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Original article

Distal sensory disorders in Dupuytren's disease

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ABSTRACT

Purpose: Dupuytren's disease is a common and disabling condition. Its pathophysiology is not well understood. Some patients complain of postoperative loss of fingertip sensitivity that could be due either to the surgery or to the disease itself. Our hypothesis is that distal sensory disorders are a component of Dupuytren's disease.
Methods: We performed a prospective, single-center study to compare two populations: controls and patients with Dupuytren's disease. Subjects were excluded if they were under 18 years of age or had any disease or treatment that could alter finger sensitivity or test comprehension. Sensitivity was determined using Weber's static two-point discrimination test. Each ray of the tested hand in the Dupuytren's patients was classified as healthy or diseased; the diseased rays were graded using the Tubiana stages and the type of involvement (pure digital, pure palmar, palmar-digital).
Results: The study enrolled 56 patients in two comparable groups of 28 patients and 28 controls. A statistically significant difference was found between the affected hands of Dupuytren's patients and the hands of the controls. There was also a significant difference in the mean sensitivity of affected and normal rays in the Dupuytren's patients.
Conclusion: Preoperative distal sensory disorders are a component of Dupuytren's disease that could be related to neuropathy and/or mechanical nerve compression.
Level of evidence: IV, case-control study, diagnostic study.

1. Introduction

Despite a high prevalence (about 10% of Northern European population, 500,000 cases in France and 15,000 surgical procedures per year) [1–4] and nearly two centuries after it was first described by Baron Dupuytren, the pathophysiology of Dupuytren's disease is still not fully understood. While collagen proliferation and disease progression factors have been described [1–5], we still do not know exactly how it develops or progresses.

There is currently no conservative (nonsurgical) treatment for this mysterious disease. Surgery is the preferred treatment along with needle fasciotomy; however, these two treatments have a high risk of complications (particularly iatrogenic nerve lesions) [6] and of recurrence. Hence, it is important to understand the pathophysiology of Dupuytren's disease so that curative conservative treatments can one day be developed.

In the hand, the thickened superficial palmar aponeurosis creates adhesions around the proper digital nerves that could cause nerve compression. These adhesions lead to finger contractures that alter function [7]; however, we do not know whether they also alter finger sensitivity. We know that certain signaling pathways participate in the function of digital nerves and the development of Dupuytren's disease. In our clinic, we have observed that some patients complain of loss of sensitivity in both their healthy and diseased fingers after surgery. To our knowledge, no study has explored the impact of Dupuytren's disease on finger sensitivity, independent of any other disease that can alter sensitivity. Although these sensory disorders may be related to the surgery, we hypothesized that sensitivity is altered in Dupuytren's disease due to compression by the adhesions or due to neuropathy.

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The goal of this study was to verify that hypothesis.

2. Methods

2.1. Study population

The study compared two populations: controls and patients with Dupuytren's disease. The latter group was subdivided into healthy and diseased rays. All subjects were included prospectively after providing informed consent.

The subjects in the "control" group were selected from hospitalized patients or those seen in consultation. The exclusion criteria were Dupuytren's disease or previously treatment for this disease, being under 18 years of age, confirmed alcoholism (more than two drinks per day and/or a complication related to chronic alcohol consumption), diabetes with complications, Raynaud's disorder, history of upper limb or cervical spine disease or surgery (including carpal tunnel surgery), along with any other treatment or disease that could alter finger sensitivity (including platinum-based chemotherapy). Also, the subjects needed to speak French and be free of any neuropsychiatric disorder that could affect their comprehension of the questionnaire or test.

Subjects in the "patient" group were selected from those consulting for surgical treatment of their Dupuytren's disease and were subject to the same exclusion criteria as the controls. Each finger of the patients' hands was classified as either healthy or diseased. Disease progression in each diseased finger was graded based on the Tubiana stages [8–11] and the type of involvement: pure digital, pure palmar or digital–palmar according to Alnot and Tubiana [11].

Only the hand affected by Dupuytren's was tested in the patient group, while both hands were tested in the control group.

2.2. Methods

2.2.1. Weber's static 2-point discrimination test

For this observational, single-center study, the sensitivity of each finger's hemipulp in patients with Dupuytren's disease was compared to that of the control group. Informed consent was obtained for each patient before the test. For this kind of study, our institution did not require any institutional review board (IRB) approval, as sensitivity testing is part of clinical examination.

The data was collected using Weber's static 2-point discrimination test or Weber disk test [12] to objectively measure fine epicritic sensation (discrimination between 2 and 26 mm). The test was explained to the subjects, who had their eyes open and were given enough trials to ensure they fully understood the test. The test was then done with the subjects' eyes closed. In each subject, the fingers were tested individually from the first to fifth. If the patient was unsure, the test was repeated as many times as necessary until a reproducible, definitive response was achieved. The test started with a 12 mm gap between the two points. The gap was reduced by 2 mm for each subsequent test, except for the 4, 3 and 2 mm gaps, until the subject could no longer distinguish the presence of two points. The value recorded was the smallest gap the subject could discern between two points. The same examiner performed all the tests.

2.2.2. Statistical tests

A descriptive analysis was done using Microsoft Excel software to calculate the mean, median, standard deviation, minimum and maximum values. GraphPad Prism software (version 6.00, GraphPad Software, San Diego, CA, USA) was used to perform the statistical testing and generate graphics. The threshold for statistical significance was set at 5% ($p < 0.05$). To compare the quantitative variables in two groups of independent subjects, a Student's *t*-test was used if the data were normally distributed and a Mann–Whitney test if they were not. The normality of the data distribution was determined with a D'Agostino-Pearson test. To compare the quantitative variables in more than two independent groups, the mean values of each parameter for a category of subjects (sub-groups) was compared with a Kruskal–Wallis nonparametric test ($n < 30$ for each subgroup). Post-hoc testing of differences between subgroups was done with Dunn's test.

2.2.3. Comparisons

The mean sensitivity (primary outcome measure) of patients with Dupuytren's disease was compared to that of the controls; the healthy rays were compared to the diseased rays in the Dupuytren's patients.

For the secondary objectives, the mean sensitivity of the diseased rays in the Dupuytren patients was compared to that of the controls; the sensitivity in the diseased fingers in Dupuytren's patients was compared according to the Tubiana stage; the sensitivity of the rays affected by Dupuytren's was compared by type of disease.

2.2.4. Financing sources

No funding was received for this study.

3. Results

3.1. Study population

Between November 2015 and November 2016, 56 patients (43 men, 13 women) with a mean age of 62 years (28–84) were enrolled:

- 28 Dupuytren patients, thus 28 affected hands (280 hemipulps) which consisted of 37 diseased rays (74 hemipulps) and 103 healthy rays (206 hemipulps);
- 28 controls, thus 56 hands (560 hemipulps).

Other than smoking habits, the two groups were comparable (Table 1).

3.2. Mean sensitivity

The mean value in the Weber static 2-point discrimination test was 5.307 mm (95% CI [5.172–5.442]) in the controls and 5.996 mm (95% CI [5.788–6.205]) for the Dupuytren patients.

Among the Dupuytren's patients, the healthy rays had a sensitivity of 5.854 mm (95% CI [5.613–6.096]) and the diseased rays had a sensitivity of 6.392 mm (95% CI [5.983–6.801]).

The mean value for sensitivity in terms of Tubiana disease stage was 5.500 mm (95% CI [4.947–6.053]) for stage 1, 6.688 mm (95% CI [6.120–7.255]) for stage 2 and 7.800 mm (95% CI [6.377–9.223]) for stage 3.

Table 1
Population.

Group	Dupuytren's patients	Controls	*p*
Number	28	28	> 0.05
Men	22 (78.57%)	21 (75%)	> 0.05
Age (years)	63 (40–84)	62 (28–74)	> 0.05
Right-handed	23 (82.14%)	23 (81.48%)	> 0.05
Diabetes	3 (10.71%)	3 (10.71%)	> 0.05
Smoker	**10 (35.71%)**	**4 (14.29%)**	**< 0.05**
Manual laborer	5 (17.86%)	5 (17.86%)	> 0.05

In bold: only significant difference between the two groups.