3

Pathology

THE evolution of our understanding of the structural changes in Dupuytren's contracture has been in three phases. Originally regarded as a contracture of the flexor tendons and termed ' crispatura tendinum,' the fault was transferred by Cline (1808), Astley Cooper (1822) and Dupuytren (1832) from the tendons to the palmar aponeurosis. Since then the basis of the condition has frequently been placed in the palmar tissues anterior to the palmar aponeurosis. Although Goyrand (1834) first suggested this alternative to Dupuytren's explanation and refuted the traumatic theory of origin, Dupuytren's authority was so great that this opposing view was given little attention until Langhans (1887), who first described the microscopic structure of Dupuytren's contracture, stressed the progressive replacement of the surrounding palmar connective tissues, and this hyperplastic process in the tissue anterior to the aponeurosis was also noted by Nichols (1899).

Anderson (1891) described the pathology as an ' inflammatory hyperplasia ' commencing in the subcutaneous tissue of the palm, involving the skin and fascia secondarily and replacing the adipose connective tissue, but it was not until half a century later that this structural basis of the condition was restated and demonstrated by Meyerding *et al.* (1941). Nevertheless there is no current textbook which does not dismiss the pathology of Dupuytren's contracture as ' a contracture of the palmar aponeurosis ' and it is necessary in this chapter to reconsider the structural changes both macroscopic and microscopic in order to place correctly the seat and mode of progress of this condition.

This chapter is based on a study of the histological structure of specimens freely selected at operation, from which it has been concluded that, although the palmar aponeurosis is intimately involved in Dupuytren's contracture, this represents only one aspect of a change which may occur in any of the palmar connective tissues and is usually secondary to changes arising within the fibro-fatty tissue on its superficial aspect (MacCallum and Hueston, 1962). It should be stressed that the pathological changes in this disease are virtually unique and not capable of classification into any of the standard groups of neoplasia, inflammatory or reparative disease, but are more of the nature of connective tissue metaplasia.

MACROSCOPIC CHANGES

Either one of two changes may be seen as the earliest sign of Dupuytren's contracture. In most patients there is a palmar nodule (Fig. 2, A) but in a few a

From Hueston JT. Pathology. In: Dupuytren's Contracture. Livingstone, London 1963, pp 22-51.

short interphalangeal band producing flexion deformity of the proximal interphalangeal joint (Fig. 2, B).

The palmar nodule.

The early nodule is dome shaped and is usually attached to the superficial aspect of the palmar aponeurosis in the line of the ring finger. In 10 per cent. of patients coming to operation, nodules were found in relation to the thumb, either

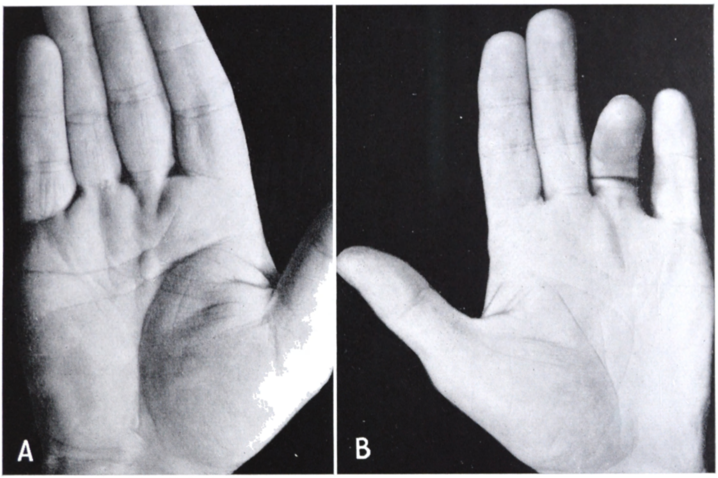

FIG. 2

The two presentations of Dupuytren's contracture.

A, Palmar nodule. B, Interphalangeal band.

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overlying the radially inserted intrinsic muscles or near the free margin of the first web space.

Dissection of a palmar nodule demonstrates that it lies in the subcutaneous fibro-fatty layer (Fig. 3, A). Its deep fixation is usually to the palmar aponeurosis but at the margins of the palm it has sometimes very little deep fixation, giving the appearance of a direct change of a fat loculus into a fibrous nodule (Fig. 3, B).

The nodule which is fixed to the palmar aspect of the aponeurosis fuses with it but never protrudes on the deep aspect of the aponeurosis. This regular freedom of involvement of the deep aspect and the constant appearance of the palmar nodule protruding from only the palmar aspect of the aponeurotic plane suggests a lesion applied to the aponeurosis rather than arising from it. The poorly defined

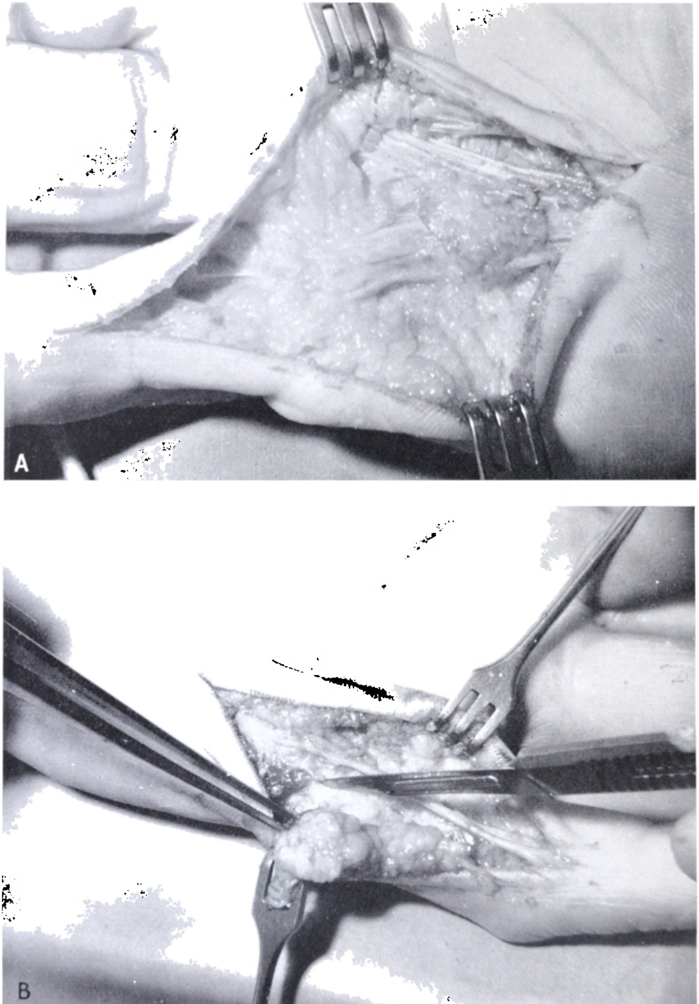

FIG. 3

[*See opposite page for legend*

margins of most nodules which during dissection demonstrate fixation at all points to the fibrous strands of the normal palmar subcutaneous layer, would suggest to an observer without preconceived ideas of aetiology an origin from the deeper elements of this layer nearest to the aponeurosis.

FIG. 4

Dissection of a nodule and band from the fascia and insertion of abductor digiti minimi.

The most distinctive palmar nodule is found remote from the anatomical aponeurosis, occurring at the ulnar border of the palm and overlying the tendon of insertion of abductor digiti minimi (Fig. 4). It is this nodule which may occasionally be demonstrated at operation to be free of fixation to the underlying deep fascia of the intrinsic muscles and in fact to be situated simply within the layer of subcutaneous fibro-fatty tissue. Nodules of the dense poorly circumscribed fibroplastic tissue, referred to hereafter as Dupuytren's tissue, have been dissected from the subcutaneous tissue overlying the pisiform bone and flexor retinaculum. Such occasional freedom of deep fixation of the marginal palmar nodules supports

Fig. 3.—A, Dissection of palmar aspect of a band passing to the little finger showing a nodule applied to its anterior aspect at the level of the distal palmar crease. B, Nodule being dissected from subcutaneous tissues at the ulnar border of the base of the little finger. This appearance suggests an origin from the local fibro-fatty tissue. (Fig. 3, A is reproduced by permission of the Editor, *Australian and New Zealand Journal of Surgery*.)

the suggestion that the origin of the nodules may not be from the aponeurosis itself but from the overlying fibro-fatty tissue.

The interphalangeal band.

In those cases where interphalangeal flexion has been the first sign, dissection often reveals dense, discrete, glistening bands, 2 to 5 mm. in diameter, passing from the proximal to middle phalanges intimately related to the digital neurovascular bundle and at times merging dorsally with the extensor expansion or the joint capsule.

These bands show fixation to the phalanges without any palmar connections, are free of nodules and may show little local adhesion to the fatty tissue of the finger. The often extremely tortuous course of the neurovascular bundle around these interphalangeal bands indicates their origin from the connective tissue normally supporting the neurovascular bundle, this bundle then having been displaced by the straightening and shortening of the developing bands.

FIG. 5
A typical palmar plaque in a woman which may remain for many years without producing finger deformity.

NATURAL HISTORY

The palmar nodule may remain stationary for decades. Other nodules may appear in the palm or in the proximal segments of one or more fingers, the latter often being without deep fixation in their early stages. Confluence of adjacent foci in the central palm may produce a raised plaque across which the flexor creases pass deeply and over which the epidermis and dermis become fixed. This appearance is commoner in women and often does not progress to a flexion deformity, which may explain why fewer operations are required in women (Fig. 5).

The palmar changes usually become slowly more discrete and the tissue becomes firmer and whiter than the early poorly defined greyish nodule. This shrinkage of the diffuse palmar nodules to denser more discrete bodies, leaving the intervening palmar tissues once more apparently free of disease, is not regarded as a disappearance but rather as an aggregation of the formed tissue.

No definite instance has been observed of a palmar nodule disappearing although this has been reported by careful observers including Gordon (1948) and Iselin (1954). Such observations must be of considerable importance when the aetiology is considered.

Flexion deformity has not been observed in the presence of palmar nodules alone. It is the bands which are responsible for the principal feature of Dupuytren's

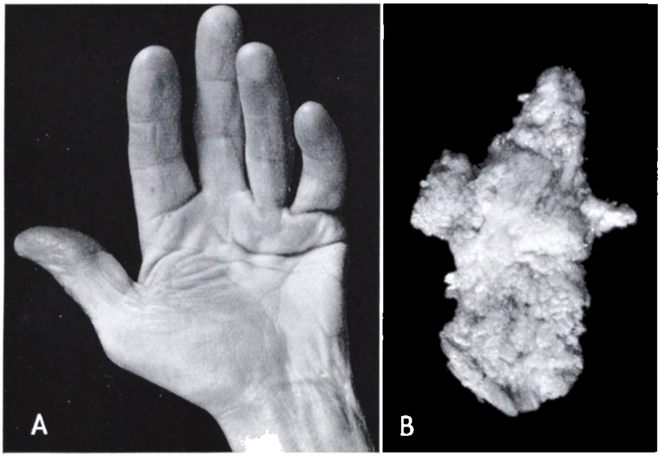

FIG. 6

From the hand illustrated (A), the tissue removed by limited fasciectomy is seen from the palmar aspect (B). Both distal and proximal to the nodule the incorporation of subcutaneous fat loculi on the surface of the developing band can be seen.

contracture although nodules always precede the appearance of bands and metacarpophalangeal joint flexion deformity.

In progressing cases, an opaque fibrous thickening may be seen on the palmar aspect of the aponeurosis for one or two centimetres around the palmar nodules. In the line of the relevant digit, this roughened aspect of the aponeurosis becomes raised up to be continuous with the developing band. An early band is usually better developed proximal to the nodule and distally is still opaque with fat loculi incorporated in its surface (Fig. 6). Although continuous with the aponeurosis, the band stands forward several millimetres and lies close beneath the skin (Fig. 7). Distal to the nodule an early band is often more difficult to dissect from the adjacent palmar fibro-fatty tissue but the aggregation of the palpable band is attached to one or both sides of the proximal or middle phalanx.

The deep aspect of the palmar aponeurosis remains glistening, smooth and free from the diffuse changes and attachments of its palmar surface except for the deep intertendinous septa which pass to the metacarpals and support the common digital neurovascular bundles. These septa, which constitute the principal attachment of the palmar aponeurosis, are found to be thickened in advanced cases with flexion deformity of the fingers but no nodules have been observed in the septa. Discrete dense tendinous bands continuous with the distal end of a thickened intertendinous septum are sometimes found passing from the neck of the metacarpal to the proximal

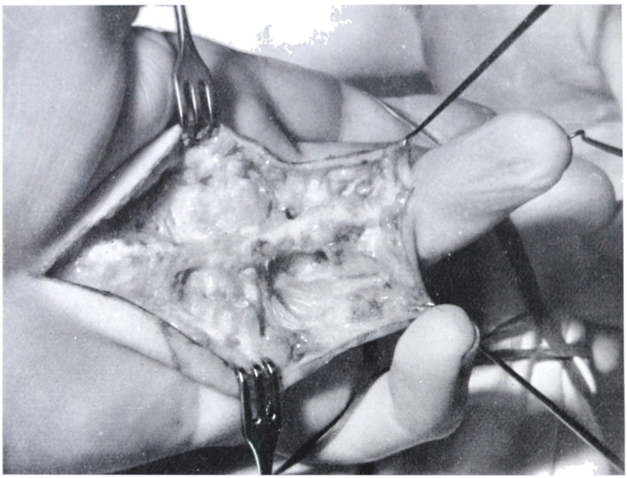

FIG. 7

Operative dissection of a palmar band shows it to be on a plane anterior to that of the original aponeurosis as indicated by the transverse fibres.

phalanx, grossly displacing the neurovascular bundle and maintaining a flexion deformity after excision of the principal pretendinous band. These deep bands are analogous in appearance and structure to the interphalangeal bands of the fingers.

Thickening of a band occurs along with progressing flexion deformity rather than preceding it. Long-standing flexion deformity is found to be associated with more discrete almost tendinous bands. The role of work hypertrophy in the production of the bands, which has been propounded by Luck (1959), is supported by the atrophy of the band when the tension is relieved by fasciotomy (Fig. 37).

Considerable tension is developed in a band when the finger is forcibly extended. On incising such a band from its superficial aspect the ends spring apart and retraction makes the cut end concave. This sudden separation of the cut ends

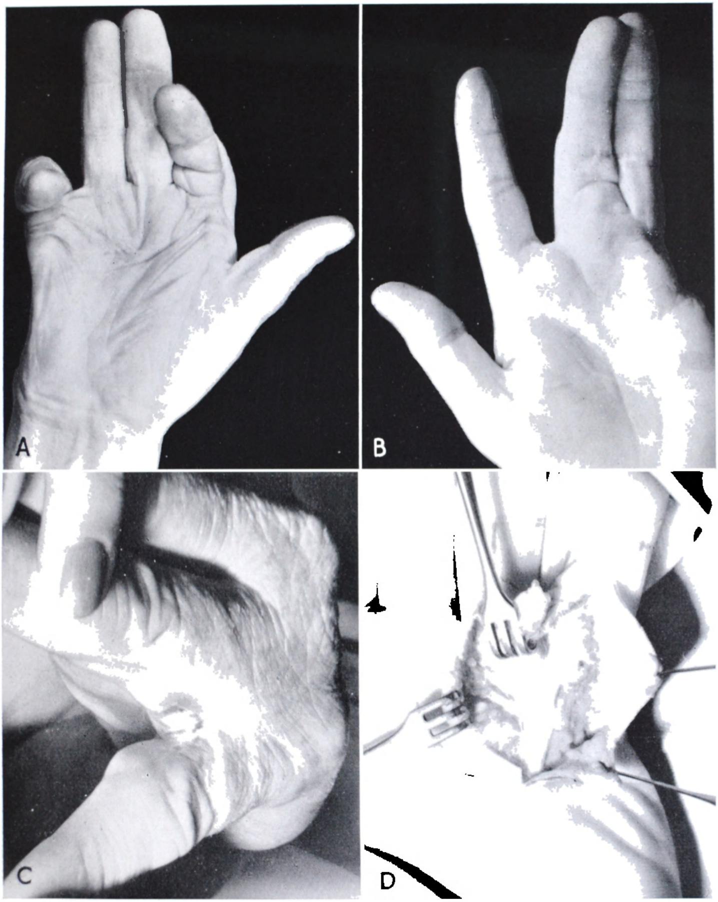

FIG. 8

Web space contracture.

A, First web space contracture by a prominent band from the proximal two segments of the index finger. Note also abduction of the little finger by abductor digiti minimi band. B, Third web space contracture which was symmetrical in the other hand. C, Fourth web space contracture with intertrigo due to skin maceration. D, Exposure of Y-shaped contracting bands in the same hand as C.

(See also Fig. 52.)

of the band is sometimes found to occur before the whole thickness has been divided. It is significant that the remaining deepest part of the band, which was clearly not

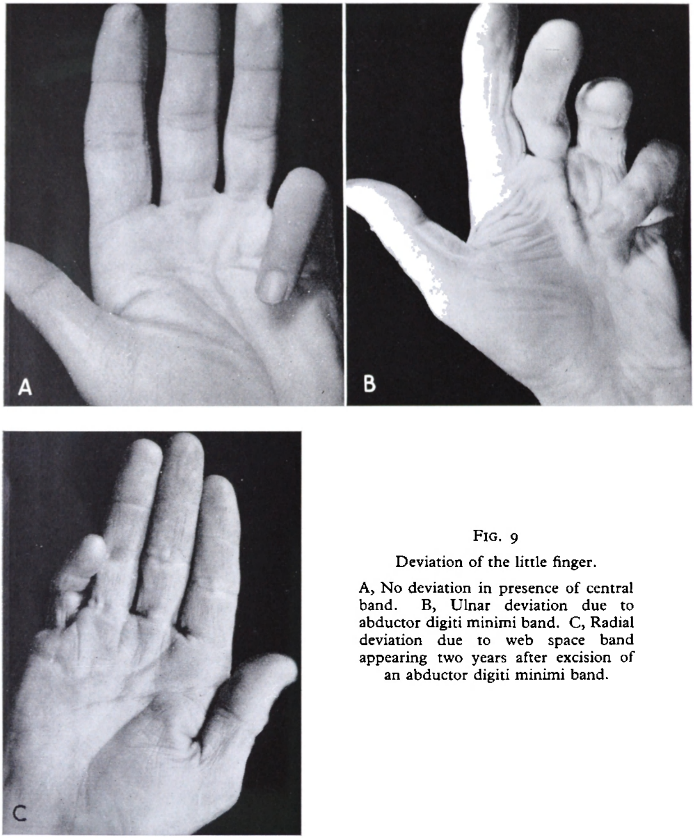

FIG. 9

Deviation of the little finger.

A, No deviation in presence of central band. B, Ulnar deviation due to abductor digiti minimi band. C, Radial deviation due to web space band appearing two years after excision of an abductor digiti minimi band.

contributing to the contraction, can be seen to be the plane of the transverse fibres of the original palmar aponeurosis. This indicates that the principal site of contracture is anterior to the aponeurosis itself and the longitudinal fibres merge with this newly formed superficial mass of tissue.

The fat on either side of the band shows varying degrees of fibrous replacement,

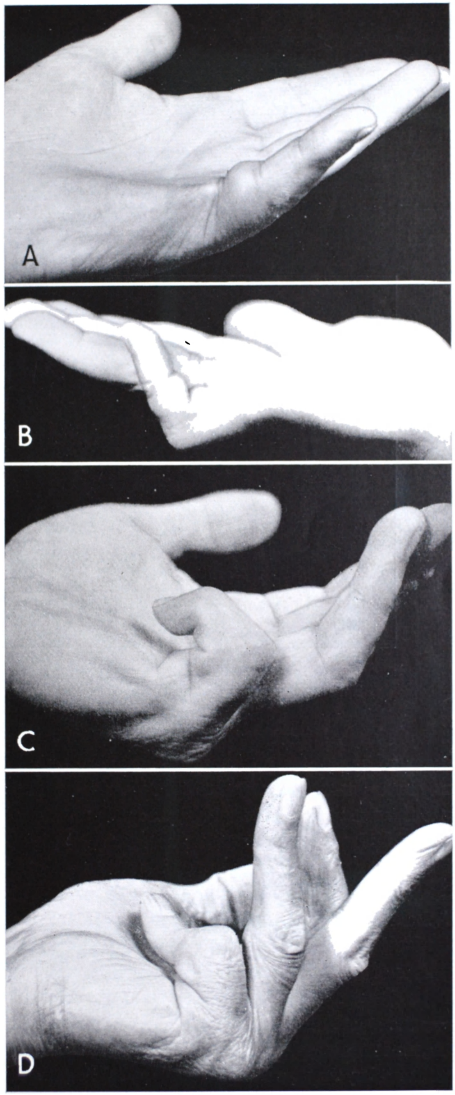

FIG. 10

Four types of little finger deformity.

A, Metacarpophalangeal flexion only. B, Proximal interphalangeal flexion only. C, Flexion of all three joints. D, Hyperextension of distal interphalangeal joints with flexion of two proximal joints.

ranging from slight in the proximal palm to almost complete in the region of the nodule which is found to have attachments in all directions, not only proximally to the skin and distally into the digital skin and skeleton, but dorsally to the metacarpophalangeal joint capsule and radially in many cases across the web spaces to adjacent fingers thus limiting separation of these fingers (Fig. 8). A nodule may thus be seen as the centre of a field of radiating fibrous bands and septa.

When more than one nodule is present, several foci of contracture may be demonstrated with multiple palmar bands and finger deformities. The nodule overlying the abductor digiti minimi tendon is often a spectacular example of this centripetal fibrosis and contraction as it puckers the adherent skin, flexes the proximal

FIG. 11

Two digital nodules almost confluent and drawing up a thin palmar band.

interphalangeal joint by its longitudinal fascial attachments, abducts the little finger when adherent to the abductor digiti minimi tendon (Fig. 9, B) and finally may hyperextend the terminal interphalangeal joint by involvement of fibres passing into the extensor expansion (Fig. 10, D) elsewhere.

Nodules often arise within a finger (Fig. 11), are firm, roughly elliptical and on dissection are found to be merging freely into the subcutaneous fat of the finger. In early digital nodules it is often difficult to demonstrate any discrete fascial or skeletal attachments but in older lesions there may even be new bone formation in the band insertions to the phalangeal margins.

Skin pits are common in Dupuytren's contracture and usually pass proximally to be fixed by the apex to a tense fibrous slip from a palmar band. Pits are commonest at the distal palmar crease (Fig. 12, A) but occur elsewhere if the palmar nodule has a discrete dermal attachment and sometimes in the finger. Tiny pits produced by very fine contracting fascial strands are seen usually on the radial side of the hand (Fig. 12, B). Obstruction to the orifice of a palmar skin pit has been seen to lead to acute abscess formation requiring drainage by disimpacting the obstructed skin pit orifice. A less common form of skin involvement is a flat featureless keratotic plaque, arising in the region of the distal palmar crease (Fig. 12, B). Although distortion of the crease lines is common (Fig. 13), little true contraction

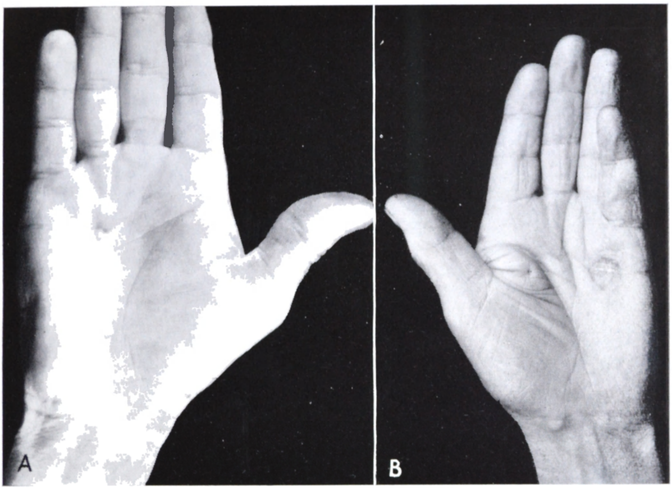

FIG. 12

Types of skin involvement.

A, The common skin pit in the region of the distal palmar crease, with distally directed orifice due to contraction of the proximal superficial palmar fibrous elements to which the dermis is normally fixed at the distal palmar crease line. B, In the radial palm is a tiny deep orifice, commonly on this side of the palm and in relation to the base of the thumb. A dense dermal plaque is seen in the ulnar palm, keratotic and devoid of papillary ridges, due to diffuse replacement of the dermal papillae by sclerotic fibrous tissue.

of the skin occurs and some fixation of the skin over palmar nodules is usual. The operation of subcutaneous fasciotomy, in which the skin returns to its normal dimension on division of the band, demonstrates that the skin has retained its elasticity and has been included only passively in the contracture.

Despite meticulous excision of aponeurosis and abnormal tissue a recurrence of Dupuytren's tissue is common in those patients who required operation while the disease was rapidly progressing and particularly if they have a strong family history. Recurrences in the finger require secondary excision more often than those in the palm (see Chapter 8) and at operation have macroscopic features strikingly similar to a virgin case. These nodules of recurrent Dupuytren's tissue indicate that, as they could no longer have arisen from any pre-existing anatomical fascial bands, they must have developed from the normal fibro-fatty tissue remaining in the region. The relative freedom of palmar recurrences from contraction suggests that this normally occurs through involvement of the longitudinal aponeurotic fibres. The proximity of recurrences in the fingers to tendon sheaths and phalanges may account for the continued tendency for flexion deformity to be produced.

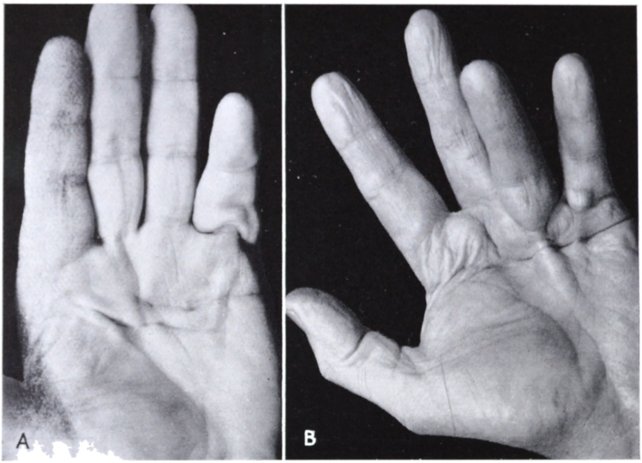

FIG. 13

Crease line distortion depends on site of contracting focus. In (A) a nodule in the little finger with attachment to the proximal digital crease line produces a concavity facing proximally, whereas multifocal contraction in the central palm is beginning to produce distal crease line concavities facing distally. In (B) a balance of tension exists between two clearly visible nodules, one in the proximal segment of the ring finger and one in the proximal palm, so that the distal palmar crease line remains undistorted.

Summary of macroscopic features.

The earliest observed change, the palmar nodule, which may be multifocal, appears to arise within the palmar connective tissues applied to the anterior aspect of the palmar aponeurosis.

Centrifugal fibrosis from the nodule or nodules results in fixation to all structures—skin, aponeurosis, skeleton—but not to tendons in synovial sheaths.

Contraction occurs along with thickening of the nodule and bands which are raised in the line of maximum tension.

The appearance and behaviour of recurrent Dupuytren's tissue is consistent with its origin from the local fibro-fatty tissue.

MICROSCOPIC CHANGES

The histological picture typical of Dupuytren's contracture is a combination in varying proportion of fibroblastic proliferation and collagen formation in which these two phases of activity may be freely intermingled or in which the hyperplastic cellular foci are separated by dense bands of collagen. The distribution of the fibroplastic activity within the one specimen may vary from large areas within a nodule to scattered patches along the length of a palmar band or islands among the

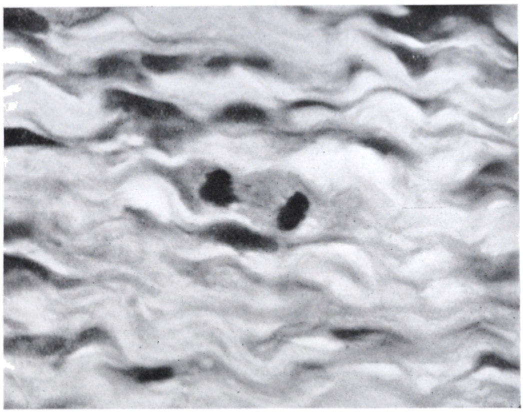

FIG. 14

Mitotic figure in a hyperplastic palmar nodule (× 600). Histologists unfamiliar with Dupuytren's contracture have wrongly interpreted it, particularly in the foot, as fibrosarcoma.

fat loculi of the distal palm and fingers. Excellent accounts of the histology have been given by Meyerding *et al.* (1941) and Nezelof and Tubiana (1958) but while some workers have attributed a prognostic significance to the histological picture, most agree that little correlation is possible between the histological picture and the natural history except that long-standing thin palmar strands are usually extremely poor in cells and recent recurrent tissue is usually predominantly young fibroplastic tissue.

The structure of a hyperplastic cellular area is characteristic, consisting of fleshy nucleated fibroblasts arranged in parallel or in elliptical foci merging peripherally with collagen bundles but often very clearly demarcated from these by intervening vascular septa. The cellular elements of the bundles vary from closely set, relatively short, plump, parallel spindles with oval nuclei, very little intercellular collagen and sometimes fairly numerous mitotic figures (Fig. 14), to elongated narrow nuclei widely separated by much collagenous material and showing no mitoses at all. The appearance of these nodules on section consequently varies

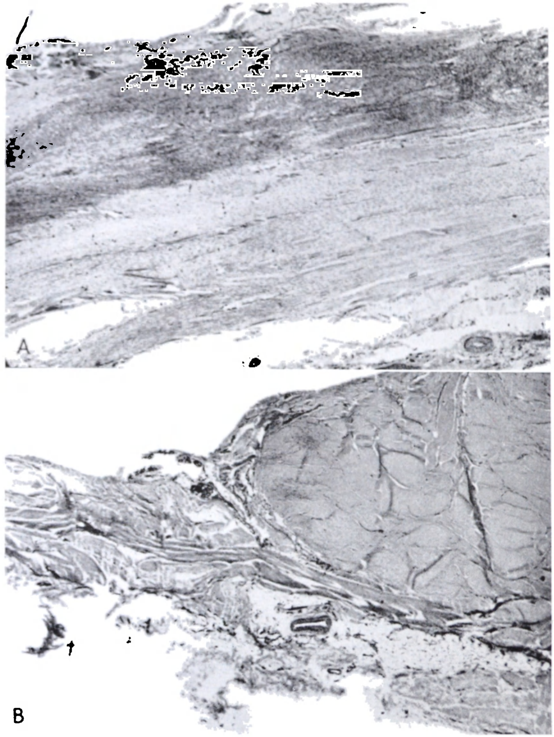

FIG. 15

A, Longitudinal section of a palmar band showing the hyperplastic recently formed layer overlying the more mature layer of the aponeurosis ($\times$ 25). (Reproduced by permission of the Editor, *Australian and New Zealand Journal of Surgery*.) B, Transverse section showing band lying anterior to the plane of the transverse fibres of the palmar aponeurosis, and incorporating its longitudinal fibres. The freedom from involvement of the tissues deep to the aponeurosis is clearly shown ($\times$ 15).

enormously in staining character and moreover varies from point to point in the same specimen, sometimes within a very short space. On the assumption that the signs of proliferative activity precede those of differentiated maturity, maturity means age. A repetition of the process over several months or years gives rise to the mixed picture seen in most specimens.

Collagen deposition is mainly orientated in the direction of the principal band and it has been noted that the plane of the original palmar aponeurosis is often preserved intact on the deep aspect of the palmar specimen so that although its structure has become incorporated into the main mass of new tissue, this has been formed on its palmar aspect, there remaining on the deep aspect of most specimens a plane of uninvolved loose fatty and areolar tissue (Fig. 15, A and B). This is not

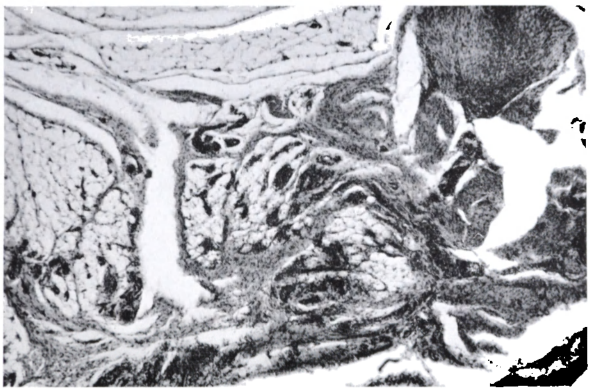

FIG. 16

Replacement of fat loculi by perivascular fibroblastic proliferation at the margin of a palmar nodule (× 50).

seen in the distal palmar or digital specimens where the limit of the change is poorly defined in all directions.

The peripheral changes are seen in most cases to pass into the fatty tissue on the palmar and lateral aspects and often to include areas of fat within the distal part of the dissected operation specimens (Fig. 16), confirming the macroscopic appearance. The change of greatest interest in this adjacent and included fibro-fatty tissue is an increased vascularity (Fig. 17, A). The new vessels are small-calibre arterioles and capillaries, frequently thick-walled and sclerosed, lying between the fat loculi where they are surrounded by sheaths of small round cells and new fibroblasts suggesting a gradual fibrous replacement of fat loculi.

Within the hyperplastic foci the new fibroblasts can be seen to be arranged around sheaths of branching blood vessels (Fig. 17, B). As the fibroblasts mature the nuclei become elongated and separated by increasing amounts of collagen and orientate themselves parallel to the major surviving vessels which are found mainly

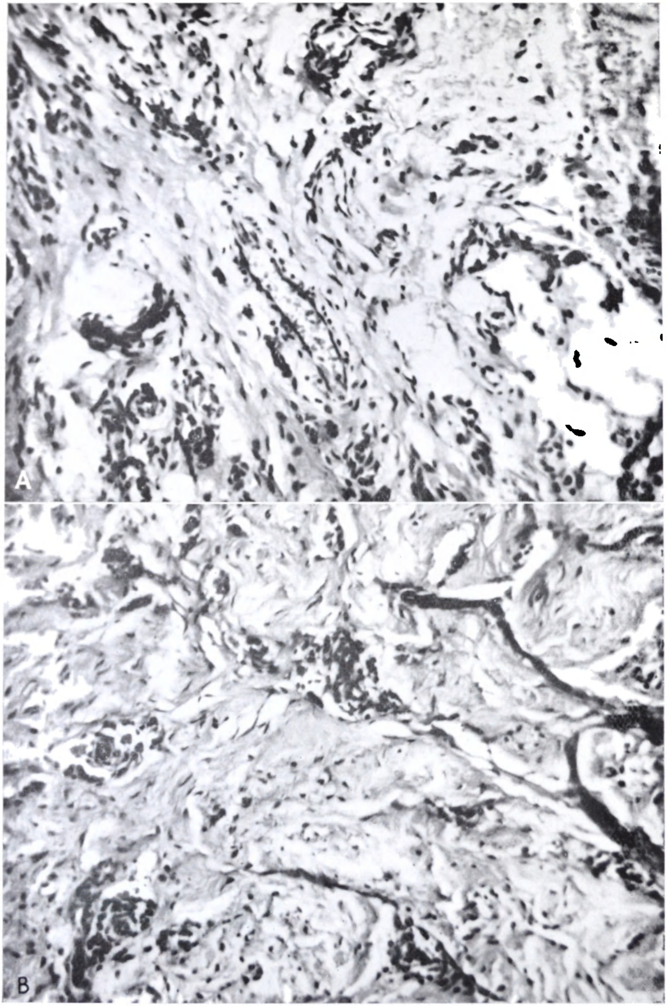

FIG. 17

The sequence of fibroplasia.

A, Perivascular fibroblastic proliferation replacing fat loculi (× 40). B, Irregularly fibroblastic nodule with still intense vascularity (× 40).

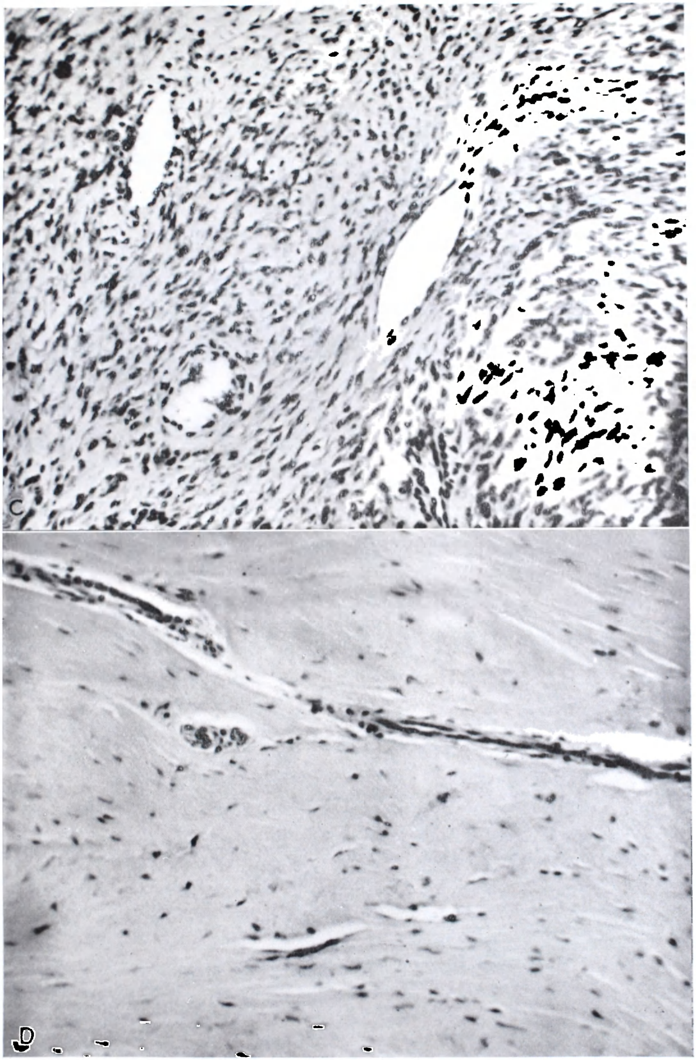

FIG. 17

The sequence of fibroplasia.

C, Young fibroblasts becoming orientated in direction of tensile stress (× 40). D, Dense mature collagen band with scanty fibroblasts (× 40).

in the line of longitudinal stress (Fig. 17, C and D) but may run with the vessels in abruptly differing directions. The direction of the fibres is most disturbed where there is nodule formation.

The fibroblastic invasion and replacement of the palmar fat is regarded as the clue to the production of Dupuytren's tissue. Although the perivascular infiltration may form small round-cell collections, this is consistent with the normal picture of tissue proliferation and does not signify an inflammatory response. No polymorphs or giant cells have been found nor any eosinophils to suggest an allergic factor.

FIG. 18

Longitudinal slit-like spaces in a palmar band, perhaps being tension artefacts ($\times$ 50).

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The centrifugal spread of this proliferative process from an initial palmar nodule along pre-existing fibrous septa to the skin, along the palmar aponeurosis and through the fibro-fatty connective tissue of the palm into the digits is accompanied and followed by a maturation which slowly produces contraction of the newly formed elements. Only when these have fixed attachments and a joint line has been crossed does actual deformity follow.

Examination of mature palmar bands and the dense interphalangeal bands revealed a scattered fibroblastic process between heavy collagen bundles which clarify the macroscopic enigma of band production without preceding nodule formation. Slit-like spaces (Fig. 18) are present in many hyperplastic foci and bands and although some contain blood cells there are many which do not contain blood, are not lined by endothelium, and which may be tension artefacts of contraction.

The relation of the newly formed tissue to the skin is consistent with the replacement rather than displacement of the subcutaneous and dermal elements. Thus the newly formed tissue may pass directly into the vascular dermal papillae overlying a nodule, surrounding Pacinian corpuscles and sweat glands which may be separated from the overlying dermis by two or three millimetres of newly formed tissue.

Broadbent (1955) and Nezelof and Tubiana (1958) have drawn attention to enlargement of the Pacinian corpuscles and describe these enlarged corpuscles as losing their myelin sheaths. It is extremely difficult to be certain whether the Pacinian corpuscles are indeed abnormal in Dupuytren's contracture. By measurements at operation it has been possible to confirm that these bodies frequently are 3·5 to 4 mm. in length and 1·5 to 3 mm. in width. They may constitute a positive nuisance during dissection of the distal palm. However, it is normal for Pacinian corpuscles to enlarge during life (Cauna and Mannan, 1958) reaching 3 to 4 mm. in length during the sixth decade, and there has been little chance to study a control series of hands at operation in the same age groups as the patients with Dupuytren's contracture. Histologically no structural abnormality can be detected in Pacinian corpuscles removed at fasciectomy and the loss of myelin referred to by earlier writers is difficult to interpret unless they observed demyelination of the entering nerve fibre, because the corpuscle itself is normally devoid of a myelin sheath.

Small red-cell extravasations and deposits of iron pigment are commonly seen, usually in the hyperplastic foci (Fig. 19, A and B). The pigment may be intra- or extra-cellular and is interpreted as evidence of past microscopic interstitial haemorrhages. This pigment, which is sometimes seen adjacent to areas of fibre rupture, is neither frequent enough nor constant enough to represent anything more than the fragile nature of any recently formed, as yet undifferentiated, area of fibroplasia and need not be seriously considered as an aetiological factor in the development of Dupuytren's contracture (Chapter 5).

Histologically similar hyperplastic tissue is found to comprise the knuckle pads and plantar nodules of patients with a strong Dupuytren's diathesis (Chapter 4).

Professor Sir Peter MacCallum, Emeritus Professor of Pathology in the University of Melbourne, holds the opinion that changes suggesting a conversion of striated muscle fibres to Dupuytren's tissue can be demonstrated in some specimens where the nodule at operation had been adherent to and merging with formed skeletal muscle masses such as palmaris brevis, abductor digiti minimi or the abductor pollicis brevis. The transformation is first suggested in a change of the staining character in the middle of the muscle bundle where the fibres alter in their characteristic staining, with Masson's stain from brown to blue; with Van Gieson from yellow to red; with haematoxylin and eosin from red to very pale pink and with phosphotungstic acid from purple to light brown, and simultaneously with the change there occurs a loss of cross-striation. There follows one of two lines of dedifferentiation, either extensive laying down of dense collagenous tissue between connective tissue nuclei with pointed ends and wavy outline or the proliferation of cells with ill-defined margins and plump rounded nuclei showing one or more

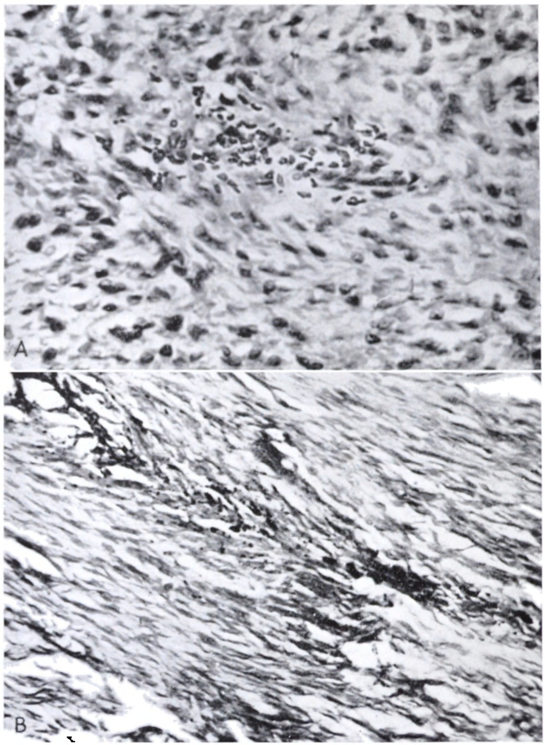

FIG. 19

A, Microhaemorrhage due to capillary rupture within a hyperplastic focus (× 100). B, Free iron pigment near the margin of a nodule, indicating previous microhaemorrhage in this region. Rupture of adjacent collagen fibres indicates origin of this haemorrhage (× 50).

nucleoli with frequent mitotic figures. These also lay down collagen and the nuclei ultimately assume the same form as those of the other group. In each case there is an enormous increase in bulk of tissue, the fibres swell and fuse and the bundles become in fact characteristically staining connective tissue bundles. About the cells collagen becomes deposited in greater or less amount. This interesting conception may be regarded as a further facet of the general pattern of connective tissue behaviour in Dupuytren's contracture.

Summary of microscopic features.

A sequence can be demonstrated from an increased vascularity of the palmar fibro-fatty tissue with perivascular cellular proliferation replacing fat loculi, to the production of hyperplastic foci and finally the maturation collagen in mature bands.

In Dupuytren's contracture such a process appears to commence on the palmar aspect of the palmar aponeurosis and to extend centrifugally along the formed fibrous elements of the palm, including the aponeurosis with its intertendinous septa, the normal fine fibrous septa to the palmar skin and into the fingers. Maturation with collagenisation leads to shrinkage and contracture. The deep bands in the fingers and palm appear to have scattered fibroplasia rather than aggregation into nodules and it is their close relationship to the digital skeleton which allows the production of early and severe contracture even in the absence of palmar nodules.

There is no evidence of inflammation, whether allergic, traumatic or infective, and the presence of free iron pigment is noted as an incidental finding.

TENDON SHEATHS

On flexion of a normal finger there is a folding opposite each interphalangeal joint of the thin segment of fibrous flexor sheath, whose support is provided only by a few oblique crossing fibres. In Dupuytren's contracture there is rarely any evidence at operation of direct involvement of the fibrous flexor sheath in the fibroplasia and contracture of the overlying connective tissues and it is most unusual to find that the tendon sheath offers any obstacle to correction of even long-standing interphalangeal flexion deformity. The flexor tendons are always quite uninvolved.

However, when recurrence of Dupuytren's contracture occurs in a finger the newly formed fibrous tissue, being more closely applied to the previously cleanly dissected flexor sheath, is continuous with the outer layers of the sheath (Fig. 20, A and B). Subsequent contraction thus involves the sheath both actively and passively. It may be possible even at subsequent operations to dissect off the involved outer layer of the flexor sheath sufficiently to correct flexion deformity but ultimately the sheath itself is so fully involved that its incision is necessary to correct interphalangeal deformity and the surgical implications of this change are discussed in Chapter 7.

JOINT CHANGES

No joint changes specific to Dupuytren's contracture are found except for a rare involvement in severe or recurrent cases of the collateral ligaments and capsule in precisely the same way as the fibrous flexor sheath (Fig. 21).

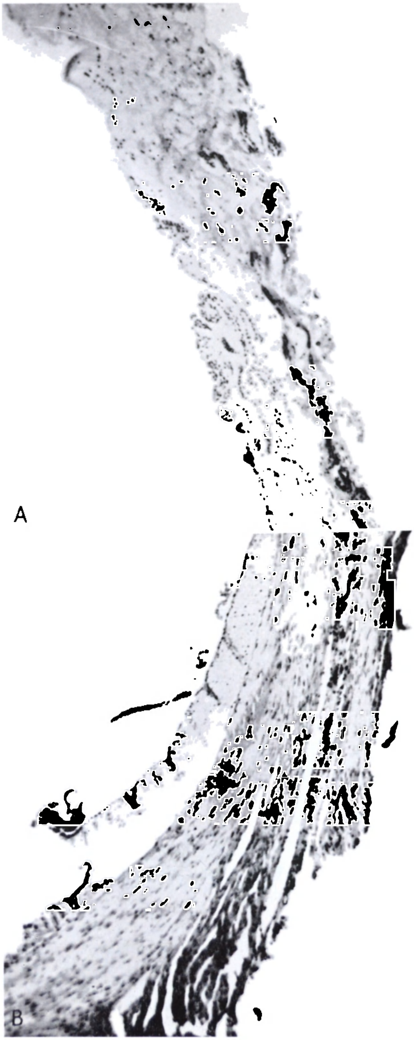

FIG. 20

A, Normal flexor tendon sheath in thin mobile segment. B, Recurrent Dupuytren's tissue involving flexor tendon sheath directly. The lining is also seen to be thickened, possibly from the previous operative trauma (×25).

The anterior capsular contracture of the proximal interphalangeal joint is limited mainly to the limbs of the arcuate ligament and is discussed more fully in relation to attempts at its surgical correction in Chapter 7.

Such long-standing interphalangeal flexion as occurs in Dupuytren's contracture leaves the

FIG. 21

FIG. 22

Fig. 21.—Deposits of Dupuytren's tissue intimately applied to the capsule of the proximal interphalangeal joint in an epileptic woman (× 25).

Fig. 22.—Proximal interphalangeal joint, dislocated dorsally after division of anterior capsule. The head of the proximal phalanx is seen to be devoid of cartilage in its dorsal two-thirds where, owing to long-standing severe flexion deformity, this facet has been in contact with the immobile extensor apparatus.

dorsal two-thirds of the cartilaginous cap of the proximal phalanx exposed to contact with extensor tendon and devoid of its normal stimuli of pressure and friction from the base of the middle phalanx. This disused area of cartilage slowly loses its typical structure and reverts to a more primitive fibrous structure sharply demarcated by the line of articulation (Fig. 22). Such permanent, irreversible loss of cartilage from the facet of the phalangeal head is an important factor limiting complete return of joint function after fasciectomy. Subluxation does not occur at the proximal interphalangeal joint because the middle phalanx in full flexion is normally in contact with the neck of the proximal phalanx, lying here in a reflexion of synovium which protrudes proximally below the arcuate ligament in full flexion (Fig. 23).

The metacarpophalangeal joint is rarely found to be uncorrectably flexed, presumably because the anterior capsular structures are separated from bony

FIG. 23

Lateral radiograph of a normal proximal interphalangeal joint in full flexion showing contact of base of middle phalanx with neck of proximal phalanx. This state of affairs in Dupuytren's contracture has been incorrectly regarded as a subluxation.

fixation to the metacarpal neck by the distal ends of the interosseus muscle origins. The distal interphalangeal joint remains free from deformity unless the digital deposition of Dupuytren's tissue extends beyond this joint (Fig. 24) or unless prolonged stretching of the middle segment of the extensor mechanism over the proximal interphalangeal joint has allowed the lateral segments to produce hyperextension at the distal interphalangeal joint (Fig. 25). Dissections have shown this hyperextension deformity to be uncorrectable by collateral ligament section and requires division of the terminal extensor tendon. Extension of some of the Dupuytren's tissue into the extensor apparatus over the middle phalanx has been already noted but careful dissections at operation and of 20 amputated fingers have failed to demonstrate involvement as a discrete entity of the retinacular

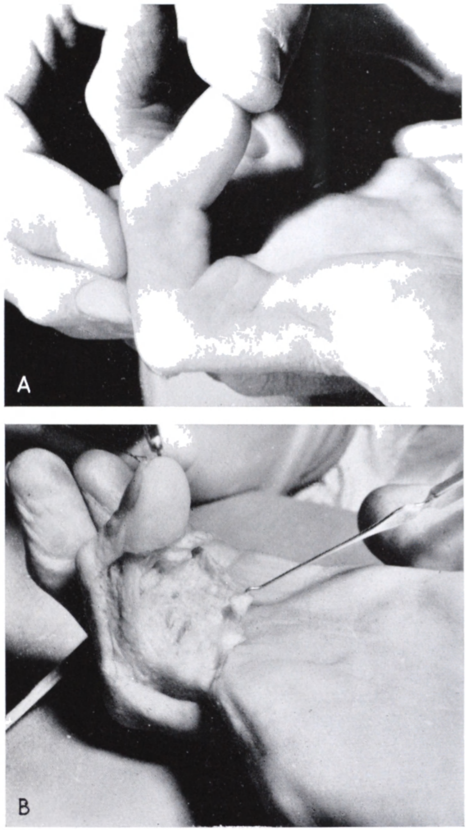

FIG. 24

A, Both distal and proximal interphalangeal flexion deformity.
B, Dense band passing from proximal to distal phalanx, being attached far beyond the distal joint.

ligament of Landsmeer (1949) which would admittedly have provided an attractive explanation for this progressive distal interphalangeal extension with proximal interphalangeal flexion deformity.

Implications of the pathological findings.

It has seemed a paradox that continued hyperplasia should be associated with shrinkage. The coincident fibrosis in many areas of the new tissue accounts for the tension developed and deformity occurs when this force is acting across joints. As flexion occurs it seems from the slit-like spaces that the tissue planes of the band and nodule may slide upon each other and it is possible the volume of the thickened, shortened band may be little less than the uncontracted band.

There is nothing in the histology to support a theory of reparative granulation

FIG. 25

Hyperextension deformity of distal interphalangeal joint tends to occur when the proximal interphalangeal joint is flexed to a right angle and no balancing band extends beyond the distal joint (as in Fig. 24).

tissue providing the hyperplastic nodules as was propounded by Skoog (1948). The presence of iron pigment is consistent with minor vascular ruptures occurring in the softer hyperplastic nodules during the normal stresses of everyday work and it is significant that there is rarely any evidence of inflammatory response in relation to this pigment. Skoog also points to interruption of the fibres of ' fasciculi of the aponeurosis ' at the margins of the hypercellular areas and relates his histological and aetiological theory to this fascial rupture phenomenon.

This appearance has recently been confirmed by the careful preparation of specimens and taking of sections by Larsen *et al.* (1960), but the tissue examined in the region of these nodules is newly formed tissue, while for the most part the plane of the original palmar fascia is deep to and not included in these areas. The nodules and their surrounding areas of newly formed fibrous tissue have been deposited on and fuse with the original palmar aponeurosis. Rupture (Fig. 19, B) or interruption of these new fibres is not to be unexpected at these sites where cellular hyperplasia is concentrated and fibre immaturity at its greatest.

There is no evidence of a true inflammatory basis, either infective, traumatic or allergic, and the histology is consistent only with a progressive fibroplasia from the perivascular cellular cuff. The theory of Krogius (1921) that the new tissue arises from residues of embryonic muscle in the palm has been recently revived by Stein *et al.* (1960), on the basis of ' bundles of spindle cells which take tinctorial shadings suggestive of muscle ' in operative specimens but they provide little actual evidence of the existence of this hypothetical muscle tissue. Their observations however do place the primary lesion of Dupuytren's contracture in the fibro-fatty tissue immediately anterior to the aponeurosis and help to substantiate the present concept. Dedifferentiation of normal striated muscle fibres in the superficial palmar musculature may possibly lead ultimately to its taking part in the production of Dupuytren's tissue.

The increased palmar vascularity and perivascular proliferation which appears to be the basis of the structural changes in Dupuytren's contracture are consistent with the incidence studies of Chapter 2. It is not unreasonable to expect a change in vasomotor control in disused hands to occur with increased vascularity of the soft tissues and this may be possibly demonstrated also in chronic alcoholism and some of the other diseases associated with this condition (Chapter 5).

Recurrence of Dupuytren's contracture after fasciectomy has been blamed upon inadequate removal of the palmar aponeurosis and its extensions (Kanavel *et al.*, 1928) but, particularly in the fingers, it is common to find recurrence within a field which has been thoroughly cleared of aponeurosis and Dupuytren's tissue. The most likely explanation for histologically identical tissue being reformed in an adequately cleared area is that it has arisen from the replaced subdermal fibro-fatty tissue. No recurrence has occurred after Wolfe graft replacement of the skin in areas totally cleared of fat. Aetiological theories involving injury to fascial structures can no longer be put forward to explain the recurrence of Dupuytren's contracture, whereas the present findings of its structure and mode of development are supported by the very circumstances of recurrence.

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