Fritz Schajowicz

Tumors and Tumorlike Lesions of Bone and Joints

Springer-Verlag
New York Heidelberg Berlin

Tumors and Tumorlike Lesions of Bone and Joints

Fritz Schajowicz

Professor of Pathology
National University of Buenos Aires
Director
International Reference Center for
Histo-Pathologic Diagnosis of Bone
Tumors and Allied Diseases
World Health Organization and
Latin American Registry of Bone Pathology

Visiting Distinguished Professor
Rush-Presbyterian-St. Luke's Medical Center
Chicago, Illinois

With 948 Illustrations and 2 color inserts

Springer-Verlag
New York Heidelberg Berlin

Fritz Schajowicz, M.D.
Head
Osteo-Articular Pathology Center
Hospital Italiano
Gascon 450
Buenos Aires, Argentina

Visiting Distinguished Professor
Rush-Presbyterian-St. Lukes Medical Center
Chicago, Illinois

Library of Congress Cataloging in Publication Data
Schajowicz, F
Tumors and tumor-like lesions of bone and joints.
Bibliography: p.
Includes index.
1. Bones—Tumors. 2. Joints—Tumors. 3. Bones—Diseases. 4. Joints—Diseases. I. Title.
RC280.B6S32 616.9'9271 80-24707

9 8 7 6 5 4 3 2 1

ISBN 0-387-90492-1 Springer-Verlag New York Heidelberg Berlin
ISBN 3-540-90492-1 Springer-Verlag Berlin Heidelberg New York

Tumors and Tumorlike Lesions of Bone and Joints

To the memory of Professor Jakob Erdheim

To my wife Adela and
my daughters Monica and Graciela

Foreword

In the past 50 years considerable progress has been made in orthopedics and traumatology. One of the principal reasons for these advances has undoubtedly been the separation of these specialties from general surgery. Alongside this development the number of those devoted to the study and treatment of locomotor disabilities, who could formerly be counted on the fingers of one hand—at least in our country—has multiplied by thousands and even more have subspecialized. This accelerated growth has encouraged the sharpening of diagnostic skills, technical improvement, and the application of advances in other fields of medicine to orthopedics. However, paradoxically enough, one of the most important aspects of orthopedics, bone pathology, has not attracted enough specialists worldwide to handle the complex problems, encountered daily, that only an expert and experienced pathologist is capable of resolving.

Within the modern milieu, the personality and accomplishments of Professor Fritz Schajowicz stand out distinctly. Dr. Schajowicz, of Austrian origin, studied with Professor J. Erdheim of Vienna. Having afterwards been granted a fellowship to extend his knowledge of bone pathology at the Rizzoli Orthopedic Institute of Bologna under the direction of Professor Vittorio Putti, he complemented this work with the study of clinical orthopedics at that prestigious institution. In 1938, Professor Jose Valls visited the Rizzoli Institute and, recognizing the outstanding training of Professor Schajowicz, invited him to move to Argentina where we were in need of an expert pathologist. It has now been 40 years since Dr. Schajowicz joined our team, and his collaboration has been an invaluable aid.

Schajowicz is not only an eminent and expert pathologist and a keen investigator of intricate and complex tissue structures; he is also an excellent clinician, who knows the varying symptoms of lesions—their local, general and humoral reactions—and an expert interpreter of x-rays of lesions of the skeleton as well. It is for these reasons that Dr. Schajowicz does not accept any speciment for study in his Pathology Center that is not accompanied by its corresponding clinical history, laboratory test results, and x rays, all of which are discussed with the attending surgeon.

Once settled in Buenos Aires, Dr. Schajowicz obtained grants and technical assistance from the World Health Organization and the National Institutes of Health of the United States. With this financial assistance and the aid of volunteers, he was able to set up a Center of Bone and Joint Pathology, the site of the Latin American Register of Bone Pathology, which began its activities in 1962 in the modest locale of the Italian Hospital of Buenos Aires.

So many cases requiring his opinion have come to this center that the collection of radiographs and photographs is enormous, and the Latin American Register can be considered one of the most complete in the world. The accumulated material has been used not only for research but also for the instruction of many pathologists and orthopedists who want to deepen their knowledge of this difficult field of pathology.

Through the collaboration of Dr. Schajowicz, Professor José Valls and myself, a book was published in 1942 on puncture biopsy in bone lesions, describing a method that became so widely accepted that the number of aspiration biopsies performed and examined by the author of this book totals more than 8000. The most important statistic on aspiration biopsies of the vertebral bodies, now numbering 2200, is maintained at the Center of Bone Pathology. This biopsy technique, which we helped to standardize, is now used routinely throughout the world.

Dr. Schajowicz joined the Department of Pathological Anatomy of the Medical School

of the University of Buenos Aires as an Associate Professor and spent three years there as a full professor before he resigned the post because, as a bone pathologist, he did not want to wander from his self-appointed path.

Because his accomplishments have been internationally acclaimed, the World Health Organization named him Head of the International Reference Center for Histo-Pathologic Diagnosis of Bone Tumors and Allied Diseases, collaborating with him an important group of specialists the world over. As they were intrigued by the diversity of opinion with respect to classification of primitive bone tumors, Dr. Schajowicz with Ackerman and Sissons established a classification system published by the World Health Organization, which has been translated into several languages and accepted worldwide.

Dr. Schajowicz has traveled the world, working as a fellow with Hirsch in Sweden on the pathology of the lumbar disc and the cervical spine, working with Trueta in Oxford, England, on osteoarthritis of the hip, teaching courses, lecturing, and above all displaying the abundant material he has collected in order to pass on his knowledge and share his ideas.

Having arrived at such heights in his profession, he has decided to publish this book, in which he summarizes his long, intense life's work. His total dedication to bone and joint pathology has been amply demonstrated by his many articles published in the most prestigious journals of the specialty. We do not hesitate to state that this work will be of fundamental use to pathologists, orthopedists and radiologists and we anticipate its great success.

I would like to give my personal thanks to Dr. Schajowicz for the irreplaceable collaboration that has been such a great help to us in solving the numerous cases sent to us for treatment. With the passing of the years we have established a friendship and mutual regard and it pleases me to recognize them now. Perhaps it is on this account that Dr. Schajowicz has distinguished me with the honor of writing this Foreword to his "masterwork," for which I owe him my gratitude.

Carlos E. Ottolenghi, M.D.
Professor Emeritus, School of Medicine
Department of Orthopedics and Traumatology
National University of Buenos Aires
Full Member, National Academy of Medicine

Preface

Diagnostic pathologists, orthopedic surgeons, and radiologists are often confronted with problems of the diagnosis and treatment of tumors of the locomotor system. It is especially for these groups that I have prepared this work. The experiences of many workers in this field are summarized here, but my personal concepts and experience during more than 40 years of continuous work in osteoarticular pathology are the basis of this book.

During a period of 37 years, 4913 primary bone tumors and over 1100 tumor-like lesions (among 19,600 cases of orthopedic pathology) have been studied and documented in our laboratory, which in 1962 became the headquarters of the Latin American Registry of Bone Pathology and in 1965 became the International Reference Center of Bone Tumors of the World Health Organization. In order to limit the size of this volume, metastatic tumors of bone and tumors of jaws of specific odontogenic origin are excluded. On the other hand, I have included a chapter on the controversial group of pseudotumoral and neoplastic processes involving joints.

I have adopted and follow in this volume the World Health Organization classification and definitions of bone tumors, which I published in 1972 with L. V. Ackerman and H. A. Sissons, in collaboration with L. H. Sobin and H. Torloni. This classification, based on histologic criteria, includes benign and malignant neoplasms, primary in bone. Certain tumor-like processes are also included because of their frequent clinical and histologic similarity to bone tumors. Since 1972, only slight modifications of this classification have been necessary, for example, the addition of a few new tumor entities, some of which are still controversial ("malignant osteoblastoma" and "malignant fibrous histiocytoma of bone").

The diagnosis of a bone lesion should be established in every case by combined clinical-radiologic and pathologic investigations. Therefore, clinical, especially radiologic features are described and illustrated extensively here. Preference is given, as far as possible, to the comparative study of the gross pathologic and radiographic appearance of the resection or amputation specimen, preferable of thin slabs of the specimen. The clinical features are complemented by detailed descriptions of the histology and are accompanied by numerous photomicrographs, several in full color, in order to facilitate the task of the practicing pathologist. Only a few electron-micrographs have been included, because electron microscopy as a routine method of bone tumor diagnosis is still of limited value.

For each tumor entity we have briefly commented on the most common and most convenient type of treatment presently in use at our and other specialized centers. The extensive bibliography will guide the interested reader to detailed studies in the literature; however, the rapid increase of original contributions in recent years, especially from the United States, makes it practically impossible to do full justice to all authors.

Over 90% of the cases included in our statistics came from the various orthopedic departments in Argentina. A limited number of cases referred from other countries are included because of their rarity or special interest, but this does not modify our statistical data greatly. We had also at our disposal the data from the Registry of the Chilean Orthopedic Society, the Committee of Bone Tumors of Uruguay, and from two centers in Brazil dedicated primarily to the study of bone tumors, headed by Dr. Donato de Prospero and Dr. C. Lemos; their kindness and cooperation is gratefully acknowledged. Their figures are very similar to ours and confirm our data on the incidence and relative frequence of the different tumor types.

Acknowledgments

I wish to express my gratitude to the late professor and chairman of the Department of Orthopedic Surgery of the University of Buenos Aires, Professor José Valls, who gave me the opportunity to equip and organize a laboratory dedicated exclusively to diagnosis and research in orthopedic pathology. After the retirement of Professor Valls, I continued my work under his successor, Professor C. E. Ottolenghi, who during many years of close cooperation contributed his unfailing enthusiasm and friendship to the function of our laboratory, which later became a separate entity, the Center of Osteoarticular Pathology, open to the contribution of all physicians.

I am greatly indebted to my colleagues of the Italian Hospital (Buenos Aires) and to the many orthopedic surgeons in Argentina and other countries, who sent their cases to our Center and granted the use of their material for this and previous publications.

My grateful acknowledgment goes to my colleague and friend, Dr. R. L. Cabrini, for many years of close and fruitful cooperation in orthopedic pathology research, the result of which are the many articles published in this field.

I have a special debt of gratitude to my wife Adela, who since the foundation of the Latinoamerican Registry of Bone Pathology and during more than ten years of indefatigable and enthusiastic cooperation was responsible for its organization and administrative work, thus making the statistical and graphic documentation of this volume possible.

I want to express my appreciation to Dr. E. H. Santini Araujo who, working under a fellowship of the Argentine Orthopedic Society in my laboratory, has spared no effort in the accumulation of the statistical data that accompany the text.

My thanks to the staff of my laboratory for their unfailing assistance, in particular to the secretary, Mrs. P. Benjuia, the technicians, Mrs. A. Sens and Mrs. S. Turano, and the photographer L. Lobos. I owe a special acknowledgment for the efforts and skillful help of our photographer H. H. Busani, who made the great majority of the excellent gross photographs and reproduced the radiographs and photomicrographs.

The final preparation and publication of this book was made possible by the invaluable encouragement and support of Dr. J. Galante, Chairman of the Department of Orthopedic Surgery of the Presbyterian–St. Lukes Medical Center, and by the financial help of his department and that of the Department of Pathology, directed by Professor R. Wainstein: to both my deep appreciation. Working at this medical center for 14 months as Visiting Professor, I received the efficient collaboration of the medical and technical staff and especially of Dr. D. Petasnick of the Radiology Department.

My debt of gratitude goes to the Technical Administrator of the Department of Orthopedics, Mr. R. Urban, and to the secretaries Mrs. Aerelia Hill and Miss Sue Crow for their careful preparation of a great part of the manuscript. To Mr. Charles Hover of the Medical Illustration Services of the Rush Medical College goes my appreciation for the careful preparation of many of the illustrations.

I warmly acknowledge Dr. H. Torloni, former medical officer of W.H.O.'s Cancer Unit, who participated in every phase of the preparation of the bone tumor classification and the work of our Reference Center, and his successor Dr. L. H. Sobin for his encouragement and for obtaining W.H.O.'s permission to use part of the photographic material.

My special thanks go to the following editors and publishers for granting permission to reproduce illustrative material from my own publications which are acknowledged in

the corresponding legends: The Journal of Bone and Joint Surgery (British and American editions), American Cancer Society, Inc. (Cancer), Acta Orthopaedica Scandinavica, J. B. Lippincott Company (Clinical Orthopedics), and Butterworths Scientific Publications, London.

I am greatly indebted to my publishers for their careful attention to this volume, especially to Larry Carter and Berta Steiner for their untiring efforts.

Contents

Introduction

Among the wide variety of human tumors, primary bone tumors are comparatively rare, which explains why only a few centers have been able to collect an appreciable number of cases. A major factor in the progress in bone tumors study was the establishment of regional tumor centers or registries, following the American example, in many countries (Holland, Sweden, England, Japan, Latin America, and others). Having centralized data-collection centers makes it possible to assemble in a relatively short time abundant material that can be used in standardizing terminology and diagnosis, in carrying out research and epidemiologic studies, and above all in teaching and training medical specialists. The latter task is of fundamental importance because the majority of pathologists have little opportunity to acquire sufficient experience with this group of skeletal lesions, the study of which moreover requires certain technical expertise not possessed by all of them.

It is difficult to obtain accurate figures for the overall incidence of bone tumors because most of the available statistical data are compiled from death certificates, which do not specify the type of tumor. From an analysis of the reported cancer deaths in the United States for 1948, Steiner estimated that primary bone tumors constituted about 1% of all fatal malignant tumors. In Great Britain, approximately the same incidence of primary bone tumors was obtained from mortality figures for 1950–1954 (MacKenzie et al. 1961), an incidence of 0.8%–0.9%. A later United States statistic (Miller 1976; Young and Miller 1975) indicated that they account for the mortality of 1.87 per million among children under 14 years of age, an incidence that rises to 11.97 deaths per million among people between 15 and 19 years of age. Information on the relative frequencies of different types of primary malignant bone tumors in the various national series may be influenced by unrepresentative selection of cases and by the way in which the diagnostic definitions are applied (Miller and Dalager 1974). However, a comparison of different series, such as from Britain, Holland, the United States (cases treated at the Mayo Clinic, 1909–1977), and Japan (cases from Bone Tumor Registry, 1966) show a close similarity between the different figures.

The bone tumor registry of East Germany, which has a population of approximately 17 million and where the notification of all malignant tumors is obligatory, registered 4897 malignant bone tumors (3402 plasmacytomas and 1495 other primary tumors) during an 11-year period (Dominok and Knoch 1977). Glass and Fraumeni (1970) (United States) examined 1532 death certificates of all children under 15 years of age who died from these neoplasms from 1960 to 1966 for type of tumor, race, and sex and found an average annual mortality among white children of 3.04 deaths per million as contrasted with 2.26 among nonwhite children. Among children 15–19 years old during 1965–1966, the corresponding bone tumor rates were 9.93 for whites and 7.84 for nonwhites. This difference in the mortality rates for the two races was due mainly to the extremely low frequency of Ewing's sarcoma in nonwhite individuals under 20 years of age. This discrepancy was subsequently demonstrated by others in the United States (Jensen and Drake 1970; Linden and Dunn 1970; Miller 1970) and for blacks in Africa, who show a similar near-absence of Ewing's tumor (Williams 1975). Blacks thus appear to be genetically resistant to this form of bone neoplasia—an important point in differential diagnosis and in tumor etiology.

In general, we are only at the beginning of our

research on etiology and pathogenesis. Therefore, the exchange of experience among different groups of investigators is vitally important to progress in this still-obscure field. Although experimental and human pathologic evidence is more and more supportive of the hypothesis of the viral etiology of malignant bone tumors, at present, a substantial dose of ionizing radiation is the only agent known to be a potential cause of bone cancer in man. It also appears possible that ionizing radiation is able to activate latent tumor viruses.

Despite recent advances, there is still considerable diversity of opinion regarding the histogenesis, nomenclature, classification, and treatment of bone tumors and tumorlike conditions. The close collaboration of research workers with the diagnostic pathologist and the clinician, and the application of modern methods such as histochemical studies, autoradiography, tissue cultures in vitro, genetic studies, fluorescent and electron microscopy, are bringing us closer to an understanding and interpretation of the vital processes occurring in skeletal tissue. In addition to the hematopoietic activity of the bone marrow, these processes consist primarily of formation and destruction of bone (apposition and resorption), which throughout life proceed in a harmonious manner but which are profoundly disturbed under pathologic conditions.

Diagnosis of Bone Tumors

All those dedicated to the study of skeletal disorders agree that a combined clinical, radiologic, and pathologic study, supplemented whenever necessary by biochemical and hematologic investigations, is essential in order to arrive at the precise diagnosis of an osseous lesion. However, at present, these methods play only a limited role in the diagnosis of most bone tumors and should not be regarded as essential sources of information, except under special circumstances.

Radiology

Radiology is of great importance in the diagnosis of bone tumors. Radiographs should always be available to the pathologist, who should never make a definite diagnosis without knowing the radiologic features. It is also of fundamental importance to provide the pathologist with detailed clinical information (such as duration and type of symptoms, previous trauma or irradiation, pathologic fracture).

However, despite significant advances in radiographic diagnosis, including tomography, angiography, and computerized tomography (CT), the exact diagnosis of a bone tumor is often impossible or misleading. In Argentina, the orthopedic surgeon, and not the radiologist, usually interprets the plain radiographs and requests, whenever necessary, other special radiologic investigations, which are then discussed with the pathologist and radiologist before a biopsy is undertaken. The radiographs are then submitted together with the tissue specimen to the pathologist.

Bone reacts to the presence of neoplastic, metabolic, inflammatory, or other processes in two different ways: by new bone formation or by bone resorption. The two processes are often combined, one predominating over the other. The following points should be ascertained from a radiographic examination of a bone lesion:

1) Whether the lesion is monostotic or polyostotic
2) The type of bone affected (tubular or flat)
3) The site of the lesion with reference to the epiphysis, growth plate, metaphysis, or diaphysis, and with reference to its medullary, cortical, or juxtacortical location
4) An estimate of how much of the total length and circumference of the bone is affected
5) The presence or absence of adjoining soft-tissue changes with particular mention of fascial planes, tumor tissue, etc.
6) The nature of any bone changes present (destructive or radiolucent of moth-eaten, permeative, or geographic type, proliferative, or mixed)
7) The character of the bony margins of the lesion (sharp, ill-defined, thick, thin, increased or decreased density)
8) The nature of any cortical bone changes, such as the involvement of medullary or periosteal surfaces, cortical invasion, pressure atrophy
9) The density of tumor tissue, with particular regard to the presence of calcification and its roentgenographic characteristics (solid, punctate, smokey)
10) The character of periosteal reaction (laminated or "onion peel," solid, sunburst, or Codman's triangle)

Radiographic techniques may vary in accordance with the nature of bone destruction or proliferation, as well as with the presence or absence of perifocal soft-tissue changes.

Special Radiographic Procedures

Body-section radiography (tomography), magnification techniques, xeroradiography (Nessi et al. 1978), the use of substraction techniques, and other methods must be employed whenever routine roentgenographic exposures fail to reveal adequately the roentgenographic characteristics of the bony or soft-tissue abnormality.

Angiography. Angiography plays only a limited role in the diagnosis and management of bone and soft-tissue tumors. The greatest contribution of angiography is the demonstration of the full extent of the tumor, which is helpful in planning initial resection of soft-tissue tumors or in outlining the local extraosseous extent of malignant bone tumors (Hudson et al. 1975; Halpern and Freiberger 1970). However, according to the majority of authors, the distinction between benign and malignant lesions is unreliable (Viamonte et al. 1973; Hudson et al. 1975) and the abnormal vascularity nonspecific in the diagnosis of malignant neoplasms.

Computerized Axial Tomography. Although relatively new as a diagnostic method, computerized axial tomography (CAT) has proved helpful to the operating surgeon in the preoperative evaluation of soft-tissue and bone tumors. CAT provides information not previously available by plain film and angiography regarding precise size of the tumor mass, its location and relationship to muscle bundles and fascial planes, definition of the margins of the tumor and the relation to neural, vascular, and bony structures. This evaluation, which was difficult or almost impossible with angiography of pelvic lesions (Intro. Fig. 1), is of particular value to the orthopedic surgeon when planning the feasibility of en-bloc resections in bone tumors, a method used more frequently than before (Weis et al. 1978).

Scintigraphy (Bone Scanning)

With the development of appropriate instrumentation and radiopharmaceuticals, radionuclide imaging has emerged as an additional powerful tool in the study and evaluation of most pathologic processes of the skeleton, being the major indicator used in differentiating monostotic from polyostotic disease (Malmud and Charkes 1975).

Before 1970, bone scans were done with strontium 85; because of the high radiation dosage, only patients with known cancer and local areas could be studied. Greater strides were made after 1970, when the short-lived strontium 87m and fluorine 18, and a little later 99m-technetium(Tc)-labeled polyphosphate and 89m-technetium-labeled diphosphonate were introduced as bone-scanning agents by Subramanian and others 1972; (Subramanian and McAfee 1977).

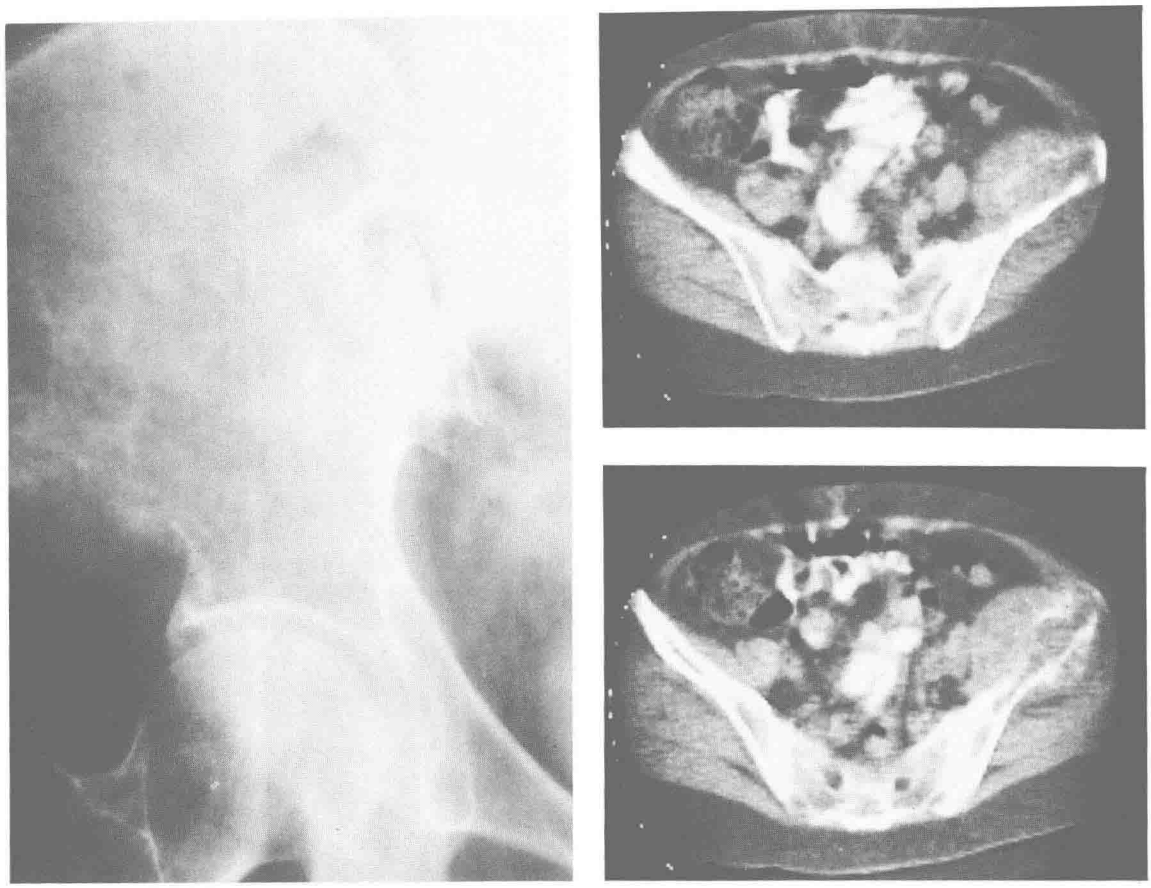
The low-cost, low-absorbed radiation dose (about 500 mrads) led to improved imaging devices and improved resolution and made bone scanning with these pharmaceuticals an important, routine diagnostic procedure in many institutions. For example, an anterior and posterior skeletal survey can now be performed in about 30 min. The mechanism of localization of 99m-Tc-labeled phosphate compounds is not entirely clear despite their obvious affinity for bone, exchanging with the phosphate group, or being involved in any process of calcification when adequate blood supply is maintained.

Increased uptake of radionuclides is highly nonspecific. Any pathologic process in bone resulting in new bone formation (reactive or tumor bone), increased blood flow or bone turnover as also normal growth, will show increased radionuclide uptake (Galasko 1969, 1975). Therefore, a bone scan is usually not reliable for identifying the specific type of tumor or for differentiating malignant from benign processes.

Gallium 67 citrate, a "tumor-seeking agent," is deposited in actively functioning and dividing cells as well as in white blood cells. It is therefore picked up by inflammatory lesions, but it is useful and is applied extensively for staging lymphomas. For details on the indications and limitations of radionuclide imaging, the reader is referred to Fordham and Ramachandran's (1977) review article.

Pathology

A biopsy should be systematically carried out in all cases, because it is impossible to determine the exact nature of the affection by the previously mentioned methods. It should not be omitted in any case in which radical surgery, radio-, or chemotherapy is contemplated.



a b

Fig. 1,a,b. Male, 36 years old. Chondrosarcoma of the left ilium. a Radiograph of an osteolytic, poorly limited lesion with destruction of the cortex and penetration into the soft tissues. b Computerized tomograms show the extension of the tumor and the penetration into the pelvis. (Courtesy of Dr. Petasnick, Rush-Presbyterian-St. Luke's Medical Center.)

Biopsy can be carried out in two ways: (1) surgical biopsy (incisional or excisional) and (2) needle biopsy (aspiration or trocar biopsy). Regardless of the procedure used, it should be interpreted by a pathologist who has a good basic knowledge of bone pathology. He must know the exact site of the material submitted, together with the clinical and radiologic information.

Surgical Biopsy

Despite doubts raised concerning the danger of an increase in the growth or spread of a malignant tumor after biopsy, there is no objective evidence for this contention. Most investigators maintain that surgical biopsy carried out by a competent surgeon under the necessary conditions of asepsis and with the correct techniques (with or without a tourniquet) does not involve any great danger. However, in cartilaginous lesions, an incisional biopsy may result in tumor implantation, often making adequate further surgery difficult.

The Netherlands Committee on Bone Tumors (1966) recommends prior irradiation in the hope that this procedure will lower the viability of any cells that may be disseminated during the biopsy. Realizing that even a moderate dose will cause changes in such highly radiosensitive lesions as Ewing's sarcoma and reticulum-cell sarcoma, they advise a daily dose to the tumor of 400 rads on two successive days, the biopsy to be performed immediately after the second irradiation. Most investigators, including the writer, do not employ this procedure.

The major source of error in diagnosis is inadequate tissue due to defective technique: The specimen is taken from the periphery of the lesion, that is, from zones of reactive bone formation or from necrotic tissue.

When the material is obtained by open surgical biopsy, two possibilities present themselves: One can order an immediate histologic examination, during the operation, by means of frozen sections, or one can close the wound and await the results after embedding the material in paraffin. Frozen sections (of fresh or formalin-fixed material) are the preferred diagnostic procedure at the Mayo Clinic and in other centers, particularly when surgical treatment is to be carried out immediately.

By improving standards of frozen sections, the cryostat constitutes a great advance. A major advantage of frozen sections is that the surgeon can judge immediately whether the specimen is adequate and can verify that he has not taken edematous, necrotic tissue or adjacent healthy tissue. However, only a few pathologists have sufficient experience with frozen sections of bone tumors to give an immediate opinion when the possibility of amputation has to be considered. Many prefer to embed the material in paraffin because they feel that frozen sections do not always permit recognition of the necessary histologic details, particularly in giant cell tumors and in cartilaginous and "round cell" tumors. They feel that neoplasms such as chondroma, chondrosarcoma or Ewing's sarcoma, primary reticulosarcoma of bone, multiple myeloma, metastasis of undifferentiated carcinoma or neuroblastoma, present sufficient difficulties in differential diagnosis, even with paraffin sections, and reason that the difficulties are even greater with frozen sections.

Indeed, local conditions and experience and the degree of mutual confidence of clinicians and pathologists must, necessarily, control the practice adopted in any institution.

Aspiration (Puncture or Needle) Biopsy

The value of needle biopsy in diagnosing bone lesions has been discussed widely. One of the main objections to the technique has been the degree of confidence that can be inspired by a diagnosis based on relatively small particles of tissue. Some orthopedic surgeons and bone pathologists, especially Lichtenstein (1977), are still opposed to this method, although it is accepted without reservation in many important centers for use with vertebral lesions, because it replaces a difficult and major operation.

In our institute, as in other centers in Latin America, aspiration biopsy is the method of choice. In several previous publications, the writer alone or in collaboration with Valls, Ottolenghi, and others (Valls et al. 1941, 1942, 1948, 1954), reported the advantages, disadvantages, and technical details of this proceeding, especially the approach to the vertebral bodies at their different segments (Intro. Fig. 2a).

In 1976, I reported the results of 7165 puncture biopsies, including 1900 vertebral lesions, performed during a 33-year period with about 73% positive results (Schajowicz and Hokama 1976) (Intro. Fig. 2b). This number has increased to more than 8000 cases, including approximately 2200 vertebral punctures.

Like many other pathologists, we were at first skeptical about this procedure, especially because the pioneers of this method at the Memorial Hospital of New York, who have used it since 1931, recommended the preferred or exclusive use of the smear, a technique that requires considerable experience to distinguish the cytologic characteristics of the various tumors (Coley et al. 1931; Ellis 1947; Martin and Stewart 1936; Snyder and Coley 1945). However, after the first attempts, we became enthusiastic about the method when we realized that it was not necessary to carry out difficult cytologic interpretations: It was possible to obtain good histologic sections after embedding the more important parts of the aspirated fragments in paraffin. The only difference between this and the usual open biopsy is that the pathologist must make his diagnosis from smaller pieces than he normally would.

In 1947, Frank Ellis stated that he used the paraffin-block method almost exclusively. We use both methods, giving priority to the histopathologic interpretation of the embedded material, with which we have obtained more satisfactory results.

In general, we follow, with slight modifications, the technique employed at the Memorial Hospital of New York, using a needle 2 mm in diameter with a short bevel, well sharpened, and with metal syringes to which the needle can be fitted securely. However, to extract a specimen from the lumbar vertebrae, we designed with Valls and Ottolenghi (Valls et al. 1941, 1942, 1948, 1954) a special set of instruments composed of a needle guide, two needles, and a lined metal plate, which makes it

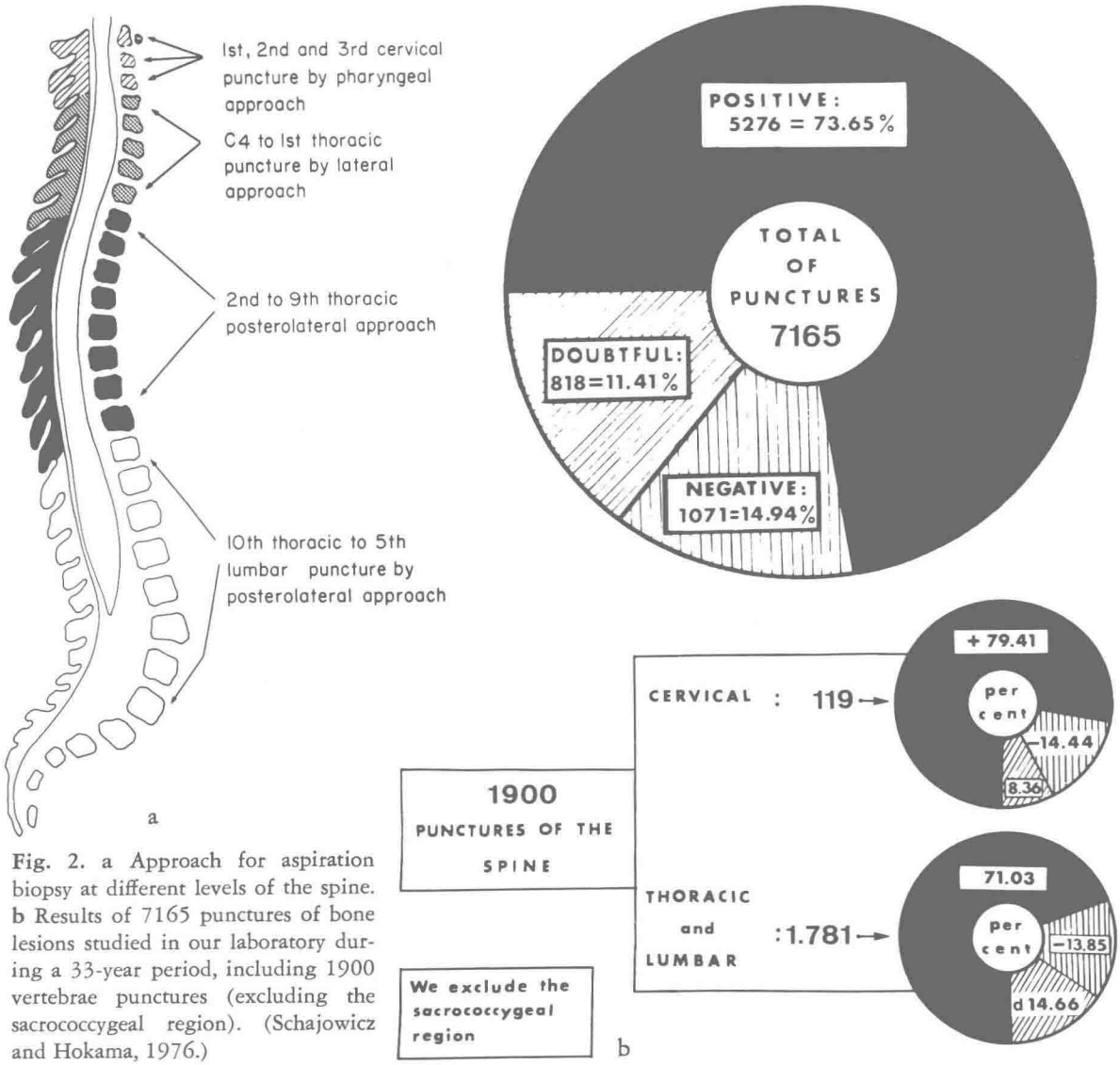


Fig. 2. a Approach for aspiration biopsy at different levels of the spine. b Results of 7165 punctures of bone lesions studied in our laboratory during a 33-year period, including 1900 vertebrae punctures (excluding the sacrococcygeal region). (Schajowicz and Hokama, 1976.)

possible to reach this difficult site easily and with no danger (Intro. Figs. 3, 4). Ottolenghi (1969) has used a slight modification of this technique for the approach to the second to ninth dorsal vertebrae, which we had previously considered contraindicated (Intro. Fig. 5). For the first three cervical vertebrae, puncture by the pharyngeal approach is indicated, and for the fourth cervical to the first dorsal vertebrae, puncture by the lateral approach is indicated (Intro. Figs. 6, 7).

Our technique of vertebral puncture has been adopted by many centers with or without modifications, with various types of needles or trocars, some much larger than our original 2-mm needle (Frankel 1954; Ray 1953; Siffert and Arkin 1949; Sicard et al. 1958). The needle biopsy specimen is placed in sterile physiologic saline solution. It is then possible to prepare smears that are air-dried and stained with methylene blue, May-Grünwald-Giemsa, and hematoxylin-eosin (H-E). The residual material is embedded in paraffin for histopathologic examination, and, if necessary, bacteriologic examination or inoculations of guinea pigs can be performed. A recent improvement of the cytologic study is the use of the cytospin technique for the aspirated liquid.

On some occasions, histochemical studies (alkaline phosphatase and glycogen stains) can be performed and are an important aid to diagnosis. The specimen