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Research Article

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Analysis of High-Frequency Ultrasound in the differential Diagnosis of Lumps in Foot and Hand

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Abstract: ***Objective:*** To investigate the ultrasonogram characteristics of common lumps in hand and foot, pursuing for greater understanding of hand and foot lumps. ***Methods:*** 65 cases of ultrasonographic characteristics of lumps in hand and foot were retrospectively analyzed, including the location, size, shape, boundary, internal echo and posterior echo, surrounding relationship and blood flow. ***Results:*** Among 65 cases, there were 26 cases of tendon sheath cyst, 16 cases of tenosynovitis giant cell tumor, 10 cases of hemangioma, 4 cases of tendon sheath fibroma, 3 cases of epidermoid cyst, 2 cases of Schwannoma, 2 cases of fibrolipoma, 1 case of angiolipoma and 1 case of neurofibroma. The preoperative and postoperative pathological diagnoses of 45 cases, accounting for 69.23%, were consistent, 3 cases (4.62%) were misdiagnosed, which included that 2 cases of tenosynovitis giant cell tumor were misdiagnosed as tendon sheath cyst, 1 case of neurofibroma as epidermoid cyst, and the preoperative diagnosis of the rest 17 cases(26.15%) were indefinite. ***Conclusion:*** The high-frequency ultrasound can diagnose properties of lumps in foot and hand well, providing diagnosis basis for further treatment in clinic.

Keywords: High-frequency ultrasound; Lumps; Hand and foot

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There have been a few characteristics of high-frequency ultrasound such as high resolution for soft tissue, easy practice and accessible dynamic imaging observation, making it clear to display the location, shape, size, internal echo of superficial lumps and the relationship between the mass and the surrounding issue, so it is used as the first-choice examinational method of lesions in hand and foot. In this article, the retrospective analysis on 65 cases of ultrasonographic characteristics of lumps in hand and foot confirmed by operation pathology is aimed at raising awareness of common disease in foot and hand and improving ultrasonic diagnostic accuracy.

1 Materials and methods

(1) Case selection:65 cases confirmed by surgery and pathology from July 2016 to October 2017 treated in our hospital, 27 cases of male, 38 cases of female, whose ages vary from 5 to 82 years old, the average is 47. 50 ± 17. 46. All patients had high-frequency ultrasound scan of lumps before operation.
(2) Instrument and methods: Philips IU22 and GE Logic 9, real-time line high frequency probe with the frequency of 7 to 10MHz were used for the diagnosis. Select and preset the instrumental examination condition of skeletal muscles. Multisection scan of mass and surrounding tissue structures were performed by two dimensional ultrasound for checking the lumps position, size, shape, internal echo, posterior echo, surrounding relationship and blood flow.

2 Results

2.1 Pathology results

There were 65 cases in total, 26 cases (40.00%) of tendon sheath cyst, 16 cases (24.61%) of tenosynovitis giant cell tumor, 10 cases (15.38%)

of hemangioma, 4 cases (6.15%) of tendon sheath fibroma, 3 cases (4.62%)of epidermoid cyst, 2 cases (3.08%) of schwannoma, 2 cases (3.08%) of fibrolipoma, 1 case (1.54%) of angiolipoma and 1 case (1.54%)of neurofibroma. The preoperative and postoperative pathological diagnoses of 45 cases (69.23%) keep the same, 26 cases of tendon sheath cyst, 8 cases of hemangioma, 3 cases of epidermoid cyst, 1 case of fibrolipoma, 3 cases of lipoma and 4 cases of tenosynovitis giant cell tumor are included. Besides, there were 3 cases (4.62%) of misdiagnosis that 2 cases of tenosynovitis giant cell tumor were misdiagnosed as tendon sheath cyst and 1 case of neurofibroma was misdiagnosed as epidermoid cyst, the rest 17 cases (26.15%) have unclear preoperative diagnoses and characteristics to be determined. Typical cases of all kinds of mass and the ultrasonographic characteristics are as follows.

2.2 Ultrasonic features

Tendon sheath cyst :26 cases all presented as fluid sonolucent area with clear boundary next to the tendons or joints, the diameter varies from 0.3 to 1.5cm; 9 cases of oval shape, 17 cases of irregular shape; 4 cases of low internal echo and good sound transmission; 26 cases of no blood flow signal inside the lesion.

Tenosynovitis giant cell tumor:14 cases performing as hypoechoic mass with clear boundary next to the tendons (Figure 1.), wide contact with the tendons without being influenced by their activity, 2 cases of similar free-echo mass; 0.3 to 1.3 cm of diameter; 10 cases of regular shape, 6 cases of irregular shape; 1 case of visible dotted blood flow inside, 15 cases of no apparent blood flow(Figure 2).

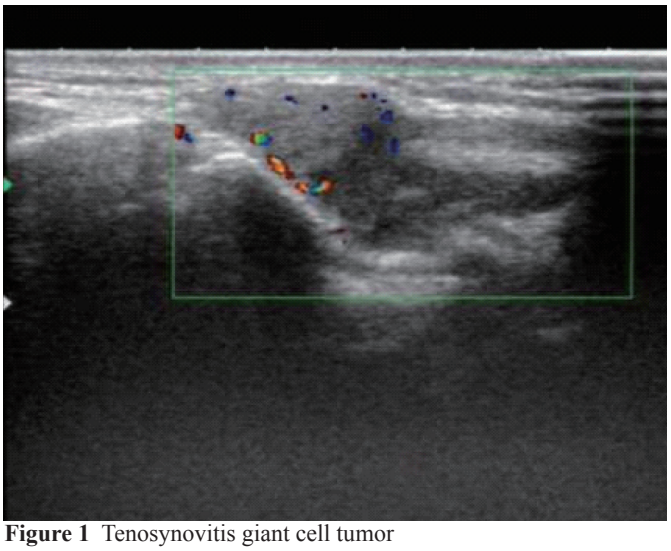

Figure 1 Tenosynovitis giant cell tumor

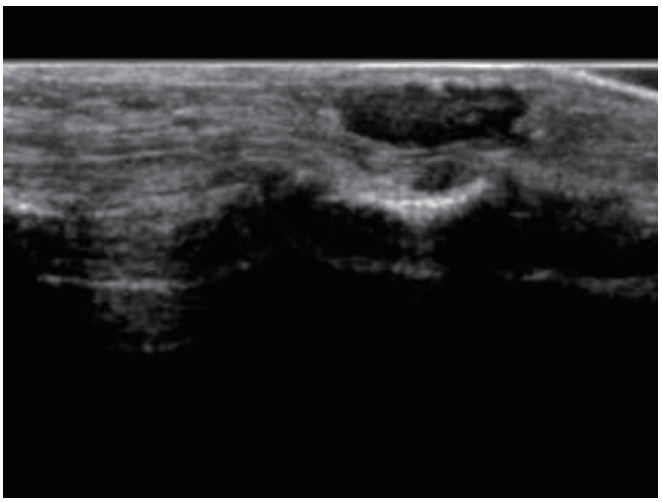

Figure 2 Tenosynovitis giant cell tumor

Hemangioma: 10 cases were all located in subcutaneous soft tissue with the diameter of 0.6cm to 2.4cm and presence of hypoechoic mass, irregular shape and plenteous vein blood flow signals with low velocity (Figure 3).

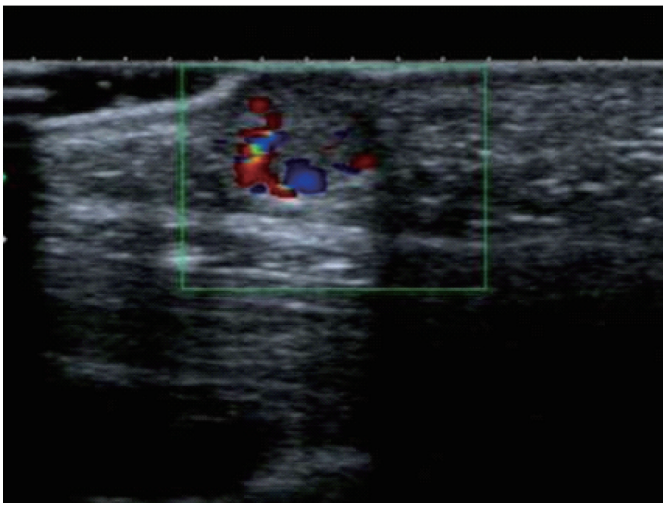

Figure 3 Hemangioma

Tendon sheath fibroma: 4 cases had the presence of hypoechoic lump with hypodermic elliptic shape, clear boundary, irregular shape and 0.2 to 1.2cm in diameter. The internal echo was uneven. 3 cases of the inside and surrounding tumor were not seen apparent blood flow, but there could been dotted blood flow surrounding the other one case (Figure 4).

Epidermoid cyst: 3 cases all performed as hypodermic medium echo nodules with clear boundary, the front was close to the skin layer, the posterior echo was enhanced, there is no obvious blood flow signal inside but rich blood flow signals surrounding the mass during infection.

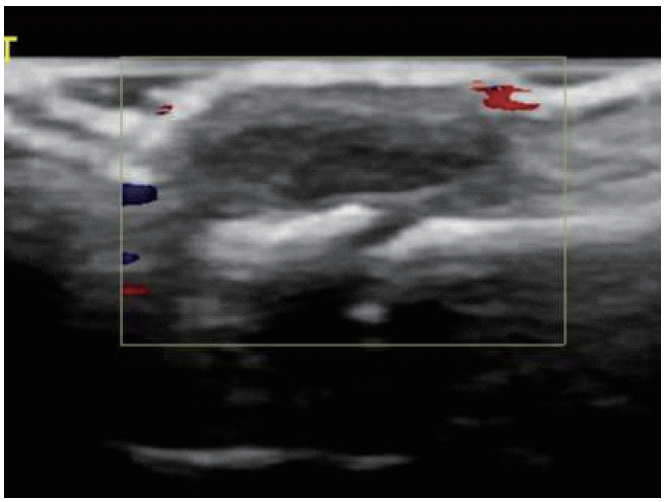

Figure 4 Tendon sheath fibroma

Fibrolipoma: The two cases located in hypodermic fat layer and were 4.9cmx3.7cm and 0.8cmx0.4cm in size with presence of irregular shape, performing as enhanced echo and low echo, the inside echo was lack of average internal echo and evident blood flow signals (Figure 5).

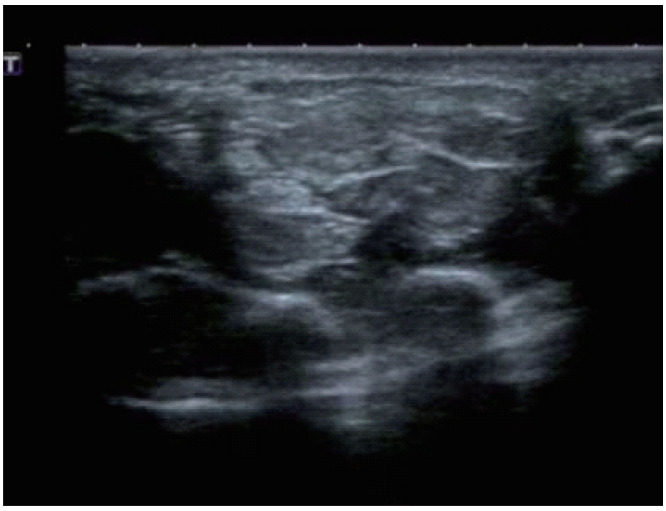

Figure 5 Fibrolipoma

Angiolipoma: It was medium to high echo nodule which located in hypodermic fat layer. It showed as irregular shape, fuzzy boundary, surrounding the finger bones and 2.6cmx2.0cm in size without blood flow signal (Figure 6).

Schwannoma: One case in hand (2 lumps), the other case in foot (1 lump); The lumps were all in the hypodermic fat layer, 0.7cm to 2.5 cm in diameter. Both of them showed as hypoechoic solid mass of ellipse and clear boundary. The internal echo of one case was homogeneous, two cases had cystic degeneration and one case showed rat-tail sign without any obvious blood flow signals (Figure 7).

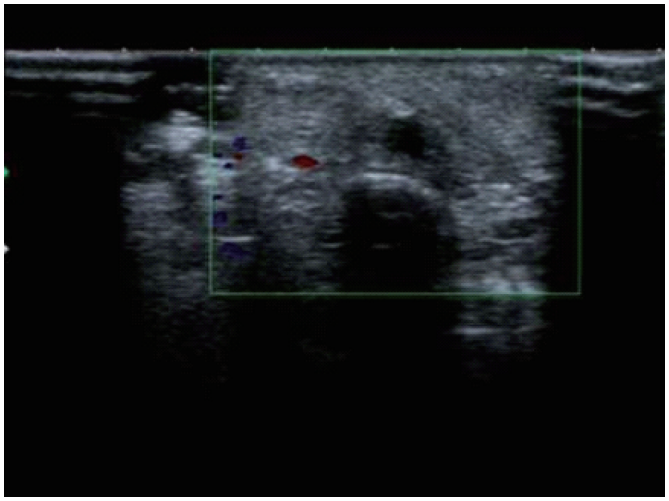

Figure 6 Angiolipoma

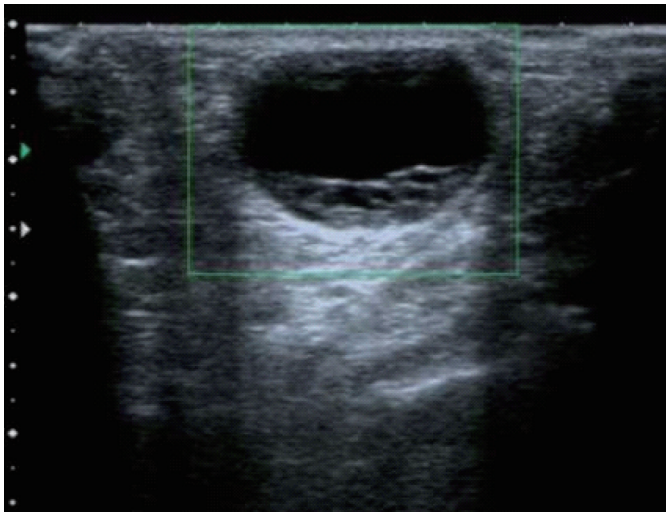

Figure 7 Schwannoma

Neurofibroma: It located in the wrist part with the size of 1.6cmx2.0cm, this case showed as cystic, clear boundary and bad effect of echo, squeezing the median nerve backward (Figure 8).

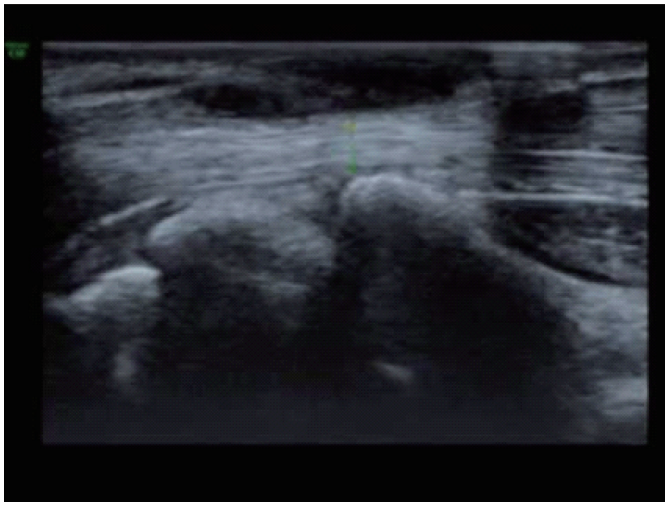

Figure 8 Neurofibroma

3 Discussion

The high-resolution of high-frequency ultrasound makes it possible to clearly display articular capsule, the tendon, tendinous sheath, synovialis and other fine structures in hand and foot, indicating that its increasing important role in the diagnosis of hand and foot lumps. Most of this group of cases were ganglion cyst, which accounts for 40%. It showed presence of thin-walled, irregular cystic with no echo, most were located next to the tendon or joint accompanied by poor echo in capsule while the casual hemorrhage, trauma or infection. There had been high accuracy of this disease's ultrasound diagnosis, all patients selected were diagnosed correctly.

Giant cell tumor of tendon sheath is a kind of solid painless mass that occurs in fingers or hand[1], being recognized as benign lesions synovial hyperplasia which grows limitedly and it is usually next the tendon[2-3]. Its description dates back to 1941 by Jaffe, et al[4]. The ultrasound is divided into limited and diffuse ones. In this experimental group, there were 15 cases of limited growth and 1 case of diffuse growth. Most ultrasound results were the presence of hypoechoic mass with clear boundary, mostly regular shape and homogeneous internal echo. Some giant cell tumor of tendon sheath had been locally aggressive which can result in bone erosion[5], so it's easy to misdiagnose it as bone tumor. However, 16 cases of this group did not show like this above. It is reported that giant cell tumor of tendon sheath has numerous blood flow signals in many references, but all 15 cases here had no obvious blood flow signal, probably because of their small size, whose maximum diameter of nodules is 1.3 cm and the minimum is 0.3cm, so the nodules are too small for ultrasound to be sensitive to internal blood flow. Moreover, there were presence of low internal echo in 14 cases (see Figure1) and no echo in the rest 2 cases (see Figure 2) which were misdiagnosed as ganglion cyst. Before this, there were also 2 cases showing as cystic free-echo in the 26 cases of tenosynovitis giant cell tumor studied by Wang Ying, et al. It is analyzed that maybe because giant cell tumor of tendon sheath representing as consistent echo were orderly arranged with small acoustic impedance and similar to echo-free with good sound transmission. Only 4 cases' preoperative ultrasound diagnosis were correct, the properties of other 12 cases were not diagnosed. Perhaps because of doctor's limited knowledge of these nodules whose ultrasound presence has no characteristics, the tendon sheath fibroma performs as hypoechoic nodule with clear boundary and regular shape, which is similar to the ultrasound presence of tenosynovitis giant cell tumor and difficult to distinguish.

Epidermoid cyst also called keratin cyst whose capsule wall is composed of stratified squamous cells that contain protein particles with transparent cuticle. The intracapsular content are mainly horny substance as thick as cheese. It usually occurs on skin or subcutaneous soft tissue shallow layer of head, face, neck and trunk. Most epidermoid cyst in hands or toe ends are formed with skin implants due to injury. The ultrasound shows as hypoechoic nodule of regular subcutaneous shape, contacting closely with skin layer, presence of strong echo like dense dots and enhanced posterior echo without any evident blood flow signal. 3 cases of this group were diagnosed correctly.

Lipoma is common benign tumor of mesenchymal tissue, composed of mature fat cells. It includes angiolipoma, fibrolipoma and some else categorized by the number of internal vascular tissue and connective tissue, usually located in subcutaneous fat layers with the presence of echo similar to or higher than fat echo. It is easy to diagnose combined with the location or echo characteristics by ultrasound. 3 cases of this group were diagnosed correctly.

Schwannoma and neurofibroma are neurogenic tumor. They usually occur in subcutaneous soft issues or muscles of arms and legs and neck. Both tumor cells are originated from neurilemma cell. Schwannoma is often single with envelopes and nerve stem going through its surface or bottom, growing as an eccentric shape, easily occurring denaturation and necrosis and irregular echo-free area inside it. Both 2 cases of this group had cystolization. However, the neurofibroma are often multiple without integumentum but with axons going through the center, growing surrounding the nerve[6-7].

These cases are common lumps in foot and hand of our hospital. High resolution and easy practice of the high-frequency ultrasound soft issue helps clearly ensure the mass size, location, and relationship between the surrounding issues, becoming the first-choice imaging method of lesion in hand and

foot. But there is still deficiencies and regrets in the diagnosis. Considering the shallow position of lumps in hand and foot, too many patients during the inspection, cursory and insufficient inspection and ignorance of details, we can select probe of higher frequency to check more details about its occurrence site, internal echo and surroundings. If with careful observation, we can find the lesion location, for example, tendon sheath disease occurs surrounding the tendon sheath and tendon, hemangioma, angiolipoma and neurolipoma often occur in subcutaneous fat layer, epidermoid cyst occurs subcutaneously or subcutaneous shallow layer. Pay attention to the importance of medical history like that tendon sheath disease is mostly associated with handedness and epidermoid cyst is related to trauma. We had better analyze and distinguish carefully and diagnose correctly combined with its ultrasonic characteristics.

4 Conclusion

High-frequency ultrasound can really well diagnose the property of lumps in hand and foot and directly display the location, size, internal echo and surrounding relationship, providing ultrasound diagnosis combined with ultrasonogram characteristics and diagnosis basis for clinical further treatment.

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