Lytic Lesions of Bone: A Histopathological and Radiological Correlative Study

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Abstract

In this retrospective study, the importance of cooperation between the surgeon, the radiologist, and the pathologist in diagnosing a lesion of bone was highlighted. (1) To classify lytic lesions of bone according to the histopathological diagnosis. (2) To study the clinical as well as the radiological findings. (3) To correlate the radiological diagnosis with the histopathological diagnosis. (4) To measure the agreement between the radiological and histopathological diagnosis on specific lesions. The radiological characteristics of lytic lesions were assessed based on the Lodwick system and the type of periosteal reaction present. These lytic lesions of bone were histopathologically assessed, and the radiological diagnosis was correlated with the histopathological diagnosis. The agreement between the radiological and histopathological diagnosis on specific lesions was measured statistically and compared with similar other studies conducted by different authors. Of the 212 cases studied, 80% cases showed radiological and pathological correlation. The radiologic-pathologic correlation in our study was low compared to other studies in the cases of tumor like conditions and primary bone tumors. In all the other cases correlation percentage remained the same.

Key Words: Lytic Lesions, Bone, Radiology, Histopathology, Lodwick Classification, World Health Organization Classification


Introduction

A lytic lesion of bone is defined as the destruction of an area of bone, due to a disease process. It can be due to benign tumors, malignant tumors, infections, metastasis to bone, and numerous other tumor like conditions. Many of the bone lesions look similar and are nearly impossible to differentiate by plain film alone. A concerted multidisciplinary approach including clinical, radiological and histopathology in needed in the early diagnosis of lytic bone lesions. Conventional X-rays are always the initial method of detection and localization of a tumor.

A definite pathologic interpretation should never be rendered if radiological information is not available. Furthermore, after a biopsy the radiologic features may get altered. Hence, imaging should be done before attempting a bone biopsy. This study was undertaken with the objectives to classify the lytic bone lesions according to the histopathological diagnosis and to correlate the radiological diagnosis with the histological diagnosis.

Objectives

1. To classify lytic lesions of bone according to the histopathological diagnosis
2. To study the clinical as well as the radiological findings
3. To correlate the radiological diagnosis with the histopathological diagnosis
4. To measure the agreement between the radiological and histopathological diagnosis on specific lesions.

Methods

Materials for this study were obtained from Department of Orthopaedics, Medical College, Thiruvananthapuram, Kerala, India. This retrospective study was conducted for a period of 2-year starting from May 2005 to December 2007. The study was started after obtaining the clearance from the Ethical Committee of our institute. Bone biopsies, amputation specimens with the relevant clinical findings, X-ray findings, computed tomography, and magnetic resonance imaging (MRI) findings, clinical and radiological differential diagnoses were recorded from the patient request form received in our Pathology Department. Further details if needed any were collected from the orthopedicians. X-rays were collected and discussed with consultants of radiodiagnosis. Radiological parameters, such as site of involvement, pattern of destruction, margins, expansion of cortical shell, sclerotic margin, periosteal reaction, and soft tissue extension, were studied to obtain a definite impression. The radiological features were assessed based on the Lodwicks method of classification.

Both amputation specimens as well as image-guided biopsy samples were studied. The specimens received were fixed in 10% formalin, grossed, processed and sections taken from paraffin embedded tissues. The sections were stained with routine hematoxylin and eosin stains. Immunohistochemical stains
were done if indicated. For bone tumors and tumor-like lesions classification and histopathological findings proposed by the World Health Organization (WHO) was adopted. Tumors were divided into benign and malignant according to WHO classification. Our final histopathological diagnoses were correlated with the radiological differential diagnoses. The measurement of agreement was calculated based on Cohen’s Kappa value.

Results

A total of 212 cases were studied with histopathological follow-up. Lytic lesions of bone were classified into five broad categories. Among the 212 cases, 64 were inflammatory conditions, 21 were tumor-like lesions, 44 were benign tumors, 43 were primary bone malignancies, and 40 were secondary bone malignancies (Figure 1).

The most frequent age group affected by lytic lesions of bone in our study was 10-19 years (Figure 2).

The most common lesion in this age group was osteosarcoma. 124 cases were male and 88 were female (Figure 3).

Except fibrous dysplasia, chondrosarcoma, solitary bone cyst, and multiple myeloma all other lesions showed male predominance. The most frequent presenting complaints were pain and swelling (194 and 87 cases), respectively. All the cases of metastases presented with a clinical history of pathological fracture. Most of the inflammatory conditions presented with fever. In our study, the most frequent radiological appearance encountered was lytic lesion with well-defined margin, which was detected in 113 patients. 95 cases showed lytic lesion with ill-defined margins. Matrix calcification was seen in only one out of five chondrosarcomas. 20 out of 33 cases of giant cell tumor showed typical soap bubble appearance in radiology. Tumors with soft tissue extension were clearly delineated in MRI. A few representative lesions with their imaging findings and corresponding histopathological features are shown in Figures 4 and 5.

The most frequent aspirated site was a femur. Among the 212 cases of lytic lesions of bone, 171 showed pathologic–radiologic correlation (80.66%). In 5 cases, diagnosis was inconclusive due to inadequate material. Negative correlation
Lilarani Vijayaraghavan et al. Lytic Bone Lesions

with radiological findings was seen in 38 cases. The percentage of lytic lesions showing histopathological and radiological correlation is given in Tables 1 and 2.

Discussion

Lytic lesions of bone constitute a major proportion of orthopedic specimens in our department. The clinical manifestations of bone lesions are often nonspecific, and they are often mistaken for osteomyelitis or trauma. The appropriateness criteria established by the American College of Radiology, dictate that for the initial evaluation of a bone lesion radiographs should be the first line of investigation. If the radiograph shows normal or indeterminate findings, additional imaging studies are frequently required.

In 1958, Jaffe and Hydson pointed out the importance of cooperation between the surgeon, the radiologist and the pathologist in diagnosing a lesion of bone. Precise radiological differential diagnosis of bone sarcomas is uncertain beyond indicating the presence of a tumor and biopsy remains the ultimate diagnostic method of choice. Unlike in lesions of other organ systems, the bone pathologist must have a basic idea regarding the appearances of all bone lesions in imaging. Hence, a proper correlation between imaging and histopathological findings is often the key to appropriate diagnosis.

Our study as well as similar studies by other authors pointed out that results of a percutaneous biopsy can be extremely effective and accurate as total excision of the tumor. Unusual histologic features as well as rare entities always cause diagnostic difficulty whether it is biopsy or complete excision. They will show variable features in imaging also based on the different and unusual tissue elements present. In such cases, the pathologist must know whether the radiological pattern is also variable throughout.

In our study, most of the tumor like conditions, metastases, lymphomas, myelomas and rare tumors like angiosarcomas were difficult to correlate between histopathology and radiology as the imaging features were overlapping. Yamaguchi et al. in 1996 studied 52 cases of metastatic bone tumors are usually classified pointed out that into osteolytic, osteoblastic mixed, and intertrabecular corresponding to their radiological patterns Radiographs and bone scans often fail to show metastatic lesions especially those with the intertrabecular pattern. Murphey et al. pointed out that it is not possible to differentiate between hemangioendothelioma, hemangiopericytoma, and angiosarcoma radiologically. These lesions are predominantly lytic and may reveal a honeycomb or hole within hole appearance similar to that of hemangioma. Many of these tumors are difficult to diagnose by routine histopathology alone. Further immunohistochemical markers, hematological

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Total number of cases</th>
<th>Positive correlation Number (%)</th>
<th>Inadequate sample</th>
<th>Negative correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflammatory condition</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chronic osteomyelitis</td>
<td>44</td>
<td>40 (90.91)</td>
<td>-</td>
<td>4</td>
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<tr>
<td>Tuberculosis</td>
<td>20</td>
<td>17 (85)</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Tumor like conditions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aneurysmal bone cyst</td>
<td>7</td>
<td>5 (71.43)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Nonossifying fibroma</td>
<td>1</td>
<td>1 (100)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fibrous dysplasia</td>
<td>5</td>
<td>5 (100)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intraosseous ganglion</td>
<td>1</td>
<td>0 (0)</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Intraosseous epidermal cyst</td>
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<td>0 (0)</td>
<td>-</td>
<td>1</td>
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<tr>
<td>Eosinophilic granuloma</td>
<td>1</td>
<td>0 (0)</td>
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<td>1</td>
</tr>
<tr>
<td>Solitary bone cyst</td>
<td>4</td>
<td>3 (75)</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Brown tumor of hyperparathyroidism</td>
<td>1</td>
<td>0 (0)</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 5: (a) Bone marrow granuloma with Langhans giant cell and epithelioid cells; (b) adamantinoma with epithelial and spindle cell elements; (c) spindle cell adamantinoma with sheets of spindle cells; (d) eosinophilic granuloma with eosinophils, macrophages with grooved nuclei and lymphocytes; (e) giant cell tumor with osteoclast like giant cells and plump stromal spindle cells; (f) osteosarcoma with pleomorphic malignant spindle cells and intervening malignant osteoid; (g) Ewings sarcoma with small round cells in sheets; (h) renal cell carcinoma with sheets of clear cells and highly vascular stroma

Table 1: Histopathological – Radiological correlation
workup, and molecular genetic studies are needed to arrive at a final diagnosis.

Whereas, despite unusual histological forms of adamantinoma and different types of osteosarcoma positive correlation were possible as imaging findings and location in such cases were typical. The unusual spindle cell variant of adamantinoma case in our study was sent to two other higher centers for further confirmation despite the imaging features being classical of adamantinoma. The spindle cell variant of adamantinoma can be misdiagnosed as osteofibrous dysplasia, synovial sarcoma, fibroblastic osteosarcoma, fibrosarcoma. The histological variants of adamantinoma can be better delineated by immunohistochemistry for cytokeratin.7

Conclusions

The results of our study were compared with many other studies similar conducted by different authors. The radiologic-pathologic correlation in our study was low compared to other studies in cases of tumor like conditions such as intraosseous ganglion, eosinophilic granuloma, epidermoid cyst and primary malignancies like Ewing’s sarcoma, chondrosarcoma, and multiple myeloma.6-13 In all the other lytic lesions, correlation reports were the same. The reasons for low positive correlation in these lesions may be due to the less number of cases obtained, short period of follow up and because of the nonspecific radiological findings obtained in these lesions.

Limitations

Few cases in this series were reported inconclusive due to inadequate sampling. A few cases in our study showed low radiologic-pathologic correlation. Yet another limitation in our study was the lack of availability of certain immunomarkers as well as molecular genetic tests to confirm the diagnosis of a few tumors. For these cases we had to depend on other higher centres within and outside India to confirm our diagnosis.

Abbreviations

WHO: World Health Organization
CT: Computed tomographic imaging
MRI: Magnetic resonance imaging

End Note

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Conflict of Interest

None declared.
Acknowledgment

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