

operation is probably a wise measure in all cases, and if the patient has a general anæsthetic, a calcium chloride injection may be given on the table. All our patients have been digitalized as a preoperative measure.

ANÆSTHESIA

The most difficult part of the operation is the removal of bone from the first rib, because this rib is deeply placed and has large blood vessels and nerves in close proximity. With increasing experience we were able to complete the operation under local anæsthesia alone. Of the last nine cases, six have been completed in this way without the addition of gas and oxygen.

RESULTS

Out of twenty-five cases, seventeen are alive and leading reasonably comfortable lives. Dr. Lapp's opinion is that only one would have survived without the operation.

In conclusion, I wish to stress again the need for the careful selection of patients for operative treatment. It requires the most careful co-operation between physician and surgeon. In this respect we have been particularly fortunate in having the advice and assistance of Dr. Lapp and his staff at Tranquille. Dr. Lapp early became interested in this line of treatment, and his enthusiasm and continued interest has made our work possible.

DUPUYTREN'S CONTRACTION

A REVIEW OF THE LITERATURE AND A REPORT OF A NEW TECHNIQUE IN SURGICAL TREATMENT

A PRELIMINARY STATEMENT

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CONTRACTURE of the palmar fascia was first described in detail by Dupuytren in 1831. Since that time many theories as to its cause have been advanced, but to date no satisfactory cause can be offered. Treatment is also very unsatisfactory, and it is with great diffidence that I offer in this paper an entirely new method of surgical treatment, which I believe offers in the majority of cases by far the greatest chance of a satisfactory result. It is hoped that my technique published in this paper will be taken up by orthopædic and plastic surgeons, and improved so as to suit all grades of cases.

ANATOMY

The palmar fascia invests the muscles of the palm, and consists of a central, lateral and medial portion. The central portion occupies the middle of the palm, and is of great strength and thickness. It is triangular in shape. The apex is continuous with the transverse carpal ligament, and the tendon of the palmaris longus muscle is inserted into it. As it extends distally it spreads out like a fan, and proximal to the

heads of the metacarpal bones, divides into four slips, one for each finger. Each slip again divides. The central superficial slip passes distally and is inserted into the skin of the palm and finger. The deeper portion divides into two slips, one of which passes on each side of the finger and is inserted into the fibrous sheath of the flexor tendon. From the sides of these processes offsets are attached to the transverse metacarpal ligament. This forms an arch on the palmar surface of each metacarpal bone through which the flexor tendons pass. The lumbrical muscles, digital vessels, and nerves lie in the intervals between these slips. This is a point to remember in the surgical treatment, as injury to these structures may seriously interfere with the end-result. Numerous strong transverse fibres bind the separate processes together proximally. (See Fig. 1). The central portion is intimately connected with the skin by dense fibro-areolar tissue.

ETIOLOGY

The etiology is very obscure. It is essentially a disease of middle life and old age. It occurs

more often in men than in women, and it is in no way dependent on a man's station in life. Apert¹ reports the observation of a family with Dupuytren's contraction in four generations. It affected only the men, and it appeared earlier each successive generation. Krogius² points out that the etiology must explain two

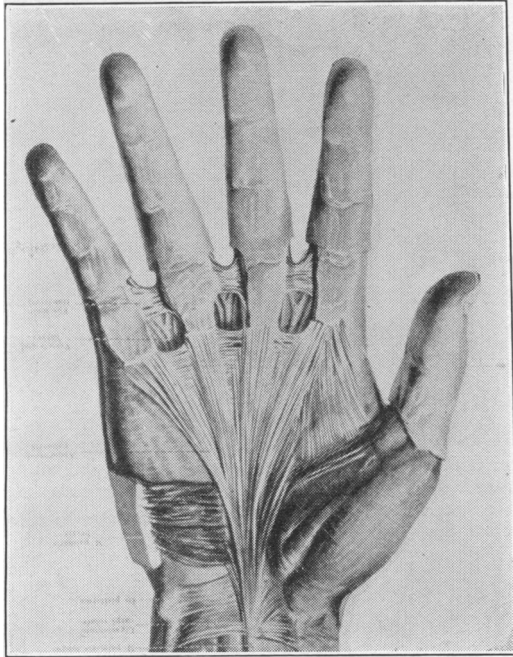


FIG. 1.—From Spalteholtz' Atlas of Anatomy.

factors: (a) hereditary incidence; (b) its symmetrical arrangement on the ulnar side of the hand. He believes the condition is a developmental disease, due to disorders of growth in the superficial palmar muscles. Schubert³ believes that the underlying factors are a hereditary tendency to a fibrous hyperplasia, and a neuro-pathic influence arising from some lesion of the ulnar nerve. Anderson⁴ states that occupation has been greatly overrated as a cause, while Adams⁵ believes it always depends on a constitutional rather than a local cause. A commission appointed in 1912 to look into the cause of Dupuytren's contraction in laceworkers in Nottingham arrived at no definite conclusion. Sir Robert Jones,⁶ however, believed it was primarily a predisposition in an individual, with palmar irritation as the exciting cause. Wainwright⁷ got excellent results following treatment with thyroid extract and believes the contracture is due to an endocrine disturbance. Ely⁸ lays stress on associated septic teeth and tonsils. Byford⁹ found septic teeth present in 34 per cent

of cases in his series. Tubby¹⁰ suggests that it is a fibrositis or a local expression of some subtle change in body metabolism. Other authors consider Dupuytren's contraction as a persisting sequel to lead poisoning.

The contracture is usually limited to the central portion of the palmar fascia. The fascia and its prolongations undergo a chronic, plastic inflammation. This is followed by a thickening and shortening of the longitudinal processes. It loses its glistening white sheen, and becomes grey and closely attached to the overlying skin. The tendons are not involved, but bony changes may occur in advanced cases.

The process begins with a nodular thickening in the palm, usually just proximal to the base of the ring finger, and the overlying skin becomes thickened and tender. Full extension becomes impossible and the finger gradually becomes drawn into the palm. More than one finger may be involved in the process. When the fingers are extended the distal bands of palmar fascia stand out as dense hard ridges in the distal one-third of the palm in the line of the axis of the fingers. The skin becomes very adherent to the underlying thickened fascia, especially at the natural skin creases.

Byford⁹ found in his series of cases that the contraction was limited to the palmar fascia in 35 per cent of cases. In 5 per cent it was limited to the digits, and in 60 per cent the combined type was present. The maximum contraction usually was complete within one year, in his experience, but may go on for years in very chronic cases.

The treatment is surgical, palliative, mechanical measures having been found totally inadequate. Tubby¹⁰ states that open operation is often followed by a wirelike scar, frequently as disabling as the original contracture. He states that the two essentials in the treatment are, first: removal of every portion of the affected fascia; and, second, prevention of scar-tissue formation by the use of fibrolysin. The latter is obsolete and has been given up. Wainwright⁷ found thyroid extract helpful. Apert¹ treated one case with radium emanation. The contraction of the fascia relaxed, leaving only a cord which did not interfere with the use of the hand. Gill¹¹ treated three cases by excision of all the diseased tissues and transplanting a piece of fat from the thigh into the space between the tendon

sheath and the skin. He emphasized the value of transverse incisions entirely.

The following case is an illustration of a contracture following the receipt of an injury which was treated unsuccessfully by local excision, and at a second operation by wide excision of all diseased fascia, followed by an immediate transplantation of a piece of fascia lata with an almost complete anatomical and a complete functional result.

D. C., aged thirty-four, a lineman with the Hydro-electric Company. On September 17, 1926, he fell and forcibly dorsiflexed the middle and ring finger of his right hand. At the time he had very severe pain in the palm, which lasted for about twenty minutes. Following this, he developed a burning sensation in the central portion of the palm. This was followed by a thickening and nodular development in the palmar fascia, the skin becoming puckered and closely adherent to the underlying fascia. The typical contracture appeared, involving the ring and middle fingers. Unfortunately, a photograph was not obtained at this time.

On November 19, 1926, a local incision was made over the affected area, and as much fascia as appeared to be diseased was removed. The wound healed by primary union. Two weeks after operation, contracture again became evident. At the end of five weeks the condition was as bad as ever, if not worse. December 29th, the old scar was excised along with a little poor skin on each side. The surrounding skin of the palm was carefully dissected up, and in spite of all the care taken it was buttonholed in one place, so closely was it attached to the underlying fascia. All newly-formed scar tissue was carefully removed and all diseased fascia. The fascia was followed upwards almost to the digital clefts, and laterally until one was sure by its glistening appearance that all the diseased portion was removed. Great care was taken not to injure the underlying digital vessels and nerves. The tendon sheaths were exposed and were seen to be not involved. Careful hæmostasis was carried out.

The wound was covered over and the thigh opened by a linear incision. The hand was again exposed and a piece of fascia lata, fashioned to fit the space left by removal of the abnormal palmar fascia, was applied, overlapping by about one-quarter of an inch. The fascia was loosely tacked down with plain catgut to the remaining palmar fascia. The skin was carefully closed with interrupted silk-worm-gut sutures. A pad was placed in the palm and a firm bandage applied. The wound in the thigh was closed.

On January 7, 1927, the patient was discharged from hospital with the hand in excellent condition. There was a slight serous discharge from the button-hole that had been made accidentally. On January 10th the stitches were removed; the wound had healed by primary union. During the patient's stay in hospital, the hand was kept fully extended on a well-padded palmar splint. After two and one-half weeks, gentle active and passive movements were started. Considerable stiffness, due to thickening in the palm, was present at the end of the month. When the fingers were flexed in the palm the patient experienced a crackling sensation as if the fascia transplant was doubling up. With gentle movements, no work, and baking, this gradually improved. At the end of ten weeks the patient went back to light work, at which he remained for three months, and then resumed his usual occupation.

The final result, two years later, is shown in Fig. 2. The thickening in the palm has entirely disappeared, the scar having contracted and flattened to the level of the

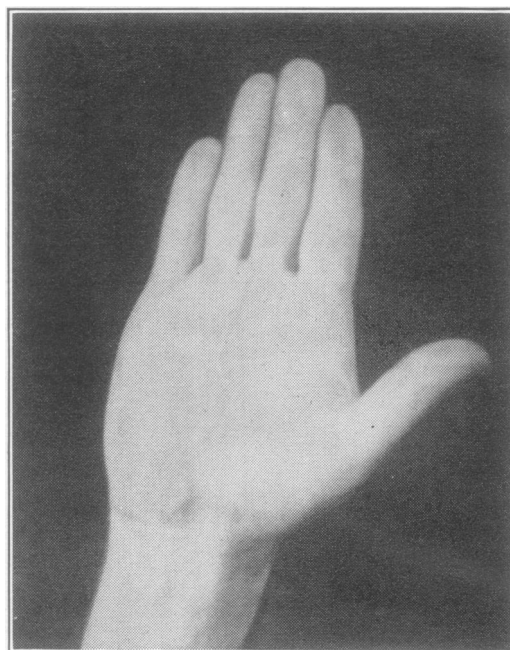


FIG. 2.

surrounding palm. There is no tenderness on pressure over the scar, and all movements are perfect. The patient is at work as usual, using a heavy pair of wire cutters constantly, and he states that he does not know he has been operated on.

SUMMARY

1. The purpose of the present publication is to present an entirely new surgical method of treatment of Dupuytren's contraction of the palmar fascia.

2. The author appreciates the fact that this publication is based upon one solitary case specially suitable for fascia transplantation. The contracture also followed soon after an accident in a young man, which is unusual. More severe grades of contracture would be more difficult to attack, and in fact, might be unsuitable.

3. In the severe types of contracture where the skin is greatly involved and might slough when stripped up, skin grafting, using the whole thickness of skin, may be employed.

4. The important points in the transplantation of fascia are:

- (a) To obtain as fine a piece of fascia as possible. A piece of the rectus sheath would do very well.

- (b) To have the transplant larger than the defect in the palmar fascia, so allowing for shrinkage.

- (c) Merely to tack the fascia in place and not strangulate any portion of it by tight sutures.

(d) Moreover, there must be no tension in the transplant.

(e) To have complete hæmostasis.

5. To keep the hand on a splint for about two weeks before any movements are started.

6. The patient should be kept from work for at least three months, so as to avoid all source of irritation. Light work is advisable for a further period of three months.

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THE RELATION OF THE ALTITUDE OF THE SUN TO ITS ANTIRACHITIC EFFECT*†

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EXPOSURE of the body to sunshine is now universally accepted as the most effective means for the prevention and cure of rickets. Solar radiation which reaches the earth's surface is composed of invisible heat rays, which have wave lengths longer than 760 millimicrons (a millimicron is one millionth of a millimetre in length); visible light, which varies in length from 760 to 380 millimicrons; and invisible ultraviolet rays, which range from 380 to 290 millimicrons. Rickets is prevented and cured by exposure to ultraviolet rays not longer than 302, or, possibly, 313 millimicrons.¹⁻⁴ Rays longer than 320 millimicrons certainly produce no discernible effect.⁵ As the shortest rays in sunshine are 290 millimicrons, and the longest ones effective in the prevention and cure of rickets 302 or 313 millimicrons, it is evident that the effective solar rays are limited to a very narrow zone of the shortest ultraviolet rays present in sunshine.

In a study of the ultraviolet end of the solar spectrum Fabry and Buisson⁶ found that the intensity of this portion of the spectrum falls

off very rapidly, being only one millionth as great at 290 as at 315 millimicrons. This very rapid falling off in the intensity of the solar spectrum is due to absorption by the earth's atmosphere and has been attributed to one of its constituents, namely ozone. This gas is situated largely in the outer limits of the atmosphere. In the lower layers of our atmosphere the effective rays are still further reduced by any smoke, dust and moisture present.

A marked seasonal variation in the prevalence of rickets has been noted by all who have studied the disease. In accord with this, we⁷ have recently demonstrated by animal experiments that the antirachitic effect of summer sunshine in Toronto is approximately eight times as great as that of winter sunshine. Dorno⁸ in the Swiss Alps, using photoelectric cells, found the ultraviolet content of the midday sun in July to be ten times greater than in January. It is thus evident there is a marked seasonal variation in the antirachitic effect of sunshine.

The question arises "What produces this variation?" Could it possibly be due to a variation in the emission of ultraviolet rays by the sun? Pettit⁹ has shown that the amount of ultraviolet rays radiated by the sun does vary, but he found this variation to bear no relation to our seasons. In fact, he found a greater amount of ultraviolet rays emitted in December, 1925, than in July, 1924.

Could this effect be produced by seasonal

* From the Laboratories of the Sub-Department of Pædiatrics, University of Toronto, and the Hospital for Sick Children. This work was aided by a grant from the Department of Health of the Province of Ontario.

† A paper read at the fortieth annual meeting of the American Pædiatric Society, Washington, D.C., May 1, 1928, and before the Section of Medicine, Academy of Medicine, Toronto, Oct. 9, 1928.

Published simultaneously with the *Journal of the American Medical Association*, Chicago, Ill., U.S.A.