Radiolucent Lesions of the Extremities

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Abstract

There are numerous conditions that produce a radiolucent lesion in a bone. Many of these are benign and of little consequence and need only occasional observation, as they usually heal spontaneously. A few are benign but do not heal spontaneously and require a limited operation. Others are malignant and must be removed surgically or irradiated. The physician evaluating the radiolucent lesion must be able to distinguish lesions that should be observed from those that should be further evaluated or treated. It is unnecessary to evaluate every radiolucent lesion as if it were a malignant tumor. With an understanding of the potential lesions and how they present, it is possible to construct an algorithm that can be used to organize an efficient and appropriate evaluation.

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The term "cystic lesion" is often used to describe an abnormality in bone. Usually, what is meant is that the abnormality looks like a void in the bone because there is no intralesional calcification or ossification and the matrix, if there is one, cannot be seen on the radiograph. Only rarely are cystic lesions actually true cysts. The use of the term "cystic" can lead to misunderstanding because orthopaedists think it refers to a fluid-filled cavity. To avoid this misunderstanding, it is best to use the term "cyst" only for lesions that are fluid-filled cavities. Unicameral bone cysts, aneurysmal bone cysts, and intraosseous ganglions are the common true cystic lesions of bone. Other radiolucent lesions should not be called cystic.

When the specific diagnosis is not known, it is better to refer to cystic-appearing lesions as radiolucent or osteolytic. However, even the term "osteolytic" can be confusing because it suggests that there is active lysis of bone, when in fact many radiolucent lesions are the result of failure of bone formation (e.g., unicameral bone cysts and enchondromas), not the result of bone destruction or lysis of bone. Therefore, to avoid confusion, lesions without calcification or ossification are best referred to as radiolucent lesions.

Differential Diagnosis

The extent of the evaluation of a radiolucent lesion in a bone is determined on the basis of the possibilities in a reasonably limited differential diagnosis list. It is not necessary or appropriate to list every conceivable diagnosis and then exclude them one at a time. A reasonable differential list for the majority of bone lesions can be limited to three or four diagnoses.[1] The initial presentation and the appearance of the lesion on plain radiographs should suggest which diagnoses are reasonable and which radiologic and laboratory studies are therefore appropriate. Only those patients whose differential diagnosis includes a malignant tumor need to undergo more than a few simple tests.

The most difficult aspect of evaluating patients with a radiolucent lesion of the extremity is deciding who needs a thorough evaluation, who should immediately undergo biopsy and receive treatment, and who can be safely observed. Making these decisions requires an understanding of the conditions that may present as a radiolucent lesion and how to distinguish one from another without always having to obtain a biopsy specimen in each case.

There are four types of tissue in the bone that do not contain calcification or ossification and will therefore appear radiolucent: fluid, fibrous tissue, cells without a matrix, and cartilage matrix without calcification or enchondral ossification. With this understanding, a list of specific diagnostic possibilities can be constructed to account for almost every radiolucent bone lesion. This list in-

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cludes the following: unicameral bone cyst, aneurysmal bone cyst, intraosseous ganglion, eosinophilic granuloma, Ewing's sarcoma, osteomyelitis, chondromyxofibroma, enchondroma, chondroblastoma, nonossifying fibroma, giant cell tumor of bone, brown tumor of hyperparathyroidism, angioma of bone, adamantinoma, myeloma, and metastatic carcinoma. The osteoid in the matrix in osteofibrous dysplasia, fibrous dysplasia, and osteoblastoma is often insufficiently mineralized to be seen on a radiograph; therefore, these conditions can also present as radiolucent lesions. Other conditions are so rare that they are not worth mentioning and need not be included in a reasonable differential diagnosis.

Initial Evaluation

An accurate history, including a past medical history and a review of systems, and a complete physical examination are the first steps in evaluating a patient with a radiolucent lesion of bone. The next, and equally important, step is a careful examination of the plain radiographs (at least anteroposterior and lateral views).

Five important variables can be used to differentiate radiolucent lesions: (1) the patient's age at presentation, (2) how the lesion was discovered, (3) the location of the lesion within the bone, (4) the radiographic appearance of the lesion; and (5) the number of lesions present. A specific diagnosis can be made or a short differential diagnosis list can generally be constructed after these variables have been determined. A decision can then be made as to whether additional diagnostic studies, a biopsy, or observation is needed.

Patient's Age at Presentation

Each of the radiolucent lesions under discussion has a limited range of patient ages at presentation (Fig. 1). In many instances, the age ranges overlap, but some diagnostic possibilities can be eliminated by separating patients into four age groups. That is, two types of radiolucent lesions with a similar radiographic appearance but with different ranges of patient age at presentation will rarely be confused. For example, eosinophilic granuloma and myeloma have similar radiographic characteristics (Fig. 2), but their ranges of patient age at presentation are so disparate that they should not be confused with each other.

The age spectrum can be divided into four groups for discussion of patient age at presentation of radiolucent bone lesions: group 1, the first 7 or 8 years of life; group 2, from age 8 or 9 to the age at closure of the growth plates (14 or 15 for girls and 16 to 17 for boys)[2]; group 3, from the late teen years (after closure of the epiphyseal growth plates) to age 40; and group 4, 40 years of age and older. Radiolucent lesions are uncommon in patients between 40 and 60 years of age, but those that do occur are more likely to be lesions seen in older adults than in younger persons; that is why patients aged 40 to 60 are grouped with the older adults.

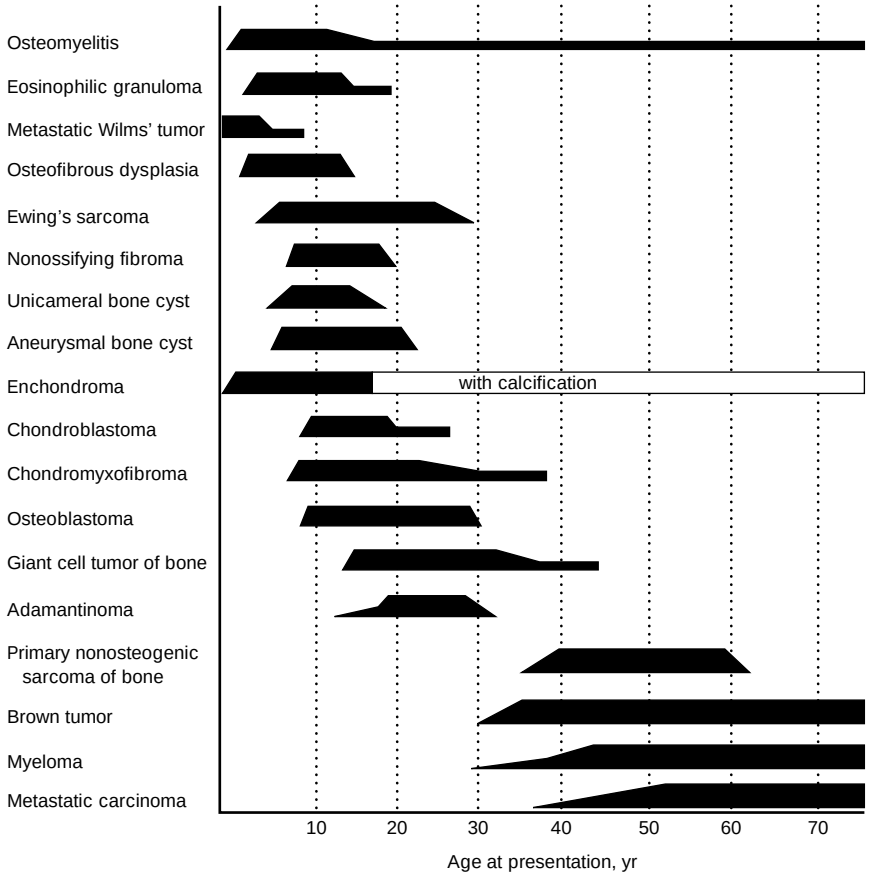

Fig. 1 Range of patient ages at presentation for the various radiolucent lesions.

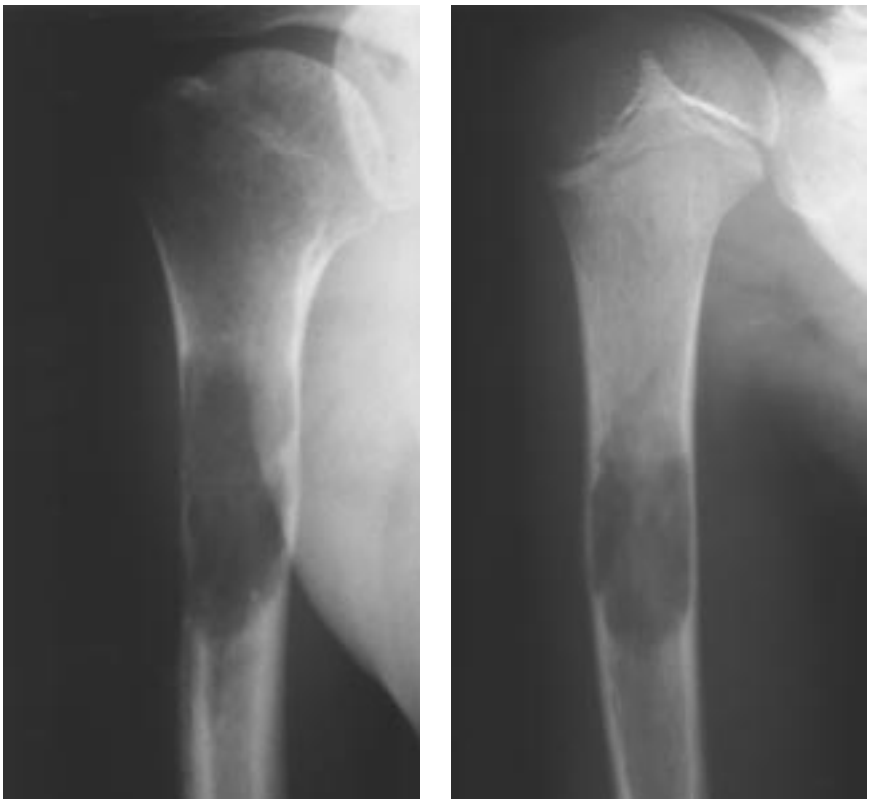

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Fig. 2 **A,** Radiograph of a patient with myeloma (a solitary plasmacytoma) in his proximal humerus. The patient is an adult (epiphyseal growth plates are closed). The radiolucent lesion has a broad border of transition and has destroyed the lateral cortex of the bone. There is minimal reaction of the bone to the lesion. Another possible diagnosis is metastatic carcinoma. **B,** Radiograph of a patient with an eosinophilic granuloma in his proximal humerus. The patient is a child (open epiphyseal growth plates). Other possible diagnoses include osteomyelitis and Ewing's sarcoma. The radiographic appearance is strikingly similar to that of the myeloma shown in **A,** but the patient ages are so different that the differential diagnoses are not the same.

The radiolucent lesions most commonly seen in group 1 are osteomyelitis, eosinophilic granuloma, and metastatic Wilms' tumor. Nonossifying fibromas, unicameral bone cysts, and aneurysmal bone cysts do occur in this age group, but are more common in the slightly older patient.

The lesions most commonly seen in group 2 include unicameral bone cysts, aneurysmal bone cysts, nonossifying fibroma, Ewing's sarcoma, osteomyelitis, enchondroma, chondroblastoma, and chondromyxofibroma. Osteoblastoma, fibrous dysplasia, and osteofibrous dysplasia are also seen in this age group.

Giant cell tumor of bone and Ewing's sarcoma are the most common radiolucent lesions seen in group 3 patients. Metastatic carcinoma is the most common radiolucent lesion seen in group 4 patients, followed by myeloma. Brown tumor associated with hyperparathyroidism is increasingly rare. Primary sarcomas of bone that are radiolucent (most common are malignant fibrous histiocytoma and fibrosarcoma) are uncommon neoplasms, but when they occur the patient is most often older than 40 years of age.

Means of Discovery

How the radiolucent lesion is brought to the attention of the physician is important. Not infrequently, it is found when a radiograph is taken for an unrelated reason, and the patient has experienced no symptoms due to the radiolucent lesion. In such cases, the lesion has an extremely low risk of being active and can almost always be observed without additional tests or a biopsy. This same approach should be remembered when a patient presents with a pathologic fracture through a radiolucent lesion. If the patient had no symptoms before the fracture, it can be treated with minimal regard for the lesion, and the lesion can then be evaluated after the fracture has healed. In contrast, if a patient reports having had symptoms before the fracture, the cause of the lesion should be determined before a decision on further treatment is made. Some patients in the second category will not need a biopsy before the fracture is healed, but the physician should be more concerned about the symptomatic lesion than the asymptomatic lesion. Pain only with activity is suggestive of an impending fracture, while prefracture pain at night, particularly pain that wakens the patient from sleep, is of considerable concern.

Location Within the Bone

The third important variable is the exact location of the radiolucent lesion within the bone. Possible locations include not only diaphyseal, metaphyseal, epiphyseal, and combinations thereof, but also cortical and medullary. Although there are numerous potential combinations of sites, for practical purposes there are

only six that need to be considered: diaphyseal-cortical, diaphyseal-medullary, metaphyseal-medullary, metaphyseal/epiphyseal-medullary, metaphyseal-cortical, and epiphyseal-medullary.

Radiolucent lesions located only in the epiphysis (secondary center of ossification) are all intramedullary and include osteomyelitis, chondroblastoma (Fig. 3), and, in adults, degenerative cysts. The location of a lesion within the metaphysis is not discriminatory because almost all bone tumors (including radiolucent bone lesions) occur most frequently within the metaphysis. The exact location within the metaphysis can be of some help. For example, unicameral bone cysts and enchondromas are centrally located metaphyseal radiolucent lesions, which are found immediately adjacent to the epiphyseal growth plate in children less than 10 years of age but are located away from the growth plate and closer to the metaphyseal-diaphyseal junction at a later age. The other metaphyseal radiolucent lesions are eccentric within the bone. Nonossifying fibroma and fibrous cortical defects appear as medullary lesions on plain radiographs, but on computed tomography (CT) they are more accurately located as subperiosteal or cortical abnormalities.

A radiolucent lesion in the metaphysis and the epiphysis in a patient with an open growth plate represents either osteomyelitis or an aggressive tumor (usually malignant), since the epiphysis serves as a barrier to tumor growth. In a patient with closed epiphyseal growth plates, giant cell tumors of bone and occasional chondroblastomas account for almost all of the metaphyseal-epiphyseal radiolucent lesions. Ewing's sarcoma can involve the epiphysis, but it is usually a metaphyseal lesion.

Few lesions arise in the diaphyses of long bones. Osteofibrous dysplasia and adamantinoma occur within the diaphyseal cortex, almost always in the tibia or fibula (Fig. 4). Ewing's sarcoma and eosinophilic granuloma may present as a diaphyseal radiolucent lesion (Fig. 5), but both are still more commonly located within the metaphysis. Metastatic carcinoma has a propensity to be located at the junction of the metaphysis and the diaphysis.

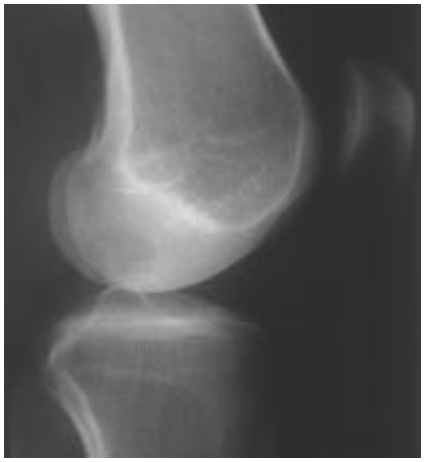

Fig. 3 Lateral radiograph of a young woman's knee shows a radiolucent lesion in the epiphysis of the distal femur. Radiolucent lesions in the epiphyses of a young child most often represent osteomyelitis. In this patient's age group (late teens to 40 years of age), chondroblastoma is more likely. In older patients most radiolucent lesions in the secondary growth center are degenerative cysts. As would be predicted from the patient's age, the lesion is a chondroblastoma. (This lesion can be seen better on the plain tomogram shown in Figure 9.)

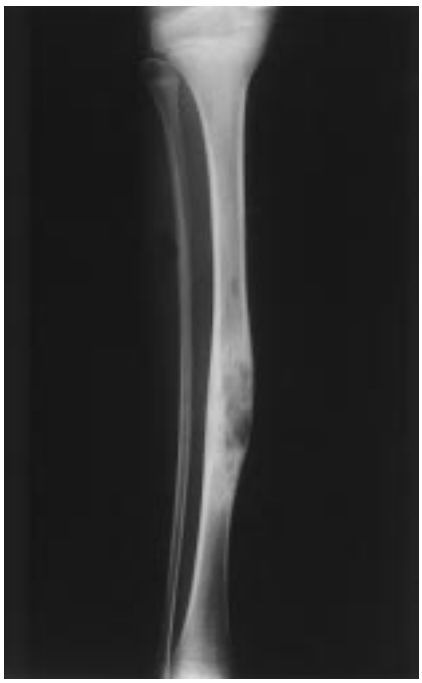

Fig. 4 Radiolucent lesions in the diaphysis are not common. This lesion is located principally within the anterior cortex of the tibia of a child. Middiaphyseal eosinophilic granuloma and fibrous dysplasia can occur in this age group, but osteofibrous dysplasia is much more likely because the lesion is in the cortex of the tibia. In an adult, adamantinoma would be the most likely diagnosis.

Radiographic Appearance

The next most important variable is the radiographic appearance of the border between the lesion and the surrounding host bone.[3] The radiographic chracteristics reflect, not only the rapidity at which the bone is being destroyed, but also how the host bone is reacting to the tumor. Tumors that are composed of small cells with little cohesion (e.g., Ewing's sarcoma, eosinophilic granuloma, and osteomyelitis) will rapidly permeate the bone so that on a radiograph it is difficult to see the margin between the tumor and the host bone. This is called a broad border of transition. Because more slowly growing tumors destroy all of the bone as they grow and invade only minimally, the bone will often have a chance to develop a reactive rim surrounding the radiolucent area. These lesions have a narrow border of transition with or without a reactive rim of bone.

When a tumor breaks through the cortex, the reaction of the

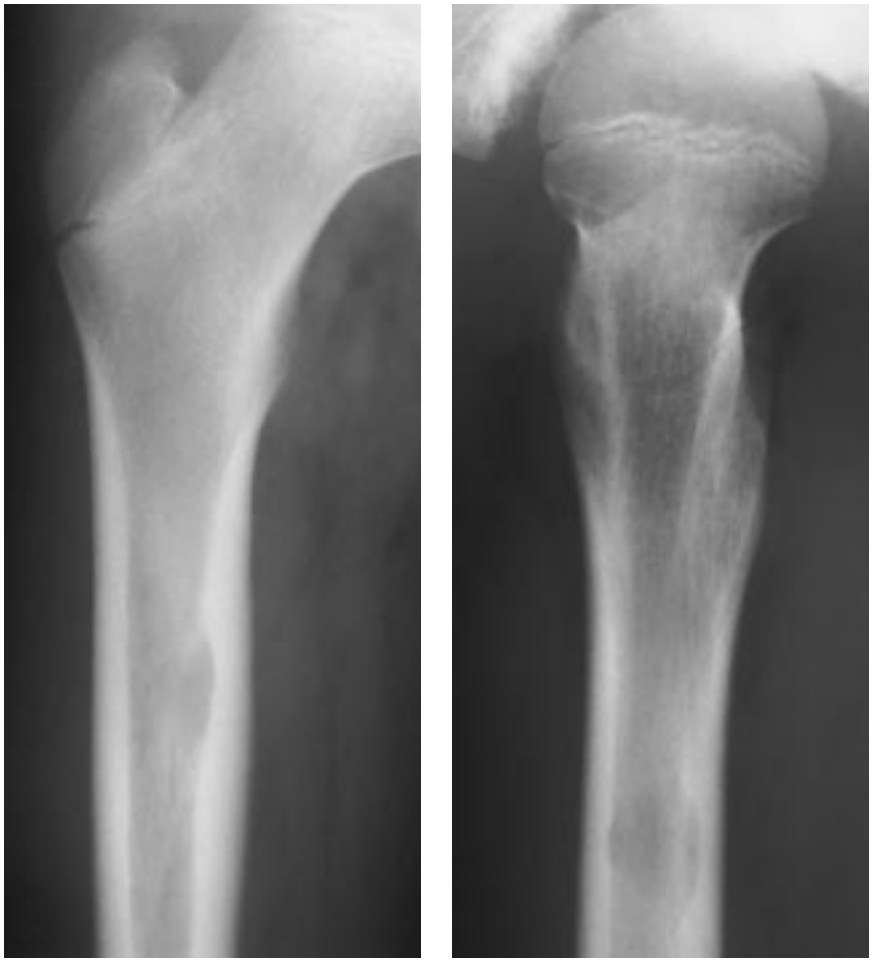

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Fig. 5 Anteroposterior **(A)** and lateral **(B)** views of the femur show a small radiolucent lesion within the medullary canal of the proximal diaphysis. This appearance is most typical of eosinophilic granuloma. Osteomyelitis and Ewing's sarcoma also have this appearance, but the lack of an acute periosteal reaction suggests a less aggressive lesion.

periosteum, as seen on the plain radiograph, provides clues to the behavior of the tumor and therefore to the histogenesis. Slowly growing solid tumors will be contained by a reactive rim of periosteal new bone. More rapidly growing tumors (usually malignant) and osteomyelitis grow so rapidly and infiltrate so aggressively that they do not allow sufficient time for the periosteum to produce a reactive capsule of bone (Fig. 6). The incomplete attempts of the periosteum to produce bone around an intramedullary lesion that has escaped through the cortex result in a variety of periosteal reactions associated with malignant tumors (especially Ewing's sarcoma). These periosteal reactive patterns can be produced by any rapidly growing lesion, benign or malignant, and even by osteomyelitis. These periosteal reactions have been called "onion-skinning," Codman's triangle, or sunburst, depending on their appearance on a plain radiograph. All of these reactions indicate a rapidly growing infiltrative process.

The relationship between the lesion and the cortex and medullary canal and the presence of periosteal reaction indicate the biologic growth behavior of the tumor. Lesions that appear to be infiltrating and are not contained by a well-developed periosteal reaction are the most rapidly growing lesions and the most likely to be malignant. Lesions that are contained by periosteal reactive bone and that have margins marked by a reactive rim in the medullary canal are the most slowly growing and the most likely to be benign. There are exceptions to this rule. Osteomyelitis is the lesion that is most often mistaken for a malignant tumor on the basis of its radio-

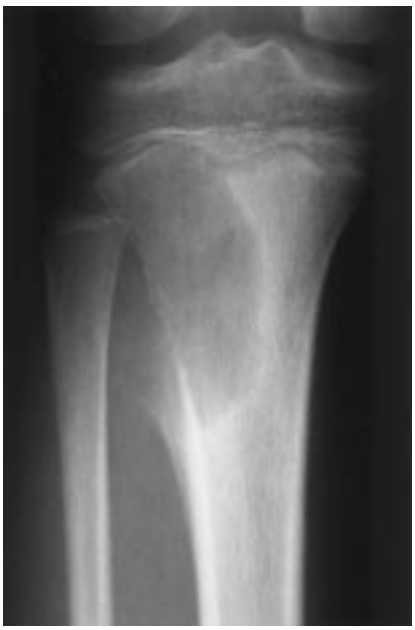

Fig. 6 An aneurysmal bone cyst in the proximal tibial metaphysis of a child. Any aggressive lesion can have this appearance. The lesion has broken through the cortex and raised the periosteum. The periosteum has produced new bone at the distal aspect of the extraosseous component of the tumor.

graphic presentation, and an aneurysmal bone cyst may have all the radiographic characteristics of a malignant neoplasm.

Number of Lesions

The fifth major characteristic that helps in developing a meaningful differential diagnosis is the number of lesions present in the skeleton. Most lesions are solitary. A patient with a few similar lesions most likely has a tumor with a known multifocal variant (e.g., nonossifying fibroma, fibrous dysplasia, eosinophilic granuloma, angioma of bone, or metastatic carcinoma). Metabolic disorders (e.g., hyperparathyroidism with brown tumors), Ollier's disease, myeloma, and metastatic carcinoma are the only radiolucent lesions that present with numerous sites of involvement.

Technetium-99m bone scanning is the most efficient method of screening the entire skeleton for unsuspected bone lesions (Fig. 7). Whenever more than one lesion is seen on the plain radiograph or there is a significant risk of other bone lesions (e.g., metastatic carcinoma, myeloma, eosinophilic granuloma, or Ollier's disease), a Tc-99m bone scan should be obtained.

Subsequent Evaluation

Once the history, physical examination findings, and plain radiographs have been reviewed, a decision can be made regarding additional diagnostic tests. Some patients need only periodic observation, with repeat radiographs and repeated questioning about their symptoms; some can immediately undergo a biopsy; and others should have additional diagnostic tests before a final management decision is made.[4]

The biopsy is the last diagnostic test that should be done.[5] If one is not confident of a short differential diagnosis after a thorough evaluation, biopsy should not be performed just to identify the lesion. It is preferable to refer the patient to a physician who has more experience with neoplasia of bone. The indication for a biopsy is to confirm the clinical diagnosis or to differentiate between the diagnoses on a short list, not to establish the diagnosis in an otherwise confusing clinical situation.

Not all radiolucent lesions warrant a biopsy. Biopsy need not be performed if (1) the clinical presentation is sufficient for a specific diagnosis; (2) the condition does not need surgical treatment; or (3) none of the lesions on the differential diagnosis list calls for surgical treatment. In these instances, observation is recommended. Osteolytic lesions that most commonly meet these criteria are unicameral bone cysts, nonossifying fibromas, and enchondromas.

Periodic follow-up is suggested when biopsy is not performed. A repeat examination and plain radiographs at 6 weeks to 3 months are warranted. Progressive or persistent symptoms or a change in the radiographic appearance will dictate the course of action at that time. When the patient has no symptoms and the radiographic appearance remains unchanged, continued follow-up is appropriate, but the time between follow-up visits can be lengthened.

Occasionally, CT or magnetic resonance (MR) imaging is indicated even when no intervention is planned. One of these studies is indicated if it is suspected that a lesion is inactive but there are subtle plain-radiographic changes that might be depicted more clearly on a CT scan or MR image. For example, endosteal scalloping and subtle periosteal reaction can be seen best on a CT scan. This is especially true of lesions that

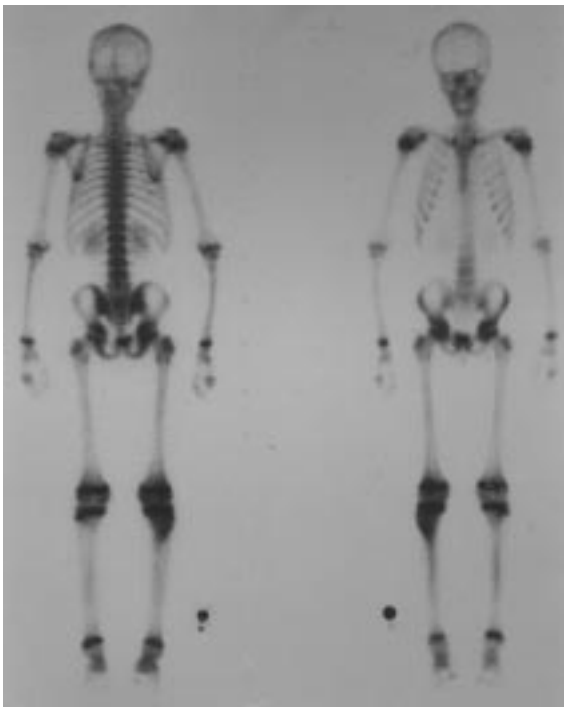

Fig. 7 Whole-body Tc-99m bone scans of the patient whose plain radiograph is shown in Figure 6. The principal use of the bone scan is to screen the skeleton for other lesions. A secondary use is to evaluate a lesion suspected of being benign and inactive. If the lesion shows no increased uptake on the scan, it is reasonable to observe the lesion periodically.

are difficult to see on plain radiographs, such as tumors located in the pelvis, scapula, or spine.

Role of Specific Diagnostic Tools

Laboratory Tests

There are few really useful laboratory tests in the evaluation of a patient with a radiolucent lesion of a long bone. In the case of an older patient with a large radiolucent lesion, serum and urine immunoelectrophoresis (IEP) should be performed to look for the elevated proteins associated with myeloma. The IEP findings can be normal, especially if the patient has a single bone lesion (plasmacytoma) or minimal disease. However, if the radiographic appearance of the lesion is typical of myeloma and the IEP has a monoclonal spike, a biopsy of the lesion is not necessary because the diagnosis can be confirmed with blood tests alone.

The serum calcium concentration and probably the serum inorganic phosphorus level should be determined for almost all adult patients with musculoskeletal complaints and an osteolytic lesion. If a metabolic disturbance is suspected but the calcium and phosphorus levels are within the normal range, renal excretion of calcium and phosphate should be measured, and the parathyroid hormone concentration should be determined. The erythrocyte sedimentation rate (ESR) is commonly determined, but it is nonspecific and of little value.[6]

Whether other laboratory tests should be done is controversial. As a rule, I obtain a screening set of laboratory tests, including a complete blood cell count, IEP, and thyroid screen, as well as determination of the ESR and blood urea nitrogen and serum alkaline phosphatase and calcium levels.

Plain Radiography

Plain radiographs remain the most important radiologic tool used to make a diagnosis or determine a reasonable differential diagnosis of a bone lesion (Fig. 8). Computed tomography and MR imaging can occasionally be useful in rearranging the order of a differential diagnosis list, but it is uncommon for a bone lesion to be diagnosed from a CT or an MR imaging study when the plain radiographs were not diagnostic, except in the sacrum, the pelvis, the scapulae, and the vertebrae, which are not well seen on plain radiographs. At least two radiographic views of the involved bone should be obtained before any other radiologic examination is done.

Plain Tomography

Prior to CT and MR imaging, plain tomography was often used in the evaluation of a bone lesion. This technique has largely been replaced by CT and MR imaging, but it still has a role, albeit limited. Small lesions adjacent to subchondral bone are often difficult to image with CT, and although they can be seen with MR imaging, plain tomography is less expensive and often just as useful (Fig. 9). Minimally displaced fatigue fractures may be seen best on a plain tomogram.

Computed Tomography

Computed tomography has revolutionized the evaluation of bone lesions.[7] With CT scans it is possible to see and measure the density of a lesion, to examine closely the relationship between the lesion and adjacent cancellous and cortical bone, and to see otherwise inapparent calcification or ossification (Fig. 10). Computed tomography has improved our ability to distinguish between lesions that appear similar on plain radio-

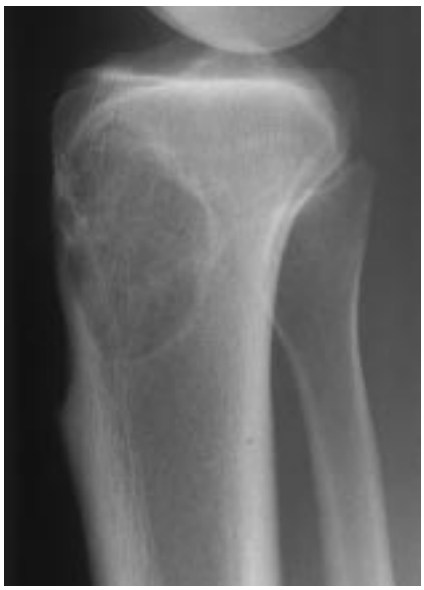

Fig. 8 Lateral plain radiograph of the proximal tibia depicts a radiolucent lesion extending to the subchondral bone. In this 35-year-old patient, the most likely diagnosis is giant cell tumor of bone. In a teenager, one would have to entertain the possibility of a radiolucent osteosarcoma, a large chondroblastoma, or an aneurysmal bone cyst, but these are much less common in this patient's age group. The plain radiograph is the most useful radiographic test in establishing a meaningful differential diagnosis.

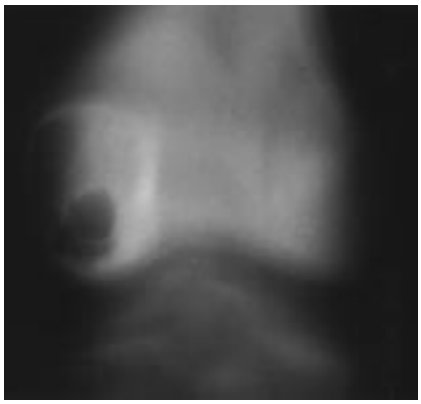

Fig. 9 Plain axial tomogram of the distal femur shown in Figure 3. Plain tomography is used less often than it was before CT scans became available, but in some circumstances, especially in lesions adjacent to a curved surface, it is valuable. The relationship of the lesion to the subchondral bone is well seen on this plain tomogram. Coronal CT scans and MR images will also show the lesion, but both are considerably more expensive.

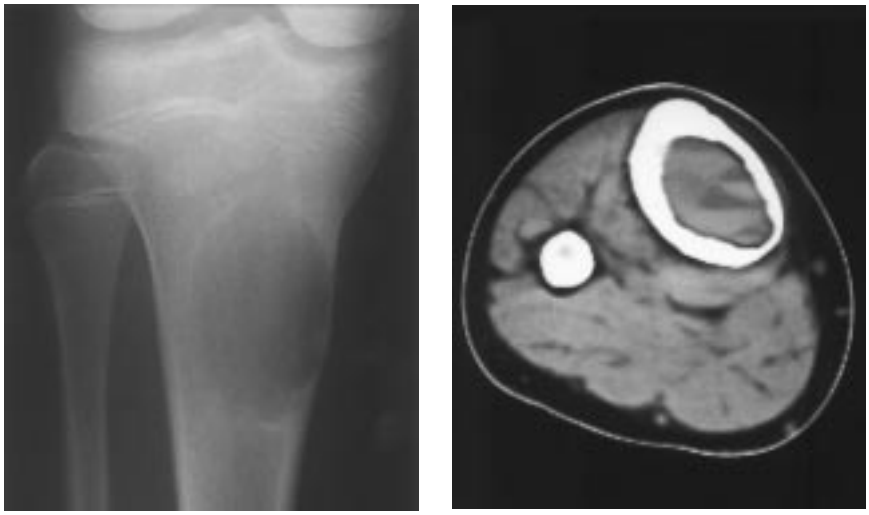

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Fig. 10 **A,** The lesion seen on this plain radiograph is most consistent with a unicameral bone cyst, although it could represent fibrous dysplasia or a nonossifying fibroma. **B,** On this CT scan the radiolucent lesion has the density of fluid (measuring markers are not shown on this photograph), indicating a cystic lesion. The only reasonable diagnosis that would be consistent with the plain radiographic and CT appearance is a unicameral bone cyst.

graphs and frequently provides confirmation of a diagnosis suspected from the plain radiographs so that biopsy is not needed. Computed tomography is best for visualizing minimal amounts of calcification and ossification, for examining lesions within the cortex of the bone, and for seeing the interface between a radiolucent lesion and the cortex.

Magnetic Resonance Imaging

It is possible that MR imaging will replace CT as the radiologic test of choice for all bone lesions (Fig. 11), as it already has for soft-tissue lesions.[8,9] It provides images in three planes and is so sensitive to tissue characteristics that even if there is only a minimal difference, it will be easily seen. Minimal calcification and ossification are not easily seen on MR images, and it can be difficult to appreciate the extent of cortical erosion, especially if the erosion is not completely through the bone. However, all other characteristics are more easily seen with MR imaging.

Arteriography

Arteriography is rarely indicated in the evaluation of a bone lesion. An arteriogram should be obtained only when an extremely vascular lesion is suspected (e.g., metastatic renal cell carcinoma) and preoperative embolization is planned.

Radionuclide Bone Scanning

Technetium-99m bone scanning is the most useful of the radionuclide studies available for the evaluation of bone lesions.[10] The uncommon radiolucent lesion of bone with normal uptake on a Tc-99m bone scan (neither increased nor decreased activity) is unlikely to be active, and observation is almost always the appropriate treatment. Myeloma and eosinophilic granuloma are the two radiolucent lesions of bone that have a significant incidence of false-negative bone scans, but the incidence of false-negative scans is no more than 25%. The most useful quality of Tc-99m bone scanning is its ability to reveal occult lesions within the skeletal system. All patients who are at risk of having more than one lesion should undergo this study. Gallium bone scans have been advocated, but they have limited use in the evaluation of a patient with a radiolucent bone lesion.

Diagnostic Algorithm

An algorithm for the evaluation of a patient with a radiolucent lesion in an extremity can be constructed (Fig. 12). On the basis of the patient's age and symptoms and the radiographic appearance, the lesion can be placed into one of four

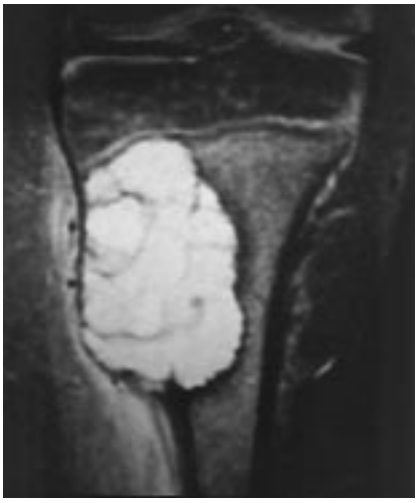


Fig. 11 Coronal T2-weighted MR image of an aneurysmal bone cyst. After plain radiography, MR imaging has become the most useful radiologic test for evaluation of bone and soft-tissue lesions. Anatomic extent can be seen in three planes, and sometimes tissue type is suggested by the signal characteristics of the lesion.

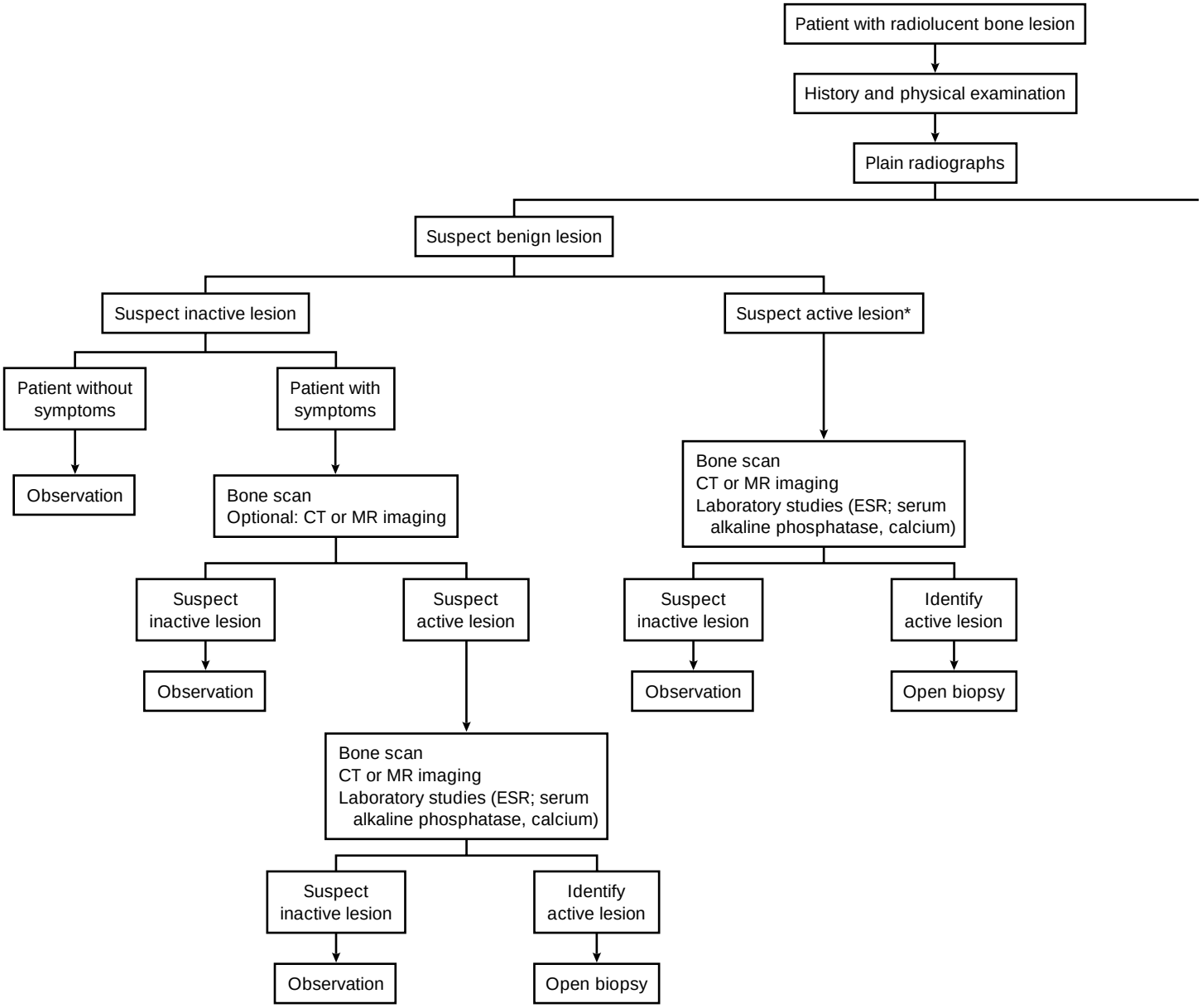
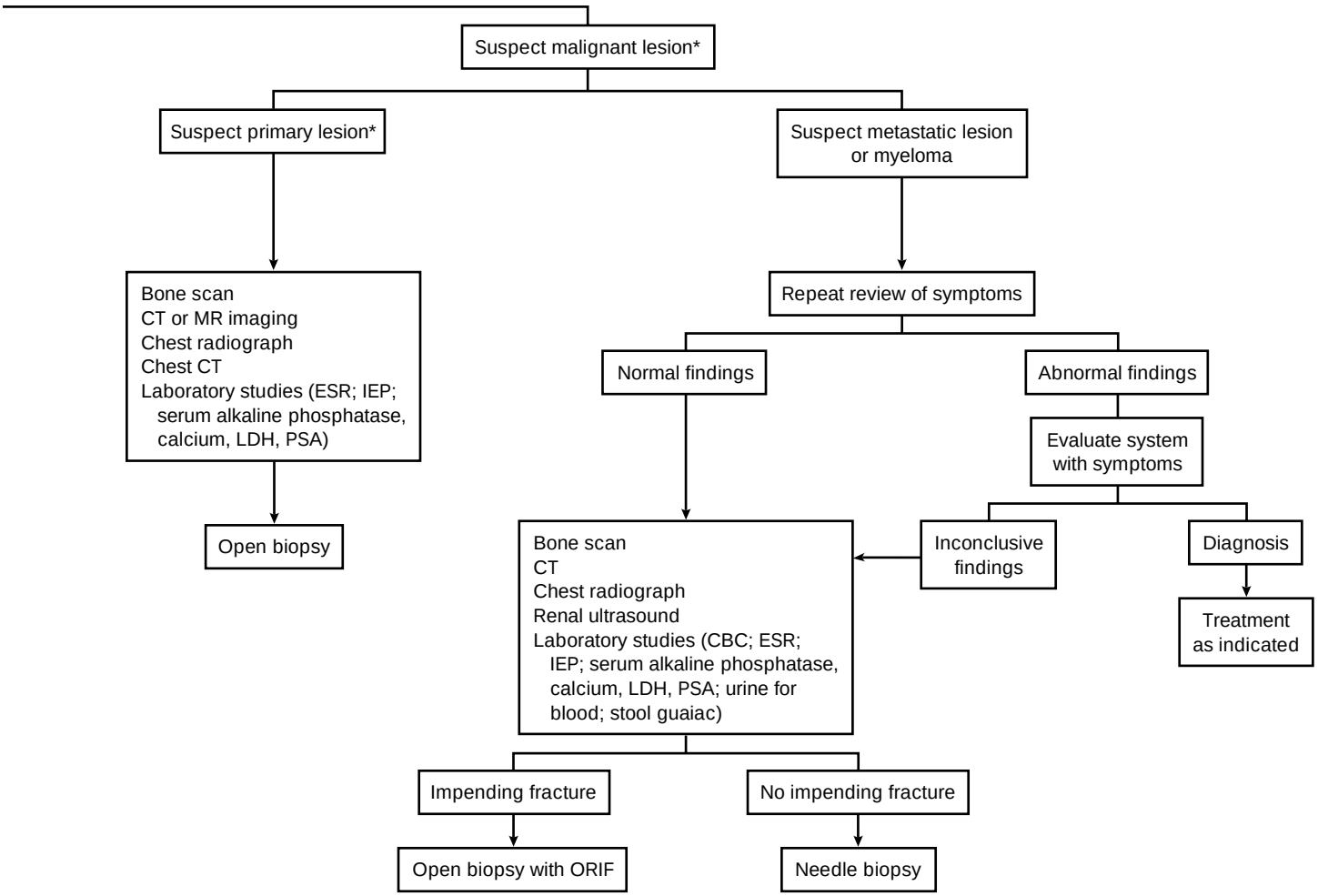


Fig. 12 Algorithm for the evaluation of a patient with a radiolucent lesion of an extremity. Asterisk indicates a point at which referral is indicated if the evaluating physician is not prepared to treat the patient, Abbreviations: CBC = complete blood cell count; LDH = lactate dehydrogenase; ORIF = open reduction and internal fixation; PSA = prostate-specific antigen.

categories: (1) suspected of being benign and inactive; (2) suspected of being benign and active; (3) suspected of being a primary malignant lesion; or (4) suspected of being a myeloma or a metastatic malignant tumor.

Those lesions suspected of being benign and inactive should be evaluated further only if the patient is having symptoms, and biopsy should be performed only if the subsequent evaluation suggests that they are actually active lesions. A patient with a lesion that is suspected of being benign and active should undergo a technetium bone scan, CT or MR imaging, and a few simple blood tests. A biopsy can be done after these tests if the lesion is determined to be one that requires



treatment. The surgeon should be prepared to treat on the basis of the findings from a frozen section, which necessitates consultation with the pathologist before the biopsy so that the pathologist can be prepared.

Patients with bone lesions that are thought to be primary malignant tumors need the most thorough evaluation before biopsy because there is the greatest potential of biopsy-related adverse effects in this group. The biopsy should always be carefully planned. A patient with an apparently metastatic carcinoma or myeloma can undergo needle biopsy unless there is an impending fracture, in which case an open biopsy can be done while an internal fixation device is applied.

Referral is indicated whenever the physician suspects that he or she may ultimately be uncomfortable managing the patient's lesions. One of the critical lessons learned in musculoskeletal tumors has been that the physician who performs the biopsy should be the physician who directs the definitive treatment.

Summary

Although a tissue-specific diagnosis is usually eventually necessary when treating a patient with a radiolucent bone lesion, biopsy is not the first thing that should be done when a lesion is found. The pathologist often needs more clinical and radiologic information before a specific diagnosis can be made. Further staging of the lesion increases the possibility that the definitive treatment can be done at the same time as the diagnostic biopsy. Completing the evaluation before biopsy allows better planning and thereby lessens the effect of the biopsy on a subsequent resection.

It is not necessary to perform all possible diagnostic tests on every radiolucent lesion seen. Often, only a history, physical examination, and plain radiographs are necessary. When additional tests are requested, they should be obtained to answer specific questions, and it helps the radiologist if those questions are made clear. Once a differential diagnosis list of not more than four or five diagnoses has been made, it can be decided whether a biopsy is necessary and, if so, how to perform it.

In general, any lesion that cannot be confidently placed in the category of benign, inactive lesions should undergo biopsy. Benign, inactive lesions can be followed with serial examinations and radiographs. Lesions that are suspected of being benign and active or malignant and that are treated without preoperative irradiation or chemotherapy should undergo biopsy and be definitively treated at the same operative procedure. Only those lesions suspected of being malignant and in need of preoperative irradiation or chemotherapy should undergo biopsy without immediate definitive treatment.

A systematic evaluation of radiolucent bone lesions will provide the patient with the best treatment. Biopsy, when necessary, should be the last step of the evaluation.

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