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CASE REPORT

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Bone metastasis from breast carcinoma with fluid-fluid level

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Case report

A 75-year-old woman presented with pain and swelling of the right knee. She had a history of right breast carcinoma treated by radial mastectomy in 1981. Bone metastasis was diagnosed in 1986 at the proximal right humerus and distal right femur, for which external radiation was performed. The patient's clinical course was uneventful for 7 years until her present admission. The physical examination found a palpable mass in the superior aspect of the right popliteal fossa. The results of all laboratory tests were normal.

Bone scintigraphy revealed increased radiotracer uptake at the proximal right humerus and distal femur. Plain radiographs showed a lytic humeral lesion and a ''bubbly'' metaepiphyseal femoral tumor measuring 6×4×4 cm. The femoral lesion was characterized by internal septated trabeculation with expanded cortex. There was no mineralized matrix (Fig. 1). Earlier radiographs performed at an outside institution were unfortunately not available for comparison. Magnetic resonance (MR) imaging (Signa, General Electric, Milwaukee, Wisc., operating at 1.5 T) showed a multicystic and expansile tumor surrounded by a dark, lobulated rind of cortical bone. The lesion contained multiple, loculated collections of variable signal intensity, depending on the MR sequence, with fluid-fluid levels (Fig. 2). Metastatic breast adenocarcinoma was diagnosed. There were focal bulges of the tumor in the soft tissue of the popliteal fossa. A bone biopsy was performed, followed 2 weeks later by knee surgery with a custom-hinge total prosthesis. The postoperative

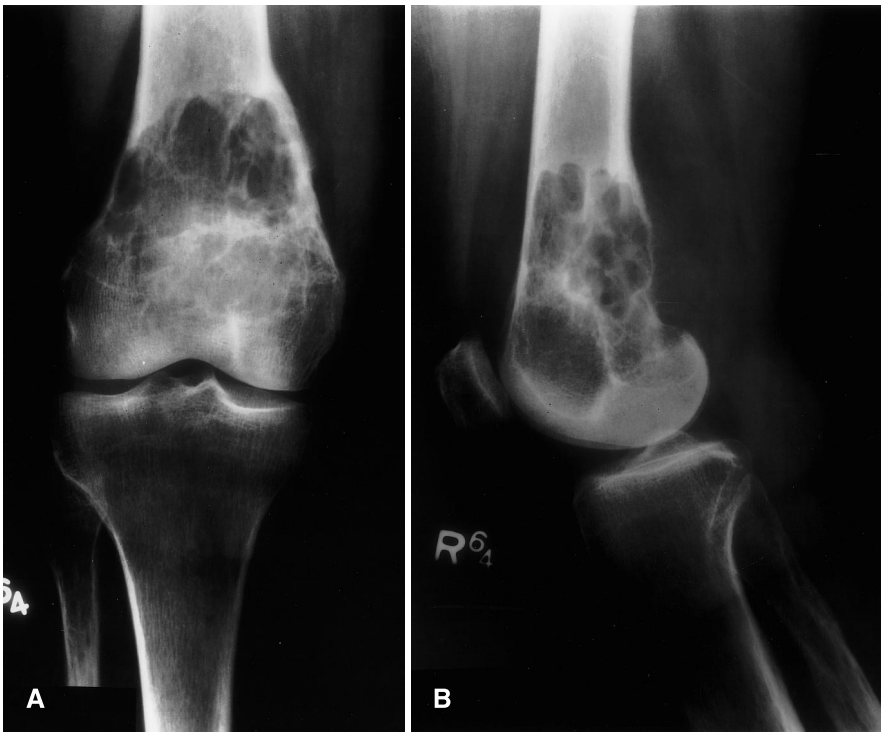

Fig. 1A, B Plain radiographs of the right knee show a septated and expansile lytic lesion of the femur extending from the distal diahysis to the epiphysis. There is scalloping of the inner cortex with discrete posterior periosteal reaction

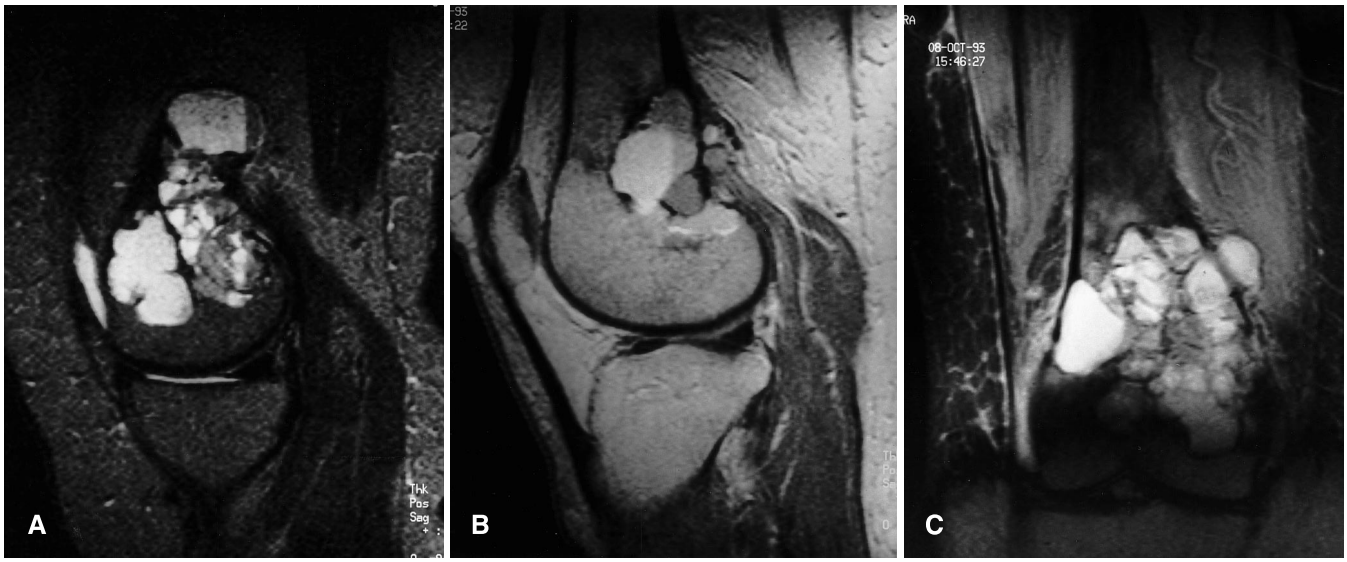

Fig. 2A–C Sagittal T2 (TR 2900/TE 80), sagittal proton-density (TR 2900/TE 20), and coronal inversion recovery (TR 1900/TE 20/TI 150) images demonstrate the multicystic lesion of the distal right femur. Fluid-fluid levels are depicted within the septated femoral tumor with the patient laying supine in the MR scanner. Compare Fig. 2A with 1A, and Fig. 2B, C with Fig. 1B. MR imaging shows the diverticulum-like extension of the tumor through the posterior and medial cortex, which is not detected on plain radiographs

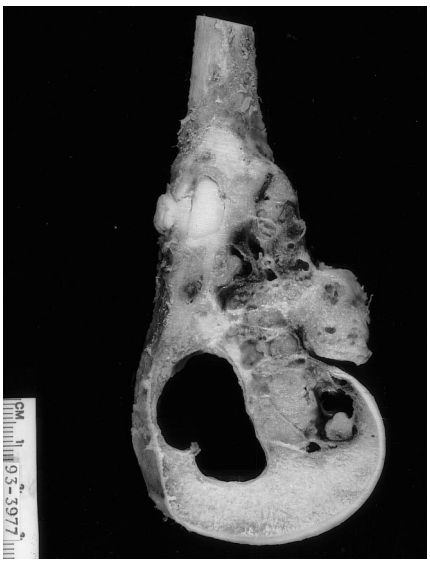

Fig. 3 Gross specimen of the distal right femur shows the multicystic and multinodular diametaepiphysial lesion with tumoral bulges in the posterior aspect. Note the similarity of the specimen to the MR images shown in Fig. 2A, B

course was unremarkable. The patient was discharged 10 days after surgery and was followed for rehabilitation.

The differential diagnosis includes metastatic breast carcinoma with a very unusual radiographic appearance, aneurysmal bone cyst, and radiation-induced sarcoma.

Grossly, the excised specimen consisted of a 12-cm length of the distal right femur. On cut section, much of the medullary bone was replaced by a multinodular and multicystic tumor measuring 6 cm in its greatest dimension (Fig. 3). The lesion extended from the distal diaphysis into the epiphysis. It protruded through the bone cortex at multiple sites. Although the tumor extended beneath the articular surface, it did not penetrate through the cartilage into the joint space. The bone resection margin was widely free of tumor. The tumor nodules consisted of tan, soft, and friable tissue. Cystic formation was prominent. The cysts ranged from 0.1 to 4 cm in diameter and contained hemorrhagic fluid and necrotic debris. Nodules and cysts were separated by fibrous septae that varied from thin and delicate to thick and coarse.

Microscopically, the tumor was a gland-forming, epithelial neoplasm that infiltrated and destroyed the bone trabeculae. The predominant architectural pattern was that of dilated, duct-like structures separated by bands of desmoplastic stroma (Fig. 4). These large and open duct-like structures corresponded to the cysts noted grossly. They were lined by malignant epithelial cells arranged in micropapillary and rigid cribriform formations (Fig. 4). Also noted were the more solid, complex papillary formations corresponding to the solid nodules seen macroscopically. The tumor cells were polygonal to columnar with oval nuclei. Many of the cells lining the cystic spaces demonstrated apocrine-like apical snouts (Fig. 4). Although the pathology of the patient's previous primary breast cancer was not available for review and comparison, the lesion involving the distal femur was morphologically consistent with a metastatic adenocarcinoma from a breast primary. There was no evidence of radiation osteitis.

Discussion

Breast carcinoma has a propensity to metastasize to active red bone marrow of the axial skeleton, humerus, and femur. It is responsible for about 50% of femoral metastases with pathologic fracture [1]. The peak occurrence of metastasis is between the fourth and sixth decade of life with an average latency of 30 months

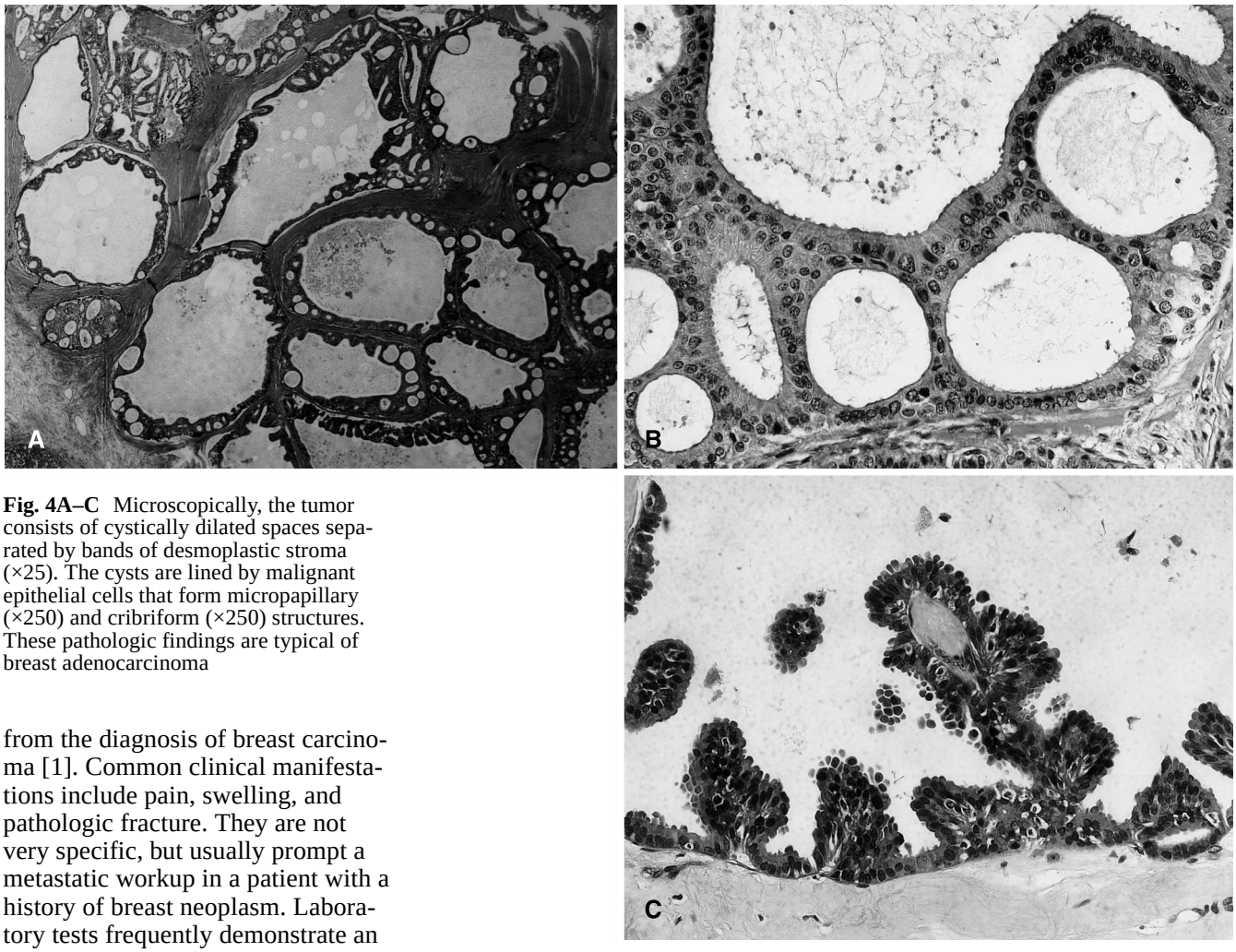

Fig. 4A–C Microscopically, the tumor consists of cystically dilated spaces separated by bands of desmoplastic stroma (×25). The cysts are lined by malignant epithelial cells that form micropapillary (×250) and cribriform (×250) structures. These pathologic findings are typical of breast adenocarcinoma

from the diagnosis of breast carcinoma [1]. Common clinical manifestations include pain, swelling, and pathologic fracture. They are not very specific, but usually prompt a metastatic workup in a patient with a history of breast neoplasm. Laboratory tests frequently demonstrate an increased serum alkaline phosphatase. Bone scintigraphy shows an increased radiotracer uptake at involved sites.

Radiographically, three patterns of bone metastasis from breast carcinoma have been described: lytic, mixed lytic-blastic, and purely blastic, which respectively account for about 65, 25, and 10% of all cases [1]. Bone metastasis may demonstrate different combinations of these three patterns and mimic a large spectrum of skeletal tumors. The presented femoral lesion was intriguing on both plain radiographs and MR imaging. There was lysis and expansion of the distal femur. This feature is rare and appears more characteristic of metastasis from renal cell or thyroid carcinoma [1, 2]. Similar to our radiologic presentation, malignant spread of renal or thyroidal origin has a metadiaphyseal location, eccentrically fusiform bone expansion, intratumoral septation, and a thin shell of periosteal formation.

The enlarging femoral tumor, presenting 7 years after our patient had been treated with radiation, raised the suspicion of radiation-induced sarcoma (RIS). RIS involves predominantly the shoulder, pelvic girdle, and femur [3]. The diagnosis of RIS rests on the strict criteria of (1) a past clinical history of radiation, (2) the tumor arising within the field of that radiation, and (3) a latency ranging from 3.3 to 50 years from the radiation therapy to the histologically proven development of RIS [3–5]. Even though RIS is a possibility in the presented case, its extremely low frequency of less than 0.1%, the absence of pagetoid lytic-blastic lesions, and the lack of radiation osteitis sequelae make RIS less likely.

Aneurysmal bone cyst (ABC) fits the description of our patient's septated metaepiphyseal tumor. ABC, in almost half of the cases, is considered a secondary process arising from anomalous hemodynamic conditions of preexisting primary neoplasms such as giant cell tumor, fibrous dysplasia, bone trauma, and osteosarcoma [1]. ABC may overshadow the primary lesion with its exuberant growth. ABC has been reported to demonstrate a characteristic MR and CT fluid-fluid level

(FFL) pattern with a well-defined smooth or lobulated cortex [6, 7]. FFL is, however, not pathognomonic for ABC; it is also encountered in a large variety of benign and malignant lesions containing serous fluid and/or blood products. Giant cell tumor, cystic degeneration of fibrous dysplasia, cystic chondroblastoma, malignant fibrous histiocytoma, and telangiectatic osteosarcoma may show FFL [7, 8]. FFL is extraordinarily rare in metastatic carcinomas involving bone. Only one case of bone metastasis from primary carcinoma of the bronchus has been documented with FFL on CT [9] and, to our knowledge, no cases of metastatic breast carcinoma have been reported with such findings. The FFL pattern depicted by MR in this case may be secondary to gravity-dependent hemorrhagic and necrotic fluid collections constituting layers of different densities within septated cavities [7].

In summary, a case of bone metastasis from breast carcinoma is presented. The right distal femoral tumor demonstrated an unusual pattern on plain radiographs and MR. The expanding lytic feature is reminiscent of renal or thyroid carcinoma dissemination. The patients history of radiation therapy raised the suspicion of radiation-induced sarcoma. The MR fluid-fluid level is nonspecific, including ABC and radiation-induced osteogenic sarcomatous transformation in the differential diagnosis. To the best of the authors' knowledge, no case of bone metastasis from breast cancer has been documented with fluid-fluid level on MR. The pertinent clinical information of the patient makes bone metastasis a prime diagnosis. Bone biopsy remains nonetheless important for the definitive identification of the tumor.

References

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