50 Years Ago in CORR

Parosteal Osteogenic Sarcoma: Treatment by Block Resection

Everett J. Gordon MD CORR 1959;14:171–178

As with most diseases, the concepts and terminology of bone sarcomas have changed over time. In the early part of the 20th century after the ready availability of biopsy and radiographs, doctors recognized only a few types of recognized primary malignant bone tumors. In his 1937 textbook, McMurray listed but three major bone tumors: osteogenic sarcoma, “Ewing’s Tumour,” and multiple myelomata [7]; Campbell, in 1939, listed five: chondromyxosarcoma, osteoblastic, chondroblastic, chondrosarcoma, and osteolytic [1]. While these numbers in common textbooks should not reflect the state of knowledge of malignant tumors, they do reflect the relative paucity of recognized types or subtypes of tumors. Osteogenic sarcomas, for example, were subsequently subtyped based primarily on differing prognoses. Among these subtypes were the various “juxtacortical” or “surface osteosarcomas,” including parosteal and periosteal tumors. The implication of these terms is that the tumors lie outside the medullary cavity, when in fact a small percent do not.

Gordon, in 1959 in CORR [4], ascribed the original description of parosteal tumors to Geschickter and Copeland in 1951 [2]. The tumor was juxtacortical and had a histologic appearance similar to that of myositis ossificans and was considered to have benign and malignant forms, and with

propensity to recur after resection or to metastasize. In their 13 cases, seven recurred after local resection and four of those patients died with metastases. They recommended amputation with recurrences owing to the rather grave prognosis. Clearly, the tumors were either inadequately resected or extended into the medullary cavity, and were associated with a worse prognosis. By 1959, Gordon noted a number of names ascribed to these sorts of tumors: periosteal osteogenic sarcoma, parosteal osteoma, juxtacortical osteogenic sarcoma, and parosteal osteogenic sarcoma. He also noted the difficulty of distinguishing this tumor from others: osteogenic sarcoma, exostosis, and osteochondroma (Fig. 1). He believed these lesions should not be biopsied owing to the potential for seeding, and rather recommended “local resection” (which we would likely consider marginal resection today). Gordon recommended en bloc resection for small lesions, but amputation “in most instances of parosteal osteogenic sarcoma.”

While classic osteosarcoma constitutes the large majority of lesions, variants account for perhaps 20–25% with the following frequencies: telangiectatic 3.5–11%, parosteal 3–4%, periosteal 1–2%, gnathic 6–9%, and small cell 1% [5]. The high grade surface lesions are infrequent variants [6, 9]. With the exception of these latter lesions, surface sarcomas

generally have a better prognosis than the intramedullary lesions and the parosteal sarcoma being better than the periosteal sarcoma. The subtypes reflect changes in thinking about these tumors. Contemporary imaging and histologic grading are crucial for determining how surface osteosarcomas should be treated: low grade parosteal tumors limited to the surface may be treated with wide or segmental resection, while high grade tumors or those extending into the intramedullary cavity should be treated with segmental resection and chemotherapy.

Genetic characterization appears to relate to malignant potential: a subgroup of parosteal tumors have ring chromosomes with amplified material from chromosome 12 (12q13-15) and high grade osteosarcomas more frequently have amplified genetic sequences on the short arm of chromosome 12 than the low grade [3]. Furthermore, MDM2 and CDK4 genes are frequently co-amplified in two separate amplicons in parosteal OS and less frequently in classical high-grade OS [8]. Differential gene expression may imply different mechanisms or etiologies for the development of osteosarcoma variants. Genetically characterizing malignant potential will undoubtedly supplement imaging and help clinicians select more patient-specific treatment in the near future.

In contrast to the aggressive recommendation of Gordon in 1959, most

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Fig. 1 August, 1955, preoperative roentgenogram. Cortical mass, metaphysis, lower femur, no medullary involvement. (Reprinted with permission and ©Lippincott Williams & Wilkins, from Gordon EJ. Parosteal osteogenic sarcoma: Treatment by block resection. *Clin Orthop Relat Res.* 1959;14:171–178.)

surgeons today rely on high quality imaging to select treatment and to avoid amputations when less radical surgery will suffice.

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