Arteriography in Bone Tumors

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Abstract. On the basis of 100 cases the usefulness of arteriography in bone tumor diagnosis is evaluated. In cases where standard radiography is nondiagnostic, arteriography represents a most useful guide to establishing the diagnosis by helping to differentiate benign from malignant disease, by defining the extent of the lesion, and by assisting in the selection of the best site for biopsy.

Key words: Arteriography — Bone tumors — Inflammatory lesions of bones.

Primary bone tumors constitute only a small minority of human neoplasms. Despite their relatively low incidence, however, they attract considerable attention on account of some inherent characteristics of their malignant manifestations. Malignant bone tumors occur primarily early in life and have a bad prognosis, attributable, at least partially, to a considerable delay in diagnosis. This delay is clearly related to the lack of specific clinical symptoms, rendering radiologic examination a crucial component in the diagnosis of these neoplasms. The radiologist has attempted to justify this decisive role through a systematic analysis of the pathologic changes observed on conventional radiographs [18]. Conventional radiography (plain film, tomography) not only demonstrates the site and size of the tumor, but offers, moreover, valuable information regarding the rate of growth, which is reflected by specific patterns of bone destruction and repair (Fig. 1). Radiography alone, however, does not provide sufficient information to be a guide to treatment. Histologic proof by biopsy is indispensable. Biopsy contributes the twofold data of histologic category (from the most differentiated cell type) and of prognosis (from quantitating the least differentiated cell type) [9]. Nevertheless, it is of the utmost importance to obtain the maximum diagnostic information from the radiologic examination, since the histologic diagnosis itself may be subject to error. On the one hand, the tumor tissue is often heterogeneous (Fig. 2), while, on the other hand the biopsy specimen consists often of only a small portion of tissue which may not be representative of the tumor as a whole [21]. Consequently, it becomes obvious that errors in predicting the aggressive nature of the tumor and even of establishing the exact histologic type cannot always be avoided by the pathologist. The diagnostic approaches of both the radiologic and histologic investigations are therefore not competitive, but are essentially complementary, still leaving, however, some sources of error. Since conventional radiography, including computer analysis, has largely achieved its maximum yield of information, the residual factor of error might be reduced further by adding arteriography as a method of investigation (Fig. 1).

Although arteriography is a well-established radiologic method for investigation of intracranial, intrathoracic, and intra-abdominal organs, this technique has not gained wide acceptance in the diagnosis and management of bone tumors. In particular, considerable controversy exists concerning its value in contributing additional information to orthodox studies, its role being limited to definition of soft tissue extensions of bone tumors and to indication of appropriate sites for biopsy [4, 5, 22, 23].

The theoretical reasons for introducing arteriography to bone tumor diagnosis are threefold (Table 1): (1) No doubt exists that blood supply is essential for every living tissue. (2) Microangiographic studies have demonstrated a clear-cut correlation between the degree of vascularization and the biological activity of a particular tumor [12, 13]. The most highly
vascularized areas in fibrosarcomas and chondrosarcomas, for instance, have been shown to be the most malignant histologically. (3) Some authors have also found a definite parallel between the differentiation of the tumor parenchyma and the differentiation of its vascular structures [2, 17]. Poorly developed differentiated tumors have had a correspondingly poorly developed vascular bed. This observation is of particular importance, since it is well known to pathologists that bone tumors can be composed, firstly, of portions of greater or lesser differentiation or secondly, of totally different components (e.g., osteogenic sarcoma with chondroblastic, osteoblastic, and fibroblastic elements). In consequence, the degree of vascularity within different portions of the tumor may vary greatly.

The use of arteriography in the diagnosis of bone tumors, however, carries with it certain definite limitations which deserve emphasis (Table 1): (1) The abundant intraosseous vascular network is almost

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**Fig. 2A and B. 9, 52 years: Chondrosarcoma.**

*Structural heterogeneity of tumor tissue.*

A Portion of tumor with abundant cellular and vascular elements × 400

B Completely avascular chondromatous portion × 65