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Utility of High Resolution Ultrasound in Diagnosis of Aneurysmal Bone Cyst in Clavicle

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Abstract: The clavicle is an unusual site for primary bone tumors among flat bones. True benign neoplasm of clavicle is less common than malignant. Aneurysmal bone cyst (ABC) is an uncommon benign tumor in clavicle which is commonly seen in long bones. The clavicle is involved in 3% of all cases of ABC. ABC can be primary, arising de novo and secondary (arise adjacent to or in conjunction) with primary bone tumor. Ultrasound (USG) is extremely useful in detecting primary and secondary bone tumors causing cortical disruption with the soft tissue component. The USG can detect fluid –fluid levels within ABC, which move with changes in the patient's position. If 100% of the lesion showed fluid- fluid levels, malignant aetiology is unlikely. We report a case of a 11- year old female patient presented to the ultrasound department for painless swelling in right clavicular and supraclavicular region since 1 month. Lateral half of clavicle showed an expansile well-defined multilocular and cystic lesion showing multiple medium level internal echoes which moved with gravity with fluid-fluid levels. No solid component was noted. Findings were suggestive of aneurysmal bone cyst arising from right clavicle showing hemorrhage in various stages. Fine needle aspiration cytology was suggestive of aneurysmal bone cyst.
Keywords: Clavicle, aneurysmal bone cyst, fluid-fluid levels.

INTRODUCTION

The clavicle is an unusual site for primary bone tumors among flat bones. True benign neoplasm of clavicle is less common than malignant. Metastatic tumors in clavicle are commoner than primary tumors in the clavicle. The incidence of tumor in clavicle in the entire body is less than 1%. Ewing's sarcoma (4%), aneurysmal bone cyst (3%) and hemangiopericytoma (2%) are seen in decreasing order of occurrence in clavicle. ABC is uncommon benign tumor in the clavicle which is commonly seen in long bones. The clavicle is involved in 3% of all cases of ABC. ABC commonly involves either end of clavicle and is seen as an eccentrically placed mass. It presents as a slowly progressive, painless bony swelling. ABC occurs in the metaphyseal regions of long bones in 60-70% cases. Sites involved are tibia (15%), vertebra (14%), femur (13%), humerus (9%), pelvis (8%), ulna (4%), clavicle (3%), ribs, scapula and skull (2%). Histologically, it is characterized by cavernous blood filled cyst though it is a non-neoplastic condition with remote chances of metastases; aggressive therapy is needed due to massive bone destruction and extension into adjoining soft tissues [1].

CASE REPORT

A 11- year old female patient presented to the ultrasound department for painless swelling in right clavicular and supraclavicular region since 1 month. There was no history of trauma. Local USG of the right clavicle and supraclavicular region was done by linear high resolution 7-12 MHz probe. Lateral half of clavicle showed an expansile well-defined lesion measuring approximately 58x38x56 mm in transverse, Antero-posterior and cranio-caudal dimensions .It was multilocular and cystic showing multiple thin septations. Most of the cysts showed medium level internal echoes which moved with gravity, with fluid-fluid levels (Figure 1,2). No solid component was noted. No calcification or vascularity was seen. The findings were suggestive of aneurysmal bone cyst arising from the right clavicle showing hemorrhage in various stages .A radiograph of right shoulder AP view showed an expansile osteolytic lesion arising from the lateral half of right clavicle with a narrow zone of

transition (Figure 3). No calcification was noted. Magnetic resonance imaging (MRI) of the right shoulder with clavicle was done. It showed a large expansile lesion of size measuring approximately 6.2x 4.6x4.1 cm in transverse, Antero-posterior and cranio-caudal dimensions arising from the lateral half of right clavicle showing multiple septations and appeared hyperintense on T2WI and STIR with hypointense areas with fluid-fluid levels s/o hemorrhage in varying stages .No restricted diffusion was noted on DWI. Other visualised ribs, right glenohumeral joint, right sternoclavicular joint appeared normal. The lesion was extended upto articular surface of the right acromioclavicular joint. The findings were suggestive of aneurysmal bone cyst. FNAC was performed. On aspiration, 8cc of hemorrhagic fluid was aspirated. Smear showed predominantly blood, pink proteinaceous material admixed with inflammatory cells with pinkish material suggestive of osteoid. Hematoma with immature callus formation .Excision biopsy was suggested.

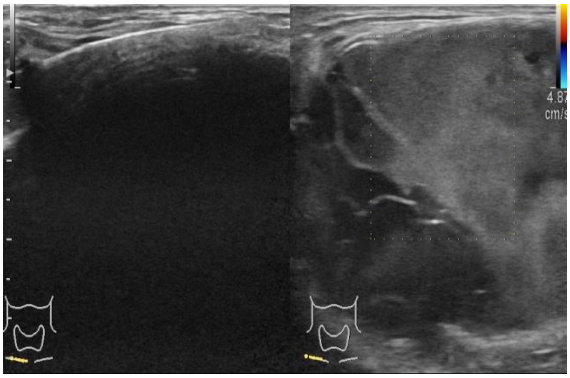

Fig-1: Ultrasound of right clavicle showing expansile well-defined multilocular cystic lesion showing medium level internal echoes

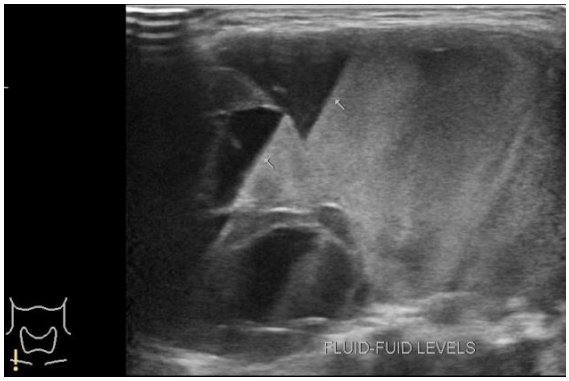

Fig-2: Ultrasound of right clavicle showing expansile well-defined multilocular cystic lesion showing medium level internal echoes moving with gravity, with fluid-fluid levels

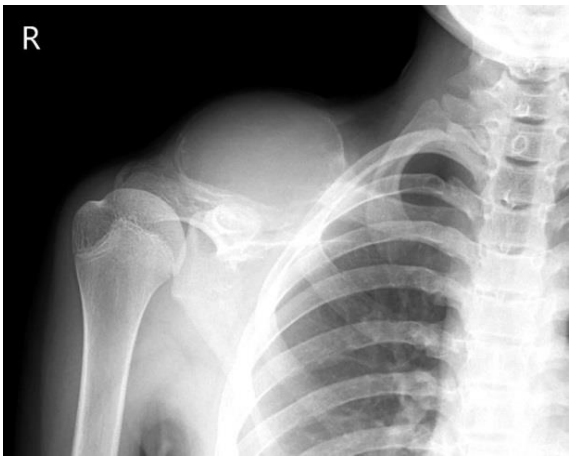

Fig-3: Radiograph of right clavicle showing well-defined expansile osteolytic lesion in lateral half of right clavicle with narrow zone of transition

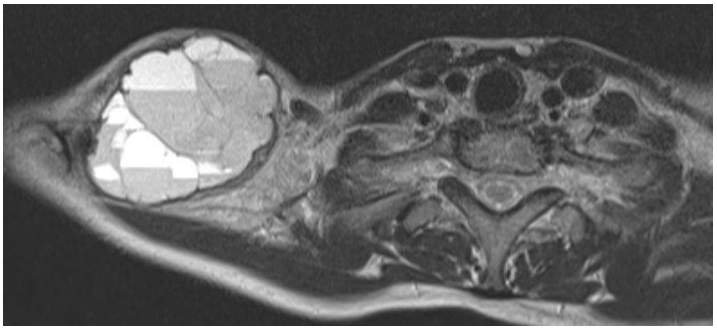

Fig-4: MRI of right clavicle (axial T2WI sequence) showing expansile well-defined multilocular cystic lesion showing multiple fluid-fluid levels

DISCUSSION

Aneurysmal bone cyst accounts for 2.5% of all bone tumors, peak incidence is in the 2nd decade of life with known 2nd predilection. 80% ABC'S occur in the immature skeleton below 20 years of age. The clavicle is a rare site for bone tumors [2]. Smith *et al*. reported 30 cases of malignant and 28 cases of benign tumors in clavicle in a series of 58 patients with clavicular tumors over a period of 50 yrs. Only 6/58 (10%) had an ABC of clavicle [3]. ABC should be considered in the differential diagnosis in all patients with clavicular swelling.

Though benign, it is a locally aggressive lesion characterized by multiloculated cystic tissue filled with blood [4]. The term ABC was coined by Jaffe and Lichtensteinin 1942 based on its radiographic features [5].

As defined by WHO, ABC is a tumor consisting of blood filled spaces separated by septa of connective tissues and occasional giant cells [6].

ABC can be primary arising de novo and secondary (arise adjacent to or in conjunction) with primary bone tumor. On histology, it is characterized by multiloculated cyst like spaces and channels filled with blood and lined by fibrous septa that may or may not contain osteoclast like giant cell, osteoid, woven bone and chondroid matrix[7].

Its pathogenesis is uncertain and it is postulated to arise from a local circulatory disturbance leading to an increased venous pressure and production of hemorrhage in the bone. Low incidence of ABC in clavicle is due to low venous pressure in the clavicle. Most primary ABC'S show (16; 17) (q22; p13) fusion of the TRE17/CDH11-USP6 oncogene. This fusion causes increase cellular cadherin-11 activity that arrests osteoplastic maturation in a primitive state. Secondary ABC arises from a pre-existing chondroblastoma, chondromyxoid fibroma, osteoblastoma, and fibrous dysplasia, giant cell tumor, rarely from malignant tumors like osteosarcoma, chondrosarcoma and hemangioendothelioma [8].

Proposed mechanism is increased venous pressure causes hemorrhage in the bone, which leads to osteolysis. Osteolysis in turn causes further hemorrhage causing exponential tumor growth; hence, ABC'S are common in long bones. There venous pressure is high and marrow content is greater [9].

USG is not useful in detection of intramedullary bone lesions as sound waves cannot penetrate the normal cortex. However, it is extremely useful in detecting primary and secondary bone tumors causing cortical disruption with the soft tissue component. It is also useful for USG guided percutaneous biopsy without ionizing radiation. It helps in the evaluation of post-operative sites for tumor recurrence when artifacts on MRI and CT due to orthopedic hardware preclude their use. Due to thinning and destruction of the cortex the sound waves can have sufficient sound transmission to detect underlying bone lesion and characterize it. The USG can detect fluid – fluid levels within ABC, which move with changes in the patient's position [10]. This confirms the cystic nature of the lesion. O' Donnnell and Saifuddin evaluated the diagnostic significance and prevalence of fluid-fluid levels (FFLS) in focal bone lesion in 738 consecutive patients. Malignant neoplasms showed FFLS in less than 1/3rd of the lesion. Decrease in % of malignancy was found with increase in the total volume of FFLS. If 100% of the lesion showed FFLS change no malignant lesions were found. Aggressive high grade necrotic bone tumors like telangiectasia, osteosarcomas can show FFLS in more than 2/3 rd of the lesion. However, these tumors show a small solid component [11].

The differential diagnosis includes eosinophilic granuloma, giant cell tumor, unicameral bone cyst, fibrous dysplasia, chondroblastoma, chondromyxoid fibroma, chondrosarcoma, Ewing's sarcoma[12]. Various treatment options are curettage, resection, saucerisation, radiotherapy, cryotherapy, vascular occlusion. Resection leads to lower recurrence rate. The combination of cryosurgery and curettage offers low recurrence rate. Radiotherapy is reserved in cases that cannot be operated due to location and to prevent damage to the function of important structures.

Radiotherapy can cause radiation induced injury to physician and can cause a radiation induced sarcoma. Pre- surgical embolization of feeding vessel decreases vascularity making the surgical procedure less bloody[12].

CONCLUSION

Aneurysmal bone cyst affecting clavicle is rare. Though CT and MRI are diagnostic, USG is extremely useful in diagnosing ABC by detecting multiple fluid-fluid levels with multiple internal echoes moving with gravity.

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