connections make it possible to have a complete neurologic lesion without apparent neurologic compromise. The presence of these anomolous connections and neural loops underscores the importance of meticulous, wide exposure and thorough knowledge of the variable anatomy when dissecting the forearm and hand.

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# Pacinian corpuscle hyperplasia in the hand

**Proliferation of pacinian corpuscles adjacent to the digital nerves in the hand is very rare. Patients are usually seen initially with a history of previous trauma and severe localized pain. The symptoms, signs, and surgical treatment of previously reported cases are reviewed and histological criteria from this case are proposed to define this condition. In addition to a neuroma or glomus tumor, pacinian corpuscle hyperplasia should be considered in the differential diagnosis of digital or palmar pain. (J HAND SURG 1991;16A:865-9.)**

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Pathologic disorders of the pacinian corpuscles have been reported very infrequently but most have been located within the hand. Three distinct abnormalities of pacinian corpuscles have been described. Nodules located in the skin over the dorsal aspect of the hand or digits or the palmar surface of the distal phalanges that contain structures resembling pacinian corpuscles have been designated pacinian neurofibromas.[1-3] Digital pain caused by a single enlarged pacinian corpuscle located beneath the epineurium of a digital nerve has been reported in only five patients in the literature.[4-7] Proliferation of pacinian corpuscles of normal size located adjacent to the proximal digital nerves or in the distal phalanges constitutes true hyperplasia. There have been only nine previously reported patients with pacinian corpuscle hyperplasia.[4, 8-12]

A patient is described with localized pain in the distal palm caused by hyperplasia of pacinian corpuscles adjacent to the ulnar digital nerve to the index finger and the radial digital nerve to the long finger, just distal to the bifurcation of the common digital nerve. We review

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Received for publication March 19, 1990; accepted in revised form Oct. 24, 1990.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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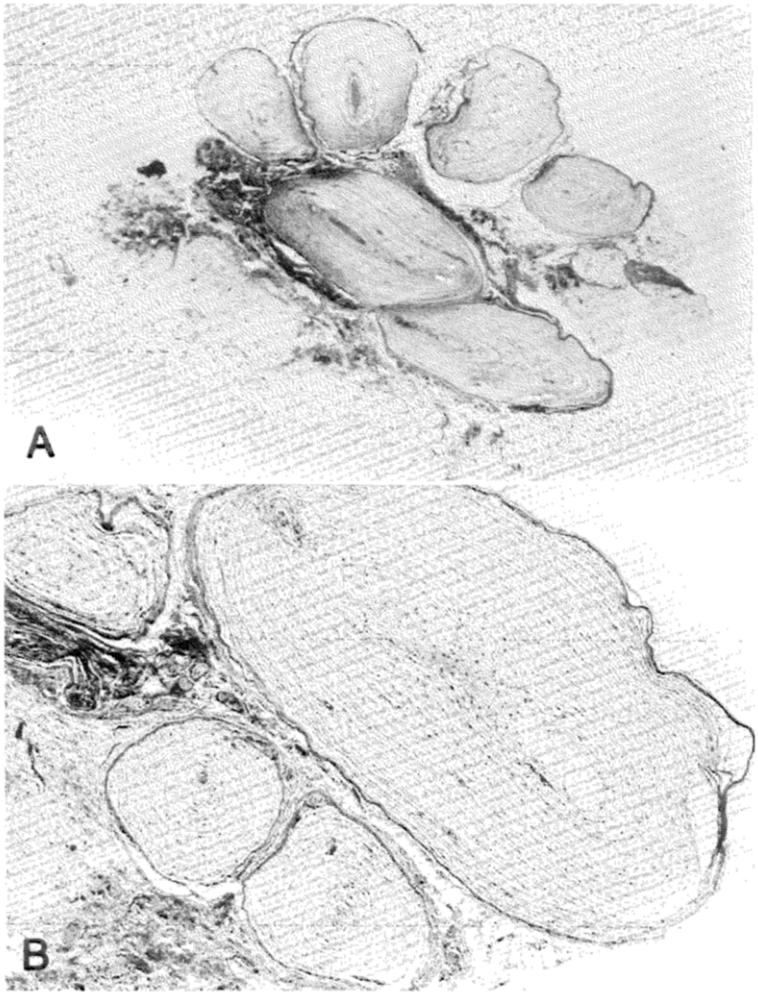


**Fig. 1. A,** Low-power photomicrograph showing large cluster of pacinian corpuscles lying within the subcutaneous adipose tissue, ranging in size from 1 to 2 mm in diameter. (Magnification ×10; hematoxylin and eosin stain.) **B,** High-power photomicrograph of the pacinian corpuscles showing the classic structure of concentric lamellae of connective tissue surrounding a central core containing an unmyelinated nerve fiber. (Magnification ×40; hematoxylin and eosin stain.)

clinical features and topographical distribution of the previously reported cases of pacinian corpuscle abnormalities.

## Case report

A 55-year-old woman was seen initially with a 2-year history of pain over the palmar aspect of her left hand between the metacarpal heads of the index and long fingers. She had sustained an undisplaced fracture of her left elbow 2 years previously. Three months after this fracture, transient inability to flex her index finger developed. Normal flexion of this finger recovered spontaneously without treatment, but after this episode she complained of pain and tenderness to pressure between the metacarpal heads of her left index and long fingers. She had been treated with several steroid injections in the area but her symptoms did not improve.

Examination revealed a well-defined area of tenderness just distal to the distal palmar crease between the flexor tendon sheaths of the index and long fingers. This area appeared to be slightly swollen when compared with the corresponding area in her right hand. There was no triggering of the flexor tendons to her index or long fingers. Sensation was slightly diminished over the ulnar aspect of the index finger and the radial aspect of the long finger. There was no Tinel sign over the area and the pin test for a glomus tumor was negative. Injection of local anesthetic into the area temporarily relieved her symptoms.

Conservative treatment with splint immobilization and antiinflammatory medications was unsuccessful, and the area was explored under axillary block anesthesia. There were several loculated deposits of steroid material in the subcutaneous tissues, but the most significant finding was of multiple pacinian corpuscles adjacent to the ulnar digital nerve to

**Table I.** Previous reports of pacinian corpuscle hyperplasia

| *Author* | *Case* | *Age* | *Sex* | *Local pain* | *Sensory changes* | *Mass* | *Trauma* | | *Relief by surgery* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *Local* | *Distant* | |
| Patterson 1956 | 1 | 33 | F | No | No | Yes | No | No | Yes |
| Zweig and Burns 1968 | 2 | 54 | M | No | Yes | No | No | Yes | Yes |
| | 3 | 42 | F | Yes | No | No | No | Yes | Yes |
| Hart et al. 1971 | 4 | 66 | F | Yes | No | No | No | Yes | With neurectomies |
| Sandzen and Baksic 1974 | 5 | 59 | F | Yes | No | Yes | Yes | No | Yes |
| | 6 | 21 | M | Yes | No | Yes | Yes | No | Yes |
| Rhode and Jennings 1975 | 7 | 44 | M | Yes | Yes | Yes | Yes | No | Yes |
| | | | | | | | | | Yes |
| | | | | | | | | | Yes |
| Schuler and Adamson 1978 | 8 | 47 | F | Yes | No | No | No | No | Yes |
| | 9 | 55 | M | Yes | No | No | Yes | No | Yes |
| Gama and Franca 1980 | 10 | 35 | F | Yes | Yes | Yes | Yes | No | Yes |
| | 11 | 23 | F | Yes | Yes | Yes | Yes | No | Yes |
| Chavoin et al. 1980 | 12 | 51 | M | Yes | No | No | Yes | No | No |
| Greider and Flatt 1982 | 13 | 69 | M | Yes | No | Yes | Yes | No | Yes |
| Friedman et al. 1984 | 14 | 18 | F | Yes | No | No | Yes | No | Yes |
| Brynildsen 1985 | 15 | 33 | F | No | Due to injury | No | Yes | No | Yes |

**Table II.** Site and type of previous reports of pacinian corpuscle hyperplasia

| *Author* | *Case* | *Digit involved* | *Site* | *Type* |
|---|---|---|---|---|
| Patterson 1956 | 1 | Thumb | Adjacent to distal phalanx | B |
| Zweig and Burns 1968 | 2 | Long | Radial and ulnar digital nerves just distal to bifurcation | A |
| | 3 | Long | Radial digital nerve just distal to bifurcation | A |
| Hart et al. 1971 | 4 | Index | Radial and ulnar digital nerves along the middle and distal phalanges | D |
| Sandzen and Baksic 1974 | 5 | Ring-small | Common digital nerve proximal to bifurcation | B |
| | 6 | Long | Radial digital nerve base of proximal phalanx | B |
| Rhode and Jennings 1975 | 7 | Index | Ulnar digital nerve just distal to bifurcation | A |
| | | Index | Ulnar digital nerve just distal to bifurcation | B |
| | | | Ulnar nerve | C |
| Schuler and Adamson 1978 | 8 | Index | Adjacent to distal phalanx | B |
| | 9 | Small | Ulnar digital nerve, middle phalanx | B |
| Gama and Franca 1980 | 10 | Thumb | Radial digital nerve, distal phalanx | B |
| | 11 | Ring-small | Radial and ulnar digital nerves just distal to bifurcation | B |
| Chavoin et al. 1980 | 12 | Long | Radial and ulnar digital nerves just distal to bifurcation and along the proximal phalanx | D |
| Greider and Flatt 1982 | 13 | Index | Distal phalanx | B |
| Freidman et al. 1984 | 14 | Index | Radial digital nerve, base of proximal phalanx | A |
| Brynildsen 1985 | 15 | Small | Radial and ulnar digital nerves, base of proximal phalanx | A |

the index finger and the radial digital nerve to the long finger for a distance of approximately 1 cm from the bifurcation of the common digital nerve. The pacinian corpuscles were all excised under the operating microscope. After operation her hand pain resolved completely. Histological examination confirmed numerous pacinian corpuscles with a density between 10 and 20 corpuscles per square centimeter (Fig. 1, *A* and *B*).

## Discussion

Lamellar corpuscles were first described by Vater in 1741 but bear the name of the Italian anatomist Pacini who described their histological structure in 1835. Pacinian corpuscles are pearl-gray structures, easily visible without magnification, measuring 1 to 4 mm in length and up to 2 mm thick. In the human hand, pacinian corpuscles have been observed in the deep layer of the palmar corium, below the sweat glands in the palmar subcutaneous fat, adjacent to the periosteum along the lateral aspect of the proximal and middle phalanges, between the flexor tendons and the periosteum of the proximal and middle phalanges, and around the attachments of the interosseous muscles. Each pacinian corpuscle consists of concentric lamellae composed of connective tissue surrounding a central acellular space containing the unmyelinated termination of a myelinated nerve fiber from the digital nerve.[13] They are rapidly adapting sensory receptors that are primarily concerned with appreciation of fine touch and vibration. They also have a close topographical relationship with the glomerular arteriovenous anastomoses in the fingertips, and it has been postulated that they may play an additional role in the regulation of local digital blood flow.[14] There has been one report of a glomus tumor that was associated with pacinian corpuscle hyperplasia.[12]

Several distinct abnormalities of pacinian corpuscles have been described. Tender nodules over the dorsal aspect of the hand or digits or over the palmar surface of the distal phalanges have been classified histologically as pacinian neurofibromas.[1-3]

Abnormalities of the pacinian corpuscles associated with the digital nerves have been classified by Rhode and Jennings[4] according to their size, number, and location. Type A describes a single enlarged subepineural corpuscle. The most common abnormality is type B and consists of a grape-like cluster of normal size pacinian corpuscles attached to the digital nerve by a fine filament. Slightly enlarged corpuscles arranged in tandem beneath the epineurium constitute the extremely rare type C abnormality. Type D abnormalities consist of hyperplastic pacinian corpuscles arranged along the entire length of a digital nerve. Five type A subepineural pacinian corpuscles have been reported previously in the literature[4-7] and presumably produce symptoms of pain by direct impingement on the digital nerves. Tupper[15] however considers this subepineural position of a pacinian corpuscle to be a normal anatomic finding. Type B pacinian corpuscle hyperplasia has been described in nine previous case reports.[4, 8-12] Pain is produced either by direct compression of the digital nerve or by direct excitation by the application of pressure to the palmar surface of the hand or digit. However, asymptomatic hyperplasia of pacinian corpuscles has been reported as an incidental finding at the time of digital nerve repair in a blind person.[16] It has been postulated that hyperplasia may be secondary to an increased demand for fine touch. Type D hyperplasia has been described in only two patients[17, 18] and the type C abnormality is extremely rare[4] (Tables I and II).

The majority of patients with pacinian corpuscle abnormalities are seen initially with the predominant symptom of pain, which in some cases may be incapacitating. Only a minority of patients have associated symptoms of numbness and approximately 50% had a palpable swelling. They seem to occur predominantly in the distal palm around and just distal to the bifurcation of the common digital nerves or in the distal segments of the thumb and index finger. The most significant factor on review of the previously reported cases of pacinian corpuscle abnormalities has been a history of local or distant trauma to the hand. The patient in our study had a previous history of distant trauma to the extremity and local trauma that may have been produced by several steroid injections. In fact, hyperplasia may have been a complication of local steroid injections. All patients with type A and type B abnormalities have obtained complete resolution of their symptoms after surgical excision of the pacinian corpuscles. However type D abnormalities are less amenable to simple surgical excision, the two reported patients having required bilateral digital neurectomies or ray amputation for eventual pain relief.

Because of the rarity of these abnormalities and the paucity of histological information, there are no accepted histological parameters as to what constitutes hyperplasia. The average number of pacinian corpuscles has been reported to be 3 to 5 per square centimeter.[16] In this patient as many as 10 pacinian corpuscles were observed in one square centimeter in a single plane, and it would seem reasonable to propose a histological definition of pacinian corpuscle hyperplasia as having at least twice the average number of pacinian corpuscles per square centimeter.

Pacinian corpuscle hyperplasia should be considered in the differential diagnosis of severe localized pain in the distal palm or over the palmar aspect of the distal phalanges, especially with a history of previous trauma either to the local area or to the same upper extremity. Injection of local anesthetic into the area should relieve the patient's pain temporarily, but definitive diagnosis can only be made at the time of surgical exploration. Excision of all the hyperplastic corpuscles has been almost uniformly curative.

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