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ORIGINAL STUDY

Dupuytren's disease : Outcome of the proximal interphalangeal joint in isolated fifth ray involvement

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In this study of 38 patients, we assessed the clinical result following surgical treatment of Dupuytren's disease with isolated fifth ray involvement, particularly with respect to the proximal interphalangeal joint. Three surgical techniques were used : limited fasciectomy, segmental fasciectomy and dermofasciectomy. At a mean follow-up time of 53.6 months, there were no residual deformities nor recurrences in the metacarpophalangeal joint. At the proximal interphalangeal joint, there was an overall improvement of 45° in movement with a residual flexion deformity avering 30°. The recurrence rate in this series was 39%. There was no significant difference in residual deformity or recurrence rate between the various surgical techniques used.

Fifth ray involvement in Dupuytren's disease remains a surgical challenge, especially at the proximal interphalangeal joint. Residual deformity and recurrence rate remain high, irrespective of the surgical technique used.

Keywords : Dupuytren's disease ; fifth ray ; surgical treatment ; outcome.

INTRODUCTION

Fifth ray involvement in Dupuytren's disease is frequent and is often a frustrating problem for the surgeon. Proximal interphalangeal (PIP) joint contractures have a poor prognosis in terms of residual deformity or recurrence following surgery. The reported recurrence rate after PIP joint release varies between 0 and 71% (*17*). Different surgical techniques, such as fasciotomy, radical, limited or segmental fasciectomy, dermofasciectomy, capsuloligamentous release of the PIP joint, and primary amputation of the little finger, have been used in the past to address this problem. We studied the outcome of surgical treatment in patients with isolated fifth ray involvement, to avoid interference from possible impairment of other fingers in the evaluation of the outcome.

MATERIALS AND METHODS

Between 1998 and 2001, 49 patients were operated for isolated Dupuytren's contracture of the little finger with either PIP joint involvement alone or PIP joint and metacarpophalangeal (MCP) joint involvement. Isolated contractures of the MCP joint were excluded from the study. We also excluded those who had been previously operated for Dupuytren's disease on the ipsilateral hand. Thirty-eight patients (27 men and 11 women) remained for follow-up : 13 patients with isolated PIP joint flexion

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contracture and 25 patients with both PIP and MCP involvement. The right side was affected in 25, the left side in 13. The dominant hand was operated in 26 and the non-dominant hand in 12.

The median age at the time of operation was 56 years (range 38-75). All the operations were performed by the senior author or under his supervision.

The surgical procedures performed were as follows : isolated limited fasciectomy using a linear incision with Z-plasty in 16 cases or a zigzag (Bruner) incision in one case ; segmental fasciectomy as described by Moermans (*10, 12*) in 13 cases ; and in 9 cases a dermofasciectomy as described by Hueston (*10*) was used. The full-thickness skin graft used was taken from the medial side of the forearm. A PIP capsulotomy was done in 2 cases only. The extension of the PIP joint obtained during surgery or at the first post-op consultation (5 days following surgery) was recorded. Post-operative splinting was used in 31 patients. Initially the extension splint was applied night and day, with 2-hour intervals during the day, followed by night-time splinting alone. During the 2-hour intervals, the patients were encouraged to begin active range of motion exercises of their hand.

The aim of this study was to evaluate the final outcome of the PIP joint contracture as well as the recurrence rate in Dupuytren's disease after a minimal follow-up period of 2 years. A minimal delay of 2 years between operation and evaluation was chosen based on the papers of Rodrigo *et al* (*14*) and Rombouts *et al* (*15*), who indicated that recurrence rates can only be adequately measured after 2 years.

The mean follow-up time was 54 months (range, 27-75 months). Patients were evaluated about risk factors that have been associated with Dupuytren's disease. They were questioned and examined for ectopic disease and recurrence or extension of Dupuytren's disease. Patients were asked about the global hand function and satisfaction using a visual analogue score (VAS). Measurements of residual deformity at the PIP and MCP joints and range of motion were obtained.

RESULTS

The results are summarised in tables I, II, III and IV. The average pre-operative extension deficit at the PIP joint was 53.9° (SD 23.3° ; range 15-90°). When the MCP joint was also involved the extension deficit averaged 33.3° (SD 26.7° ; range 10-80°). Total active range of motion (TAM) was 73.6° in the MCP joint and 45.5° in the PIP joint (table I).

In 16 patients a limited fasciectomy was done, 15 times through a linear incision and Z-plasty and once using a Bruner skin incision. The average pre-operative extension deficit at the PIP joint in this group was 54.1° (SD 23.0°) The MCP joint contracture (n = 6) and extension deficit averaged 38.3° (SD 24.2°). In 13 patients a segmental fasciectomy was performed using semicircular skin incisions as described by Moermans (*12*). The average PIP joint contracture was 48.5° (SD 24.1°) and MCP joint (n = 9) extension deficit averaged 32.5° (SD 29.3°). A dermofasciectomy procedure was used in 9 patients. The average extension deficit at the PIP joint was 61.7° (SD 23.0°) and 46.0° (SD 36.0°) at the MCP joint (n = 5). Additional capsulotomy of the PIP joint was performed in 2 cases to gain extension : one during a segmental fasciectomy and one during a limited fasciectomy.

Immediately following surgery, no patient had residual deformity at the MCP joint. Twenty-six patients regained full extension of the PIP joint. The average residual extension deficit for the other 12 patients was 15.8° (SD 7.3° ; range 10-35°).

In this series we had 7 complications : in one patient the ulnar digital artery required ligation following a vascular lesion, 3 patients had temporary hypaesthesia, one patient developed a wound infection which was treated with oral antibiotics, one

Table I. — Pre-operative data

	Proximal interphalangeal joint		Metacarpophalangeal Joint	
	Ext. deficit (°)	TAM (°)	Ext. deficit (°)	TAM (°)
Fasciectomy	54.1 (SD 23.0)	38.3 (SD 25.7)	38.3 (SD 24.2)	77.5 (SD 24.8)
Moermans	48.5 (SD 29.3)	47.7 (SD 25.5)	32.5 (SD 29.3)	74.2 (SD 25.4)
Hueston	61.7 (SD 23.0)	34.4 (SD 22.6)	46.0 (SD 36.0)	65.0 (SD 27.4)
Overall	53.9 (SD 23.3)	40.5(SD 24.9)	33.3 (SD 26.7)	73.6 (SD25.0)

TAM = total active range of motion

Table II. — Post-op. Extension deficit

	Degrees PIP Contracture	n
Excellent	< 15°	17
Good	15°-30°	8
Fair	30°-45°	3
Poor	> 45°	10

developed a superficial skin necrosis and one developed a complex regional pain syndrome, which was treated with calcitonine injections and physical therapy.

Five patients were re-operated for recurrent disease. All had recurrent PIP joint contractures. Their mean PIP joint flexion contracture at the time of the second operation was 69° (SD 17.5° ; range 45°-90°). The mean time interval between the two operations was 29.7 months (range, 8 to 48 months). Four patients were treated with a Hueston dermofasciectomy and one was treated with an island flap. At final review, the mean PIP joint flexion contracture was 48° (range 20°-90°) (fig 1).

At final follow-up (mean 53.6 months ; range, 27-75 months), not one MCP joint demonstrated residual deformity. Seven patients had a compensatory hyperextension of the MCP with an average of 20° (range 10-30°), associated with an extension deficit at the PIP joint, averaging 45.7° (range 5-90°). Eight patients had full extension of the PIP joint, 9 patients had less than 15° of residual deformity, 8 patients had an extension deficit between 15° and 30°, 3 patients had an extension deficit between 30° and 45°, and 10 patients (including the 5 patients who had been re-operated) had a extension deficit of more than 45° (table II). The mean PIP joint flexion contracture was 29.7° (SD 29.1° ; range 0-90°). The total active range of motion (TAM) was 94.3° at the MCP joint and 66.6° at the PIP joint (table III). The extension deficits at the PIP joint for the different techniques are shown in table IV.

The improvement coefficient of Thomine (*19*) was 44.9% at the PIP joint with an average correction of 27.0° (SD 28.3°) (table IV).

Recurrence of the disease was seen in 18 patients. Thirteen patients had recurrence at the same level, 3 had local extension of the disease and 2 patients had a combination of recurrence and extension. The recurrence rate for the fifth ray was 39.4%.

Risk factors typically associated with Dupuytren's disease are listed in table V. Fifteen patients were genetically predisposed, 17 patients had bilateral disease, 4 patients had diabetes mellitus and 1 patient had epilepsy. Six patients had an excessive consumption of tobacco and 4 of alcohol. An association with ectopic disease was seen in 7 patients ; 4 patients had Garrod's knuckle pads, 2 had plantar fascia fibromatosis (Ledderhose's disease), and one patient had la Peyronie's disease. In the multi-variant analysis of the predisposing factors using a backward regression model, none of the predisposing factors for Dupuytren's disease were found to be a determining factor for recurrence of disease or final extension deficit.

Using the visual analogue score, the global hand function was 9.7 (SD 0.73) and the global satisfaction was 8.2 (SD 2.7).

The relationship between pre- operative deformity and extension deficit at final follow-up is

Table III. — Total active range of motion

	PIP		MCP	
	Pre-op (°)	Post-op (°)	Pre-op (°)	Post-op (°)
Fasciectomy	38.3 (SD 23.0)	65.0 (SD 30.1)	77.5 (SD 24.8)	93.7 (SD 12.0)
Moermans	47.7 (SD 25.5)	75.0 (SD 23.7)	74.2 (SD 25.4)	96.5 (SD 10.7)
Hueston	34.4 (SD 22.6)	61.7 (SD 24.2)	65.0 (SD 27.4)	92.2 (SD 6.2)
Overall	40.5 (SD 24.9)	66.6 (SD 28.5)	73.6 (SD 25.0)	94.3 (SD 10.3)

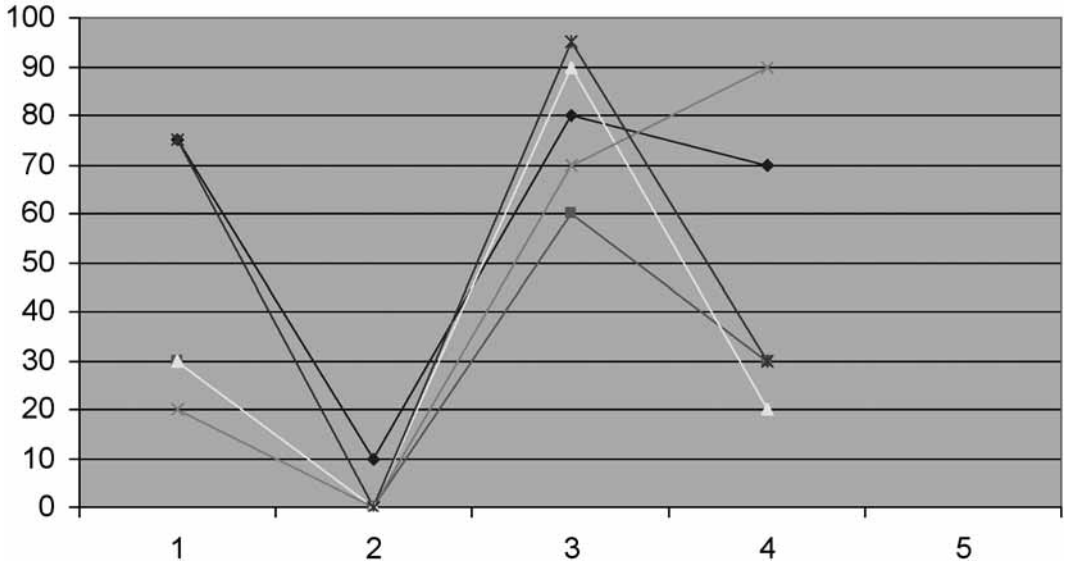

Fig. 1. — Recurrence pattern for re-operated patients (n = 5) (1 = preoperative flexion deformity, 2 = immediate postoperative situation, 3 = flexion at recurrence, just preop, 4 = at final follow-up) (each patient is represented by a different line).

Table IV. — Extension deficit of PIP joint

		Pre-op	Immediately post-op	Follow-up	Avg Amount of Correction		Recurrence	
Type operation :	N	PIP ° (SD)	PIP ° (SD)	PIP ° (SD)	degrees	Percent*	N	Percent
Fasciectomy	16	54.1 (23.0)		27.5 (28.2)	22.8 (34.1)	46.20%	6	37.70%
Moermans	13	48.5 (24.1)		28.8 (33.5)	19.6 (39.8)	40.60%	5	38.50%
Hueston	9	61.7 (23.0)		35.0 (26.2)	26.7 (16.2)	43.30%	4	44.40%
Overall	38	53.9 (23.3)	15.8 (7.3)	29.7 (29.1)	27.0 (28.3)	44.90%	15	39.40%

$$\text{* Correction coefficient of Thomine} = \frac{\text{(preop-deformity)} - \text{(postop-deformity)}}{\text{(preop-deformity)}} \times 100$$

Table V. — Risk factors and ectopic disease

	N
Genetic	15
Bilateral disease	17
Diabetes Mellitus	4
Epilepsy	1
Tobacco	6
Alcohol	4
Garrod's knuckle pads	4
Ledderhose's disease	2
La Peyronie's disease	1

shown in figure 2. There is a positive correlation between severity of the pre-operative deformity at the PIP and MCP joint and the clinical outcome at follow-up ($p = 0.00001$, paired t-test). The degree of correction, however, is not related to the pre-operative extension deficit. The only significant factor in determining the clinical outcome (extension deficit at follow-up and recurrence) was the pre-operative extension deficit for PIP joint ($p = 0.052$). Age and sex of the patient, the pre-operative MCP extension deficit, and the surgical technique were no significant determining factors.

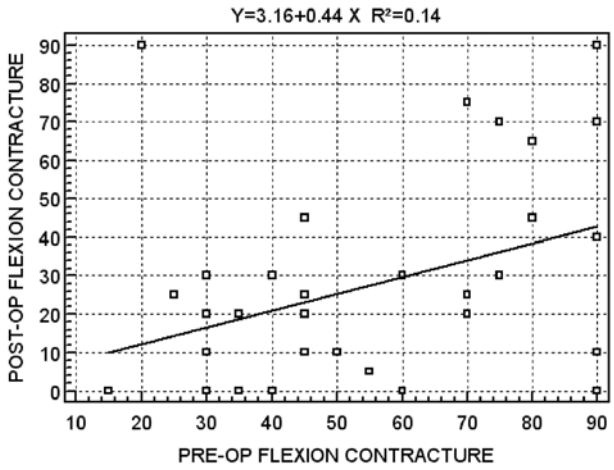

Fig. 2. — Pre- and post-operative comparison : (N = 31, with exclusion of the 5 patients with recurrence and 2 with incomplete preoperative files).

DISCUSSION

Dupuytren's disease affecting the fifth ray is notorious for its poor surgical results. Simple fasciectomy often leads to incomplete release of flexion contracture and to recurrences, so that primary amputation was the most common approach to a severely contracted little finger during the first half of last century (*5*). The most problematic joint is the PIP joint rather than the MCP joint. Even with a longstanding Dupuytren's flexion contracture, the MCP joint can be corrected surgically. This is due to the specific anatomical features of the capsuloligamentous structures of the MCP joint, which do not predispose to secondary flexion contractures (*1, 16*). The shape of the metacarpal head and the insertion of the collateral ligaments are such that the ligaments are under maximum tension when the MCP joint is flexed. Our observations confirmed this. All of the patients (n = 25) with MCP joint involvement corrected to full extension. At final follow-up, no recurrences at the MCP joint were seen.

Longstanding flexion contractures at the PIP joint, however, may cause secondary contractures and adhesions in the capsuloligamentous structures (*17*). As a consequence, the joint may not fully extend even after the diseased fascia has been excised.

During the second half of the last century, further attempts were made to decrease the flexion contracture of the PIP joint and the recurrence rate. To avoid amputations, Moberg *et al* (*11*) suggested arthrodesis of the PIP joint or wedge osteotomy as salvage procedures.

With increasing knowledge of the anatomy of the PIP joint, several authors suggested releasing the secondarily contracted structures of the PIP joint in order to increase extension. These structures are the flexor tendon sheath and retinacular ligaments (*5*), the check-rein ligaments (*20*), the accessory collateral ligament and the proximal attachment of the volar plate (*2*). Attenuation of the central slip of the extensor tendon and its role in the pathogenesis of the extension deficit has also been addressed (*2, 7*). Poor results were achieved with extensor tendon repair, and this technique was abandoned (*5*). The value of capsuloligamentous release has also been questioned. In the series of Weinzweig *et al* (*21*), Beyermann *et al* (*3, 4*) and Ritchie *et al* (*13*), a significant difference in the final outcome for the PIP joint after comparing a combined fasciectomy with capsuloligamentous release and fasciectomy alone could not be demonstrated. Breed and Smith (*5*) further demonstrated that gentle passive manipulation of the PIP joint after the fasciectomy produced better long-term results than a capsuloligamentous release.

The problem of secondary shortening of the palmar skin has been addressed by Hueston (in *10, 17*). A dermofasciectomy, originally described for treating recurrent disease, can also be used for primary surgery in younger patients. Hueston proposed this method not only to address skin shortage, but also to produce a firebreak, and to replace dermis infiltrated with myofibroblasts (*10*).

Moermans (*12*) described a more conservative approach to treat Dupuytren's contracture : segmental aponeurectomy. Here no attempts are made to remove all diseased tissue ; the goal is rather to achieve discontinuity, thus releasing longitudinal tension. When there was a shortage of skin, he suggested Y-V plasties.

Two studies examined the results for isolated fifth ray involvement in Dupuytren's disease. Tropet *et al* (*18*) retrospectively examined 148 hands with a

minimum follow-up of 5 years. Their study included 33 cases of fasciectomy alone, 114 cases of fasciectomy combined either skin graft in the palm (85) or a digital skin graft (29), and one amputation. The mean flexion deformity was 21° at final evaluation, versus a pre-operative flexion deformity at the PIP joint of 71°. The Thomine correction coefficient was 70.4%. Goubier *et al* (*6*), retrospectively reviewed 30 cases with a mean follow-up of 22 months. In this series the Tubiana classification was used, so that there were no absolute values (in degrees) available for the PIP joint alone. Five patients underwent a percutaneous needle fasciotomy, 24 patients were treated with a limited fasciectomy and one patient was treated with a dermofasciectomy. The improvement coefficient in this series was 60% for mixed forms (MCP and PIP joint involvement), and 46% for PIP joint deformity.

Abe *et al* (*1*) studied 75 hands treated for Dupuytren's disease in Japan. Fifty of these patients had involvement of the little finger. They noted an improvement of 38% for the fifth ray ; no distinction was made between MCP and PIP joint.

In a prospective study, Ritchie *et al* (2004) (*13*) evaluated the PIP joint of the fifth ray in 19 patients. The mean follow-up was 3 years. In their series they had two groups ; those that underwent a simple fasciectomy (n = 8), and those that underwent a fasciectomy and capsuloligamentous release (n = 11). The mean pre-operative flexion deformity in the first group was 28° (range 20-45°) and 70° (range 45-94°) in the latter group. The correction obtained in the simple fasciectomy group was 71% versus 58.6%. in the capsuloligamentous release group. The overall recurrence was 39.4%. This was slightly higher in the dermofasciectomy group (44,4%), maybe because of the relatively smaller number of patients in that group. Also, one patient in this group developed a complex regional pain syndrome with severe recurrence of contracture (90°) that required a re-operation after 8.3 months. Excluding this patient the recurrence rate was 37.5% (3/8).

Our recurrence rate, is similar to other studies. Rodrigo *et al* (*14*) had a 63% recurrence after subtotal fasciectomy. Le Clercq and Tubiana (*8*) found a 66% recurrence in 50 hands with an average of 10-year follow-up. Rombouts *et al* (*15*) studied 77 operations using a limited fasciectomy technique. They had a recurrence of 39%. McFarlane and McGrouter (*9*) reported the rate of recurrence and extension between 50 and 60 % for all types of operations. Moermans (*12*) had a recurrence rate of 35.7% using only a segmental fasciectomy. In the series of Tropet *et al* (*18*) and Goubier *et al* (*6*), the recurrence rate for the little finger was 16.7% and 17.2% respectively. In the series of Abe *et al* (*1*), 14 patients had recurrence or extension of disease. The recurrences occurred in little fingers only (n = 10). In this series, the recurrence rate for the little finger was 20%. Moermans (*12*) reported a recurrence of 28.2% at the MCP joint and 31.5% at the PIP joint of the little finger.

In analysing our 5 patients that underwent a second operation, three initially had a PIP joint contracture of 30° or less (2 had 30° and 1 had 20°). At the time of their second operation, these patients had an average of 73° extension deficit, and at final follow-up, they had an extension deficit of 47°. We hypothesize that these three patients were in the proliferative phase. The cords are not well developed in this stage, so it is likely that some diseased tissue is left behind, allowing for early recurrence. Rombouts *et al* (*15*) found a significant relationship between the histological classification and the recurrence rate : histological type 1 corresponds to the proliferative phase, characterised by the presence of mitotic figures and a recurrence rate of 70%. Type 2 is called the fibrocellular phase. Type 3 the fibrotic or residual phase consists of broad bundles of collagen fibres with very few cells and a recurrence rate of only 8%.

In our series 25 patients had residual deformity of 30° or less (table II). Three patients had between 30 and 45° residual deformity and 10 patients had more than 45° residual extension deficit at the PIP joint. This residual deformity does not cause an important functional problem because the global hand function, using a visual analogue score, was 9.7 (SD 0.73). This can be explained by the fact that in this series only one finger was involved and there were no bilateral diseases.

Isolated fifth ray involvement in Dupuytren's disease remains a surgical challenge. The residual

deformity and recurrence rate for the little finger remains high, irrespective of the surgical technique used.

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