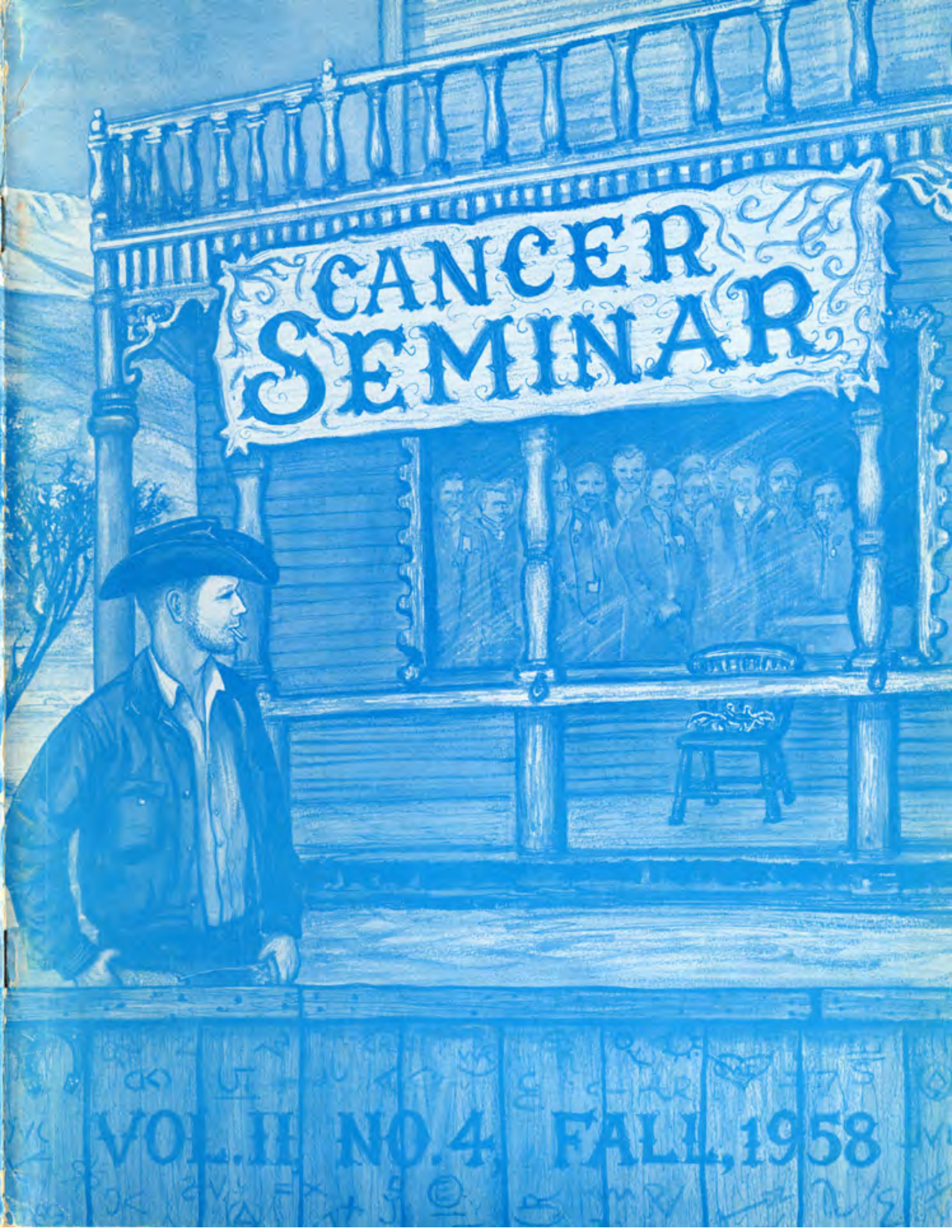

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CANCER SEMINAR

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JUAN A. DEL REGATO, M. D., *Editor*

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BONE TUMORS

THIS was our eleventh annual CANCER SEMINAR. In these conferences, we have explored, without exhausting them, numerous fruitful possibilities of radiologic-histopathologic studies of clinical cases. We thought it timely, however, to repeat some of the tried subjects and decided to have a second conference on Bone Tumors. If the problems presented by these tumors remain the same, there has been significant transformation in our understanding and attitudes in the face of these problems. This is particularly true of benign lesions: a varied and more sophisticated nomenclature has replaced the old clichés in the response of our participants. There is also a greater inclination to the radical treatment of malignant tumors based on a more hopeful outlook.

A total of 446 radiologists, pathologists, surgeons, etc., attended this CANCER SEMINAR at the Broadmoor Hotel of Colorado Springs, on September 6th, 1958. They were rewarded by the repeat performance of two of our previous speakers: DR. PHILLIP J. HODES, Professor of Radiology, Jefferson Medical College, Philadelphia, and DR. LAUREN V. ACKERMAN, Professor of Surgical Pathology, Washington University, St. Louis. Their authoritative discussions were complemented by the wealth of clinical experience of our third guest, DR. FRED C. REYNOLDS, Professor of Orthopedic Surgery, Washington University, St. Louis. The proceedings are now presented in printed form for permanent record and for the benefit of a large group of correspondents in this country and abroad.

We wish to thank again, those who have helped our efforts as guest speakers, contributors or participants, and also those who have written to us their words of appreciation and encouragement.

J. A. DEL REGATO, M. D.

Colorado Springs
October, 1959.

1. "Adamantinoma" of the Tibia

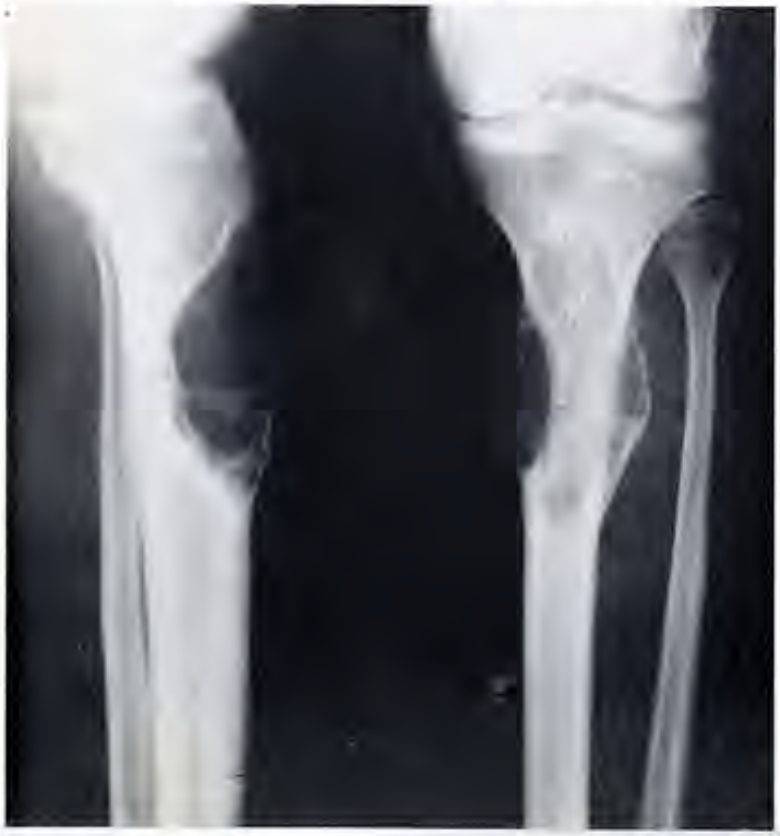
Contributed by RAUL MARCIAL-ROJAS, M. D., San Juan, Puerto Rico

THE PATIENT was a 44-year-old man in August, 1953, when he complained of pain in the left knee and leg which was aggravated by walking.

Dr. Hodes: In September, 1951, Dr. Ackerman and I discussed bone tumors before this CANCER SEMINAR. I well remembered how worried I was, though I had worked hard and I thought I was fairly well prepared. Today, I am even more worried than I was seven years ago. I have worked harder preparing for this Seminar; yet, I do not feel as well prepared as I did then. The reason is obvious. Today there are more bone diseases to think of than there were in 1951; the odds are greater against me, therefore. The fact that Dr. Ackerman has learned more during these years will not help matters either. I should like to acknowledge my indebtedness to Doctors Lent Johnson and Roy Thompson of the Armed Forces Institute of Pathology, my associates and residents, all of whom worried over these tumors with me. I am particularly grateful to Lent Johnson, with whom I spent many rewarding and refreshing hours. His keen analysis of roentgen findings, unquestionably sharpened my perception. His ability to express in words roentgen manifestations of bone disease, I consider important, for it enables individuals to speak in graphic terms which are mutually understandable. Many of those terms are incorporated in my descriptions.

This monostotic lesion is located in the proximal end of a tubular bone. It is medullary in origin and extrinsically placed. It arises in the proximal end of the diaphysis and involves also the metaphysis. There is an associated pathological fracture. The lesion is fairly well encapsulated. Some attempt at margination is noted along the proximal border in the antero-posterior projection. The distal border is also well demarcated. The thin shell of bone surrounding the tumor is intact along its lateral margin; the medial margin reveals some destruction. Buttressing of bone with the formation of Codman's cuffs is noted in the antero-posterior projection; also there is evidence of invasion and permeation of bone which must lie along the posterior margin of the tumor mass. There is only minor perifocal soft tissue swelling, with no definite evidence of extension into the soft tissues. The tumor reveals no evidence of calcified tumor matrix. Minor trabeculation is observed which is probably more apparent than real.

Fig. 1 — Roentgenogram showing an eccentrically located, well encapsulated cystic lesion of the proximal third of the tibia.



Giant cell tumor: The cystic and expanding characteristics of this tumor are consonant with this diagnosis. Giant cell tumors are also eccentrically placed. Usually, however, they lie much closer to the epiphysis. Commonly, also as the giant cell tumor extends beyond the normal contour of bone, it loses evidence of margination and does not present the clearly defined shell of bone here present. *Aneurysmal bone cyst:* These are benign tumors; the tumor which occupies our attention is a malignant tumor. *Adamantinoma:* These also may be cystic lesions but they usually occur in the middle third of the tibia. Very common is the history of trauma. *Fibrosarcoma:* These tumors occur commonly in the older age group. Usually, they arise in the metaphysis in the medullary portion of the bone and are eccentrically placed. They are expanding cystic lesions which may vary in aggressiveness. This tumor lies in the field from which fibrosarcomas arise.

Dr. Hodes' impression: A slowly growing malignant bone tumor. 1) FIBROSARCOMA. 2) GIANT CELL TUMOR.

Roentgenologic Impressions Submitted by Mail:

Aneurysmal cyst	45	(1)*
Giant cell tumor	30	(1)
Adamantinoma	20	(1)
Benign bone cyst	13	
Non-osteogenic fibroma	9	(1)
Chondroma	8	
Sarcoma	18	(2)
Others	47	

Dr. Regato: Dr. J. A. Campbell, of Indianapolis, made a diagnosis of periosteal fibrosarcoma. Dr. H. L. Garland, of San Francisco and Dr. W. B. Seaman, of New York City, submitted an impression of adamantinoma; Dr. R. Sherman, of New York City, and Dr. H. Hauser, of Cleveland, preferred aneurysmal bone cyst.

J. M. Dell, Jr., M.D., Gainesville, Florida (by mail): The three conditions that I know which are capable of producing bone expansion of this size, all in being eccentrically situated in the cortical shaft are: hydatid disease, aneurysmal bone cyst and malignant angioblastoma.

* In the past, our correspondents have indicated that our tabulated diagnoses differ greatly, probably because they are a mixture of opinions of the experts with those of less experienced pathologists. In this CANCER SEMINAR, we chose six international authorities of world renown as radiodiagnosticians and surgical pathologists, their diagnoses are indicated in parenthesis in every case, to permit the observation that they often differ among themselves.

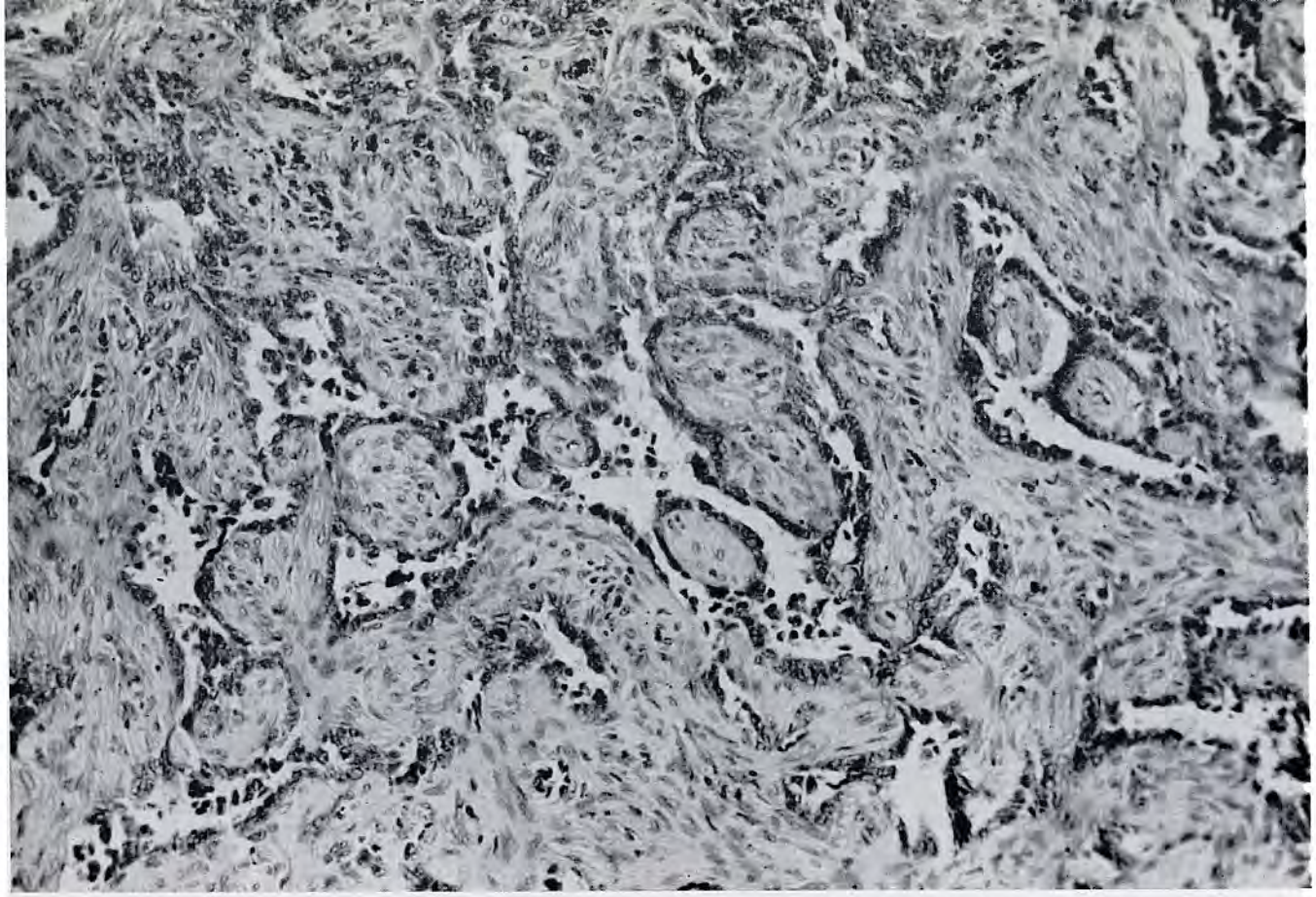


Fig. 2 (Moderate power) Photomicrograph showing areas of the tumor which suggest endothelial origin with prominent vascularity (A.F.I.P. Acc. No. 218757—18).

Operative findings: A biopsy was reported as showing "myxosarcoma"; slides of this biopsy have not been located. The lesion was curetted and bone chips were placed in the cavity.

In November, 1954, the patient started to complain of pain. In September, 1956, the pain had increased and the roentgenogram showed signs of recurrence. In May, 1957, a biopsy was reported as showing chronic inflammation, fibrosis and reactive bone formation. An extensive curetting was carried out in September, 1957, from which material the Seminar slides were processed.

Dr. Ackerman: The group of cases that we are to discuss today represent a varied collection. Some of them are very clear cut and we can be certain of the diagnosis, treatment and future course for the patient; there are a number of cases that make me feel inadequate from the standpoint of microscopic diagnosis. Usually, however, in any bone tumor we are able to determine, in a general way, whether a given neoplasm is benign or malignant, and by consultation with the surgeon and radiologist, we can decide upon the correct course of action. In all instances, it is imperative that there be the closest possible cooperation with the clinician and the radiologist. We must be certain that the biopsy is adequate, well prepared and that it comes from a diagnostic zone.

This is an adamantinoma of the tibia. Grossly the lesion usually produces a well delimited osteolytic defect in the tibia, often arising close to the apiphyseal line; it frequently destroys the cortex extending out into the soft tissue. The color is often pale tan-white with translucent zones. It may extend into the soft tissues and secondarily involve a well delimited portion of the fibula. At times the cortex is thickened and firm. It may undergo cystic degeneration and show particles of bone within the neoplasm. In 33 cases reviewed by Changus et al. practically all were in the tibia with the exception of one in the ulna, one in the femur; in two instances the fibula was also involved with the tibia.

Microscopically this lesion suggests possible endothelial origin. Vascular spaces filled with red blood cells are common and these are separated by loose cellular connective tissue framework (Fig 2.). Microscopically Baker described three patterns: "The first pattern consists of masses of epithelial islands in which the peripheral cells are columnar and arranged in a palisaded fashion. The central cells of these masses are stellate, producing reticulum formation. Within the center of the reticulum, cystic areas may exist. This pattern can be easily mistaken for adenocarcinoma. At times, the columnar peripheral palisaded cells appear to be lining a lumen, producing an alveolar arrangement. The second pattern consists of islands of cells resembling basal cells, varying greatly in size and shape and scattered throughout a fibrous stroma. Palisading may again be a feature of the peripheral cells. Cystic areas may be present within the epithelial masses which are quite reminiscent of basal cell carcinoma. The third pattern consists of islands of squamous epithelium scattered throughout a fibrous stroma. Great variation in size and shape of the islands is found. Pearl formation is a feature." The histogenesis of these tumors has long been in doubt. The most appealing one is trauma with implantation of basal cells of the epidermis deep in the subcutaneous tissues. Many patients with adamantinoma of the tibia have had a history of injury, and, of course, the tibia is a long bone on which the skin is closely applied to the periosteum. This type of lesion grows slowly with a punched out, osteolytic defect. Occasionally it might be treated with localized en-bloc excision, but because of the extent of the process, amputation is the treatment of choice.

Dr. Ackerman's diagnosis: ADAMANTINOMA OF THE TIBIA.

Histopathologic Diagnoses Submitted by Mail:

Angiosarcoma	61	
Adamantinoma	42	(5)*
Non-ossifying fibroma	12	(1)
Metastatic carcinoma	21	
Giant-cell tumor	8	
Osteosarcoma	6	
Others	24	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

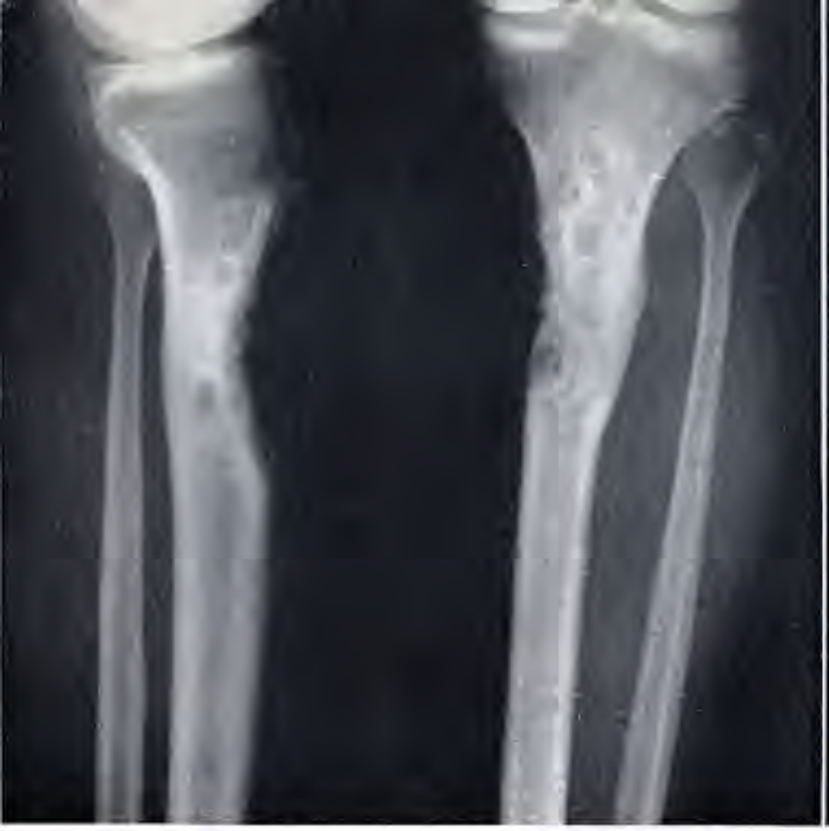


Fig. 3 — Roentgenogram following curettement and introduction of bone chips (Nov. 1954).

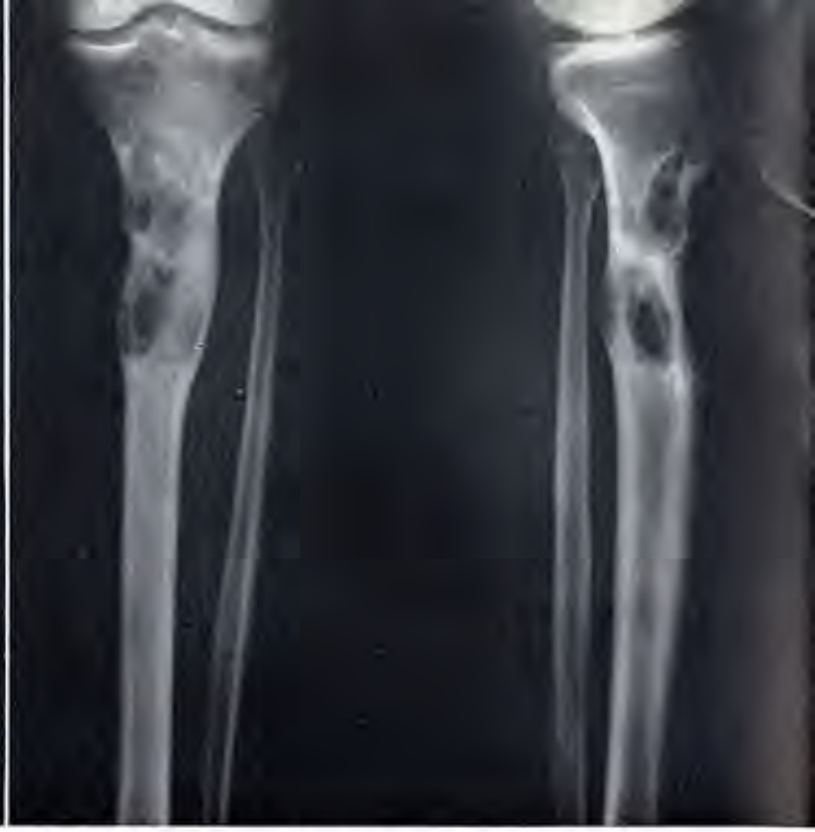


Fig. 4 — Roentgenogram showing signs of recurrence (Sept. 1956).

Dr. Regato: Dr. J. B. McNaught, of Denver, and Dr. E. F. Geever, of Washington, D. C., submitted a diagnosis of angiosarcoma. Dr. D. Brachetto-Brian, of Buenos Aires, designated this tumor as a tubular variety of angioendethelioma, without blood content. Dr. L. Lichtenstein, of Los Angeles, submitted a diagnosis of "so-called" adamantinoma of the tibia, fibrous type. Dr. F. Bang, of Copenhagen, and Dr. R. Hirtzler, of Zagreb, made a diagnosis of fibrosed giant-cell tumor.

C. Oberling, M. D., Paris (by mail): This is a tibial adamantinoma with pseudoangioblastic structures. I am not in agreement with Doctor Stewart's contention that these tumors are angioblastomas. Tibial adamantinomas, like salivary gland tumors, in which adamantinoid structures may be equally present, occasionally exhibit endotheliomatous structures similar to that of true endotheliomas (Volkman's tumors).

Subsequent history: A mid-thigh amputation was carried out on February 19, 1958. There were small foci of remaining tumor. No evidence of metastases to date.

Dr. Reynolds: I would like to ask Dr. Hodes if he feels that the presence of a Codman's triangle always indicates the presence of a malignant tumor. Once you know the diagnosis, it is easy to look back and say that the first treatment of this case was inadequate. However, I think that the clinician has to be somewhat suspicious of the pathologist when he says that he is dealing with a low-grade malignant tumor: one has to take that with a little reservation, and it might be well to consider treating it as a more benign lesion. This is a very rare tumor and my experience with it is practically nil. The proper treatment undoubtedly would have been the complete ablation of the tumor at the first operation; it is only necessary that you remove all the tumor cells. If this can be done in a fashion to preserve function of the extremity, then that should be the operation. In this particular case, I would doubt very much if local resection could be accomplished with preservation of adequate function of the extremity; therefore, amputation or probably disarticulation of the knee, would have been necessary and would have given a better over-all functional result than a mid-thigh amputation.

M. Berthrong, M. D., Colorado Springs, Colorado: Dr. Reynolds' comment reminds me of Dr. Rich's advice to surgeons; when not sure of the nature of the tumor and if asked for advice, he would say: "I'd strongly recommend that you cut all this tumor out". It would be interesting to know how Dr. Reynolds knows when he has had all the cells out. It has always puzzled me why these tibial tumors are called adamantinomas, for they don't look at all like adamantinomas; at least the few I've seen. It does seem to me that it might be a synovial tumor; I wish Dr. Ackerman would comment on the possibility that cells that stuck in there by a little bit of trauma, might not have been synovial cells as well as epithelial cells.

C. Berdjis, M. D., San Antonio, Texas: Dr. Ackerman said that there was no possibility of a giant-cell tumor. However, the only section we had was composed of two parts, one strongly suggested a benign giant-cell tumor; the other part was what Dr. Ackerman showed as adamantinoma. However, Col. Luckman who saw this slide thought that this tumor looked like sclerosing hemangioma in some areas, which is almost the same thing that Dr. Ackerman thought, an adamantinoma with vascular aspect. I am wondering if there are two tumors here.

Dr. Reynolds: A question was asked how a surgeon could tell if he had all the cells. There are two ways. One, when you do a local resection, you don't expose any tissue around the tumor. If you have to do it in block excision, that material then is examined by the pathologists to be sure that you are completely around the tumor.

P. Martineau, M. D., Detroit, Michigan: Was this slide from tissue taken at a second operation? The character of this lesion might have been modified a great deal by trauma of the first operation. I think that most of us felt that these small groups of budding, growing cords of cells were angioblastic. Did you think these were truly neoplastic or just reaction to injury?

R. Schaffer, M. D., Fort Worth, Texas: In treating this low-grade malignant lesion, would it be possible to remove it by zinc chloride fixation plus local excision? Could you tell that it was all removed by this procedure?

Dr. Ackerman: As a matter of fact, I am not at all certain in my mind about these lesions, which I have designated as adamantinomas: this is a very loose sort of term, but I think we are stuck with this name for a lesion which fulfills the things we have been discussing. I do not know the histogenesis of this lesion; to me, this doesn't look synovial. There must have been some change in this lesion because of surgery, but I think that the basic character of this lesion is one that would produce considerable proliferation of fibroblasts, and because of its vascular appearance, hemorrhage and hemosiderin pigmentation would be prominent. Dr. Marcial chased through the mountains of Puerto Rico for that first slide, but did not succeed.

I should say that the use of zinc chloride paste is pseudoscientific. Perhaps it might work under the rare circumstances, when you have a full-time pathologist assigned to this tumor, cutting one millimeter away a week and he keeps on looking. I think that this method is sort of primitive and, as you might judge, I would be against it.

Dr. Hodes: In answer to Dr. Reynolds' question about the Codman's cuff. Of course, this is not pathognomonic of malignant tumors; it's a mere index of periosteal reaction. I do believe, however, that if you look very carefully at the Codman's cuff associated with a malignant tumor, you will find an irregularity, a pleomorphism that you don't see when you are dealing with something that has suddenly caused the periosteum to come away from the outer layer of the bone.

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2. *Fibrosarcoma of the Femur*

Contributed by FRANK VELLIOS, M. D., Indianapolis, Indiana

THE PATIENT was a 65-year-old woman in June, 1957, when she complained of pain in the lower third of the right thigh. Movements awoke pain and there was considerable weight loss but no palpable mass. Hemoglobin was 12 grams per cent and repeated serological tests for syphilis were negative.

Dr. Hodes: This tumor occupies the distal third of a tubular bone; apparently it is monostotic. Centrally placed, and medullary in origin, it occupies the shaft of the femur extending from the diaphysis into the proximal portions of the metaphysis. The medullary defects look like snowflakes of calcific debris which are not unlike the bone defects observed in infarction. Distributed throughout these calcific densities is evidence of cancellous bone and cortical bone destruction with some "punched out" areas, "washed out" areas and "permeated" areas. There is no attempt at margination along its proximal or distal ends. The cortex is destroyed. Periosteal proliferation, laminated in type, is visualized with ease. A Codman's cuff is observed along the proximal and medial aspects of the tumor in the anteroposterior projection. Of considerable importance are the flocculent, "snowflake-like" densities within the medullary canal which are characteristic of calcified chondroid matrix.

Whereas mixed *osteosarcomas* may be associated with this type of medullary calcific debris, the roentgen appearance is highly suggestive of primary *chondrosarcoma*. Osteosarcomas and *fibrosarcomas* may contain areas of necrosis which calcify. All forms of osteosarcoma arise in this portion of the femur and this, too, is of little assistance in distinguishing between them.

Dr. Hodes' impression: A fairly aggressive malignant bone tumor. 1) CHONDROSARCOMA. 2) OSTEOSARCOMA.

Roenigenologic Impressions Submitted by Mail:

Chondrosarcoma	97	(6)*
Osteosarcoma	15	
Fibrosarcoma	13	
Metastatic carcinoma	6	
Others	33	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. J. Keleki, of Athens, Greece, Dr. F. J. Gorishek, of Denver, and Dr. P. C. Swenson, of Philadelphia, all submitted an impression of secondary chondrosarcoma. Dr. R. Calderón, of Managua, Nicaragua, suggested parosteal fibrosarcoma.

Operative findings: A biopsy was done and as a consequence, there was a pathological fracture. On November 20, 1957, a mid-thigh amputation was carried out. A more radical procedure was rejected because of the bad general condition of the patient. A large gray-white firm tumor was found destroying the entire two fractured segments of the bone. The periostium was completely destroyed, the medullary cavity was necrotic. The tumor infiltrated the muscles, the fat, the popliteal vein and sciatic nerve. There were hemorrhagic nodules with calcific deposits. There was gross evidence that the tumor had been transected in the bone and soft tissues.

Dr. Ackerman: This is an extremely unusual case for many reasons. Dr. Frank Vellios sent me the original material: there was extremely well differentiated connective tissue present and there were inflammatory cells intermingled with the fibrous tissue (Figs. 4 & 5). Mitotic figures were few and far between. Many sections were made and I could not convince myself that this was a malignant lesion, although, radiologically it was thought by most radiologists to be a malignant neoplasm, possibly chondrosarcoma. Then,

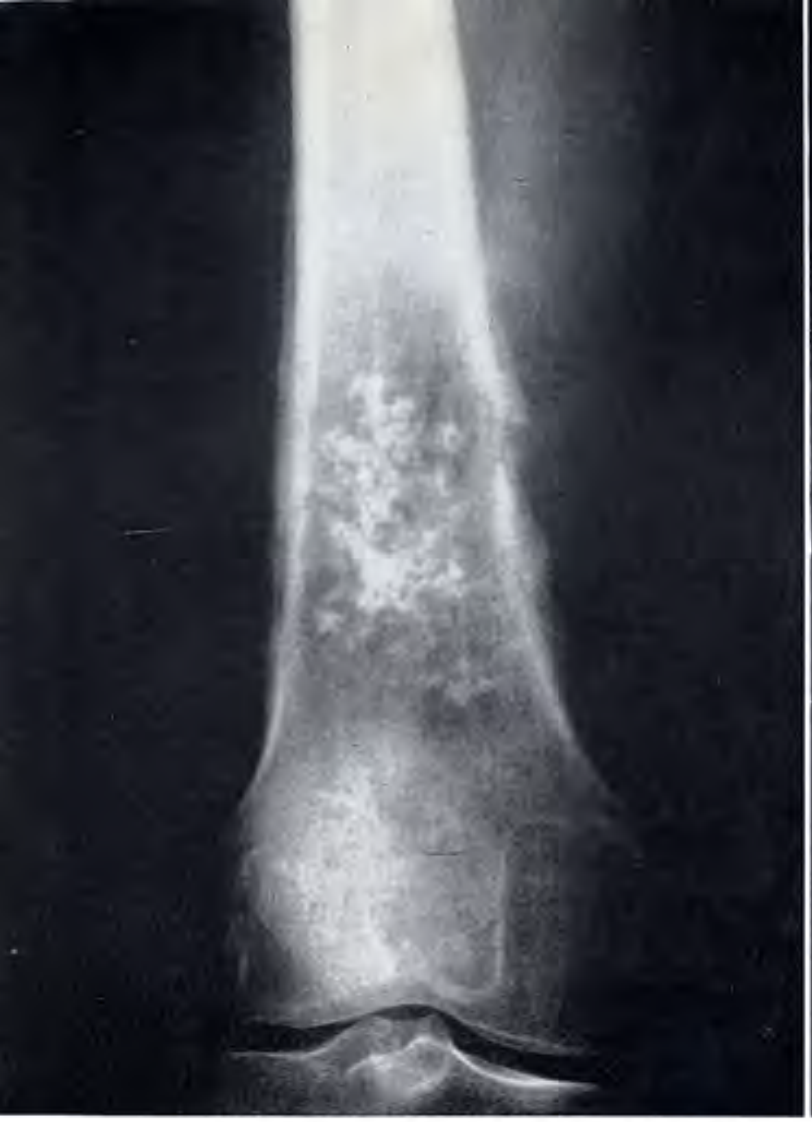

Fig. 1 — Roentgenogram of the distal third of the femur showing medullary calcific defects with destruction of the cortex.

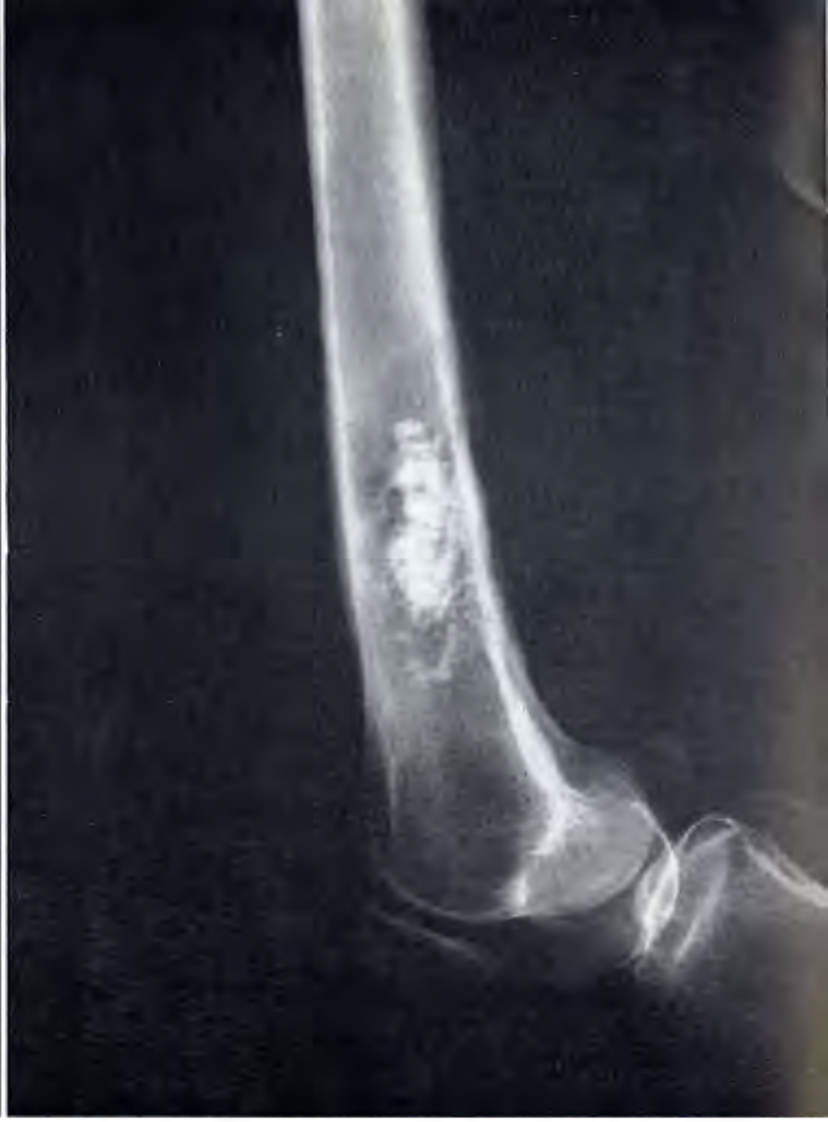

Fig. 2 — Lateral roentgenogram showing the apparent intrinsic origin of the changes.

three months later this lesion recurred. It grew up into the soft tissue and amputation was done. On cut section of the gross specimen which Dr. Vellios kindly sent to me, there was an obvious tumor present. This arose apparently from within the medullary canal of the femur, broke through the cortex anteriorly and posteriorly invading the soft tissue. In the medullary area there were isolated, pearly-white areas measuring approximately 1 cm that appeared cartilaginous. Innumerable sections were taken. The cartilaginous area showed cartilage partially calcified. The tumor was fibrosarcoma, well differentiated, but showed both normal and abnormal mitotic figures. There was a small amount of osteoid in one section, but I did not feel this was a part of the neoplasm.

I did not feel the cartilage present had anything to do with the neoplasm and represented merely cartilaginous islands which had become partially calcified. It was rare to us, but we have seen it in this bone and particularly in the humerus. We have never seen a fibrosarcoma that was so well differentiated and produced such a rapidly destructive lesion. It is difficult to determine what the prognosis is, but if we judge by the rapid recurrence and large tumor mass that was present, the possibility of vascular invasion is present.

Fibrosarcoma frequently occurs in the region of the knee joint. In the cases reported by Gilmer, 80 per cent occurred in this zone. It invariably produces an osteolytic defect, destruction of the cortex and extension into the soft tissue. Grossly, it is grayish-white to pink. Microscopically, there are few well differentiated lesions. This tumor is most common in the second, third and fourth decades. There is some correlation with the degree of differentiation of the neoplasm (Gilmer).

Dr. Ackerman's diagnosis: FIBROSARCOMA OF THE FEMUR.

Histopathologic Diagnoses Submitted by Mail:

Fibrosarcoma	118	(4)*
Fibrosarcoma in Paget's	3	(1)
Neurogenous tumors	22	
Non-ossifying fibroma	12	
Leimyosarcoma	4	
Chondrosarcoma	3	
Others	15	(1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. R. A. Willis, of Leeds, submitted a diagnosis of fibrosarcoma and suggested the possibility of its association with Paget's disease. Dr. M. B. Dockerty, of Rochester, Minnesota, submitted a fibrosarcoma, grade 2, probably arising in a chondrosarcoma. Dr. F. Schajowicz, of Buenos Aires, also saw a fibrosarcoma within a chondrosarcoma. Dr. D. Rosenberg, of Santiago de Chile, submitted fibrosarcoma of bone.

A. P. Stout, M.D., New York (by mail): I question whether this is a primary tumor of the bone with extension to the surrounding soft tissues, or a soft tissue tumor invading bone. It is either a fibrosarcoma with storiform pattern or a differentiated fibrosarcoma of a type I would not expect to metastasize (supposing the tumor maintains this pattern

in all its parts). Since I have never seen a tumor like this arising from bone, I will guess that it is a differentiated soft part fibrosarcoma with invasion of the femur.

Subsequent history: The patient did fairly well until March, 1958, when she started to cough and became dyspneic; numerous masses were palpated in the abdomen. On April 29th, 1958, the patient expired; no autopsy was done.

Dr. Reynolds: I cannot say that osteosarcoma, fibrosarcoma or chondrosarcoma may arise in cartilaginous rest or in chondromas. We have seen this same picture and usually it was in either a case of chondrosarcoma or of one of the malignant tumors of fibroblastic origin. Fibrosarcoma of bone, typically, is a rather slow-growing tumor that metastasizes somewhat late; this lesion metastasized very rapidly, thus has not behaved as one would expect fibrosarcoma of bone. This patient, from the specimen as well as from the history, had the amputation carried out apparently either through the pathological fracture or near to it. It obviously went through tumor, and excepting those unusual cases where you are trying to get rid of a hopeless, painful tumor mass, it is always bad surgery to cut through tumor in carrying out the amputation. The excuse, in this case, was that this patient was in very poor general condition; that influenced the surgeon to take an easier route. Actually, to take the leg off above the obvious local tumor would, perhaps, have increased the magnitude of the operation. On the other hand, the increase is not so great that I think one would do better to try to get above the tumor, if an amputation is to be carried out. I think that they were forced to do something for a lesion that presumably is not sensitive to radiations; they were dealing with a pathological fracture in a malignant tumor, that probably was not going to heal and which is very painful: it is a useless extremity so it's better to take it off.

D. C. Dahlin, M.D., Rochester, Minnesota: It was the opinion of Dr. Dockerty and my own that this was a fibrosarcoma. I thought it was quite capable of metastasizing; because of the roentgenogram, I suggested that it was secondary to a chondrosarcoma. We have seen a number of cases of very low-grade chondrosarcomas that even Dr. Ackerman might have trouble diagnosing, in which fibrosarcoma or fibroblastic osteogenic sarcoma or just plain osteogenic sarcoma sprouted off one corner of them. Sometimes the surgeons have given us the poorest material for biopsy; another problem is that a very low-grade chondrosarcoma may be under-diagnosed and hence under-treated. The recurrence may be like this; that is, quite capable of metastasizing and killing the patient. I don't know how often low-grade chondrosarcomas kick up in grade, but it's often enough to be a real problem. I'd like to study more of that central part of this lesion.

L. Lowbeer, M.D., Tulsa, Oklahoma: The conclusion that one seems to draw from this case is that the pathologists cannot predict whether a tumor such as this will or will not metastasize. Dr. Stout called it a differentiated fibrosarcoma and concluded that it will not metastasize. On the other hand, we see these extremely cellular and very aggressive-looking growths, like the ossifying fibromas of the maxilla, which are locally invasive, and of course, do not metastasize.

Fig. 3 — Gross appearance of the surgical specimen in cut section.

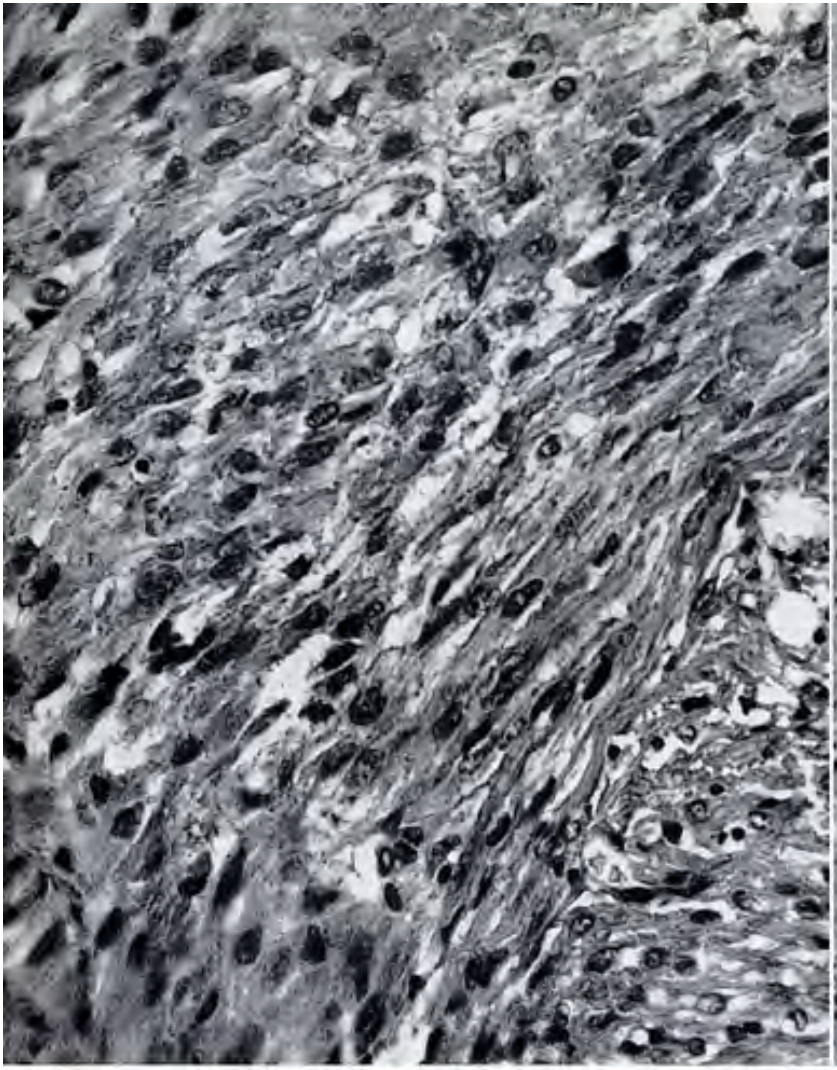

Fig. 4 — (High power) Photomicrograph revealing area of the tumor with relatively acellular fibrous tissue and infiltration with lymphocytes and plasma cells (A.F.I.P. Acc. No. 218757—56).

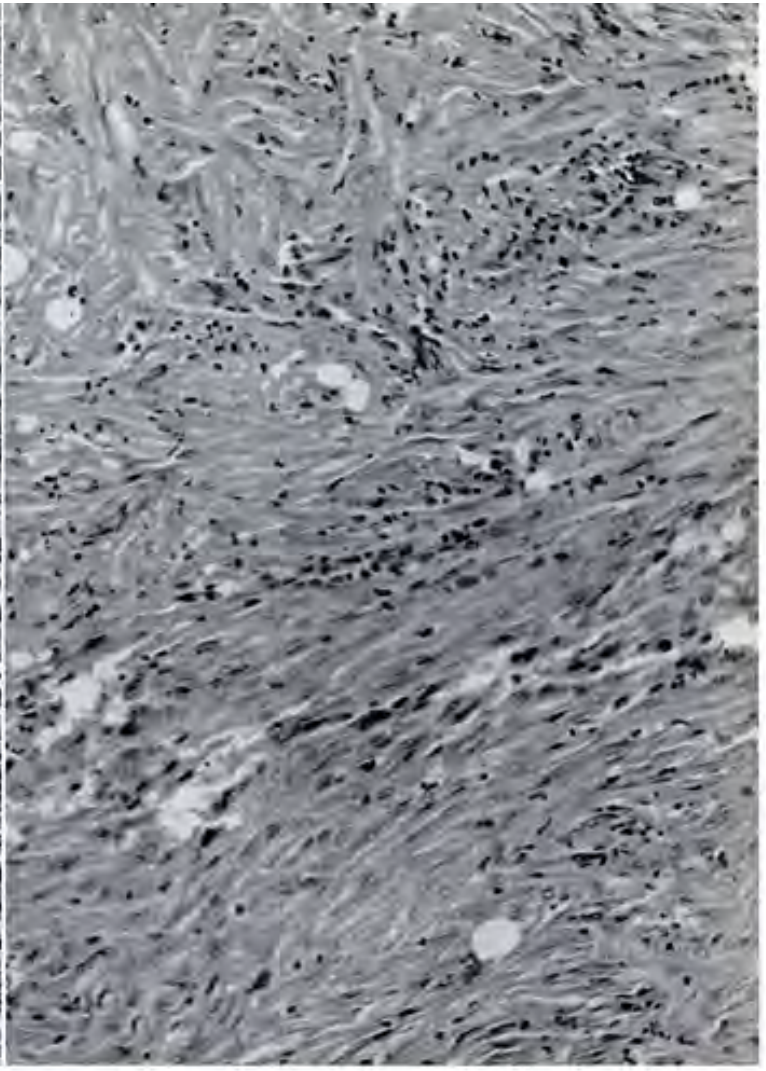

Fig. 5 — (Moderate power) Photomicrograph showing zone of fibrosarcoma with fibroblastic areas that are well differentiated, with only rare mitotic figures (A.F.I.P. Acc. No. 218757—39).

However, one has to ask whether perhaps the operative procedure was instrumental in causing metastases which perhaps may not have occurred spontaneously.

Dr. Ackerman: I agree with everything Dr. Dahlin said. As a matter of fact, we tried our best to prove that this was a chondrosarcoma that had taken on a pattern of fibrosarcoma. I had seen this on several occasions, but on sections of this area of the cartilage, I could not prove such an evolution. I would think that if we take the radiographic view together with the gross appearance, we must conclude that this is a primary bone tumor which is extending out into the soft tissue rather than the reverse.

Dr. Hodes: I will use these criteria in the future: I must admit that I am confused at a much higher plane now.

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3. Metastatic Carcinoma of the Tibia, Primary Lung

Contributed by Joseph F. Kuzma, M. D., Milwaukee, Wisconsin

THE PATIENT was a 69-year-old man in the summer, 1956, when he suffered an injury to the left leg with abrasion, swelling and hematoma; the roentgenogram showed no bony changes and the hematoma was aspirated. One year later, in July, 1957, he again received trauma in the same area. The swelling recurred and a bluish fluctuant mass developed over the tibia. The hemoglobin was 12 grams per cent; there were 17,700 white cells per cubic mm.

Dr. Hodes: This is a monostotic bone tumor arising in the middle third of a tubular bone. It is cortical in origin extending into the medullary canal posteriorly and anteriorly into the overlying soft tissue. It is not clearly defined; a rather thick margin of reactive bone delineates its posterior aspect. There is definite destruction of the cortex within the tumor mass; this destruction tends to blend imperceptively with the proximal normal cortex, but distally, some cortical thickening is evident suggesting a Codman's cuff. Calcific debris is distributed throughout the entire tumor. Seen with difficulty within the bone, the densities are brilliantly demonstrated in the tangential projection. Here they extend into the overlying soft parts. In some respects, these densities suggest calcified osteoid matrix and calcified chondroid matrix. The tissue mass overlying this debris seems well encapsulated. At its distal end, a faintly defined shell of bone is barely perceptible.

Fig. 1 — Roentgenogram showing a destruction of the middle third of the tibia involving the cortex and extending into the soft tissues.

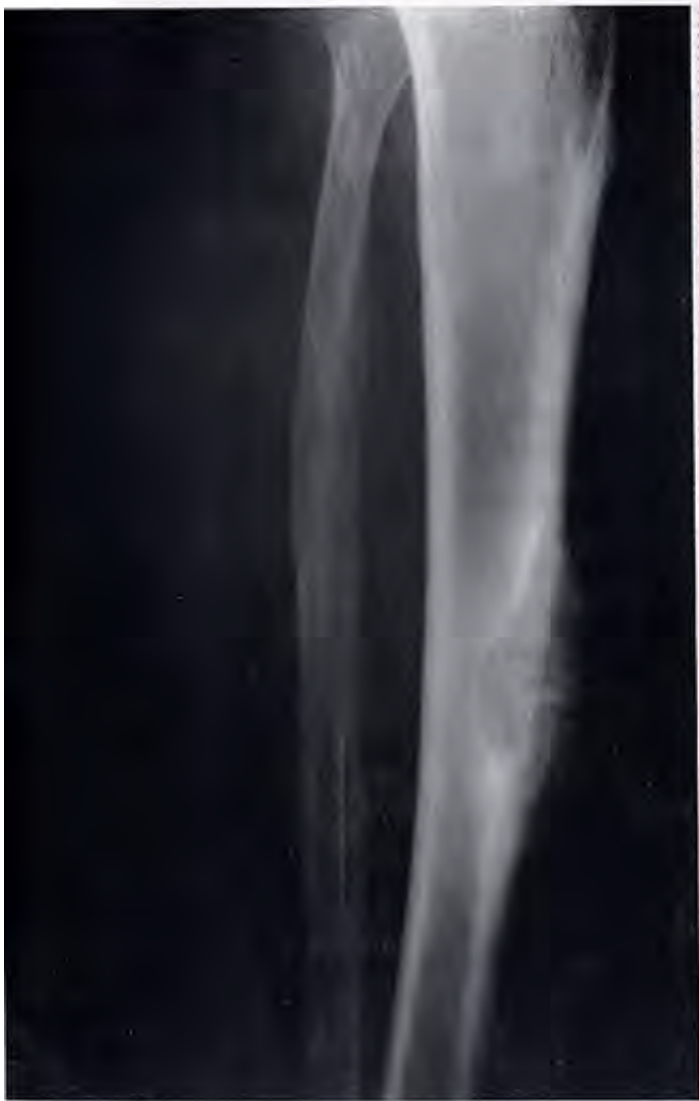


Fig. 2 — Segment of the tibia showing polycystic lesion containing blood.

There are elements in this tumor which suggest it is malignant. This history of injury, however, makes one think of a local reaction to trauma, whether it be hemorrhage alone, or hemorrhage with secondary infection. The periosteal proliferation and bone resorption could be explained by a low-grade granulomatous process; yet there were no focal signs of infection clinically.

This is not a simple cystic lesion, but it could be a *hemorrhagic cyst*. The probabilities are that needling this lesion has influenced its local roentgen characteristics. Metaplasia can cause very bizarre radiological and histopathological changes. This may account for the bizarre character of this patient's clinical and radiological findings. *Adamantinoma* notoriously occur following trauma and this is the favorite site for the development of adamantinoma; but these lesions tend to invade the medulla, rather than the overlying soft parts. The features suggesting malignancy in this lesion cause one considerable concern for this could be an unusual *osteosarcoma*. Certainly the periosteal proliferation is in keeping with this possibility, even though the history militates against the diagnosis. *Metastatic malignant tumor* should be mentioned only because occasionally seeding of malignant cells at the site of bone trauma does occur; the history in this patient does not suggest this. We seriously doubt that a metastatic lesion could grow as rapidly as has this one. Yet, the possibility does exist and must be conjured with.

Dr. Hodes' impression: A benign bone tumor. HEMORRHAGIC CYST with metaplasia.

Roentgenologic Impressions Submitted by Mail:

Inflammatory lesion	63	(1)*
Hematoma	9	(1)
Osteosarcoma	40	(1)
Osteosarcoma in Paget's	9	
Parosteal fibrosarcoma	18	(1)
Metastatic carcinoma	3	
Others	30	(2)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. P. M. Ducheman, of New York City, and Dr. R. N. Todd, of Lincoln, Nebraska, submitted a diagnostic impression of osteomyelitis. Dr. R. W. Dohnalek, of Denver, favored osteogenic sarcoma on the basis of Paget's disease. Dr. V. G. LaTourrette, of Denver, submitted metastatic carcinoma. Dr. P. Desaive, of Liege, Belgium, suggested osteosarcoma.

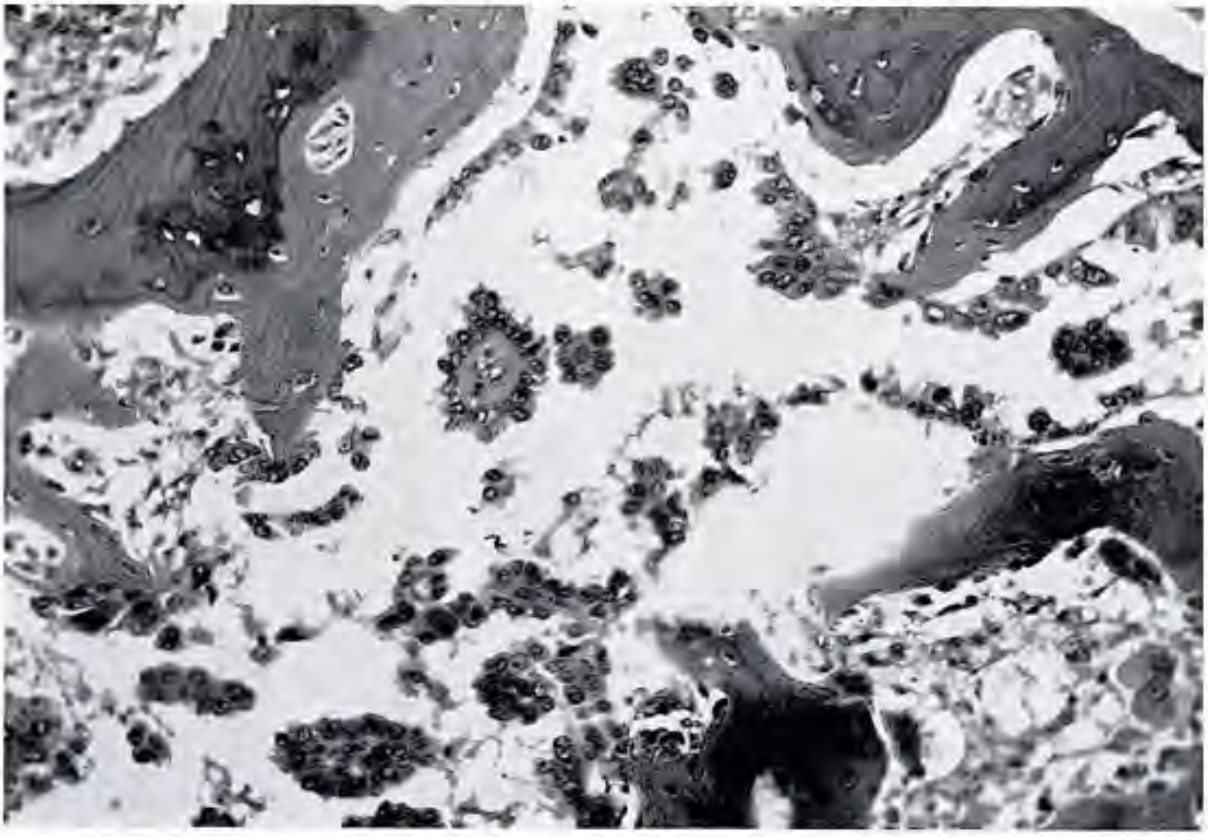
Operative findings: In August, 1957, a segment of the tibia 13x5x5 cm, including the tumor, was removed and a bone graft inserted. The central area of the tumor was polycystic and contained brownish blood. Between the cysts the nodular proliferation of tissue was hard and hemorrhagic and presented occasional calcifications.

Dr. Ackerman: This biopsy demonstrates tumor growing between bony trabeculae, which in some instances show cement lines indicating destruction and repair. The tumor forms apparent acini and is papillary. We think, therefore, that this is a metastatic papillary cancer. There are a few focal areas of calcification within the tumor. It is apparently not forming any secretion. In some zones the cytoplasm of the tumor instead of being pink is clear.

This lesion was destructive in the mid-portion of the tibia and is, therefore, most likely a metastatic cancer. I know of no primary bone tumor with this pattern. It could come from several sources. The stomach is unlikely, the prostate does not usually have this pattern, and the most probable source is the kidney. The negative mucin stain has some value in supporting this organ as a primary site. This tumor does not resemble any adamantinoma that I have ever seen.

Dr. Ackerman's diagnosis: PAPILLARY CARCINOMA, METASTATIC.

Fig. 3 (Moderate power) Photomicrograph of metastatic papillary carcinoma within the bone, surrounded by reactive cancellous trabeculae (Wash. Univ. neg. 58—5407).



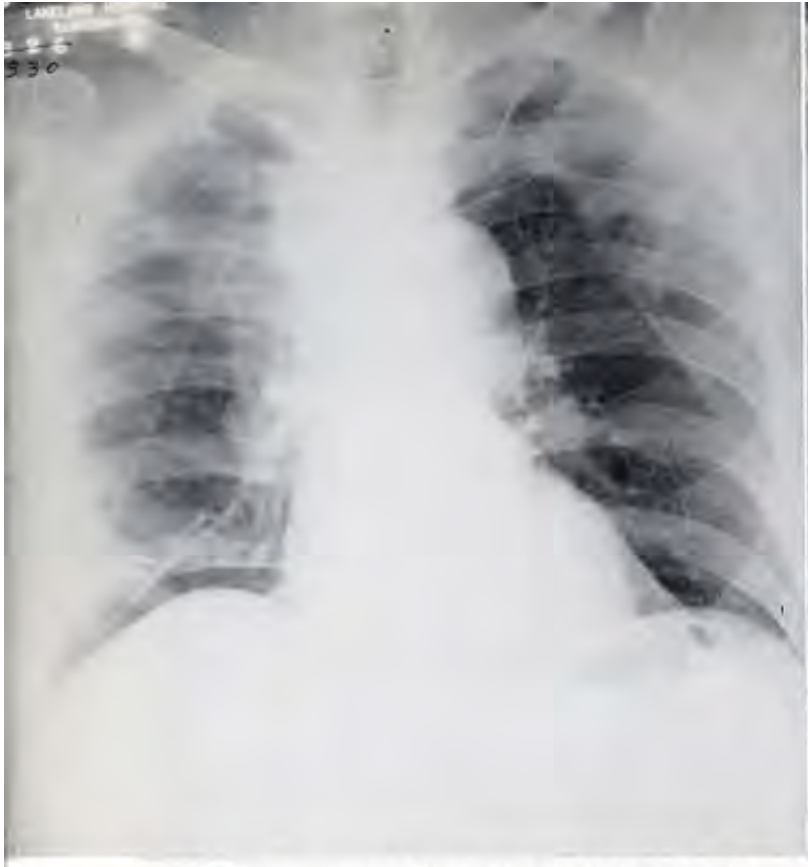


Fig. 4 — Roentgenogram of the chest taken at the time of the operation and showing pulmonary changes suggesting carcinoma of the bronchus (Aug. 1957).

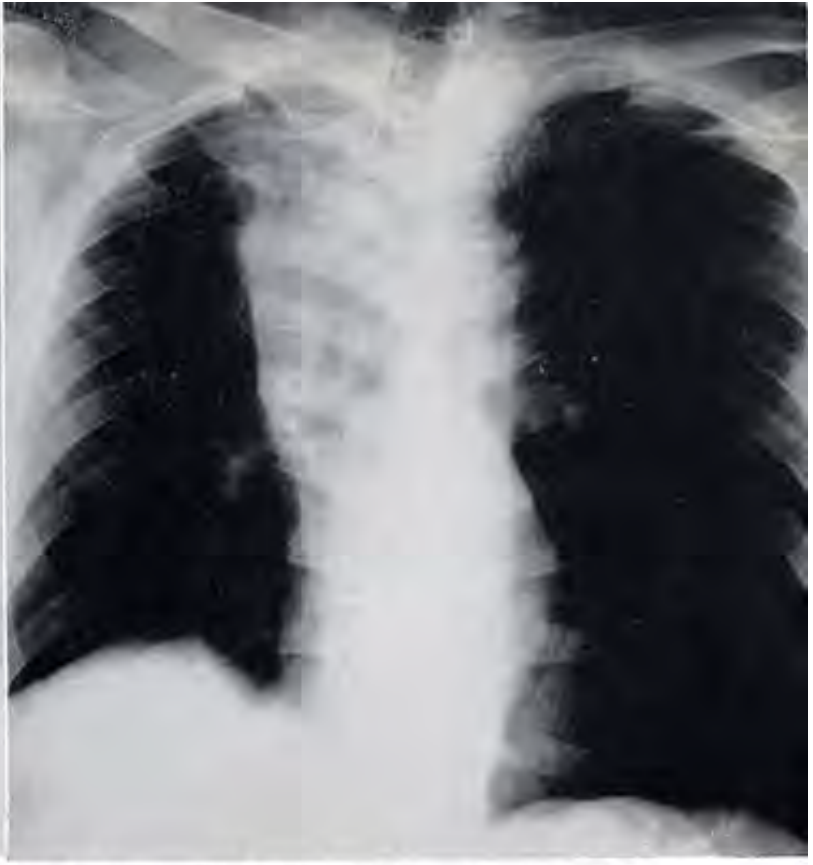


Fig. 5 — Roentgenogram of the chest showing progress of the pulmonary tumor and obvious destruction of the right clavicle, previously covered by date marker (Nov. 1957).

Histopathologic Diagnoses Submitted by Mail:

Metastatic adenocarcinoma	90 (2)*
Metastatic carcinoma	51 (3)
Osteosarcoma	18
Malignant giant cell tumor	3
Others	14 (1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Fig. 6 — Autopsy specimen of primary carcinoma of the bronchus.

Dr. Regato: Dr. Morgan Berthrong, Colorado Springs, also made a diagnosis of metastatic papillary carcinoma. Most of the authorities agreed to a diagnosis of metastatic carcinoma, but varied in their suggestions for a probable primary. Dr. F. Bang, of Copenhagen, suspected the thyroid; Dr. R. Hirtzler, of Zagreb, and Dr. C. A. Hellwig, of Halstead, Kansas, favored a renal origin; Dr. W. H. Hartmann, of New York, suggested a prostatic primary and Dr. D. L. Dawson, and five other residents in pathology of Denver, made a diagnosis of metastatic bronchial carcinoma.

Subsequent history: In November, 1957, osteolytic lesions were discovered in the distal end of the right clavicle and on the right seventh rib and there was also a right sided mediastinal mass at the level of the aortic arch; the lungs appeared clear. The patient expired in November, 1957, of uremia. Autopsy revealed the presence of a carcinoma of the bronchus with widespread skeletal and visceral metastases.

Dr. Reynolds: There is nothing in the history of this case that would indicate that a biopsy was obtained before local resection and bone graft was undertaken. Before definitive treatment is undertaken in bone lesions, we should have a definitive diagnosis; if a biopsy had been obtained, we would have avoided an operative procedure that did very little for the patient.

H. J. McGee, M.D., Denver, Colorado: This hemoglobin of twelve grams and the white count of 17,700 might be compatible with a myelocytic anemia which would go along with the findings we have outlined.

D. C. Dahlin, M.D., Rochester, Minnesota: I would like to ask Dr. Reynolds if he feels that there is a place for definitive treatment in metastatic bone tumors if the primary has been controlled.

Dr. Reynolds: Attempts at local resection in metastatic bone lesions, in my experience, have been completely unsatisfactory even though the primary lesion is apparently under reasonable control. We have attempted it a few times and each time we wound up with complete failure in that our

local resection was not adequate to remove all the tumor so that we did not save an extremity. The other type of definitive treatment that is indicated in metastatic bone lesions is in the presence of a pathological fracture; a fracture in a long bone creates an extremely difficult problem for the patient. An intermedullary fixation may frequently allow that patient to be up and around relatively pain-free for many months before he succumbs.

D. C. Dahlin, M.D., Rochester, Minnesota: We have one long term cure after amputation for a metastatic hypernephroma that appeared eight years after the primary had been controlled. I suppose that the opportunity for amputation must be very rare.

Dr. Reynolds: It is unusual, in my experience, to have an opportunity to do an amputation or a long term relief of a tumor. We have done even radical amputations to relieve a patient of a fungating painful mass that we could not control in any other way, as purely a palliative amputation. I didn't learn whether or not this patient walked on this extremity for an appreciable time before the patient died.

J. F. Kuzma, M.D., Milwaukee, Wisconsin: I am sorry to say that the patient did not walk after the operation. The posterior cortex of the tibia was fractured during the procedure and because of that, he was not permitted to bear weight on that extremity. He was bed-ridden from that time until he died.

Dr. Regato: Dr. Kuzma, you performed autopsy of this patient; were you satisfied that this was a carcinoma of the bronchus?

J. F. Kuzma, M.D., Milwaukee, Wisconsin: I was perfectly satisfied that this was a bronchogenic carcinoma, originating in the bronchus of the right upper lobe. I think the gross photograph substantiates that quite well.

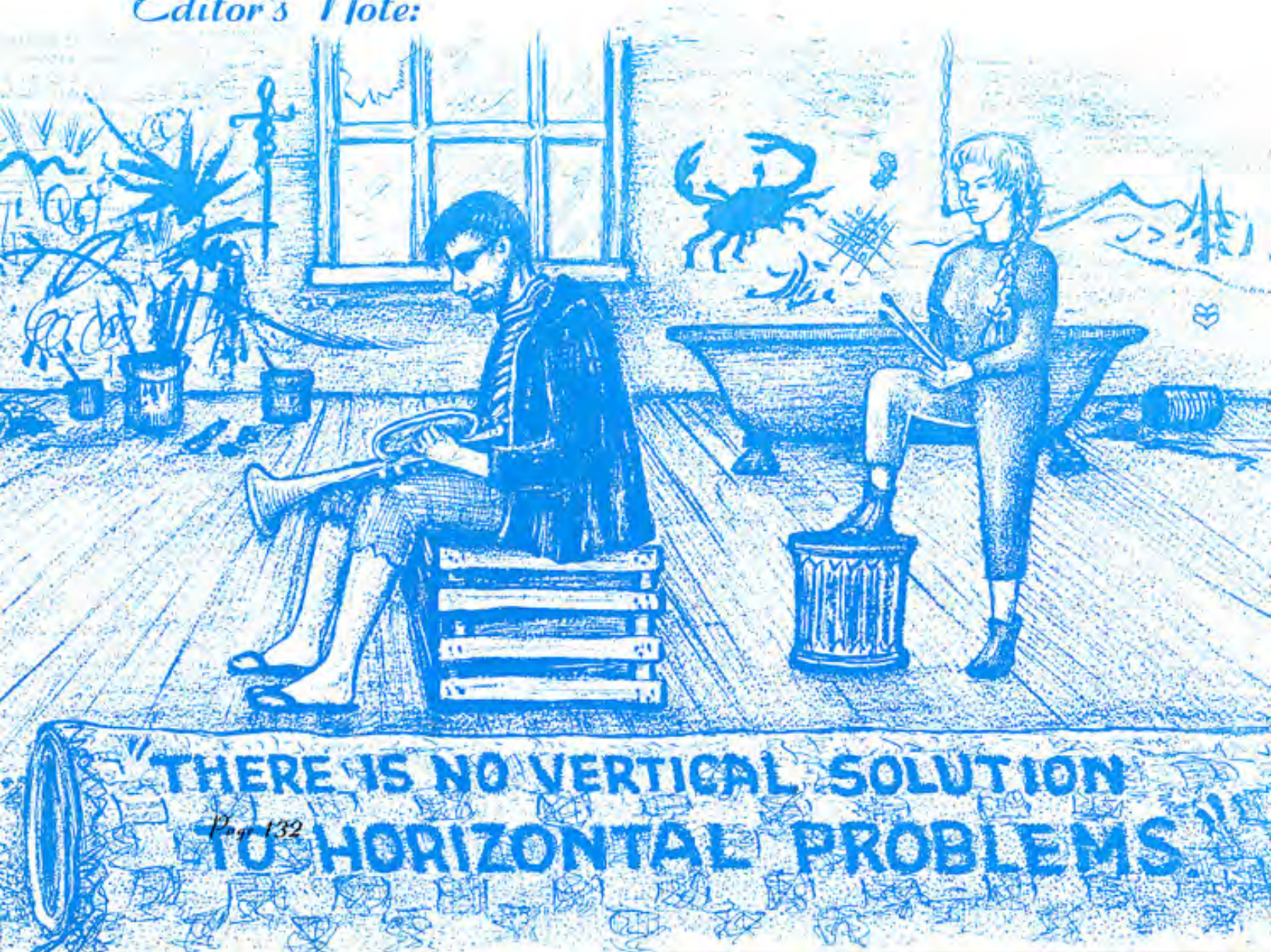
R. S. Clayton, M.D., El Paso, Texas: In the film shown there was a right upper lobe lesion which we would have suspected as due to carcinoma of the bronchus; this would have led us to biopsy rather than resection.

Dr. Regato: A roentgenogram had been taken at the time that the procedure in the leg was being done. The lesion in the clavicle, which was obvious, was hidden by the marker on the film and the pulmonary lesion was not diagnosed until the operation had been performed.

Dr. Hodes: There's no question but that the original film shows a bronchogenic carcinoma. If I had seen this, they would have biopsied rather than to operate. This brings me to a fundamental question: how many times will one see metastatic disease at the site of trauma in bone?

Dr. Regato: We had, year before last, a patient who had had trauma to the head. An osteolytic lesion developed there and eventually was proven to be a metastatic renal lesion. It has been suggested that perhaps trauma sometimes decides the site of a metastasis.

Editor's Note:



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4. *Hemangioma of the Humerus*

Contributed by Robert W. Byrne, M.D., Dann B. Claudon, M.D., and Frederick Gaensler, M.D., Milwaukee, Wisconsin

THE PATIENT was an 8-year-old boy in May, 1950, when he complained of pain in the left shoulder following a fall; another fall six months later resulted in visible tumefaction and limitation of motion of the left arm.

Dr. Hodes: This remarkable monostotic lesion involves the entire shaft of the humerus. It probably arose within the medulla and in its expansion and growth has entirely destroyed any semblance of the medulla or cortex in the normal shaft of the bone. Trabeculation is most prominent. Several pathological fractures in the lower half of the tumor are obvious. The shell of tumor bone is intact except for the fractures. The epiphyseal cartilaginous plates are unaffected; the epiphyseal centers of ossification also are unaffected. Very little overlying soft tissue change is evident.

Dr. Hodes' impression: A benign tumor: HEMANGIOMA.

Roentgenologic Impressions Submitted by Mail:

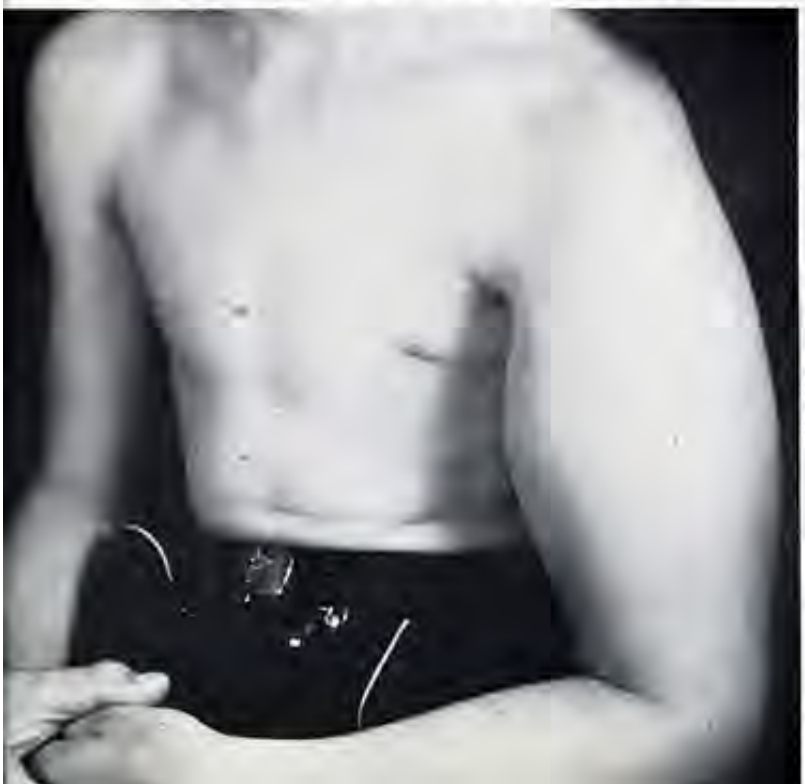
Hemangioma	61	(3)*
Fibrous dysplasia	39	(1)
Aneurysmal cyst	36	(2)
Giant cell tumor	13	
Wow!	1	
Others	31	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. J. C. Evans, of New York City, and Dr. B. L. Pear, of Denver, submitted an impression of aneurysmal bone cyst. Dr. P. C. Swenson, of Philadelphia, Dr. L. J. Brown, of Herrin, Illinois, Dr. H. Hauser, of Cleveland, and Dr. P. Roesler, of Colorado Springs, all offered a diagnosis of hemangioma.

Operative findings: In October, 1951, the humerus was exposed anteriorly; the periosteum was thickened and could not be separated from the cortex. There was profuse hemorrhage from enlarged sub-periosteal vessels; the patient went into shock and 3,000 cc of blood were administered before blood pressure was again obtained. All the soft growth was removed with a gouge. A fibular graft was placed between the distal sheath and the proximal partial sleeve. The cortical shell was then crushed for better approximation. It was impossible to remove all of the growth; the periosteum was overlapped on itself and closed with catgut. A total of 5,000 cc of blood was administered during the operation.

Fig. 1 — Deformity of the left arm caused by the tumor.



Dr. Ackerman: This is a hemangioma of bone of the cavernous type. Blood is present in many of the endothelial lining spaces and there is rather abundant connective tissue between the spaces. I see no evidence of malignant change nor do I think that any one of these cases ever becomes malignant.

Except in the vertebrae, this is an extremely rare lesion. We have seen this type of lesion in the humerus, fibula, clavicle and rib. The cortex over the hemangioma may be greatly thinned, show irregular destruction, and be accompanied by moderate periosteal bone proliferation. In the skull the full-thickness of the bone may be entirely destroyed. The periosteum remains intact, but there is subperiosteal bone formation that roentgenographically gives an impression of radiating spicules of bone that has been likened to a "sunburst". Hemangiomas are frequently multiple. Multiple bone involvement has been reported under the titles of cystic angiomatosis (Jacobs and Kimmelstiel) and hemangiomatosis of the skeleton (Ritchie and Zeier). A single bone may also have multiple foci of involvement. Hemangiomas of viscera, particularly spleen and liver, may be associated with hemangiomas of the bone. Fairbank has observed that occasionally hemangioma may become erosive enough to involve adjacent bones. It has also been noted that in the long bones the hemangioma has a tendency to begin in the cortex with little or no involvement of the medulla. In the vertebrae the shape of the bone is well maintained. The rare capillary hemangiomas reported have a histologic pattern similar to that of the capillary hemangiomas of skin. The case reported by Sherman occurred in a two-year-old child and involved the distal femur. The lesion was destructive and was diagnosed as osteomyelitis.

Prognosis of these lesions is excellent. Radiation therapy would certainly control the lesion but often it may not be diagnosed until after excision.

Dr. Ackerman's diagnosis: CAVERNOUS HEMANGIOMA.

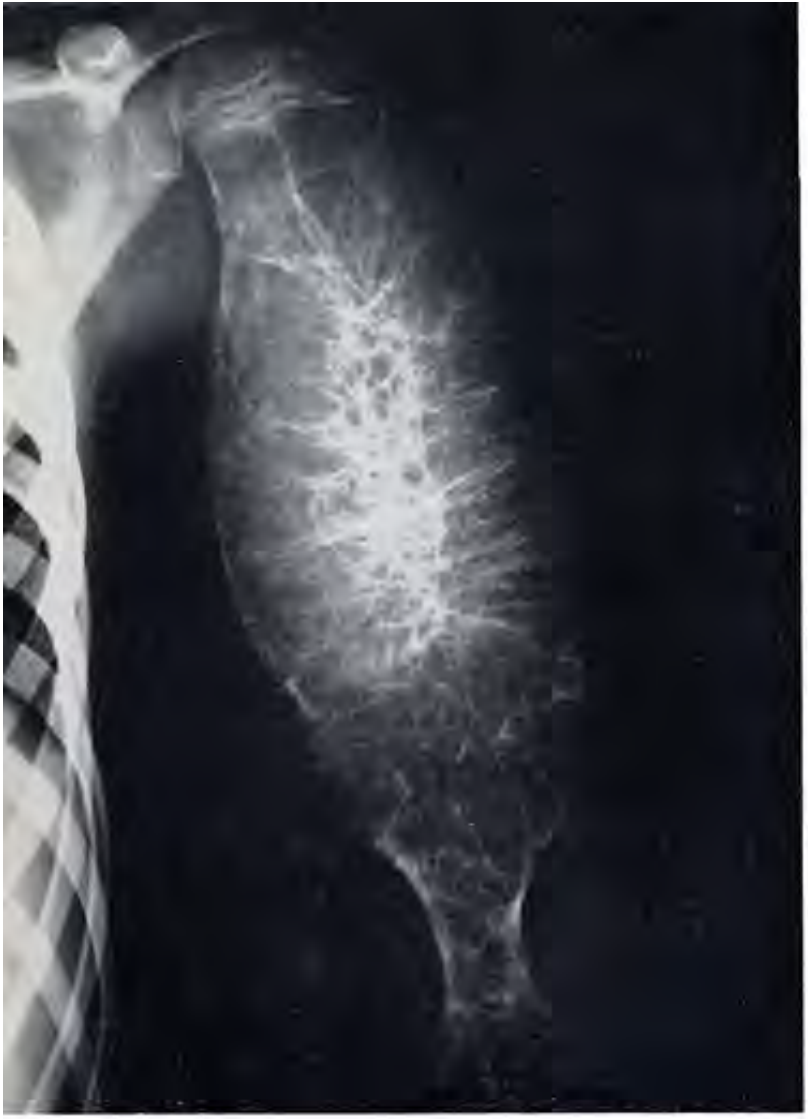
Histopathologic Diagnoses Submitted by Mail:

Hemangioma	142	(5)*
Hemangioendothelioma	8	(1)
Others	6	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Almost without exception the experts agreed to a diagnosis of hemangioma. Drs. M. B. Dockerty and D. C. Dahlin of Rochester, Minnesota, suggested the possibility that this may be a fibrovascular hematoma. Dr. C. Oberling, of Paris, submitted hemangioendothelioma.

Subsequent history: In June, 1952, roentgentherapy was administered in an effort to destroy the remaining part of



the growth; no details of the technique and dosimetry were given except for the fact that the epiphyses were covered. In November, 1952, a second intervention was decided upon: the axillary artery was clamped, the arm and periosteum were incised along their length, a triangular portion of the bone was removed to give access to the transplanted fibular graft which appeared free from the growth. A nine inch guide wire was driven along the shaft of the fibular graft, then a nail was inserted and the bone stabilized.

In June, 1954, a third surgical intervention took place; sequestra were removed and the pin exposed; the guide wire was divided and removed.

In April, 1958, the examination of the patient revealed that the wrist, elbow and shoulder motions in both arms were equal to a degree; the left triceps and biceps were slightly underdeveloped.

The roentgenogram showed amazing remodeling of the left humerus; the distance from the achromium to the epicondyle was 3 cm shorter in the left arm than in the right, otherwise the two extremities were remarkably identical.

(At the completion of this presentation, the audience burst into spontaneous applause.)

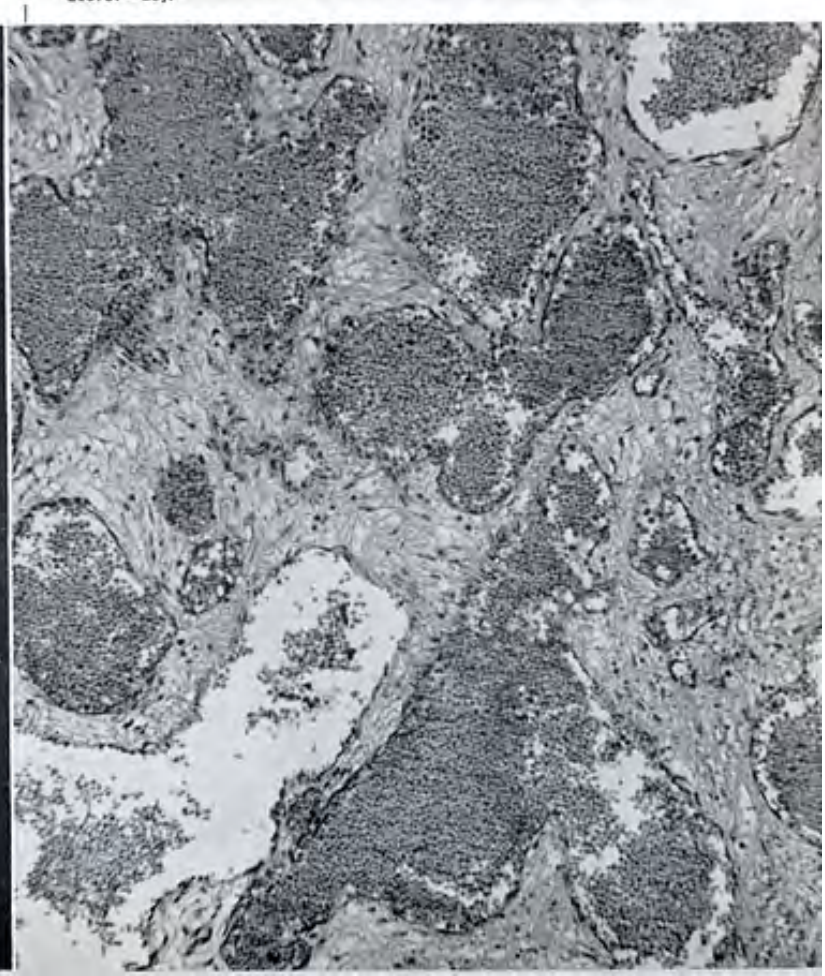
Dr. Regato: I agree with you; the courageous attending physicians of this fortunate patient deserve your applause.

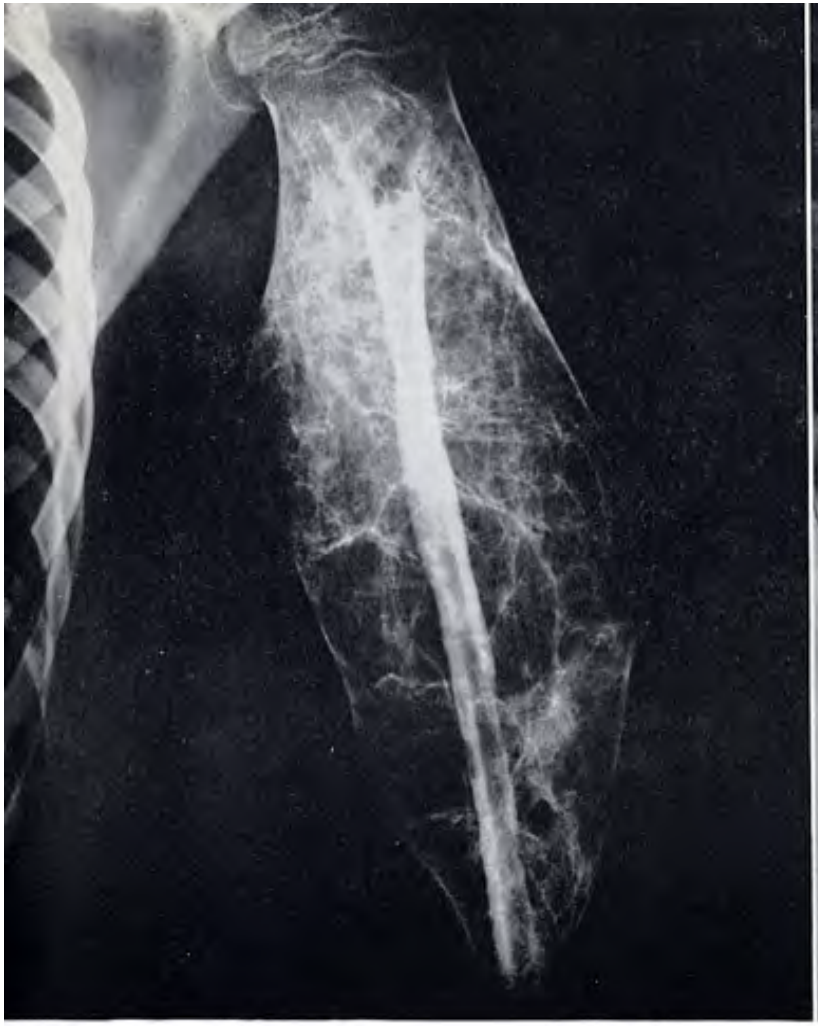
Dr. Reynolds: I have never seen a similar case and I doubt if many have. When I first saw the roentgenogram of this case, I began to search through all my musty, old books to see if anyone had ever published one like it. Geschickter and Copeland have a case very similar involving the upper half of the humerus that was a hemangioma, so that I was reasonably sure that this was a hemangioma.

Fig. 2 — Roentgenogram of the left arm; expansive growth destroying the normal architecture and presenting trabeculation.

Fig. 3 — Gross appearance of the growth.

Fig. 4 — (Low power) Photomicrograph. Classic example of hemangioma with endothelial line space filled with red blood cells and separated by connective tissue (A.F.I.P. Acc. No. 218757—20).





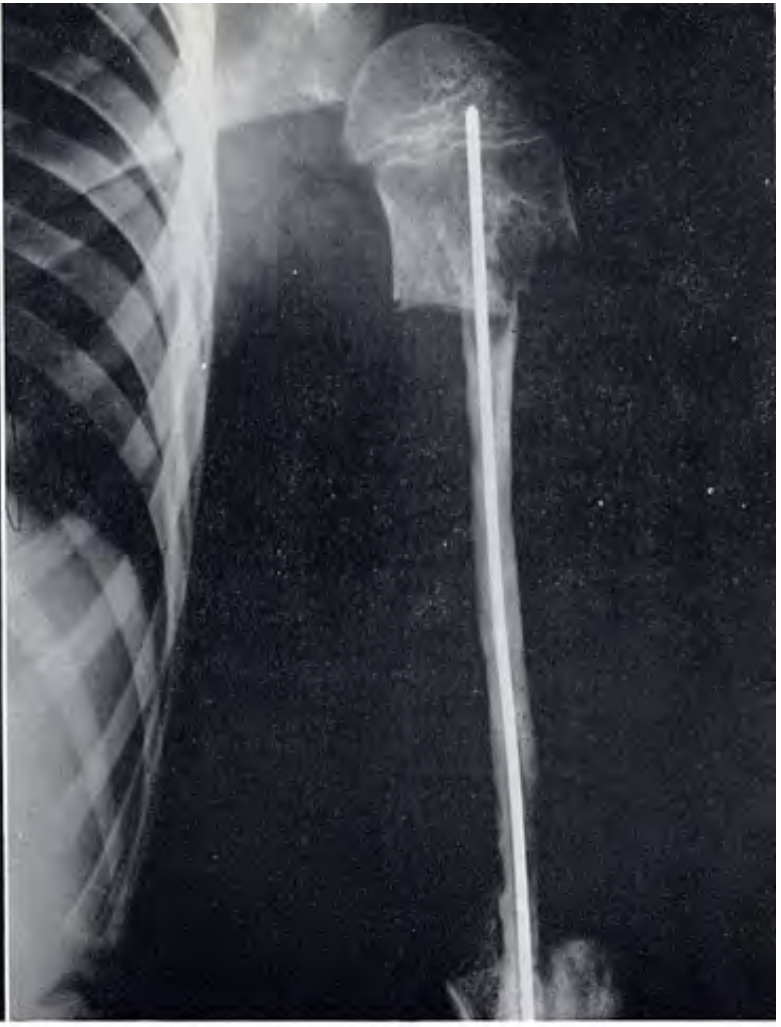


Fig. 5 — Roentgenogram showing fibular graft in place. (above)

Fig. 6 — Roentgenogram showing metal pin through fibular graft (Dec. 1952). (upper right)

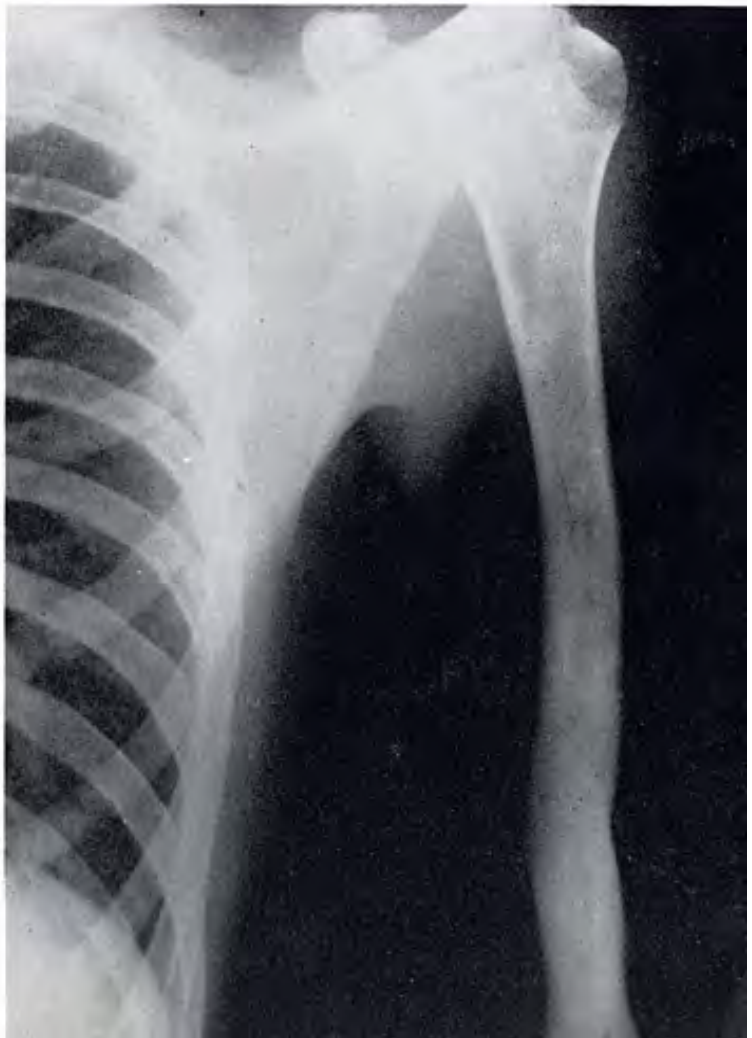
Fig. 7 — Recent roentgenogram of the left arm (April, 1958).

Concerning the treatment, if one were suspicious that this was a hemangioma, perhaps an arteriogram before surgery might have been of some help in showing, for instance, that there were one or two large mother vessels which they could have ligated before opening the bone. This type of lesion, as you all know, is benign, but continues to grow and one can never get all of the vessels out by any type of surgery. I wish to compliment Dr. Claudon for attempting the surgery that was done in this case. But I feel certain that he must have been awake most of the night after the operation wondering what other specialty he could go into. The thing that amazes me in this case, is that they have been able to remove all of the tumor and have now reconstituted an essentially normal humerus. I am not aware of another instance in which any hemangioma of the extremities involving bone that the entire tumor was removed by local resection method.

D. C. Dahlin, M.D., Rochester, Minnesota: It is hard to understand how a hemangioma can produce just so much involvement. Most hemangiomas that we have seen in bone have had no fibrous component between the vessels; I wondered if a malformation developing along with the hemangioma would explain its tremendous size.

Dr. Hodes: I do not believe that we are using angiography enough in these bone tumors.

L. J. Brown, M.D., Herrin, Illinois: I would like to hear any comment about the relative value of the roentgenther-



apy given to this patient as opposed to the surgery or in connection with the surgery.

Dr. Regato: I have no experience in the treatment of hemangiomas of the bone with radiotherapy. In general, the adult hemangiomas are not radiosensitive. I would have thought that the amount of radiations to be given here would have been tremendous in order to affect that growth permanently; if it had been a smaller lesion in another situation, radiotherapy might have been more justifiable, I think, than in this instance. But, above all, who could have, by any means equalled this remarkable result?

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5. *Atypical Osteosarcoma (?) of the Scapula*

Contributed by James A. Johnson, M. D., Colorado Springs, Colorado

THE PATIENT was a 20-year-old college football player in June, 1951, when he first complained of pain in the right shoulder; a diagnosis of bursitis was made and he was given roentgentherapy without relief of pain. In November, 1951, there were limitations of the shoulder movements; the supraspinatous bursa was excised, but pain and limitation of movements persisted. In January, 1952, there was a diffuse tumefaction over the upper part of the scapular region and the patient had lost 30 pounds in weight.

Dr. Hodes: This is an extensive bone tumor involving the scapula and its perifocal soft tissues. The tumor probably arose in the region of the base of the coracoid process and the acromion. It is medullary in origin, the medulla has been replaced by tumor bone which is increased in density. The overlying cortex in this region is totally destroyed. The blade of the scapula reveals numerous areas of "invasion", "permeation", and "osteolysis". In its active growth the tumor has broken through the glenoid fossa pushing fragments of bone before it. The latter is an index of the highly aggressive nature of this tumor. The entire shoulder girdle reveals evidence of invasion. Of importance is the fact that this tumor shows no tendency toward calcification in the soft parts. This is a highly malignant bone tumor of medullary origin. The patient's age, the fact that he was troubled for approximately nine months, plus the absence of calcific debris in the tumor beyond the bone, suggests this is either a Ewing's tumor, or a reticulum cell sarcoma. Because of the patient's age, the probabilities are we are dealing with a Ewing's tumor.

Dr. Hodes' impression: A highly malignant bone tumor. 1) EWING'S TUMOR. 2) RETICULUM-CELL SARCOMA.

Roentgenologic Impressions Submitted by Mail:

Ewing's tumor	54	(2)*
Reticulum cell sarcoma	30	
Osteosarcoma	39	(2)
Chondrosarcoma	21	(1)
Synovioma	18	
Too tough for me!	1	
Others	25	(1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. R. Sherman, of New York City, and Dr. S. Di Rienzo, of Córdoba, Argentina, submitted an impression of reticulum cell sarcoma. Dr. J. C. Evans and Dr. W. B. Seaman, of New York City, offered a diagnosis of Ewing's tumor. Dr. W. S. Keyting, of Denver, favored synovial sarcoma and Dr. G. F. Lull, Jr., of Denver, osteogenic sarcoma.

Dr. Ackerman: This is an obvious malignant tumor growing between cancellous trabeculae and extending into the soft tissue; it is so undifferentiated that it is difficult to be certain of the diagnosis. This could be an undifferentiated metastatic tumor from some unknown source. A thyroid, pancreas, lung, or kidney tumor would be unlikely. A testicular tumor would be a remote possibility. I think that on the basis of probability, taking into consideration all the clinical and pathologic findings, this is not metastatic but primary. If it is primary, it is not a cartilaginous tumor, plasma cell myeloma or a Ewing's tumor. I would consider reticulum cell sarcoma and osteosarcoma; in favor of reticulum cell sarcoma is the abundant cytoplasm, prominent nucleoli and probably abundant reticulin. However, this tumor does not have the usual uniform pattern of reticulum cell sarcoma and there are some microscopic findings which do not fit. These include considerable variation in size and shape of cells and a rather large number of large cells. In the undifferentiated osteosarcoma we have had microscopic fields which looked somewhat like this. I would like to have had the opportunity to look at many sections in the hope of finding some diagnostic area, such as tumor evolving from neoplastic osteoid. If this tumor responds dramatically to irradiation therapy, I would feel that the diagnosis of reticulum cell sarcoma is supported. If the tumor does not respond, I would feel quite certain that a diagnosis of reticulum cell sarcoma is incorrect.

Dr. Ackerman's diagnosis: Malignant tumor. ATYPICAL OSTEOSARCOMA?

Histopathologic Diagnoses Submitted by Mail:

Ewing's tumor	92	
Reticulum cell sarcoma	45	(4)*
Various sarcomas	24	(1)
Metastatic carcinoma	3	(1)
Hodgkin's	2	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. C. Sirtori, of Milan, Dr. J. P. Kerneis, of Nantes, France, and Dr. M. Navarro-Roca, of Santiago de Cuba, submitted Ewing's sarcoma. Dr. G. Fishkin, of Los Angeles, and Dr. A. O. Severance, of San Antonio, preferred a reticulum cell sarcoma. Dr. C. Oberling, of Paris,

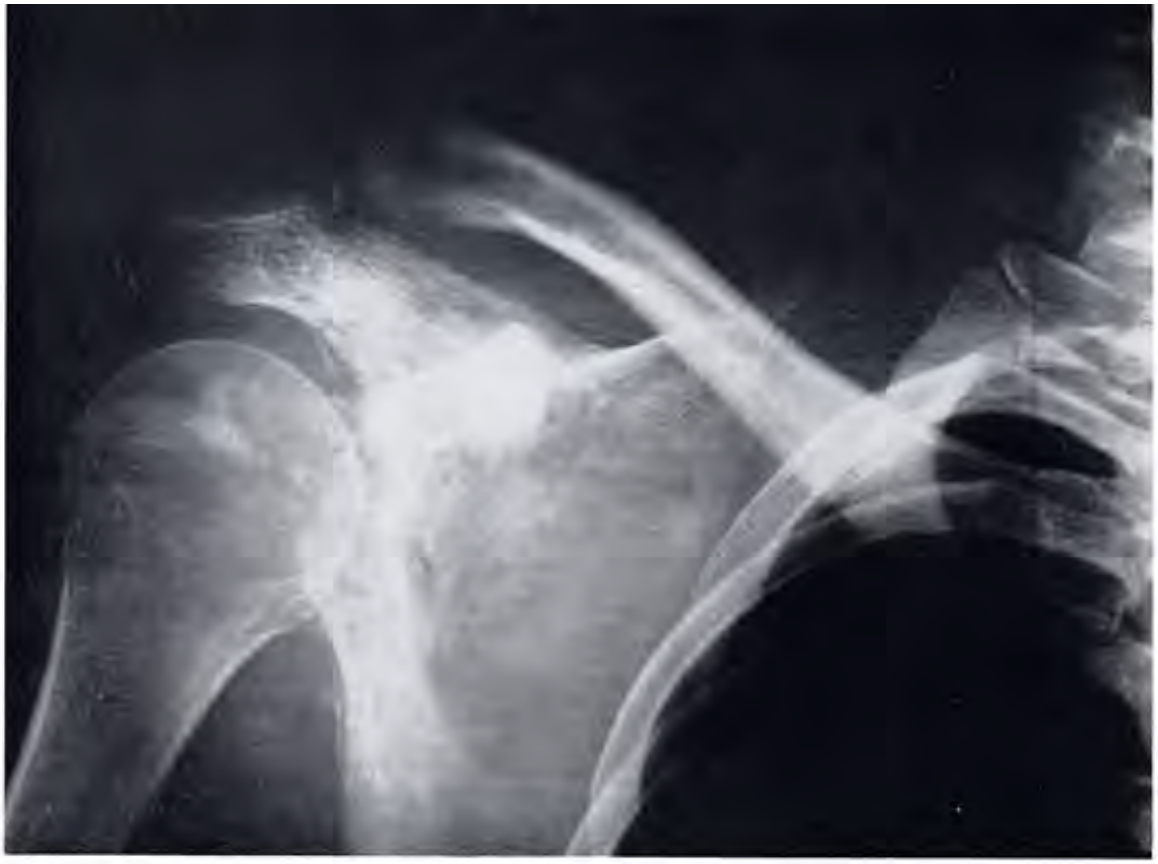
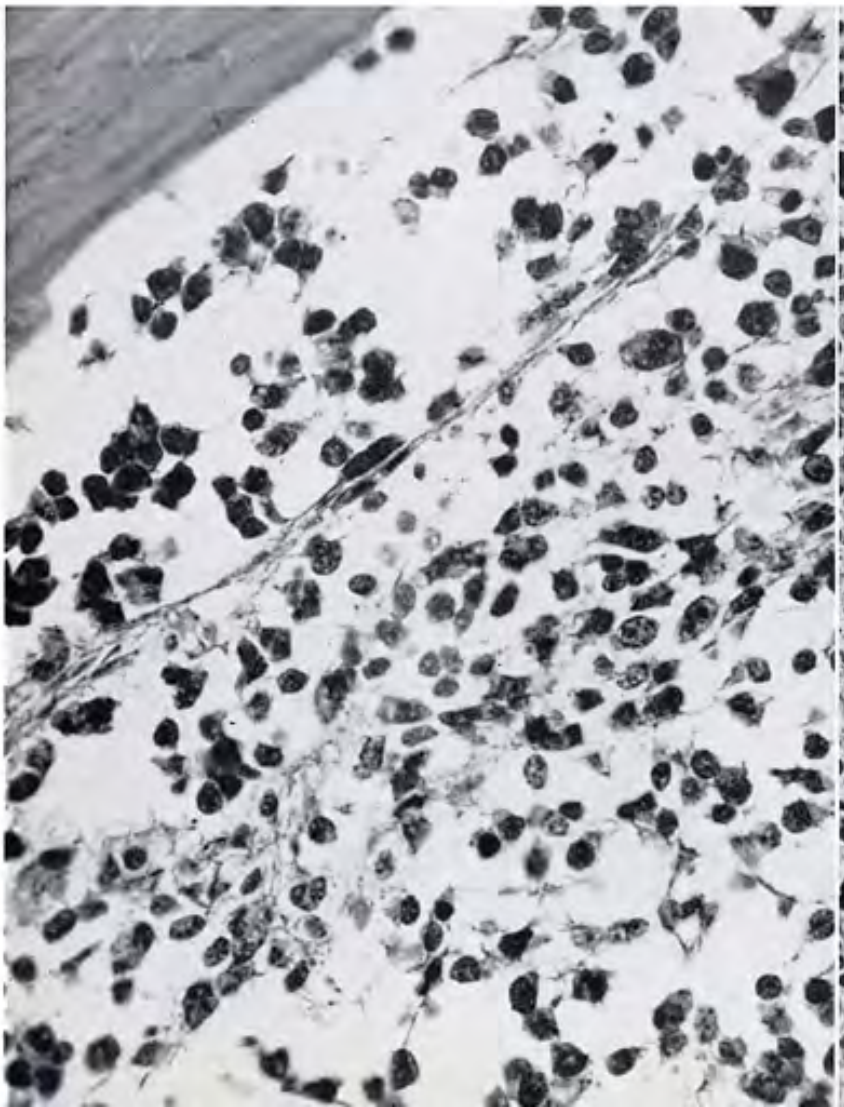
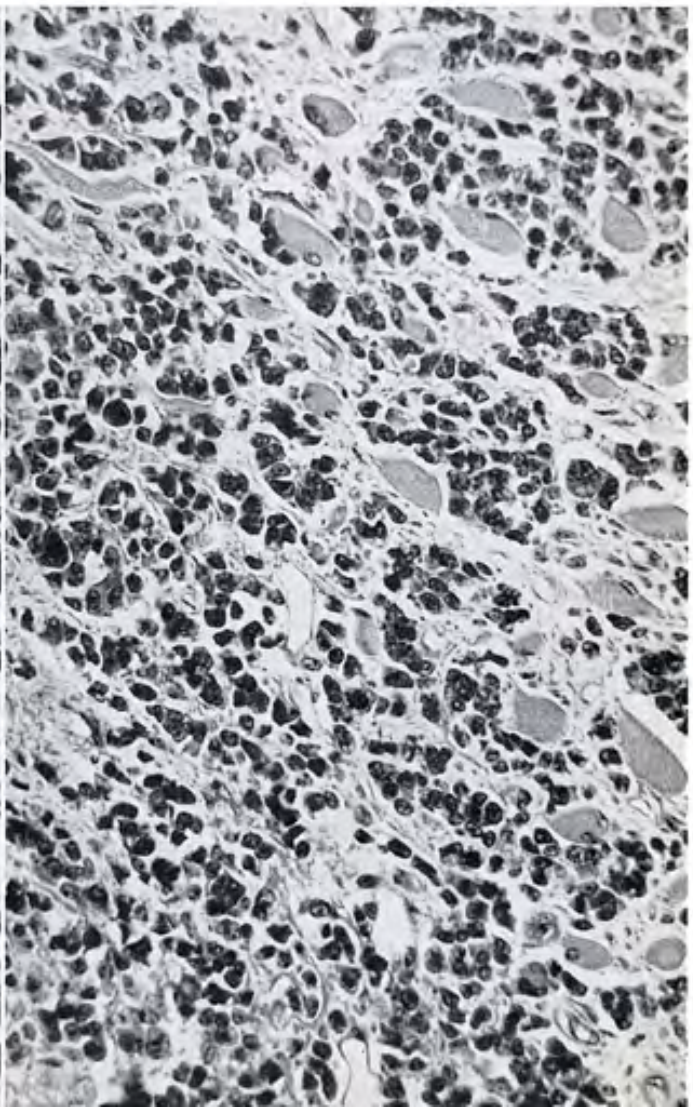


Fig. 1 — Roentgenogram of the right shoulder; extensive tumor involving the scapula and surrounding tissues.

Fig. 2 — (Moderate power) Photomicrograph showing an undifferentiated neoplasm, possibly atypical osteosarcoma (Wash. Univ. Neg. 58—4508-A).

Fig. 3 — (Moderate power) Photomicrograph: tumor growing between muscle bundles (Wash. Univ. Neg. 59—5098).





submitted reticulo-myelosarcoma. Dr. R. Willis, of Leeds, offered a diagnosis of polyhedral-cell malignant tumor of unknown nature, possibly metastatic. Dr. F. Vellios, of Indianapolis, submitted osteosarcoma.

Subsequent history: The patient's general condition had deteriorated; there was intense pain and considerable loss of motion of the right shoulder. In January, 1952, roentgentherapy was started. There was very slight diminution of pain and practically no diminution of the size of the shoulder mass, in spite of intensive irradiation through several fields.

In March, 1952, new masses appeared in the temporal region and *severe* pain developed in the lumbar region and lower extremities, as the general condition continued to deteriorate. Roentgentherapy was administered to the lumbar spine without relief of pain. Treatments were discontinued. The patient developed left facial paralysis, urinary retention and paralysis of the lower extremities. In May, 1952, he expired; tumor was found in the scalp, dura, parietal pleura, ribs, lungs and vertebrae. There was definite residual tumor in the right shoulder.

Dr. Reynolds: In a case like this, where you have a rather uncertain pathological diagnosis, the surgeon has an extra difficulty. We have treated patients with both Ewing's sarcoma and reticulum-cell sarcoma with roentgentherapy to have the initial lesion disappear, and the lesion of the bone actually healed, only to have the patient die with disseminated disease later on. In some cases we have given roentgentherapy and then two or three weeks later, amputated the extremity and no viable tumor was found, yet the patient still died of disseminated tumor. I would be very pessimistic about the outcome of a case like this. The fact that the tumor spread to the head and to other bones would seem to indicate that this would fall more into the reticulum-cell sarcoma group rather than that of osteosarcoma; although osteosarcoma does occasionally metastasize to bone, it is not common. The fact that there was very little, if any, response to roentgentherapy again would indicate that this tumor was not one of the radiosensitive tumors of the Ewing or reticulum-cell sarcoma group. I would have given the initial roentgentherapy, but after that failed to give relief of pain and there were not other signs of metastases, I would have been inclined to do a shoulder-girdle disarticulation, but I doubt very much that any method of treatment would have been successful in saving this patient.

There has been continuing discussion as to the place of roentgentherapy in the treatment of malignant bone tumors. Part of the misunderstanding and doubt is due to reported series of cases in which you could not be sure that the reports concerned the same type of tumor. There has been of recent a rebirth of the idea that malignant bone tumors should be treated with roentgentherapy and then, at a later date, an amputation carried out; rather than to have surgery alone. There is not sufficient information for me to make up my mind as to the benefits of roentgentherapy. It seems to me that the only chance we have to save a patient with one of these malignant tumors, is to remove the tumor before it metastasizes.

D. C. Dahlin, M. D., Rochester, Minnesota: We squeeze this tumor into the reticulum-cell sarcoma group; our experience has been that when they are atypical enough, that you have to squeeze them into that category and they usually have about the same bad outlook as a Ewing's.

L. Lowbeer, M.D., Tulsa, Oklahoma: I wonder whether Dr. Ackerman makes no distinction between Ewing's sarcoma and reticulum-cell sarcoma. I thought that both originate from reticulum cells, but that Ewing's sarcoma is an extremely primitive one where the tumor cells do not produce any reticulin and which occurs in young persons. Whereas, a reticulum-cell sarcoma per se, produces a great deal of reticulin and collagen, it is found in all ages and it has a totally different prognosis.

Dr. Ackerman: I make this distinction. I would say that there is such a tumor as a Ewing's tumor; it has a very poor outlook and it has the characteristics that Dr. Lowbeer has indicated. I have also seen cases sort of in betwixt and between which I had a lot of trouble deciding what they were exactly; so perhaps there is a shadowy borderline between these two as I believe Dr. Stout had once indicated. Reticulum-cell sarcomas are very distinctive from the clinical, radiographic, and microscopic point of view as well as in their response to radiation therapy; this case does not seem to fit in. Neither does it seem to fall into the category of a Ewing's tumor; it didn't have the microscopic characteristics.

R. Todd, M.D., Lincoln, Nebraska: Regarding the efficacy of radiotherapy, I know of a case irradiated for a reticulum-cell sarcoma involving the proximal humerus; the humerus was disarticulated, but it was found that the tumor involved the glenoid fossa; intensive radiotherapy was administered postoperatively and there was no evidence of recurrence four years later.

Dr. Regato: Reticulum-cell sarcomas as well as Ewing's tumors are commonly radiosensitive. If we take this as their character, we should naturally doubt the identity of any such tumor which is not radiosensitive, particularly when their morphology is not too characteristic. On the other hand, one could also argue that even tumors that are normally radiosensitive could be occasionally radio-resistant and vice versa. A good example are malignant melanomas; although the majority of these tumors will grow under irradiation, a few may show considerable radiosensitivity. Similarly, radiosensitive tumors may occasionally appear radio-resistant, but I believe the latter case is rarer. In the face of very questionable basis for a definite diagnosis, I believe that it is sound to suspect that a bone tumor which shows no radiosensitivity is probably not a reticulum-cell sarcoma.

Dr. Reynolds says that he is disappointed that many of the cases they have treated eventually died of metastases; obviously those metastases were already there and treatment of the primary, whether surgical or radiotherapeutic, could not take care of them. The important test of whether radiotherapy can or can not be useful, particularly in avoiding amputation or disarticulation, is in the fact that radiotherapy does and has definitely proven to be able to sterilize the source locally.

A. O. Severance, M.D., San Antonio, Texas: Has Dr. Ackerman been given the privilege to study any of the slides of this autopsy material? If not, has the pathologist obtained any information that we don't have here to settle this problem?

Dr. Regato: Most of the slides for the Seminar were not made from the lesion of the shoulder, but from the other bone lesions found at autopsy.

H. J. Cnes, M.D., Sioux City, Iowa: I wonder if Dr. Ackerman might discuss this lesion in terms of reticulum-cell sarcoma as a lymphoma, rather than that of reticulum-cell sarcoma of the bone, particularly in view of the fact that the metastases that were noted could be multiple sites of origin.

Dr. Ackerman: I really can't discuss it any more; I've said everything I knew. What I would like to do is to study the primary bone tumor at autopsy to see the effect of irradiation and I would also like to study the other slides to see whether there are some pay-off zones, but I suspect very

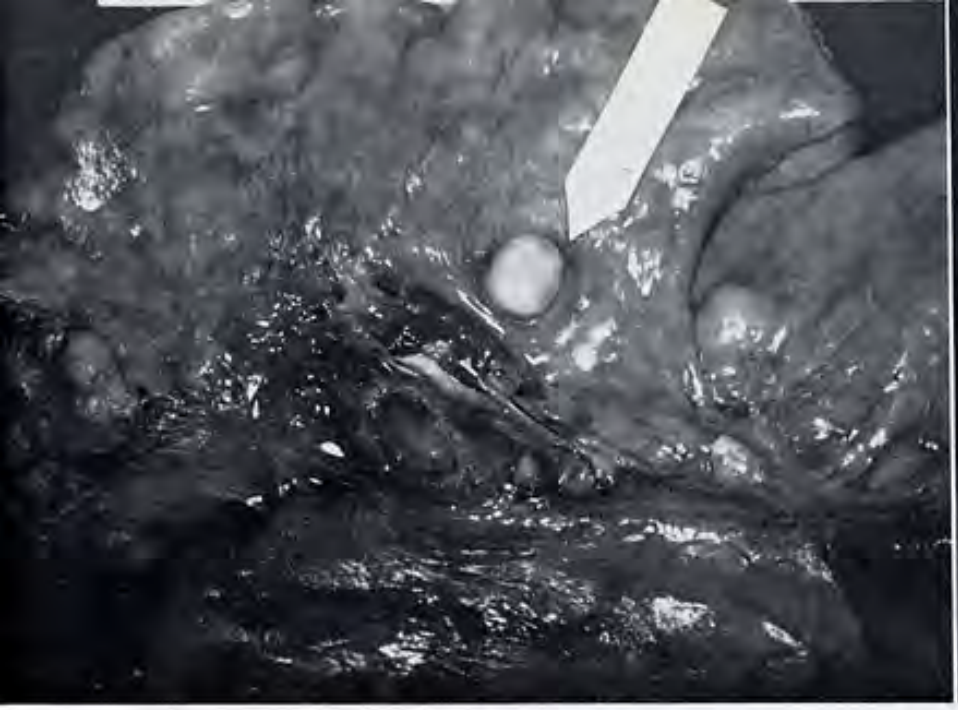


Fig. 4 — Gross post mortem appearance of metastases to the pleura.

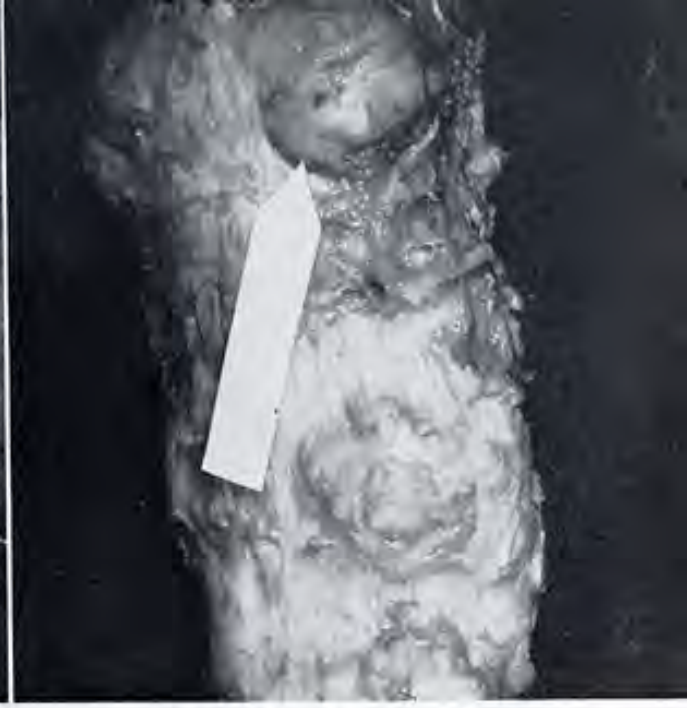


Fig. 5 — Gross post mortem appearance of the surface of the spine.

strongly that I would still be in the never-never land of not knowing. I'm sorry I'm so ignorant.

M. Berthrong, M.D., Colorado Springs, Colorado: It is interesting to note that Dr. Stewart, in a recent consultation, admitted that the present status is so confusing that he felt certain that if Dr. Ewing himself were to come back today, he wouldn't have the slightest idea of what constituted Ewing's tumor.

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6. *Cranial Bone Metastasis from Carcinoma of the Cervix*

Contributed by Leo Lowbeer, M. D., Tulsa, Oklahoma

THE PATIENT was a 68-year-old lady in December, 1955, when she received a trauma over the right side of the forehead; shortly afterwards pain developed. In April, 1956, there was a visible swelling and the pain persisted.

Dr. Hodes: This is a solitary lesion in the parietal bone which is associated with no evidence of intracranial disease. The lesion involves the entire thickness of the calvarium with destruction of the inner and outer tables plus the diploe. This totally osteolytic lesion is not sharply demarcated. Along its posterior margin, only slight "smudging" is observed; along the anterior margin of the defect, however, definite invasion of the parietal bone is clearly demonstrated. Overlying the tumor mass is a soft tissue "cap" approximately one and one-half centimeters in thickness.

In a patient 68 years of age, osteolytic lesions of the skull associated with superimposed soft tissue masses usually are due to metastatic carcinoma. Primary malignant tumors of the bones of the calvaria are very rare. Whereas, no one can gainsay the possibility, that this is a solitary myeloma, it would be an unusual manifestation of solitary myeloma, because the latter commonly are more sharply demarcated, multiple, and rarely are they covered by a sizable soft tissue "cap". A bone survey, chemistry studies, and a more adequate history would probably prove invaluable in the differential diagnosis.

Dr. Hodes' impression: A malignant bone tumor. 1) METASTATIC CARCINOMA. 2) MYELOMA?

Roentgenologic Impressions Submitted by Mail:

Metastatic carcinoma	52 (1)*
Myeloma	33 (1)
Eosinophilic granuloma	30 (1)
Leptomeningeal cyst	14
Oligodendroglioma!	1/2
Others	39 (3)

* In parenthesis, the impressions of six outstanding radiodiagnosticians

Dr. Regato: Dr. P. C. Swenson, of Philadelphia, submitted eosinophilic granuloma; Dr. J. M. Dell, of Gainesville, Florida, preferred a myeloma. Dr. C. A. Good, of Rochester, Minnesota, Dr. W. B. Seaman, of New York City, and Dr. E. Salzman, of Denver, all favored a metastatic carcinoma.

Operative findings: The tumor grew rapidly and a left sided hemiparesis developed. A biopsy was done and a diagnosis of "hemangiopericytoma" was rendered. Doctor A. P. Stout rendered this opinion at the time: "I feel certain that this is not a reticulum-cell sarcoma, because of cell shapes and arrangement. I have seen two or three tumors like this and have tentatively classified them as hemangiopericytomas, although I was uncertain as to whether or not the diagnosis was justified; if it is not, I can think of no other name for it."

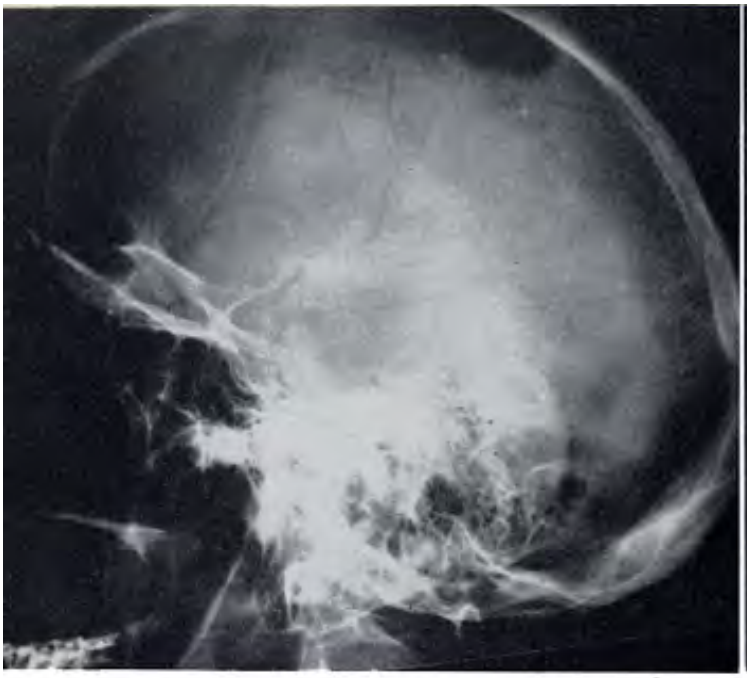


Fig. 1 — Roentgenographic appearance of sharply demarcated osteolytic lesion of the parietal bone (Dec. 1955).

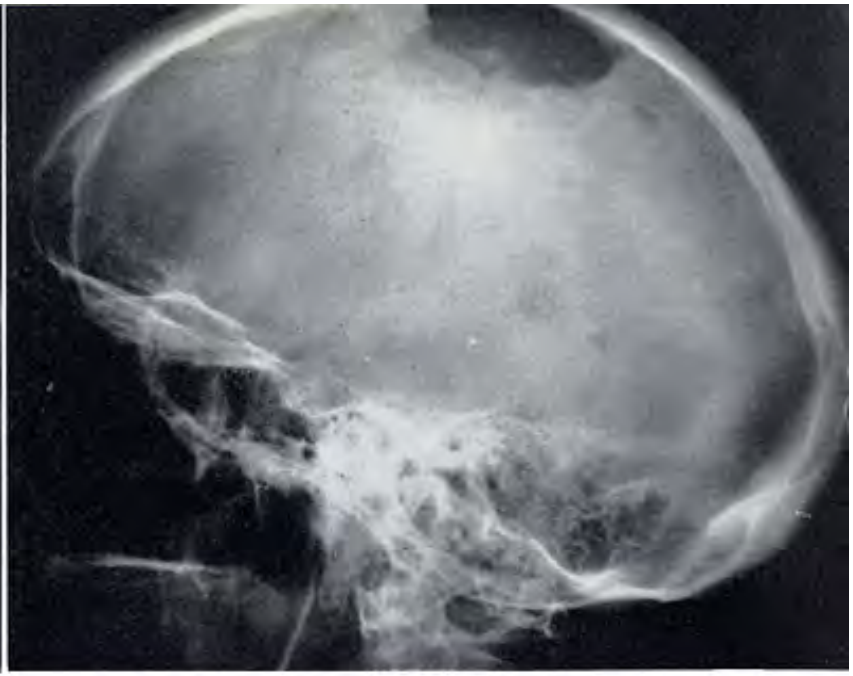


Fig. 2. — Appearance of the lesion after radiotherapy (Sept. 1956).

Dr. Ackerman: This tumor which is undifferentiated and demonstrates some variation in the size and shape of the cells has prominent individual nuclei with prominent nucleoli. In some areas this suggests carcinoma, in others reticulum-cell sarcoma. There is undoubtedly a moderate amount of reticulin present. I am unable to say on the basis of the microscopic pattern whether this tumor is primary or metastatic. I can only say it is malignant. If you take into consideration the fact that the patient is 68 years of age and has a destructive lesion of the parietal bone, then the chances are almost 100 per cent that it is metastatic.

Dr. Ackerman's diagnosis: METASTATIC MALIGNANT TUMOR, unclassified; primary source undetermined.

Histopathologic Diagnoses Submitted by Mail:

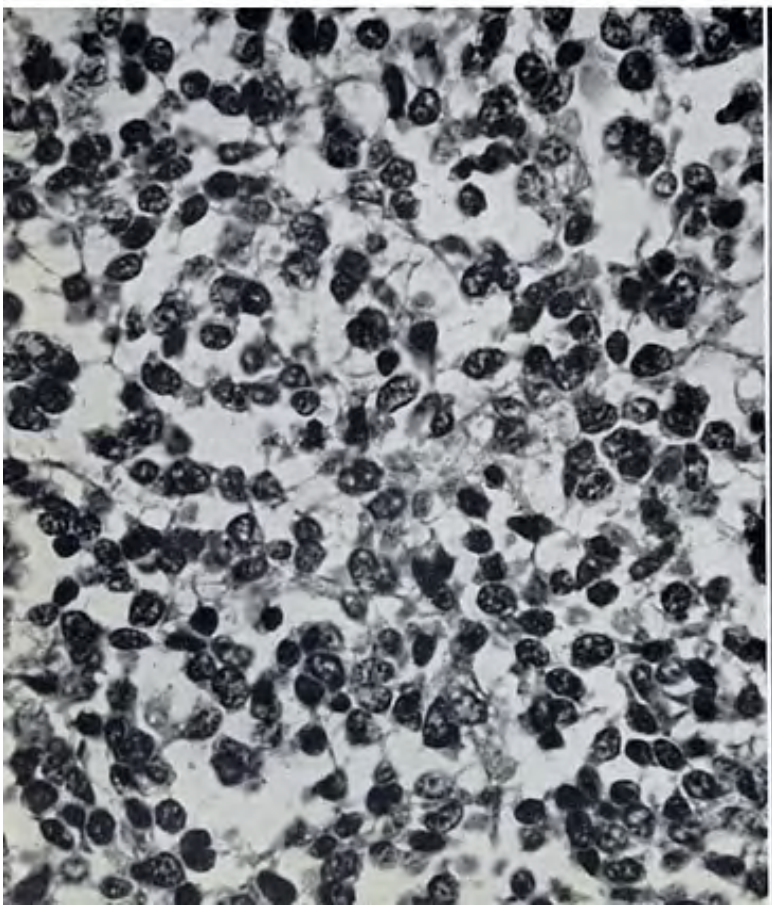
Reticulum-cell sarcoma	60 (1)*
Lymphosarcoma	27 (1)
Metastatic carcinoma	32 (1)
Malignant tumor, unclassified	9 (2)
Myeloma	22 (1)
Meningeal sarcoma	4
Others	3

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. C. A. Hellwig, of Halstead, Kansas, offered a diagnosis of myeloma. Dr. W. Hartmann, of New York City, suggested an undifferentiated malignant mesenchymal tumor. Dr. D. Brachetto-Brian, of Buenos Aires, favored a meningioma, Dr. J. H. Childers, of Galveston, Texas, considered this as a metastatic carcinoma; Drs. J. B.

Fig. 3 — (High power) Photomicrograph: Undifferentiated malignant tumor with cells varying in size and shape; the pattern is not diagnostic (Wash. Univ. Neg. 58—4510).

Fig. 4 — Roentgenogram of the chest showing bilateral pulmonary infiltration (Sept. 1956).



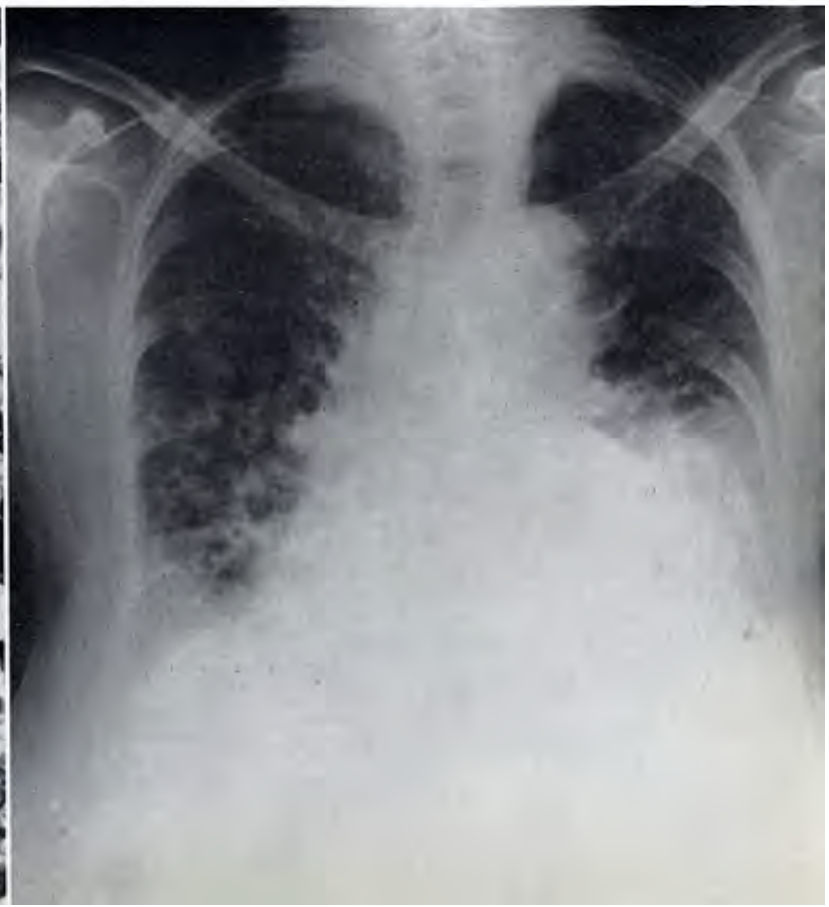


Fig. 5 — Post mortem appearance of the parietal bone; no residual tumor found.

Fig. 6 — Gross appearance of liver metastasis.

McNaught and R. L. Hawley, of Denver, also made a diagnosis of metastatic carcinoma, suggesting a bronchial primary.

Subsequent history: Since surgical removal was impossible, radiotherapy was administered; the tumor regressed rapidly and the hemiparesis disappeared. Four months later, the patient complained of pain in the chest and became dyspneic. The roentgenograms of the skull showed development of new osteolytic lesions, there was evidence of lymphangitic metastases of the lungs.

In October, 1956, the patient expired. A large defect in the right parietal region contained no tumor. Extensive nodular masses were found in both lungs and hemorrhagic pleural effusion. There were also metastatic nodules in the liver, heart, kidneys, adrenals and spleen. There was no tumor in the pelvis.

In reviewing the patient's history at autopsy, it was learned that the patient had been treated for carcinoma of the cervix, Stage II, in November, 1952. Review of the original biopsy revealed an anaplastic carcinoma with only rare pearls of epidermoid differentation

Dr. Regato: Distant metastases from carcinoma of the cervix used to be observed very rarely. As the control of the primary lesion is obtained more often, there are more and more patients who die from distant metastases without recurrence or persistence of the primary. There is, however, the possibility to be considered of two independent lesions.

D. DeSanto, M. D., San Diego, California: I think the fact that you have a primary tumor of the cervix doesn't rule out a lymphoma because primary lymphosarcomas in the cervix, although rarely, do occur. I recall having had one. I didn't diagnose it on the original biopsy, but about four or five years later some inguinal lymph nodes appeared and then the diagnosis was obvious.

L. Lowbeer, M. D., Tulsa, Oklahoma: The discussors have shown far more acumen as pathologists and radiologists than our consultants, which shows that foresight is more difficult than hindsight. Foresight implies an approach to every case as though it were a Seminar case. In the first place, one should pay more attention to the history; we knew nothing about the history. In the second place, one should always consider a metastasis; which we didn't. The diagnosis of hemangiopericytoma was made because of the considerable amount of reticulin; if we had paid more attention to the reticulin stain, which wasn't shown here, we would have seen the definite epithelial character of this neoplasm.

As it stands now, this is a rare case of hematogenous metastasis from a carcinoma of the cervix; it must be assumed that the metastatic tumor cells in the skull were present at the time the patient was treated for cervical carcinoma and that they were vitalized by the trauma. Obviously, all the metastases which occurred later came from the metastasis in the skull for no primary tumor was present.

7. Metastatic Carcinoma (?) in a Vertebra

Contributed by KARL T. NEUBUERGER, M.D., Denver, Colorado

THE PATIENT was a 58-year-old lady in the summer of 1955, when she developed severe lumbar pain. A radiographic examination revealed collapse of the eleventh thoracic vertebra; roentgentherapy was started but discontinued. In June, 1956, she sustained a fall and had a fracture and dislocation of the cervical spine; the condition of the dorsal vertebra remained unchanged. In August, 1956, she developed intense abdominal pain; there was flaccid paralysis of both lower extremities, urinary and fecal incontinence.

Dr. Hodes: This patient presents a polyostotic disease involving the flat bones. The eleventh rib has been destroyed and the vertebral body has been transformed; there is evidence of bone destruction in the sixth thoracic vertebra.

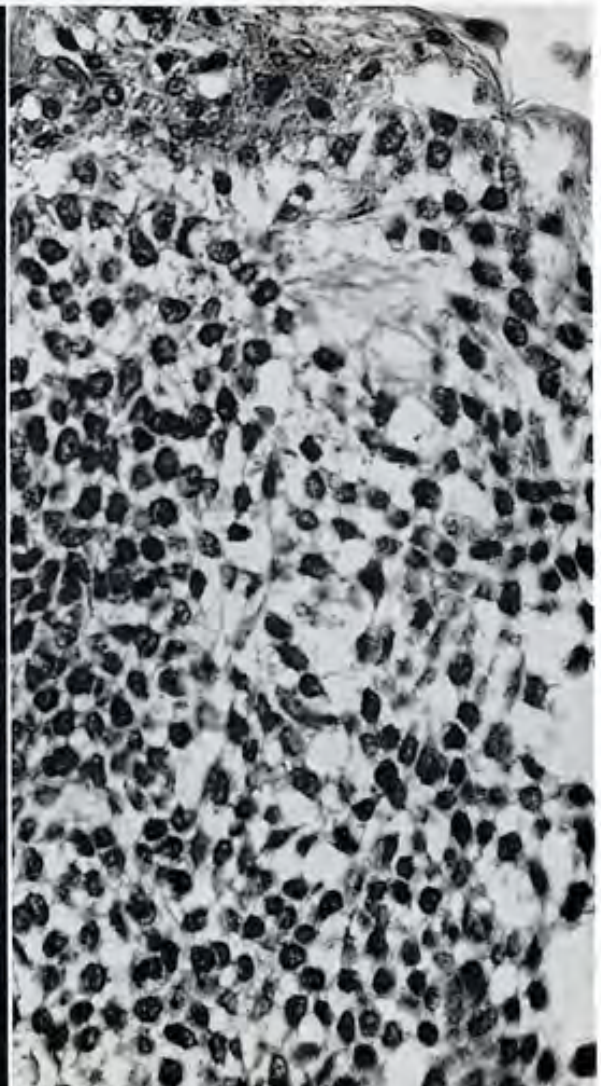
There is a distinct difference in the density of the sixth compared with the eleventh thoracic vertebra. The probabilities are that the dense appearance of the eleventh is the result of radiation therapy. Both the sixth and the seventh reveal evidence of compression fractures involving primarily the right half of the vertebral body with approximately 10-15 per cent loss in vertical stature. The adjoining intervertebral spaces do not seem compromised. In the sixth, there is obvious destruction of the pedicle on the right side. In the eleventh, neither pedicle is demonstrated.

The eleventh rib is totally destroyed. In its place irregularly distributed calcific debris tends to conform to the general course of a rib. Highly significant, however, is the manner in which this rib destruction blends with the destruction in the vertebral body. The appearance suggests that the tumor mass in the eleventh vertebra extends directly into the adjoining rib. Noteworthy also, are the changes in the articulation between the left eleventh rib and the vertebral appendage. There are no soft tissue masses discernible. The liver is not enlarged. The spleen is not enlarged. This polyostotic process apparently is medullary in origin. It has attacked only spongy bone.

At age 58, the most common malignant polyostotic tumor is *metastatic disease*. Apparently the tumor involving the eleventh thoracic vertebral and rib spread directly as a solid mass. The fact that the liver is not enlarged does not militate against metastatic disease for, not uncommonly, does one find an absence of invasion of soft tissues when the skeleton is primarily involved. One would hardly expect multiple myeloma to spread directly from the vertebral

Fig. 1 — Roentgenogram showing complete destruction of the eleventh rib and changes of the vertebra.

Fig. 2 — (High power) Photomicrograph: Undifferentiated tumor with non-diagnostic pattern (A.F.I.P. Acc. No. 218757—77).



bodies to the rib in the manner here depicted. Also, multiple myeloma does not produce the advanced neurological changes that occurred in this patient. *Lymphosarcoma* and *Hodgkin's disease* could also produce these bone lesions; *reticulum-cell sarcoma* also must be considered. In the latter, perifocal soft tissue invasion is common. The fact that this patient's liver and spleen are not enlarged seems significant and militates against some form of round cell tumor.

Dr. Hodes' impression: A malignant disease. 1) METASTATIC TUMOR. 2) MYELOMA.

Roentgenologic Impressions Submitted by Mail:

Metastatic carcinoma	57	(4)*
Myeloma	27	(1)
Neurogenous tumor	18	
Chondrosarcoma	17	
Reticulum-cell sarcoma	9	
Others	25	(1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. R. Calderón, of Managua, Nicaragua, submitted an impression of myeloma; Dr. M. B. Goodwin, of Clovis, New Mexico, preferred chondrosarcoma. Dr. R. D. Moseley, of Chicago, and Dr. L. H. Garland, of San Francisco, favored a metastatic carcinoma. Dr. L. J. Brown, of Herrin, Illinois, also suggested metastatic carcinoma from a bronchial primary.

Subsequent history: Roentgentherapy was administered with some definite palliation of symptoms, but the patient's general condition continued to worsen. In March, 1957, she expired. Autopsy revealed the widespread presence of tumor in the cervical, thoracic and lumbar vertebrae as well as lesions of the ribs and sternum.

Dr. Ackerman: There is fibrous tissue replacement of the medullary canal. There is osteoplastic resorption of bony trabeculae with numerous cement lines. There are nests of epithelial cells present that show cystic changes. There are possible secretion droplets present. This could be a metastatic cancer from many sources such as the ovary, cervix, lung, etc.

Dr. Ackerman's diagnosis: METASTATIC CARCINOMA, primary undetermined.

Histopathologic Diagnoses Submitted by Mail:

Metastatic carcinoma	48	(2)*
Adamantinoma	33	(3)
Angiosarcoma	21	
Fibrosarcoma	9	
Osteosarcoma	8	
Hymenglopericytoma!	1	
Others	46	(1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. H. K. Giffen, of Omaha, and Dr. M. C. Wheelock, of Chicago, made a diagnosis of adamantinoma. Dr. E. F. Geever, of Washington, D. C., and Dr. R. R. Rember, of Denver, designated it as angiosarcoma. Dr. C. A. Hellwig, of Halstead, Kansas, submitted hemangiopericytoma. Dr. B. G. Fishkin, of Los Angeles, preferred a diagnosis of metastatic salivary-gland tumor. Dr. F. Bang, of Copenhagen, suggested metastasis from a synovial sarcoma, and Dr. L. Lowbeer, of Tulsa, Oklahoma, from a granulosa-cell tumor of the ovary.

L. Lichtenstein, M. D., of Los Angeles (by mail): The cytology of this tumor is certainly reminiscent of adamantinoma. I have never seen or heard of one developing in the vertebral column, but on the other hand, I would not know what else to call it.

A. P. Stout, M. D., New York (by mail): I presume this must be a chordoma although a very unusual one and in a rare vertebra.

Dr. Reynolds: Did you find a primary at post mortem?

K. T. Neubuerger, M. D., Denver, Colorado: We did not find a primary tumor. It was a multiple fibrosarcoma of bone. Maybe the slides didn't show that well enough, but my slides certainly did not allow for any other diagnosis. And I felt it was a case which resembled that published about fourteen years ago by Steiner.

Dr. Reynolds: The material we have and the diagnosis of all this material was apparently obtained from the post-mortem examination. I would like to point out that biopsy of these lesions in the spine is a useful procedure. In this particular case it probably would have made little, if any difference, but to treat spine lesions on the basis of a roentgenogram leads to errors. A needle biopsy could have been done on this lesion; or, if not, an open biopsy.

J. H. Childers, M. D., Galveston, Texas: I would like to ask Dr. Neubuerger if this patient had a history of skin tumor, perhaps a squamous cell carcinoma or a basal cell carcinoma, which had been treated several months prior to the time the bone lesions were noted. This question is prompted by an experience we had in Galveston: a man of approximately this same age with a large lesion in the femur had a baso-squamous carcinoma of his neck. Both were studied histologically and the metastases showed some interesting areas with adamantinoma-like pattern.

K. T. Neubuerger, M. D., Denver, Colorado: Actually, this patient had a lesion of the skin of the nose which was removed years before. We were quite unable to find out anything about that. We seriously considered that this might have been a malignant tumor and that the bone lesions were metastatic, but we could not find out anything about the nature of this tumor.

Dr. Ackerman: I have seen about four or five cases that were supposed to be almost garden variety basal cell carcinomas that metastasized widely and caused the death of the patient. This is very unusual, of course.

References

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Steiner, P. E.: Multiple diffuse fibrosarcoma of bone. Am. J. Path., **20:** 877-893, 1944

8. *Chondroblastoma of the Os Calcis*

Contributed by Leo Lowbeer, M. D., Tulsa, Oklahoma

THE PATIENT was a 14-year-old boy in September, 1956, when he complained of pain in the right heel which had been present for several months and had been aggravated by a football injury causing him to limp. There were no outward physical signs.

Dr. Hodes: This tumor is sharply demarcated. Its margin, however, reveals little or no reactive bone. Instead, the trabeculae seem suddenly to lose their density at the margin of the somewhat cystic disease. Numerous trabeculae course through the bone defect. Some are incomplete; others deossified; others totally destroyed.

This looks like a benign process, either a tumor, or inflammation. Among the latter, one would consider *eosinophilic granuloma*. Usually, the latter are more cystic; the trabecular pattern in lesions this size almost always is totally destroyed; commonly too, but not invariably, more reaction is demonstrated along the margin of the granuloma. Simple *bone cyst* is a possibility; it is not seriously considered because of the persistence of the trabeculae within the deossified zone; simple cysts usually are devoid of this. Benign *chondroblastomas* arise near the epiphyseal centers. Although rather young, this patient is within the age group in which these tumors are found. Usually the margin of chondroblastomas is far more clearly delineated. As a rule, a dense line of reactive bone surrounds the defect. Sometimes calcific debris is deposited within the cystic portion of the tumor.

Dr. Hodes' impression: A benign bone tumor. 1) CHONDROBLASTOMA. 2) GIANT OSTEOID OSTEOMA.

Roentgenologic Impressions Submitted by Mail:

Eosinophilic granuloma	55	(3)*
Bone cyst	39	(2)
Chondroblastoma	17	(1)
Osteoid osteoma	14	
Tuberculosis	12	
Ewing's tumor	7	
Others	27	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

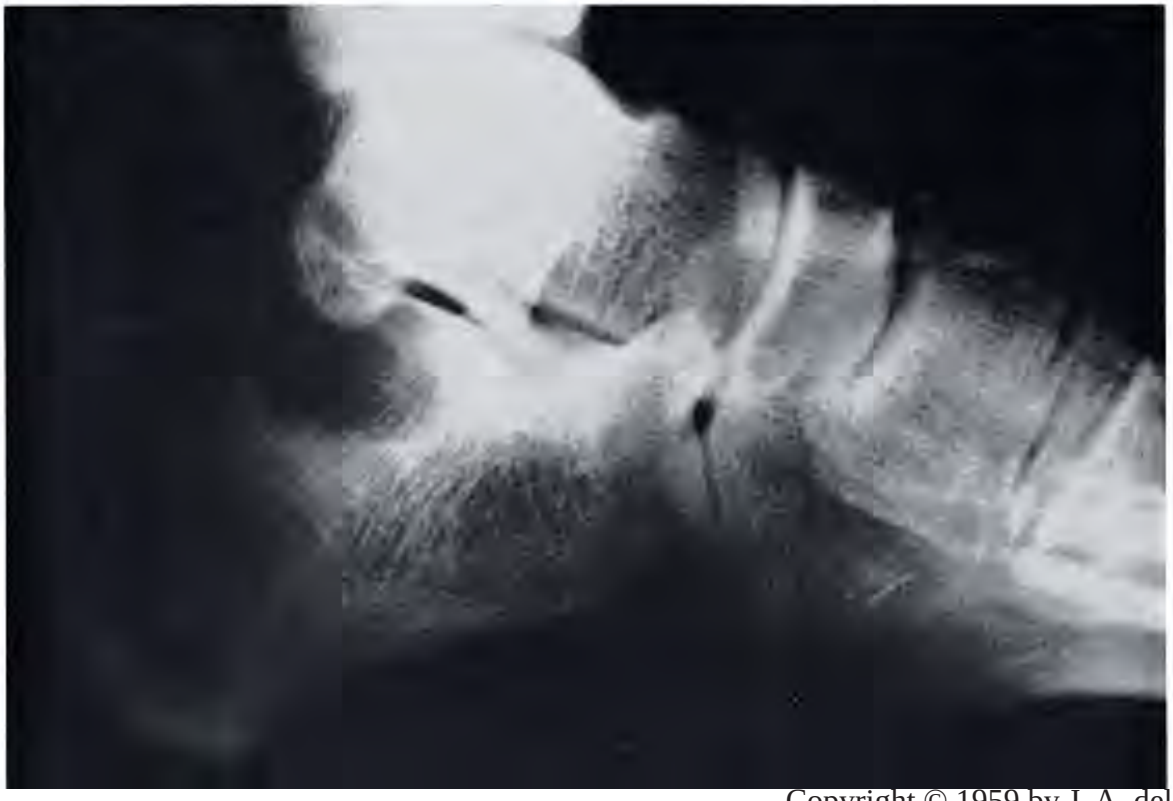
Dr. Regato: Dr. E. Salzman, of Denver, and Dr. A. S. Tucker, of Cleveland, Ohio, suggested eosinophilic granuloma. Dr. G. F. Lull, Jr., of Denver, and Dr. F. Campoy, of Seville, Spain, preferred a benign calcaneal cyst. Dr. F. J. Gorishek, of Denver, made an unequivocal diagnosis of chondroblastoma. Dr. B. Felson, of Cincinnati, also suggested chondroblastoma, but commented that he rather doubted this possibility.

Operative findings: In September, 1956, the oscalcis was exposed and the lesion entered; a thorough curetting was carried out. The material removed was moderately firm, whitish in color.

Dr. Ackerman: This lesion is difficult to interpret, but is believed to be benign. It has some of the features of both chondroblastoma and chondromyxoid fibroma. There are cellular zones of cartilage and beginning areas of calcification so typical of chondroblastoma. Large numbers of giant cells are present which have the appearance of osteoclasts. There are some extremely cellular areas present, but mitotic figures are few and far between; this lesion demonstrates the pluri-potential character of the skeletal matrix cells.

Benign chondroblastoma is a neoplasm of bone of cartilaginous origin, the basic cell of which is capable of producing a chondroid matrix. Multinucleated giant cells are often abundant, and undoubtedly, have led to the mistaken diagnosis of giant cell tumor. The cellular areas, cartilage formation, necrosis and mitotic figures probably account for the incorrect diagnoses of osteosarcoma and chondrosarcoma, which, unfortunately, have not been uncommon. A malignant counterpart of benign chondroblastoma (Copeland and Geschickter) has not been recognized by us. However, a morphological relationship to chondromyxoid fibroma has been described by Dahlin.

Fig. 1 — Sharply demarcated, apparently benign, lesion of the calcaneum.



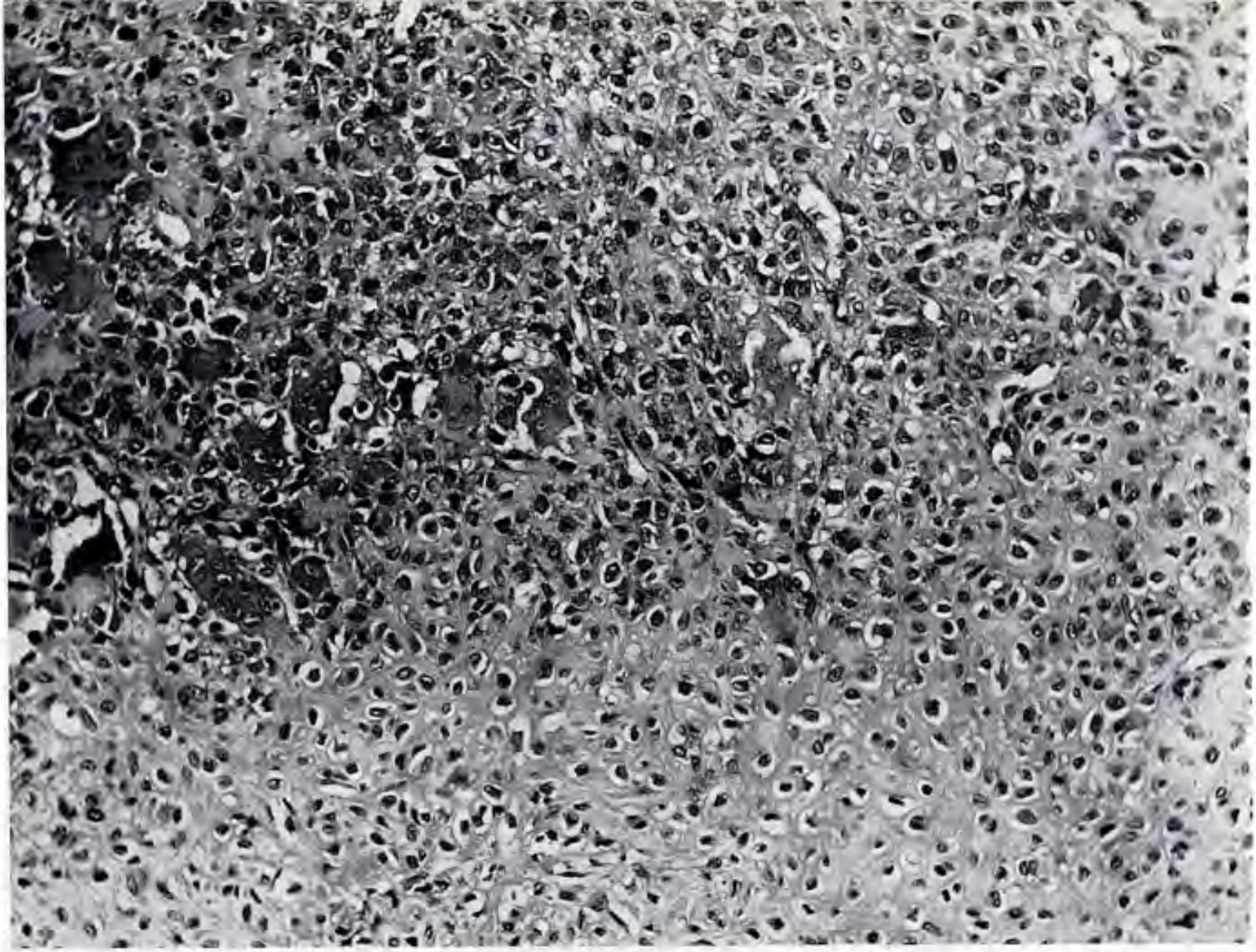


Fig. 2 — (Moderate power) Photograph: Rather typical zone of chondroblastoma showing giant cells and embryonic chondroblasts and cellular areas.

Benign chondroblastomas almost invariably arise in the epiphyseal region. Dahlin states that rare examples have been seen in the metaphysis of a bone, with only a minor epiphyseal component. The tumor tends to remain confined to the epiphyesal area, but may invade into the metaphysis; rarely a chondroblastoma will erode articular cartilage or actually perforate into the joint space (Dahlin; Lichtenstein). The most common bones involved are the upper end of the humerus, upper and lower ends of the femur, and the upper end of the tibia.

The cell that gives benign chondroblastoma its distinctiveness is a cell considered to be a chondroblast. It is a polygonal to rounded cell with a round or oval nucleus. In cellular areas the cell may have a spindle contour.

Nucleoli are common; mitotic figures are not difficult to find, but are not numerous. A feature of these cells that is an aid in diagnosis of the tumor is the clearly defined cell membrane. This is not seen in every field, as it is soon apparent from study of this tumor that the cell pattern is varied. A chondroid substance forms the stroma, if any, in the cellular areas. Foci, seemingly of transition from the cellular areas into cartilage, are seen. Multinucleated giant cells are common, but not as numerous as in giant cell tumors. Jaffe and Lichtenstein describe two types of giant cells: a small multinucleated giant cell associated with the tumor components and a larger multinucleated giant cell seen in areas of hemorrhage and vascular sinuses. The former they consider to be tumor giant cells and the latter multinucleated macrophages. It is in the areas of the large multinucleated giant cells that a mistaken diagnosis of giant cell tumor may be made. In addition to giant cells, the stroma is fibrous and vascular, tending to support the diagnosis of giant cell tumor.

Dr. Ackerman's diagnosis: CHONDROBLASTOMA.

Histopathologic Diagnoses Submitted by Mail:

Benign chondroblastoma	117	(5)*
Benign giant cell tumor	27	(1)
Chondromyxoid fibroma	3	
Xantogranuloma	2	
Others	15	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Most of the experts on this side of the Atlantic submitted a diagnosis of chondroblastoma. Dr. R. Willis, of Leeds, Dr. C. Sirtori, of Milan, and Dr. F. Bang, of Copenhagen, offered benign giant cell tumor.

L. Johnson, M. D., Washington, D. C. (by mail): This is a tumor that arises with special frequency from the os calcis, and which is not yet adequately described in the literature. It looks in some areas like an enchondroma, in others like a giant cell tumor, in others like a Codman's tumor and occasionally, there are fibromatous and osteoid areas. When they occur in long bones, they are metaphyseal in origin; there are gradations that link them closely to the chondromyxoid fibroma. To find them readily, these cases are filed at the Armed Forces Institute of Pathology under the name of enchondromatous giant cell tumors.

L. Lichtenstein, M. D., Los Angeles (by mail): My impression is that this is an off-beat chondroblastoma that

apparently falls into the group of tumors derived from cartilage-forming connective tissue; it has nothing in common with giant cell tumors of bone. Tumors such as these are called enchondromatous giant cell tumors, but I do not favor resurrecting giant cell tumor variants.

D. C. Dahlin, M. D., Rochester, Minnesota: This benign chondroblastoma demonstrates that the amount of cartilage present may be very small and you may have to take more than one section to prove that it is a benign tumor.

Dr. Reynolds: This lesion is very easy to treat of course, local curettment and replacement of the cavity with bone grafts is usually successful. Actually, the greatest difficulty with this lesion is that it may be over-diagnosed and a more radical procedure carried out.

C. C. Dundon, M. D., Cleveland, Ohio: We had one of these tumors at the upper end of the humerus and regarded it as a giant cell tumor; the patient sustained a pathological fracture; he was treated by irradiation. The lesion regressed for about two or three years, then recurred, and was irradiated again. The patient eventually went to Dr. Coley of the Memorial Hospital of New York. The lesion turned out to be a chondroblastoma. The patient had a local resection first; then a shoulder girdle disarticulation; she is living yet. The degree of radiosensitivity was moderate with three applications of 600 roentgens: there was remission for two or three years.

L. Lowbeer, M. D., Tulsa, Oklahoma: I know of one case of chondroblastoma which had been misdiagnosed as an osteosarcoma and because the patient refused amputation, was heavily irradiated. About fifteen or twenty years later, a soft tissue tumor developed over this area which turned out to be a liposarcoma and the roentgenograms of the bone, at that time, showed that the bone was completely solidified and cured: there was no trace of tumor left. The original slides, which had been diagnosed as osteosarcoma, were reviewed. They were found to show a chondroblastoma. Lent Johnson calls these tumors enchondromatous giant cell tumors: it indicates that the tumor cell cannot only produce cartilage, but also can convert it to chondroblast or osteoblasts; Lichtenstein thinks the giant cell tumor is something entirely different.

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9. *Chondromyxoid Fibroma of the Fibula*

Contributed by Fred Hartshorn, M. D., Paul K. Hamilton, M. D., and Frank J. Gorishek, M. D., Denver, Colorado

THE PATIENT was a 15-year-old boy in November, 1957, when he complained of pain in the left ankle elicited by exercise. There was a hard tumefaction 5x3 cm over the lateral aspect of the ankle. The routine laboratory procedures were reported within normal limits.

Dr. Hodes: This monostotic lesion occupies the distal third of the fibula. It is medullary in origin and may be centrally placed, although, one cannot deny that originally, it may have been eccentric. The diaphysis is primarily involved with extension of the tumor mass into the metaphysis. This is an expansile bone tumor with sharply demarcated margins. At its distal edge, medially, there is a pathological fracture. The expansion has taken place more prominently in the medial direction where eivdence of molding of the adjoining tibia is obvious. Normal cortex has been replaced by a shell of tumor tissue. The shell is intact, except for minimal defects due to the fracture. Some cortical reaction is observed along the proximal margin of the tumor. The proximal and distal margins of the cystic mass are crisp and sharply defined. Apparent trabeculation is present, but this probably reflects variations in endosteal bone absorption and proliferation.

This is obviously a benign bone tumor. The benign cystic tumors which occupy distal ends of tubular bones include various fibrocystic disturbances, such as bone cyst, fibroma, ossifying fibroma, fibrous dysplasia, etc. Simple *bone cysts* tend to be less "scalloped" in contour; they may cause bone expansion and some may lie at a distance from the epiphysis due to the influence of growth. *Fibrous dysplasia* usually is not this centrally placed. Usually, too, the lesions in fibrous dysplasia tend to be more of cortical origin; certain it is that monostotic fibrous dysplasia could look like this. *Non-osteogenic fibromas* notoriously occupy this portion of a long bone. They are metaphyseal in origin and, most commonly, are found in the lower limbs; they cause bulging and pseudotrabeculation. Commonly, too, in the fibula the expansion by the tumor mass tends to be most marked along its medial aspect, as is the case in this patient. Non-osteogenic fibromas are medullary in origin and eccentrically placed. *Chondromyxoid fibroma* is metaphyseal in its location, medullary

Fig. 1 — Roentgenogram showing a centrally placed cystic lesion of the distal third of the fibula.

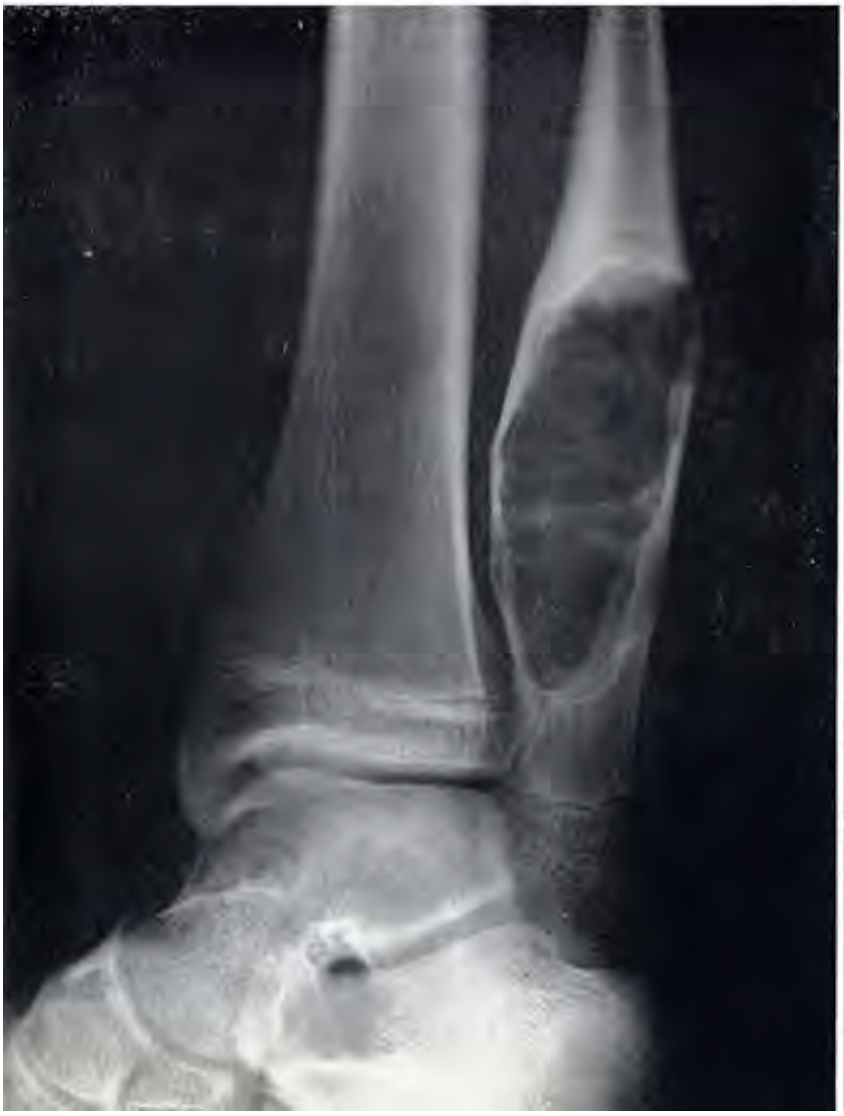

Fig. 2 — Gross appearance of the tumor.

in origin and causes bulbous tumor masses. Chondromyxoid fibromas are rare; commonly, there is complete resorption of the shell-like tumor bone which envelops it.

Dr. Hodes' impression: A benign tumor. 1) NON-OSTEOGENIC FIBROMA. 2) CHONDROMYXOID FIBROMA.

Roentgenologic Impressions Submitted by Mail:

Bone cyst	64	(2)*
Fibrous dysplasia	31	
Non-osteogenic fibroma	30	(2)
Chondromyxoid fibroma	7	(2)
Giant cell tumor	15	
Others	16	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. J. A. Campbell of Indianapolis, also submitted non-ossifying fibroma. Dr. D. W. Dohmalek, of Denver, and Dr. R. D. Moseley, of Chicago, offered fibrous dysplasia; Dr. L. H. Garland, of San Francisco, suggested fibroma. Dr. C. A. Good, of Rochester, Minnesota, and Dr. R. Sherman, of New York City, made a diagnosis of chondromyxoid fibroma. Dr. J. Barber, of Cheyenne, submitted bone cyst.

Operative findings: In November, 1957, the patient was operated upon. A well encapsulated and circumscribed tumor of the lower end of the left fibula was found; the medial cortex appeared invaded in several places. The fragments of tissue removed were soft and had fragments of bone attached.

Dr. Ackerman: This is an unusual neoplasm that we would call chondromyxoid fibroma. The location of the lesion, radiographic appearance, age of the patient and microscopic pattern are all compatible with this diagnosis. The lesion is often removed by curettage with the result that only fragments are available for gross examination. The fragments are glistening, gray-white with the appearance of cartilage. From totally removed specimens, it is noted that the lesion tends to be lobulated in contour, solid, firm, but resilient, white to gray-white to tan and appears well circumscribed. The tumor replaces the bone and causes sclerosis of surrounding bone. By expansion, the cortex may be eroded with the periosteum serving as the limiting membrane. The tumor imparts the suggestion that it is cartilaginous, but it is not slimy as the myxoid element would suggest. In the long bones of the lower extremities, chondromyxoid fibroma is most frequently located eccentrically in the metaphysis. Although located in the metaphysis, the majority lie near or contiguous to the epiphysis (Dahlin). The lesions have varied from 1.5 cm. to 8 cm. in greatest diameter among the reported cases.

A broad spectrum of histologic features is seen in this neoplasm. In most of the tumors, myxomatous zones seem predominant. Fields of chondroid material, which are present in every tumor, may be difficult to find or may predominate. The lobular pattern observed in the gross is maintained histologically by thin fibrous bands; in the bands blood vessels may be seen. In addition, foci or multinucleated giant cells, macrophages, mononuclear leukocytes, hemosiderin pigment and focal calcification are seen. The latter, along with ossification, is unusual.

The cells forming the myxomatous areas may be extremely bizarre. The nuclei vary from ovoid to round to polygonal. Many have elongated fibrillar processes. The matrix is bluish when stained with hematoxylin-eosin and does not give a positive response with the mucicarmine stain. In the more mature lesions, collagen fibers become numerous in the lobules and may result in hyaline foci (Jaffe and Lichtenstein). Dahlin believes that the increased concentration of nuclei at the periphery of the lobules is of "extreme importance" in the identification of this neoplasm. These cellular areas, the bizarre cells in the myxomatous lobules and the chondromatous zones have led to a diagnosis of malignant tumor of bone, usually chondrosarcoma. For instance, four of Dahlin's cases and two of Jaffe and Lichtenstein's cases were diagnosed as malignant tumor prior to the identification of this entity.

Chondromyxoid fibroma occurs predominantly in adolescents and young adults with no sex predilection. The lesion has been seen in the tibia, femur, ulna, fibula, metatarsal, tarsal, phalanx, calcaneus, vertebrae, rib, and pelvis. Most patients complain of pain in the tumor area with an awareness of a mass, which has been present for months. Roentgenologically, the tumor will be accurately localized, and because of its sharp outline, will be diagnosed as benign, and often incorrectly, as an aneurysmal bone cyst. This differentiation may be extremely difficult. As far as is known, the tumor is benign, but if inadequately removed may locally recur. Although curettage may give success in therapy, the ideal, when possible, would be excision of the tumor surrounded by a rim of normal bone.

Dr. Ackerman's diagnosis: CHONDROMYXOID FIBROMA.

Histopathologic Diagnoses Submitted by Mail:

Chondromyxoid fibroma	120	(5)*
Non-ossifying fibroma	13	
Fibrous dysplasia	7	(1)
Aneurysmal cyst	6	
Simple bone cyst	6	
Chondromyxosarcoma	9	
Others	10	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: With few exceptions, the experts agreed in the diagnosis of chondromyxoid fibroma.

Dr. Reynolds: Lesions in the long bone, like this one, are problems to the clinicians; whether he should do a biopsy or do an excisional biopsy at the time of the initial procedure, it is difficult to decide. The radiographic appearance usually suggests that you are dealing with a relatively benign lesion: if the leison is sufficiently far removed from the epiphysis, I would do an excisional biopsy as the primary procedure, a complete excision of the lesion. There are reported cases of chondromyxoid fibroma that have recurred after local curettment and packing with bone chips, with consequent secondary operative procedures. So that one would be justified in excising the bone as a primary procedure and putting in a graft; before the graft was put in, it would be wise to have a frozen section.

D. C. Dahlin, M. D., Rochester, Minnesota: I think all the important points have been covered. I might emphasize that we have seen about twenty of these lesions, and in every one, the roentgenologist considered the lesion to be benign.

M. Berthrong, M. D., Colorado Springs, Colorado: Dr. Ackerman, I realize that your slide might have had cartilage; mine did not. In the absence of cartilage, would you call this a chondroid myxoid fibroma; is the old diagnosis of myxoma still legal?

Dr. Ackerman: My slide did show some chondroid material.

D. C. Dahlin, M. D., Rochester, Minnesota: Admitted that in this case there was not too much chondroid present, it is important for us to recognize that in this particular specific type of lesion, the amount of various elements varies considerably. This group of lesions has often been overdiagnosed by the pathologists in the past. That is why I think that, even though it is predominantely myxoid, it would be better to recognize it as a member of this category so that you will know that it is benign.

Dr. Hodes: But isn't it true, Dr. Dahlin, that these cystic lesions can have all kinds of junk in, chondroid, myxoid, and any other thing?

D. C. Dahlin, M. D., Rochester, Minnesota: Oh, not in Rochester!

P. Russo, M. D., Oklahoma City, Oklahoma: What would you do with an asymptomatic lesion of this nature?

Fig. 3 — Classic appearance of chondromyxoid fibroma with cellular zones suggesting fibrous tissue and immature cartilage.

Dr. Reynolds: In a lesion of this size, I would be inclined to attempt a radical procedure. We have seen metaphyseal fibrous defects in the fibula that look very similar to this, that we have been satisfied to leave alone; but I can find no objection to surgical intervention in this one.

Dr. Hodes: In an earlier case of Ewing's tumor, we came up with a diagnosis of a reticulum-cell sarcoma, and in this case many radiologists said that this was an osteogenic fibroma, and then the true diagnosis turned out to be chondromyxoid fibroma. Dr. Reynolds, do you consider these as radiological errors?

Dr. Reynolds: I don't think that one can say that these are gross errors in radiological diagnoses. There is very little difference in the clinical course and in the radiographic appearance of the non-ossifying fibromas and the chondromyxoid fibromas.

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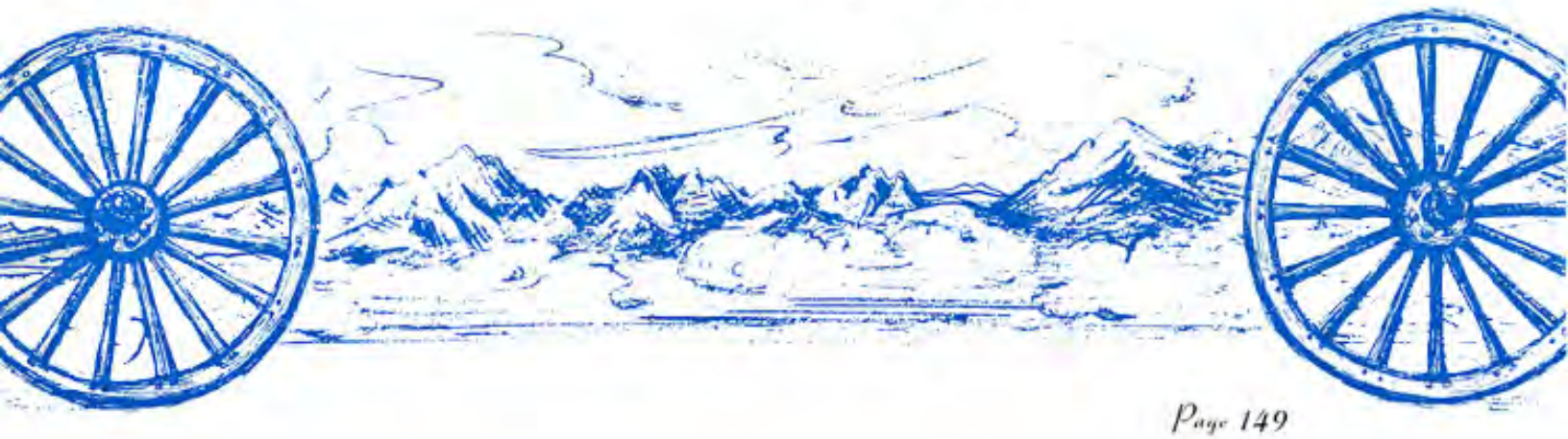


10. *Malignant Giant Cell Tumor of a Lumbar Vertebra*

Contributed by GEORGE J. MATT, A.M.C. and FRANK W. KIEL, A.M.C.,
Fort Sam Houston, Texas

THE PATIENT was a 36-year-old man in November, 1951, when he complained of progressive lumbar pain of a few months duration.

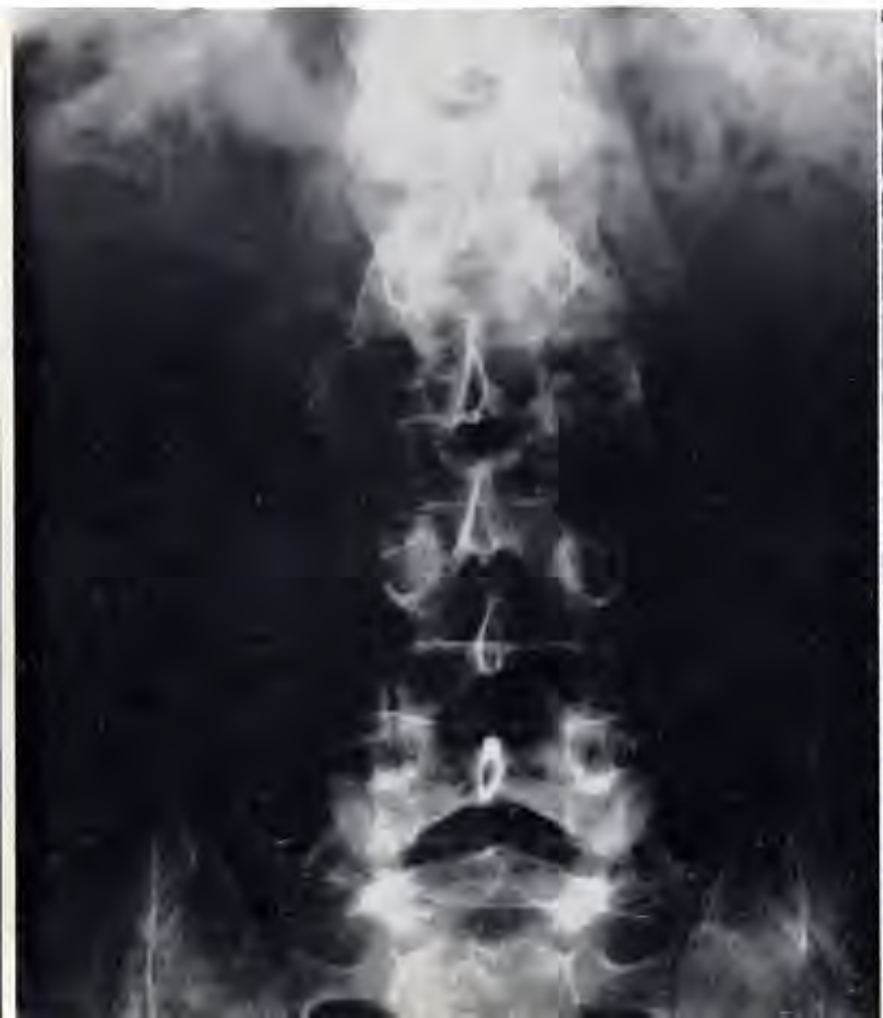
Dr. Hodes: This is a monostotic lesion arising in the vertebral body; the pedicles may be affected, but the transverse processes and the spinous process seem normal. The lesion is medullary in origin. It is an expansile tumor which has entirely replaced the normal cancellous bone. Its bulging is due to the cystic nature of the disease, rather than the slight decrease in stature of the vertebral body. The tumor is enveloped by a thin shell of bone, which is intact along the left side, but seems to be breaking through the shell on its right side. Within the cyst, there is evidence of calcified tumor matrix seen more clearly along the right side than on the left. There is no evidence of invasion of the overlying fascial planes. As one would expect, in the presence of a cystic vertebral lesion, the intervertebral spaces above and below the affected lumbar segment reveal a little narrowing. These changes merely indicate herniation of the intervertebral disc into the cystic tumor mass.

This is a benign bone tumor and among the possibilities one must include *giant cell tumor* and *angioma*. Occasionally, *solitary myeloma* may be confused with giant cell tumors in the spine. Occasionally too, *metastatic carcinoma*, particularly from the kidney, may mimic a benign cystic tumor within the spine. The lesion does not look malignant. It is a well encapsulated cystic mass, which does show a pathologic fracture. Myeloma and metastatic carcinoma may, therefore, be relegated to a diagnostic position of secondary importance. Myeloma at the age of 36, would also prove unusual. This could be an *aneurysmal bone cyst;* these form cystic masses which could look exactly like the region this patient has. Statistically, the most common cystic tumor of the spine is the *giant cell tumor*. Characteristically, it affects the vertebral body alone. The patient's age is consonant with this diagnosis.

Dr. Hodes' impression: A benign tumor. 1) GIANT CELL TUMOR. 2) ANEURYSMAL BONE CYST.

Fig. 1 — Roentgenogram showing expansile lesion of the third lumbar vertebra.

Fig. 2 — (High power) Photomicrograph showing giant cell tumor with benign appearing stroma (Wash. Univ. Neg. 58—5884).



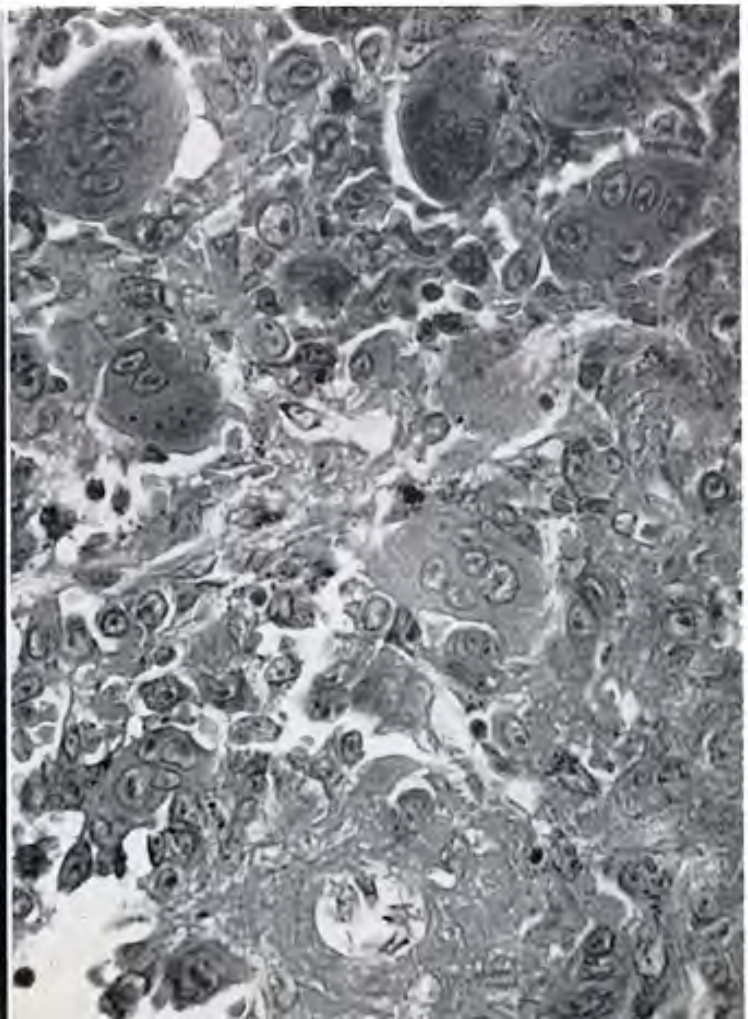


Fig. 3 — Gross post mortem appearance of the primary tumor.

Roentgenologic Impressions Submitted by Mail:

Myeloma	49	(2)*
Giant cell tumor	36	(2)
Metastatic carcinoma	25	
Reticulum-cell sarcoma	21	
Aneurysmal cyst	20	(1)
Hemangioma	9	
Can't see nothing!	1	
Others	15	(1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: This was a particularly difficult roentgenogram to reproduce and many of the participants admitted that theirs was just a guess. Dr. C. A. Good, of Rochester, Minnesota, suggested myeloma. Dr. R. D. Moseley, of Chicago, Dr. H. Hauser, of Cleveland, Dr. J. C. Evans and Dr. W. B. Seaman, of New York City, all suggested a giant cell tumor.

Operative findings: In November, 1951, an attempt to surgical removal was made, followed by a spinal fusion.

Dr. Ackerman: This case was very difficult for me. The differential diagnosis was between aneurysmal bone cyst and giant cell tumor. I finally got a slide on the case which convinced me that this was a giant cell tumor, rather than an aneurysmal bone cyst. It must be remembered that aneurysmal bone cyst is common in the vertebrae and giant cell tumor is very rare. Therefore, the differential diagnosis is important, because aneurysmal bone cyst is not malignant and never becomes malignant. On the contrary, giant cell tumor may become malignant or be malignant on first examination. This tumor is made up of giant cells supported by vascular connective tissue. A small amount of osteoid is present; this is not against the diagnosis of giant cell tumor. Microscopically, this tumor appears benign, but we have already seen several examples of perfectly benign appearing giant cell tumors that have metastasized and killed the patient. This sequence of events is the exception rather than the rule. Because it has happened, I no longer put the dsignation "benign", but simply "giant cell tumor". The lesion would have to be treated by radiotherapy.

Aneurysmal bone cyst is a benign, solitary, localized tumor most often appearing in the vertebrae, flat bones or long bones. Almost all other bones of the body have been reported involved including isolated instances of aneurysmal

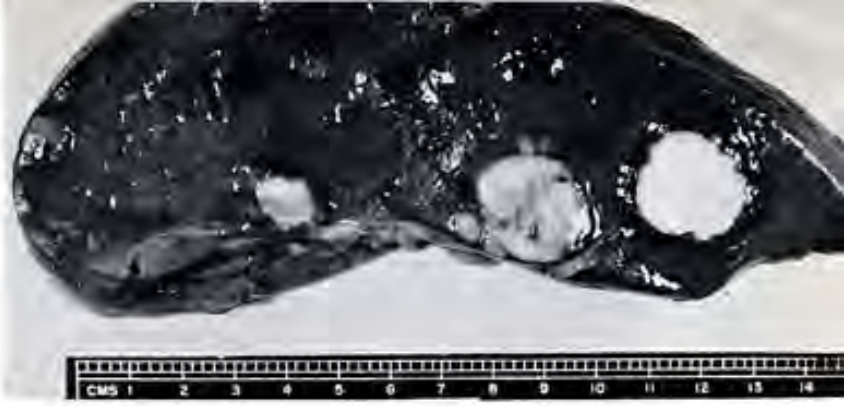


Fig. 4 — Appearance of metastases to the spleen.

bone cysts of the occipital bone, sternum, phalanges, rib, metatarsals, and metacarpals. In long bones, the lesion may reside in the shaft or at either end. It is commonly eccentric, but may be central in its location. Its frequent subperiosteal position has often been demonstrated. Because of the expansile nature of the lesion, the bone of involvement is greatly distorted and may be partly destroyed. Basically, the lesion is formed by large and small vascular channels that may be outlined by trabeculae of fibrous tissue, fibrous tissue and osteoid or a granulation-like tissue in which numerous multinucleated giant cells are seen. The trabeculae separating the cavernous channels are of different thicknesses and lengths, tending to be spindly. Solid areas of fibrous tissue, spindly osteoid and mature bone and giant cells may be seen. The latter, along with the cavernous channels, may give rise to the misdiagnosis of vascular giant cell tumor. Cartilage has occasionally been observed. Areas of active osteoid and bone formation with proliferative stromal background may be present.

The commonest locations of this neoplasm are in the ends of long bones, particularly the lower end of the femur, the upper end of the tibia, and the lower end of the radius. These sites make up about 65 per cent of the cases, and if one adds the remaining lesions in long bones, this will raise the percentage to 80 per cent (Jaffe). Gross examination of intact lesions is infrequent as, first, they are relatively rare tumors and, second, their treatment, if surgical, usually consists of curettage and replacement with bone chips in order to preserve the function of a bone. Therefore, gross examination of intact specimens may include small bones of the hand or lesions which have failed to respond to therapy, or in instances where the tumor has become malignant. In an untreated malignant giant cell tumor, the lesion is usually eccentrically located with the metaphysis. It has rather sharp borders, and the tumor is made up of vascular, grayish-red tissue with, perhaps, zones of necrosis. Commonly, the cortex is thinned; it is not rare to find evidence of tumor extending through the cortex into the soft tissues. If a tumor becomes large, it will extend toward the joint and even cross the joint. If it crosses the joint to involve another bone, it usually does so by passing around an involved bone as in Windeyer's case, where it spread from the head of the femur across the joint space into the ilium. Of course, there may be trabeculation extending across the cystic cavity. The gross examination of these specimens may be complicated by the fact that the lesion has persisted and locally recurred, and evidence of the previous bone chips may be present. Fracture into the larger tumors in the weight bearing bones is not uncommon. Periosteal reactive bone is uncommon.

The basic microscopic pattern of a giant cell tumor is that of a moderately vascularized stroma, associated with rather plump spindle-shaped or ovoid-shaped cells. These are regularly interspersed by giant cells. The giant cells have multiple nuclei, sometimes as many as fifty to one hundred. There may be, of course, areas of scarring, cyst formation and hemorrhage. We have never seen cartilage present within such a neoplasm, but the presence of osteoid is not rare. In twenty-seven consecutive cases we found osteoid in nine. The microscopic pattern may be compli-

Fig. 5 — Metastatic lesion on the apex of the heart.

cated when sections are taken from an area of previous fracture. We have also observed with others, that adult reactive bone may be present around the peripheral margins of the tumor as it extends into the soft tissues, and we have also seen bone formation in a metastasis in the lungs.

Jaffe emphasized the importance of histologic grading of the neoplasms with emphasis on the stromal component of the tumor. As stromal cells become more prominent and giant cells decrease in number, the degree of malignancy increases. The stromal cells also have more prominent nuclei, show an increase of mitotic figures, and the giant cells might also show such increase of mitotic activity. Jaffe divided them into Grades I, II and III. If a giant cell tumor shows zones of malignant change (Grade III), we have found this to be of significance. These changes correlate with the chance of local recrudescence and distant metastases. In the well differentiated tumor (Grade I) a few neoplasms may behave in an unorthodox fashion, and in Grade II lesions, it is often impossible to predict the outcome. Therefore, to us, grading is of limited value. It must be emphasized that needle biopsy of such apparent Grade I lesions may not show the most undifferentiated zone, and if curettment is done, multiple sections must be taken in order to be certain that the most malignant areas are found.

Dr. Ackerman's diagnosis: GIANT CELL TUMOR.

Histopathologic Diagnoses Submitted by Ma'l:

Aneurysmal cyst	32	
Benign giant cell tumor	31	
Malignant giant cell tumor	30	(3)*
Osteosarcoma	17	
Q.n.s. for dx!	1	
Others	23	(3)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. C. Strand and Dr. R. G. Vernon, of Dubuque, Iowa, coincided in the diagnosis of aneurysmal cyst. Dr. N. F. C. Gowing, of London, submitted osteogenic fibroma. Dr. H. F. Giffen, of Omaha, preferred osteosarcoma. Dr. M. Navarro, of Santiago de Cuba, Dr. C. Sirtori, of Milan, Italy, Dr. H. A. Sissons, of London, and Dr. C. Oberling, of Paris, all submitted a diagnosis of malignant giant cell tumor.

Subsequent history: Following biopsy, which was reported as showing a benign giant cell tumor, roentgentherapy was administered; no details of technique and dosimetry were given. One year later, a recurrence was noted, he was again operated upon and the fusion reinforced. Roentgentherapy was administered again.

In July, 1955, the patient developed pain on the anterior aspects of the right thigh; shortly afterwards, he presented muscular weakness and the patellar and ankle reflexes were absent. A surgical exploration revealed widespread recurrence of the tumor which was now designated as a malignant giant cell tumor. An almost complete flaccid paralysis of the lower extremities developed. Roentgentherapy was instituted again with regression of pain and recovery of muscular strength. In January, 1956, the pain had recurred and became severe; a bilateral chordotomy was carried out at the level of the first to third thoracic vertebrae. In May, 1956, he started to complain of diplopia; shortly afterwards, he had an uncontrollable hemorrhage from the nasopharynx and expired.

Autopsy revealed metastatic lesions of the liver, lungs, heart, spleen and sphenoidal area of the base of the skull.

Dr. Reynolds: A patient with this unfortunate lesion in the spine is really in between the devil and the deep blue sea. My experience is that roentgentherapy is of temporary benefit in the relief of symptoms, but the tumor soon recurs, and sooner or later, cord pressure intervenes; if decompression is carried out, the patient may be better for awhile, but finally gets into the state of this unfortunate patient. Surgical eradication of this lesion is not feasible or possible. There have been vertebrae excised, but I have not attempted it; I think it would be a terrible experience for the surgeon, and I am not just sure what he would put in its place. But in this particular type of case, if it were feasible, it might be considered.

Dr. Regato: Dr. Dahlin, do you grade your giant cell tumors?

D. C. Dahlin, M. D., Rochester, Minnesota: That's the one thing we can't grade in Rochester.

W. M. Silliphant, M. C., Washington, D. C.: I was a little surprised that Dr. Ackerman could not qualify this as benign or malignant; I thought it was malignant; the reason I thought so was in my slide; I was quite certain it was invading muscle; to me, it meant a malignancy. Lent Johnson did call it a malignant giant cell tumor.

M. Berthrong, M. D., Colorado Springs, Colorado: I would like to ask Dr. Ackerman whether or not he thinks there is a hinterland between the aneurysmal bone cyst and the giant cell tumors.

Dr. Ackerman: The aneurysmal bone cysts are much rarer than the giant cell tumor. I think they are really two different things, although I don't know the pathogenesis of aneurysmal bone cysts. I have seen only a few of those and the ones that I have recognized as such, all have been fairly typical, radiographically and microscopically. If there was any hinterland case, it is this case.

Dr. Hodes: I realize how loaded this deck is. I get one film and usually it's no good, and I write and I say, "Juan, how about another film?" and he doesn't even answer the letters; but Lauren can always get more and more slides!

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II. *Osteosarcoma of the Femur of a Dog Following Administration of Calcium*[45]

Contributed by Joseph F. Kuzma, M. D., Milwaukee, Wisconsin

THE PATIENT was a precocious and hairy female, who had been able to stand unassisted within a few weeks of her birth. In January, 1956, when 3-years-old, she developed a swelling of the left thigh, was unable to walk and lost considerable weight.

Dr. Hodes: This is a monostotic lesion occupying the distal half of the femur in a dog. It is medullary in origin. The lesion probably arose in the metaphysis extending into the epiphysis, as well as the diaphysis. The medullary canal has been replaced by bone destruction and bone proliferation. The overlying cortex has been destroyed with marked periosteal proliferation and invasion of the adjoining soft tissues. The overlying soft tissues reveal calcified osteoid and chondroid tumor matrix. Of interest, is the apparent joint involvement. Whereas, the joint surfaces do not seem to be destroyed, the tumor appears to lie within the joint itself, and unquestionably, lies around the joint.

This is a highly malignant bone tumor which has destroyed everything within and around it. There are components of calcified chondroid matrix, as well as calcified osteoid matrix with a wide variation in the patterns. The manner in which the medullary canal has been destroyed is especially interesting, for not only is there complete "osteolysis", "invasion", "permeation" and "punched out" areas, but also there is evidence of bone proliferation. This is the favorite site for the various types of osteosarcoma. This tumor will unquestionably reveal an admixture of all of these elements.

Dr. Hodes' impression: A highly malignant bone tumor. OSTEOSARCOMA.

Roentgenologic Impressions Submitted by Mail:

Osteosarcoma	89	(3)*
Neuroblastoma	27	(2)
Metastatic adrenal tumor	21	
Chondrosarcoma	16	
Osteosarcomatous bitch!	1	(1)
Others	18	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. R. Sherman, of New York City, Dr. S. Di Rienzo, of Córdoba, Argentina, Dr. L. Arrieta-Sánchez,

Fig. 1 — Destructive lesion of the distal half of the femur of a dog showing bony proliferation.

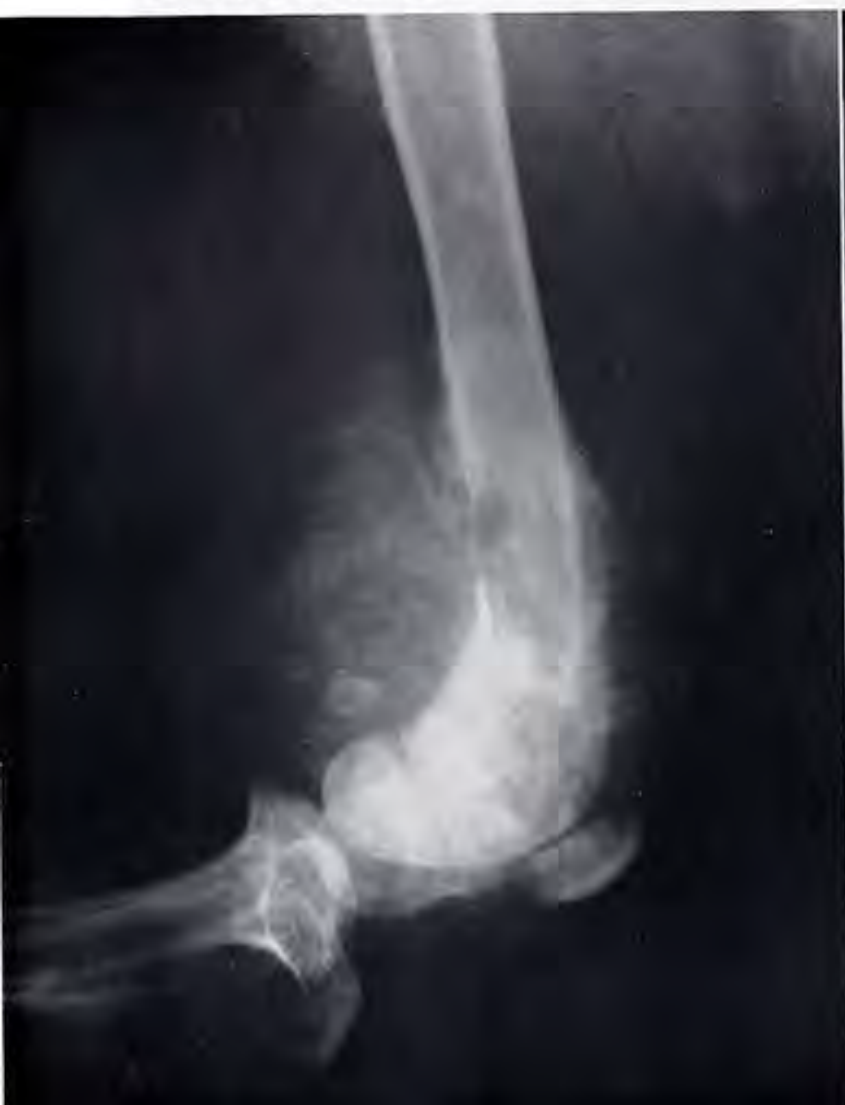

Fig. 2 — Gross appearance of the extremity in cut section.

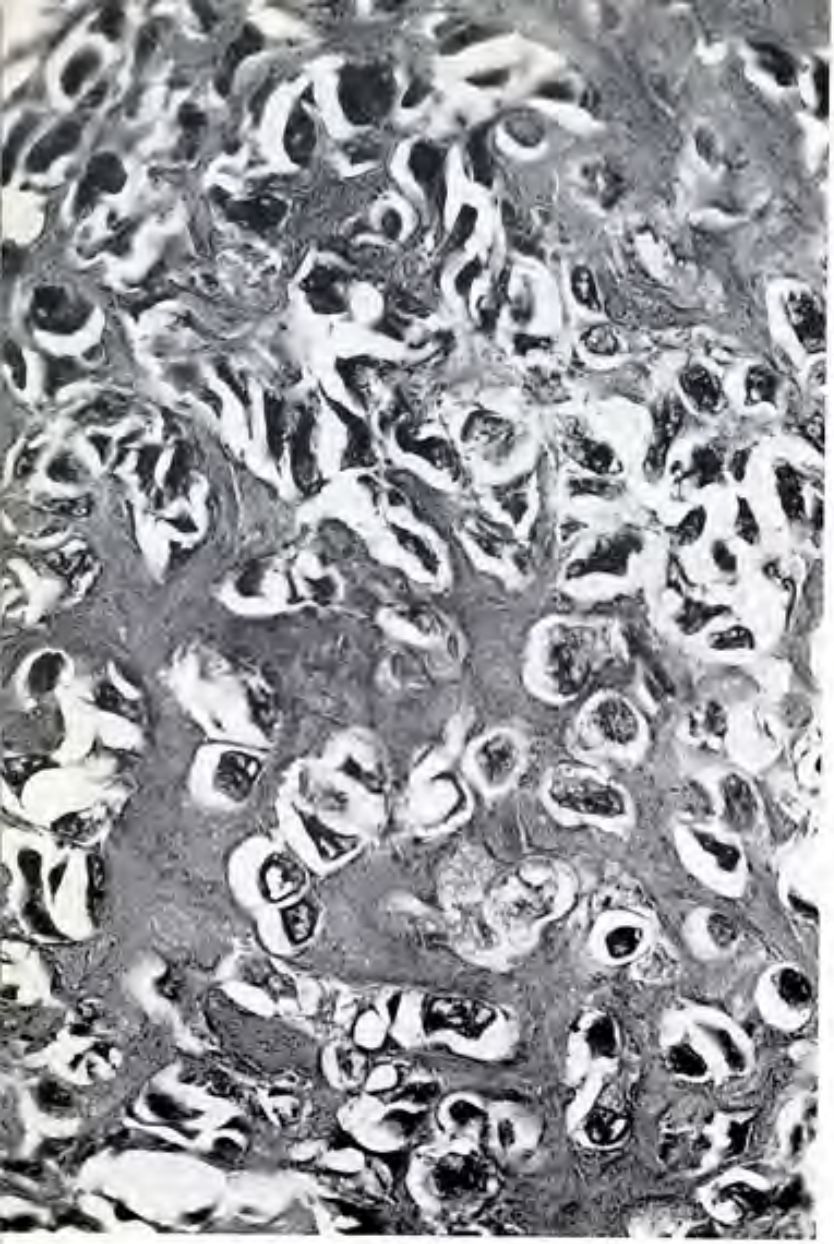

Fig. 3 — (High power) Photomicrograph of well differentiated osteosarcoma with osteoid formation (A.F.I.P. Acc. No. 218757—76).

of Panama City, and Dr. E. Salzman, of Denver; all offered a diagnosis of osteosarcoma. Dr. B. Felson, of Cincinnati also submitted osteosarcoma and commented that the subject looked like a "four legged" bitch.

Dr. Ackerman: This is an osteosarcoma which is forming considerable osteoid. There are wide areas of extremely undifferentiated stromal background. I suspect that cortical bone has been completely destroyed in some areas. There is also neoplastic cartilage, so that if one looked at a single area, one might think it was a chondrosarcoma. This precocious female was probably very hairy, and was, apparently, a little dog. Smith and Jones collected, from several series, 5,315 neoplasms of dogs. In this group, there were 125 osteogenic sarcomas, 7 osteomas, 2 giant cell tumors, and 10 chondrosarcomas. Jones reported to me in a personal communication that "these tumors are seen most frequently in the ends of the long bones, particularly humerus, femur and radius, in that approximate order. I believe that the tumors occur in a fairly young age group, and large breeds such as Boxers and Great Danes, are considered to be more prone to these tumors. We have seen secondary pulmonary osteoarthropathy, in a few cases, in which metastases were present in the lungs. I believe a rather high incidence has been observed in dogs given radioactive bone-seekers." Feldman reported a case in a male English Setter. The lesion was given radiotherapy, but the dog died with distant metastasis and persistence of the tumor. Nielsen reported 53 cases of canine osteosarcoma. He advised euthanasia, even in the absence of pulmonary metastasis.

Dr. Ackerman's diagnosis: OSTEOSARCOMA.

Histopathologic Diagnoses Submitted by Mail:

Osteosarcoma	118	(3)*
Chondrosarcoma	42	(2)
Adrenal tumor	3	
T'ain't human!	1	
You dog!	1	
Others	8	(1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. C. A. Hellwig, of Halstead, Kansas, and Dr. R. L. Hawley, of Denver, made a diagnosis of chondrosarcoma. Dr. F. Vellios, of Indianapolis, Dr. M. B. Dockerty, of Rochester, Minnesota, and Dr. A. O. Severance, of San Antonio, all favored osteosarcoma.

Subsequent history: A revision of past history of this dog revealed that when one year old 3.5 millicuries of Calcium ^{45} per kilogram of weight had been injected experimentally. As a consequence, she eventually expired.

J. F. Kuzma, M. D., Milwaukee, Wisconsin: We have had over 300 malignant tumors produced by radioactive Strontium and Calcium in mice, rats and dogs. The occurrence of these experimental lesions leave me with great apprehension in looking at human clinical material. Certainly in the late stages, the full prototype of any of the human lesions is encountered, but in the early lesions, the ability to diagnose them histologically as being malignant or not, is a terribly frightening experience to me. This dog died with pulmonary metastasis, so this is obviously a malignant one.

Dr. Reynolds: After splenectomy using beryllium, they have been able to produce osteosarcomas in a very high percentage of cases at the Mayo Clinic; it makes a useful tool for experimental purposes.

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12. *Parosteal Osteosarcoma of the Tibia*

Contributed by ALEXIS E. LURCHENCO, M.D., FOSTER MATCHETT, M.D., and KENNETH A. ALLEN, M.D., Denver, Colorado

THE PATIENT was a 40-year-old woman in December, 1953, when she first complained of a painless tumefaction of the medial aspect of the left leg; the patient had first noticed a swelling near the knee in 1940, 13 years previously. Serum calcium and phosphorus were within normal limits.

Dr. Hodes: This is a monostotic lesion occupying the proximal third of a tubular bone; it is osteoblastic; it arises in the metaphysis and it is cortical in origin. Not only has it destroyed the cortex, it has invaded also, the underlying medullary canal. Extending into the overlying soft tissues is a mass of solid "lumpy" bone, which is sharply demarcated. Proximally, it blends imperceptively with the destroyed cortical bone. Distally, an apparent line of cleavage exists between the tumor mass and the normal cortical bone. The latter clear-cut differentiation between tumor bone and normal bone is also obvious within the medullary canal. The overlying soft tissues are not affected by this tumor.

This is a slowly growing bone tumor (13 years) which arises from the cortex. The manner in which this lesion has grown, indicates it is not an aggressive tumor; only a parosteal osteogenic sarcoma would act in this manner. All other forms of sarcoma would be less well differentiated.

Dr. Hodes' impression: A malignant bone tumor of very low aggressiveness. PAROSTEAL OSTEOGENIC SARCOMA.

Roentgenologic Impressions Submitted by Mail:

Chondrosarcoma	60	(1)*
Osteosarcoma	38	(1)
Parosteal sarcoma	27	(4)
Chondroma	25	
Others	17	

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. A. S. Tucker, of Denver, submitted osteochondroma, but suspected that the short duration of symptoms meant malignant transformation. Dr. W. B. Seaman, of New York City, submitted chondrosarcoma. Dr. W. S. Keyting, of Denver, suggested osteosarcoma. Dr. C. A. Good, of Rochester, Minnesota, and Dr. J. C. Evans, of New York City, and Dr. E. Salzman, of Denver, suspected a parosteal variety of sarcoma.

Subsequent history: The first biopsy was done in the beginning of 1954 and a diagnosis of ossifying fibroma was rendered. In April, 1956, there were signs of growth; removal of a large part of the tumor was done; the material was white, shiny and trabeculated. A diagnosis of subperiosteal fibrosarcoma was then considered. In July, 1957, the patient was seen in consultation at the Mayo Clinic and more radical treatment was advised; a mid-thigh amputation was done.

Dr. Ackerman: We believe this to be an example of the rare type of osteosarcoma, best termed parosteal osteosarcoma. Dwinnell found only 15 cases out of over 400 cases of osteosarcoma. Grossly, these lesions form large masses in intimate association with the periosteum and cortex. Destruction of the cortex is at times present, and the lesion may extend to involve the marrow cavity. In one of the cases described by Dahlin, the tumor had been present for at least seven years without any involvement of the marrow cavity. The tumor forms an irregular, bosselated, firm mass. Interspersed between a disturbed bony pattern, cartilage can be identified. In Dwinnell's 15 cases, 10 involved the distal end of the femur, and the other five the humerus and tibia. The tumor tends to surround the bone, and in certain cases, may completely envelope it. Reactive periosteal bone formation is rare. At times, muscle may enter the tumor. The bony component predominates.

Microscopically, this is an extremely difficult lesion to identify and many in the past were called myositis ossificans or atypical bone and cartilage formation. Furthermore, one of the reasons for statements in the literature that myositis ossificans becomes osteosarcoma is related to lack of knowledge of the entity, parosteal osteosarcoma. This statement is well supported by the clinical findings, roentgenograms, gross material and microscopic pattern of the individual cases reported (Paul, Coley, Chambers); these three cases are all resumed in an article by Geschickter. In the diagnosis of this lesion, it is imperative that the pathologist be familiar with the long clinical duration of the lesion and the rather typical radiographic pattern. If multiple biopsies are taken or multiple sections made, there may be wide zones in which bone and osteoid will be well oriented, and it will be difficult, if not impossible, to designate it as a malignant tumor. There are often areas in which the malignant quality of this tumor can be identified by seeing obviously malignant zones evolving from a sarcomatous stroma. Osteoid may show calcification. In the islands of cartilage, there may be zones compatible with chondrosarcoma (Dwinnell). In this particular case, there is very well formed bone in which the stromal elements are difficult to identify as malignant. There is also prominent osteoid formation and a sarcomatous stroma.

We believe that this is a subvariant of osteosarcoma and deserves to be separated from the usual osteosarcoma. This tumor has a long clinical duration and a rather classic radiographic pattern. It is possible that in a few locations it could be treated by adequate local excision, but in most instances amputation is the treatment of choice. Treatment in this case was amputation which we believe was correct.

Dr. Ackerman's diagnosis: PAROSTEAL OSTEOSARCOMA.

Histopathologic Diagnoses Submitted by Mail:

Fibrosarcoma	39	(4)*
Parosteal sarcoma	17	
Osteosarcoma	37	
Ossifying fibroma	33	
Benign osteoma	6	(2)
Fibrous dysplasia	7	
Others	22	

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. F. Leidler, of Houston, and Dr. R. Hilley, of Denver, offered a diagnosis of myositis ossificans. Dr. A. P. Stout, of New York City, submitted parosteal osteoma. Dr. D. C. Dahlin, of Rochester, Minnesota, preferred a low grade osteosarcoma. Dr. C. Sirtori, of Milan, offered parosteal osteogenic fibrosarcoma. Dr. A. O. Severance, of San Antonio, and Dr. B. G. Fishkin, of Los Angeles, submitted fibrosarcoma arising on Paget's disease. Dr. C. Oberling also submitted fibrosarcoma with Pagetoid transformation of the invaded bone.

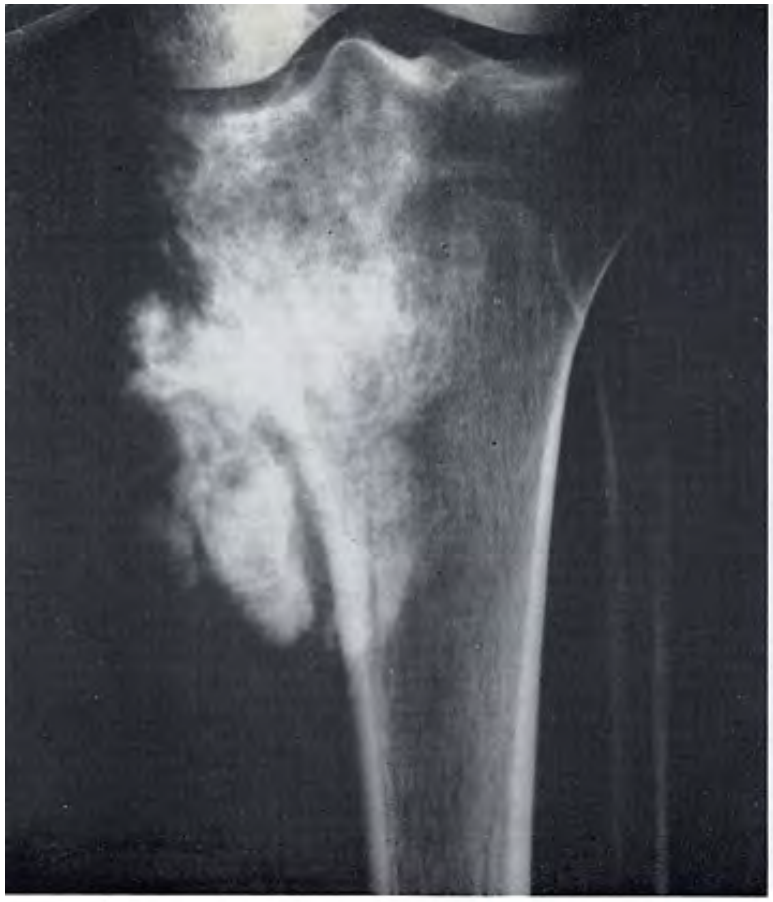

Fig. 1 — Osteoblastic lesion of the metaphysis of the proximal end of the tibia (Dec. 1953).

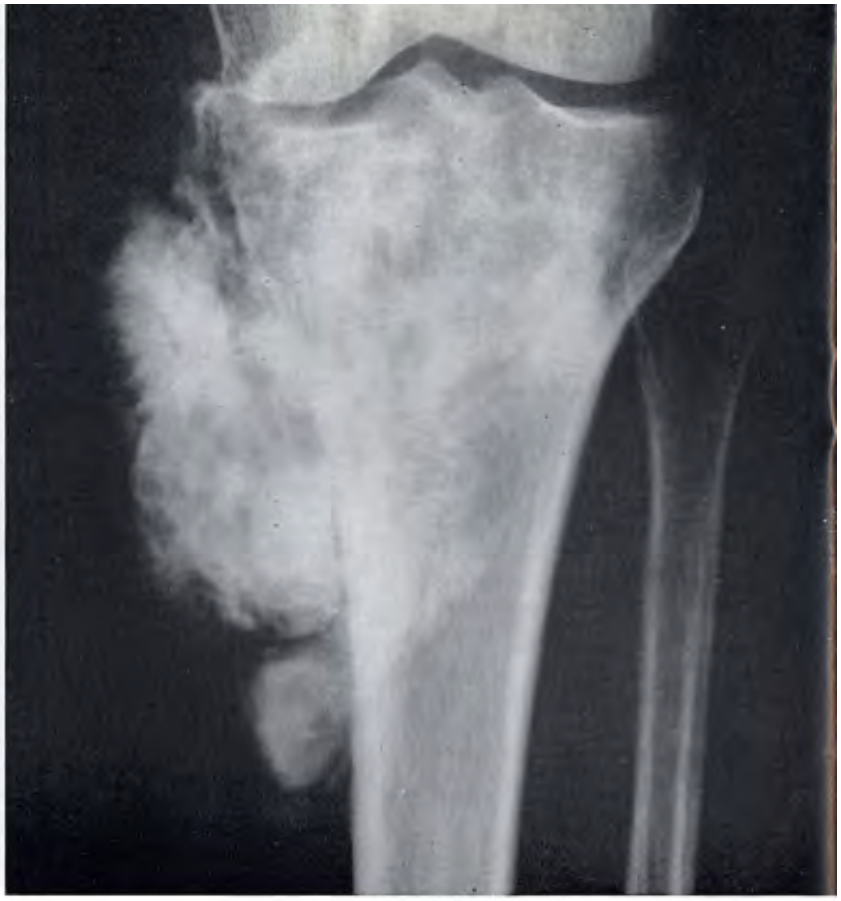

Fig. 2 — Roentgenogram showing further development of the lesion before local excision (April, 1956).

Fig. 3 — Roentgenologic appearance after local excision and recurrence (April, 1957).

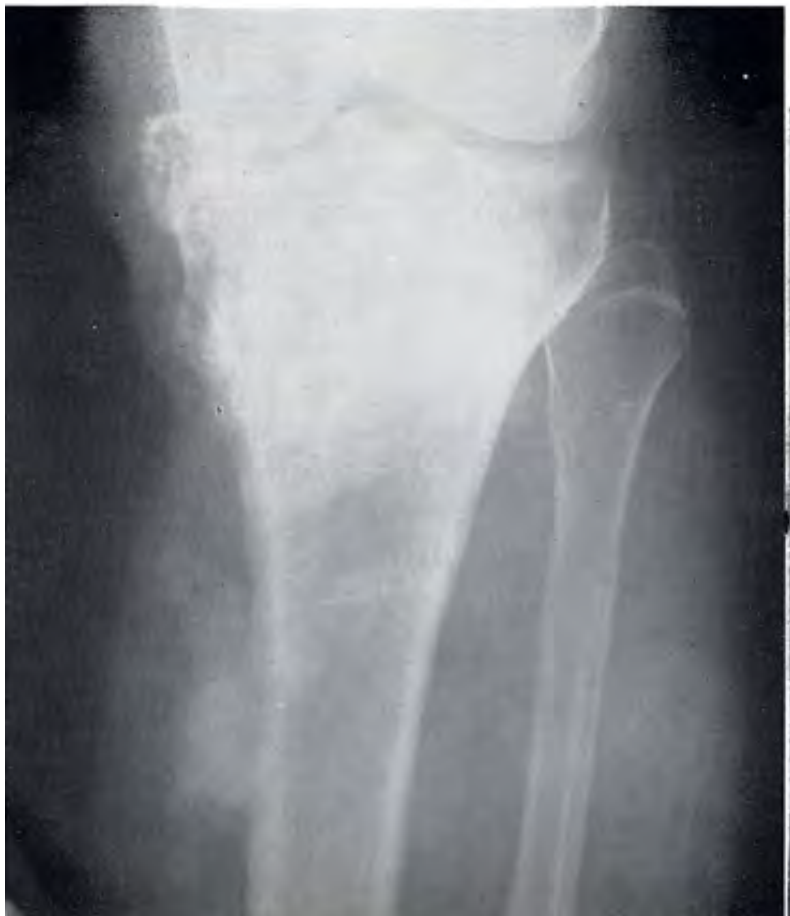

Fig. 4 — Cut section of the gross specimen after amputation.

F. Schajowicz, M. D., Buenos Aires (by mail): This is histologically a fibrosarcoma; this diagnosis does not agree with the roentgenologic appearance. It is evident that we are dealing with a sarcomatous transformation of a previously benign lesion which could be Paget's disease (mosaic structures are present) but, more probably, parosteal osteoma. I would classify this lesion as juxta-cortical or parosteal osteosarcoma.

L. Lichtenstein, M. D., New York City (by mail): Parosteal ossification. There are some who, following Geschickter and Dahlin, would label this lesion a parosteal osteogenic sarcoma, even though the spindle stroma is hardly that of a frank sarcoma. I would not recommend rushing into above-knee amputation, but would rather follow the patient.

Subsequent history: In June, 1958, the patient was examined by Dr. Matchett; she appeared well and has adjusted to the use of a prosthesis.

Dr. Regato: Dr. Dahlin, would you care to open the discussion on this case? I believe you were consulted and you saw several biopsies before the leg was amputated.

D. C. Dahlin, M. D., Rochester, Minnesota: We just called it a low-grade osteosarcoma, but it was, in fact, parosteal roentgenographically. As far as I know, you can't tell whether or not they are parosteal without gross or roentgenographic evidence. Out of twenty cases that we have seen, either six or seven have died of metastases that were proven at necropsy. I think that this tumor is too frankly malignant to warrant any conservative management.

Dr. Reynolds: As you can see, the surgeon has a terrible time with the pathologist, because he outlines what the treatment should be; and if you deviate from that, and the patient has an unfortunate outcome, you are completely wrong. In this particular lesion which has extended well up into the site of the joint, I think that an amputation would probably be the operation of choice. However, if the lesion is localized so that you can get above and below it with an en-block dissection, I think, perhaps, you have a chance to get a cure by such a procedure. A great deal of selectivity has to be used in deciding whether to do an amputation or a block dissection. I mean a block dissection and not a local excision. You have to stay away from the tumor.

Dr. Hodes: I believe that the diagnosis of Paget's disease radiologically is one of the easiest things in the world. And since we have come across it three times in this CANCER SEMINAR, with the inference that these lesions arise on the basis of Paget's disease, it might be a good idea that when the pathologists run into such a thing, they should get some help from somebody who knows what he is looking at.

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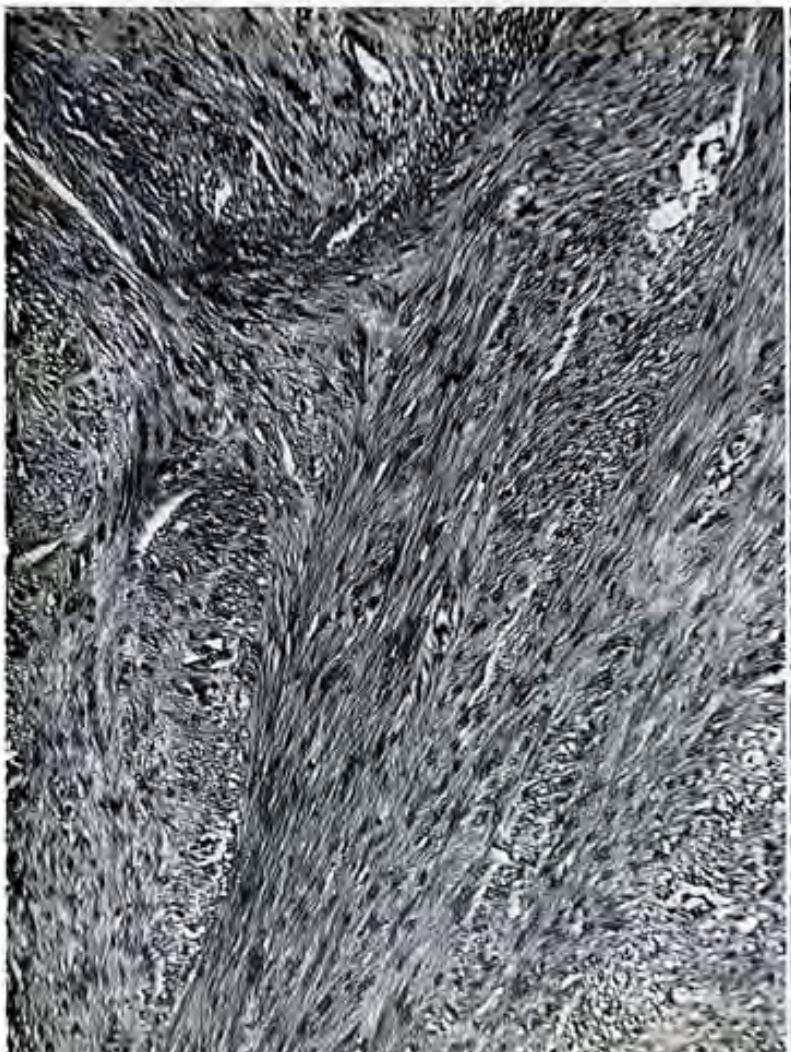
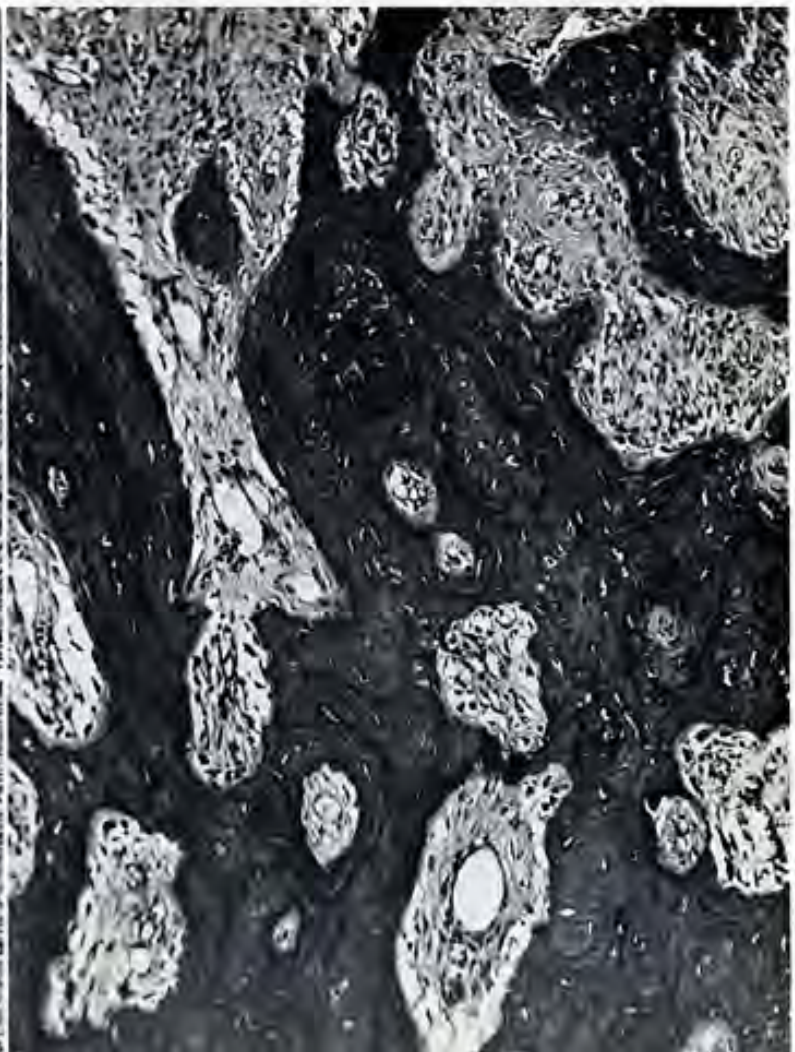
Fig. 5 — (Low power) Photomicrograph showing area in which the stroma shows obvious fibrosarcoma (A.F.I.P. Acc. No. 218757—64).

Fig. 6 — (Low power) Photomicrograph showing another area in which there is extremely prominent bone overgrowth; it is impossible to identify the stroma as malignant (A.F.I.P. Acc. No. 218757—63).





13. Well Differentiated Osteosarcoma of the Ulna

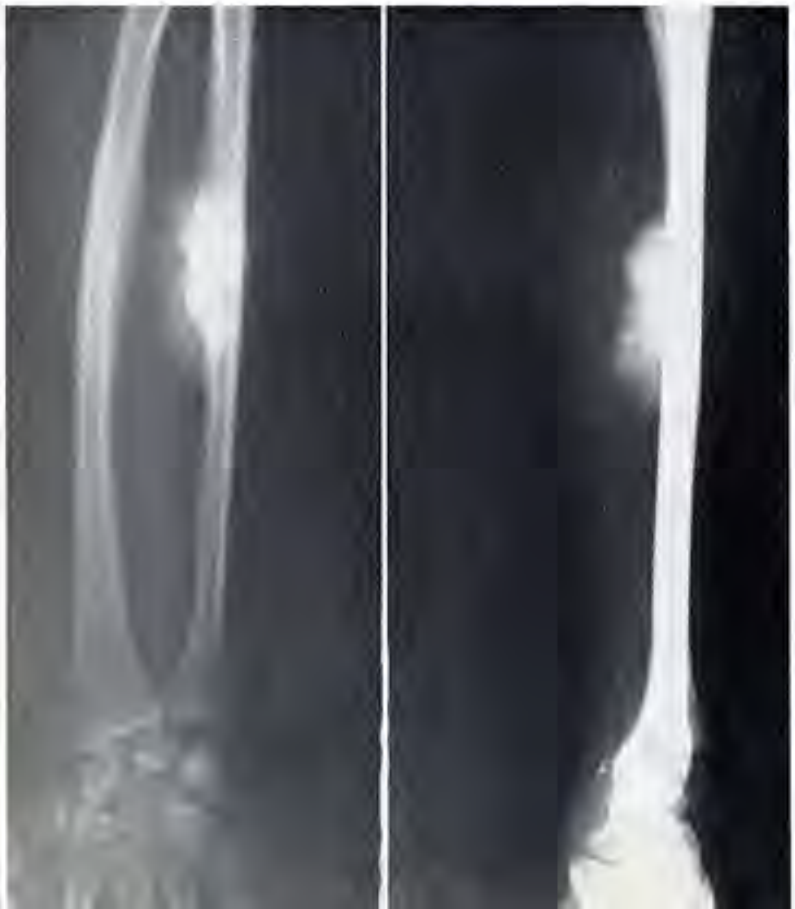
Contributed by LAWRENCE J. MCCORMACK, M. D., and JOHN B. HAZARD, M. D.,
Cleveland, Ohio

THE PATIENT was a 17-year-old girl in November, 1942, when she first complained of pain in the right forearm. On examination, there was a palpable, hard, fixed, 5 cm mass attached to the middle third of the ulna. The hemoglobin was 82 per cent; the urinalysis and blood serology were negative.

Dr. Hodes: A monostotic lesion which springs from the middle third of a long bone. It is cortical or periosteal in origin; the underlying bone does not seem to be affected. This is a remarkable tumor, one which we have never seen before. I am not sure whether this lesion is primarily periosteal in origin or cortical in origin. Both might produce the marked periosteal proliferation. The overlying soft tissues are not infiltrated; instead, the tumor appears to be pushing the fascial planes ahead of it. There is no evidence of a Codman's cuff and the adjoining radius is perfectly normal.

The periosteal proliferation, plus the cortical destruction, suggests that this is an aggressive bone tumor. The most common bone tumor in a patient 17 years of age would be an *osteogenic sarcoma*. It is only fair to say, however, that this would be a most unusual site of origin for an osteogenic sarcoma; also, the peculiar periosteal proliferation and cortical destruction without invasion of the medulla cause one to be wary of this diagnosis. One could postulate the presence of an osteochondroma of the radius. *Osteochondroma* springing from this portion of the bone would be most unusual also.

Fig. 1 — Front and lateral roentgenograms showing lesion arising from the middle third of the ulna (Nov. 1942).



Dr. Hodes' impression: A malignant bone tumor, possibly arising upon a congenital defect (osteochondroma): 1) OSTEOSARCOMA; 2) CHONDROSARCOMA.

Roentgenologic Impressions Submitted by Mail:

Parosteal osteosarcoma	78	(2)*
Ewing's tumor	48	
Parosteal osteoma	15	(3)
Others	22	(1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. G. F. Lull, Jr., of Denver, and Dr. H. Hauser, of Cleveland, submitted Ewing's tumor. Dr. B. Felson, of Cincinnati, and Dr. P. C. Swenson, of Philadelphia, favored a benign parosteal osteoma. Dr. R. Sherman, of New York City, and Dr. F. Campoy, of Seville, made a diangosis of parosteal osteosarcoma.

Operative findings: On November 10, 1942, a wide block excision of a 10 cm segment of the ulna was done and replaced by a fibular graft. The tumor measured 6x3 cm and covered two-thirds of the circumference of the ulna in some places. On section, the tumor was hard and finely granular; it contained no area of necrosis.

Dr. Ackerman: This lesion is difficult to evaluate microscopically. In the differential diagnosis, osteosarcoma, myositis ossificans and excessive callus formation secondary to fracture must be considered. We have no history of fracture, nor can I see any evidence of fracture in the reproduced roentgenogram, but this does not rule out this possibility and we would do our best to obtain a history of trauma.

The roentgenogram is compatible with so-called myositis ossificans in its appearance. The history of trauma is absent in about 50 per cent of the cases. The gross appearance of these lesions varies with the time of their evolution. Lewis cited Strauss' 127 cases of traumatic myositis ossificans as showing the following anatomic distribution: "sixty-four of these occurred in the flexor muscles of the upper arm, the brachialis anticus being the one most frequently affected; forty-three occurred in the quadriceps femoris; thirteen in the adductor muscles of the thigh; two in the gluteal muscles; one in the muscles of the ball of the thumb, and one in the temporal muscle". Ossification varies in the time of its appearance, usually is not present in the first two weeks. There are, usually, no zones of hemorrhage, either old or recent. Invariably, when the pathologist receives a biopsy or an excision of the lesion, the process is well established. Frequently, there is no muscle included within the actual lesion. There is often a zone of demarcation with a good capsule. In some of the lesions of the buttock, there has been no connection to the bone. In the region of the thigh and around the elbow joint, undoubtedly, the periosteum plays a role. For instance, in a fifteen-year-old boy, a roentgenogram taken at the fifth week showed a so-called characteristic dotted-veil appearance. This seemed so characteristic to the radiologist and the surgeon, that no biopsy was taken and no treatment given. Two years later,

the soft tissue lesion had disappeared, and there was a zone of periosteal thickening. We have had a number of these lesions in atypical locations that were frequently incorrectly diagnosed as extraosseous osteosarcoma, or possibly as extensions of a primary osteosarcoma of bone into the soft tissues. Grossly, these lesions were fairly well delimited and the roentgenogram showed evidence of bone around their peripheral margins.

Microscopically, the diagnosis of myositis ossificans is difficult, unless one knows the normal evolution of this lesion. We have felt that our understanding of this process has been simplified by establishing different zone phenomena. In our cases, the lesions early in their evolution, perhaps the first 10 days, are extremely difficult to diagnose because of their undifferentiated pattern. With the passage of time, however, zone phenomena develop which enable the diagnosis to be made. The central area shows a highly cellular area with atypical mitotic figures and great variation in size and shape of cells. This zone exactly resembles an undifferentiated sarcoma. As one progresses toward the periphery, organization of the tissue begins to take place, and there is a certain regularity of the pattern with poorly defined osteoid tissue. In the margins of the lesion, there is well formed bone covered with a connective tissue capsule. In a case in a fifteen-year-old girl, there was a soft tissue mass of the abdominal wall of unknown duration. This lesion was thought to be a possible soft tissue sarcoma, but under the low power there was incipient osteoid material and good orientation of the process. No further treatment was given, and there was no further trouble. Rather infrequently, cartilage is present in these lesions.

This lesion of myositis ossificans occurs usually in healthy, vigorous, young males. In about one-half the instances, there will be history of trauma. Periosteum is not necessary to production of the lesion. We do not find evidence of recent or old hemorrhage. It is possible, but as yet not proven, that the initial change is damage to muscle. The lesion may grow to considerable size, particularly when it occurs in the buttock. The clinician must be alert to this possibility, particularly in the young adult, and should consider myositis ossificans when the lesion is in close association with the periosteum or in the soft tissue. It is particularly important that the pathologist know the history, the location and the time that the process has been present in order to correctly evaluate the biopsy or excision. We already know of several instances of amputation for this benign lesion. In some instances, when the lesion is recognized by roentgenogram and biopsy, no treatment is given. If the lesion is excised early in its evolution, it may recur. The prognosis is excellent with conservative treatment.

However, I finally decided against the diagnosis of myositis ossificans. I feel that this represents a low grade osteosarcoma. It is granted that we usually do not see osteosarcoma in the mid-shaft of a bone in a young person. Osteosarcoma occurring in the shaft of a bone usually occurs in a male over 40 with Paget's disease. This lesion shows poor zone pattern and the pattern of the osteoid in the bone is not like that seen in myositis ossificans. Furthermore, there is diffuse infiltration of muscle by neoplastic cells. I have yet to see this in myositis ossificans. Therefore, I would have to conclude that it is well differentiated osteosarcoma. I would also feel that it could be treated by adequate local resection if this were possible, but I would not be against amputation. Furthermore, I would assume that the prognosis would be relatively good because of the good differentiation. The prognosis in osteosarcoma is not as dismal, as usually it is made out to be, and in lesions with low mitotic activity, cure rates can be as high as 40 per cent.

Dr. Ackerman's diagnosis: OSTEOSARCOMA, well differentiated.

Fig. 2 — Gross appearance of the tumor in cut section.

Histopathologic Diagnoses Submitted by Mail:

Osteosarcoma	119	(5)*
Chondrosarcoma	18	
Myositis ossificans	10	
Parosteal fibrosarcoma	13	
Osteoid osteoma	3	
Others	9	(1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Most of the experts agreed to a diagnosis of osteosarcoma. Dr. L. Lowbeer, of Tulsa, submitted a diagnosis of myositis ossificans, florid phase; Dr. C. Strand, of Dubuque, Iowa, also favored this diagnosis.

Subsequent history: In 1943, the fibular graft was removed and replaced by a tibial graft. The patient remained well until well until December, 1956, thirteen years later, when she died of a rapidly developing adenocarcinoma of the breast at age 31.

Dr. Reynolds: I probably would have done a biopsy on this case before deciding the treatment of this patient. If the surgeon is willing to ignore nerves, blood vessels and other structures around the bone and do a block dissection, then this procedure is perfectly alright at times. I would prefer, however, to have a biopsy before treating the patient. In all probability, the biopsy would have confused the issue and with a diagnosis of osteosarcoma, we would have had to sacrifice an extremity; the patient is much better off this way.

D. C. Dahlin, M. D., Rochester, Minnesota: This is a controversial subject, as you well know. We have recently

gone over our cases, quite a sizeable series, and to the surprise of many people, we find that counting all of our proved osteogenic sarcomas, the five year survival rate is 19 per cent and the ten year survival rate is 15 per cent.

Dr. Ackerman: When this article by Dr. Dahlin came out, showing that osteosarcoma was curable in surprising proportion, many thought possibly that something had happened to the system of grading at the Mayo Clinic. But the follow-up has been complete; I have reviewed a fair number of these cases and I think they are very obvious osteosarcomas. Furthermore, they don't all look well differentiated, some of them look terrible. So I think that, perhaps, we have been a little bit too pessimistic. In view of this series of Dr. Dahlin's, Dr. Reynolds suggested that we review the material at Barnes Hospital, which we have almost finished, and I believe that although we don't have as many cases (of course!) as does the Mayo Clinic, our results are going to turn out to be just about the same. So we are not as pessimistic as we have been in the past.

Captain M. E. Griffen, Jr., San Antonio, Texas: If there are definite radiographic signs of malignancy, how reliable do you feel this is? We have had several cases with definite radiographic signs of malignancy with a pathologic diagnosis of benign tumor; this presents a big problem to the clinician as to how the case should be treated.

Dr. Hodes: I truly believe that if you have a fair amount of experience, and even more important, if you would study the film as Dr. Ackerman does his slides, you ought not to be wrong very often. This has been our experience.

I was sure that this was not a myositis ossificans; this is something radiologists can identify very easily.

R. S. Clayton, M. D., El Paso, Texas: I'm a little bothered by the use of the term "proved" in regard to five and ten year survivals in osteogenic sarcoma. We observe here the spread of difference of opinion of very capable pathologists in every part of the country. We see cases that are judged benign sarcomas, which later metastasize and the patient dies. We see cases that are diagnosed as malignant which are treated and survive. I am not quite sure just what is meant by the term "proved", inasmuch as there is such a wide divergence of opinion and wide divergence of results.

Fig. 3 — Roentgenogram showing fibular graft in place (April, 1943).

Dr. Ackerman: Dr. Dahlin's cases are cases which I think any pathologist in this room would have no difficulty in saying that they were highly malignant tumors. In chondromyxoid fibromas, chondroblastomas, and things of that nature, interpretations may differ. I agree that if a radiologist like Dr. Hodes said something is malignant, it probably is malignant. However, if a capable pathologist received tissue which he thought was benign, I don't believe that the radiographic interpretation would be an indication to amputate the leg. Though rarely, it's possible even for Dr. Hodes to be wrong; it is possible for the surgeon to be wrong by taking the biopsy from the place where the tumor is not, and no matter how capable the pathologist, it is impossible to diagnose what we don't get. Finally, the biopsy may be difficult to interpret and we may not be able to make a diagnosis of malignant tumor histologically. But in about a hundred per cent of instances, putting everything together, I think that you should have a diagnosis of malignant tumor; if we maintain this sort of philosophy, the least harm to the patient will result. But all people involved, particularly with bone tumors, must have a fair degree of competence in their specialty.

R. S. Clayton, M. D., El Paso, Texas: Dr. Ferguson in 1940-42, analyzed 400 cases that were truly sarcomas; a competent panel of pathologists reviewed the material and agreed that they were sarcomas. He showed that immediate amputation was not the best treatment; Geschickter and Copeland, continued to espouse immediate amputation and their patient's uniformly died. Pathologists tell me that Ferguson's material has been reviewed and that many of his cases are not now considered sarcomas; if they keep changing the rules of the game, I'm not quite sure what they mean by "proved".

Dr. Ackerman: I'd like to comment about Dr. Ferguson. I thought he was a pretty clever fellow and there are also others who have adopted the same attitude in breast cancers. Their philosophy goes this way: throw one hundred people into a room that have osteosarcomas and lock the doors, feed them a little food every now and then; at the end of a six months period, you drag out all the dead ones, that leaves the more favorable group. Operate on this group and your results will be much better. However, if you are a surgeon who is interested in curing the greatest number of patients, and don't particularly care what your cure rate is, then you treat the one hundred patients. So I'm not in favor of this wait and see technique. I also think that if pathologists can't improve with time, then we're just not very good.

L. M. Overton, M. D., Albuquerque, New Mexico: We, as clinicians, have a definite responsibility to the pathologists: unless he has the tissue, he cannot make the diagnosis. As it was pointed out with myositis ossificans and some of the other lesions, where you may do a radical procedure, or you may preserve an extremity, it is quite important to have adequate biopsy.

Dr. Ackerman: I am in favor of conserving extremities, if possible, particularly when the lesion is benign.

Dr. Regato: It is important, as Dr. Reynolds said, that the surgeon, who is going to carry on the definitive treatment, be the one to do the biopsy. It is important also, that the patient and relatives should be thoroughly prepared to meet the issues; no surgeon should undertake to biopsy a bone or soft tissue lesion, if he is not certain that the patient or the family will permit him to proceed with definitive treatment, and if they do not understand that a mutilation is one of the possibilities. It is sad to have a patient visibly worsening for weeks, traveling from one

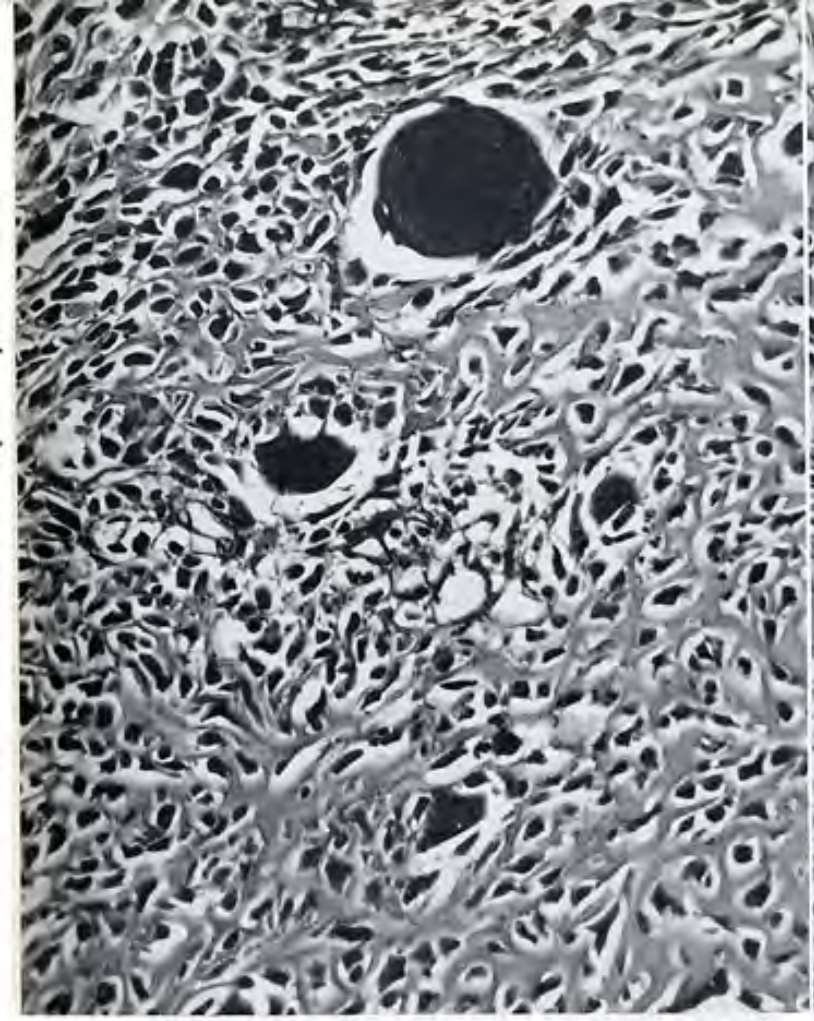


Fig. 4 — (High power) Photomicrograph demonstrating osteoid formation and a rather cellular area indicative of well differentiated osteosarcoma (Wash. Univ. Neg. 58—4515).

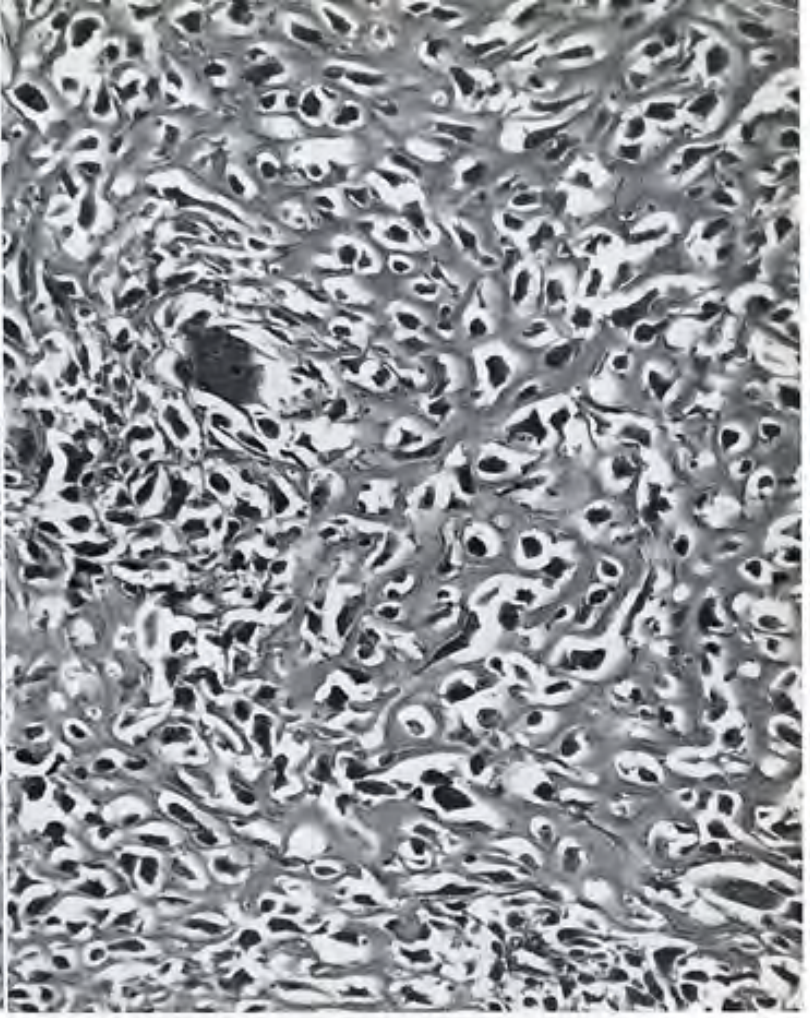
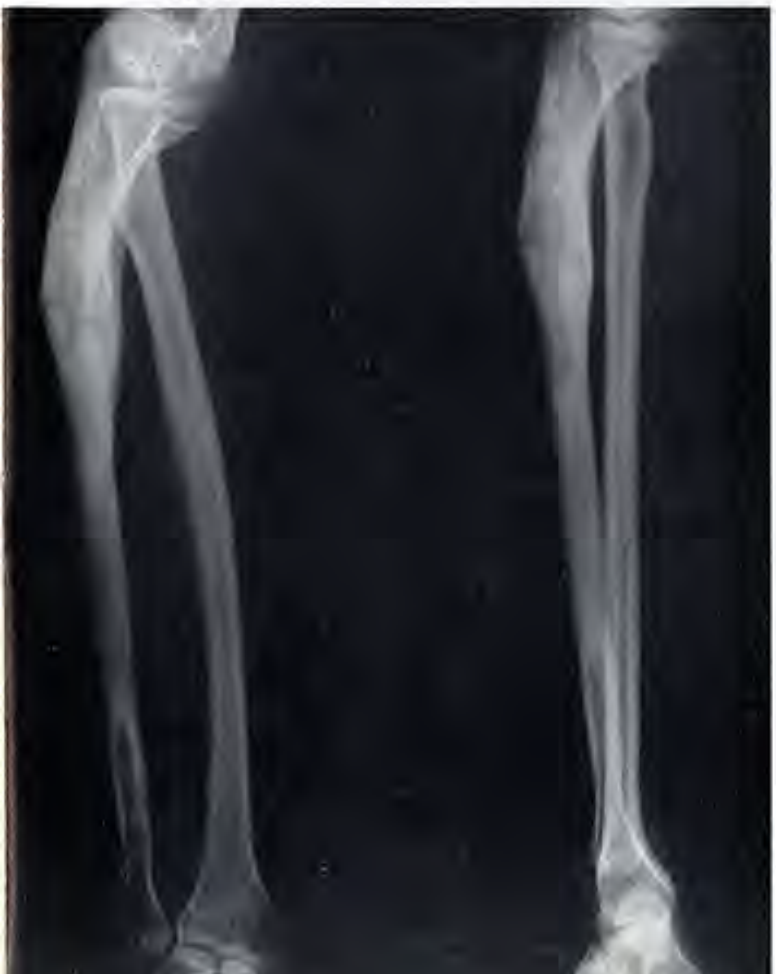


Fig. 5 — (High power) Photomicrograph showing undifferentiated tumor forming osteoid and growing between muscle bundles in the periphery of the lesion (Wash. Univ. Neg. 58—5099).

Fig. 6 — Appearance of the extremity years after operation (Aug. 1948).



center to the other, hoping to find someone who would agree not to amputate. If one is pessimistic about the outcome of patients, one usually leans towards neglect or abstention. I personally favor an optimistic attitude, of giving the patient the benefit of the last doubt. I don't care if the chance is only one in one hundred cases, or in one thousand; I never know which is that one patient.

Dr. Ackerman: We are the happy type!

L. J. Brown, M.D., Herrin, Illinois: Inasmuch as we have already seen twice at these CANCER SEMINARS, that trauma can influence metastasis, I'd like to have a comment about trauma influencing a primary origin of osteosarcoma.

Dr. Regato: That has been covered by this statement: "Because you find toads after the rain, it hasn't necessarily rained toads".

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Strauss: See Lewis, D.

14. *Atypical Chordoma (?) Invading the Sacrum*

Contributed by Richard E. Hermann, M. D., and Emanuel Salzman, M. D.,
Denver, Colorado

THE PATIENT was a 41-year-old man in January, 1954, when he noticed a painless swelling in the right sacral region; he gave a history of poliomyelitis at the age of four. On examination, there was severe kyphoscoliosis and a hard mass arising from the right side of the sacrum.

Dr. Hodes: This tumor arose in the right half of the sacrum and presented posteriorly. Radiographically, the tumor appears to be well encapsulated and well differentiated from adjoining soft tissue and bone. The single roentgenogram of the pelvis reveals a great deal of calcified chondroid and calcified osteoid matrix. Most of the tumor contains solid lumpy bone; in a few areas, flocculent densities suggest the presence of chondrosarcoma. The general appearance is one of a slow growing tumor. The distortion of lower sacral foramina below the tumor, plus the manner in which the right sacroiliac joint borders the tumor, support this postulate. From the single roentgenogram, one cannot tell whether or not the fifth lumbar vertebral body and its appendages on the right side, have been invaded by the tumor.

The presence of a sacral tumor immediately calls to mind *dermoid, teratoma* and *chordoma* to which this site is host. Usually, these tumors are midline tumors; usually too, they cause bone destruction; also, the vast majority present anterior to the sacrum. The lesion, which concerns us, is asymmetrically placed; it has produced bone and presents posteriorly. Whereas, no one can gainsay these diagnostic possibilities, we are inclined to relegate them to a position of lesser importance, for the reasons given above. The distorted neural canals in the sacrum could be a reflection of *neurofibromatosis.* Since neurofibromas may undergo malignant degeneration in ten per cent of the cases, one could postulate that this patient had a neurofibroma which was secondarily invading bone. In the latter, however, bone is destroyed rather than produced. Finally, one must consider malignant degeneration of a spur of bone or an *osteochondroma* springing from the posterior aspect of the sacrum to the right of midline. Such a tumor, a *chondrosarcoma,* particularly in an individual forty-one years of age, could be slow growing. Usually, however, they cause pain, but this does not militate against this possibility.

Dr. Hodes' impression: A slow growing primary bone tumor. 1) CHONDROSARCOMA; 2) CHORDOMA.

Roentgenologic Impressions Submitted by Mail:

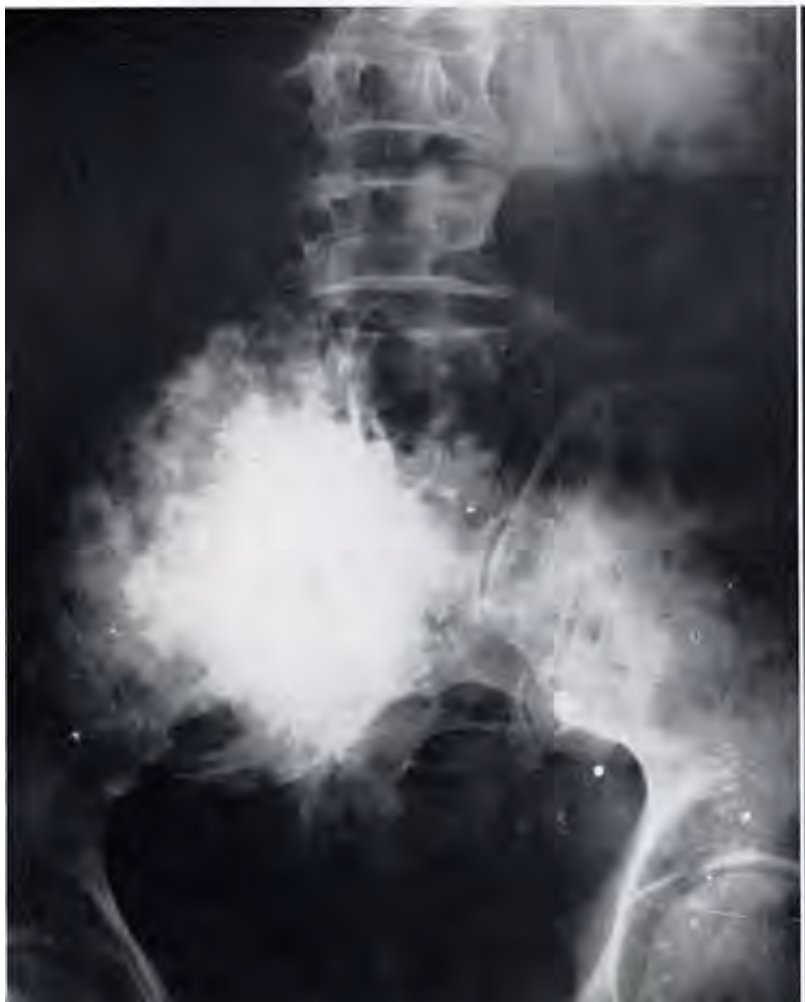
Chondrosarcoma	73 (5)*
Osteochondroma	37 (1)
Chordoma	16
Calcified hematoma	15
Others	24

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Most of the experts submitted an impression of chondrosarcoma. Dr. J. S. Keleki, of Athens, Greece;

Fig. 1 — Roentgenogram showing dense osteoblastic lesion arising from the right side of the sacrum (Jan. 1954).

Fig. 2 — Roentgenogram showing progress of the lesion (Sept. 1957).



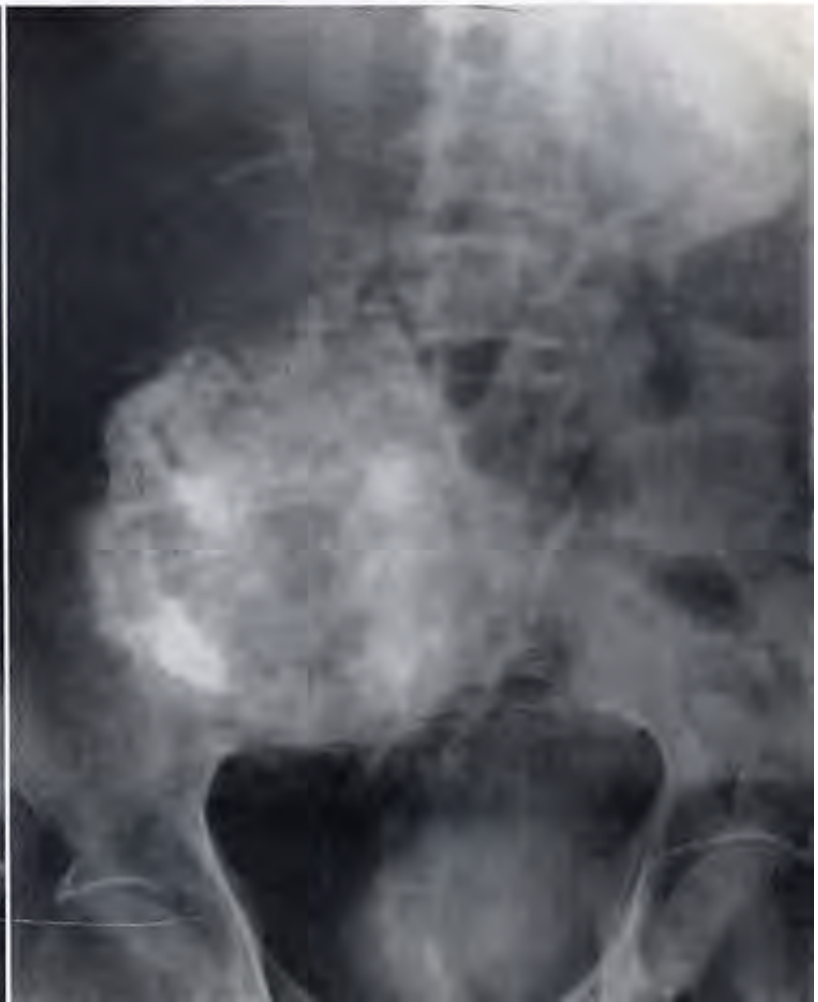


Fig. 3 — Gross post mortem appearance of the lesion.

Fig. 4 — (Moderate power) Photomicrograph showing an undifferentiated malignant tumor (Wash. Univ. Neg. 58—4516-A).

Dr. B. Felson, of Cincinnati, and Dr. R. Sherman, of New York City, suggested chordoma as an alternative.

Subsequent history: Biopsy was done in May, 1956, and reported as showing sarcoma consistent with osteosarcoma, but with areas of chondrosarcoma. Roentgentherapy was administered with a total of 3,000 roentgens given in eight weeks to one large field; following the treatment, the skin became tanned. The pain persisted and the patient was obliged to walk with crutches.

In September, 1957, the mass seemed stationary, but swelling of the right leg appeared; the patient developed severe abdominal pain and expired in shock. An autopsy revealed that the patient had died of a perforated gastric ulcer and peritonitis. A large tumor, 12x15x20 cm confined to the lower lumbar vertebrae, sacrum and right iliac bone was found; on section, it was formed by thin-walled cysts containing a dark gelatinous material. There were no metastases.

Dr. Ackerman: There is a highly cellular tumor present that has cells with pink cytoplasm, clear cytoplasm and slightly vacuolated cytoplasm. The nuclei do not appear vacuolated. Epithelial mucin stain is negative. Fat stain, however, is positive. Sudanophilic material was present in large amounts within the cytoplasm of viable cells. This finding, therefore, brings up the possibility of primary liposarcoma or metastatic tumor that contains large amounts of fat. I have seen one authenticated case of primary liposarcoma of bone. This tumor microscopically demonstrated signet ring cells and was similar to the liposarcomas seen arising in soft tissue (Dawson). In another case with involvement of bone, I made a diagnosis of primary liposarcoma and it later proved to be metastatic from a small cancer of the kidney. This does not look like the usual carcinoma of the kidney, which also often contains large amounts of fat. I have never seen a primary neoplasm of bone with this pattern, with the possible exception of chordoma. It is in the usual location, right age group and has a clinical history that is compatible. This was the most difficult case for me in this CANCER SEMINAR.

Dr. Ackerman's diagnosis: Malignant tumor, unclassified. ATYPICAL CHORDOMA (?).

Histopathologic Diagnoses Submitted by Ma'1:

Chordoma	57	(1)*
Neoplasm, unclassified	30	(1)
Myeloma	15	(1)
Osteosarcoma	14	
Liposarcoma	12	
Chondrosarcoma	11	
I-don't-knoma	1	
Others	32	(3)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. M. B. Dockerty, of Rochester, Minnesota, concluded to a benign lesion; Dr. R. Willis, of Leeds, suggested proliferative and degenerative changes around a sacro-iliac osteoarthritis; Dr. B. G. Fishkin, of Los Angeles, felt that this was a non-malignant localized reticulo-endotheliosis; Dr. C. Strand, of Dubuque, offered calcifying hematoma. Dr. H. A. Sissons, of London, preferred a calcified chondroma; Dr. L. Lichtenstein, of Los Angeles, found an unusual focus of myeloma with secondary amyloid deposition and ossification. Dr. D. Brachetto-Brian, of Buenos Aires, suggested reticulo-angio sarcoma and advised a search for lipids. Dr. L. Lowbeer, of Tulsa, considered metastatic melanoma; Dr. F. Vellios, of Indianapolis, wondered if this could be a reticulum-cell sarcoma of the sacrum. Dr. F. Bang, of Copenhagen, offered myxochondro-sarcoma; Dr. F. Schajowicz, of Argentina, suggested irradiated osteosarcoma. Dr. C. Oberling, of Paris, submitted a diagnosis of atypical

chordoma. Dr. J. P. Kerneis, of Nantes, France, qualified it as a "chordoma avec cellules physalifores".

L. Johnson, M. D., Washington, D. C.: "The bulk of this lesion is mature bone and bone marrow with nothing resembling a neoplasm; it contains no cells that would suggest a sarcoma, except for a few areas containing clusters of cells labeling the lesion as a neoplasm. These close-packed proliferating cells are very large, with prominent nucleoli such as seen in hepatomas, ganglioneuromas and melanomas; in some areas, the cells gradually enlarge and develop bubbly cytoplasm; from here they seem to fade-off into fatty marrow cells. In other areas, the cells seem to merge gradually into promyelocytic cells that are scattered through the fatty marrow; the marrow spaces are filled in some places with scarcely stainable albuminoid or mucoid material in which there is scattering of spindle cells forming sheets.

"The case is unique, and out of range of those described in the literature. The cell is of the same type of some exceedingly rare tumors which the Armed Forces Institute of Pathology staff has begun to suspect may be related to a primitive fat cell somewhere in the lipoblast stage, having some kinship to the fetal and hibernating fat. Since there is increasing evidence that fat cells may be a stem cell, from which hemopoietic and bone tissue can emerge by direct metaplasia, it would not be surprising if in some instances, a tumor arising from these cells may show fat, bone and signs of hemopoiesis, all in profusion." (Opinion emited in January, 1958.)

Dr. Reynolds: I would be inclined to do nothing in this case.

D. C. Dahlin, M. D., Rochester, Minnesota: I didn't know what it was. I thought that it was probably benign.

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15. *Metaphyseal Fibrous Defect of the Humerus*

Contributed by Franz Leidler, M. D., Houston, Texas

THE PATIENT was a 17-year-old man in May, 1957, when he sustained an injury to the left shoulder with consequent local pain. The blood calcium was 10.3 mg per cent, with 4.3 mg per cent of ionized calcium; the blood phosphorus was 4.5 mg per cent.

Dr. Hodes: This tumor occupies a major portion of the proximal half of the humerus. In some respects, there seems to be two lesions: the proximal lesion, eccentrically placed; and the distal lesion, centrally placed. The probabilities are, however, that these are one and the same lesion, with the older portion of the abnormality lying in the proximal portion of the bone. The lesion is medullary in origin. It arises in the diaphysis and involves the metaphysis. It lies at a significant distance from the cartilagenous epiphyseal plate. Both lesions have caused absorption of medullary bone. In the proximal portion, the lesion is cystic and bulges somewhat. At the site of bulging, the cortex is thin. The distal portion of the lesion is also eroding cortical bone. The lesion extends across the entire diameter of the bone and is eroding the cortex from within. There is no evidence of periosteal reaction. In some areas, the cystic lesion is "trabeculated" or scalloped in appearance; in others, particularly the distal portion of the lesion, there is no evidence of the above.

This is obviously a benign process, and probably belongs to one of the fibrocystic disturbances of bone. Except for the fact that this is a rather large lesion, it demonstrates all of the features characteristic of *solitary bone cyst*. It lies at a distance from the epiphyseal plate; it is located in the shaft of the tubular bone and is of medullary origin; it has caused some cortical erosion without periosteal proliferation, and the bone does reveal evidence of bulging. This lesion also, in many ways, simulates *fibrous dysplasia*, monostotic in type; this is a distinct diagnostic possibility. Usually, fibrous dysplasia involves cortical bone. The patient is rather young; also, this lesion lies at a distance from the epiphyseal plate; in all other respects, this might be a variant of *giant-cell tumor*. *Non-ossifying fibromas* more often involve the lower limbs; usually, they do not involve as long a segment of the tubular bone, as had been demonstrated in this patient. If one could identify a fibrous cortical defect elsewhere, perhaps that would support this diagnosis.

Dr. Hodes' impression: A benign bone lesion of fibrocystic nature: 1) FIBROUS DYSPLASIA; 2) BONE CYST.

Roentgenologic Impressions Submitted by Mail:

Bone cyst	48 (2)*
Fibrous dysplasia	39 (2)
Non-ossifying fibroma	21 (1)
Eosinophilic granuloma	12
Hemangioma	9
Others	36 (1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. R. S. Spurck, of Denver, made a diagnosis of simple cyst. Dr. H. Hauser, of Cleveland, and Dr. L. H. Garland, of San Francisco, suggested fibrous dysplasia. Dr. R. N. Todd, of Lincoln, Nebraska, and Dr. R. Sherman, of New York City, preferred a non-ossifying fibroma. Dr. J. A. Campbell, of Indianapolis, submitted osteitis fibrosa cystica.

Operative findings: In June, 1957, the lesion was curetted and the cavity filled with bone chips.

Dr. Ackerman: This is a classic example of metaphyseal fibrous defect (Jaffe), a lesion which may rarely be missed radiographically, but microscopic diagnosis may be difficult without the roentgenogram. We believe that this is not a true neoplasm. We believe it arises from some aberration at the epiphyseal plate: (1) It has been found only in the metaphysis of a bone. (2) It migrates (relatively) away from the epiphysis as the bone grows in length. (3) It tends to be elongated in the longitudinal axis of the bone, as though the abnormal development had occurred over a period of time. (4) Ponsetti and Friedman have illustrated three successive lesions arising from the same area of the epiphyseal plate, indicating that the factors producing the defects may act intermittently. (5) No evidence of malignant transformation or unusual mitotic activity has been noted (Cunningham).

Curettement is curative, but we believe that this lesion in reality needs no treatment. We have seen it diagnosed incorrectly as giant cell tumor and even as fibrosarcoma.

Dr. Ackerman's diagnosis: METAPHYSEAL FIBROUS DEFECT.

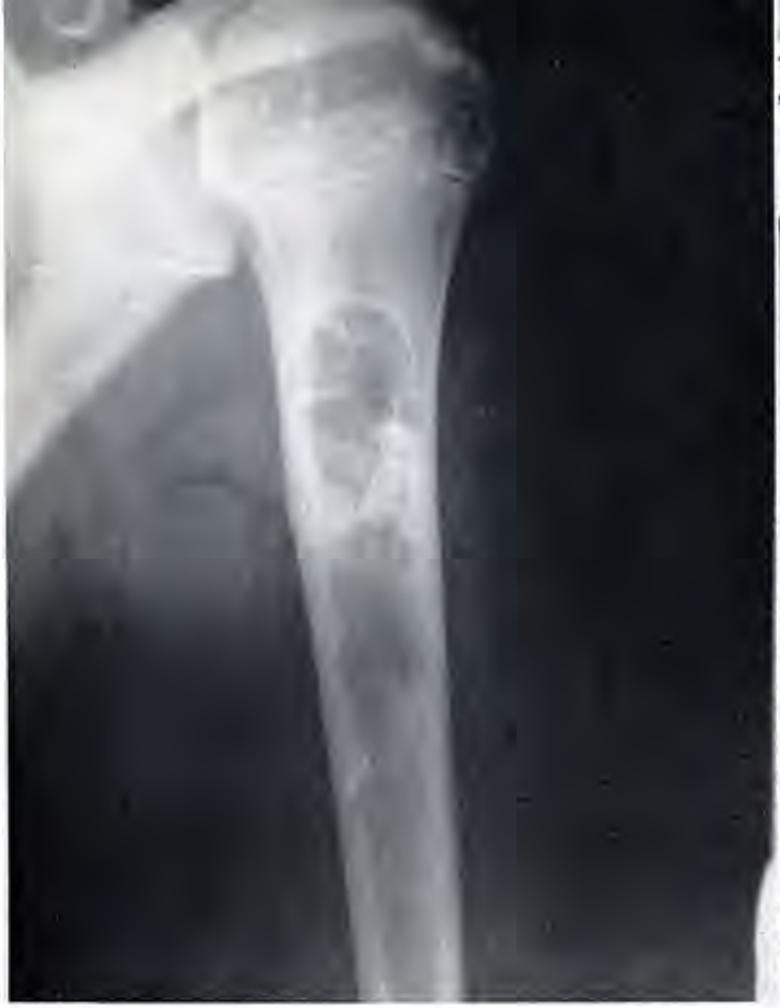

Fig. 1 — Roentgenogram showing cyst-like medullary lesion of the diaphysis of the humerus.

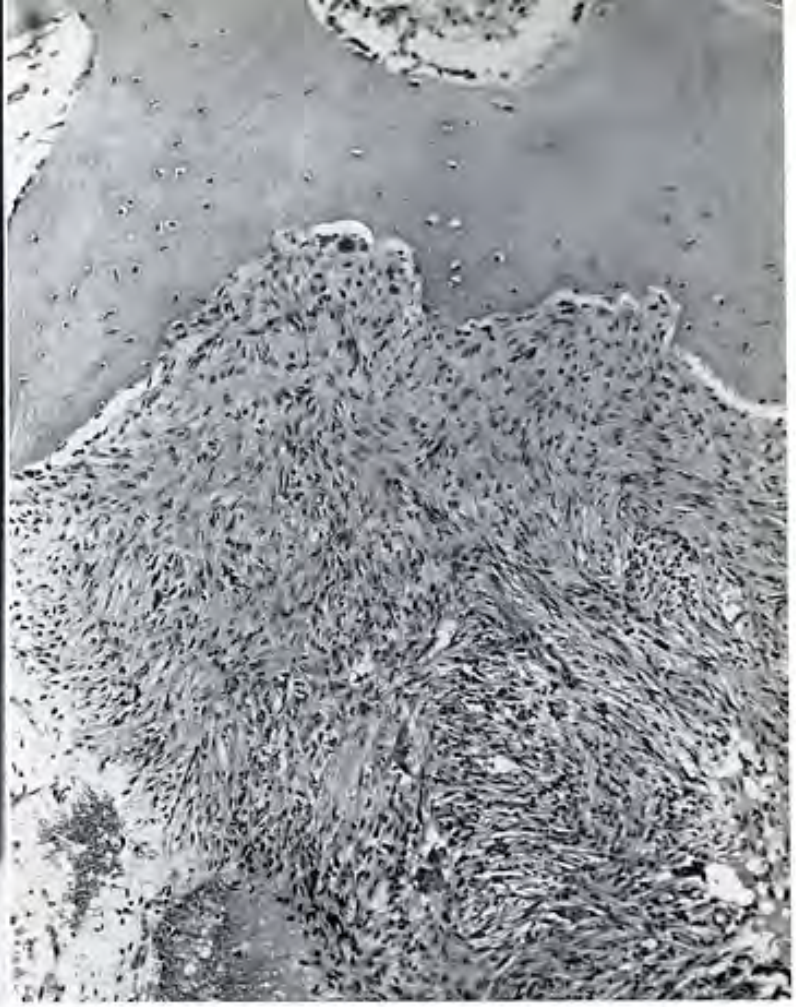

Fig. 2 — (Low power) Photomicrograph demonstrating the essential fibrous nature of the lesion together with heavily sclerotic bone (Wash. Univ. Neg. 55—3593-A).

Histopathologic Diagnoses Submitted by Mail:

Benign giant-cell tumor	79	
Osteitis fibrosa	17	(1)*
Fibrous dysplasia	15	(2)
Ossifying fibroma	13	
Non-ossifying fibroma	12	(1)
Metaphyseal fibrous defect	9	(1)
Bone cyst	7	
Others	8	(1)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. F. Vellios, of Indianapolis, and Dr. Morgan Berthrong, of Colorado Springs, submitted fibrous dysplasia; Dr. H. K. Giffen, of Omaha, offered benign giant cell tumor; Dr. B. G. Fishkin, of Los Angeles, preferred osteogenic fibroma and Drs. M. B. Dockerty and D. C. Dahlin, of Rochester, metaphyseal fibrous defect.

H. A. Sissons, M. D., London (by mail): I suppose that giant-cell tumor is the obvious answer to this case, but I think that the stroma is too fibrous, the roentgenologic appearance very dubious, and the presence of considerable amount of scattered bone formation in the stromal tissue is against this diagnosis. Even with the statement that blood chemistry is normal, I would suspect hyperthyroidism, and I would like to know that further investigation eliminated this possibility. In such a case, I would regard the lesion as a benign fibrous process such as non-osteogenic fibroma.

Subsequent history: In the beginning of September, 1958, the young man remains a very active sportsman. The ionized calcium remains within normal limits. He has no weakness. At our request, a skeletal series will be done.

Dr. Reynolds: I am in perfect agreement with the treatment as rendered here of curettement and packing it with bone chips. I remember a lesion this large in the distal femur associated with pathological fracture in a doctor's child; although the radiographic appearance seemed perfectly compatible with metaphyseal fibrous defect, after about two years they couldn't stand it any longer, and they finally had to clean it out; it was a metaphyseal fibrous defect.

D. C. Dahlin, M. D., Rochester, Minnesota: I believe as Dr. Sissons did, that the stroma is too fibrous for a giant cell tumor, so that histologically, as well as because of location, that diagnosis is not tenable.

L. Loubeer, M. D., Tulsa, Oklahoma: In what way would the lining wall of a solitary bone cyst look different from this? Could this lesion, perhaps, turn itself into a solitary bone cyst if left alone?

Dr. Ackerman: If you had a surgeon who made a vigorous currettement of the lining wall of a unicameral bone cyst, you could easily get areas that could be confused with metaphyseal fibrous defect; we have made that mistake. However, if you have the roentgenogram and know the operative findings, no such error will be made. In a fairly large number of these cases, we have never seen such an evolution towards bone cyst.

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Extra. *Melorheostosis (?)*

Contributed by David W. Smithers, M. D., *and* N. F. C. Gowing, M. D., London, England

THE PATIENT was a 51-year-old woman in October, 1956, when she gave a history of pain in the right thigh of eight months duration; there were no other complaints and her general condition was excellent. The A/G ratio was 2.2:1, the thymol flocculation was 1 plus; the paper electrophoresis was normal. The acid phosphatase: 4 units per 100 ml; the alkaline phosphatase: 25.4 units per 100 ml; calcium: 9.1 mg per 100 ml; and phosphorus: 3.4 mg per 100 ml.

(The material available in this case was insufficient to yield the necessary total number of slides; for this reason, the case was presented as an extra one. Slides which were graciously submitted by the contributors, after complete processing at the Royal Marsden Hospital of London, were included in a limited number of the CANCER SEMINAR boxes.)

Fig. 1 — Roentgenogram of the femur: extensive osteoblastic process with abrupt transition from abnormal to normal bone.

Dr. Hodes: This extensive osteoblastic process involves the medulla, cortex and periosteum. Within the medulla, it has almost entirely replaced normal cancellous bone. Periosteal proliferation is evident throughout the femur. In the proximal portion of the femur, there is evidence of a pathological fracture. At this level, also, within the medullary canal, is a density which suggests the possibility of sequestration. There is a remarkable difference between the appearance of the normal bone and the very dense lumpy bone which represent abnormal bone. This is a benign process for the transition from normal to abnormal bone is abrupt and clear-cut in all portions of the limb.

The elevated blood alkaline phosphatase is the only significant abnormality in this patient's blood profile. Obviously, this is a non-specific reaction to abnormal bone growth. *Melorheostosis* alone can explain this extensive osteoblastic process which involves all of the bone elements. Characteristic of this abnormality are the very abrupt changes in the roentgen appearance between normal and abnormal bone. In this abnormality too, pathological fractures occur; and pain also is a common feature.

Dr. Hodes' impression: MELORHEOSTOSIS.

Roentgenologic Impressions Submitted by Mail:

Osteosarcoma	52 (3)*
Osteosarcoma in Paget's	11
Osteosarcoma (multicentric)	7
Melorheostosis	15 (1)
Parosteal osteoma	10
You tell me!	1 (1)
Others	39 (1)

* In parenthesis, the impressions of six outstanding radiodiagnosticians.

Dr. Regato: Dr. H. Hauser, of Cleveland, suggested osteoblastic metastasis, possibly from carcinoma of the breast. Dr. R. D. Moseley, of Chicago, and Dr. B. L. Pear, of Denver, submitted multicentric osteosarcomata. Dr. J. C. Evans, of New York City, and Dr. J. Keleki, of Athens, Greece, preferred melorheostosis.

Subsequent history: The patient presented similar bone-forming lesions of the humerus and lumbar spine. Radioactive calcium studies suggested that the plasma clearance curve is composed of three exponentials with half-times of 392 minutes, 27 minutes, and 4.5 minutes, which represent respectively, excretion bone deposition and exchange in equilibrium with extracellular fluid. The patient had no history of exposure to radiations; the breath and urine were tested for radon and alfa-emitting isotopes with negative results.

The patient was treated by administration of P^{32} and androgens plus local roentgentherapy. In January, 1957, the treatment was repeated with development of sub-cutaneous bruises and drop in leucocytes and platelets; blood transfusions were given. There was relief of pain and radiographic regression of lesions, but a new one appeared in the pelvis. In April, 1958, she had little pain, walked without a cane and was in good general condition.

Dr. Ackerman: This is a lesion of bone with which I am not familiar. To my mind, this is not osteosarcoma; the

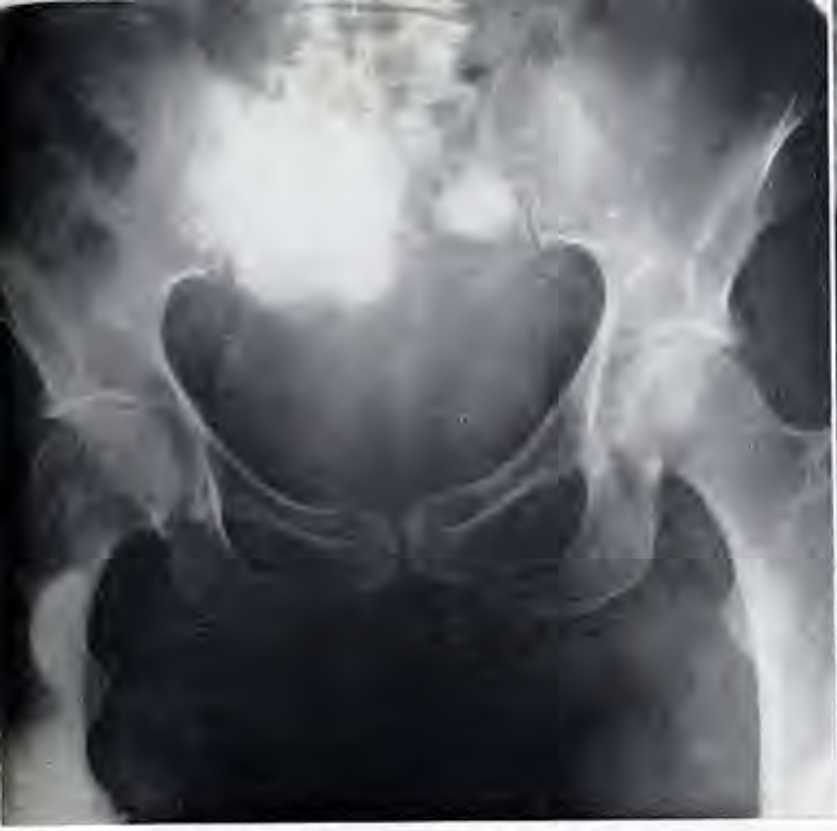

Fig. 2 — Similar dense lesions are shown on the sacrum.

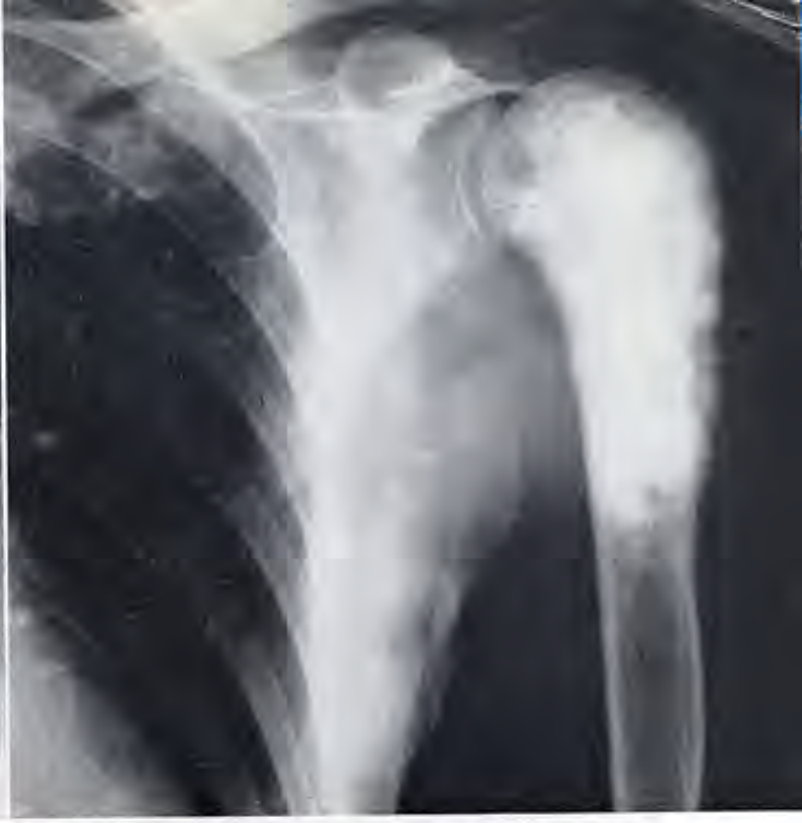

Fig. 3 — Osteoblastic lesion of same character on the epiphysis of the left upper extremity.

pattern is too uniform. Nor is this Paget's disease because the pattern, again, is too uniform. It is a lesion which has caused elevation of the alkaline phosphatase and this, without evidence of disease in more than one bone, is unusual. Therefore, there should be disease in other bones. This is not the picture of hyperparathyroidism which would also cause considerable elevation of the alkaline phosphatase. This does not appear to be osteopoikilosis, which is a general affection of the skeleton. Hereditary and familial influences are often present. It affects the entire skeleton. There are dense spots in cancellous bone. Usually there is no involvement of the cortex. There is never any involvement of the soft tissue. Neither is this osteopetrosis (marble bones or Albers-Schonberg's disease). In this condition, there is a distinct familial tendency and the disease is occasionally inherited. There is a tendency to fracture. Usually, there is excessive density of most or all the bones of the skeleton. Anemia is often severe. Serum calcium is normal or may be elevated; phosphatase is normal. There are fine striations, transversely and longitudinally, in the metaphysis and epiphysis. The shaft of a long bone may be solid with the medullary cavity obliterated and there is fibrosis of the marrow. I see no evidence of previous irradiation and, therefore, cannot say that this is a picture of irradiation effect. There is good marrow present.

If I had to make some diagnosis, I would say this is melorheostosis. There are eight cases reported with involvement of several bones. Usually, it is confined to one limb; the leg is a common site. There is often pain. There are no hereditary or familial influences. Three-fourths of 37 cases were under 35 years of age. There is excessive formation of dense bone in the vicinity of the joint. The joints may be affected. Deposits of bone in the soft tissue are usually in the region of the hip, knee, ankle and foot. The limbs may be shortened. Radiographically, there is a flow of dense streaks and blotches. The skull, spine and ribs usually escape. This lesion apparently effects the shaft more, but has extended outside. In this condition, there is sclerosed bone, either endosteal or cortical, and compact over-crowding of the lamellae, with interlacing pattern of immature and adult bone (Fairbank).

Dr. Ackerman's diagnosis: Benign lesion, type undetermined; rule out MELORHEOSTOSIS.

Histopathologic Diagnoses Submitted by Mail:

Osteosarcoma	27 (3)*
Osteosarcoma in Paget's	10
Benign osteoma	9
Paget's disease	4
Osteoblastomatosis, osteopoikilosis, melorheostosis	8 (1)
Others	10 (2)

* In parenthesis, the diagnoses of six outstanding surgical pathologists.

Dr. Regato: Dr. R. Willis, of Leeds, and Dr. F. Vellios, of Indianapolis, suggested the possibility of melorheostosis. Dr. J. McNaught, of Denver, offered Paget's disease plus osteosarcoma. Dr. D. C. Dahlin, of Rochester, Minnesota, made a diagnosis of osteogenic sarcoma; Dr. H. A. Sissons, of London, also felt that this is a highly differentiated osteosarcoma. Dr. A. O. Severance, of San Antonio, submitted chondrosarcoma.

A. P. Stout, M. D., New York (by mail): This has been a collection of bone tumors and lesions, second to none in rarity and in difficulty in diagnosis. I have never seen a lesion exactly like this. It appears to have the histological features of osteoid osteoma, but not the gross and clinical aspects. I think it is benign and would call it *osteoblastomatosis.*

Subsequent history: In the beginning of September, 1958, this patient was examined by Dr. N. Howard, of London, who wrote: "She has further swelling and pain in the middle of the right thigh between two previously irradiated areas. Hemoglobin is 75 per cent and the white count 1200. We wonder if this is due to P^{32} treatments she has received."

Dr. Reynolds: I would like to say one thing in closing, if I might: I would like to reiterate that in suspected bone lesions, the clinicians should attempt to make provisional diagnoses by taking careful histories, doing careful physicals and complete chemical studies, as well as radiographic studies, not only of the area involved, but also of the chest

and a skeletal series. When this is accomplished and with a provisional diagnosis (even though it may be wrong), you may then approach a biopsy. In most instances, where there is any question of doubt at all, biopsy is indicated; biopsy may be done under tourniquet and determined by frozen section, or one may do a formal biopsy. We have been testing Dr. Ackerman by doing a frozen section in each case, but we have not carried out definitive treatment until we have had the formal sections. So far, he has been right every time, and so, perhaps, we may decrease the chances of tumor spread associated with biopsy, by doing the frozen section in carrying out the definitive operation at that time; but this takes an extremely competent pathologist. There is a definite increase of danger of spread of the tumor with biopsy, whether done by needle or open operation. Of course, the smaller the trauma, the smaller the chance of spread.

Thank you very much for the privilege of having been here with you.

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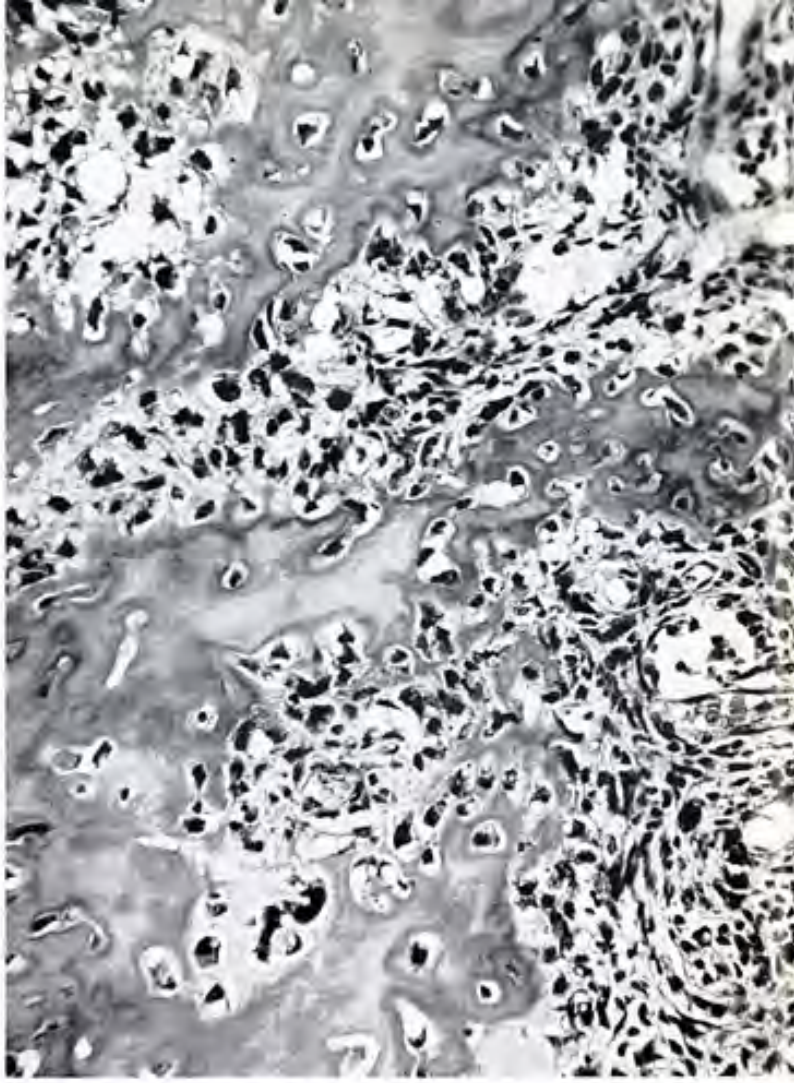


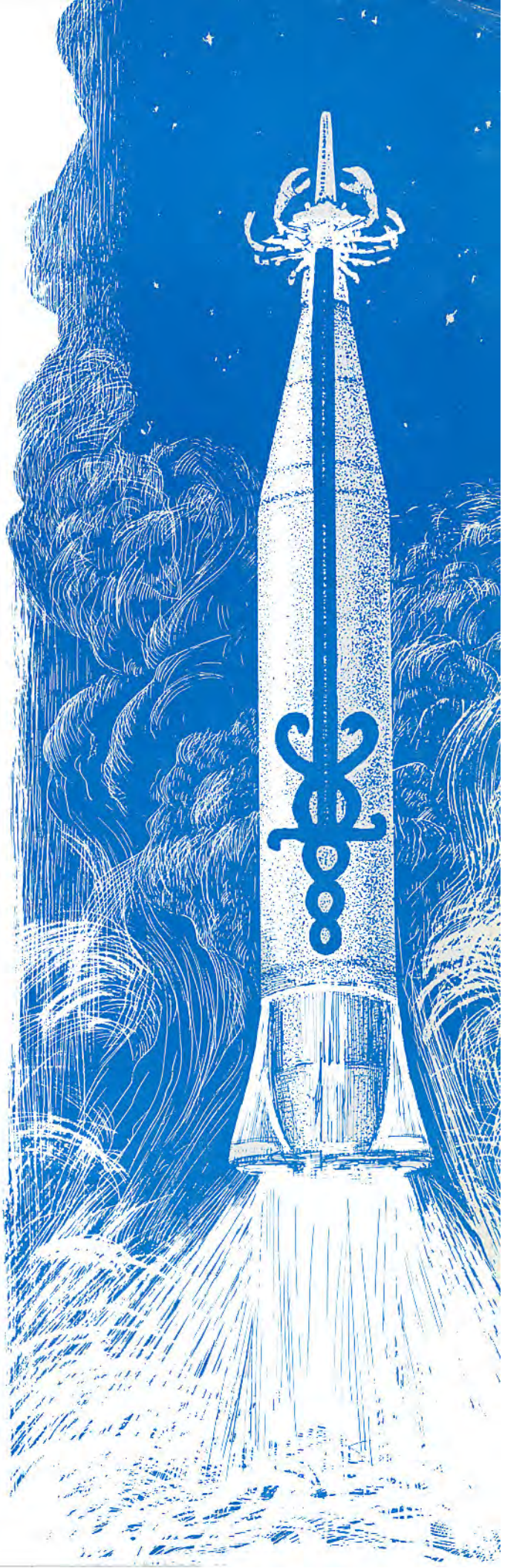
Fig. 4 — (Moderate power) Photomicrograph showing a representative area with bone, osteoid and rather cellular stroma but no evidence of neoplasm (Wash. Univ. Neg. 58—4517).

Our Guest Speakers

PHILIP J. HODES, M. D., Professor of Radiology at Jefferson Medical College; he graduated from the University of Pennsylvania in 1931. He is Consultant in Radiology to the Armed Forces Institute of Pathology and is well known for his numerous didactic contributions to the radiological literature. Doctor Hodes was the guest of the Penrose Cancer Hospital.

LAUREN V. ACKERMAN, M. D., Professor of Surgical Pathology and Pathology at Washington University, St. Louis, Missouri; he graduated from the University of Rochester Medical School in 1932. He is Consultant in Pathology to the Armed Forces Institute of Pathology. Doctor Ackerman was the guest of the College of American Pathologists.

FRED C. REYNOLDS, M.D., Professor of Orthopedic Surgery at Washington University Medical School and consultant to the St. Louis Children's Hospital; he graduated from Washington University Medical School in 1934. Doctor Reynolds was the guest of the Penrose Cancer Hospital.

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