

Percutaneous fasciotomy for the treatment of Dupuytren's disease—a systematic review

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Abstract

Background Dupuytren's disease is described as a thickening of the palmar fascia. It typically affects men of Northern European descent in their fifties. The disease process starts as a nodule at the distal palmar crease that progressively gives rise to a cord invading distally toward the finger. Historically, different treatments have been described. Our purpose was to perform a meta-analysis of the evidence published on the percutaneous fasciotomy (PCF) treatment.

Methods We searched Medline, PubMed, and the Cochrane Library for articles evaluating the use of PCF for Dupuytren's disease. No study was excluded based on quality.

Results The search yielded nine studies. Because of their different methodologies, a meta-analysis could not be performed. However, we were able to extract common qualitative conclusions. PCF is an effective treatment modality for patients in whom general anesthesia is contraindicated, with a good outcome especially at the metacarpophalangeal joint, a low recurrence rate in the short term, and few complications.

Conclusions Similar conclusions were reached by all the articles under study. Nevertheless, there remains the need for a prospective study with a higher statistical power and

standardized clinical evaluation and surgical methods in order to achieve more objective quantitative results. It would also be pertinent to compare the outcomes and complication rates of PCF with the new collagenase treatment.

Keywords Dupuytren's disease · Percutaneous release · Palmar fasciotomy · Percutaneous fasciotomy

Background

Historical

Dupuytren's disease tends to progress locally and recur after surgical treatment. The first reference to Dupuytren's disease dates back to 1614 by Felix Plater [11]. In 1823, Sir Astley Cooper described fasciotomy as the technique to release the flexion contracture encountered in Dupuytren's disease [10].

Epidemiology

The prevalence of Dupuytren's disease varies from 2% to 42%, typically affecting men of Northern European descent in their fifties [11].

Etiology

Once thought to be autosomal dominant and expressed with variable penetrance, the disease is now believed to have a multifactorial etiology with a role for both genetic and environmental factors [14]. It has been associated with smoking [11] and chronic alcoholism, with several medical conditions, notably diabetes mellitus and epilepsy, as well

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as acute injuries such as fractures, penetrating wounds, and lacerations of the hand [14].

In an attempt to better understand the pathophysiology behind Dupuytren's contractures, research has recently revealed an upregulation of fibrogenic cytokines such as epidermal growth factor, platelet-derived growth factor, and transforming growth factor- α in Dupuytren tissue. These cytokines lead to fibroblast growth and differentiation into myofibroblasts, which in turn deposit extracellular matrix [2].

Clinical Presentation

Dupuytren's disease most commonly involves the ring finger, the small finger, and the thumb in this order and tends to occur bilaterally with one hand more severely affected than the other [11]. It usually starts as a nodule around the distal palmar crease [12, 14]. The nodule is firm and fixed to the skin [14]. As the disease progresses, the nodule gives rise to a cord that matures and extends distally toward the finger. Some patients also suffer from Ledderhose's disease (plantar fibromatosis), Peyronie's disease (penile fibromatosis), and Garrod's nodes (knuckle pads) [11].

Management

The first treatment for Dupuytren's disease, percutaneous fasciotomy (PCF), was introduced in 1777 by Henry Cline. It consisted of making incisions to release the pathological cords with the blade of a bistoury knife [13]. However, the high rate of recurrence associated with this technique [8] led to the introduction of radical fasciectomy [8, 13], and later to more limited fasciectomy [8]. In 1952, Baxter et al. introduced injection of steroids into nodules. This has allowed softening of the nodules, but it failed to induce regression of the contractures [13].

Nowadays, there are still no clear indications for surgery [14]. However, a flexion contracture of 30° or more at the metacarpophalangeal (MCP) joint and any contracture at the proximal interphalangeal (PIP) joint result in significant impairment of the hand. At this stage, surgical correction becomes an option [11]. Once surgery is elected, there are five different ways to proceed: fasciotomy (percutaneously or through an open approach), local fasciectomy, regional fasciectomy, radical fasciectomy [11], or dermatofasciectomy. Complications of surgery include inadvertent division of a digital artery or nerve, hematoma, skin necrosis, infection, and recurrence most commonly at the PIP joint. Complex regional pain syndrome is another complication of surgery, occurring more often in women (7% vs. 3% after surgery) and after an extensive procedure [14].

Because the surgical treatment neither cures contractures nor prevents disease extension and because of the complications associated with it, recent research has focused on exploring nonsurgical therapies. Several have been found inadequate for management of Dupuytren's contractures. However, the injection of mixed collagenase subtypes into the pathological cords to lyse them and subsequently facilitate their rupture has shown promising outcomes [2]. This treatment modality has become FDA-approved for adult patients with Dupuytren's disease and a palpable pathological cord [6].

Objectives

The aim of this article is to provide a systematic review on PCF, as a surgical option for the treatment of Dupuytren's disease, its advantages, and disadvantages. We performed a thorough search of the literature to select studies and evaluate whether they reached common conclusions regarding the following:

- Improvement in joint contracture after PCF
- Rate and type of postoperative complications after PCF
- Rate and time to recurrence of disease after PCF
- Comparison of the results obtained at the MCP joint and those obtained at the PIP joint
- The impact of the preoperative degree of contracture on the outcome of PCF
- Patient satisfaction

Methods

Data Sources

We searched Medline, PubMed, and the Cochrane Library for original articles and reviews published in English, from 1983 to 2009. We identified additional articles by checking the references.

Study Selection

The selection process was done in three steps: titles, then abstracts, and finally full article texts. We selected prospective, retrospective, and randomized controlled trials evaluating the use of PCF for Dupuytren's disease that, in majority, indicated what joints were involved, the postoperative improvement at each joint, the postoperative complications, the rates of recurrence, and the time to recurrence. We excluded studies that compared PCF to other surgical techniques in the treatment of Dupuytren's disease. No study was excluded based on quality since this would have reduced the number of

studies significantly, and a meta-analysis or systematic review would not have been possible.

Data Extraction and Quality Assessment

When a study was selected, we used a data extraction form to collect the following information:

- Study design
- Number of patients enrolled
- Number and type of joint affected by Dupuytren's disease
- Details of the surgical technique
- Use and duration of splinting
- Type and rate of post-op complications
- Measure of improvement of the joint contracture
- Rate of disease recurrence and time to recurrence postoperatively
- Patient satisfaction

Results

Results of the Search

We selected nine studies, all cohort studies, and no randomized controlled trials. All had adequate follow-up (see Tables 1 and 2).

Included Studies

Colville (1983) treated 95 preselected patients with PCF. Contracture release was evaluated postoperatively by measuring the degree of extension deficit from the metacarpal plane. There was a 57° improvement in extension deficit immediately postoperatively that continued to improve 3 months after surgery by an average of 14°. This further gain of extension was attributed to wearing a splint at night for 3 months. At the 3-year follow-up, there was a loss of extension of 30° compared to immediately postoperatively. Complications were limited to tingling in the fingers, resolving after a number of weeks. It was concluded that PCF allows recovery of useful extension, and that even if the results are not permanent, the patients can be treated with the same technique years later [4].

Rowley (1984) performed PCF on 107 fingers that were divided into two groups: fingers with dominant MCP joint contracture and fingers with dominant PIP joint contracture. In both groups, PCF was deemed unsatisfactory for PIP joint contracture, and there was a rapid deterioration to the preoperative level. However, early surgery in PIP dominant disease favored some improvement most likely because secondary joint contracture of the capsule and collateral ligaments had not yet formed. On the other hand, PCF leads to satisfying improvement at the MCP joint in both groups, and in its own group, the improvement is marked and sustained. This difference in results between MCP and PIP

Table 1 Demographics of the studies

Authors	Title	Population				
		Male	Female	M:F	Mean age	Bands involved
Colville (1983)	Dupuytren's contracture—the role of fasciotomy	95		NS	50–79	NS
Rowley et al.(1984)	Assessment of percutaneous fasciotomy in the management of Dupuytren's contracture	NS	NS	7.2:1	62	MCP ₃ >PIP ₄ : 53.6% of fingers PIP>MCP: 41.7% of fingers
Bryan and Ghorbal (1987)	The long-term results of closed palmar fasciotomy in the management of Dupuytren's contracture	21	22	NS	NS	NS
Duthie and Chesney (1997)	Percutaneous fasciotomy for Dupuytren's contracture—a 10-year review	141	19	NS	NS	NS
Foucher et al. (2001)	Percutaneous needle fasciotomy in Dupuytren disease	139	32	NS	NS	154 palmar bands, 82 palmar and finger bands, 5 finger bands
Foucher et al. (2003)	Percutaneous needle aponeurotomy: complications and results	173	38	NS	65	NS
Van Rijssen and Werker (2006)	Percutaneous needle fasciotomy in Dupuytren's disease	44	8	NS	65	NS
Cheng et al. (2008)	Needle aponeurotomy for Dupuytren's contracture	7	1	NS	67	NS
Lee and Hunter-Smith (2009)	Needle fasciotomy for Dupuytren's disease: an Australian perspective	37		NS	NS	NS

M:F male to female ratio, NS not specified, MCP metacarpophalangeal joint, PIP proximal interphalangeal joint

Table 2 Outcomes of the studies

Study	Intervention	Outcome			Recurrence
		Definition	MCP	PIP	
Colville (1983)	Release proximal to distal palmar crease, proximal to web crease, proximal to PIP joint crease with Swann Morton No. 11 blade	Degrees of extension deficit from metacarpal plane	Preop: 102° At 0 month: 45° At 3 months: 31° At 6 months: 50° At 1 year: 56° At 3 years: 75°		NS
Rowley (1984)	PCF proximal to distal palmar crease	Maximum active extension	At 3 and 14 months: ↑ ^a	At 3 and 14 months: = ^b	PIP joint contracture returns rapidly to preop level
Bryan (1987)	Small incision to one side of Dupuytren's band in palm and tenotomy knife used to divide band	Deformity	9 fingers: ↑ 8 fingers: = 27 fingers: ↓ ^c At 5.3 years	7 fingers: ↑ 7 fingers: ↓ 5 fingers: = At 5.3 years	7 patients had subsequent fasciectomy
Duthie (1997)	Median and ulnar nerve block with tourniquet	Overall fixed flexion contracture (MCP+PIP)	At 0 month: 22° At 10 years: 57°		66% of patients needed further surgery
Foucher and Matizos (2001)	19-gauge needle, PCF at multiple levels starting in finger	Extension gain	79% ↑	54% ↑	Rate of disease activity ^d 54%
Foucher and Navarro (2003)	Local anesthesia, forearm tourniquet. PCNF started in the finger to more proximal with a 19-gauge needle	Extension gain	79% ↑	65% ↑	Global activity rate ^e 69%
Van Rijssen (2006)	25-gauge needle, cords sectioned in palm and fingers	TPED ^f	At 1 week: 88% ↓	At 1 week: 46% ↓	Total recurrence rate 65%
Cheng (2008)	23-gauge needle, release sites on palm and proximal phalanx	Mean flexion contracture	At 0 month: 100% ↓ At 22 months: 70% ↓	At 0 months: 76% ↓ At 22 months: 41% ↓	NS
Lee (2009)	19-gauge needle, release starts in palm towards the fingers	Patient-filled out questionnaire	65% patients reported improvement		Recurrence between 6 and 12 months in 3 patients

MCP metacarpophalangeal joint, PIP proximal interphalangeal joint, NS not specified, PCF percutaneous fasciectomy

^a“↑” Increase in outcome

^b“=” Unchanged outcome

^c“↓” Decrease in outcome

^d Rate of disease activity defined as the number of patients in whom a loss of extension was observed after a mean follow-up of 2.5 years [1]

^e Global activity rate defined as the number of patients who had a recurrence or extension of disease after a mean follow-up of 3.2 years [13]

^f TPED: total passive extension deficit, defined as the addition of the flexion contractures at the MCP, PIP, and DIP (distal interphalangeal joint) of affected digits

joints was attributed to the fasciotomy being restricted to proximal to the distal palmar crease in order to decrease the risk of neurovascular injuries. Therefore, it was concluded that PCF should be performed for fingers with MCP dominant disease, especially if PIP joint contracture was recent and mild. Postoperative complications were limited to skin tears [10].

Bryan (1987) performed PCF on 43 patients. Successful surgery was defined as resolution of deformity at the MCP joint or 50% decrease in the contracture. If patients showed increase in finger contracture or developed additional distal finger deformities, they were not considered successes. The study showed that 57% of patients with Dupuytren's disease involving mainly the MCP joint maintained correction of the contracture at 5 years. The authors concluded that PCF was best suited to patients with mainly MCP joint involvement. For PIP joint disease, it was a useful preliminary procedure without any long-term benefit. The procedure was also thought to be a good option for patients with limited life expectancy and those whose health precluded general anesthesia [1].

Duthie (1997) treated 160 unselected patients with PCF. At 10 years, 34% patients did not need further surgery. The remaining 66% underwent radical fasciectomy on average 60.4 months later. Complications were limited to skin tears in 4% of the patients. This study concluded that the original contracture does not point out those patients who will eventually need local fasciectomy. Moreover, since Duthie was the first to follow patients for 10 years, it was concluded that PCF in patients with less aggressive disease allows long-term benefit. Finally, those patients who needed subsequent local fasciectomy still enjoyed improvement for a considerable amount of time [5].

Foucher (1998) performed PCF on 241 selected fingers. A splint to maintain the operated finger in extension was worn at night for 1 month. The total gain (MCP+PIP+DIP) of the preoperative lack of extension was of 72.1%, with a higher gain at the MCP joint (79.6%) than at the PIP joint (53.7%). The authors did not specify whether this gain was immediately postoperatively or at the 1-month follow-up, therefore implying a role for splinting. The authors report a rate of re-intervention of 11% and at 2.5 years follow-up, a rate of disease activity of 54%. It remains unclear whether the rate of disease activity includes those patients needing further surgery. The complications reported were one neuroma discovered at second operation, one bleeding in an anticoagulated patient, nine skin ruptures, one suspicion of complex regional pain syndrome, and 29 nodes sensitive to pain 1 month postoperatively. The complication rate was found to be similar to blade fasciotomy. It was concluded that PCF was best performed in patients with isolated and moderate flexion at the MCP joint who compensate by hyper-extending the PIP joint. The authors also concluded

that the rate of disease activity after PCF was higher than with fasciectomy in a population with milder disease [7].

Foucher (2001) later conducted a second study of 211 patients including some of the patients of the first study. Again, an orthosis keeping the finger in extension was to be worn at night postoperatively. The mean total extension gain, immediately postoperatively, was 76%. There was a statistically significant ($p>0.05$) difference between the mean gain at the MCP joint (79%) and at the PIP joint (65%). The reoperation rate was 24%. At 3.2 years follow-up, the recurrence rate was 58%, and the rate of disease activity, including disease recurrence and extension, was 69%. The complications were very similar to those recorded in the first study. The authors concluded that PCF was best indicated for patients with an easily accessible cord, elderly patients, and patients with mainly MCP joint contracture. It should also be considered in patients who use a palmar support to ambulate, or who have associated co-morbidities, such as arthrosis, who are anticoagulated or who have a short life expectancy. They report that PCF is a quick and simple method with few complications especially when the surgeon has good anatomical knowledge. It offers a short leave from work, limited wound care, and low cost [8].

Van Rijssen (2006) operated on 52 patients. The rays were classified according to Tubiana's staging system based on their total passive extension deficit (TPED; sum of extension deficit at MCP, PIP, and DIP joints). At 1 week follow-up, mean TPED was reduced by 77%, with 88% at the MCP joint, 46% at the PIP joint, and 75% at the single DIP joint. There was no statistical difference between the results of different stages. At 9 months follow-up, there was no statistically significant deterioration of the TPED. At 33 months follow-up, 42% rays had further surgery for recurrence. For the remaining 58% rays, the TPED had increased by 44%, which was statistically significant. Recurrence was defined as a 30% increase in TPED, and a total recurrence rate of 65% was reported. There was no statistically significant difference in recurrence between the different Tubiana stages. Complications included two patients with a slightly decreased sensibility on one side of the finger and two patients with a 1-cm reduction of flexion. Van Rijssen concluded that PCF is a good surgical option for elderly patients for whom a minimally invasive procedure is more important than lasting results. In other patients, it may be used to delay fasciectomy [13].

Cheng (2008) performed PCF on eight Chinese patients. A splint maintained the finger in extension for 8–12 weeks. Immediately postoperatively, there was a 100% improvement of the mean flexion contracture at the MCP joint, whereas at the PIP joint, the improvement was 76%. After 22 months, the retained improvement was 70% at the MCP joint and 41% at the PIP joint. No patient had undergone

further surgery at the 22-month follow-up [3]. This could be due to the fact that patients of Asian ethnicity seem to present milder forms of Dupuytren's disease that seldom require surgical intervention [11]. The author reports 27% skin tears that healed within 2 weeks without infection. He concluded that with PCF, long-term results are better maintained at the MCP joint than at the PIP joint [3].

Lee (2009) treated 37 Australian patients with PCF. Postoperatively, a splint was fitted and was worn for an unknown period of time. Improvement was assessed by a questionnaire filled out by the patients. Twenty-six patients responded, 65% of which reported significant improvement of their hand, with minimal time to return to work and rapid return of normal hand function. Recurrence was noted in three patients at 6 to 12 months postoperatively. However, none required further surgery. One flexor tendon injury was reported. Lee concludes that PCF is a useful technique that hand surgeons should include in their expertise. It should be offered to patients with Dupuytren's contractures, and its potential complications and risk of early recurrence should be explained [9].

Discussion

When reviewing the above studies in view of performing a meta-analysis, we noted that they are very different in their methodologies. First, the selection criteria of patients and their age range vary significantly from one study to the other: while some studies select a group of patients as those who would benefit most from PCF, others perform it on an unselected group of patients. Importantly, while some studies included patients with a previous operation for a contracture, others did not. The surgical technique also varies from one author to the other. Not only do the studies use different surgical instruments to release the contractures (knife blades or needles of various sizes) but they also release them at different sites in the hand. Some authors dissect the diseased cords at both palmar and digital levels; others restrict the fasciotomy to the palm to avoid neurovascular injury. Foucher stated that blade fasciotomy and 19-gauge needle achieved the same results [7], but we lack a comparison of all the different instruments used. Furthermore, the report of the outcome varies from one study to the other: while some evaluate the fixed flexion contracture, others measure the passive or active extension deficit, and yet others calculate the total passive extension deficit, which makes comparison of outcomes between the studies challenging. Finally, while some authors have their patients wear a splint postoperatively, others do not, and whether splinting helps maintain postoperative improvement is unclear. For the above reasons, we were unable to perform a meta-analysis in order to produce a higher level of evidence.

Despite all of these differences in methodology, the conclusions arrived to by the different articles are essentially the same. PCF is a simple and quick procedure with very few complications when performed by an experienced surgeon with good anatomical knowledge. It represents a good treatment option for patients whose health precludes general anesthesia, and elderly patients or patients with a limited life expectancy for other reasons. The technique allows better and longer-lasting results at the MCP joint than at the PIP joint, and this seems to be independent of whether the dissections are performed in the palm and digits versus the palm only. Duthie conducted the study with the longest follow-up time (10 years), and the average time to further surgery in patients who had a second operation was 60.4 months [5]. He therefore demonstrated that even in patients who had recurrence and needed further surgery, they enjoyed good hand function for a considerable amount of time. The procedure may also have a role in delaying local fasciectomy.

The complication rate reported by the studies is low. The main complication is skin tear, reported in 27% of patients by Cheng [3]. Foucher reported digital nerve paresthesia in 4.6% of patients [7], and Van Rijssen reported hypoesthesia in 5.5% of patients [13]. Foucher diagnosed one patient with complex regional pain syndrome [7], and Lee reported one patient with partial flexor tendon injury (discovered after a palmar fasciectomy for a recurrence) [9]. Although skin tear is reported as a complication, it could be considered part of the treatment for Dupuytren's disease. Indeed, the band contracture also leads to contracture of the skin overlying it. Thus, skin tears, when left open, prevent skin contractures from forming, which in turn help maintain and optimize the global finger contracture release. If they need to be closed, they should be closed in a longitudinal fashion instead of a transverse fashion. When performing fasciotomy with a needle, the size of that needle (19 vs. 23 vs. 25) does not seem to affect the rate or types of complications.

In terms of its recurrence rate—the most commonly used argument against PCF—most studies analyzed are good at reporting it. However, they seldom define recurrence or the threshold at which it is decided to re-operate a patient. In fact, it is the very essence of the percutaneous technique that makes recurrence a challenge to define because of postoperative persistence of disease tissue [8]. Van Rijssen, for instance, defined recurrence as an increase in TPED (total passive extension deficit), during follow-up, of 30° or more compared to the immediate postoperative TPED. This was chosen because the center where the author practices recommends surgery to patients with TPED of 30° or more [13]. This seems like a reasonable way to define recurrence. However, different doctors recommend surgery at different stages of disease. Moreover, the patient always has a say in

the decision of undertaking surgery: a significant disability of the hand could prompt surgical treatment even if the contracture does not reach the cutoff angle for operation. Furthermore, most of the studies when calculating the reoperation rate do not specify whether further surgery was performed for recurrence of the previously operated on band or for disease extension. The recurrence rate might even be lower than reported in these studies if we consider that patients who return for follow-up tend to be the ones doing worse. When dealing with recurrence, Duthie and Bryan re-operate using palmar fasciectomy. However, it seems there is no contraindication to repeating fasciotomy after disease recurrence as per Colville, Foucher, Cheng, as well as Lee [3, 4, 7, 9].

Conclusion

PCF is an old technique, first introduced in 1777. In the twentieth century, palmar fasciectomy became the gold standard when treating patients with Dupuytren's disease. It presents, however, some drawbacks such as a longer healing period and delayed return to daily activity.

Through this systematic review, we evaluated nine studies to determine whether PCF was an adequate treatment modality for Dupuytren's disease, with minimal complications and an acceptable recurrence rate. We propose that PCF be offered not only to elderly patients but also to all patients who are willing to accept a risk of recurrence of their disease in the long-term. Indeed, the technique is very attractive when considering its good outcome and the rapid return to usual hand function. Moreover, the surgical technique has been associated with a low rate of complications.

Although the use of an extension splint has not consistently led to a postoperative improvement, it seems reasonable to explain to patients that wearing an extension splint at night for 1 month and doing regular extensor exercises could help maintain their postoperative improvement.

The studies evaluated did not precisely make a distinction between the MCP and the PIP joints in terms of contracture release, recurrence, and complications. Also, they were not

standardized in terms of contracture evaluation, technique used for release, and postoperative evaluation. Therefore, in the future, a prospective study with a bigger number of patients and standardized evaluation and treatment could give more objective information. Moreover, PCF should also be evaluated as a means to treat recurrent Dupuytren's bands. Finally, it would be interesting to compare PCF with the new FDA-approved collagenase treatment especially in terms of symptom relief, recurrence, and cost-effectiveness.

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