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Pathological Fracture Assessment in Metastasis Tumor

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Introduction

Pathologic fractures represented a developing concern in the field of outer orthopedic oncology. The frequency of pathologic fractures is rising, basically because of further management and treatment of metastatic cancer prompting delayed endurance. In this way, finding of the causative pathology is of principal significance in the effective treatment of a pathologic fracture and is an essential for continuing with increased life expectancy . Pathologic fracture happen through areas of debilitated bone credited to either primary bone lesion or benign tumor, metastasis, or fundamental metabolic anomalies, with the normal component being adjusted skeletal biomechanics optional to pathologic bone. [(1)]

An impending fracture is a biomechanically debilitated area of bone that has an inclination to break with undeniably less power than would be expected for the typical unresolved issue due to the pathophysiology of the hidden injury. For example, ordinary weight-bearing through a pathologic lesion could steer the results towards a pathologic fracture due to the biomechanical delicacy of the encompassing hard bone engineering. Impending fracture might require prophylactic fixation , meaning intervention by surgical before a crack occasion for enlarging intrinsically powerless bone and forestalling future disappointment. [(2)]

There are two classification systems used for approaching pathologic fractures:

Harrington criteria was first depicted by Harrington et al. in 1980 to decide when must be apply surgical intervention as internal fixation . Harrington measures depends on four boundaries: lesion includes over half of cortical bone, the lesion is more prominent than 2.5 cm, presence of pain following radiotherapy, and fracture of the lesser trochanter. There are critical limits to this evaluating system as it just applies to the proximal femur and doesn't represent specific tumor pathology. [(3)]

Mirel criteria was first portrayed by Mirel in 1989 and has been extrapolated as a calculation for prophylactic fixation. The review was a review investigation of 78 injuries of long bones that had gone through radiation treatment without prophylactic interior fixation .This scoring system has a limit of 12 points, with in excess of 8 focuses demonstrating the requirement for prophylactic fixation [(4)].

There are five perceived carcinomas that most often metastasize to bone, including lung, breast , thyroid, renal, and prostate. The most well-known locales for skeletal metastasis incorporate the spine, proximal femur, and pelvis. [(5)]

Around 1.7 million individuals are determined to have malignant growth every year in the United States. Metastatic illness of the bone will influence roughly 5% of these patients, shifting in light of tumor type. [(6)]

Roughly 8% of these patients will support a pathologic fracture, in view of a review examination by Higinbotham on 1,800 patients with metastatic malignant growth to bone. [(7)]

Osteolytic lesion of bone happen result to growth prompted enactment of osteoclasts by upregulation of RANK ligand. [(8)] Osteoblastic lesion happen reason to endothelin 1, which is emitted by the tumor. Pathologic fracture happen through these lesion due to adjusted biomechanics. [(9)]

Histology differs in light of the wellspring of the original lesion . As a general rule, tumors are evaluated as low, intermediate , or high grade. The grade of the lesion depend on the level of cell atypia, pleomorphism, mitosis, matrix structure formation , and Lower-grade tumors are naturally less forceful, while higher-grade tumors are more forceful and are subsequently more able to additional spread and metastasis. [(10)]

At the point when a pathologic fracture is distinguished through a lesion of obscure beginning, a complete workup should be led to recognize the etiology and phase of the disease. [1]

Lab examination ought to incorporate a total blood count, thorough metabolic analysis (with extraordinary consideration regarding serum calcium and soluble phosphatase), prothrombin/INR, activated partial thromboplastin, erythrocyte sedimentation rate, urinalysis, urinary protein electrophoresis, and serum protein electrophoresis. Tumor explicit markers, including prostate-specific antigen (PSA) and carcinoembryonic antigen (CEA), and so on, may likewise be thought of. Lab anomalies might exist auxiliary to threat and may clarify the wellspring of tumor. For instance, a urinalysis might give some knowledge into the origins of pathology [11].

Assuming that hematuria is available, renal cell or urothelial carcinoma ought to be thought of. In the event that Bence-Jones proteins are available, multiple myeloma is possible. Pregnancy tests ought to likewise be acquired in ladies of child bearing age preceding imaging. [1]

Radiological examination of pathologic fractures starts with radiographs of the fracture site and the elaborate bone completely. A plain radiograph is the absolute most significant imaging methodology and gives the most data about pathologic tumors . There are various forceful elements reminiscent of a pathologic lesion that might be recognized on X-beam, which include: lesion breadth > 5 cm, cortical interference, periosteal response, and related pathologic fractures. A chest radiograph ought to likewise be gotten. Processed tomography (CT) of the chest, abdomen , and pelvis with oral and intravenous contrast ought to be obtained for determining in which tumor stage place . Entire body bone scintigraphy ought to likewise be gotten. Bone scans are especially helpful for distinguishing osteoblastic action. In the event that lab examination has affirmed the determination of multiple myeloma, a skeletal review might be obtained in lieu of a bone scan, which could neglect to recognize the level of osteolysis present in different locales. This thorough technique is the highest quality level and is fruitful in distinguishing the beginning of the lesion in 85% of cases. [12]

Advanced imaging of the bones might be incorporated for preoperative preparation or on the other hand in the event that there is a worry for primary bone sarcoma. Different causes to get CT imaging are to assess the level of osteolysis by the 3- dimension technique of the lesion, especially in regions with complex systems like the pelvis. considering magnetic resonance imaging (MRI) used for assessment of the level of soft tissue contribution as well as neurovascular tissues. Consider mammography for demonstrated patients when an essential breast carcinoma can't be prohibited. Positron emission tomography is turning out to be more well known and is profoundly delicate for distinguishing infections and tumors.. The explicitness of positron emission tomography alone is just 30%, however it increments to half when joined with figured tomography. [13]

A biopsy is performed following the finish of laboratory and radiological investigation.There are six perceived causes to finish an staging workup before biopsy. [14]

Material and methods

This research is retrospective cohort study which assisted pathological fracture in metastatic tumor in bones in national cancer institute in misurata from 9/2020 to 3/2021 and total number of cases was 25 patients

Inclusion criteria: Age of patient was between 35 and 80 Pathological fracture that caused by tumor

Exclusion criteria: any patient has concomitant bone diseases with bone tumor.

Results

Table (1) Demographic and clinical characteristic of studied patients

Characteristic	n (%)	Test	P-value
Age			
≤ 60	11 (42.3%)	0.62	0.433
> 60	15 (57.7%)	3.85	0.050
Sex			

Female	18 (69.2%)		
Male	8 (30.8%)		
Diagnosis			
Breast	18 (69.2%)	3.85	0.050
Prostate.	6 (23%)		
Parotid	1(3.9%)		
multiple myeloma.	1(3.9%)		
Histo		34.38	0.000
IDC	17 (65.4%)		
DCI	2 (7.7%)		
AAC	4 (15.4%)		
Non ACC	2 (7.7%)		
Plasmocyte	1 (3.8%)		
Clinical presentation		0.15	0.695
pain	14 (53.8%)		
fracture	12 (46.2%)		
Type lesion		7.00	0.030
Blastic	15 (57.7%)		
Mixed	6 (23.1%)		
lytic	5 (19.2%)		
location		13.62	0.009
humerus	6 (23.1%)		
radius	4 (15.4%)		
femur.	12 (46.2%)		
spine	3 (11.5%)		
tibia	1 (3.8%)		
Site		16.69	0.002
diaphgsel	2 (7.7%)		
Metaphyseal	12 (46.2%)		
Neck of femur	3 (11.5%)		
head of femur	1 (3.8%)		
Epiphyseal	8 (30.8%)		
Size		7.00	0.030
<1/3	6 (23.1%)		
1/3 -- 2/3	5 (19.2%)		
> 2/3	15 (57.7%)		

In this study a number of cases were calculated: about 26 cases were presented with metastatic pathological fracture ,15 cases were above 60 years old,18 cases female and 8 case male were presented.

The main complaints of most patients are pain (impending fracture) and 12 patients presented with fracture.

Most type of tumor was breast cancer (invasive ductal carcinoma in 17 case) and was presented with 18 cases 69.2% from total numbers, the second type of tumor was in male 6 case of prostate cancer 23.1% from total numbers.

In our research we found most site of pathological fracture was happened in femur 12 case (46.2%) and second place was in humerus 6 cases (23.1%)

Where in metaphyseal bone location was most region metastatic and fracture did then following in epiphyseal the most second region as 46.2% and 30.8% from total number la of cases respectively

The usual tumor lesion are mixed or lytic or mixed histopathologically ,in our study founded Blastic lesion most comebacks then mixed and lastly lytic as 57.7%, 23.1%,19.2% respectively.

Discussion

Bone is the third most frequent site of metastasis, behind lung and liver. Prostate and breast cancer (BC) are responsible for the majority of the skeletal metastases (up to 70%).(18)This reflects both the high incidence and relatively long clinical course of these tumors. The overall incidence of bone metastasis is not known. [(15)] The relative incidence of bone metastasis by type of tumor, in patients with advanced metastatic disease, is: 65-75% in BC; 65-75% in prostate; 60% in thyroid; 30-40% in lung; 40% in bladder; 20-25% in renal cell carcinoma and 14-45% in melanoma. [(16)]

Andrea Angelini et al ,Between 2016 and 2017, 40 patients with pathologic fracture (29 cases) or impending fracture according to the Mirels score (11 cases) of the proximal femur, were treated in our Institute and prospectively collected. There were 29 females (72.5%) and 11 males (27.5%), with a mean age at diagnosis of the metastasis of 63.6 years (range 35 to 92 years).[(17)]

In our study we found most conmen type of breast cancer That cause of metastatic pathological fracture is invasive ductal carcinoma where the count 17 cases from 18 cases that caused By breast cancer While in other study, Sunjay Jain, Charlotte Fisher, ….etc they have examined the clinical records of 1238 patients with operable breast cancer to identify the sites of metastatic disease. infiltrating lobular carcinoma (ILC) more commonly metastasised to the bone marrow ($P < 0.01$). Bone involvement as the initial presentation of distant metastatic disease occurred in over 50% of women with ILC, significantly more commonly than in those with IDC (34%, $P < 0.01$). [(18)]

In our study most come site of metastatic pathological fracture were in femur and it is about 12 cases 46.2% where in study in other region also femur is most commen region ,Rodney K. Beals MD, Grant D……etc etal founded that Three hundred and thirty-eight patients with breast cancer have been reviewed. About half of the patients with skeletal metastases developed femoral involvement, usually bilateral [(19)]

Bone metastasis are classified as osteolytic, osteoblastic or mixed, according to the primary mechanism of interference with normal bone remodeling:

Osteolytic, characterized by destruction of normal bone, present in multiple myeloma (MM), renal cell carcinoma, melanoma, non-small cell lung cancer, non-hodgkin lymphoma, thyroid cancer or langerhans-cell histiocytosis. [(20)]

The great majority of BC produces osteolytic metastases, Osteoblastic (or sclerotic), characterized by deposition of new bone, present in prostate cancer, carcinoid, small cell lung cancer, Hodgkin lymphoma or medulloblastoma, Mixed, if a patient has both osteolytic and osteoblastic lesions, or if an individual metastasis has both osteolytic and osteoblastic components, present in BC, gastrointestinal cancers and squamous cancers. Although BC gives origin predominantly to osteolytic lesions, 15-20% of women have osteoblastic lesions, or both type of lesions [(21)]

In our study we found the most common type of lesion is blastic lesion where 15 cases (57.7%) are Blastic lesions 6 cases (23.1%) was mixed lesion and 5 cases (19.2%) was lytic lesion.

Conclusion

At this research when assessment of pathological fracture in metastatic tumor Depends on a lots of factors , the most one type of metastatic lesion and histopathological ,location ,age of patient was also risky reason where osteoporosis play role in old patient , size of lesion should not be necessary to be large to be risky while small lesions that less than ⅓ of width may cause risky according to miral criteria.

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