



EARLY FUNCTIONAL OUTCOME OF PERCUTANEOUS NEEDLE APONEUROTOMY FOR THE TREATMENT OF DUPUYTREN'S CONTRACTURE

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Abstract

Background: Dupuytren's contracture is a progressive fibroproliferative disorder of the palmar fascia, leading to fixed flexion deformities and impaired hand function. Percutaneous needle aponeurotomy (PNA) is a minimally invasive technique offering rapid recovery and functional improvement. This study aimed to evaluate the early functional outcomes of PNA in patients with Dupuytren's contracture. **Patients and Methods:** A prospective cohort study was conducted at Basrah Teaching Hospital between December 2023 and September 2024. Twenty-five patients with clinically evident Dupuytren's contracture and a palpable cord underwent PNA under local anesthesia. Total passive extension deficit (TPED) and Disabilities of the Arm, Shoulder, and Hand (DASH) scores were assessed preoperatively and at six weeks postoperatively. Disease severity was classified using the Tubiana grading system.

Results: The cohort included 19 males (76%) and 6 females (24%), with a mean age of 62 ± 12.5 years for males and 57 ± 11.7 years for females. The ring finger was most frequently affected (85%), and MCP joints were involved in 44.2% of cases. PNA achieved substantial correction across all Tubiana stages, with mean TPED improvement exceeding 92% ($p = 0.641$). DASH scores improved significantly in all stages, with the greatest functional gain in stage IV (mean reduction 44.55 points, $p = 0.003$). Complications occurred in 3 patients (12%), including skin sloughing, infection, and chronic pain.

Conclusion: PNA is an effective and safe intervention for Dupuytren's contracture, providing rapid deformity correction, significant functional improvement, and minimal complications. It represents a valuable treatment option, particularly for patients unsuitable for extensive surgery or general anesthesia

Keywords

[Dupuytren's contracture](#), [percutaneous needle aponeurotomy](#), [functional outcome](#), [minimally invasive](#), [DASH score](#)

Main Subjects

[Orthopedics](#)

Introduction

Dupuytren's contracture is a progressive fibroproliferative disorder characterized by the formation and thickening of pathological cords within the palmar fascia, leading to gradual shortening of the fascia and fixed flexion deformities of one or more fingers¹. The metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints are most frequently affected. As the disease advances, the resulting deformity can significantly impair hand function and negatively affect quality of life².

The prevalence of Dupuytren's contracture varies widely across populations, ranging from 0.2% to over 50%, with the highest rates reported in individuals of Northern European descent³. The disease is more common and more severe in men⁴. While historically rare in Asian and Black populations, recent studies from Japan and Taiwan indicate prevalence patterns comparable to those seen in Europe⁵. A combination of genetic and environmental factors contributes to disease development; diabetes mellitus, alcohol consumption, liver disease, smoking, manual labor, epilepsy, and previous hand trauma have all been implicated as risk factors⁶.

A wide range of therapeutic options has been described for symptomatic contractures.

Conservative measures include physiotherapy and rehabilitation, radiotherapy, intralesional steroid or 5-fluorouracil injections, and oral tamoxifen^{7,8}. Surgical options range from percutaneous needle aponeurotomy (PNA) and open fasciotomy to partial, radical, or dermofasciectomy. Although complete fasciectomy offers the lowest recurrence rates, it is the most invasive approach and carries a higher risk of complications⁹. This has shifted clinical interest toward less invasive interventions.

The percutaneous technique was revived in 1972 when Lermusiaux and Debeyre described performing fasciotomy through a 25-gauge needle under local anesthesia, later known as percutaneous needle fasciotomy⁸. The method was popularized by Foucher and has been associated with favorable clinical outcomes. More recently, collagenase injections have emerged as a nonoperative alternative. While collagenase therapy provides satisfactory correction in MCP joint contractures, its success at the PIP joint is more limited, particularly in advanced deformities¹⁰. Nonetheless, percutaneous approaches remain attractive due to rapid recovery, early return to daily

activities, minimal wound care requirements, and limited need for formal rehabilitation¹¹. In this study, we report the early outcomes of patients with Dupuytren's contracture managed using the PNA technique.

Patients and methods

This prospective cohort study was conducted in the Orthopedic Department of Basrah Teaching Hospital between December 2023 and September 2024 to assess the early functional outcomes of PNA in patients with Dupuytren's contracture. Consecutive patients presenting with clinically evident disease were recruited. Inclusion criteria were a flexion contracture of $\geq 30^\circ$ at the MCP, PIP, or DIP joints and a clearly palpable pathological cord, with voluntary agreement to participate. Patients with postoperative recurrence, active infection, hand osteoarthritis or rheumatoid arthritis, stiff joints, or refusal to participate were excluded.

Each patient underwent a thorough clinical evaluation, including the Hueston tabletop test and goniometric measurement of passive extension deficits at the MCP, PIP, and DIP joints. These measurements were used to calculate the total passive extension deficit (TPED) and classify disease severity according to the Tubiana grading system, where Grade I = $0-45^\circ$, Grade II = $45-90^\circ$, Grade III = $90-135^\circ$, and Grade IV = $>135^\circ$.

Patients also completed a standardized questionnaire covering demographics, health status, and risk factors, along with the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire. The DASH consists of 30 items scored from 0 to 5, producing a 100-point scale where lower scores indicate less disability. DASH scores were recorded preoperatively and six weeks postoperatively. PNA was performed under superficial local anesthesia using 2% lidocaine. After sterile preparation, a 25-gauge needle was introduced percutaneously to divide the cord at multiple levels from proximal to distal, ensuring no tendon involvement by repeated finger motion checks. Passive extension was applied after each release to maximize correction, and any small skin tears were left to heal by secondary intention. The procedure required approximately 10–20 minutes, after which a volar extension splint was applied for two weeks. Patients received paracetamol and cefixime for five days and subsequently performed active finger exercises with splinting for an additional four weeks. Follow-up assessments were conducted at 1, 2, 4, and 6 weeks, recording TPED immediately after the procedure and at six weeks, postoperative DASH scores, and any complications.

Early Functional Outcome of Percutaneous Needle Aponeurotomy for the Treatment of Dupuytren's Contracture

Data analysis was performed using SPSS (Version 24). Categorical variables were presented as counts and percentages, while continuous variables were summarized as mean $\pm$ standard deviation. Comparisons of

continuous outcomes across time points, including TPED and DASH scores, were analyzed using one-way ANOVA, with statistical significance set at $P < 0.05$.

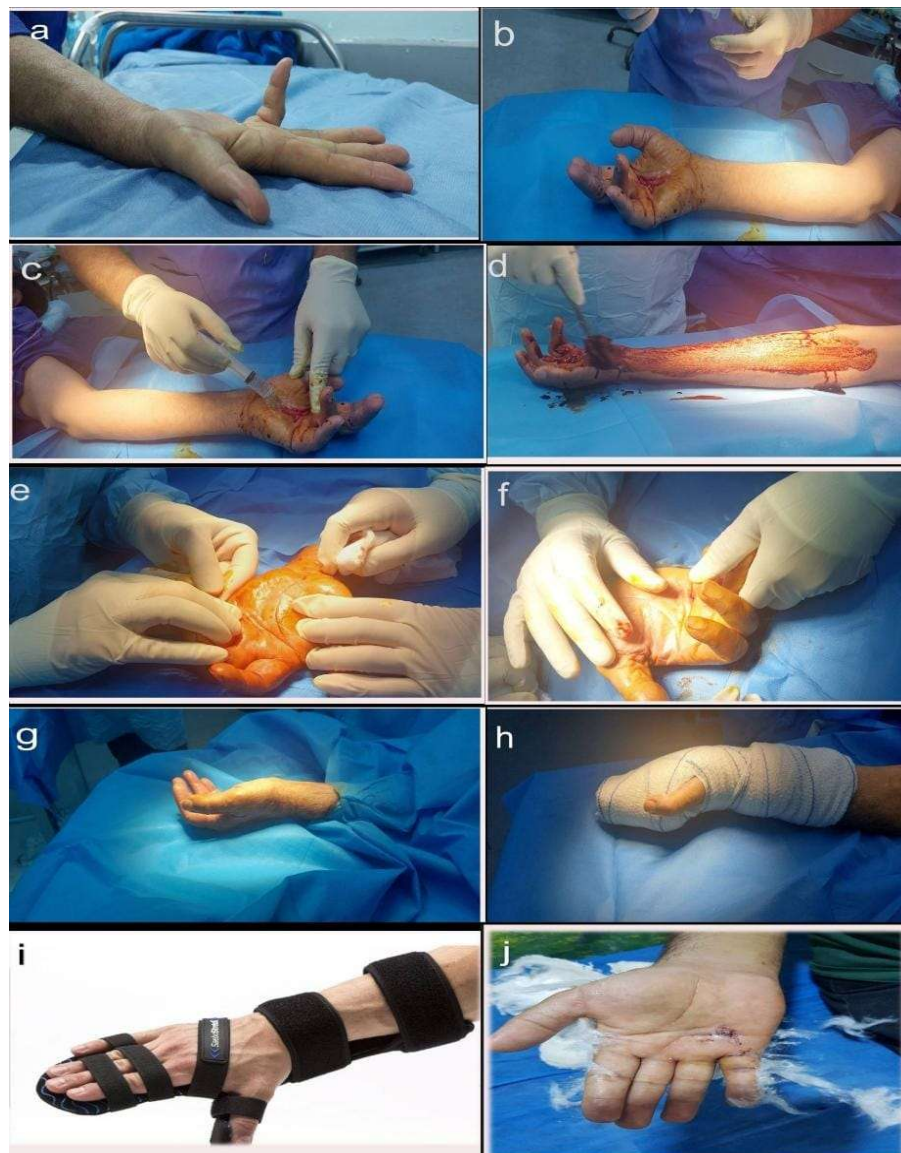


Figure 1: Surgical technique of percutaneous needle aponeurotomy that used in our study :(a) Pre-operative contracture. (b) Preparation of the hand for local anesthesia. (c) Injection of local anesthesia. (d) Sterilization and draping. (e) Percutaneous needle used to section the cords at multiple levels. (f) Finger movement (g) Hand in resting position after complete the procedure (h) volar slap with fingers in extension position.(i)Extension splint used in rehabilitation period.(j)The hand of same patient after 2weeks.

Results

A total of 25 patients were included, most of whom were male (76%), with a male-to-female ratio of 3.17:1 and mean ages of 62 ± 12.5 years for males and 57 ± 11.7 years for females (Table 1). Participants represented various occupational groups, with office workers being the most common (36%).

Table 1: Patient demographic characteristics

Variables		count	Percentage
Gender	Male	19	76 %
	Female	6	24%
Male/female ratio		3.17/1	
Profession	Office Worker	9	36%
	Heavy Worker	4	16%
	Moderate Activity	6	24 %
	Housewife	6	24%
Age (years)		(mean $\pm$ SD)	
male		62 ± 12.5	
Female		57 ± 11.7	

Figure 2 illustrates the distribution of affected hands, with right-hand involvement being most frequent (45.1%), followed by left-hand (29.4%) and bilateral involvement (25.5%).

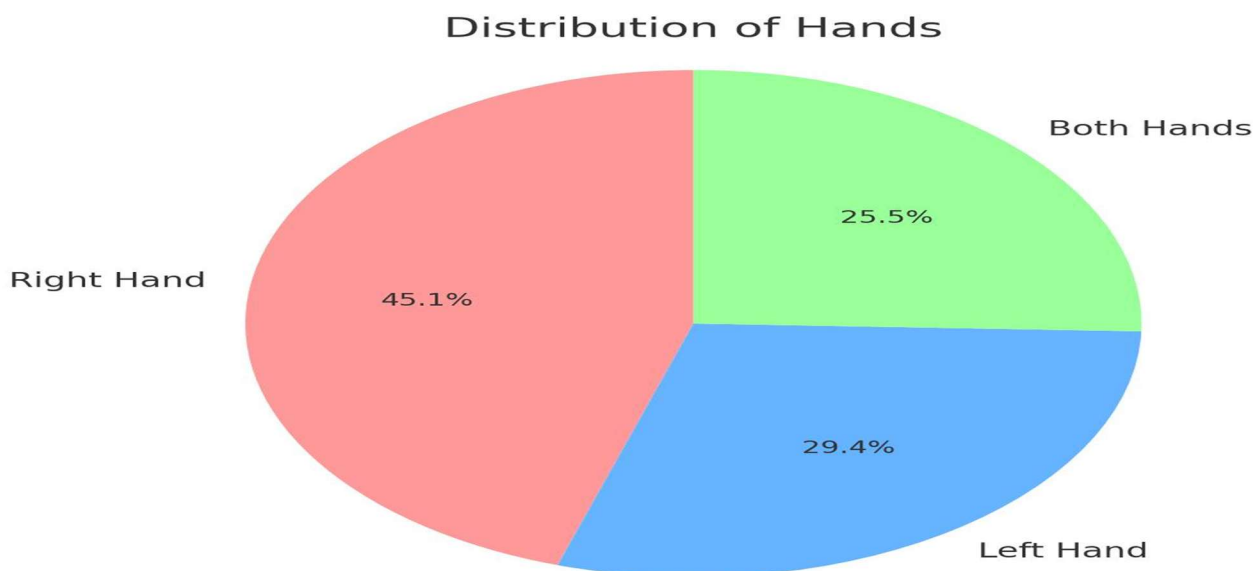


Figure 2: Distribution of the Dupuytren's deformity across the involved hands

Table II shows the distribution of deformity across digits and joints. The ring finger was the most commonly affected (85%), followed by the little finger (31%). MCP joints were the most frequently involved across all digits (44.2%), while the index finger showed no involvement.

Table II: The distribution of Dupuytren's among the fingers and joints

Involved Digit	Side (R/L)	Involved Joint (count + percentage)			Total
		MPJ	PIJ	DIJ	
Little (15)	R= 8 L= 7	15 (48.4%)	11 (35.5%)	5 (16.1%)	31 (100%)
Ring (35)	R= 19 L= 16	35 (41.2%)	30 (38.8%)	20 (23.5%)	85 (100%)
Middle (2)	R= 1 L= 1	2 (66.7%)	1 (33.3%)	0 (0%)	3 (100%)
Index (0)	R= 0 L= 0	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Thumb (2)	R= 2 L= 0	2 (66.7%)	-	1 (33.3%)	3 (100%)
Total (54)	R= 30 L= 24	54 (44.2%)	42 (34.4%)	26 (21.3%)	122 (100%)

Table III presents disease severity by sex and Tubiana stage. Stage III was most common among males, whereas females exhibited a smaller number of cases overall, with relatively higher representation in stage IV on the left hand.

Table III: The distribution of the involved fingers among the sex and stages

Severity (tubaina stage)	Right hand		Left hand		Total	
	male	Female	male	female	Right hand	Left hand
I	2 (11.1%)	3 (60%)	0	1 (25%)	5	1
II	6 (33.3%)	0	5 (45.5%)	0	6	5
III	6 (33.3%)	1 (20%)	3 (27.3%)	1 (25%)	7	4
IV	4 (22.2%)	1 (20%)	3 (27.3%)	2 (50%)	5	5
Total	18(100%)	5 (100%)	11 (100%)	4 (100%)	23	15

Table IV summarizes TPED improvement across Tubiana stages. All stages showed substantial correction (92–94%), with no statistically significant difference between stages ($p = 0.641$). Stages III and IV exhibited the highest correction percentages

Table IV: the degree of correction in the deformity in relation to each Tubaina stage

Tubaina stage	TPED score				P-value*
	Preoperative (mean $\pm$ SD)	Postoperative 1 st week (mean $\pm$ SD)	Postoperative 6 th week (mean $\pm$ SD)	Mean difference (preoperative to the 6 th week)	
I	39 $\pm$ 3	3 $\pm$ 2	3 $\pm$ 2	92.30%	0.641
II	76.36 $\pm$ 4.64	4.64 $\pm$ 3.71	4.64 $\pm$ 3.71	93.92%	
III	109.09 $\pm$ 6.27	6.27 $\pm$ 5.20	6.27 $\pm$ 5.20	94.25%	
IV	183.18 $\pm$ 9.64	9.64 $\pm$ 6.10	10.55 $\pm$ 6.13	94.24%	

***One-way ANOVA test**

Functional improvement measured by DASH scores is shown in Table V. All stages demonstrated marked postoperative reduction, with significant improvement overall ($p = 0.003$). The greatest functional gain was observed in stage IV.

Table V: DASH score pre and postoperatively in each Tubaina stage of Dupuytren's contracture.

Tubaina stage	DASH score		Mean difference (preoperative to the 6 th week)	P-value*
	Preoperative (mean ± SD)	Postoperative 6th week (mean ± SD)		
I	66.25±3.15	38.75 ± 2.4	27.5	0.003
II	77.88±4.8	40.63 ± 2.2	37.25	
III	93.33 ± 1.05	56.67 ± 4.02	36.66	
IV	94.55 ± 1.67	50 ± 6.19	44.55	

*One-way ANOVA test

Postoperative complications occurred in 3 patients (12%), including skin sloughing, infection, and chronic pain syndrome (Figure 3).

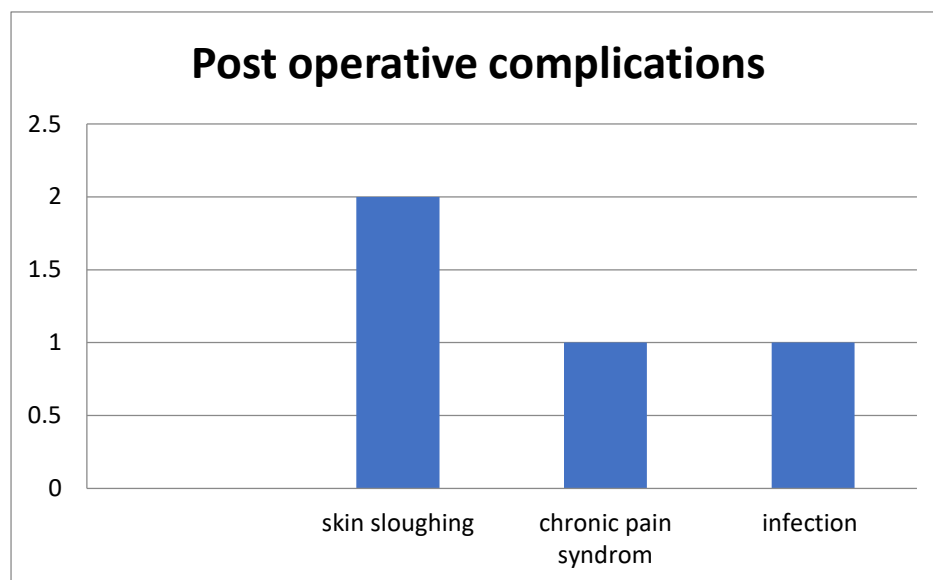


Figure 3: Post-operative complications among the studied patients (out of 25 patients)

Discussion

Dupuytren's disease is a progressive fibroproliferative disorder of the palmar fascia, leading to contractures and significant hand dysfunction. Our study demonstrates that PNA is an effective minimally invasive treatment, allowing rapid restoration of hand function, substantial deformity correction, and high patient satisfaction with a low complication rate. Six-week follow-up results highlight the advantages of PNA in achieving favorable clinical outcomes while minimizing morbidity, supporting its role as a safe alternative to more invasive surgical approaches.

Male predominance was obvious (76%, male-to-female ratio of 3.17:1) aligns with previous researches. In 1962, Early conducted a comprehensive population study in Manchester, England, which identified a male-to-female ratio of 8.2:1 among individuals under 65 years of age and 2:1 among those over 75 years, indicating that gender differences tend to diminish with age¹². Similarly, a large-scale study by Mikkelsen et al. examined 16,000 residents of a small coastal town in Norway, reporting a male-to-female ratio of 5.8:1 for individuals aged 50–54, which progressively declined to 1.2:1 in the 85–89 age group¹³. The age distribution of participants in this study (36 years–80 years) further supports these findings. The mean age

in our cohort, 62 years for males and 57 years for females, corresponds with the typical onset of Dupuytren's disease in the sixth and seventh decades of life, consistent with the observations of Lanting et al.¹⁴.

Bilateral involvement was observed in 52% of patients, similar to Ling and Karakaplan et al., who reported 53.6%¹⁵. The ring finger (85%) and little finger (31%) were the most commonly affected, while the index finger showed no involvement, corroborating findings by Auld et al.¹⁶ and Karbowiak et al.¹⁷. This distribution reflects the disease's predilection for ulnar-sided digits, consistent with other reports, including Sasaki et al.¹⁸.

PNA is widely recognized for its minimal invasiveness and rapid recovery compared to open fasciectomy. Studies by Hurst et al. demonstrated that while open fasciectomy offers more durable results, PNA is equally effective in achieving immediate deformity correction, with fewer complications and shorter recovery times¹⁹. In our study, PNA achieved deformity correction rates exceeding 90% across all Tubiana stages in this study. These results are consistent with the findings of van Rijssen et al., who reported a 91% correction rate following PNA in a cohort of 212 patients²⁰. Notably, stages III and IV in our study demonstrated the highest correction rates

(94.25%), suggesting that PNA is effective even in severe cases. However, our findings contrast with Winberg et al., who reported slightly lower correction rates for stage IV (85%), attributing this to the more advanced fibrotic changes in these patients²¹.

Postoperative complications were observed in 3 patients (12%), including skin sloughing (8%), infection (4%), and chronic pain (4%). These rates are lower than those reported in a systematic review by Krefter et al., who found a 19% complication rate following percutaneous needle fasciotomy²², and considerably lower than open surgical techniques, which can reach 13% for complex

regional pain syndrome and 9% for infection^{23,24}. The low incidence of complications further supports PNA as a safe and minimally invasive alternative.

PNA is an effective and safe treatment for Dupuytren's contracture, achieving high rates of deformity correction and significant functional improvement with minimal complications and faster recovery compared to open surgery. It represents a valuable option, particularly for patients who are poor candidates for general anesthesia or extensive surgical procedures.

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Work Concept and Design: 1,2

Data Collection and Analysis: 1,2

Responsibility for Statistical Analysis: 1,2

Writing the Article: 1, 2

Critical Review: 1, 2

Final Approval of the Article: 1, 2

Availability of Data and Material:

The corresponding author will provide the datasets generated and/or analyzed during the current study upon reasonable request.

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