شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

INTRODUCTION

Magnetic resonance imaging (MRI) is is an imaging modality that uses non-ionizing radiation to create useful diagnostic images it's favored modality for evaluation of skeletal tumors because of its soft tissue contrast, multi-planar imaging capability, and lack of radiation exposure. MRI is valuable for lesion detection, characterization, diagnosis, and staging **(Walker et al., 2011).**

The specificity of MRI can be raised by administrating IV contrast mainly to identify soft tissue masses, tumor necrosis and margins of the tumor, yet, this technique could not be performed in patients with impaired renal function or poor venous access **(Subhawong et al., 2014).**

DWI was added to MRI techniques as it increases sensitivity and specificity by detecting the micro-diffusion changes of water into intra and extracellular spaces **(Tingting et al., 2014).**

Diffusion signal intensity relies on the Brownian motion or self-diffusion of water molecules at a microscopic level within tissues. Extracellular water has more freedom in motion than intracellular water, which is limited in its motion by intracellular organelles. Water molecular diffusion in acquired diffusion-weighted imaging (DWI) sequences is therefore reflective of tissue cellularity. Tissue diffusivity is often termed the apparent diffusion coefficient (ADC) and is usually expressed in units as μm2/s or ×10−3mm2/s **(Khoo et al., 2011).**

The degree of restriction to water diffusion in biologic tissue is inversely correlated to the tissue cellularity and the integrity of cell membranes, the motion of water molecules is more restricted in tissues with a high cellular density associated with numerous intact cell membranes (e.g., tumor tissue). The lipophilic cell membranes act as barriers to motion of water molecules in both the extracellular and intracellular spaces. By contrast, in areas of low cellularity or where the cellular membrane has been breached, the motion of water molecules is less restricted. A less cellular environment provides a larger extracellular space for diffusion of water molecules **(Subhawong et al., 2014).**

As with lesions of any other organ system, many bone tumors are easy to diagnose, but a few will be difficult. The plain film is the most important image which is helpful in diagnosis. Bone tumors are classified depending on the kind of matrix produced or the cytology of the tumor cells in cases without matrix production, the cases are then divided into benign and malignant counterparts. The staging system uses two criteria: the histological grade and extent of the tumor **(Araujo et al., 2015).**

Bone tumors consist of a wide variety of different neoplasms. These tumors vary in terms of incidence, clinical presentation and require a diverse array of therapeutic options. The incidence of benign bone tumors is debated due to their often asymptomatic presentation and difficulty in detection **(Eyesan et al., 2011).**

Overall, 8 different types can be distinguished, osteochondroma, osteoma, osteoid osteoma, osteoblastoma, giant cell tumor, aneurysmal bone cyst, fibrous dysplasia and enchondroma. These tumors can be roughly divided into categories based on their cell type: bone-forming, cartilage-forming, as well as connective tissue and vascular **(Woertler, 2003).**

Malignant bone tumors, i.e., osteosarcoma and Ewing's sarcoma are more frequent in children and adolescents **(Grimer et al., 2010),** While Sarcomas account for approximately 1 % of all adult cancers **(Eisenhart-Rothe et al., 2011).**

As patients with cancer live longer, the incidence of metastatic bone disease is increasing Skeletal metastases are the final common pathway of many malignancies and can result in skeletal related events (SREs) such as pathological fracture, spinal cord compression, bone pain, and hypercalcemia **(Weber et al., 2006).**

In fact, bone is the third most common site of metastatic malignancy after lung and liver the most common cancers to metastasize to bone are breast, prostate, thyroid, lung, and kidney. In autopsy studies the incidence in breast and prostate cancers is as high as 73 % **(Yu HH et al., 2012).**

Lytic metastases are more likely to fracture. The most common sites of bone metastases are spine, pelvis, femur, and rib **(Heymann, 2009).**

So we need to evaluate the important role of diffusion sequence in MRI protocol done to patients with bone tumor or tumor like lesions in our study.

PROTOCOL OF THE STUDY

What is already known on this subject?

What does this study add?

MRI is a diagnostic mainstay for detection and differentiation of bone tumors. However, a projection regarding the biological dignity of lesions is based on standard MRI sequences remains difficult and uncertain.

This study was undertaken to analyze whether diffusion weighted MRI (DWI) can distinguish between benign & malignant bone tumors.

Aim of the work:

The aim of this study is to evaluate the diagnostic performance of quantitative parameters derived from diffusion–weighted imaging (DWI) in differentiating benign and malignant bone tumors.

Research question:

Is diffusion-weighted MRI useful and effective in differentiating benign from malignant bone Lesions?

Research Hypothesis:

Null Hypothesis: Diffusion-weighted MRI has no role in differentiating benign from malignant bone lesions.

Alternative Hypothesis: Diffusion-weighted MRI has a role in differentiating benign from malignant bone lesions.

Patients and Methods:

Study Design: Comparative Cross Sectional Study.
Sample Size: 32

Study Setting: Ain Shams University Hospitals, outpatient clinics and private centers.

- a. Full detailed history
- b. Checking for contraindication of MRI.
- c. Written consent from the patients to participate in this study according to ethical committee approval.
- d. Detailed explanation of imaging procedure.
- e. Pathological reports of the tumor's nature.

The selected patients will fulfill the following criteria:

- Patients selected on clinical bases suggesting presence of bony tumors or tumor like lesions.
- No Age prediction.

Exclusion criteria:

- Patients with cardiac pacemakers.
- Patients with cochlear implants.
- Contrast injection in pregnancy.
- Contrast injection in chronic renal failure patients.

Sample size calculation:

Assuming an effect size of 0.9 in ADC parameter diffusion DWI in malignant compared to benign bone lesion, a sample size of 16 in each group is enough to detect such effect, if two at 0.05 alpha end & 0.80 power of the test.

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BONE TUMORS

Primary bone tumors are relatively uncommon Although the incidence of benign bone tumors is higher than the incidence of malignant bone tumors, it is likely that benign lesions are underestimated because they often are asymptomatic and not clinically recognized. Primary malignant bone tumors are rare and represent a difficult category of tumors for appropriate recognition, classification and treatment. In addition, primary bone tumors are outnumbered by metastases from carcinomas, melanoma, or hematologic malignancies, such as plasmacytoma **(Franchi, 2012).**

The radiographic approach to bone tumors consists of analyzing a certain lesion in an organized manner, paying attention to specific radiographic features such as location, margins and transition zones, periosteal reaction patterns, mineralization, lesion size, and whether or not soft tissue components are present Patient age and determining whether the lesion(s) is single or multiple are fundamental clinical data for diagnosis. Some types of tumors have a predilection for certain age groups. With the exception of multiple myeloma, primary malignant bone tumors are typically solitary lesions, whereas benign tumors tend to present as multiple lesions **(André, 2016).**

Table (1): WHO classification of soft tissue and bone tumors

CARTILAGE TUMOURS	HAEMATOPOIETIC TUMOURS
Osteochondroma Chondroma Enchondroma Multiple chondromatosis Chondroblastoma Chondromyxoid fibroma Central, primary, and secondary Peripheral Dedifferentiated Clear cell	Plasma cell myeloma
	Malignant lymphoma, NOS
	GIANT CELL TUMOUR
	Giant cell tumor Malignancy in giant cell tumor
	NOTOCHORDAL TUMOURS
	Chordoma
	VASCULAR TUMOURS
	Hemangioma Angiosarcoma
	SMOOTH MUSCLE TUMOURS
OSTEOGENIC TUMOURS	Leiomyoma Leiomyosarcoma
Osteoid osteoma	**LIPOGENIC TUMOURS**
Osteoblastoma	Lipoma Liposarcoma
Osteosarcoma	
Conventional	**NEURAL TUMOURS**
Chondroblastic	Neurilemmoma
Fibroblastic	**MISCELLANEOUS TUMOURS**
Osteoblastic	Adamantinoma Metastatic malignancy
Telangiectatic	
Small cell	
Secondary	
Parosteal, Periosteal	
High grade surface	
FIBROGENIC TUMOURS	**MISCELLANEOUS LESIONS**
Desmoplastic fibroma	Aneurysmal bone cyst
Fibro sarcoma	Simple cyst
FIBROHISTIOCYTIC TUMOURS	Osteofibrous dysplasia
	Langerhans cell histiocytosis
Benign fibrous histiocytoma	Erdheim-Chester disease
Malignant fibrous histiocytoma	Chest wall hamartoma
EWING SARCOMA/PRIMITIVE NEUROECTODERMAL TUMOUR	**JOINT LESIONS**
	Synovial chondromatosis
Ewing sarcoma	

The radiologic workup of musculoskeletal tumors can be both cost-efficient and extremely helpful to the referring clinician if one proceeds in a thoughtful and logical manner. Initially, a musculoskeletal tumor should be simply imaged with a plain film. It should be remembered that plain films remain the most reliable imaging method for assessment of both biological activity and probable histologic diagnosis of an osseous lesion. Although soft tissue involvement by an osseous lesion may be incompletely assessed by plain film, the osseous findings are seen with much better resolution on plain radiographs than with either computed tomography or magnetic resonance. Plain film therefore is used to arrive at a reasonable differential diagnosis or at least to categorize the lesion as to degree of aggressiveness. In order to do this, we have found it useful to include an assessment of 10 determinants in the description of a tumor. If these determinants are accurately described, the correct diagnosis or at least a limited differential diagnosis usually becomes obvious **(Masood et al., 2017).**

These determinants are as follows:

1. **Age of the patient:**

This can be an extremely important determinant in some lesions in which the age range of occurrence may be quite narrow .For example, malignant osseous lesions in patients under 1 year of age are usually metastatic neuroblastoma. Malignant osseous lesions in the age range of 1–30 are usually osteosarcoma or Ewing sarcoma. Malignant osseous lesions in the 30- to 60-year range most commonly will be either chondrosarcoma, primary lymphoma, or malignant fibrous

histiocytoma, while malignant lesions in the age range over 50 most commonly will be due to metastatic disease or multiple myeloma. Several other osseous lesions have fairly limited age ranges as well.

2. Soft tissue involvement:

Cortical breakthrough of a bone lesion to create a soft tissue mass generally suggests an aggressive lesion. Such soft tissue masses will often distort but not obliterate nearby muscle planes.

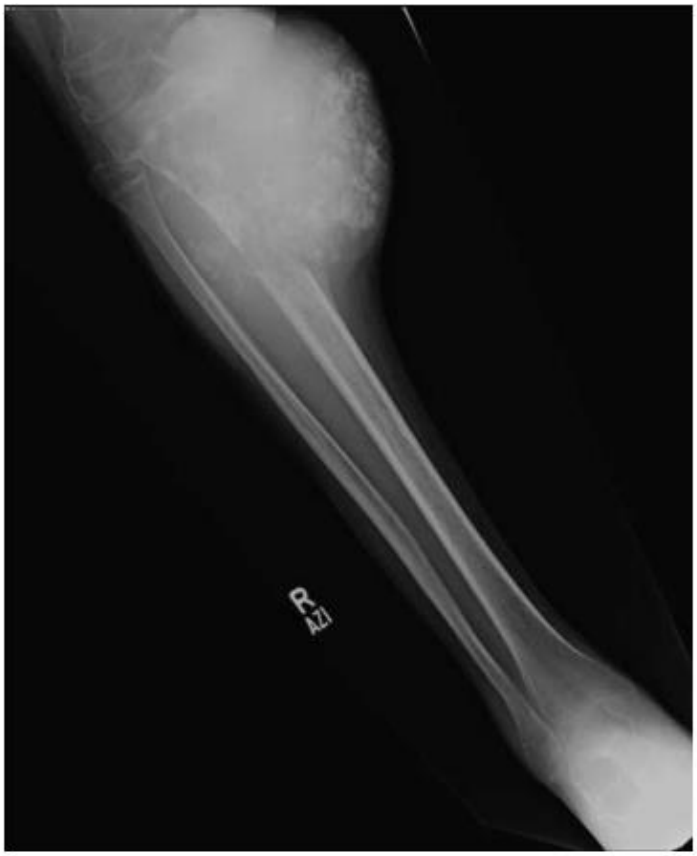

Fig. (1): Cortical break with soft tissue component, an aggressive lesion

3. Pattern of bone destruction:

Common terminology includes the terms "geographic" (well-defined or map-like lesion, the least aggressive pattern), "moth-eaten" (holes, with less well-defined margins, appearing more aggressive), and "permeative" (a poorly demarcated pattern which is often very difficult to visualize and represents a highly aggressive lesion). It is not always easy to differentiate between the moth-eaten and permeative patterns. Furthermore, since both represent an aggressive pattern, it is not necessary to differentiate between the two, and the term permeative should serve well for both.

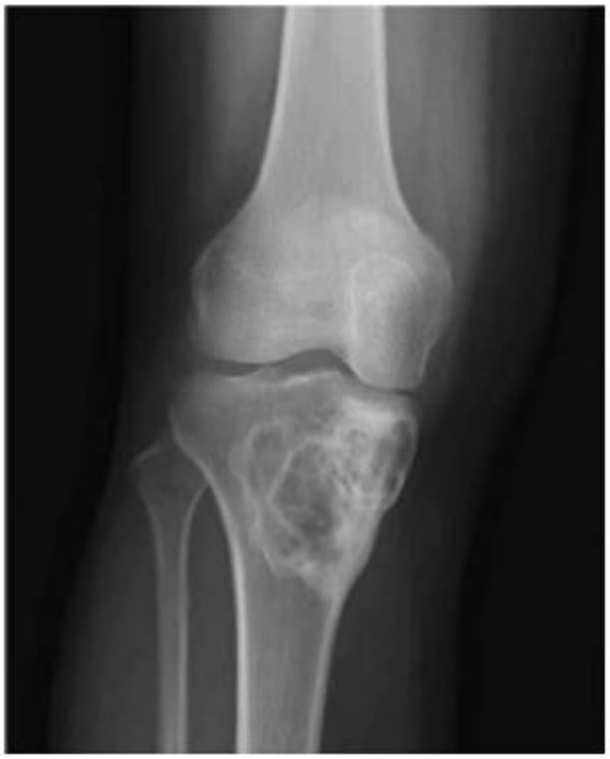

Fig. (2): Eccentric geographic lesion with a sclerotic margin, a healing non-ossifying fibroma is present in proximal tibia