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Research Article

Comparative Surgical Management of Dupuytren´s Contracture: Percutaneous Needle Aponeurotomy vs Limited Open Fasciectomy

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Abstract

Introduction: The optimal treatment for Dupuytren's disease remains debated. While limited open fasciectomy (LOF) is considered the gold standard, it is associated with higher complication rates, greater postoperative pain, and longer recovery periods. This study compares clinical and functional outcomes, recurrence rates, complications, and discharge timing between percutaneous needle aponeurotomy (PNA) and LOF.

Materials and Methods: We conducted a retrospective review of 98 patients treated for Dupuytren's disease between 2016 and 2023. Patients underwent either PNA or LOF and were assessed using the Tubiana and Michon classification, URAM, and MHQ questionnaires. Variables included joint involvement, follow-up duration, complications, and recurrence. Statistical analysis was performed using STATA v.15, with significance set at $p < 0.05$.

Results: Patients in the PNA group showed greater improvement in Tubiana staging (mean 1.5 vs. 1.2 in LOF, $p = 0.037$), shorter follow-up to discharge (mean 4.85 vs. 23.13 weeks, $p < 0.001$), and fewer follow-up visits. Overall complication rates were 24% in LOF and 17% in PNA. Major complications were more frequent in the LOF group, including nerve injuries and one amputation. PNA patients had fewer skin injuries and no severe adverse events. Functional outcomes favored PNA in daily activity (MHQ: 90.5 vs. 78.4; $p = 0.046$) and pain scores (MHQ: 18.4 vs. 33.6; $p = 0.041$). Recurrence rates were comparable.

Conclusions: PNA demonstrated favorable clinical and functional outcomes with significantly lower morbidity and faster recovery compared to LOF. It offers a safe and effective minimally invasive alternative for selected patients with Dupuytren's disease.

Keywords: *Dupuytren's Disease Treatment, Percutaneous Aponeurotomy, Limited Fasciectomy*

Introduction

The definitive treatment for Dupuytren's disease remains debated, with common options including collagenase injection (limited in Europe), percutaneous needle aponeurotomy (PNA), and limited open fasciectomy (LOF). LOF is considered the gold standard for achieving a more definitive treatment outcome. However, this technique is associated with a higher rate of local complications, increased postoperative pain, and longer recovery times(1).

The aim of this study is to evaluate the clinical and functional outcomes of PNA, pain level as well as the time to discharge, complications, and recurrence rates, in comparison to patients undergoing LOF.

Materials and Methods

This is a retrospective study of 98 patients operated on at Hospital Universitario del Henares by upper limb surgeons between 2016 and 2023. Variables studied included age, sex, dominance, laterality, number of affected digits, involvement of the metacarpophalangeal joint (MCPJ), proximal interphalangeal joint (PIPJ), preoperative classification using the Tubiana and Michon scale(2), and the surgical technique performed.

Inclusion criteria included surgical indications: MCPJ contracture >30º or PIPJ >15º and a positive Hueston test(3), or symptomatic contracture limiting hygiene or function. At final follow-up, the Tubiana and Michon scale and Hueston test were repeated, and patients completed the Unité Rhumatologique des Affections de la Main (URAM)(4) and the Michigan Hand Questionnaire (MHQ)(5). Follow-up duration, complications, and recurrence were recorded. Recurrence was defined as an extension deficit >20º in a previously fully extended finger, based on prior studies(1,6).

Demographic data showed a mean age of 65 years, with 81 men (83%). Right hand involvement was present in 49%, and bilateral in 1%.

Surgical Technique: PNA(6–8)

The limb was aseptically prepared with chlorhexidine and sterile drapes up to the wrist. Under sterile conditions, a 10 cc syringe and 25G (0.5 x 16 mm) needle were used to infiltrate 1% mepivacaine subcutaneously over the cord (Figure 1A). Using another needle of the same gauge, a distal-to-proximal aponeurotomy was performed by inserting it onto the pretendinous cord (Figure 1B). After partial release, the affected digit was hyperextended to rupture any remaining cord fibers (Figure 1C). This step was repeated as needed across all involved sites until maximal extension was achieved (Figures 2 and 3).

In patients with PIPJ contracture, preoperative Doppler ultrasound was used to ensure no neurovascular risk from the pretendinous cord (Figure 4).

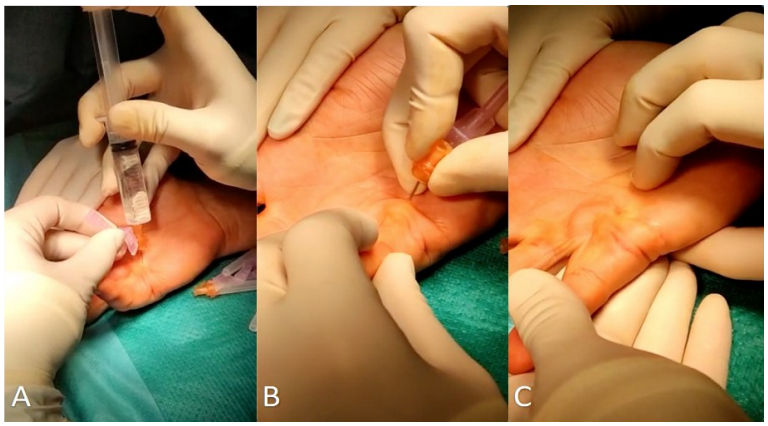

Figure 1: *A. Subcutaneous infiltration of 1% mepivacaine.*
B. Perforation of the pretendinous cord.
C. Hyperextension of the 5th digit and rupture of the remaining cord.

Figure 2: *Immediate result Post PNA.*

Figure 3. *A and B Pre-PNA images of a LSF MCPJ contracture. C and D. Immediate result post-PNA*

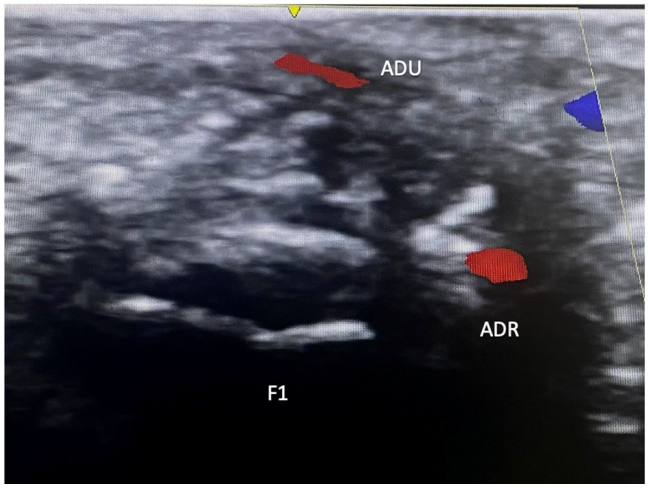

Figure 4: *Doppler ultrasound of an LSF showing the radial digital artery in its anatomical position and the ulnar digital artery over a spiral cord at the volar aspect of the first phalanx.*

Statistical Analysis

Descriptive analysis of the study population was performed (Table 1). The association between the surgical technique and outcomes of interest was evaluated (Table 2). Statistical analysis was performed using STATA v.15, considering a p-value < 0.05 as significant.

Results

Preoperatively, in group 1 (LOF): 3 patients (6%) had Tubiana stage N, 24 (48%) stage I, 17 (34%) stage II, 2 (4%) stage IID+, and 4 (8%) stage III. In group 2 (PNA): 20 (43%) had stage I, 17 (34%) stage II, 9 (21%) stage III, and 1 (2%) stage IV (Table 3).

Postoperatively, using the Tubiana scale, 32 patients (63%) in group 1 achieved stage 0, 18 (35%) stage I, and 1 (2%) stage III. In group 2, 34 (72%) achieved stage 0, 12 (26%) stage I, and 1 (2%) stage II (Table 4).

A statistically significant difference in contracture improvement was observed, with a mean improvement of 1.5 points in the PNA group vs. 1.2 in the LOF group ($p = 0.037$).

There was also a significant difference in follow-up duration until discharge ($p < 0.001$), with group 1 averaging 23.13 weeks (SD 4.62) and group 2 averaging 4.85 weeks (SD 11.56). Additionally, 76.6% of patients in the PNA group required only one follow-up visit, compared to 98% of LOF patients needing more than one week of follow-up ($p < 0.001$). All PNA patients were discharged within a week unless complications or recurrences occurred.

Table 1. Descriptive analysis of the study population.		
	N= 98	% (N) / Mean (SD) Median(IQR)
Age	N= 98	65.0 (10.6) 65.7 (57.5-72.05)
Sex		
Male		83% (81)
Female		17% (17)
Laterality		
Right		49% (48)
Left		50% (49)
Bilateral		1% (1)
Number of affected fingers		1.4 (0.6) 1 (1-2)
Surgical technique		
PNA		48% (47)
LOF		52% (51)
PIPJ involvement		
No		53% (52)
Yes		47% (46)
MCPJ involvement		
No		6% (6)
Yes		94% (92)

Abbreviations: *PNA, percutaneous needle aponeurotomy; LOF, limited open fasciectomy; PIPJ, proximal interphalangeal joint; MCPJ, metacarpophalangeal joint.*

Table 2. Bivariate Analysis between surgical technique and outcomes of interest.				
Variable	PNA	LOF	Stadistic	p-value
Follow up time (weeks) (mean/SD)	4.85 (11.56)	23.13 (4.62)	T (-10.12)	<0.001
Follow up time category			(OR:163.6)	<0.001
≤ 1 week	76.6% (36)	2%(1)		
>1 week	23.4% (11)	98% (50)		
Overall complications			0.64	0.425
No	83% (39)	76% (39)		
Yes	17% (8)	24% (12)		
Complications excluding recurrences			1.44	0.322
No	94% (44)	86% (44)		
Yes	6% (3)	14% (7)		
Recurrence			0.14	0.713
No	85% (40)	82% (42)		
Yes	15% (7)	18% (9)		
Skin injuries			2.17	0.191
No	91% (43)	98% (50)		
Yes	9% (4)	2% (1)		
Reinterventions			0.02	1.000
No	89% (42)	90% (46)		
Yes	11% (5)	10% (5)		
Hueston test			0.20	0.651
Negative	83% (39)	86% (44)		
Positive	17% (8)	14% (7)		

Abbreviations*: PNA, percutaneous needle aponeurotomy; LOF, limited open fasciectomy*

Table 3. Pre-surgical Tubiana & Michon classification		
	LOF(%)	PNA(%)
Grade		
0	6	0
I	48	43
II	34	34
IID+	4	0
III	8	21
IV	0	2

***Abbreviations**: PNA, percutaneous needle aponeurotomy; LOF, limited open fasciectomy.*

Table 4. Post-surgical Tubiana & Michon classification		
	LOF(%)	PNA(%)
Grade		
0	63	72
I	35	26
II	0	2
IID+	0	0
III	2	0
IV	0	0
Improvement	1.2	1.5(P = 0.037)

***Abbreviations**: PNA, percutaneous needle aponeurotomy; LOF, limited open fasciectomy.*

Table 5. Functional Scores		
	LOF	PNA
URAM	12.9	9.1
MHQ	71.3	79.1
Overall hand function	68.5	71
Activities of daily living	**78.4**	**90.5(p = 0.046)**
Pain	**33.6**	**18.4(p = 0.041)**
Work	71	72
Aesthetics	69	75
Satisfaction	68.8	73.6

***Abbreviations**: PNA, percutaneous needle aponeurotomy; LOF, limited open fasciectomy URAM,Unité Rhumatologique des Affections de la Main. MHQ, Michigan Hand Questionnaire*

Figure 5. *Recurrence and reintervention rates in both techniques.*

Figure 7: *Cutaneous skin tear as a PNA technique immediate complication.*

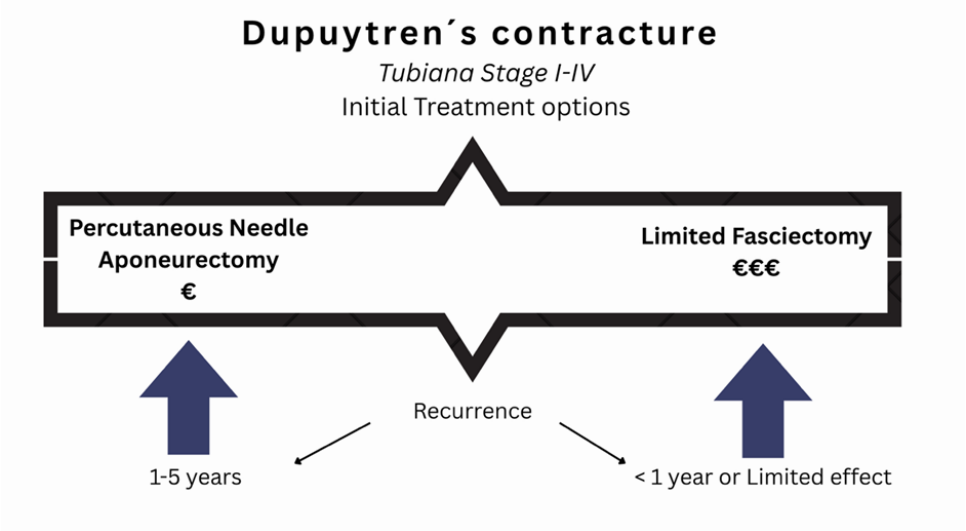

Figure 8: *Dr. Mella´s Algorithm modification*

In group 1, the complication rate was 24% (12 cases), including 18% recurrence over 7 years. Only 4% (2 cases) required reoperation with LOF. Group 2 had a 17% complication rate with 15% recurrence over 4 years. Of the 7 recurrences, 5 (11%) were treated with repeat PNA. Importantly, beyond recurrences, the LOF group had more severe complications: 2 nerve injuries (3.92%) requiring repair, 6 cases (11.76%) of paresthesias/hypoesthesias, 2 cases of joint stiffness requiring arthrolysis, and one MCF-level amputation due to pain, hypersensitivity, and a fixed PIPJ flexion.

In contrast, 4 patients (9%) in the PNA group experienced minor cutaneous injuries managed with local wound care (Figure 7).

Out of 98 patients, 60 completed the URAM and MHQ. Group 1 had a URAM mean score of 12.9 and MHQ overall hand function of 71.3. Group 2 scored 9 and 79, respectively. Statistically significant differences were observed in MHQ activities of daily living (PNA 90.5 vs. LOF 78.4, p = 0.046) and pain scores (PNA 18.4 vs. LOF 33.6, p = 0.041) (Table 5).

The Hueston test at final follow-up was negative in 86% of LOF patients and 83% of PNA patients.

Discussion

Van Rijssen et al. (2006)(1) conducted a randomized trial comparing 88 PNA-treated and 78 LOF-treated fingers. For Tubiana stages I and II, outcomes were similar, but LOF was superior for higher grades. In our study, most patients in both groups were stages I and II (LOF 82%, PNA 77%), but unlike Van Rijssen, our LOF group had only 8% stage > III, whereas PNA had 23%, yet showed better extension improvement.

The LOF group had 5% major complication rate versus 0% in the PNA group, similar to prior findings. Skin tears (28%) were the most common PNA complication per Zachrisson et al.(9), while our study reported 9%. No severe complications (infection, flexor tendon or permanent nerve injury) were observed in PNA.

Patient satisfaction favored PNA (73.6 vs. 68.8). Pain was lower in PNA (18.4 vs. 33.6), where lower MHQ scores indicate less pain.

Van Rijssen also reported lower DASH scores in the PNA group across all time points. In our study, functional scales were similar except for MHQ activities of daily living, favoring PNA (90.5 vs. 78.4).

In Van Rijssen's 5-year follow-up(10), recurrence was significantly higher with PNA (84.9%) than LOF (20.9%) and occurred earlier. In our cohort, LOF had 18% recurrence in 7 years; 3 occurred <1 year, 6 after >5 years. PNA had 15% recurrence over 4 years.

Dr. Mella's 2018 review(11) proposed an algorithm prioritizing minimally invasive treatment (PNA or collagenase) initially, switching to LOF if recurrence occurred within one year or results were unsatisfactory. Removing collagenase from the algorithm leaves PNA as the primary option (Figure 8).

Our study aimed not only to measure palmar contracture improvement (Tubiana/Michon) but also functional and subjective outcomes using URAM and MHQ. Both showed comparable outcomes to LOF with fewer complications and without compromising the possibility of future LOF if needed. PNA offered better postoperative recovery, allowing same-day return to daily and work activities.

Follow-up duration exceeded that of other longitudinal studies. However, limitations include lack of standardized discharge timing and only 60 patients completing questionnaires despite >70% contact rate. As a retrospective study, selection bias is possible due to lack of randomization. Future prospective, randomized studies with consistent variables and hand-specific functional tools are recommended.

Due to collagenase restrictions in Europe, PNA emerges as a cost-effective alternative with comparable functionality and recurrence rates, fewer complications, and safe outcomes when properly performed. Unlike collagenase, its lower cost—demonstrated in other studies(12)—could not be analyzed here due to Spanish national health system data limitations.

Conclusions

PNA yielded satisfactory clinical and functional results, significantly improving palmar contracture, daily activity, and pain compared to LOF. It reduced follow-up visits and operating room use, allowing outpatient performance and same-day return to activity with minimal complications. We recommend it for selected patients who may benefit from its advantages.

Conflict of Interest

The authors declare no conflicts of interest.

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