Fibromatosis of the palmar fascia, or Dupuytren's contracture, has been the subject of many exhaustive studies, and much has been written concerning its etiology, pathology, and treatment. In most of these studies, reference has been made to the fact that there is occasionally involvement of the plantar fascia by a similar process. Since the involvement of the plantar aponeurosis is rarely symptomatic, it has been considered relatively unimportant. Recently, however, in separate reports, Skoog,1 Luck,2 and Pickren and co-workers3 have shown that the lesion in the foot is a distinct clinical entity, with characteristic gross and microscopic anatomy. They have demonstrated that the lesion occurs more frequently than is generally recognized and that important problems in differential diagnosis may arise unless this distinct clinical entity is well known. In this paper, the term disease is used instead of contracture because, in the foot, contractures are rare since extension of the fascia to the phalanges is either absent or insignificant.

**CHARACTERISTICS**

In the foot, the lesion is characterized by nodule formation, medially, near the highest point of the longitudinal arch (fig. 1). Contractures are rare. Involvement of the plantar aponeurosis may be present without involvement of the palmar aponeurosis, or the lesion may be limited to one foot. Microscopic study demonstrates that the nodules consist of masses of well-differentiated proliferating fibroblasts. They arise within the plantar fascia and usually bulge toward the subcutaneous tissue but occasionally toward the deep structures of the foot. Such nodules may arise anywhere in the plantar aponeurosis. Because of the tissue changes discussed, the lesion has been called fibromatosis of the plantar fascia. It is unfortunate that, because of local recurrences of these very cellular fibrous tumors, they have been overdiagnosed and overtreated as fibrosarcoma. It is well established that this is a benign lesion that is adequately treated by resection of the entire plantar fascia.

We have recently treated six patients with fibromatosis of the plantar aponeurosis. It is felt that the need for a more widespread awareness of the problems of recognition, diagnosis, and treatment warrant a brief report of these cases. In addition, we would like to discuss further the histopathology.

**REPORT OF CASES**

**Case 1.**—A 72-year-old man was admitted to the hospital complaining of tender nodules in both feet. The nodule in the right foot had been present for 12 years and the one in the left foot for 8 years. For two years, he had noted the gradual development of a nodule in the right palm. The lesion in the palm was asymptomatic, but those in the feet were painful when bearing weight. Examination revealed early changes of fibromatosis in each hand and the characteristic tumor masses on the medial border of each foot (fig. 1). The entire left plantar fascia was excised through an incision extending from the first metatarsal head to the os calcis on the medial border of the foot. When the fascia was exposed, there were two nodules in the medial portion that bulged toward the subcutaneous tissue (fig. 2). The pathologist's report was as follows: "Section shows a portion of fascia with several adjoining focal areas of fibroblastic proliferation of the type seen in Dupuytren's contracture" (fig. 3).

The postoperative course was uneventful. The patient became ambulant with no pain in the left foot. At a later date, through a similar incision, the right plantar fascia was removed. The tumor mass on the right side was found arising within the plantar aponeurosis and bulged toward the deep structures of the foot. It was not encapsulated, and there was no evidence of infiltrate one year later. The disease, or vessels. The pathologist's report stated: "The lesion noted on gross examination represents a cluster of several more or less discrete nodules that are invested and united by fibrohyaline connective tissue containing scattered dilated capillaries. The nodules possess a highly cellular stroma and are composed of parallel bundles of closely packed fibroblasts of quite uniform morphology. The diagnosis is plantar fascia, Dupuytren's contracture." The wound healed, and the patient became ambulant with no complaints. One year later, there was no evidence of recurrence in either foot.

This patient's case illustrates the typical clinical picture and classic gross and microscopic appearance of symptomatic Dupuytren's disease in the foot. Since there was involvement of all four extremities, the clinical entity was easily recognized. It should be emphasized, however, that lesions were present in the foot long before there was recognizable disease in the hands.

**Case 2.**—A 26-year-old man was admitted to the hospital complaining of painful nodules on the plantar surface of the right foot. When he was 18 years old, soon after induction into the Army, he noted the development of such nodules in both feet. They were excised, but, because of recurrences, additional nodules were removed one year later. The disease was then diagnosed as multiple neurofibromas of the plantar surface of the feet. Five years later, one nodule was removed from the right foot for biopsy. The pathologist's report was as follows: "The section contains several pieces of dense fibrous connective tissue that have the appearance of fascia. Among the fibrous strands of the fascia, there is new formed dense connective tissue in which there are spindle-shaped parallel nuclei. There is no evidence of inflammation or malignancy. The histological picture is most like that of Dupuytren's contracture of the plantar fascia."

On another hospital admission, the same slides were reviewed by another pathologist who reported "dense fibrous tissue compatible with, but not pathognomonic of, neurofibromas." A consultant pathologist reported: "Cellular fascial fibroma (some call these low grade fibrosarcomas) in which local recurrences can surely be expected." On the basis of a clinical diagnosis of Dupuytren's disease of the foot, the entire left plantar fascia was excised. The pathologist's report was "recurrent fascial fibroma." Two years after the operation, the patient had no recurrences in the left foot and had no com-
plains other than "numbness" caused by resection of the medial plantar nerve. On his last hospital admission, he complained of pain in the right foot and asked for the radical operation that gave relief in the left foot. The plantar fascia was exposed as in case 1. Multiple nodules were seen throughout the fascia, and the defect resulting from previous surgery was plainly visible. The remaining fascia was excised. The pathologist's report stated: "The hard mass noted on gross examination consists of a conglomeration of small nodules composed of whorled bundles of fusiform cells resembling fibroblasts. In the center of the nodule, these cells are closely packed and possess a very scant and somewhat poorly staining cytoplasm; toward the periphery, the connective tissue fibers become much courser, stain conspicuously with eosin, and appear partly hyalinized. This lesion is poorly delimited and appears to merge gradually with the adjoining fascia. The diagnosis is plantar fascia of the right foot, Dupuytren's contracture." The wound healed uneventfully, and he became ambulant and asymptomatic. He has since been lost to follow-up. His operations were performed in four different hospitals. There was never any evidence of involvement of the palmar fascia. There was obviously much difference of opinion concerning the diagnosis. The impression of neurofibromatosis led several surgeons to the belief that surgical cure was not feasible. It is felt that calling these tumors recurrent fibromas or low-grade fibrosarcomas is both inaccurate and dangerous since it has resulted in unnecessary amputation. This patient's course illustrates that only complete excision of the plantar fascia prevents recurrence.

Case 3.—A 27-year-old white man was admitted to the hospital for treatment of a tender nodule on the medial aspect of the left foot. Two years earlier, he had fractured the left tibia. As part of his fracture treatment, the left leg was placed in a walking plaster. When the cast was removed, the patient noted a callus on the medial border of the foot. Soon the callus disappeared, but it was replaced by a gradually enlarging mass beneath the skin, which was painful when bearing weight. Four months after removal of the cast, the mass was excised through a small incision. The surgeon noted that it was a part of the plantar fascia and that its removal left a defect in the fascia. The pathologist's report was as follows: "The specimen consists of a hyperplastic scar rich in cells. This lesion should be completely excised." There was no evidence of disease in the other foot or in either palm. The patient was discharged for outpatient care and was readmitted nine months later for treatment of a recurrent mass.

Because of the pathologist's previous report, the patient was presented to the hospital tumor board where there was considerable discussion concerning the nature of this lesion. It was felt by some that the lesion represented a recurrence of a very cellular tumor previously suspected of malignant potentialities and that it should, therefore, be treated as a malignant lesion. The board finally recommended wide excision of the mass. At the time of operation, a large recurrent nodule in the plantar fascia was found, and the entire plantar aponeurosis was excised. The pathologist's report said: "The sections are similar to those seen previously in that the tissue again has the appearance of reactive fibroblastic hyperplasia. In addition to the increased cellularity, there are several normal appearing mitoses. This is felt to be compatible with clinical diagnosis of Dupuytren's contracture." Convalescence was uneventful. Two years later, there was no evidence of recurrence.

Fig. 1 (case 1).—The typical size and position of the tumor mass in Dupuytren's disease of the foot.

Fig. 2 (case 1).—The tumor nodules arising from the medial portion of the plantar fascia.

Fig. 3.—Microscopic section showing great cellularity at the center of a nodule in Dupuytren's disease (hematoxylin and eosin stain; × 570).
It is felt that this patient had classic Dupuytren’s disease in one foot, without involvement of the other extremities. We have seen one other patient in whom the disease developed after the use of a walking plaster. Luck states that he has seen it several times, and Ledderhose* reported 50 cases in 1897. The presence of the callus when the plaster was removed and the subsequent development of the mass immediately beneath the callus lend support to the thought that trauma in some instances precipitates the disease.

Finally, from the discussion concerning the diagnosis in this case, it is obvious that an unnecessary amputation might have been suggested as proper treatment. We have recently seen a patient in the tumor clinic for follow-up examination who has a classic recurrence of Dupuytren’s disease in one foot. He had two previous operations at another institution and was advised that, if there was any recurrence, his leg should be amputated.

COMMENT
Recently, Pickren, Smith, Stevenson, and Stout reviewed the world literature and, with 16 additional cases, discussed this disease thoroughly. They prefer to designate it as fibromatosis of the plantar fascia. They emphasized that between the years 1927 and 1949, only seven cases were seen at the Presbyterian Hospital in New York and that two of those were treated by amputation. During that same period, nine other patients were sent to their laboratory. In five of these, the lesions had been diagnosed as potential or actual fibrosarcoma. Their review contains a comprehensive discussion of the clinical features, pathology, etiological factors, diagnostic problems, and method of treatment.

It is our belief that this disease is commoner than is generally recognized. This report is based on a study of six patients who had symptomatic involvement of the plantar fascia. It is felt that the significant features of the disease are adequately illustrated by the cases already discussed. Patients who had symptomatic palmar involvement with minimal asymptomatic plantar disease have not been considered. It appears very important to emphasize that, whatever the underlying cause may be, this disease may involve any one or all four of the extremities in various combinations. While the degree of involvement may vary, the clinical picture is characteristic. In the feet, contractures are rare because, as mentioned before, extension of the fascia to the phalanges is either absent or insignificant. Tumor formation is typical.

The term Dupuytren’s disease has been retained because it is felt that it describes, for the clinician, a definite benign disease diagnosed on the basis of clinical and gross and microscopic pathological characteristics. Over treatment is then unlikely. There are other reasons for designating this condition as Dupuytren’s disease. There is as yet no agreement as to etiological factors. Pickren and associates discussed many factors, came to no conclusion, and, while remarking on the wide variety of causes suggested, stated that “while any one of these many bizarre associations of maladies with fibromatosis of the palmar and plantar fascia must seem due purely to chance, one pauses to wonder if they may not play the part of a trigger mechanism in individuals who have a congenital susceptibility.”

In the present series of six patients, there is no common etiological factor apparent. Histological study of excised plantar fascia, however, reveals uniformly present changes that seem to indicate the mechanism by which any causative factor produces the fibrous tumor.

In previous studies, the tumor has been considered the important lesion. In discussing the pathogenesis of Dupuytren’s contracture in the hand, Luck has stated that the nodule is the essential lesion. In discussing the microscopic appearance of the lesion in the foot, Pickren and associates stated that “the normal broad, acellular collagen bands of the plantar fascia terminated at nodules of young fibroblasts and interdigitated with other bundles of highly cellular new tissue.” Skoog reported that these nodules arise in areas in which the normal collagen bundles are broken. He believes that nodules arise from perivascular connective tissue in response to such degeneration. He has demonstrated iron pigment in the areas of degeneration. He believes that in the foot, whatever other causes might be involved, the lesion is more prominent on the medial side at the highest point of the arch because mechanical strain produces the greatest degree of fiber rupture. Ledderhose also reported that this is a degenerative disease.

In our own material, we have never seen the formation of nodules in an area of normal plantar fascia. It is felt that, in the areas of nodule formation, the fibrillation, fragmentation, hyalinization, and changes in staining reaction of collagen fibers indicate degenerative disease of connective tissue and that nodule formation represents a reactive hyperplasia. The presence of increased numbers of thick-walled small vessels and focal collections of round cells is considered part of the host response to a degenerative process. If it is felt that the underlying disease is degeneration of the plantar fascia, reactive nodules may develop in many areas, and only complete excision of the plantar fascia will prevent recurrence.

It has frequently been stated that, in many cases, unusual trauma has appeared to precipitate the disease, yet, because it is difficult to demonstrate that trauma plays an important role in the majority of patients, it is usually held that the history of trauma is incidental. If it is believed that degenerative change precedes tumor formation, then it seems rational that unusual trauma to normal fascia might produce the necessary degenerative process and, therefore, be the important etiological factor. It is conceivable also that many agents might change the palmar or plantar fascia so that degenerative change follows what is considered normal use. On the basis of the evidence available, one does not seem justified in excluding trauma as a cause of Dupuytren’s disease or fibromatosis of the plantar fascia.

SUMMARY AND CONCLUSIONS
Fibromatosis of the plantar fascia or Dupuytren’s disease is a distinct clinical entity that occurs more frequently than is generally recognized. It is suggested that the disease is a reactive fibrous hyperplasia following degenerative disease of the plantar fascia.

Unless the lesion is recognized as a clinical entity, benign in nature, the histological features associated with recurrences may suggest malignant disease and result in overtreatment. Only complete excision of the plantar fascia will prevent recurrence.

76 W. Adams (26) (Dr. Pedersen).