with pathological fractures in skeletal metastases, wide resection is justified for solitary metastasis, "favorable" tumor histotype, good general condition of patient and long free interval from treatment of primary cancer. Another study suggests that a metastasis in the proximal or distal femur or the proximal humerous should be treated with a broad resection of the lesion and arthroplasty. On the other hand, this type of treatment is intended for palliative care and not therapeutic. There are suggestions for closed intramedullary fixation over open reduction and internal fixation or mega-prosthetic reconstruction, in order to reduce the morbidity rate associated with the surgical procedure. But, in any surgical treatment that the surgeon chooses, the fixation must be rigid, so that there can be a post-operative function [18-21]. Treatment of metastatic humeral lesions is a challenging topic as indications vary, several surgical therapeutic options exist, different

types of adjuvant treatment are available, and many patient and tumor factors need to be considered. The most commonly used implants are intramedullary nails, endoprostheses, and plate and screws. It is unclear to what extend these patient, tumor, and surgeon factors influence surgical decision making. It is essential for the standardization of guidelines, technique and criteria development, to understand better, what treatment is recommended, what parameters should be considered to be quantified when approaching a patient with bone metastasis and what influence it would have on the treatment of metastatic humeral fractures [22,23]. CFR-PEEK nails seem to be a good solution in patients with pathologic or impending fractures of the long bones [24]. No matter of life expectancy, studies suggest that either intramedullary nailing or plate fixation with bone cement augmentation and radiotherapy for pathological fractures of the humerus shaft are safe ways to improve quality of life and arm function [25-30].

Conclusion

Internal osteosynthesis was preferred in this patient due to the location of the fracture. Following biopsy, stabilization of the fracture and oncologically oriented surgical treatment should be performed. Attention should be given to the initial displacement, stability and location of the pathological fracture[31]. More aggressive treatment is aimed for patients with longer expected survival, such as wide resection of the metastatic lesion, mega-prosthetic reconstruction and postoperative radiation therapy. On the other hand, at patients whose expected survival is shorter, many studies tend to choose less aggressive and less morbid treatments, such as internal fixation and adjuvant radiation therapy [32-35]. Another study suggests the use of IM nail due to less blood loss during and after the operation [36]. Patients treated with locking plate and screws showed a great short-term functional recovery, whereas patients treated with mega-prosthesis showed better local oncologic control [37]. Internal fixation with locking plate and screws is essentially palliative and aims at the immediate effective stabilization of the fracture, pain relief, and recovery of limb mobility, with the ultimate goal being the restoration of functional independence and quality of life as early as possible. On the other hand, there are studies that suggest that the reduced invasiveness and minimal tissue aggression of the surgical technique, good results in immediate stabilization, pain relief the reduced rate of surgery-related complications, made the closed intramedullary humeral nailing the best option in established or impending diaphyseal fractures [38-42].

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Bibliography

- Society. American Cancer. "Cancer facts and figures 2017" (2013).
- 2. Jayarangaiah Apoorva., *et al.* "Bone Metastasis". *StatPearls* (2022).
- 3. Rizzo Sarah E and Shachar Kenan. "Pathologic Fractures". *Stat*-*Pearls* (2022).
- 4. Toma CD., *et al.* "Metastatic bone disease: a 36-year single centre trend-analysis of patients admitted to a tertiary orthopaedic surgical department". *Journal of Surgical Oncology* 96.5 (2007): 404-1410.
- Wedin R and HCF Bauer. "Surgical treatment of skeletal metastatic lesions of the proximal femur: endoprosthesis or reconstruction nail?". *The Journal of Bone and Joint Surgery. British Volume* 87.12 (2005): 1653-1657.
- 6. Janssen Stein J., *et al.* "Complications After Surgical Management of Proximal Femoral Metastasis: A Retrospective Study of 417 Patients". *The Journal of the American Academy of Orthopaedic Surgeons* 24.7 (2016): 483-494.
- Biermann J Sybil., *et al.* "Metastatic bone disease: diagnosis, evaluation, and treatment". *The Journal of Bone and Joint Surgery. American Volume* 91.6 (2009): 1518-1530.
- 8. Papagelopoulos Panayiotis J., *et al.* "Advances and challenges in diagnosis and management of skeletal metastases". *Orthopedics* 29.7 (2006): 609-622.
- Coleman RE. "Metastatic bone disease: clinical features, pathophysiology and treatment strategies". *Cancer Treatment Reviews* 27.3 (2001): 165-176.
- Hage WD., *et al.* "Incidence, location, and diagnostic evaluation of metastatic bone disease". *The Orthopedic Clinics of North America* 31.4 (2000): 515-228.
- 11. Casadei R., *et al.* "Humeral metastasis of renal cancer: Surgical options and review of literature". *Orthopaedics and Traumatology, Surgery and Research: OTSR* 104.4 (2018): 533-538.
- Murray JA and FF Parrish. "Surgical management of secondary neoplastic fractures about the hip". *The Orthopedic Clinics of North America* 5.4 (1974): 887-901.
- 13. Quinn Robert H., *et al.* "Contemporary management of metastatic bone disease: tips and tools of the trade for general practitioners". *Instructional Course Lectures* 63 (2014): 431-441.

14. Ratasvuori Maire., *et al.* "Prognostic role of en-bloc resection and late onset of bone metastasis in patients with bone-seeking carcinomas of the kidney, breast, lung, and prostate: SSG study on 672 operated skeletal metastases". *Journal of Surgical Oncology* 110.4 (2014): 360-365.

- 15. Errani Costantino., *et al.* "Treatment for long bone metastases based on a systematic literature review". *European Journal of Orthopaedic Surgery and Traumatology: Orthopedie Traumatologie* 27.2 (2017): 205-211.
- Yu Xiuchun., *et al.* "Clinical outcomes of giant cell tumor of bone treated with bone cement filling and internal fixation, and oral bisphosphonates". *Oncology Letters* 5.2 (2013): 447-451.
- 17. Choi Eun-Seok., *et al.* "Intramedullary Nailing for Pathological Fractures of the Proximal Humerus". *Clinics in Orthopedic Surgery* 8.4 (2016): 458-464.
- 18. Hunt Kenneth J., *et al.* "Surgical fixation of pathologic fractures: an evaluation of evolving treatment methods". *Bulletin (Hospital for Joint Diseases (New York, N.Y.))* 63.3-4 (2006): 77-82.
- Jacofsky David J and George J Haidukewych. "Management of pathologic fractures of the proximal femur: state of the art". *Journal of Orthopaedic Trauma* 18.7 (2004): 459-469.
- 20. Narazaki Douglas Kenji., *et al.* "Prognostic factors in pathologic fractures secondary to metastatic tumors". *Clinics (Sao Paulo, Brazil)* 61.4 (2006): 313-320.
- 21. Ruggieri Pietro., *et al.* "Protocol of surgical treatment of long bone pathological fractures". *Injury* 41.11 (2010): 1161-1167.
- 22. Angelini Andrea., *et al.* "Treatment of pathologic fractures of the proximal femur". *Injury* 49.3 (2018): S77-S83.
- 23. Cappellari Alessandro., *et al.* "New concepts in the surgical treatment of actual and impending pathological fractures in metastatic disease". *Injury* S0020-1383 (2020): 30952-30959.
- 24. Pala Elisa., *et al.* "Intramedullary nailing for impending or pathologic fracture of the long bone: titanium vs carbon fiber peek nailing". *EFORT Open Reviews* 7.8 (2022): 611-617.
- 25. Dijkstra S., *et al.* "Treatment of pathological fractures of the humeral shaft due to bone metastases: a comparison of intramedullary locking nail and plate osteosynthesis with adjunctive bone cement". *European Journal of Surgical Oncology: The Journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology* 22.6 (1996): 621-626.

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- Ricard Marc-Antoine M., *et al.* "Intramedullary Nailing Versus Plate Osteosynthesis for Humeral Shaft Metastatic Lesions". *Cureus* 13.3 (2021): e13788.
- 27. Choi Eun-Seok., *et al.* "Intramedullary Nailing for Pathological Fractures of the Proximal Humerus". *Clinics in Orthopedic Surgery* 8.4 (2016): 458-464.
- Moura Diogo Lino., *et al.* "Treatment of Pathological Humerus-Shaft Tumoral Fractures with Rigid Static Interlocking Intramedullary Nail-22 Years of Experience". *Revista Brasileira De Ortopedia* 54.2 (2019): 149-155.
- 29. Moon Bryan S., *et al.* "Is It Appropriate to Treat Sarcoma Metastases with Intramedullary Nailing?" *Clinical Orthopaedics and Related Research* 475.1 (2017): 212-217.
- Krygier Jeffrey E., *et al.* "Operative management of metastatic melanoma in bone may require en bloc resection of disease". *Clinical Orthopaedics and Related Research* 472.10 (2014): 3196-3203.
- 31. Frassica FJ., *et al.* "Special problems in limb-salvage surgery". *Seminars in Surgical Oncology* 13.1 (1997): 55-63.
- 32. Althausen P., *et al.* "Prognostic factors and surgical treatment of osseous metastases secondary to renal cell carcinoma". *Cancer* 80.6 (1997): 1103-1109.
- Bocchi L., *et al.* "The surgical treatment of metastases in long bones". *Italian Journal of Orthopaedics and Traumatology* 14.2 (1988): 167-173.
- 34. Buggay David and Kenneth Jaffe. "Metastatic bone tumors of the pelvis and lower extremity". *Journal of Surgical Orthopae-dic Advances* 12.4 (2003): 192-199.
- 35. Rath B., *et al.* "Differenzierte Therapiestrategien bei Knochenmetastasen der Extremitäten" [Differentiated treatment strategies for bone metastases of the extremities]". *Der Orthopade* 48.9 (2019): 752-759.
- Koob Sebastian., *et al.* "Intramedullary Nailing Versus Compound Plate Osteosynthesis in Pathologic Diaphyseal Humerus Fractures: A Retrospective Cohort Study". *American Journal of Clinical Oncology* 45.9 (2022): 379-380.
- 37. Rovere G., *et al.* "Proximal humerus fractures treatment in adult patients with bone metastasis". *European Review for Medical and Pharmacological Sciences* 26.1 (2022): 100-105.
- Pretell Juan., *et al.* "Treatment of pathological humeral shaft fractures with intramedullary nailing. A retrospective study". *International Orthopaedics* 34.4 (2010): 559-563.

39. Dijkstra S., *et al.* "Treatment of pathological fractures of the humeral shaft due to bone metastases: a comparison of intramedullary locking nail and plate osteosynthesis with adjunctive bone cement". *European Journal of Surgical Oncology: The Journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology* 22.6 (1996): 621-626.

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- 40. Sarahrudi Kambiz., *et al.* "Surgical treatment of pathological fractures of the shaft of the humerus". *The Journal of Trauma* 66.3 (2009): 789-794.
- 41. Laitinen Minna., *et al.* "Treatment of pathological humerus shaft fractures with intramedullary nails with or without cement fixation". *Archives of Orthopaedic and Trauma Surgery* 131.4 (2011): 503-508.
- 42. Gebhart M., *et al.* "Metastatic involvement of the humerus: a retrospective study of 51 cases". *Acta orthopaedica Belgica* 67.5 (2001): 456-463.

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