



Dupuytren's contracture: an analysis of outcomes of percutaneous needle fasciotomy versus open fasciectomy

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Abstract

Background: Percutaneous needle fasciotomy (PNF) is a minimally invasive technique used to manage Dupuytren's contracture. We compared outcomes of PNF versus open fasciectomy (OF) to examine the suitability of PNF in Australia.

Method: A retrospective cohort study using two questionnaires regarding Dupuytren's treatment was used to assess patients with uncomplicated primary disease. The primary outcomes were immediate and medium-term correction of contracture (2-year mean follow-up to time of survey). Secondary outcomes were patient satisfaction and complications including tendon/nerve injury, infection, skin necrosis and vascular damage.

Results: One hundred fifty-five out of 191 surveys were returned (81%). The final analysis included 125 cases (65%), 73 PNF and 52 OF. No significant differences were observed between both groups with regards to follow-up time, gender, smoking status, co-morbidities or preoperative deformity grade. No significant differences were observed in terms of immediate or medium-term deformity correction, tendon/nerve injury or circulatory complications. The postoperative infection rate was higher with OF, with these patients 7.57 (95% confidence interval 1.56, 36.77; $P = 0.01$) times as likely to have a postoperative infection as patients undergoing PNF. A higher number of patients who underwent PNF were told that they would require another operation (30% versus 12%; $P = 0.02$). Satisfaction scores were similar (OF 33.2 versus PNF 32.6; $P = 0.82$).

Conclusion: The OF and PNF procedures provide comparable deformity correction for uncomplicated primary Dupuytren's disease in the immediate perioperative period. The reduced side effect profile of PNF should prompt surgeons to consider incorporating it in their practice for the first-line management of uncomplicated primary Dupuytren's disease.

Introduction

Dupuytren's disease remains an important cause of significant morbidity and impaired hand function as a result of palmar fascia shortening and progressive digital flexion deformities. Hand surgeons recognize that it is a disease that can be controlled but not cured. Dupuytren's was first described by Felix Plater¹ but a misinterpretation of his original Latin text resulted in Henry Cline being recognized as the first to characterize the disease.² Dupuytren's disease is an autosomal dominant disorder with variable penetrance.³ The prevalence is highest among Northern European populations with values of up to 30% in Norwegians aged over 60 years.³ John

Hueston, the Australian hand surgeon, wrote that 'Dupuytren's contracture is virtually confined to people of European descent' and observed that the incidence in countries such as Australia, Canada, Wales and England are similar as they all essentially represent diluted strains of Danish or 'Viking' stock.⁴

Surgical intervention and fasciectomy remain the mainstays of treatment and while effective, they are associated with higher rates of major complications such as nerve injury, infection and complex regional pain syndrome when compared with the percutaneous needle fasciotomy (PNF).⁵ Conversely, PNF has been associated with higher rates of skin complications, including late skin contractures and tears.⁵ Recurrence rates following open

fasciectomy (OF) vary; however, recent data suggest average recurrence rates of 39% at a median follow-up time of 4 years.⁵

In contrast PNF, first described by Debeyre,⁶ is a relatively simple procedure in which the bevel of a needle (19–25-gauge) is used to divide digital and palmar cords. Formal physical rehabilitation is rarely required and recovery times are short.^{6,7} However, recurrence rates are higher with the PNF (62% at a median follow-up time of 4 years).⁵ Countries with high uptakes of the PNF include France and Italy, with rates of use of 21% and 20% respectively.⁸ Recently published data suggest that the PNF is a cost-effective treatment. The cost of PNF was \$96 474 per quality adjusted life year gained versus no treatment compared with open partial fasciectomy, which cost \$820 114 per quality adjusted life year gained versus no treatment.⁹ The use of PNF has been viewed with caution by many surgeons, both within Australia and more generally. This is in part due to concerns about the potential for nerve injury through the use of this ‘blind’ technique and reports of high recurrence rates.^{7,10}

There is limited published data comparing medium-term outcomes of the OF and PNF. As a result, the effectiveness of PNF relative to other approaches remains unresolved.⁵ This study aims to compare PNF and OF by measuring clinically relevant outcomes.

Methods

Study design

A retrospective cohort study design was utilized. Suitable candidates were recruited from a database of all consecutive patients who underwent either the PNF or OF between January 2003 and June 2011. Eligible patients were mailed questionnaires in July 2011 and a second mail-out was conducted in August 2011. The Institutional Human Research Ethics Committee approved the study. The questionnaires used were the British Society for Surgery of the Hand survey and the Patient Evaluation Measure (PEM).¹¹ Patients who underwent either the PNF or OF were eligible if this operation was the first treatment for the given contracture (i.e. patients were receiving treatment for uncomplicated primary Dupuytren’s disease). Patients with recurrent or severe disease (i.e. those who required skin grafting or amputation) were excluded.

Patients were analysed based on the treatment received (i.e. PNF or OF). One surgeon in the department performed PNF routinely for all patients presenting with primary uncomplicated disease. Patients presenting to any other department surgeon were offered the OF as first-line treatment. In total, eight patients (6.4%) were required to recall details of their condition from greater than 5 years ago (i.e. they had their surgery in 2006 or earlier).

A total of 188 patients, representing 191 contractures, were deemed eligible and sent surveys (three patients returned two surveys answering questions for separate surgeries on separate contracted digits).

Our PNF technique involved the use of a 19-gauge hypodermic needle to divide cords at various levels. Starting distally and working proximally, pathological cords were divided while keeping the finger in passive extension, allowing progressive straightening of the finger with each cord division. A light dressing and splint were applied postoperatively.¹⁰

Primary outcomes

The primary outcomes were immediate and medium-term (mean follow-up time of 2 years to time of survey) postoperative change in flexion deformity. Immediate postoperative change was assessed by asking patients to grade the level of deformity correction immediately after treatment as ‘none at all’, ‘partly corrected’, ‘almost corrected’ or ‘fully corrected’. Medium-term postoperative change was measured with the use of two diagrams, as designated by the British Society for Surgery of the Hand¹² (Supporting Information Fig. S1A). Patients were asked to choose from a set of diagrams which assessed preoperative and current deformity grades. Levels of severity ranged from one to five with one being designated the least severe grade of deformity and five the most severe. (Supporting Information Fig. S1B). Medium-term change was then calculated by subtracting the current deformity grade from the preoperative deformity grade. A positive medium-term change was defined as a decrease of two or more grades from baseline to follow-up.

Secondary outcomes

Secondary outcomes were complication rates and patient satisfaction. Complications assessed using the British Society for Surgery of the Hand questionnaire included postoperative nerve injury (essentially neurapraxia as our series had no complete nerve injuries), infection, circulatory disturbances and the requirement for another operation (which was assessed by asking patients if they had been told that they would require another operation on the same finger). Patient satisfaction, assessed with the use of the PEM,^{11,13} included; (i) quality of treatment provided, (ii) satisfaction of outcome, and (iii) overall satisfaction. Each category was assessed using a series of questions utilizing a visual analogue scale. The PEM score for each patient was calculated using the sum of the values from sections two and three, expressed as a percentage of the maximum possible score, with a lower score representing a better outcome and a higher score a worse one. The first category, which investigated the quality of treatment provided by clinicians, was excluded from the final PEM score to ensure a clear representation of patient opinions regarding outcomes rather than personal opinions about doctors, as outlined by Dias *et al.*¹³

Statistical analysis

Statistical analysis was carried out using IBM SPSS Statistics Version 20. Categorical variables were compared with Fisher’s exact test and continuous variables with the unpaired *t*-test. *P*-values of less than 0.05 (5%) were chosen as the level of significance. Standard univariate binary logistic regression was performed to investigate the effect size of various predictors on the primary outcome of medium-term change in deformity grade and secondary outcomes of complications and wound infection.

Results

Survey response

One hundred fifty-five of the 191 surveys (81%) were returned. Of these 155 returned surveys, 125 (65%) were included in the final analysis, with 73 cases having been treated with PNF and 52 with

OF. Of the remaining 30 cases not included in the final analysis, 27 refused to participate and three failed to adequately complete the survey. Reasons for participation refusal were not given.

Baseline characteristics

The mean follow-up times of both groups were the same (2 years) (Table 1). Similar follow-up time ranges were also observed in the OF and PNF groups (2–92 months and 1–87 months, respectively). The mean age of patients in the OF group was greater than that of the PNF group (68 and 64 years respectively, $P = 0.01$). There was a significantly higher number of patients with a ‘mainly desktop’ occupation type that underwent PNF as compared with OF (39 and 17% respectively, $P = 0.02$) as well as a significantly higher number of patients without ischaemic heart disease or diabetes in the PNF group as compared with the OF group (82 and 64% respectively, $P = 0.03$).

A significantly higher number of patients in the PNF group were allowed to continue their prescribed anticoagulation therapy (53% PNF versus 12% OF; $P = 0.01$).

Preoperative deformity grade results showed no significant differences between the two groups for all grades (Supporting Information Fig. S2). Grade 5 and 4 were the most common preoperative gradings (58% of total).

Primary outcome: correction of deformity (immediate perioperative period)

No significant differences were observed between the two groups in terms of the immediate level of deformity correction (Table 2).

Primary outcome: correction of deformity (mean follow-up time of 2 years)

Patients who had an OF were 1.22 times (95% confidence interval (CI) 0.59, 2.55; $P = 0.59$) as likely as patients having a PNF to have a positive medium-term change in deformity on univariate analysis (Table 3). Of note, smoking had little effect on outcomes.

Secondary outcome: complications

No differences were observed between the two groups in terms of postoperative neurapraxia or vascular compromise (Supporting Information Tables S1, S2). A significantly higher number of patients who underwent the PNF were told that they would require another operation (30% PNF versus 12% OF; $P = 0.02$). No patient in either group had a documented nerve injury or vascular injury that required intervention; however, many reported ‘numbness’ that lasted more than 2 days in both groups. This is a finding often noted by patients in the immediate postoperative period and is consistent with normal clinical practice.

Table 1 Baseline characteristics of the patients included in this study

	Open fasciectomy	Percutaneous needle fasciotomy	Total	<i>P</i> -value
Characteristic	No. (%)	No. (%)	No. (%)	
Gender				
Male	40 (77%)	60 (82%)	100 (80%)	0.50
Female	12 (23%)	13 (18%)	25 (20%)	—
Mean age at surgery, years (±SD)	68 (±8.9)	64 (±9.8)	—	0.01
Mean follow-up time, years (±SD)	2 (±1.9)	2 (±1.6)	—	0.50
Smoking status				
Smoker	9 (17%)	5 (7%)	14 (11%)	0.09
Non-smoker	43 (83%)	67 (93%)	110 (89%)	—
Occupation type				
Mainly manual	19 (45%)	21 (30%)	40 (36%)	0.11
Mainly desktop	7 (17%)	27 (39%)	34 (30%)	0.02
Neither manual nor desktop	16 (38%)	22 (31%)	38 (34%)	0.54
Co-morbidities				
Diabetes	11 (22%)	7 (10%)	18 (15%)	0.07
Ischaemic heart disease (IHD)	11 (22%)	7 (10%)	18 (15%)	0.07
Neither IHD nor diabetes	32 (64%)	59 (82%)	91 (75%)	0.03
Anticoagulation therapy				
Patients taking anticoagulants	27 (54%)	22 (31%)	49 (41%)	0.02
Patients able to continue anticoagulants	3 (12%)†	9 (53%)†	12 (29%)†	0.01

†Percentages taken as a fraction of patients already taking anticoagulants (i.e. $n = 27$ for open fasciectomy and $n = 22$ for percutaneous needle fasciotomy).

Table 2 Primary outcome: immediate correction of deformity

	Open fasciectomy	Percutaneous needle fasciotomy	Total	<i>P</i> -value
Level of correction	No. (%)	No. (%)	No. (%)	
Poorly corrected†	10 (20%)	8 (11%)	18 (15%)	0.21
Almost fully corrected	24 (47%)	38 (53%)	62 (50%)	0.59
Fully corrected	17 (33%)	26 (36%)	43 (35%)	0.85

†Includes patients who indicated correction of either ‘none at all’ or ‘partly corrected’.

Table 3 Primary outcome: medium-term change in deformity grade

	Univariate odds ratio	P-value
Technique		
Percutaneous needle fasciotomy	1.00	—
Open fasciectomy	1.22 (0.59, 2.55)	0.59
Smoking		
Smoker	1.00	—
Non-smoker	1.19 (0.36, 3.92)	0.78
Ischaemic heart disease		
Yes	1.00	—
No	1.23 (0.45, 3.36)	0.69
Diabetes		
Yes	1.39 (0.50, 3.88)	0.53
No	1.00	—
Occupation		
Neither	1.00	—
Mainly desktop	1.78 (0.69, 4.60)	0.23
Mainly manual	2.52 (0.97, 6.53)	0.06
Anticoagulants		
Yes	1.62 (0.76, 3.45)	0.21
No	1.00	—

Table 4 Secondary outcome: infections

	Univariate odds ratio†	P-value
Technique		
Percutaneous needle fasciotomy	1.00	—
Open fasciectomy	7.57 (1.56, 36.77)	0.01
Smoking		
Smoker	1.00 (0.12-8.65)	1.00
Non-smoker	1.00	—
Ischaemic heart disease		
Yes	7.31 (1.86, 28.71)	<0.01
No	1.00	—
Diabetes		
Yes	4.48 (1.12, 17.87)	0.03
No	1.00	—
Occupation		
Neither	1.00	—
Mainly desktop	1.70 (0.27, 10.87)	0.58
Mainly manual	2.43 (0.44, 13.38)	0.31
Anticoagulants		
Yes	2.93 (0.81, 10.64)	0.10
No	1.00	—

†Because of the extreme value/relationship of an adjusted odds ratio of 17.05 (1.67, 174.42) and very wide confidence intervals, the multivariate analysis results are not presented.

From a univariate perspective, patients undergoing OF were 7.57 (95% CI 1.56, 36.77; $P = 0.01$) times as likely to have a postoperative infection as patients undergoing PNF (Table 4).

Secondary outcome: patient satisfaction

No difference was observed between the groups in terms of patient satisfaction. Mean PEM scores for the OF and PNF were 33.2 and 32.6 ($P = 0.82$) respectively, with lower scores representing greater levels of satisfaction.

Discussion

When comparing PNF and OF, for patients presenting with primary uncomplicated Dupuytren's contracture, this study suggests that

PNF is a viable alternative because of its similar efficacy profile, ease of administration and reduced risk of infection when compared with OF. Firstly, there were no significant differences between these two techniques at a mean follow-up time of 2 years in terms of change in hand deformity. Immediate postoperative deformity correction levels were also found to be similar between both groups. Secondly, the ease of administration of the PNF is well established given it can be performed in a short amount of time within the outpatient setting.¹⁰ And thirdly, from a univariate perspective, patients undergoing OF were 7.57 (95% CI 1.56, 36.77; $P = 0.01$) times as likely to have a postoperative infection as patients undergoing a PNF procedure, which is consistent with the findings of a recently published systematic review of treatments for Dupuytren's contracture by Chen *et al.*¹⁴

As expected, patients that underwent the OF procedure were less likely to be told that they would require another operation in the future (12%) as compared with those that underwent the PNF (30%; $P = 0.02$). These values do not distinguish between patients being told that they require another operation for recurrence or complication management. However, it is likely that the majority of PNF patients advised that they may require another operation were told this because of the higher recurrence rates typically observed with this procedure.

This study supports recent reports suggesting that PNF provides acceptable deformity correction without the increased risk profile of OF.¹⁵ PNF can be performed safely under local anaesthesia and in the presence of anticoagulation therapy and is therefore useful for patients with significant co-morbidities that may otherwise preclude them from more invasive and lengthy procedures.¹⁶ PNF yields similar patient satisfaction results when compared with the OF. It should be understood that many of the patients undergoing PNF will recur; however, its ease of application and acceptable risk-to-benefit profile make it a procedure to consider as an initial first-line therapy for Dupuytren's disease.

Limitations

The study design presented us with a number of limitations. The rates of complication observed in this study are higher for both procedures than some of the published rates within the literature.^{5,14,16} As a comparative study, the relatively high rates of numbness reported by patients are likely to reflect areas of numbness in the region of the surgical site, rather than any persistent loss of sensation and should be viewed with caution. We can confirm that no patient in either cohort suffered a nerve or vascular injury in this series. In addition, the authors' use of 1% Ropivacaine as the anaesthetic agent may have affected the reporting of this outcome given it can cause postoperative numbness lasting longer than 48 h.¹⁷ The rates of infection for the OF (18%) and PNF (3%) in this study were comparable with those of a previously published systematic review (which showed rates ranging from 0 to 12% for the OF and 0 to 2% for the PNF).¹⁴ OF complication rates were also consistent with previously published patient-reported rates.¹²

Self-report bias affects the way in which we self-report a variety of factors. However, factors influenced are typically those of a personal nature such as weight, physical activity or illicit drug use rather than the factors measured in this study.¹⁸ While this study is

based on self-report and thus susceptible to self-report bias, we believe it to be minimal given that such bias is likely to be non-differentiated.

The possibility of selection bias also exists as there may be a propensity to treat more complex disease with the open procedure rather than opting for the less invasive PNF. However, the two groups were well matched in terms of baseline severity.

While recurrence rates were not measured in this study, they have been previously discussed elsewhere.^{5,7,14} Recently published research by van Rijssen *et al.* found recurrence rates to be much higher at 5 years in patients undergoing PNF (84.90%) as compared with limited fasciectomy (identical to OF) (20.90%; $P < 0.001$).⁷ Although higher rates of recurrence are to be expected with the PNF and findings of lower rates of recurrence in older patients may be due to less aggressive disease in this age group.

Graded/bridging therapy

Rather than viewing the OF and PNF as two distinct treatments in direct competition with one another, we suggest viewing them as tools that should be used in conjunction to manage disease over time. Our view is that PNF plays an important role as a bridging therapy to more extensive procedures and as a first-line treatment in primary uncomplicated disease.

Conclusions

The results published in this study suggest that PNF is a viable and reasonable alternative in uncomplicated primary disease because of its similar efficacy profile, ease of administration and reduced risk of infection when compared with OF.

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Supporting information

Table S1 Complications

Table S2 One or more complications occurring

Figure S1 Panel A illustrates the diagram patients used to indicate preoperative and postoperative deformity levels. Panel B is the system used to reassign patient answers into grades (1–5) as outlined by Dias *et al.*

Figure S2 Panel A demonstrates a graphical representation of the distribution of preoperative grades among patients ($P > 0.05$ for all grades). Panel B shows the distribution of patients in terms of post-operative grades ($P > 0.05$ for all grades)