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SEGMENTAL APONEURECTOMY IN DUPUYTREN'S DISEASE

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We report 213 consecutive segmental aponeurectomies in 175 patients. Through several small curved skin incisions, segments of diseased tissue about 1 cm long were excised. No attempts were made to remove all the Dupuytren's tissue, the aim being to achieve discontinuity. The results are described in detail and compare well with conventional techniques of partial fasciectomy.

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More than 150 years after Baron Dupuytren's first description of the disease which bears his name, the operative treatment of the contracture still poses many problems. The results after surgery are often less satisfactory than they should be: recurrences and extension of the disease are frequent and the incidence of complications leading sometimes to unacceptable functional loss, is rather high. The abundance of surgical techniques proposed since Dupuytren's first fasciotomies and the continuous trend toward less aggressive procedures illustrate this major concern. The radical fasciectomy once recommended (McIndoe and Beare, 1958) has been condemned (Clarkson, 1963) because of the post-operative complications. Limited resection of the fascia through volar zig-zag or straight longitudinal incisions converted to Z-plasties has been advised instead.

However a comparative study of wound complications (Gelberman et al., 1982) confirmed previous reports (Hueston, 1961; Tubiana, 1967) showing an average 10% of flap necrosis with these procedures and demonstrated the superiority of the presently popular open-palm technique of McCash (1964), though this does not solve the difficult problems of the finger deformities and requires dressings of the wound for four or five weeks. The survey of 990 operations by McFarlane (1983) best illustrates the frequency of serious complications following today's most popular operations: an overall complication rate of 19% and loss of flexion and sympathetic dystrophy occurring alone or together in 10% of patients. These problems, the almost direct relationship between the extent of the surgical procedure and the post-operative morbidity (Gonzales, 1985) and the frequency of recurrence after all types of fasciectomy (Tubiana and Leclercq, 1985) made us look for an operation allowing a simple post-operative course and a longer relief of the contracture than usually achieved by simple subcutaneous fasciotomies.

In 1983, we began a prospective study of segmental aponeurectomy, a procedure we first heard about from R. Vilain (1982) who uses a very similar technique. The basic postulate of this operation is that, if we can create a permanent discontinuity in the retracted aponeurotic band without wide dissection of the fascia itself, then the retracted band (from which tension has been eliminated) will disappear or at least cease to act as a contracture

(Fig. 1). It has been demonstrated that this can happen in scar contractures and the idea was extended to Dupuytren's disease by I. McGregor (1985) and others. It is thus much more than a simple fasciotomy, since we create a gap in the contracted aponeurosis.

Surgical technique

Anaesthesia and haemostasis. The operation is performed under pneumatic tourniquet and usually under regional intra-venous anaesthesia.

Incisions. Small curved skin incisions about 1.5 cm. long are made over the contracted band in the palm and, if necessary, in the fingers, in such a way that if they were joined they would form a lazy S (Figs. 2a, 3a, 4a and b). They should be planned to allow the excision of the nodules since these seem to play the most significant role in the pathogenesis of the contracture (Hueston et al., 1976; Badalamente et al., 1983).

Dissection. The dissection between the skin and the contracted aponeurosis beneath must be very carefully done, close to the dermis, to avoid any bridge of fascia. This also allows re-expansion of the skin even if it is severely pitted. While an assistant pulls on the finger to keep the contracted tissue under tension, small pieces of fascia about one centimetre long are excised, beginning proximally, without further skin undermining or wide dissection of the fascia. At the base of the proximal phalanx, this is usually difficult because of the neurovascular bundles; to diminish the risk of damage of the digital nerves, it is always performed under maximum tension of the cord, never using scissors but only a scalpel blade to separate the tissues. At this point, complete extension of the fingers is usually achieved (Figs. 2b and 4c). In some cases, a shortened volar joint capsule may restrict full extension of the P.I.P. joint but it is best mobilized post-operatively and not by capsulotomy.

Skin closure. Since there is no wide dissection, the skin can be sutured without drainage. Should skin lengthening be necessary, it can be achieved by making a V-Y advancement using the pronounced curvature of the

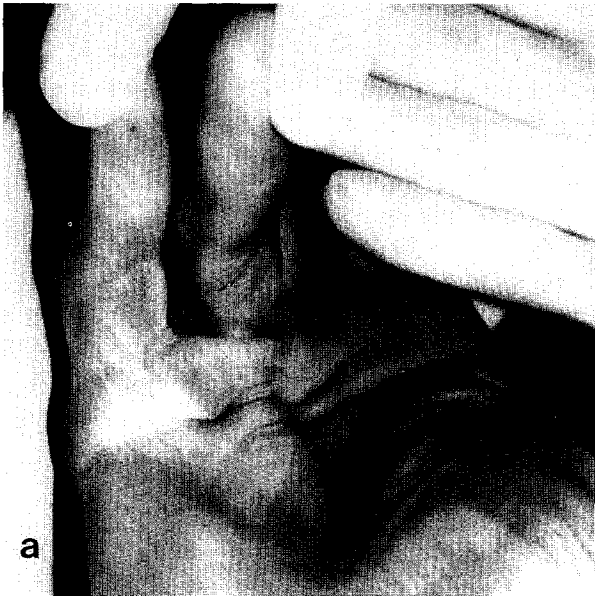
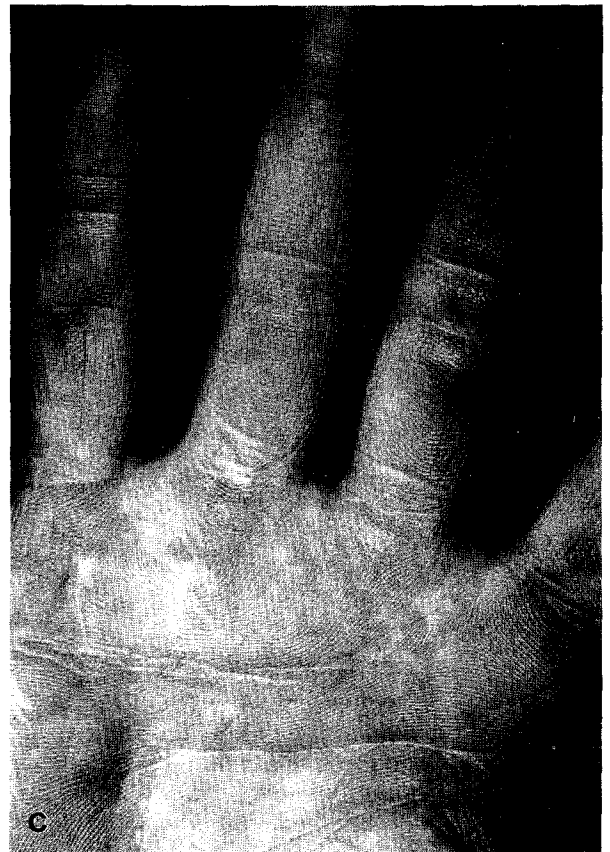


Fig. 1 (a) Contracture of fourth and fifth rays with much skin involvement in a young patient. (b) After six weeks, extension of the finger is full but a nodule of diseased fascia is still clearly visible in the palm. (c) After six months, that nodule has completely disappeared, probably due to elimination of the tension in the retracted band.



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incision. A light pressure dressing is applied to the entire hand.

After-care. Next day, active mobilization is started and a custom-made extension splint is applied which should be worn continuously between the re-education sessions for the first two or three weeks (Figs. 2c, d and e, 3b and c). This is very important, since in our experience the few patients who failed to wear the splint had bad results.

Patients

We report our first 213 consecutive segmental aponeurectomies in 175 patients: 39 women (22.3%) and 136 men

(77.7%). The average age was 62.1 years (range 29 to 81). Only 24.8% of the patients reported a family history of the disease, although no specific inquiry was made on that matter. We also found the usual high proportion of epileptic (7.9%), diabetic (4.2%) and alcoholic (7.3%) patients. In 6.7% of cases there was a history of local trauma.

36 (16.9%) of the 213 hands had undergone a previous operation on the same or other rays (13 showed an extension of the disease, 10 a recurrence and 13 a combination of the two). During our study there have, of course, been more patients with recurrence of the disease who have been operated upon, but segmental aponeurectomy could not be used because of the abundant scar

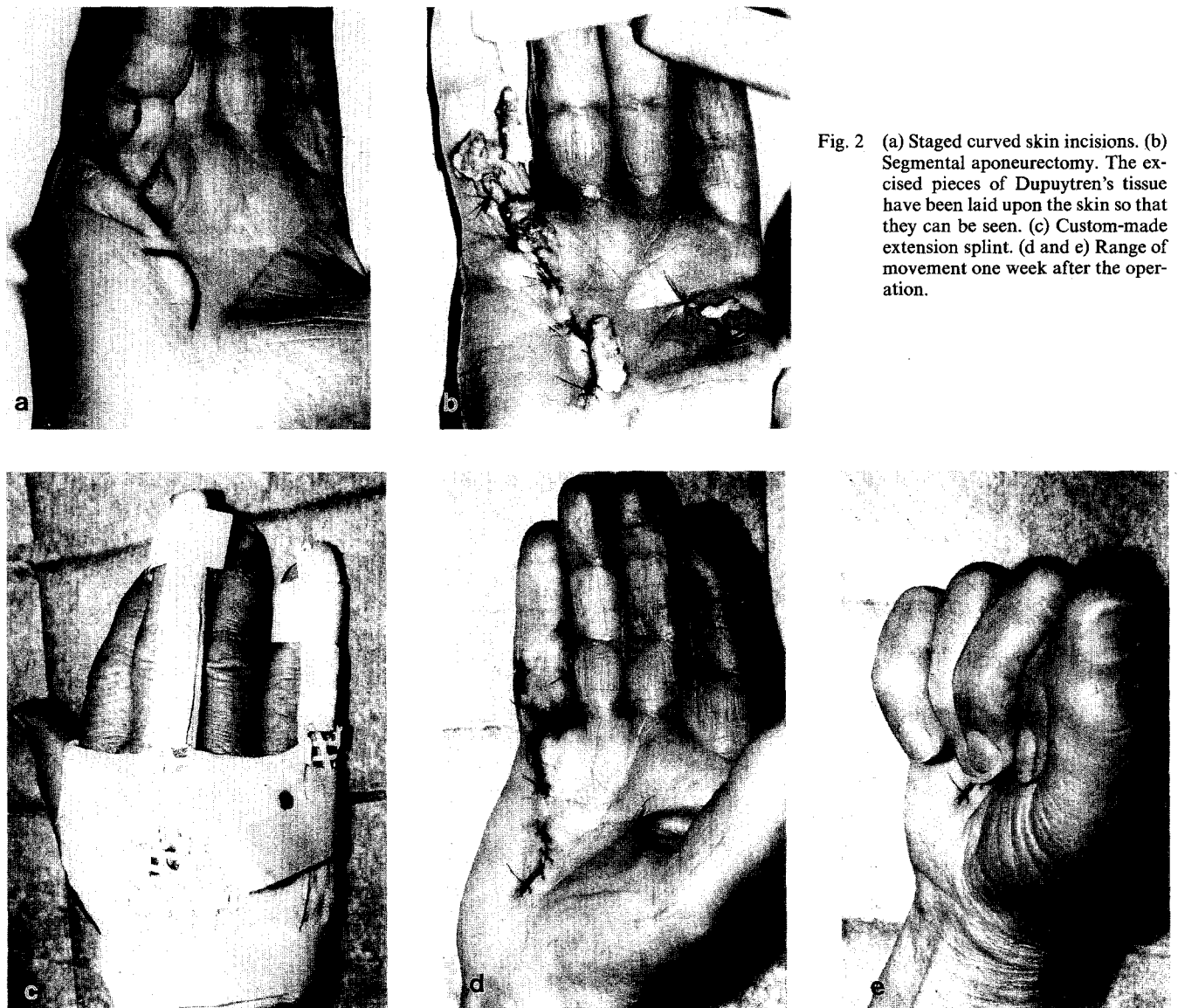


Fig. 2 (a) Staged curved skin incisions. (b) Segmental aponeurectomy. The excised pieces of Dupuytren's tissue have been laid upon the skin so that they can be seen. (c) Custom-made extension splint. (d and e) Range of movement one week after the operation.

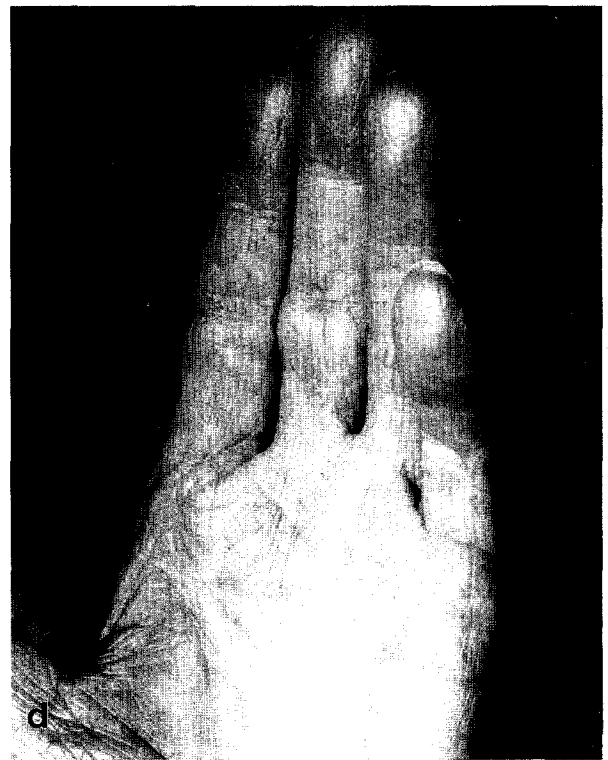


Fig. 3 (a) Multiple curved skin incisions for Dupuytren's disease affecting all rays. (b and c) Six weeks after the operation, the scars are still clearly visible but the patient has almost normal movements. (d) Five years later: slight loss of extension at the P.I.P. joint of the little finger but no further evolution of the disease.

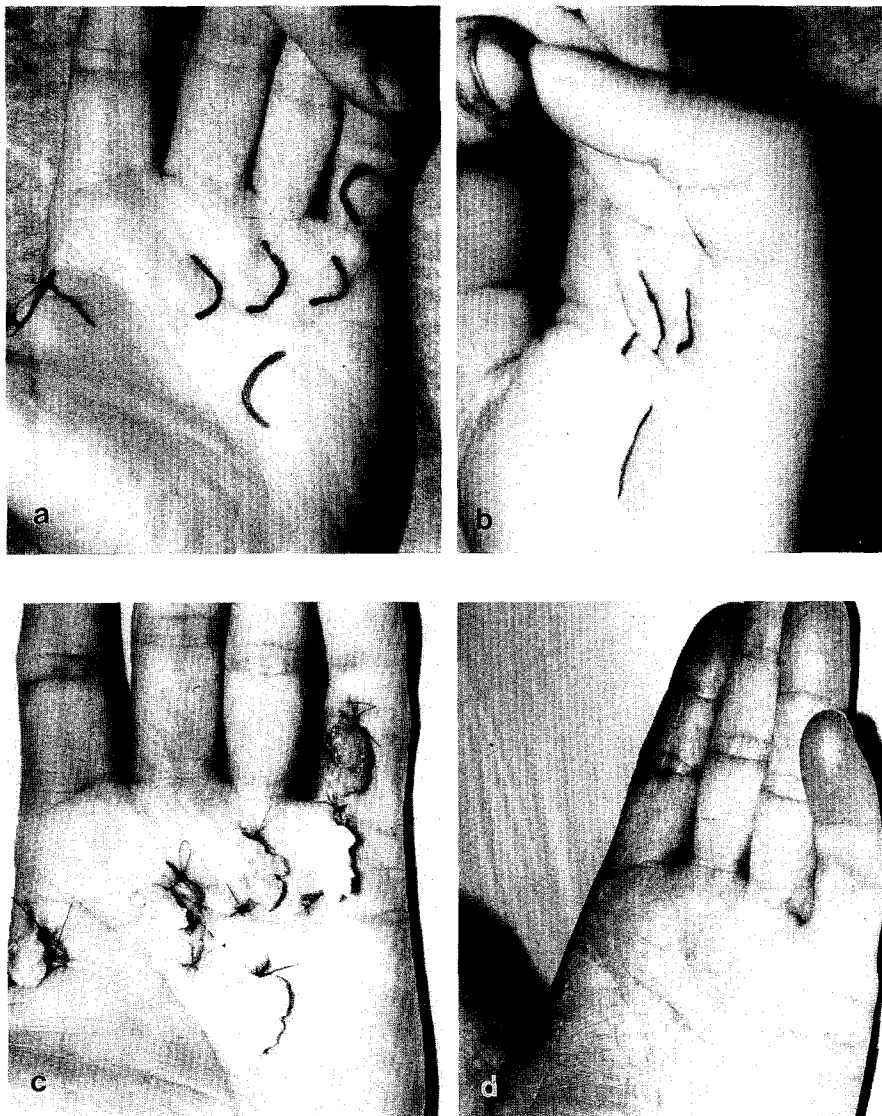


Fig. 4 (a and b) Curved incisions for contractures of the first web and of the third, fourth and fifth rays. (c) Segmental aponeurectomy. The P.I.P. joint of the little finger has not been fully corrected. (d and e) 14 months later: the extension deficit in the little finger is still present but shows no sign of increasing.

tissue so dermofasciectomy with immediate skin-grafting was performed instead (35 cases).

To evaluate the results, the pre- and post-operative mobility of the M.P. and I.P. joints were measured. We also used the assessment formula proposed by Tubiana et al. (1968) and the impairment-of-function assessment of Swanson et al. (1983), which we think is useful to show the functional impact of some possible complications such as loss of flexion.

In addition, we tried to evaluate how long the correction lasted for and the incidence of recurrences and extensions of the disease. We adopted the definition of a recurrence used by Tubiana (1985): this is the reappearance of Dupuytren's tissue in an area already cleared by operation, in contrast to an extension which is the new appearance of the same tissue in un-operated areas of the

hand. Recurrent nodules without any sign of contraction have been interpreted as true recurrences.

Pre-operative evaluation

The contractures ranged from 5° to 95° at the M.P. joints and at the P.I.P. joints from 5° to 110° . The average contracture was 37.1° at the M.P. level (276 joints) and 45.1° at the P.I.P. level (227 joints). There was a contracted aponeurotic band in the first web in 34 hands. Detailed data are presented in Table 1.

The average stage, using Tubiana and Michon's formula, was 3.2 (Standard deviation = 2.2, range 1 to 13). The distribution is shown in Figure 5.

The average impairment of function was 7.0% (S.D. = 5.8, range 1 to 31). The distribution is shown in Figure 6.

Table 1—Flexion contracture before and after operation (in degrees)

		Number of cases	Mean ± S.D.		Range	
			Before	After	Before	After
Thumb	M.P.	17	20.9 ± 11.6	1.9 ± 3.3	10–50	0–10
	I.P.	1	25.0	0	25	0
Index	M.P.	9	21.7 ± 15.2	1.3 ± 3.5	10–60	0–10
	P.I.P.	15	31.7 ± 11.1	11.6 ± 3.5	10–55	
Middle	M.P.	41	30.8 ± 14.0	0.8 ± 2.3	10–80	0–15
	P.I.P.	25	32.3 ± 14.7	6.3 ± 10.3	5–60	0–33
Ring	M.P.	117	35.9 ± 20.6	0.7 ± 3.5	5–90	0–25
	P.I.P.	59	43.5 ± 28.3	11.2 ± 18.0	5–100	0–90
Little	M.P.	92	46.0 ± 26.2	1.9 ± 6.8	5–95	0–35
	P.I.P.	127	50.2 ± 26.2	16.8 ± 19.9	5–110	0–90
Thumb web		34		1		

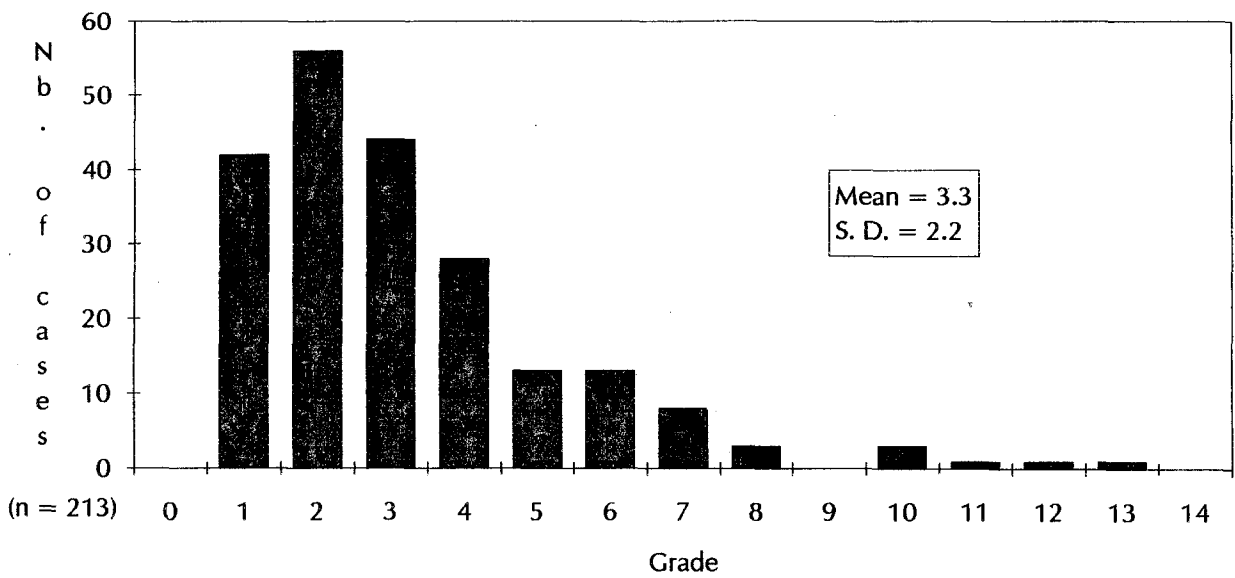


Fig. 5 Tubiana's grade before operation.

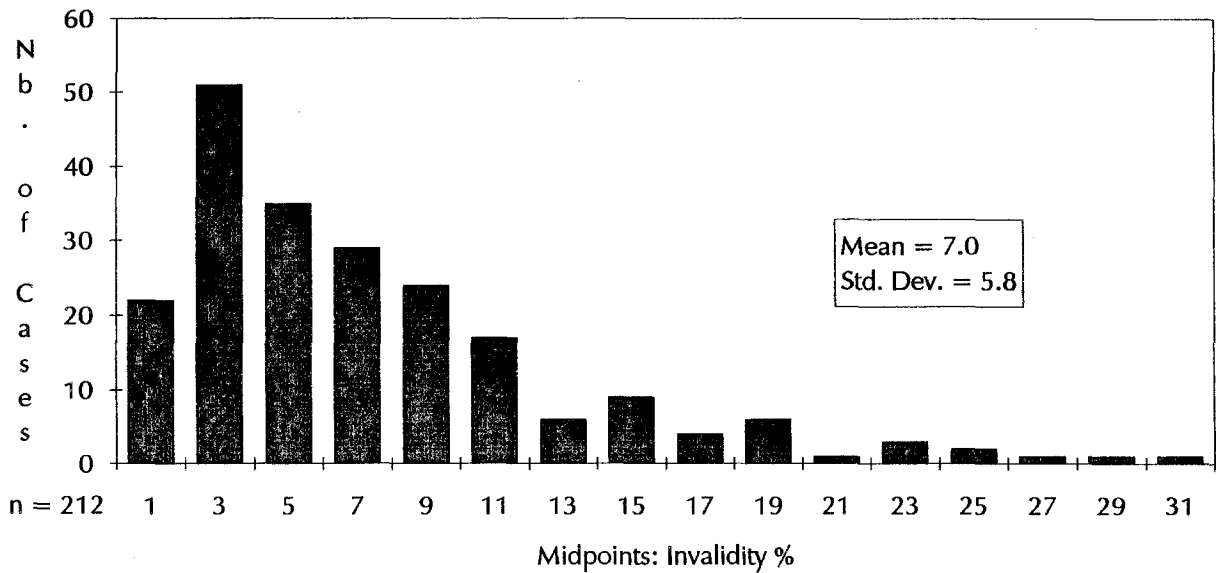


Fig. 6 Invalidation % before operation.

Post-operative evaluation

All patients were seen regularly until they had recovered a complete range of motion or we felt that the mobility would not improve any further. Most patients were under treatment for less than six weeks (range 2 to 30 weeks; median 5).

Complications

There were twelve complications (5.6%):

Haematomas. Four small haematomas developed, but without adverse consequences since they engendered neither infection nor skin necrosis.

Skin necrosis. A very small area of skin necrosis was observed in two cases. One was under treatment for four weeks, the other for seven weeks.

Nerve lesions. Two digital nerves were sectioned at the beginning of our series (cases 21 and 30) when we were still using scissors to divide the aponeurotic band. Two other nerves were sectioned later. These injuries were identified during the operation and the nerves immediately sutured.

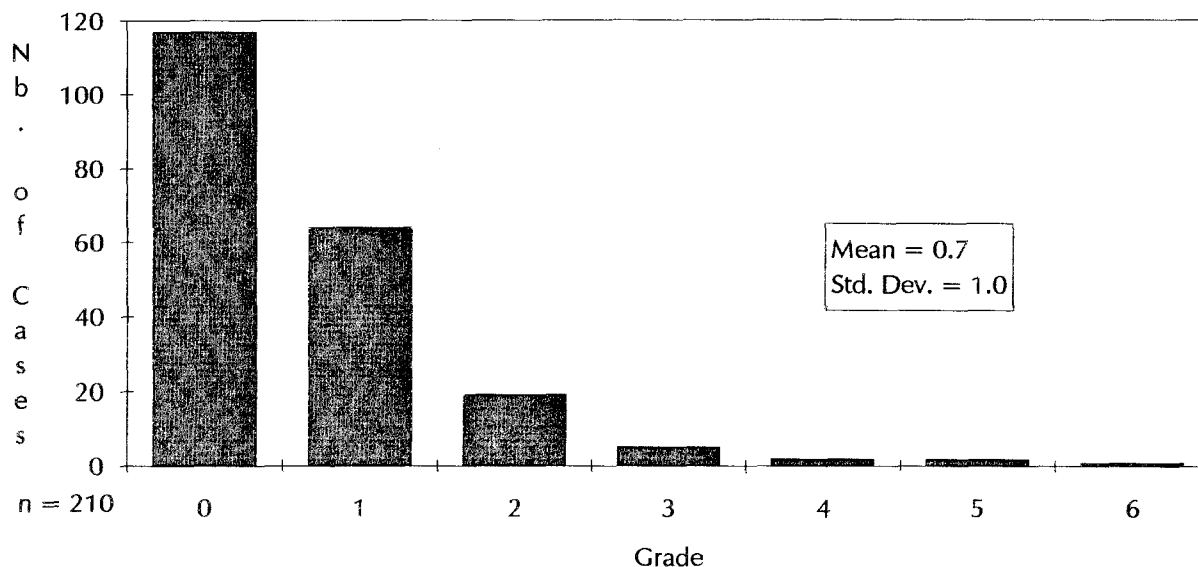
Sympathetic dystrophy. Two patients developed a severe sympathetic dystrophy: they were treated for 30 weeks and were the only ones who lost some function.

Results*Early results*

Following operation, extension of the M.P. joints ranged from 0° to 35° and the P.I.P. joints from 0° to 90°. The average residual contracture was 1.1° at the M.P. level

Table 2—Improvement of flexion contracture

		Number of cases	Perfect %	Improved %	Same or worse	Improvement Mean \pm S.D.
Thumb	M.P.	17	88.2		11.8%	88.2% \pm 33.2
	I.P.	1	100.0			100.0%
Index	M.P.	9	87.5	12.5		95.0% \pm 14.1
	P.I.P.	15	50.0	50.0		70.4% \pm 33.7
Middle	M.P.	41	97.6	2.4		98.7% \pm 7.8
	P.I.P.	25	68.0	28.0	4.0%	81.3% \pm 31.3
Ring	M.P.	117	94.8	5.2		98.4% \pm 7.9
	P.I.P.	59	56.9	38.0	5.1%	79.9% \pm 30.5
Little	M.P.	92	90.0	10.0		97.0% \pm 10.3
	P.I.P.	127	43.5	53.3	3.2%	70.2% \pm 32.0
Tubiana's grade		213	55.7	41.4	2.9%	81.9% \pm 25.0
Functional grade		213	55.5	41.6	2.9%	86.5% \pm 22.6

**Fig. 7** Tubiana's grade after operation.

and 13.7° at the P.I.P. level. A contracted band was still present in the first web of one hand. Detailed data in tables 1 and 2 confirm the typical better prognosis of M.P. contractures, even in the external rays, and the less satisfactory results of the P.I.P. joint of the little finger. They compare favourably with those reported by McFarlane (1985).

The average stage using Tubiana and Michon's formula was 0.7 (S.D. = 1.0, range 0 to 6). In 55.7% of the cases, full extension was obtained. A total extension contracture of less than 45° was found in 86.2% of the cases, as shown in Figure 7.

The average impairment of function was 1.2% (S.D. = 2.5). In 93.3% of cases, the impairment was less than 3%. The distribution is shown in figure 8.

We calculated the percentage of improvement for the joint contractures, the Tubiana and Michon's stage (mean = 81.9, S.D. = 25.0, range 0 to 100) and the impairment of function (mean = 86.5, S.D. = 22.6, range -50 to 100). These results are shown in Table 2 and Figures 9 and 10. This confirms the benefit of assessing function, since it is the only measure that reveals that the condition of two patients who developed a severe dystrophy was aggravated by the operation.

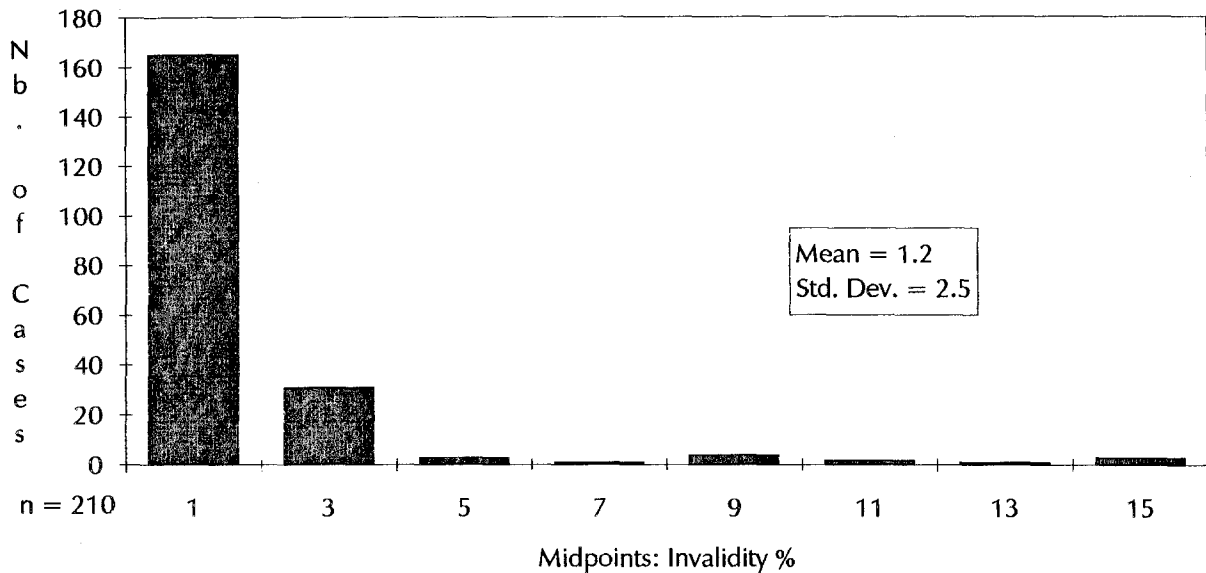


Fig. 8 Invalidity % after operation.

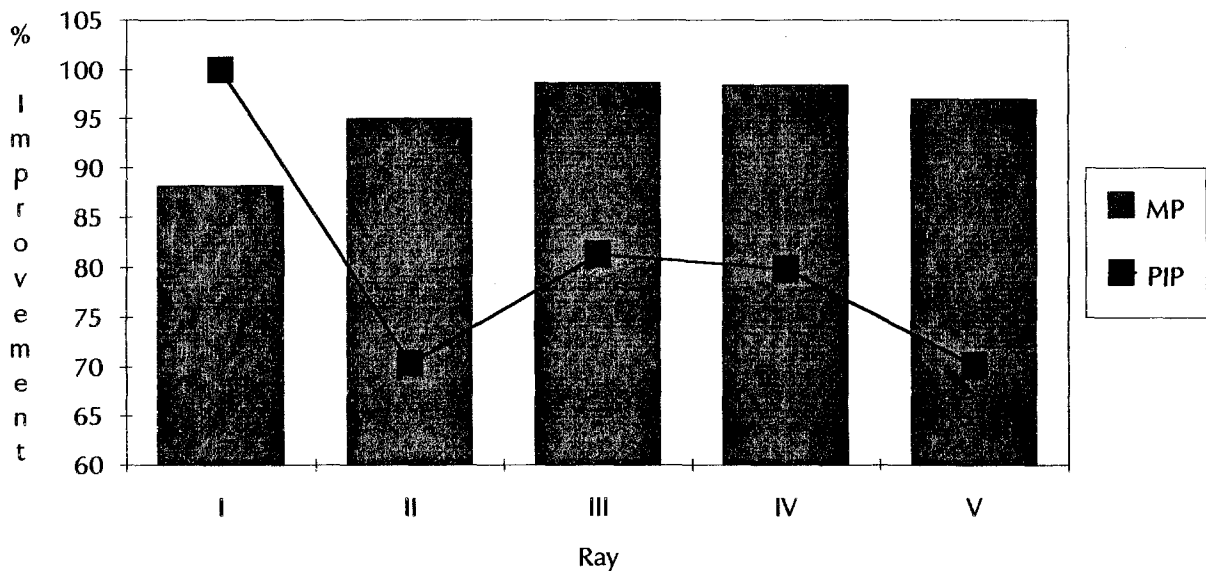


Fig. 9 Improvement in extension.

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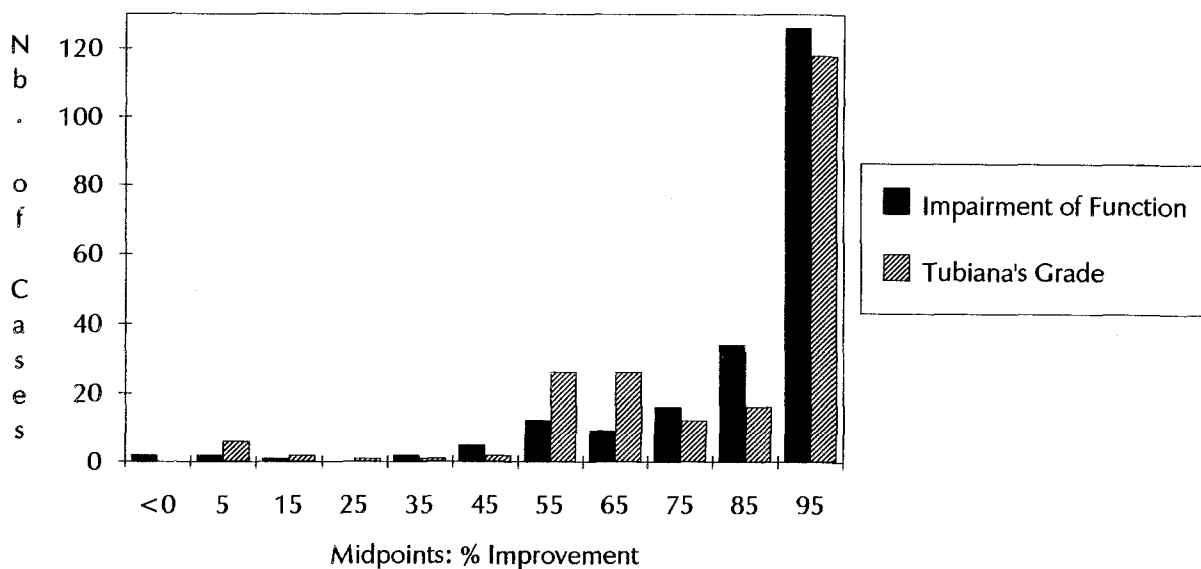


Fig. 10 Percentage of improvement.

Late results

We were able to review 84 operations in 67 patients. The pre-operative Tubiana's grade for this group ranged from 1 to 12 (mean = 3.4, S.D. = 2.2) and the impairment of function from 1 to 25 (mean = 7.0, S.D. = 5.3). The post-operative values ranged respectively from 0 to 5 (mean = 0.6, S.D. = 0.9) and from 0 to 15 (mean = 1.3, S.D. = 2.5). The average improvement of Tubiana's grade was 82.1% and that of function was 84.1%. The mean interval between operation and review was 2.6 years (S.D. = 1.6), the range being shown in Figure 11. Two cases developed

a recurrence within a few months after the operation. These are reported as in year 0.

We found extension of the disease in 12 (14.3%) of the 84 operated hands, recurrence in 18 (21.4%) and both extension and recurrence in 12 (14.3%). In 42 hands (50%), there was no sign of further evolution. Recurrences were not evenly distributed among the rays and the joints, being more common in the ulnar than in the radial rays, whereas extensions of the disease were more uniformly distributed (Table 3). Table 4 shows the number of recurrences in relation to the number of contractures originally operated upon.

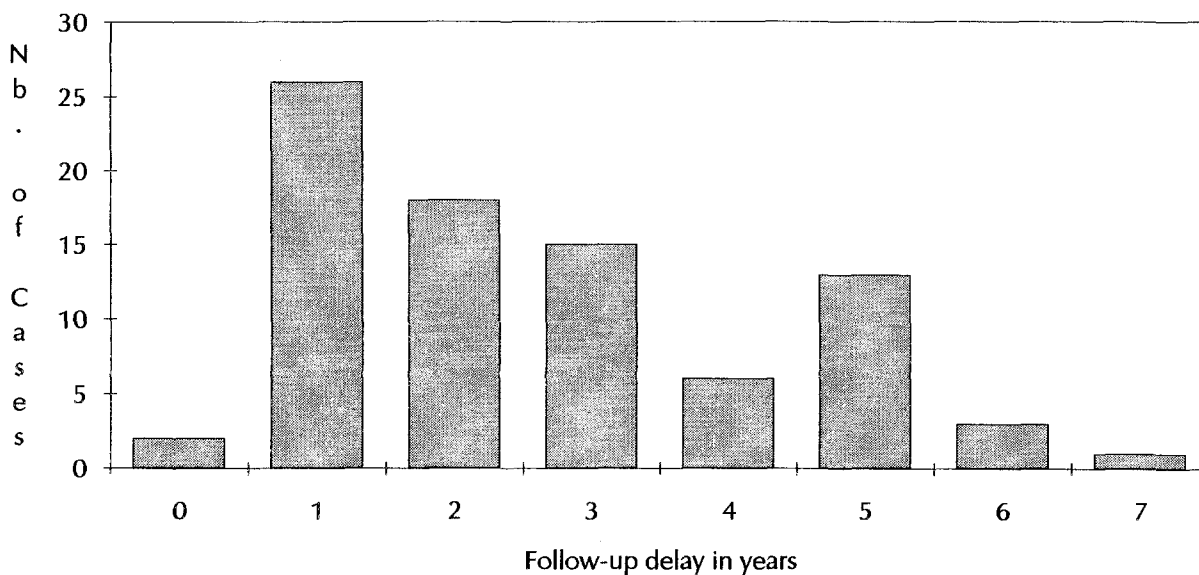


Fig. 11 Follow-up period.

Table 3—Result by ray: number of cases (% of total)

	<u>Ray</u>					
	<i>I</i>	<i>First web</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>
Normal	82 (97.6)	74 (88.1)	76 (90.5)	67 (79.8)	67 (79.8)	62 (73.8)
Extension	1 (1.2)	8 (9.5)	3 (3.6)	12 (14.3)	8 (9.5)	2 (2.4)
Recurrence	1 (1.2)	2 (2.5)	5 (5.9)	4 (4.7)	8 (9.5)	19 (22.6)
Ext. + Recur.				1 (1.2)	1 (1.2)	1 (1.2)

Table 4—Number of recurrences (percentage of operated contracture showing a recurrence)

	<u>Ray</u>									
	<i>I</i>	<i>First web</i>	<i>II</i>		<i>III</i>		<i>IV</i>		<i>V</i>	
	M.P.		M.P.	P.I.P.	M.P.	P.I.P.	M.P.	P.I.P.	M.P.	P.I.P.
Operated	9	16	8	9	21	9	49	21	39	54
Recurrence	1 (11.1)	2 (13.3)	1 (12.5)	4 (44.4)	3 (14.3)	2 (22.2)	4 (8.2)	7 (33.3)	11 (28.2)	17 (31.5)

In total, 38 hands (45.2%) had no contracture at all, 19 (22.6%) had less than 45° of total extension deficit and 48 (57.1%) had a functional impairment of 1% or less (Figs. 12 and 13). The average Tubiana's grade was 1.2 (S.D. = 1.4; range 0 to 6) and the average impairment of function was 2.8 (S.D. = 4.2; range 0 to 20).

Of the 30 recurrences, two (6.7%) had only a palmar or digital nodule, seven (23.3%) had less than 45° of total extension deficit (Fig. 12) and six (20%) had a functional impairment 1% or less (Fig. 13). The average Tubiana's grade was 2.6 (S.D. = 1.7; range 0.5 to 6) and the average impairment of function was 6.2% (S.D. = 5.3; range 0 to 20).

14 secondary operations were performed on 11 patients (three of whom had undergone a previous operation by conventional techniques): four for extension, eight for recurrence and two for a combination of recurrence and

extension. There were seven segmental aponeurectomies, six dermo-fasciectomy and one McCash technique.

We tried to identify factors influencing the recurrence rate by comparing the means in each group for patients showing a recurrence or not and by using analysis of variance to test the significance of the observed differences. Table 5 summarizes the results. We also made a cross-tabulation of sex, family and personal antecedents for the same groups of patients. We then compared the observed frequencies with the F-test (Table 6).

Discussion

Segmental aponeurectomy was studied as a possible way to achieve complete correction of the contracture (which cannot be obtained by simple fasciotomy) while trying to limit the post-operative discomfort and the sequelae of

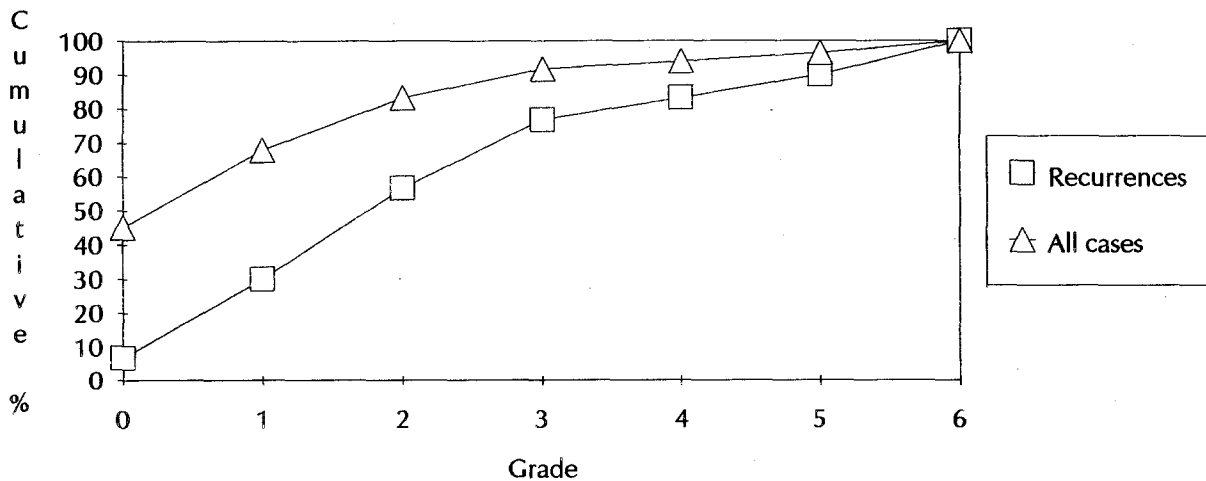


Fig. 12 Late follow-up: Tubiana's grade.

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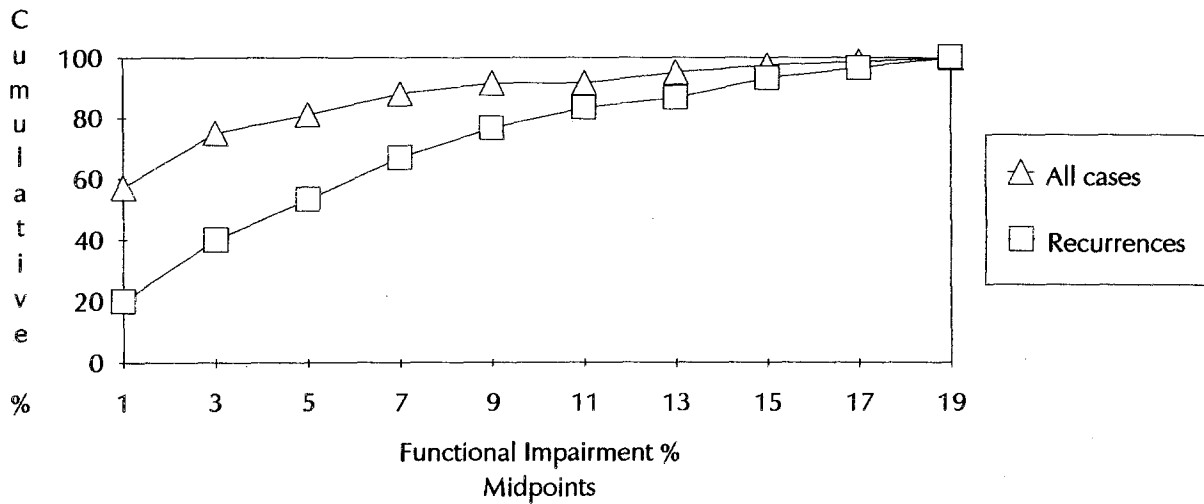


Fig. 13 Late follow-up: functional impairment.

Table 5—Means for different groups

	No recurrence	Recurrence	Significance
Years before operation	5.7	8.6	p < 0.02
Age	62.0	60.0	p > 0.25
Tubiana's grade pre-op	3.2	3.6	p > 0.4
Tubiana's grade post-op	0.4	1.0	p < 0.002

Table 6—Cross-tabulation: number of cases

		No recurrence	Recurrence	Significance
Family history	No	38	22	p = 0.7
	Yes	13	5	
Sex	Men	38	23	p = 0.7
	Women	16	7	
Personal antecedents	None	39	20	p = 0.7
	Local trauma	3	1	
	Diabetes	2	0	
	Epilepsy	3	3	
	Alcohol	6	4	

wide dissection. The early results achieved in our first 213 cases are equal to or even better than those published for other techniques. Indeed, the overall complication rate was 5.6% of which only 2.8% had long-term consequences, compared with 19% and 10% respectively in the review by McFarlane (1985). In the same way, the overall improvement of contracture at the M.P. level, as deduced from Table 2, was perfect in 93% of the cases, improved in 6% and the same or worse in 1% compared with 76.9%, 18.3% and 4.8%. At the P.I.P. level, our figures are 51.9%, 47.5% and 0.6% compared with 29.8%, 51.7% and 18.5%.

The recurrence rate in this series was 35.7%, which is comparable to that reported in other studies: 34% in Hakstian's reviews (1966 and 1974), 40% in Hueston's (1961), 63% in Mantero's (1983) and 68 in Tubiana's (1985). This is despite the fact that we have included minor recurrences with little or no contracture that could have been excluded in other studies. A true comparison of the recurrence rates is nevertheless impossible since the follow-up periods are not the same.

The recurrences were not evenly distributed among the rays and the joints. Table 4 shows that they were frequent in all P.I.P. joints but less so in the M.P. joints

except in the little finger. The greater number of operations on the ring and little fingers explains the illusion of a higher recurrence rate in the ulnar rays shown in Table 3.

The recurrences were often minimal, since 30% had less than 45° of total extension deficit and 20% had a functional impairment of 1% or less. They required a second operation in 10 of the 67 reviewed patients. Three of these had already been operated on before and showed clear signs of an aggressive disease. Overall, the first operation has been really useful, since the average pre-operative Tubiana's grade (3.4) and invalidity (7%) were greatly improved (to 0.6% and 1.3% respectively) in the early post-operative period and have only slightly deteriorated with time (1.2% and 2.8%).

What are the factors that influence the recurrence rate? Tables 5 and 6 show that there is no statistically significant association between the risk of recurrence and sex, family history, personal antecedents, age or pre-operative extension deficit. On the contrary, the length of history before operation was significantly longer in the group of patients showing a recurrence. The most important prognostic factor is the operative improvement: those cases in which the contracture was not fully corrected have a greater risk of recurrence, as shown by the highly significant difference in the post-operative Tubiana's grades. The importance of this factor was recognized by Tubiana himself (1985) but our results do not confirm the role of the other factors he mentioned: sex, age, associated disease, family history and the severity of the original contracture.

Conclusions

The results of surgery for Dupuytren's contracture have been assessed by a number of different methods and genuine comparison between procedures is extremely difficult. It is all the more so as many factors influence the results: the great variety in the severity of the disease, the operation performed and the post-operative complications, especially haematoma, skin necrosis, sympathetic dystrophy, recurrence and extension of the disease.

When trying to define the most appropriate procedure, some guidelines should be kept in mind:

1. The more aggressive the fasciectomy, the more numerous the complications (Zachariae, 1967).
2. Fasciectomy in most patients is performed to relieve finger flexion contractures which are usually causing little impairment of function (Figure 3). Is it wise to carry out operations carrying higher risks of complications and consequently of loss of function?
3. Although recurrences are frequent, Dupuytren's disease is no cancer.

Our data support our reliance on this less extensive procedure, which offers a good correction of the contracture (comparable to that after conventional operations) with fewer complications and satisfactory long-term results.

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