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Case Report

Pacinian corpuscle hyperplasia, case report ☆

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ABSTRACT

Pacinian corpuscles are mechanoreceptors frequently found between the dermis and subcutaneous tissues of the hands and feet. They are responsible for sensitivity to vibration and pressure. Pacinian corpuscle hyperplasia is a rare cause of induration in the palms of the hands or the soles of the feet, often of unknown origin or occasionally related to neurofibromatosis. It can be characterized by magnetic resonance imaging and is included in the differential diagnosis of anechoic lesions on high-resolution soft tissue ultrasound. The definitive diagnosis is made through histopathologic examination. In this case report, we present the findings of a 29-year-old patient who presented with painful nodules on the palms of both hands, with typical findings on ultrasound and magnetic resonance imaging indicative of Pacinian corpuscle hyperplasia. We also discuss the imaging findings and the differential diagnosis through a non-systematic review. Pacinian corpuscle hyperplasia is a rare condition that can be readily identified by high-resolution ultrasound and magnetic resonance imaging, and it should be considered in the differential diagnosis of hand nodules.

Introduction

Pacinian corpuscles, also known as Vater-Pacini or lamellar corpuscles, are rapidly adapting end-organ mechanoreceptors for sensing pressure and vibration. They were histologically described by Pacini in 1835 [1,2]. Pacinian corpuscles are abundant in the deep dermis, particularly the plantar aspect of the foot and toes, and the palmar aspect of the hand and fingers. They are also present near various other tissues and organs, including the conjunctiva, blood vessels, penis, urethra, vulva, clitoris, parietal peritoneum, and loose connective tissue [3].

Pathologies associated with Pacinian corpuscles are rare. Hyperplasia (or Neuroma) and Neurofibromas are 2 types of lesions that affect Pacinian corpuscles. The former is a benign hyperplastic tumor with morphology and structure similar of mature Pacinian corpuscle, with the latter is a benign tumor composed of structures resembling Pacinian corpuscles in different stages of development [4].

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In this report, we present the clinical and imaging features of a case of Pacinian corpuscle hyperplasia, demonstrating typical findings on MRI and high-resolution ultrasound.

Case report

The patient, a 29-year-old businesswoman, presented to a rheumatology consultation with tender and palpable nodules on the palms of both hands 4 months ago. The tenderness spontaneously resolved but recurred for at least 3 months. The patient had no history of trauma or relevant family history. Physical examination revealed multiple palpable nodules of the palmar surface of both hands, most of which were fixed. Some of the larger nodules were tender to palpation, particularly adjacent to metacarpophalangeal joints. Blood test showed no abnormalities.

MRI of both hands was performed using a surface coil on a 1.5 T scanner, revealing multiple nodular, round lesions on the subcutaneous plane of the palmar surface. These lesions showed very high signal on T2-weighted images and were isointense to muscle on T1-weighted images. Post-gadolinium T1 images showed variable enhancement, with some lesions exhibiting homogenous enhancement and others showing a linear peripheral rim of enhancement (Fig. 1).

Further characterization of these lesions was performed using ultrasound with an 18 MHz hockey stick probe and a 33 MHz high-resolution skin probe. The ultrasound findings were similar to the MRI findings, with multiple hypoechoic lesions up to 4 mm in diameter located on the subcutaneous plane. The lesions showed marked posterior acoustic enhancement and no internal Doppler signal (Figs. 2 and 3). Comparative images with a reference subject were obtained, demonstrating a significant increase in the number and size of these structures compared to normal (Fig. 4).

The radiology report concluded that these lesions were consistent with Pacinian corpuscle hyperplasia. No specific treatment or surgery was recommended beyond analgesia. The patient continued to experience tenderness on the more prominent nodules during follow-up.

Discussion

Pacinian corpuscles are prominent ovoid sensory receptors characterized by cells arranged around an axon, forming a typical “onion bulb” morphology. They are widely distributed in various organs and tissues, especially in the skin and hypodermis of the palms and soles. On the palms, they are present in an average of 300 corpuscles, predominantly distributed on the fingers and metacarpophalangeal joints, with sizes of up to 5 mm [2,5–7].

The term “Pacinian corpuscle hyperplasia” needs further clarification in the literature, as it is sometimes used in-

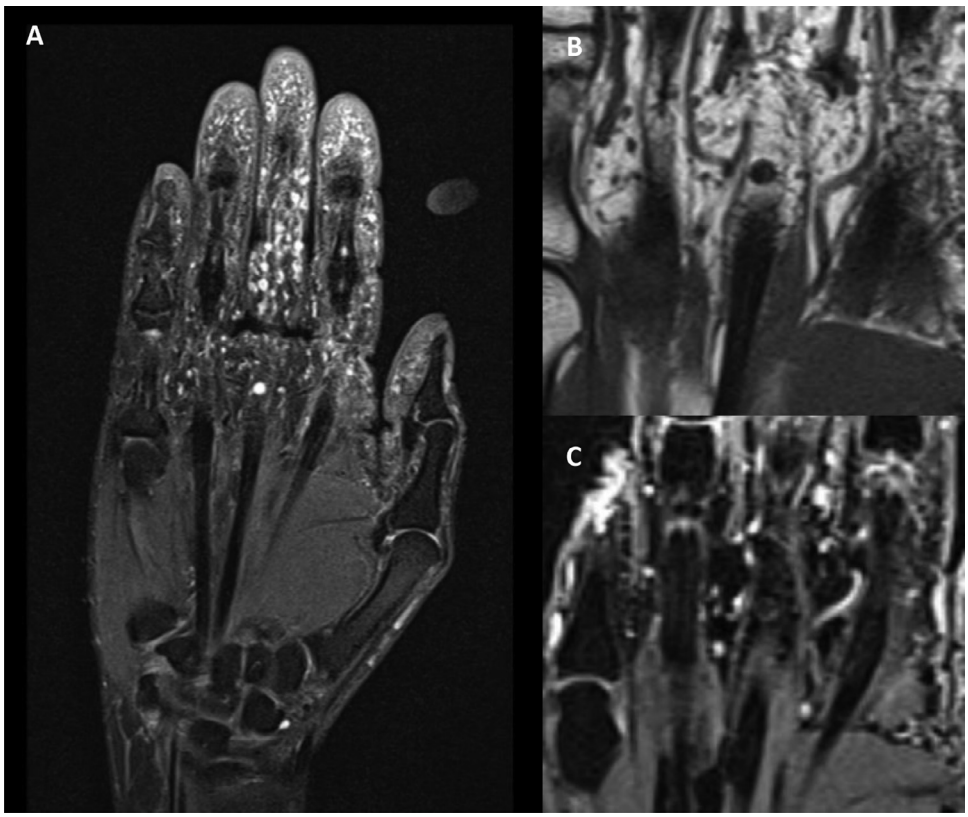

Fig. 1. (A) – T2-weighted MRI of the right hand showing multiple nodular, round lesions on the subcutaneous plane of the palmar surface, exhibiting very high signal intensity. (B) T1-weighted MRI demonstrating a lesion with isointense signal to muscle on T1. (C) Postgadolinium T1 images revealing peripheral rim enhancement of the lesion.

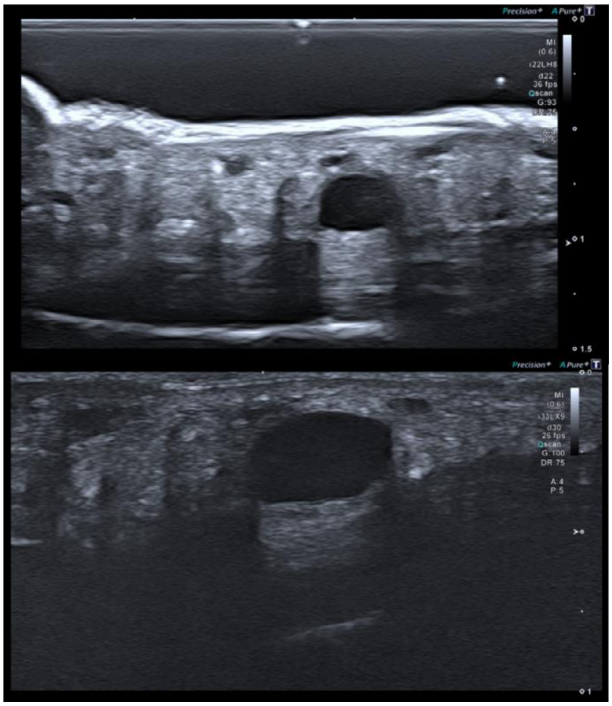

Fig. 2 – High-resolution ultrasound revealed multiple hypoechoic lesions measuring up to 4 mm in diameter. These lesions were located on the subcutaneous plane and exhibited marked posterior acoustic enhancement.

terchangeably with "Pacinian corpuscle neuroma" or "pacinioma." These terms refer to abnormal increases in size and/or density of mature Pacinian corpuscles [2].

Pacinian neurofibroma, on the other hand, has different histologic characteristics, consisting of structures resembling Pacinian corpuscles at various stages of development, accompanied by variable degrees of Schwann cell proliferation [2]. A recent systematic review has described different clinical and demographic characteristics that differentiate Pacinian neurofibroma from Pacinian corpuscle hyperplasia [4].

Pacinian corpuscle hyperplasia predominantly affects females (60.7%) with a mean age of presentation of 49.5 years. It often occurs in more than one location, and most reported cases have presented with tender digital nodules [2]. Pain and tenderness are common symptoms, but some patients may experience mass sensation, swelling, or sensory changes. Hyperplasia is commonly associated with repetitive trauma, which initiates vascular changes that can lead to corpuscle proliferation. This association is consistent with certain hand work activities frequently reported in the literature. Other associations have been made with conditions such as glomus tumors, Dupuytren's contracture, and neurofibromatosis [4,5].

The first proposed classification for hyperplasia was introduced by Rhode and Jennings [2,6], which is primarily suitable for surgical findings and challenging to apply in other contexts. Reznik et al. [8] simplified the classification into 3 subtypes:

Type 1: Single enlarged Pacinian corpuscle.
Type 2: Cluster of normal-sized Pacinian corpuscles.
Type 3: Cluster of enlarged Pacinian corpuscles.

Types 2 and 3 are more commonly encountered and have similar prevalence rates [2,4,8].

On MRI, normal-sized Pacinian corpuscles can appear as multiple nodules in the palmar subcutaneous tissues, measuring 1 to 2 mm in diameter. These nodules are isointense to skeletal muscle on T1 sequences and hyperintense on intermediate/long TE fluid-sensitive sequences. They do not show enhancement after the administration of gadolinium-based contrast. Previously, these findings were referred to as "bright spots," but they are now known to represent Pacinian corpuscles based on reports with radiologic-pathologic correlation. The hyperintensity on water-sensitive sequences is attributed to the high fluid content in the ultrastructural layers of the corpuscles and the lack of contrast media enhancement due to the tight blood-nerve barrier surrounding these sensory terminals [9,10]. MRI provides detailed anatomical information, particularly with high-resolution 3D sequences, facilitating preoperative planning [11].

High-resolution ultrasound (HRUS) using high-frequency linear probes is another imaging modality that can be employed to clarify the diagnosis. HRUS offers excellent tissue differentiation but has the limitation of reduced tissue penetration. However, it can demonstrate the size, location, and distribution of Pacinian corpuscles, which appear as round hy-

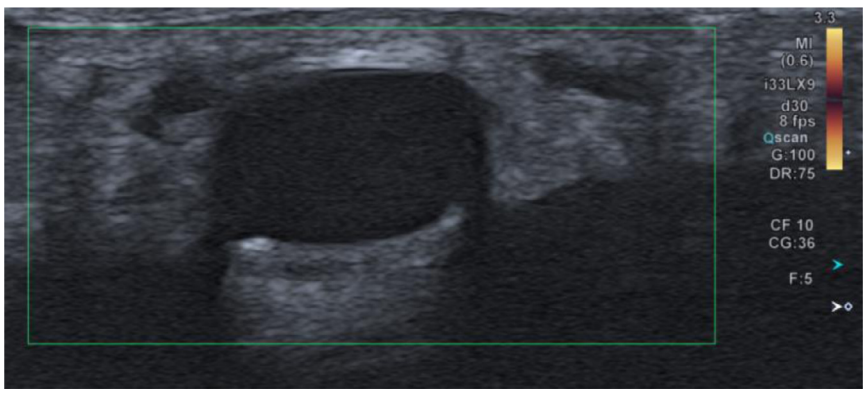

Fig. 3 – High-resolution ultrasound demonstrated a lesion characterized by the absence of internal Doppler signal.

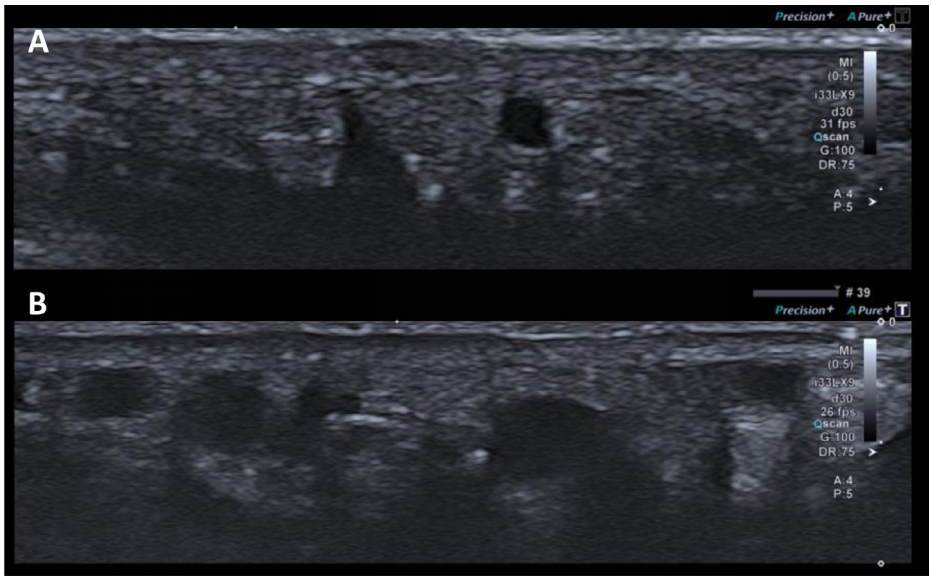

Fig. 4 – Comparative high-resolution ultrasound images showing a significant increase in the number and size of these structures (B) compared to normal (A).

poechoic structures mainly on the palmar surface of metatarsophalangeal joints [12].

No established imaging criteria define Pacinian corpuscle hyperplasia, but imaging findings can support the diagnosis and help exclude other differential diagnoses that may mimic Pacinian corpuscle hyperplasia clinically.

MRI and HRUS can help identify alternative diagnoses such as nerve neuromas, ganglion of the tendon sheath, neurofibromas, and glomus tumors. Post-traumatic nerve neuromas, which result from peripheral nerve injuries, may be confused with Pacinian hyperplasia based solely on ultrasound findings. Defining the continuity of the nerve with the lesion can help differentiate traumatic neuromas. On MRI, markers such as the "tail sign," contrast enhancement, and perineural fibrosis can indicate a nerve neuroma [13,14]. A ganglion of the tendon sheath is a cystic lesion originating from the synovial membranes of tendons. It is the most common nodule found in the hand and wrist. On ultrasound, ganglion cysts appear as anechoic/hypoechoic nodules with delicate internal septa. They usually do not show internal Doppler signals, although they may manifest as complex cystic lesions. On MRI, ganglion cysts are predominantly cystic, hyperintense on T2 and hypointense on T1, without enhancement on post-contrast images. Location and multiplicity can help differentiate ganglion cysts, which often arise from the dorsal scapholunate ligament, from Pacinian hyperplasia. However, differentiation becomes more challenging when the ganglion cysts originate from the base of the fingers (pulley system) [15]. It is not possible to differentiate "true" Pacinian neurofibromas from other entities based on imaging alone [12]. Glomus tumors of the hand may present as hypoechoic nodular lesions that are hyperintense on T2 and hypointense on T1. Their vascular nature can be demonstrated by vascular flow signals on Doppler analysis and enhancement on postcontrast T1 images.

The presented case illustrates typical imaging findings of Pacinian corpuscle hyperplasia on both HRUS and MRI, which correlated with each other. However, the diagnosis was not confirmed with the histopathology, therefore, is a major limitation of our case report.

In conclusion, Pacinian corpuscle hyperplasia is a rare condition that radiologists should be aware of. The imaging findings of normal Pacinian corpuscles and hyperplasia should be included in the differential diagnosis of hand/finger nodules. Both MRI and HRUS can contribute to the diagnosis and help exclude other conditions that may mimic it. However, histopathologic examination remains necessary to establish a definitive diagnosis.

Patient consent

The reported case was reviewed and approved by the institutional ethics committee. Following our institutional guidelines, all protected health information was removed. Individual patient consent was obtained, and assent was obtained from the patient.

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