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Predictors of Outcomes Following Fasciectomy for Dupuytren's Disease in Diabetic and Non-Diabetic Patients

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Background: The aim of this study was to compare clinical outcomes, and identify predictors thereof, after fasciectomy for Dupuytren's disease in a series of diabetic patients compared with non-diabetic patients.

Methods: Thirty-eight patients were examined following partial palmar and/or digital fasciectomy for Dupuytren's disease (11 diabetics, 27 non-diabetics). Each patient was assessed for degree of pre- and post-operative flexion contractures at the MCP and PIP joints, post-operative Patient Evaluation Measure (PEM) total score, post-operative grip strength, limited joint mobility (LJM), recurrence, extension, and a composite outcomes score based upon grip strength and the degree of joint contractures. All measurements in the diabetic cohort were compared to those in the non-diabetic group, and a logistic regression analysis was performed to identify the predictive value of several variables on outcomes.

Results: Complication rates between the two groups were statistically similar ($p = 0.67$). There were no significant differences in pre-operative MCP ($p = 0.69$), post-operative MCP ($p = 0.39$), pre-operative PIP ($p = 0.40$), or post-operative PIP ($p = 0.13$) joint flexion contractures between the two groups. Additionally, there was no significant difference in extension ($p = 0.35$) or recurrence (p~1) rates, post-operative grip strengths ($p = 0.64$), or PEM total scores ($p = 0.32$). However, the rate of LJM was significantly higher in the diabetic population ($p = 0.02$). Both female gender ($p = 0.01$) and a non-smoking status ($p = 0.04$) were found to be predictive of better outcomes following fasciectomy. Diabetes was not found to be an independent predictor of outcome ($p = 0.73$).

Conclusions: Clinical results after fasciectomy for Dupuytren's disease in diabetic patients are not different from results obtained in non-diabetic patients. Diabetes is not independently predictive of surgical outcomes. Female gender and non-smoking status are independent predictors of a better outcome following fasciectomy.

Keywords: *Dupuytren's disease, Diabetes, Fasciectomy, Outcome*

INTRODUCTION

Dupuytren's disease is a progressive, benign fibroproliferative disorder of an unclear origin affecting the hands. It classically affects males more than females, and is more notably prevalent in patients of northern European descent. In this condition, normal fascial bands develop into pathologic cords and fascial nodules permeated with myofibroblasts. Flexion contractures of the digits result, which may require operative intervention. Diabetes mellitus (DM) is a known risk factor for developing Dupuytren's disease.[1] The prevalence of Dupuytren's contractures in patients with DM is as high as 42% and tends to affect type 2 DM more than type 1.[2,3]

Despite a well-documented link between DM and Dupuytren's disease, to the authors' knowledge, only one study has examined the operative outcomes in this pa-

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tient population.[4] This study, however, was limited in its generalizability as it only assessed outcomes based upon QuickDASH scores alone. According to Degreef and De Smet,[5] no correlation of self-reported disease recurrence is seen with DM. One review suggested that surgical treatment in diabetic patients yields satisfactory results.[6] In another study, some factors that conveyed a poorer prognosis regarding recurrence included associated diseases (e.g. alcoholism, DM, epilepsy), but these were not stratified by each specific disease.[7] However, data on the efficacy of surgery in diabetics, as well as patient-related outcomes, have not been presented. It is also unclear whether the frequency of recurrence of Dupuytren's disease after fasciectomy differs between diabetic and non-diabetic patients.

Such information is crucial for appropriately counseling patients on their risks and the potential results of surgical intervention. Consequently, the void in the literature warrants further investigation. The aims of the present study were to compare clinical outcomes, and identify predictors thereof, after palmar fasciectomy for Dupuytren's disease in a consecutive series of diabetic patients and non-diabetic patients.

METHODS

This was a retrospective descriptive study. All medical records and operative reports were obtained for patients admitted to the hand surgery unit of a single regional hospital following surgery for Dupuytren's disease between 2004–2009. Patients were then followed up at the outpatient clinic with a mean follow-up duration of 62 months (range, 3–204 months). The study was approved by the local institutional review board and the protocol was carefully explained to the patients. Patients provided written informed consent to the clinical examination at follow-up. A proforma was used to collect clinical as well as pre- and post-operative data.

Thirty-eight patients were examined following surgery for Dupuytren's disease, 11 of whom were diabetic and 27 of whom were non-diabetic. Twenty-two patients had one operated hand and 16 patients had both hands operated on. Consequently, data were collected on a total of 54 operative hands, with 99 metacarpophalangeal (MCP) and 93 proximal interphalangeal (PIP) joints. All patients had undergone partial palmar and/or digital fasciectomy under general anesthesia. No additional procedures, such as skin grafting, were required. Post-operatively, a compressive dressing with a palmar plaster-of-Paris slab was applied. The operative hand was elevated in a sling overnight and the patient was then discharged the following day.

A variety of variables were assessed for each patient. Measurement parameters included the degree of joint contracture, functional outcome scoring, and grip strength. For contractures, both pre- and post-operative measurements were recorded using a goniometer. All measurements were recorded based upon the degree of flexion contracture at the MCP joint and the PIP joint. The function of the hand was assessed post-operatively utilizing the Patient Evaluation Measure (PEM) total score, and post-operative grip strength was noted using the same calibrated Jamar dynamometer with the same observer recording the measurements and calculated as a percentage of the contralateral side.[8] To qualify the patient outcomes, a composite score was developed. In this scoring method, a "good outcome" was defined as post-operative grip strength greater than 80% of the contralateral side, and MCP and PIP joint contractures of 0° at the time of follow-up. Any results outside of this definition were regarded as a "bad outcome." This score served as an objective evaluation of several variables linked to patient outcomes. The degree of joint contracture correlates to patient functional status, and grip strength is commonly used in upper extremity outcomes studies, with 80% relative strength often established as a benchmark.[9-11] Additionally, all patients were screened for post-operative limited joint mobility (LJM) using the Prayer Sign. This clinical examination was performed by having the patient place his or her hands together with the goal of pressing the palms of the hands and palmar surfaces of the interphalangeal joints together. Any gap present between these surfaces is indicative of a joint flexion contracture. The standard definitions of recurrence (disease within a previously operated site) and extension (disease in a site not previously operated on) were used. All measurement parameters in the diabetic patient group were compared to those in the non-diabetic group.

We tested a comparison of continuous variables between and within groups using a two-tailed Mann-Whitney U test and Wilcoxon signed rank test, respectively. Differences in binary variables were evaluated using Fisher's exact test. Correlations between variables were examined and a logistic regression analysis was performed to identify the predictive value of several variables for digital contracture, full correction, and grip strength based upon the composite score. A power analysis specifically for multiple regression (with a desired power of 80% and $p < 0.05$) estimated a sample size of

54 hands. All statistical analyses were performed utilizing statistical software (SPSS 14.0 for Windows, SPSS Inc., Chicago, IL), with two-tailed $p < 0.05$ considered to be statistically significant.

RESULTS

Baseline characteristics demonstrate that the diabetic and non-diabetic patient groups had comparable demographic parameters (Table 1). However, the diabetic group had a significantly greater percentage of cigarette smokers ($p = 0.03$).

With regards to the surgeries, both operative times and surgical complications were recorded. The mean operative time for patients in the non-diabetic group was 71 minutes (SD, 32 minutes), whereas the operative time in the diabetic group was 96 minutes (SD, 58 minutes). These differences were not statistically significant ($p = 0.16$). Additionally, eight complications were noted between the two cohorts. Five were observed in the non-diabetic group, including two patients who experienced skin necrosis, one post-operative boutonniere deformity, one intra-operative nerve laceration, and one case of post-operative digital hypothesia. The diabetic cohort had three complications, including one digital artery injury requiring repair, one case of skin necrosis, and one patient with a post-operative scar contracture. The complication rates between the two groups, however, were statistically similar ($p = 0.67$).

The degree of flexion contractures at both the MCP and PIP joints were also assessed. As noted in Fig. 1, the mean pre-operative MCP joint flexion contracture was 48.2° (SD, 23.5°) and the post-operative contracture was 0.4° (SD, 1.3°) in the non-diabetic group. This difference was statistically significant ($p < 0.001$). Patients in the diabetic cohort presented with mean pre-operative and post-operative MCP joint flexion contractures of 40.5° (SD, 19.9°) and 0° (SD, 3.3°), respectively. Similar to the trend in the non-diabetic patients, the post-operative MCP joint contractures were significantly less than the pre-operative ones ($p < 0.001$) among diabetic patients. When comparing the two groups, there were no significant differences in pre-operative ($p = 0.69$) or post-operative ($p = 0.39$) MCP contracture values between the two cohorts. With regard to the PIP joint, the mean pre-operative flexion contracture was 46.6° (SD, 29.2°) and the post-operative contracture was 13.6° (SD, 23.3°) in the non-diabetic group (Fig. 2). This difference was statistically significant ($p = 0.01$). Patients in the diabetic cohort presented with mean pre-operative and post-operative PIP joint flexion contractures of 41.2° (SD, 19.1°)

Table 1. Baseline Characteristics of Non-Diabetic and Diabetic Patient Groups

Characteristic	Non-diabetic patients (n=27)	Diabetic patients (n=11)	*p*-value
Age in yrs (Mean [SD])	69.0 (13.0)	68.5 (7.5)	1.00
Female/Male (N)	3/24	0/11	1.00
Family History	3 (11.1%)	1 (9.1%)	1.00
Bilateral Involvement	11 (40.7%)	5 (45.5%)	1.00
Smoking	3 (11.1%)	5 (45.5%)	0.03

N: number of patients, yrs: years, SD: standard deviation.

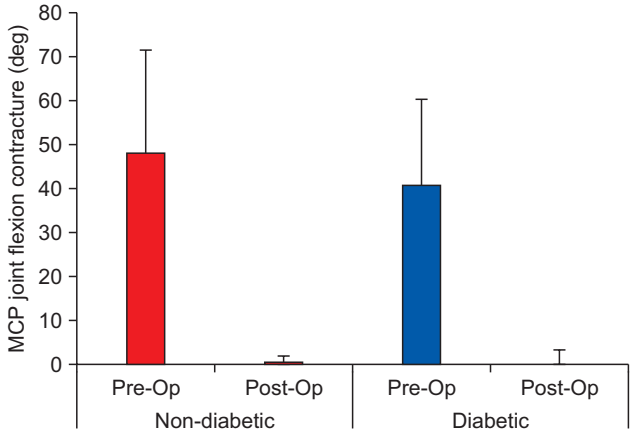

Fig. 1. Degree of MCP Joint Flexion Contractures. The pre-operative and post-operative mean values and standard deviation bars for both the non-diabetic and diabetic cohorts are provided. MCP: metacarpophalangeal, deg: degrees, Pre-Op: pre-operative, Post-Op: post-operative.

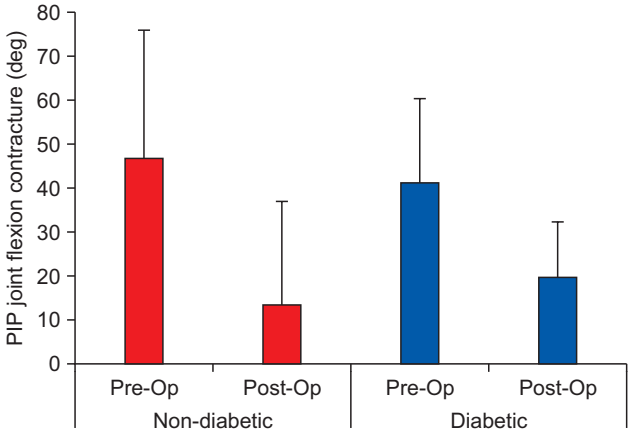

Fig. 2. Degree of PIP Joint Flexion Contractures. The pre-operative and post-operative mean values and standard deviation bars for both the non-diabetic and diabetic cohorts are provided. PIP: proximal interphalangeal, deg: degrees, Pre-Op: pre-operative, Post-Op: post-operative.

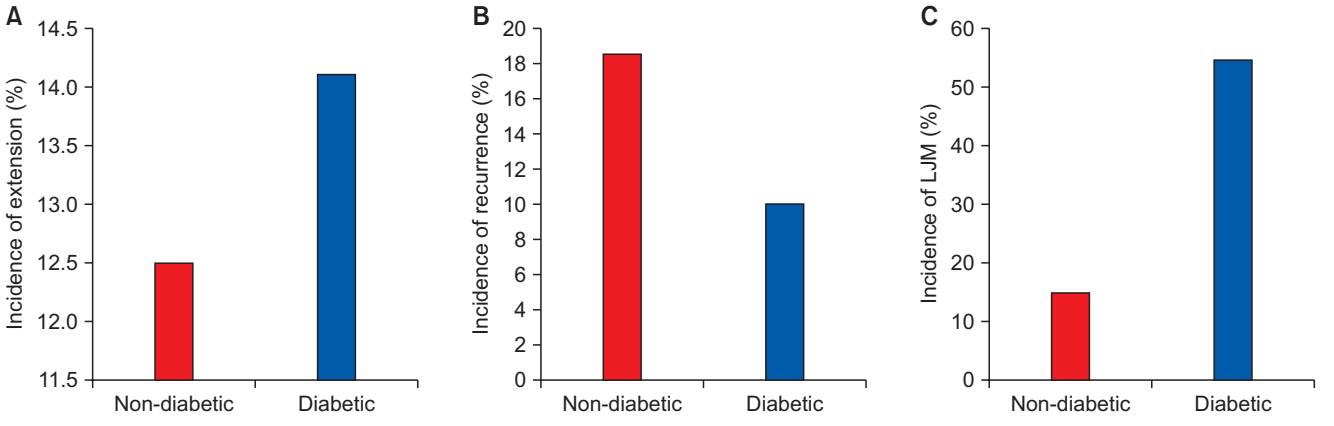

Fig. 3. Incidence of (A) Post-Operative Extension, (B) Recurrence, and (C) Limited Joint Mobility. The mean values for both the non-diabetic and diabetic cohorts are provided for each parameter. %: percentage, LJM: limited joint mobility.

Table 2. Post-Operative Grip Strength and PEM Scores of Both Cohorts. Grip strength was measured as a percentage of the contralateral side. PEM values reflect the total score. Mean and standard deviation values are provided

Characteristic	Non-diabetic patients	Diabetic patients	*p*-value
% Grip Strength	96.8±23.3	94.7±29.3	0.64
PEM	32.3±16.5	45.6±27.3	0.32

%: percentage, PEM: patient evaluation measure total score.

and 19.5° (SD, 12.8°), respectively (p = 0.03). When comparing the two cohorts, there were no significant differences in pre-operative (p = 0.40) or post-operative (p = 0.13) PIP contracture values between the two groups.

The natural history of the Dupuytren's disease of each patient was carefully evaluated. The incidence of disease extension in non-diabetic patients was 12.5% and 14.1% in the diabetic cohort (Fig. 3A). Nonetheless, there was no significant difference in the incidence of extension between the two groups (p = 0.35). Additionally, the incidence of recurrence was 18.5% and 10% in the non-diabetic and diabetic patients, respectively (Fig. 3B). Like the incidence of extension, this difference was not significant (p~1). However, the incidence of post-operative LJM (Fig. 3C) was significantly higher in the diabetic population (54.5%) than in the non-diabetic group (14.8%) (p = 0.02).

As demonstrated in Table 2, the post-operative grip strengths of the non-diabetic and diabetic patients were statistically similar (p = 0.64). Likewise, the post-operative PEM total scores were comparable between the two groups (p = 0.32). In order to evaluate for independent predictors of outcome, based upon the aforementioned composite score, a multivariate logistic regression analysis was performed. Both female gender (p = 0.01) and a non-smoking status (p = 0.04) were found to be predictive of a "good outcome" following fasciectomy. LJM approached, but did not achieve, status as a predictor (p = 0.08). There was no association between gender and smoking status (p = 0.57) or LJM (p = 0.30). Other variables such as the presence of DM (p = 0.73), laterality (p = 0.32), bilateral involvement (p = 0.51), patient age (p = 0.73), family history (p~1), and PEM score (p = 0.86) were not found to be independent predictors of outcome.

DISCUSSION

Dupuytren's disease can be a debilitating condition resulting in pathologic contractures which may interfere with activities of daily living. Prior studies have demonstrated a strong association between Dupuytren's disease and DM, as well as other conditions such as alcoholism, epilepsy, and vascular disorders.[12] These associations do not imply a cause-and-effect relationship, and not all studies verify these associations. It does appear, however, that there are diagnostic sub-populations that are more frequently affected by Dupuytren's disease. Presumably, the primary diagnosis in these patients causes changes at the molecular level that make their fibroblasts susceptible to triggers that initiate dedifferentiation into myofibroblasts, which, consequently, stimulates an imbalance in collagen turnover that leads to nodules, cords, and contractures.[13]

Notable distinctions in the presentation of Dupuytren's disease have been observed between diabetic and non-diabetic patients, namely that patients with DM

tend to have a milder form of the disease, more commonly have involvement of the middle and ring fingers (as opposed to the ring and small fingers, which is more typical for non-diabetics), and may develop Dupuytren's disease through a different pathophysiologic process.[14,15] Most of the extant literature evaluates the prevalence of Dupuytren's disease among patients with DM, but does not examine the surgical outcomes in this patient population.[1-3,6,16,17] In order to address this void, the objectives of the current study were to compare clinical outcomes, and identify predictors thereof, after palmar fasciectomy for Dupuytren's disease in diabetic patients compared with non-diabetic patients.

This study indicates that clinical results after partial palmar fasciectomy for Dupuytren's disease in diabetic patients are not different from the outcomes achieved in non-diabetic patients. This is evidenced by the lack of any significant differences in complication rates, degree of post-operative PIP or MCP joint contractures, rate of extension, grip strength, or post-operative PEM scores between the two cohorts. While limited to a single outcome measure, Eckerdal et al.'s[4] study, the only other report analyzing surgical outcomes, came to a similar conclusion. In their prospective investigation, the authors assessed the results of surgical treatment in a series of 175 patients with Dupuytren's disease. They found no difference in QuickDASH scores between diabetic and non-diabetic patients at one-year follow-up, indicating similar outcomes. Additionally, they found no difference in the healthcare costs associated with surgery in patients with DM compared to those without DM, a concept not examined in the present study but worth noting. Moreover, in their review on the diabetic hand, Papanas and Maltezos[6] stated that surgery for Dupuytren's disease in diabetic patients yields satisfactory results, but the studies they cite did not actually assess outcomes. In addition to the aforementioned variables, the present study also found no difference in recurrence rates between the two groups. This concurs with the findings of Degreef and De Smet,[5] who reported that there was no correlation between DM and Dupuytren's disease recurrence. Of note, however, our study found that patients within the DM group had greater post-operative LJM compared to their non-diabetic counterparts. While LJM and Dupuytren's disease may coexist in diabetic patients, they remain distinct clinical conditions.[14] Consequently, patients with DM may have equivalent surgical outcomes to non-diabetics with respect to Dupuytren's disease, but still have greater LJM. Additionally, the difference between the results for LJM (significant difference) and the degree of flexion contractures (no statistical difference) is likely attributable to the use of the Prayer Sign to define LJM (rather than using the arithmetic sum of the joint flexion contractures). Thus, the slightly more subjective results of the Prayer Sign could differ from the more objective findings of the joint flexion contracture measurements.

Echoing the above, our logistic regression analysis showed that the presence of DM is not predictive of surgical outcomes for Dupuytren's disease. This is consistent with the aforementioned conclusion that patients with and without DM have similar outcomes with no significant differences in degree of contractures, complications, recurrence, etc. It also highlights the internal consistency of our results. Unlike Degreef and De Smet,[5] Norotte et al.'s[7] 10-year prospective study found that certain "etiologic factors" (such as DM) were associated with a poorer post-operative prognosis in patients undergoing surgery for Dupuytren's disease. However, they based their conclusion on recurrence rate alone (citing an 82% recurrence in patients with DM), and not on actual outcomes measures.

Of the patient variables assessed, both female gender and a non-smoking status were independently predictive of a "good outcome" following partial palmar fasciectomy. With regards to smoking status, while Eckerdal et al.[4] found no difference in surgical outcomes between smokers and non-smokers with Dupuytren's disease, smoking was found to be associated with poorer outcomes in our study. Consequently, patients who smoke should be appropriately counseled about their higher risk for a less favorable outcome, and perhaps should be advised to pursue pre-operative smoking cessation to mitigate this modifiable risk factor in order to potentially improve their outcomes.

The current study is not without its limitations. Specifically, this was a retrospective investigation and, as such, it is vulnerable to recall bias. Additionally, the sample size of each patient group was relatively small. Statistically significant differences, however, were nonetheless noted between the cohorts. Moreover, with mean follow-ups of approximately five years, the outcomes and other analyses were limited to mid-term results.

In conclusion, the clinical outcomes after partial palmar fasciectomy for Dupuytren's disease in diabetic patients are no different from the results obtained in non-diabetic patients. Consequently, DM is not independently predictive of surgical outcomes. However, female gender and non-smoking status are associated with better post-operative outcomes. As with other surgical procedures, patients who smoke should be counseled on their

increased risk for a poorer outcome and encouraged to pursue pre-operative smoking cessation. Future studies should aim to assess larger patient cohorts over longer study periods, and perhaps to investigate the potential effects of inherent characteristics of DM, such as hemoglobin A1c level, fasting serum glucose level, and duration of DM treatment, on outcomes.

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