# DUPUYTREN'S CONTRACTURE

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Dupuytren's contracture is a progressive disease which involves the palmar fascia and the digital extensions of the palmar fascia, beginning as a small nodular thickening in the palm. In its most advanced form the disease causes a severe and crippling contracture of the palm and one or more of the digits. Less frequently the condition is encountered in the foot, but contracture of the toes does not occur.

### History

Dupuytren's contracture seems to have been with mankind for a very long time. The apostolic blessing may have been originated by some long forgotten cleric who was unable to extend his ring and little fingers because of Dupuytren's contracture. The earliest mention of this contracture in medical literature however, appears to be that of Plater in 1614.[90] Henry Clive also described a contracture of this type in his lectures in 1808.[14] In 1823 Sir Astley Cooper[20] described a contracture of the palmar fascia, and differentiated it from contractures caused by involvement of the flexor tendons and their sheaths. Some have argued that the disease should therefore be called Cooper's contracture. Cooper's brief mention of the contracture, however, does not contain a record of an actual dissection of a hand afflicted with the contracture, nor is there a record of an operation for relief of the contracture.

On December 5, 1831, Dupuytren[27] showed the hands of a coachman to his students. This patient had a contracture of the palmar fascia and the ring finger. Dupuytren felt that the contracture was due to the repeated palmar trauma sustained by the coachman when using his whip. In 1832, Dupuytren[28] published an article describing this condition. The article contains the first definite description of an operation for relief of the contracture. Dupuytren operated

on the coachman whom he had shown to the students, and also on a wine merchant. In each patient the operation was a multiple fasciotomy performed through several incisions. Dupuytren also described dissection of the hand of a cadaver with the contracture. His description of the gross pathologic changes has been improved upon only slightly in the past 130 years.

Since 1832 a great volume of literature about this disease has been published. There is not general agreement about the cause, pathogenesis, and pathologic changes of the contracture. Although most authors believe that the treatment of the contracture is surgical, this has not been universally accepted.

Guillaume Dupuytren, made Baron in 1816, was born on October 5, 1777, at Pierre-Buffière near Limoges. At the age of 17 he was appointed prosector at the École de Médicine, in Paris, and became surgeon second class at the Hôtel Dieu at the age of 27. In 1814 at the age of 37 he was appointed Chief Surgeon at the Hôtel Dieu. Dupuytren died in 1835 at the age of 58 after having had apoplexy at the age of 56. The many excellent biographical sketches of Dupuytren lead us to conclude that he was universally respected as a surgeon and teacher, but personally disliked by almost all who knew him.[56]

### Anatomy

The following description is meant to be an aid to the surgeon operating for Dupuytren's contracture, and is not intended to be a complete description of all details of the anatomy of the palmar fascia.

The palmar aponeurosis is a triangular sheath of fibrous tissue which lies immediately beneath the subcutaneous fat of the palm. The apex of the triangle, in the proximal palm, receives the insertion of the palmaris longus tendon, when this tendon is

present. The palmar aponeurosis is attached on its superficial surface to the skin and subcutaneous fat by numerous small vertical projections of fibrous tissue. On its deep surface, the palmar aponeurosis is separated from the flexor tendon sheaths and neurovascular bundles by a thin layer of fat and areolar tissue. Several small vertical fibrous septa, which are important surgically, pass from the deep surface of the palmar aponeurosis, between the tendon sheaths and neurovascular bundles, and attach to the preosseous fascia overlying the metacarpals and interosseous muscles, deep in the palm. From the palmar aponeurosis, a fibrous layer extends into the fingers, forming the superficial digital fascia. From the vertical septa of the palmar aponeurosis, digital projections also pass into the fingers, forming the deep digital fascia. These layers lie superficial and deep to the neurovascular bundles, respectively. In the normal, the layers of digital fascia are thin and pliable. In a finger afflicted with Dupuytren's contracture, the digital fascial layers are usually very thick, fibrotic, and contracted. Passing from one pretendinous band to another, in the finger webs, are several small fibers of the palmar aponeurosis, called the natatory ligaments. This structure may also be involved in the disease, producing quite a marked contracture of the finger webs.

## Etiology

The exact cause of Dupuytren's contracture is unknown. Dupuytren[27, 28] and Cooper[20] believed that the contracture was caused by repeated trauma to the palm. This concept has been supported and denied by many authors. Disagreement over whether or not Dupuytren's contracture is caused by trauma represents the main point of dispute among those who are especially interested in this disease. Certain predisposing factors, however, have found almost universal acceptance.

**Age.** Dupuytren's contracture occurs most frequently in the fifth, sixth, and seventh decades of life.[30, 50, 66, 67, 73, 101] In one series of 99 patients reported by Larsen and Posch,[66] only 12 were under 40 years of age. In a group of 154 patients reported by

Luck,[73] there was no patient younger than 21 years of age. The average age was 56.5 years for men, and 61.1 years for women. There are occasional reports of patients in their twenties and thirties who have Dupuytren's contracture, and very rarely a teenage patient will be found to have the disease.[30, 73]

**Sex.** Dupuytren's contracture is predominantly a disease of men. Most reported series indicate that the disease occurs seven or eight times more frequently in men than in women.[101] Hueston,[50] however, found that there was no increase in the incidence of Dupuytren's contracture in men over women.

**Race.** There is universal agreement that Dupuytren's contracture is primarily a disease of the Caucasian race. Bunnell states that Dupuytren's contracture occurs in perhaps 1 to 2 per cent of the population.[14] Certainly, however, 1 to 2 per cent of the population of the United States do not have Dupuytren's contracture in a stage which requires surgery. Early[30] found that the incidence of Dupuytren's contracture in men varies between 0.1 per cent in the age group 15 to 24, to 18.1 per cent in the age group 75 and older. In women, the variation was found to be from 0.5 per cent between the ages of 45 and 54, to 9 per cent in women 75 years of age and older. Early found an over-all average of 4.2 per cent men, and 1.4 per cent women over the age of 15 years to have some degree of Dupuytren's contracture.

The existence of this disease in the Negro has often been questioned. Certainly it does occur in the American Negro. My associates and I have operated upon at least 15 American Negroes, both male and female, with definite Dupuytren's contracture. A review of the literature[112] and personal communication with surgeons working in Africa has left me in doubt about whether or not Dupuytren's contracture does occur in the presumably pure African Negro. Dupuytren's contracture is occasionally encountered and operated upon in Japan. The contracture does occur in the Oriental, but much less commonly than in the Caucasian.[108]

**Heredity.** There is a definite hereditary tendency toward the development of Dupuy-

stren' contracture. European writers frequently report that as many as one-third of their patients with Dupuytren's contracture have a positive familial history of the disease.[25, 73, 99, 101] The incidence of a positive familial history in most series reported from the United States is somewhat lower than this.[66, 73, 121] I, and other writers, have felt that the lower incidence of a positive familial history in this country is due to the fact that so many of our population are first and second generation Americans, and really have no accurate knowledge of the medical history of their ancestors.

Except for the four predisposing factors of age, sex, race, and heredity, there is no general agreement about the cause of Dupuytren's contracture. Krogius[62, 63] in 1920 advanced the idea that Dupuytren's contracture is due to the presence of a primitive flexor brevis manus superficialis muscle within the palm. This theory has found recent support[113] but in general has not been accepted. Lund[74] in 1941 first called attention to the high incidence of Dupuytren's contracture in patients with epilepsy. He found that 25 per cent of 171 female epileptics and 50 per cent of 190 male epileptics had Dupuytren's contracture. This finding has been confirmed by several other authors.[6, 30, 38, 50, 101] The reason for the remarkably higher incidence of Dupuytren's contracture in patients with epilepsy is not clear. Arieff and Bell[6] were unable to find any correlation between the development of Dupuytren's contracture in the epileptic and the type of medication, type of seizure, or changes in electroencephalographic records. The high incidence of Dupuytren's contracture in patients with epilepsy is therefore an interesting but poorly understood observation. Epilepsy, however, is not common in patients with Dupuytren's contracture.

Dupuytren's contracture has also been regarded as a form of primary fibrositis, but this concept has not found general acceptance.[106, 107] The appearance of coronary artery disease in patients with Dupuytren's contracture[31] seems to be simply the fortuitous occurrence of two diseases of advancing years in the same person.[6, 38] Diabetes, neurocirculatory dystrophy, shoulder-hand

syndrome, alcoholism, and or cirrhosis of the liver, and many other conditions have been associated with Dupuytren's contracture by various authors.[12, 23, 50, 93, 96, 97, 117, 120] There is no general agreement in the literature which would indicate that any of these conditions are uniformly related to the development of Dupuytren's contracture.

Nezelhof and Tubiana[86] have listed seven popular etiologic theories. These authors reject each of these theories and conclude that none of them can explain the gross or microscopic changes noted in the palmar aponeurosis afflicted with Dupuytren's contracture.

Cooper[20] and Dupuytren[27, 28] both believed that the contracture arose as a response to repeated palmar trauma. Whether or not trauma plays a role in the development of the contracture is the main point of disagreement among persons interested in this disease. Moorhead,[84] McIndoe,[78] and Gordon[38] believe that there is no relationship between trauma and Dupuytren's contracture. Luck[73] believes that trauma may hasten or aggravate the contracture, but feels that the same degree of contracture would have occurred without any trauma to the palm. Clarkson[15] has recently stated that trauma, a single major injury, or repeated minor trauma, may be a causative or aggravating factor in the development of Dupuytren's contracture. Gordon,[39] more recently, has reported one case of a hyperextension injury of the long finger which was followed by the development of a nodule in the distal palm that was histologically like Dupuytren's contracture. In 1948 Skoog[101] published a most exhaustive review of Dupuytren's contracture. In this review, Skoog reported his observations of the microscopic pathology of the contracture. On the basis of this very careful study, Skoog[101, 102] concluded that trauma may play a role in the development of the disease. Larsen and Posch[66-68] have supported this hypothesis. Our support is based on our observations of the microscopic changes in the palmar fascia of patients with Dupuytren's contracture, and also on certain experimental work on the palmar aponeurosis of the monkey.

The chief argument used to disprove any

relationship between trauma and the development of Dupuytren's contracture is that in most published series, there are slightly more nonmanual workers than there are manual workers.[14, 30, 50, 56, 66, 73] This finding has been used by many authors to rule out occupational trauma as a cause of Dupuytren's contracture. The evidence has then been expanded to rule out all forms of trauma to the palm as a possible cause of the contracture. It has certainly not been finally determined whether or not trauma does play a part in the development of Dupuytren's contracture, since so many excellent studies disagree so markedly. I support the concept of Skoog, and believe that repeated minor trauma to the palm may be at least one of the inciting factors that cause the palmar aponeurosis to develop this disease.

In summary, Dupuytren's contracture seems to develop in predisposed persons as a response to some inciting agent or incident. The accepted predisposing factors are age, race, sex, and heredity; others, as yet unknown, may be operative also. I believe that repeated minor trauma to the palm is one means by which the development of the contracture can be provoked in predisposed persons. The reader should remember, however, that not all who have an authoritative opinion share this concept.

### Diagnosis

The earliest recognizable stage of Dupuytren's contracture usually begins in the palm, but may rarely occur first in one of the digits (Fig. 1). The disease begins as a small nodular area in the palmar fascia, usually at the level of the distal palmar crease and is most commonly in line with the ring finger. The nodule is usually painless and nontender, although occasionally pain and tenderness may be present to a mild degree. The development of the contracture at this stage is so insidious and symptom-free that often the patient cannot accurately recall when the disease began. As the contracture progresses, other nodules appear, either in line with the original nodule or at other points in the palmar aponeurosis (Fig. 2). The overlying skin is usually adherent to the nodules because of involvement of the small vertical fibrous attachments passing between the palmar aponeurosis and the skin. The contracture at this stage is in the proliferative phase according to the classification of Luck.[73]

As the disease progresses into the involutional stage, the size of the fibrous nodules decreases and they become firmer in consistency. At this time contracted longitudinal bands of palmar fascia may appear beneath the skin (Fig. 3). When the digital projections of the palmar fascia to the superficial and deep layers of digital fascia become involved in this process, the metacarpophalangeal joints or proximal interphalangeal joints, or both, will be gradually drawn into a fixed flexion deformity (Fig. 4A). The contracted bands of palmar and digital fascia may become greatly thickened and firmly resist all attempts at passive extension of the metacarpophalangeal and proximal interphalangeal joints. Only rarely will the distal interphalangeal joint be involved in the flexion contracture (Fig. 4B). Usually the distal interphalangeal joint is held in the extended position. Not infrequently this joint will be markedly hyperextended or have even developed a dorsal subluxation (Fig. 5).

In the final form of the contracture, designated by Luck[73] as the residual stage, only the contracted fibrous bands are present. Small nodular thickenings may be palpable within the bands. The length of the contracted bands varies greatly. Not infrequently, however, one or more bands will be observed passing from the proximal portion of the palm to the midportion of the middle phalanx, uninterrupted.

Dupuytren's contracture is more apt to involve the ulnar side of the palmar aponeurosis than any other part of the hand. Skoog[101, 102] reported the ring finger to be involved in the contracture 1451 times in 2277 hands, the little finger 1217 times, the long finger 536 times, the index finger 123 times, and the thumb only 73 times. It is more common to find the contracture in both hands, but the right hand will be involved more frequently than the left, when the condition is unilateral. Boyes[10] found that in right-handed persons the contracture was apt to appear first in either hand with
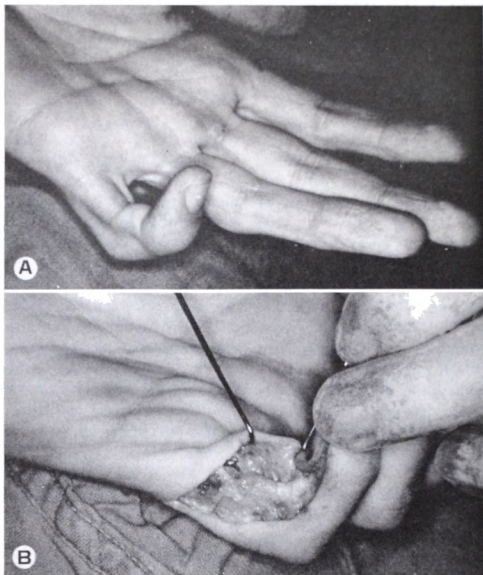
*Figure 1. A.* Dupuytren's contracture manifested entirely by nodules and contracted band in the little finger. Usually the contracture occurs first in the palm and involves the finger secondarily, but an occasional patient will be encountered with the contracture occurring only in one or more of the fingers, and no disease in the palm. *B.* Operative exposure of the contracture in the little finger. Same patient as *A.*

about equal frequency, but in 44 per cent of his patients the contracture developed in both hands simultaneously.

**Differential diagnosis.** It is not difficult to differentiate Dupuytren's contracture from other deformities of the hand. Arthritis of the hands limits flexion as well as extension. In Dupuytren's contracture, flexion is unimpaired, except in those contractures where the distal interphalangeal joint is drawn into hyperextension. Flexion deformities due to suppurative tenosynovitis usually involve the distal interphalangeal joint as well as the proximal interphalangeal and metacarpophalangeal joints. In Dupuytren's contracture, the distal interphalangeal joint is uninvolved or is held in the hyperextended position. Congenital contractures of the ring or little fingers, most often seen

in the proximal interphalangeal joint, lack the characteristic nodule and band formation of Dupuytren's contracture. Longitudinal scars and burn scars should be easily differentiated by a careful history and examination, and the same is true for extensor tendon injuries producing flexion deformity of the fingers.

**Related conditions.** A small percentage of patients with Dupuytren's contracture in the hand will also have contracture in the plantar aponeurosis (Fig. 6) (5 per cent in my experience).[22, 36, 57, 66, 73, 78, 89, 121] In a group of 171 patients with Dupuytren's contracture of the hand, Yost[121] and associates found only three patients to have the same disease in the foot. Histologically, the lesion in the foot is the same as that encountered in the hand. The nodules tend to

be larger, and perhaps somewhat more cellular. The lesion in the foot undergoes the same stages of maturation as does the lesion in the hand, but this seems to occur more slowly.[73] Contracture of the toes does not occur in Dupuytren's disease of the foot, because the plantar aponeurosis does not send pretendinous bands into the toes, as does the palmar aponeurosis into the fingers.[57]

**Knuckle pads.** Quite often, patients with Dupuytren's contracture will exhibit a nodular thickening over the dorsal surface of one or more of the proximal interphalangeal joints of the fingers. Skoog[101] has reported knuckle pads to be present in as many as 44 per cent of patients with Dupuytren's contracture. Hofmeister[45] in 1957 found the same histologic changes in the knuckle pads as those encountered in the palmar aponeurosis in patients with Dupuytren's contracture.

**Peyronie's disease.** Peyronie's disease has been considered to be another form of hereditary fascial contracture in the penis.[101, 111] The relationship between Dupuytren's contracture and Peyronie's disease was first described by Kirby in 1850.[58] McIndoe[78] has challenged this concept and believes that a relationship between Peyronie's disease and Dupuytren's contracture cannot be proved. My associate and I have never seen a patient with Dupuytren's contracture who also had Peyronie's disease.

## Pathology

**Gross pathology.** Dissection of a hand afflicted with Dupuytren's contracture reveals the primary gross morbid changes to lie entirely within the palmar aponeurosis and its various septa and digital projections. The early nodules of the disease are found to lie within the palmar aponeurosis. The borders of the nodules are ill defined and blend insensibly into the surrounding palmar fascia. The nodule itself is pale grayish-white and lacks the slightly yellow color of the normal fibers of the palmar fascia. Quite early in the development of the disease, the nodules will be found to be attached to the deep surface of the skin with little or no

intervening subcutaneous fat. One cannot demonstrate a natural cleavage plane between the nodule and the skin. According to Luck,[73] all the contracture occurs within the nodular areas, while the formation of the contracted cords, which is usually proximal to the nodules, represents hypertrophy of the palmar fascia in response to repeated stress. The skin overlying the early nodules of Dupuytren's contracture is often drawn into crescentic folds, with the concave surface of the crescent pointed proximally.

In the later stages of the disease, very thick bands of palmar aponeurosis may be noted, tenting up the overlying skin. The contracted bands are usually not attached as intimately to the skin as are the nodular areas. Often a thin layer of subcutaneous fat will be found still present between the contracted band and the deep surface of the skin. The contracted bands may occur anywhere in the hand where there is palmar
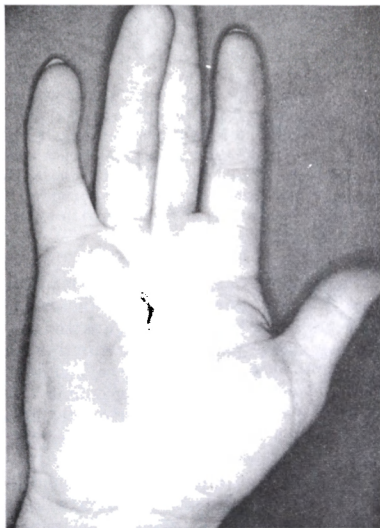


*Figure 2.* Early Dupuytren's contracture manifested primarily by two nodules in the palm in line with the ring finger. Minimal limitation of extension of the metacarpophalangeal joint of the ring finger is just beginning to occur.
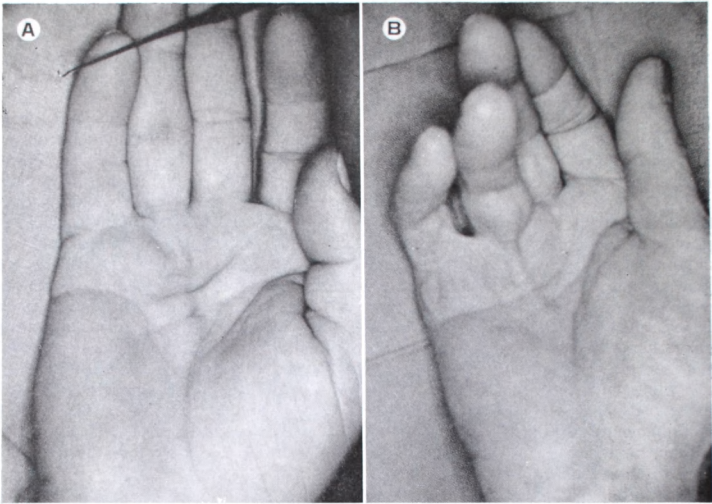
*Figure 3. A.* Slightly more advanced stage of Dupuytren's contracture than illustrated in Figure 2 The skin at the level of the distal palmar crease is just beginning to be drawn into a crescentic fold. A prominent contracted band in line with the ring finger is forming beneath the palmar skin. There is as yet no limitation of extension of the digits. This patient, when first seen, had only a solitary nodule at the level of the distal flexion crease of the palm. He developed this degree of contracture during a one year period of observation. *B.* More advanced stage of Dupuytren's contracture with a prominent band beneath the skin in line with the ring finger. There is a large proliferating nodule overlying the proximal finger segment. Limitation of extension of the metacarpophalangeal joint is pronounced. Limitation of extension of the proximal interphalangeal joint is just beginning.

fascia or one of the projections of the palmar fascia. Thus the small vertical fibrous septa passing from the deep surface of the palmar aponeurosis to the preosseous fascia may become involved in the contracture. At the level of the metacarpophalangeal joints, as the septa pass into the digits to communicate with the deep digital fascia, extremely thick bands of the contracture may be encountered.

The superficial and thus more clinically noticeable contracture of the pretendinous bands pass from the base of the palmar aponeurosis beneath the skin to enter the digits. The bands of contracture formed in the pretendinous bands tend to be somewhat more centrally located over the volar aspect of the metacarpophalangeal joint in contrast to the lateral position of the bands

formed within the small vertical fibrous septa. The contracted pretendinous bands tend to be adherent to the skin, often over a length of several centimeters. Subcutaneous fat is frequently absent in these areas. Separation of the contracted pretendinous bands from the deep surface of the skin can only be accomplished artificially with a scalpel.

The contracture formed within the pretendinous bands and superficial digital fascia tends to lie more in the midline of the digit. In the advanced form, these bands attach quite deeply along the sides of the flexor tendon sheath at the base of the middle phalanx. The contracted bands formed in the deep layer of the digital fascia attach more to the sides of the proximal and middle phalanges. An attachment of these deeper
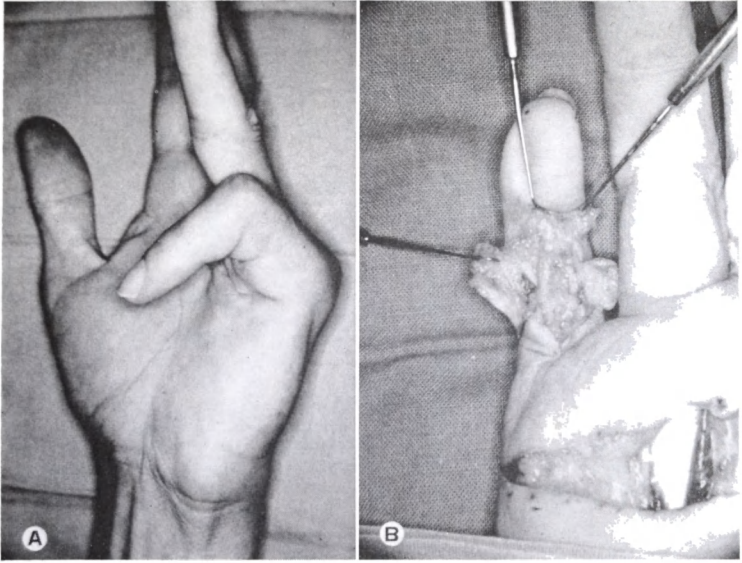
*Figure 4.* *A.* Quite advanced stage of Dupuytren's contracture involving the palm and the little finger. There is slight maceration of the opposed skin surfaces in the distal palm. When a contracture has reached this stage, secondary changes in the skin and in the joints will often preclude a completely normal return of extension. *B.* Operative exposure of the patient illustrated in *A.* Note the band in the little finger extending to the distal phalanx. This is an uncommon finding. Ordinarily the contracture does not extend beyond the midportion of the middle phalanx, and the distal interphalangeal joint remains uninvolved.

bands to the free edge of the lateral bands of the extensor apparatus may account for the tendency for the distal phalanx to be drawn into hyperextension in advanced cases of Dupuytren's contracture (Fig. 5).

In the late stages of the disease, little if any nodule formation is present. A few small very firm nodules may be palpable within the contracted palmar aponeurosis. The contracted bands at this stage often appear grossly to have undergone hyalinization, with a yellowish, almost translucent appearance.

During the involutional and residual stages (classification of Luck[73]) one will occasionally encounter areas of the contracture, either in the distal palm or in the digits, where a digital nerve appears to pass directly through a nodule of contracture. This is

caused by involvement of both the superficial and deep layers of the palmar or digital fascia on each side of the digital nerve. Careful dissection will always reveal that the digital nerve is surrounded but not actually involved in the contracture.

At times, when the palmar aponeurosis and its deep vertical projections are severely involved with Dupuytren's contracture, it may appear that the contracture is attached to the flexor tendon sheaths. It is our experience, however, that the flexor tendon synovial sheaths always remain uninvolved and are not attached to nor invaded by the contracture. By careful dissection, the synovial layer can be maintained over the flexor tendons, intact.

**Secondary changes in other tissues of the hand.** In moderately advanced and

*Figure 5.* Advanced stage of Dupuytren's contracture with limitation of extension of the metacarpophalangeal and proximal interphalangeal joints. The hyperextension deformity of the distal interphalangeal joint has extended to the point of dorsal subluxation of this joint. The hyperextension deformity of the distal interphalangeal joint probably occurs as a result of contraction of the digital fascial attachments to the lateral bands, drawing these bands forward much as in a boutonnière deformity. Production of the hyperextension deformity of the distal phalanx may at times be assisted by the repeated effort to push the handle of a tool into the palm.

later stages of Dupuytren's contracture, the overlying skin may be intimately adherent to the palmar fascia over long distances. Contracture and shortening of the skin at this stage often makes wound closure a difficult problem. In addition, the necessity for creating an artificial cleavage plane between the palmar skin and the contracture often leaves very thin skin flaps which show a poor tendency to heal.

Secondary joint contracture in the meta-carpophalangeal or proximal interphalangeal joint, or both, occurs quite commonly in the advanced stages of Dupuytren's contracture. This appears to be due to shortening of the anterior capsular and ligamentous structures of the joints. This secondary change is particularly prone to occur in the proximal interphalangeal joint and less in the metacarpophalangeal joint. Once an established joint contracture has occurred, removal of the contracted palmar fascia will not result in complete relief of the flexion deformity.

**Microscopic pathology.** In 1887, Langhans[65] published the first detailed account of the microscopic changes encountered in Dupuytren's contracture. Since that time a great number of authors have reported their observations on the microscopic changes encountered in Dupuytren's contracture.[4, 5, 7, 9, 12, 16, 17, 23, 34, 47, 49, 52, 53, 55, 62, 64-70, 86, 83, 101, 102, 113, 114] Advanced techniques in tissue preparation, staining, and histochemistry have been included in these reports as these techniques became available. There is little disagreement about the microscopic changes in the palmar aponeurosis, but there is considerable disagreement about the interpretation that should be placed upon these various changes.



*Figure 6.* Dupuytren's contracture of the foot. The location of the nodule in this patient was quite characteristic.
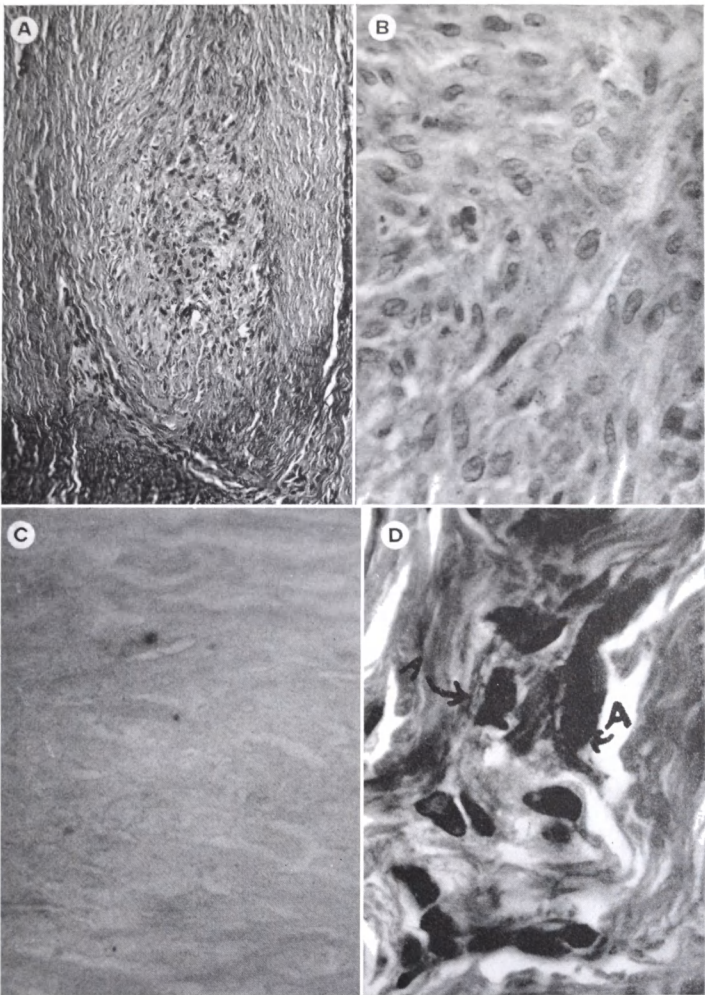
*Figure 7. A.* Low power photomicrograph of an early nodule of Dupuytren's contracture. Note that the cellular nodule in the center of the field blends insensibly into the surrounding normal palmar aponeurosis. The nodule is not encapsulated. Hematoxylin and eosin. × 135. *B.* High power photomicrograph of the early, proliferative, stage of Dupuytren's contracture. The fine black granules scattered throughout the area are hemosiderin, which appears yellow-brown in this preparation. Hematoxylin and eosin. × 400. *A* and *B* are reproduced from Larsen *et al.*[68] by permission of the *Journal of Bone and Joint Surgery. C.* Prussian blue stain, × 600, of an early nodule of Dupuytren's contracture. The dark granules are hemosiderin. They stain a deep blue, and are readily recognizable with this stain. Eosin counterstain. *D.* High power photomicrograph of a very early area of fibrous tissue proliferation in Dupuytren's contracture. The dark granules at *A* are hemosiderin granules, and stain a dense blue in this preparation. Prussian blue, hematoxylin and eosin counterstain. × 1100. *C* and *D* are reproduced from Larsen and Posch[66] by permission of *Journal of Bone and Joint Surgery.*
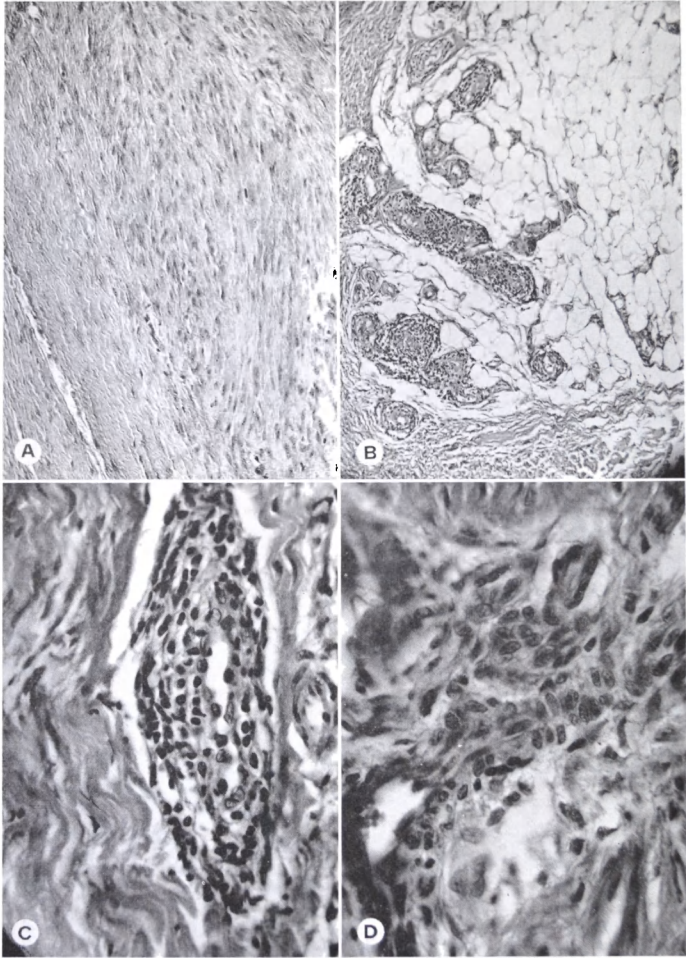
*Figure 8. A.* Low power photomicrograph of a moderately advanced stage of Dupuytren's contracture. This preparation is made with Verhoeff's elastic tissue stain and illustrates that there is no formation of new elastic tissue in Dupuytren's contracture. If elastic tissue were present in this preparation, it would be visible as very dark prominent undulating bands. × 135. *B.* Perivascular accumulation of inflammatory cells in the palm of a patient afflicted with Dupuytren's contracture. The location of these inflammatory cells is quite characteristic. The inflammatory cells are perivascular in location and are almost always encountered in the subcutaneous fat of the palm, rather than within the apo-

In the nodular or proliferative stage of the contracture, the primary lesion is one of marked fibroblastic proliferation. The early nodule of Dupuytren's contracture is primarily made up of many immature fibroblasts. There is a marked capillary vascularity of the nodule. Small collagen fibers, and perhaps also precollagen fibers, are scattered irregularly throughout the nodule. These areas are not encapsulated. Rather, they blend insensibly into the surrounding and normal palmar aponeurosis (Fig. 7A and B). Small granules of iron pigment deposit, presumably hemosiderin, may be found scattered throughout the proliferating area, particularly when the tissues are stained with Prussian blue (Fig. 7C and D). Metachromasia is present almost uniformly in the early nodules of Dupuytren's contracture. The fibers formed in the proliferative phase of the disease are entirely collagen. No elastic fibers are present (Fig. 8A).

Perivascular accumulation of inflammatory cells, almost entirely lymphocytes, is a common finding. This inflammatory response, however, is almost uniformly confined to the fat surrounding the palmar aponeurosis (Fig. 8B). Perivascular inflammation within the aponeurosis itself occurs rarely (Fig. 8C).

Some authors have noted the appearance of both capillary and arteriolar proliferation in the early lesions of Dupuytren's contracture, and have felt that the fibroblastic proliferation arises from fibrocytes clustered about the small vessels of the palmar aponeurosis (Figs. 8D and 9A).

Skoog, in 1948,[101] and Larsen and Posch, in 1960,[68] have stated that the fibers of the palmar aponeurosis at the margins of the proliferating nodules appear to have been ruptured. These fibers approach the margins of the proliferating nodule in an undulating fashion, where they terminate abruptly.

The undulating course of the aponeurotic fibers gives these fibers the appearance of having been released from tension (Fig. 9B and C). This finding, together with the hemosiderin within the proliferating nodule, which has been interpreted as evidence of previous microhemorrhage, and the fibroblastic and angioblastic proliferation within the early nodule of Dupuytren's contracture, has led the above authors to conclude that the primary lesion of the contracture is a response to microrupture of portions of the palmar aponeurosis. According to this hypothesis, the fibers of the palmar aponeurosis are ruptured. The intervening defect is then first filled with a small hemorrhage, and this area is subsequently invaded by proliferating fibroblasts and capillary buds. The reader should remember, that although I favor this hypothesis, it has not found universal acceptance, and indeed has been vigorously denied by others.

The second stage of Dupuytren's contracture has been designated the involutional stage by Luck,[73] and the third stage has been designated as the residual stage. Between the early nodules of fibroblastic proliferation and the mature collagen fibers of the residual stage, there is a steady and gradual transition of maturation of fibrous tissue. The plump, irregularly arranged nuclei of the early nodule become elongated and oval, and assume a regular pattern with the long axes of the nuclei lying roughly parallel to each other (Fig. 9D). The collagen fiber content of the contracting area increases as the nuclei assume the oval shape and regular orientation. Gradually collagen fibers become more abundant, and the nuclei become more widely separated by the collagen fibers. As these changes progress, the capillary vascularity steadily decreases. Hemosiderin, which is found in the early nodules, is not encountered in the contracture during its maturing phases.

neurosis itself. Hematoxylin and eosin. × 135. C. Perivascular accumulation of inflammatory cells within the palmar aponeurosis of a patient with Dupuytren's contracture. This is an uncommon finding. If perivascular inflammation is present, it is almost uniformly confined to the subcutaneous fat. Hematoxylin and eosin. × 400. D. Thick walled blood vessels in the palmar aponeurosis of a patient with Dupuytren's contracture, showing early proliferation of perivascular fibrocytes. Hematoxylin and eosin. × 400. A, B, C, and D reproduced from Larsen and Posch[66] by permission of the *Journal of Bone and Joint Surgery.*
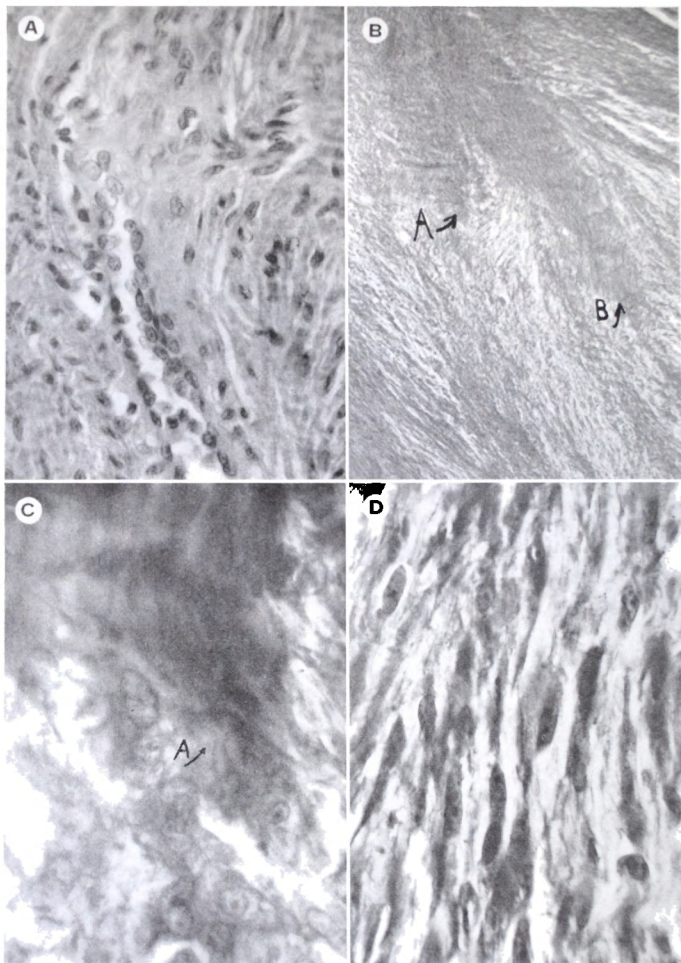
*Figure 9. A.* Section through an early nodule in the palmar aponeurosis of a patient with Dupuy-tren's contracture. Note the apparent "streaming" of immature fibrocytes along the wall of the small blood vessel. It is probable that the perivascular fibrocytes are the site of origin of the proliferating tissue of Dupuytren's contracture. Reproduced by permission of the *Journal of Bone and Joint Surgery.*[66] *B.* Section through a proliferating nodule of Dupuytren's contracture, illustrating the abrupt termination of fibers of the aponeurosis at the margin of the nodule (*A, B*). Mallory's connective tissue stain. × 135. *C.* High power view of the margin of an early nodule of Dupuytren's contracture illustrating the abrupt termination of the fibers of the aponeurosis at the margin of the nodule. The fibers at *A* are the same as those at *A* in *B.* Mallory connective tissue stain. × 1100. *D.* This photomicrograph illustrates the increase in the collagen fiber content of the nodule as it matures. The nuclei are more elongated, with their long axes arranged parallel to each other. Hematoxylin and eosin. × 400.

The ultimate fate of the maturing fibrous tissue is a very dense band of collagen fibers (Fig. 10). The nuclei are pyknotic and are seen as flattened, densely stained structures widely separated by dense collagen fiber, with little or no nuclear detail visible.

In the most advanced stage of the contracture, the collagen of the contracted band may undergo hyalinization. This has been reported by Lagier and Rutishauser,[64] and confirmed by Larsen et al.[68] The hyalinized collagen tissue within the contracted band takes the blue stain of hematoxylin and eosin, and stains red or reddish blue with Mallory's connective tissue stain.

In 1960, Larsen et al.[68] reported an experiment on the palmar aponeurosis of the monkey (Fig. 11). The fibers of the palmar aponeurosis were partially torn (Fig. 12A). The areas of partial rupture of the palmar aponeurosis were then serially excised at
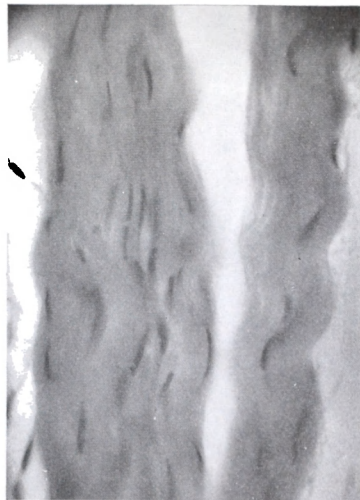


*Figure 11.* Photomicrograph of the normal palmar aponeurosis of the Rhesus monkey. Hematoxylin and eosin. × 400.



*Figure 10.* Mature scarlike stage of Dupuytren's contracture. This is a very dense, scarlike stage, with only a few blood vessels visible. The nuclei are widely separated by the collagen fibers and are quite pyknotic. Hematoxylin and eosin. × 135. Reproduced from Larsen *et al.*[68] by permission of the *Journal of Bone and Joint Surgery.*

intervals of one to nine months. The histologic appearance of the area of partial rupture of the monkey's palmar aponeurosis was identical with that of the various stages of Dupuytren's contracture. At one month a greyish-white, poorly defined nodule was found within the palmar aponeurosis (Fig. 12B). Histologically this nodule showed the same appearance as the early nodules of Dupuytren's contracture, with proliferating fibroblasts, increased capillary vascularity and hemosiderin within the proliferating nodules (Fig. 13A). Gradually over the next eight months the stages of maturation appeared in the areas of partial rupture, in the same manner that has been described for human Dupuytren's contracture (Fig. 13B). At nine months the partially ruptured areas of palmar aponeurosis in the monkey showed a dense relatively avascular scarlike appearance quite similar to that seen in the advanced stages of Dupuytren's contracture. On the basis of this experimental evidence, Larsen and Posch concluded that partial or microrupture of the fibers of the palmar
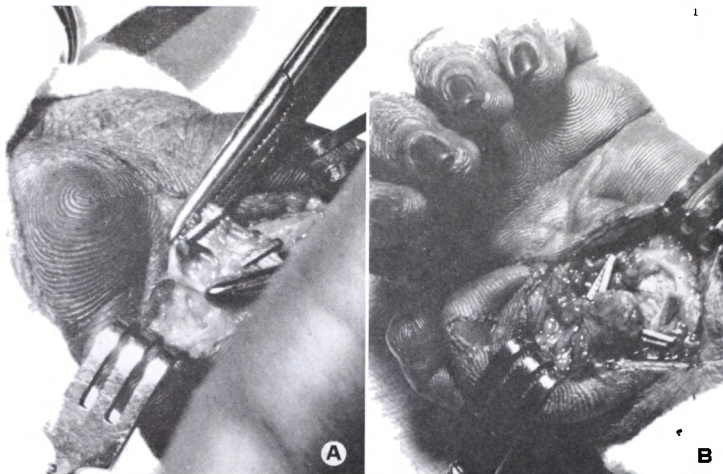
*Figure 12.* *A.* Experiment to test the effect of partial rupture of the palmar aponeurosis of the Rhesus monkey. The area to be tested is identified between small silver clips. The fascia on each side of the clips is grasped with hemostats. The segment of palmar aponeurosis between the clips is then gently pulled apart until a small degree of tearing of the aponeurosis is noted. *B.* Nodule lesion produced in the palmar aponeurosis of the monkey by the technique described in *A.* This nodule occurs only in the area of fascia lying between the clips. Control studies indicate that the nodule would not form unless the fibers were partially torn.

aponeurosis was at least one method by which the lesion encountered histologically in human Dupuytren's contracture could be produced.

**Summary.** Dupuytren's contracture begins as a proliferating vascular nodule of young fibrous tissue. Many of these nodules contain hemosiderin. Gradually the nodules mature with increasing regularity of the arrangement of the nuclei and increasing collagen fiber content. As the maturation of the fibrous tissue proceeds, the vascularity of the area decreases. Finally a mature scarlike stage is reached. At this time the contracted band is almost avascular, and there are a great number of collagen fibers widely separating very dense pyknotic nuclei.

Nezelhof and Tubiana[56] have listed seven popular etiologic theories: (1) inflammatory disease; (2) rheumatic disease; (3) congenital malformation; (4) traumatic or occupational disease; (5) collagen disease; (6) trophic, or dystrophic disease; (7) tumor. These authors have concluded that none of these theories can explain the clinical and histologic findings encountered in Dupuytren's contracture.

It must be said therefore that there is no unanimity of opinion regarding the interpretation to be placed on the histologic changes observed in Dupuytren's contracture. The exact nature of these changes, and thus the etiology of Dupuytren's contracture, therefore, remain unknown.

## Treatment

**Nonoperative treatment.** In the past, attempts have been made to treat Dupuytren's contracture by injection of various solutions such as pancreatic extract,[95] pepsin,[44] fat,[90] fibrinolysin,[71] and copper sul-
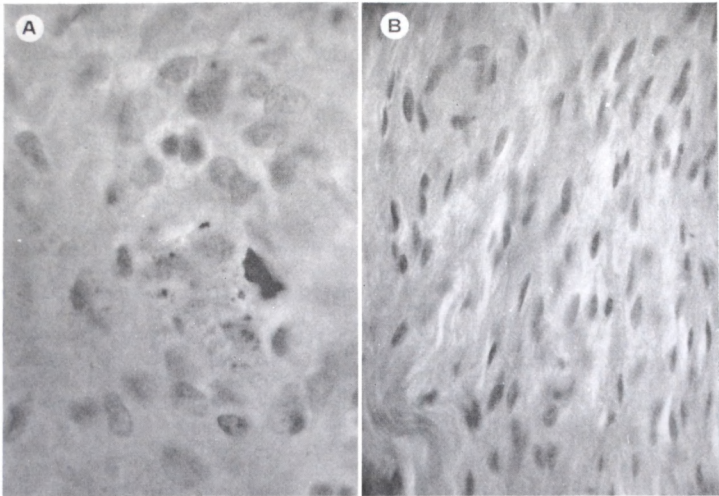
*Figure 13. A.* Photomicrograph of the proliferating nodule obtained in the palmar fascia of the monkey by partial rupture of the fascia. Hematoxylin and eosin. × 400. The dark granules visible in the field are hemosiderin granules. Note the marked similarity between this photomicrograph and Figure 7B. *B.* Photomicrograph of the proliferating nodule in the monkey's palmar fascia produced by experimental partial rupture of the fascia, five months after the experimental operation. The tissue here has undergone maturation. The collagen fiber content has increased. The nuclei are oval in shape with their long axes arranged parallel to each other. Note the similarity between the photomicrograph and Figure 9D. Hematoxylin and eosin. × 400. *A* and *B* reproduced from Larsen *et al.*[68] by permission of the *Journal of Bone and Joint Surgery.*

fate,[46] into the palm. More recently, cortisone[8] and hydrocortisone[122] have been injected into the palm in an attempt to relieve the contracture. All these methods have been found to be without value.

Vitamin E and compounds with vitamin E activity may temporarily soften the contracture, but in no instance has the disease been cured, nor has its progress been halted.[66, 67, 106, 107]

Irradiation of the palm has been reported by Finney[31, 33] and by Wasserburger[115] to have some effect on Dupuytren's contracture. Wasserburger found that the results of radiation therapy varied with the severity of the contracture, and stressed the importance of early treatment with radiation therapy. Finney also found that irradiation was only effective in the treatment of the early cases and had no effect on patients in the more advanced stages of the disease. The published results of radiation therapy appear to be inferior to those obtained with a properly selected and carefully executed operation.

**Operative treatment.** It is now generally agreed that the only consistently efficacious treatment for Dupuytren's contracture is excision of the diseased palmar aponeurosis.[10, 14, 18, 37, 56, 60, 66, 67, 80, 101] The surgeon confronted with a patient with Dupuytren's contracture has two important decisions to make. The first of these is to decide when surgery becomes necessary. Many patients with one or two early nodules of Dupuytren's contracture spontaneously arrest their disease at this point and never progress further. The nodules are painless and cause
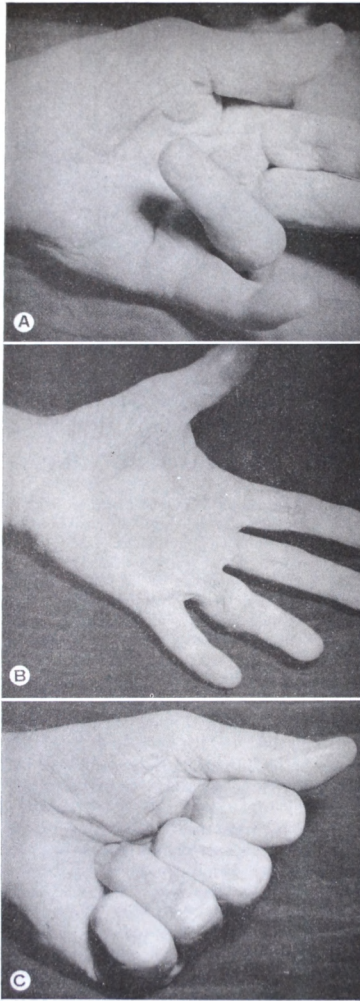
no disability. Certainly one does not operate on a patient with this minor degree of Dupuytren's contracture. On the other hand, one should not wait until a severe advanced stage of the contracture has developed. Secondary changes in the skin and finger joints, which are so commonly associated with the advanced stages of the disease, may preclude an entirely satisfactory surgical result. Patients in the early stages of the disease should be observed for progression of the disease. Those who progress may be advised to have surgery before the contracture has reached a stage at which a completely satisfactory surgical result cannot be obtained, keeping in mind, that the earlier the stage of the contracture when the operation is performed, the better will be the operative result.[78, 79] Once it has been decided that surgery for Dupuytren's contracture is necessary, the surgeon must then make his second major decision, what type of operation is to be performed.

There are in general, three types of operations commonly performed for Dupuytren's contracture. In order of increasing magnitude they are: fasciotomy, partial or limited fasciectomy, and radical or total fasciectomy. Fasciotomy is the simplest of the operative procedures performed for Dupuytren's contracture. The operation of fasciotomy may be performed by the blind or subcutaneous route, or by an open technique under direct vision. Fasciotomy performed by the subcutaneous or blind technique is accomplished with a thin, narrow-bladed knife. This is usually introduced at the ulnar border of the palm, and passed in a radial direction until the contracted bands of the disease are encountered. The knife is then gently pressed through the contracted band until the entire band has been sectioned. Open fasciotomy is usually performed by making small skin incisions directly over the contracted bands. The bands of the contracture are then divided under direct vision.

Fasciotomy was the procedure described

*Figure 14. A.* Preoperative photograph of a 78-year-old male office worker. It was felt that the patient's age and concomitant diseases precluded a more extensive operation for Dupuytren's contracture. Patient treated by simple fasciotomy

under direct vision. *B.* Same patient's postoperative ability to extend after simple fasciotomy. *C.* Same patient's postoperative ability to flex following simple fasciotomy. *A, B,* and *C* reproduced from Larsen and Posch by permission of the *Journal of Bone and Joint Surgery.*

by Cooper[20] and by Dupuytren.[27, 28] Apparently these pioneers performed the fasciotomy by the open technique. Boyes,[10] Bunnell,[14] and Luck[73] have performed the closed fasciotomy in the palm, but cautioned that this is a dangerous procedure in the fingers. The advantage of the direct or open fasciotomy over the blind or closed fasciotomy is the lessening of the danger of injury to the neurovascular bundles at the time of division of the contracted bands. We have had no experience with the subcutaneous technique of fasciotomy, but have occasionally performed the procedure of open fasciotomy under direct vision.

Fasciotomy may be performed either as a definitive procedure, or as a preliminary procedure preparatory to more radical procedures. As a definitive procedure, the technique of fasciotomy will not infrequently be efficacious in patients who have a single mature contracted band passing from the palm into one or two of the fingers. This is particularly true in patients of advanced age. The procedure may also be efficacious in patients with concomitant diseases which preclude the more extensive procedures (Fig. 14).

Occasionally, in patients with quite markedly advanced stages of Dupuytren's contracture, fasciotomy will be found to be of advantage as a preliminary procedure before more radical extirpation of the diseased palmar aponeurosis. In such cases a preliminary fasciotomy will frequently allow some recovery of skin length, thus minimizing the problems of wound closure at the time of partial or complete extirpation of the palmar aponeurosis (Fig. 15). In addition, gentle elastic traction splinting after fasciotomy may produce some improvement in joint contracture before the more definitive procedure is performed.

In my practice, fasciotomy is restricted to a preliminary operation preparatory to more radical procedures later on, or to a definitive operation for patients of advanced age, or those who have concomitant diseases which preclude a more complete operation. It should be emphasized that Tubiana[110] found that age, in itself, is not a factor which influences the postoperative result of surgery for Dupuytren's contracture.
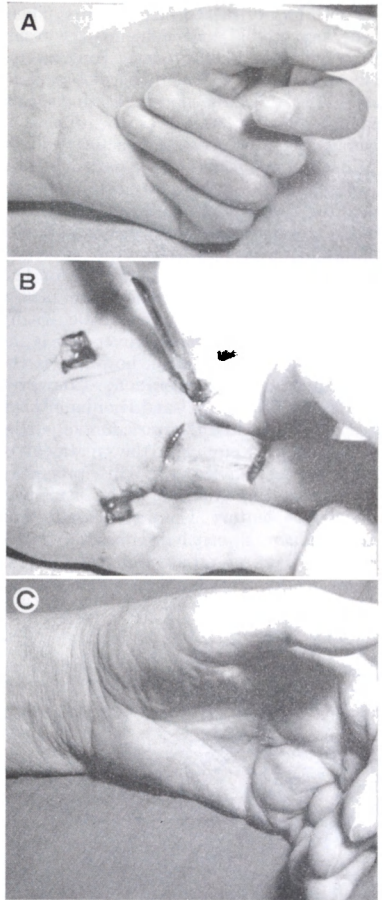


*Figure 15. A.* Preoperative photograph of a 48-year-old housewife with a severe and advanced stage of Dupuytren's contracture, showing the maximal possible preoperative extension. *B.* Same patient as *A.* Operative view illustrating multiple fasciotomy under direct vision. *C.* Patient's postoperative ability to extend after multiple fasciotomy as illustrated in *B.* The procedure in this instance was done as a preliminary operation, preparatory to more radical excision of the diseased palmar fascia. *A, B,* and *C* reproduced from Larsen and Posch[66] by permission of *Journal of the Bone and Joint Surgery.*

**Partial and limited fasciectomy.** There are many factors that influence the result of surgery for Dupuytren's contracture. The stage of the contracture before surgery is perhaps the most important single consideration.[78, 110] The earlier the disease is operated on, the more satisfactory will be the operative result. The patient's own tendency to the development of joint stiffness, together with strength of his diathesis for the development of contracture, are also important factors which will adversely affect the outcome of an operation for Dupuytren's contracture.[50] These are factors over which the surgeon has little if any control. One of the factors over which the surgeon has direct control, however, is the magnitude of the operation. Conway,[18] Hamlin,[41, 42] Hueston,[51] and Riordan,[92] have recently popularized the procedure of partial or limited fasciectomy in the treatment of Dupuytren's contracture. This procedure was practiced by Kocher[51] in the latter part of the 19th century. Conway, Hamlin, and Hueston have all concluded that the degree of postoperative morbidity increases as the
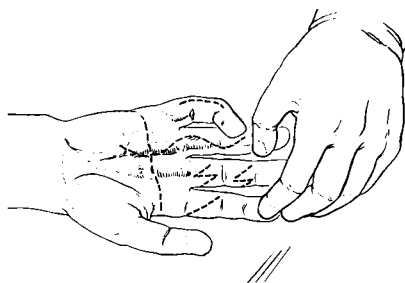


*Figure 16.* Some of the commonly used incisions for excision of Dupuytren's contracture. In the little finger the midlateral incision is illustrated. In the ring finger the sinuous longitudinal incision described by Hamlin and others for partial or limited fasciectomy is illustrated. In the long finger, multiple Z-incisions as popularized by McIndoe are illustrated. The incision of Mason, obliquely across the proximal finger segment, is illustrated in the index finger. The transverse incision in the distal palm at the level of the distal flexion crease is the incision most commonly used for radical fasciectomy.

extent of the operation increases. Hamlin found that in patients treated by partial or limited fasciectomy, there was an interval between operation and return to work of 21 days. He contrasts this with an average postoperative disability of 118 days in patients treated by complete excision of the palmar fascia. This is why the procedure of partial or limited excision of the palmar fascia, usually restricted to that portion of the fascia which is diseased, together with a small surrounding margin of normal tissue, has become popular in this country within the past 10 to 15 years. Partial fasciectomy is usually performed through an incision which has a longitudinal orientation centered over the contracted area of palmar and digital fascia. Hamlin describes a sinuous longitudinal incision (Fig. 16).[41, 42] In making this incision, care is taken to avoid crossing any of the flexion creases at right angles. Multiple Z incisions, with transposition of the triangular flaps at the time of wound closure, have also been used for the technique of limited fasciectomy (Fig. 16). An ingenious Y-V flap advancement type of incision has also been described by Deming.[26] A still more limited type of fasciectomy has been described by Luck.[73] His procedure involves excision of the "nodule-cord" unit. This in reality is a procedure slightly more radical than a simple fasciotomy, but more limited than the partial fasciectomy described by Hamlin and others.

Dupuytren's contracture may involve any portion of the palmar aponeurosis, together with its vertical fibrous septa, and also any portion of the digital fascia. Limited excision of only that portion of fascia which shows active disease, implies the willingness to accept the increased likelihood of a recurrence of the disease in those portions of the palmar aponeurosis which have not been removed by the limited procedure. Authors who advocate the limited procedure have been willing to accept an increased incidence of recurrence of the disease, or rather the appearance of the disease later on in the unremoved portions of the palmar aponeurosis. Hueston,[5] however, has questioned whether there really is an increased incidence of recurrence in patients who have had

a limited fasciectomy. He compared the results of limited fasciectomy and total or radical excision of the palmar fascia both in his own patients and in those treated by his senior associates. Hueston was unable to detect any difference in the rate of recurrence between those patients treated with the limited, and those patients treated with the radical procedure.

The authors who have advocated the limited or partial excision of the palmar aponeurosis have felt that the procedure has the following advantages. (1) The diseased area of fascia is more completely removed than with simple fasciotomy. (2) The postoperative morbidity after limited fasciectomy is considerably less than that after radical fasciectomy. (3) If recurrence or appearance of the disease in unremoved portions of the fascia does occur, it may again be dealt with by the simpler, more limited type of operation.

**Radical or total fasciectomy.** A total or radical excision of the palmar aponeurosis implies removal of not only the diseased portions of the palmar fascia, but also all the uninvolved portions of the palmar aponeurosis, together with its vertical septa, are removed as completely as possible. When nodules or contracted bands are present in the fingers, they are removed through appropriately placed incisions. It is the tendency for Dupuytren's contracture to recur in the unremoved portions of the palmar fascia which has led many surgeons to advocate complete removal of the palmar fascia at one sitting. The increased postoperative morbidity after complete excision of the palmar fascia is the disadvantage which has led Hamlin[41, 42] and others to favor the more restricted limited fasciectomy.

A great variety of incisions for radical removal of the palmar fascia have been described. McIndoe,[78] Mason,[76] and Skoog,[101, 102] have found that a single transverse incision at the level of the distal flexion crease of the palm will ordinarily provide adequate exposure. This is the incision that I most commonly use (Fig. 16).

**Operative technique.** It is essential that excision of the palmar fascia be performed in a completely bloodless field. The tourniquet that we use is a standard adult size blood pressure cuff placed over several layers of sheet wadding. The cuff is elevated to 280 mm of mercury, and may safely be left at this pressure for at least an hour and a half. A transverse incision at the level of the distal flexion crease of the palm, extending from the radial to the ulnar side of the hand, is made (Fig. 16). It is usually easier to dissect proximally first. Great care is taken to elevate all the subcutaneous fat with the skin, from the superficial surface of the palmar fascia. Where the skin is intimately adherent to the bands or nodules of the contracture, subcutaneous fat is usually absent. It is necessary then to create an artificial dissection plane between the derma and the adherent contracture. This portion of skin is then, in reality, converted to a free full thickness skin graft. No difficulty in healing of this area will be encountered, however, if every detail of the operation is performed carefully.

As the dissection progresses proximalward, small arteries will be encountered (Fig. 17). These arteries perforate the palmar fascia
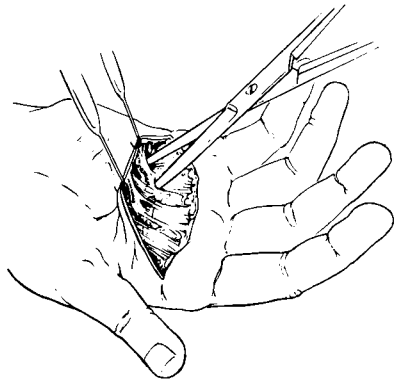


*Figure 17.* Preservation of the small arteries passing from the neurovascular bundles to the subcutaneous fat and skin of the palm. Preservation of these small vessels is important for satisfactory wound healing in radical excision of the palmar aponeurosis. The relative size of the arteries is somewhat exaggerated by the drawing.

from below, and pass into the subcutaneous fat of the palm. Preservation of these small arteries will greatly improve the circulation of the flap of skin and subcutaneous tissue which has been elevated from the superficial surface of the palmar fascia. Although careful attention to this detail of the operation was repeatedly emphasized by the late Doctor Michael L. Mason,[77] it was never published by him.

The superficial dissection is carried as far proximalward as possible. Usually it will be possible to dissect as far as the junction of the proximal and middle one-thirds of the palm. It is seldom necessary to dissect more proximally, since the most proximal portion of the palmar aponeurosis is not frequently involved in the contracture. If more proximal dissection is necessary, a curved incision in the thenar flexion crease may be made. Exposure of the borders of the triangular sheet of palmar aponeurosis ordinarily constitutes adequate dissection on the radial and ulnar sides of the fascia, unless a band is present passing into the thumb.
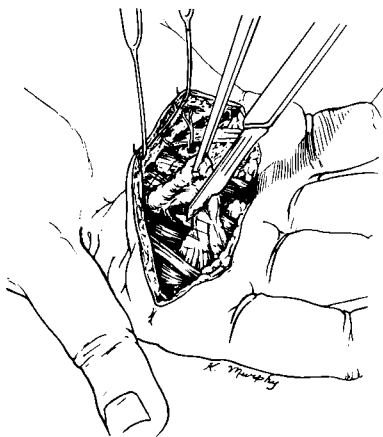


*Figure 18.* One step in the procedure of radical palmar fasciectomy. The scalpel is shown dividing one of the vertical septa of the palmar aponeurosis. The septa may become involved in Dupuytren's contracture and require removal at the time of the radical fasciectomy, or may lead to recurrence if they are not removed.

The distal dissection is then begun. Care should be taken to elevate all of the skin and subcutaneous fat from the superficial surface of the palmar fascia. Approximately 1 cm distal to the distal flexion crease of the palm, the base of the triangle of palmar fascia will be encountered. From this point on, the palmar fascia is represented only by the pretendinous bands passing into the digits. When the pretendinous bands are not involved in the contracture, they are small and difficult to identify as they pass through the subcutaneous fat. When the pretendinous bands are involved in the contracture, they are often greatly thickened and hypertrophied. Intimate attachment to the deep surface of the skin, with complete absence of subcutaneous fat, over a long distance is common. Again an artificial dissection plane must be created. Frequently the skin in this area is converted to a free full thickness graft. Preservation of the vascular supply to the skin is important here also.

Once the entire palmar fascia, together with the contracted bands has been exposed proximal and distal to the distal palmar crease, the deep dissection is begun. This dissection begins at the most proximal point and proceeds distalward in an orderly fashion. There is a small layer of fat lying between the deep surface of the palmar fascia and the neurovascular structures of the palm. This small fat layer is always present, at least in the proximal palm, even in advanced cases of Dupuytren's contracture. The proximal portion of the palmar aponeurosis may be divided transversely without injury to the nerves and arteries, if care is taken not to penetrate this small fat layer. The deep attachments of the palmar fascia are then sectioned in an orderly fashion. At first only a few fibrous attachments will be encountered. At approximately the midpalm, the vertical fibrous septa will be noted passing from the deep surface of the palmar aponeurosis to the preosseous fascia. In the radical excision of the palmar fascia, these vertical septa should be removed (Fig. 18). Three very prominent septa are encountered, separating the four groups of digital flexors. Secondary septa, however, are also present. These separate the neurovascular structures from the flexor tendons.

In complete excision of the palmar fascia (Figs. 19 and 20), both the major and secondary septa are removed. This can most conveniently be accomplished by proceeding in an orderly manner from the radial to the ulnar side of the hand, retracting the neurovascular bundles and flexor tendons as the deep attachments of the vertical septa are divided. It is always possible to separate the palmar fascia and its vertical septa from the synovial sheath of the flexor tendons. Preservation of the synovial sheath over the flexor tendons is an important detail that will help to minimize postoperative limitation of flexion.

When the vertical septa of the palmar fascia are involved in the contracture, they are greatly thickened, particularly along the sides of the metacarpophalangeal joints. The contracted bands pass into the deep digital fascia. The course of the digital nerves and arteries may be considerably altered by greatly thickened bands of contracted septa, but the contracted areas may be completely removed without damaging the digital nerves if one proceeds carefully and keeps the nerves in view at all times.

Once all superficial and deep attachments of the palmar fascia in the palm have been sectioned, attention is turned to the fingers. When there are no palpable contracted bands or nodules within the fingers, no digital incisions are necessary. When finger incisions are required, the configuration of the contracture in each finger will often determine the incision to be used (Fig. 16). A standard midlateral finger incision will give adequate exposure when the contracted band or nodule is present only on one side of the finger. Adequate exposure of contracted
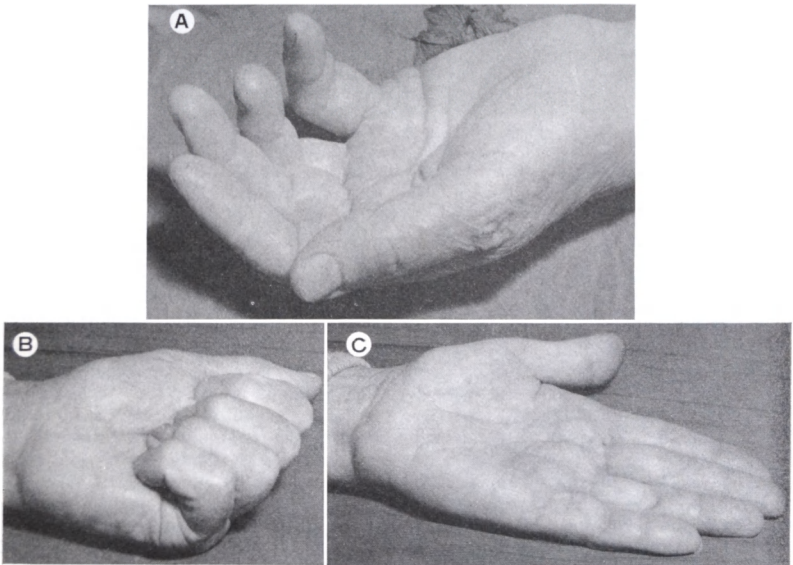


*Figure 19. A.* Preoperative view of the hand of a 75-year-old retired factory worker with moderately advanced Dupuytren's contracture involving the palm and the little finger. Patient was treated by total excision of the palmar aponeurosis. *B.* Postoperative flexion of the fingers of the patient illustrated in *A.* Photograph taken two months after surgery. *C.* Postoperative extension of the fingers of the patient illustrated in *A.* This photograph taken two months after surgery. The surgical procedure was total excision of the palmar aponeurosis.
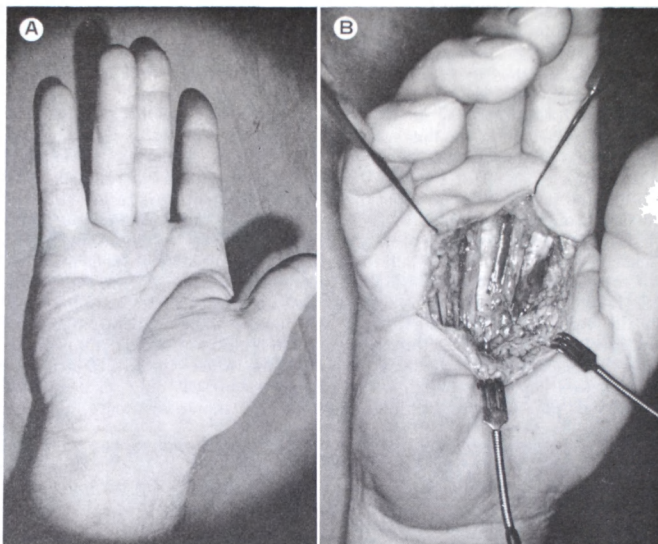
*Figure 20. A.* Preoperative view of the hand of a 48-year-old factory worker with a band forming in line with the ring finger and early limitation of extension of the ring finger. *B.* Operative exposure after excision of the palmar aponeurosis. Note the preservation of the synovial sheaths of the flexor tendons. In this instance, no finger incisions were necessary for relief of the contracture. Same patient as *A*.

bands or nodules on the opposite side of the digit is difficult through such an incision. Mason described a single oblique incision centered over the volar aspect of the proximal phalanx. This incision begins at the midlateral line on the side of the proximal interphalangeal joint and extends obliquely across the proximal finger segment, with care being taken not to incise the finger webs. This incision gives very adequate exposure for excision of contractures which are confined to the proximal segment of the finger. McIndoe[78, 101] has described a Z incision on the volar aspect of the proximal finger segment with transposition of the triangular flaps at the time of wound closure. This incision gives adequate exposure for most types of finger contracture. The reflection of L-shaped flaps, based either proximally or distally, may be required for the complete removal of contractures of unusual configuration.

During removal of contracted fascia from the digits, preservation of all subcutaneous fat possible is an important detail. The digital nerves and arteries must be identified. Frequently these structures will apparently pass through large nodules of the contracture. This, in reality, is involvement of both the superficial and deep layers of the digital fascia in the contracture. By careful dissection, the contracture may be removed without damaging the digital nerves (Fig. 21).

When a band is present, passing into the thumb, the incision must be selected to conform to the location of the band (Fig. 21C). Often these bands may be removed at the time of excision of the palmar portion of the palmar fascia, and no incision in the thumb will be required. When incisions in the thumb are necessary, a midlateral incision placed on the radial or ulnar side of the thumb, as indicated, will ordinarily produce adequate exposure of the contrac-
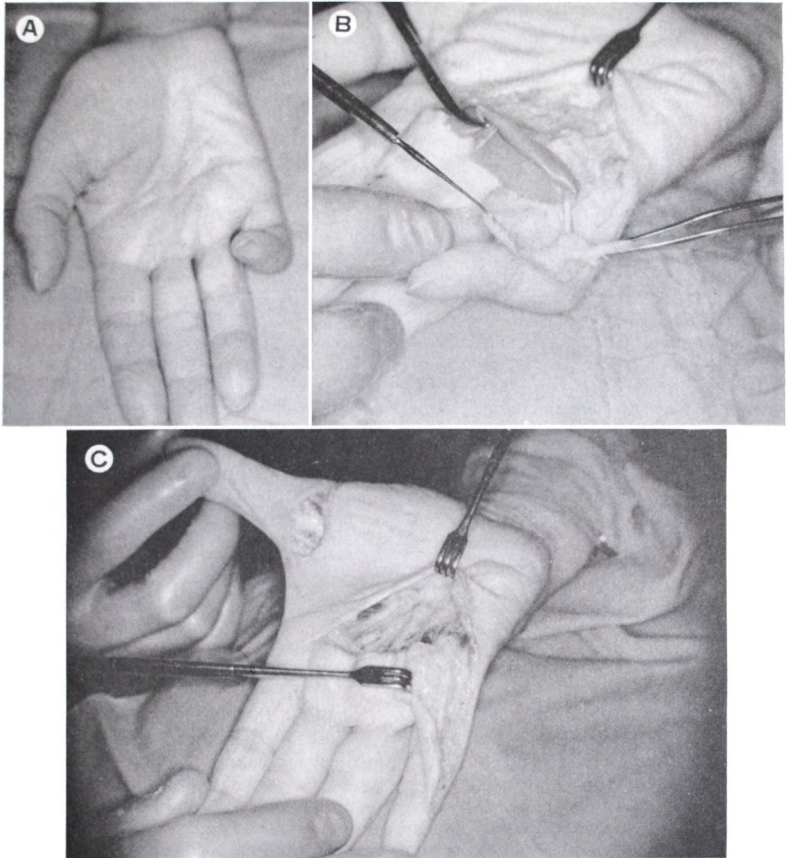
*Figure 21. A.* Preoperative view of moderately advanced Dupuytren's contracture involving the palm, the little finger, and the thumb. *B.* Same patient as *A.* Operative exposure of the digital sensory nerve on the ulnar side of the little finger. Note that the nerve appears completely surrounded by a nodule of contracted digital fascia. *C.* Operative view, illustrating radical excision of the palmar fascia. A transverse incision at the metacarpophalangeal joint of the thumb for removal of the contracted band to the thumb, and a distally based L-flap type incision for excision of the contracture in the little finger. Note the preservation of the digital sensory nerve on the ulnar side of the little finger. Same patient as *A.*

ture. Occasionally, transverse, oblique, or Z incisions placed directly over the thumb contracture will be required.

It is my practice to perform as much of the operation as possible with a scalpel. Almost the entire procedure can be performed by careful sharp dissection. The surgeon who excises the palmar fascia in this way will be rewarded during the postoperative period by less postoperative edema,

less likelihood of hematoma formation, better wound healing, and diminished post-operative morbidity. I am convinced that the technique of radical removal of the palmar fascia by the method of spread, cut, and tear, with scissors and hemostats, leads to many of the complications which have caused this procedure to be condemned.

Once all necessary dissection has been completed, attention is turned to hemostasis. The hand is wrapped in several large moistened abdominal sponges, and the tourniquet is released. Five minutes of quite firm compression of the wounds by the operator's hands will control the vast majority of bleeding. If the dissection has been performed carefully and with a scalpel, very few bleeding vessels of any consequence will be encountered. Absolute hemostasis is an important feature of a successful radical excision of the palmar aponeurosis.

Once hemostasis has been secured, the tourniquet is again inflated. The bloodless field is maintained during the period of wound closure, and until the compression dressing and splint have been applied.

We place small rubber tissue drains in the wounds. These drains are removed at the time of the first dressing change, usually on the fourth postoperative day. Tanzer[109] and Mason[76] have described a compression suture technique which provides more adequate compression of the palm, and lessens the tendency for serum or blood to accumulate beneath the skin flaps. A cotton or gauze bolus is held firmly over the wound by several interrupted sutures placed about the periphery and tied under suitable tension over the gauze bolus. Whether or not the compression suture technique is used, all authors recommend a voluminous dressing to which mild compression is applied by one of several types of elastic bandages.

Splinting of the hand in the position of function is recommended by most surgeons.

**Skin grafting after excision of Dupuytren's contracture.** After excision of Dupuytren's contracture, particularly in the advanced cases, one may find that there is insufficient skin remaining for wound closure (Fig. 22). This may be due to irreparable damage to adherent overlying skin during excision of the contracture. More commonly,

however, the palmar skin has become contracted over an area of advanced Dupuytren's contracture, and will no longer stretch to cover the palm, when the fingers are extended. In our own experience, skin grafting of the palm is necessary occasionally.[66] This has also been the experience of Conway[19] and several other authors. McIndoe,[78] however, believed that skin grafting after excision of Dupuytren's contracture, was unnecessary.

When skin grafting is required for wound closure following excision of Dupuytren's contracture, a thick split thickness skin graft is used by most. When hemostasis has been secured, and the flexor tendons have not been stripped of their tendon sheaths, these grafts will take without difficulty, and provide satisfactory coverage of the palm. Rotation flaps or distant flaps for coverage of the palm are not required.

**Wound suction.** New devices for the application of a continuous suction to wounds have appeared in the United States. When the dissection has been carefully executed and hemostasis has been secured, these devices should not ordinarily be required. This technique may be of advantage in the unusual case of persistent and uncontrollable oozing of blood.

**Postoperative care.** A voluminous compression dressing with a splint to maintain the hand in the position of function is used by most authors. Almost all patients operated on for Dupuytren's contracture show some tendency to swelling of the hand in the immediate postoperative period. The snugly applied elastic bandage is ordinarily too tight on the first postoperative day and requires loosening. Elevation of the hand will assist in control of postoperative edema. A sling is worn with the hand held high on the chest when the patient is ambulatory. Pendulum exercises of the shoulder should be instituted on the first postoperative day to prevent the complication of frozen shoulder.

Postoperative care varies with different authors. It is our practice to change the dressing on the fourth postoperative day. Drains, if they have been used, are removed at this time. A fairly bulky dressing and splinting of the hand is maintained until
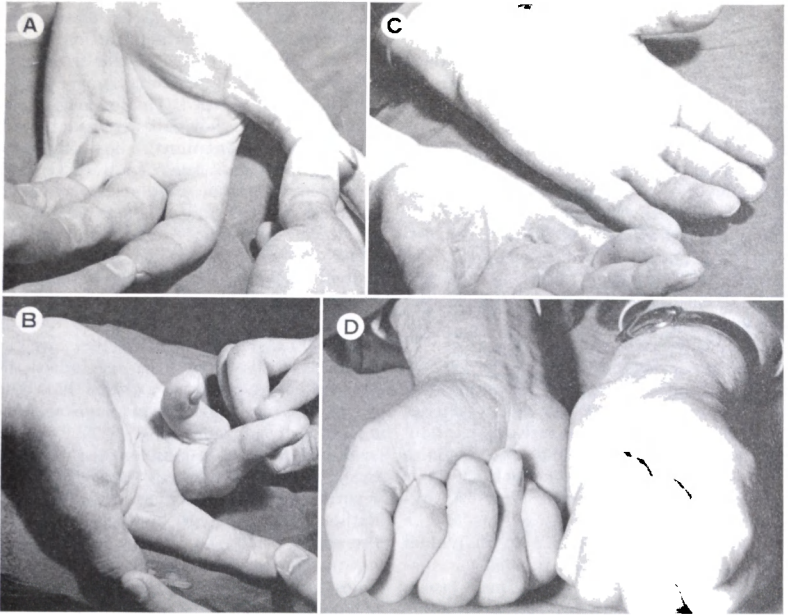
*Figure 22.* *A.* Preoperative view of the left hand of a patient with advanced Dupuytren's contracture. *B.* Preoperative view of the right hand of the patient illustrated in *A.* Note the hyperextension deformity of the distal interphalangeal joint of the ring finger. This patient was a common laborer and attributed the hyperextension of the distal joint of the ring finger to the repeated pushing of a tool handle into the palm. *C.* Postoperative extension of the patient illustrated in *A* and *B*, three and one-half months after surgery. Note the skin graft in the palm of the left hand. This hand was treated by total excision of the palmar aponeurosis, and was continuing to do well when the patient was last seen three years after surgery. The right hand was treated by multiple fasciotomy and limited excision of the contracted band to the ring finger in the palm, together with a small split thickness skin graft which is visible in the photograph. When last seen three years after surgery, this patient was beginning to develop recurrence in the right hand. *D.* Postoperative flexion of the patient illustrated in *A* and *B*, three and one-half months after surgery. Patient returned to his work as a common laborer approximately two months after surgery.

the skin wounds have completely healed, usually about the 10th to the 14th postoperative day.

Early finger motion is encouraged, particularly when digital incisions were not required at the time of surgery. Once the skin is healed, the splint and voluminous dressing are discarded. A light dressing is usually used for an additional week. Warm hand baths two to three times daily seem to be helpful, both in the reduction of postopera-tive swelling, and in lessening the tendency toward stiffness of the finger joints.

**Complications.** Complications after surgery for Dupuytren's contracture are not infrequent. Ordinarily, the more radical the procedure, the more likely complications are to occur. It is to lessen the incidence of postoperative complications that Hamlin[41, 42] and others have advocated the more restricted procedure of limited fasciectomy.

A wound infection in an elective procedure

of this type is a devastating complication. This complication has been reported quite infrequently. In our own experience, wound infections occur in approximately 0.5 per cent of operated cases.[66]

Wound hematoma is caused by faulty hemostasis. This complication should be virtually eliminated by careful attention to the control of bleeding at the time of surgery, and to the proper application of a compression dressing in the immediate postoperative period. McIndoe[78] advises the immediate evacuation of an established wound hematoma, since hematoma encourages skin loss and infection, and almost always delays return of function.

Skin loss in the postoperative period is a serious complication. Careful dissection with careful preservation of the small arteries to the skin, careful hemostasis, and careful aseptic technique will do much to minimize the frequency of this complication.

Some edema of the hand is almost always encountered after radical excision of the palmar fascia. There are wide individual variations in the tendency to edema formation after excision of the palmar fascia. Compression dressings and elevation of the hand in the immediate postoperative period will help to minimize edema formation. Use of one of the proteolytic enzymes apparently will also limit edema formation. Allaben[31] and associates have experimental evidence that intramuscular chymotrypsin assists in reduction of edema.

Postoperative stiffness is the most frequent complication after radical excision of the palmar fascia. The frequency of this complication led Hamlin[41, 42] and others to advocate limited fasciectomy as the treatment of Dupuytren's contracture. The prevention of edema and hematoma formation will do a great deal to minimize the frequency of postoperative stiffness. Once stiffness has occurred, warm hand baths several times daily together with active exercise within the limits of pain are helpful. Physiotherapy should ordinarily be avoided at this time. Pushing the stiffened joints beyond the limits of pain only produces a reactive edema which ultimately makes the stiffness worse, and delays recovery.

McIndoe[78] has listed vascular spasm as a postoperative complication. He found that no form of therapy except stellate ganglion block was of value in the treatment of this condition, and warned that further surgery on such a hand should be avoided.

**Results of treatment.** The results after surgery for Dupuytren's contracture vary with the magnitude of the operation performed,[26, 41, 42, 51, 73, 79, 92, 119] with the degree of advancement of the contracture at the time of surgical treatment, and with many individual factors inherent within the patient himself.[51] Some of these individual factors are age, sex, tendency to develop joint stiffness after minor insults, and the presence or absence of arthritis. Indeed the presence of rheumatoid arthritis has been regarded as an absolute contraindication to operation by McIndoe.[78]

Dupuytren's contracture is a disease which exhibits a fairly marked tendency toward recurrence. It has been assumed by most authors that the more limited the surgical procedure performed, the more likely one is to encounter a recurrence of the disease. Hueston has questioned whether or not this is true.[51]

Tubiana[110] found 43 per cent very good, and 39 per cent good results after excision of the palmar fascia in his patients. Local factors, and particularly the stage of the contracture at the time of surgery, had a great influence on the prognosis in Tubiana's cases. Previous injuries did not seem to influence the operative result.

The age of the patient has no influence on the operative result. The presence or absence of knuckle pads has no prognostic significance. McIndoe[78] also recognized that the results after operative therapy deteriorate as the stage of the contracture at the time of surgery becomes more advanced. Skoog[101, 102] believes that perfect functional and anatomical results can be obtained by complete extirpation of the palmar aponeurosis in all cases except those who have developed secondary joint contractures. Luck[73] found 79.6 per cent good results in his patients treated by fasciotomy together with excision of the nodular stages of the disease, and also found that a good result

was precluded in many patients by the development of irreversible skin or joint changes. Schink[98] has reported 90 per cent good functional results in his patients. In our own experience,[66] 52 per cent of patients have had a very good result after radical excision of the palmar fascia, and 22 per cent have had a good result, complicated mainly by a slight persistent tendency to joint stiffness. Poor results in our experience are the result of either complications of surgery, or irreversible changes in the joints or soft tissues and skin of the hand.

## Summary

Dupuytren's contracture is a disease of the palmar fascia, which in its advanced stages is capable of producing a crippling flexion contracture of one or more of the digits. The fundamental change within the palmar aponeurosis is that of a pronounced proliferation of fibrous tissue. The exact cause of this fibrous tissue proliferation, and thus the etiology of the contracture, is still not well understood. The only consistently efficacious therapy for the disease is surgical excision. Three operations are performed: in order of increasing magnitude, fasciotomy, limited fasciectomy, and radical fasciectomy. Many local and systemic factors influence the choice of operation in each individual patient. In 80 to 90 per cent, good to excellent results can be expected after surgical treatment of Dupuytren's contracture, provided that the operation has been properly selected, carefully performed, and that complications have been avoided.

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