Advances in Minimally Invasive Treatment of Dupuytren Disease

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KEYWORDS

• Dupuytren disease • Fat grafting • Lipofilling • Minimally invasive • Needle fasciotomy • Needle aponeurotomy • Fasciectomy • Dermofasciectomy

KEY POINTS

- Comparison is provided between minimally invasive techniques (including collagenase) and limited fasciectomy (LF) in the treatment of Dupuytren disease (DD).
- Percutaneous needle aponeurotomy and lipofilling (PALF) is a novel strategy in the treatment of DD.
- There is no difference in contracture correction and recurrent contractures within 1 year when PALF is compared with LF.
- At 5 years' follow-up, LF has significantly less recurrence compared with PALF.
- Often the choice for a patient with moderate Dupuytren diathesis is between early recurrence, fast recovery, and few complications versus late recurrence, slower recovery, and more complications.

INTRODUCTION

Dupuytren disease (DD) is a chronic progressive fibroproliferative disease originating at the palmar fascia. Due to the intricate relationship of fascia with the overlying skin, however, it could be better characterized as a fascia-skin disease. Clinically, DD starts with nodules and pits on the palmar side of the hand. Nodules or thickened areas can also form on the dorsal side at the PIP joints (Garrod pads). Subsequently, cords can develop into flexion contractures of the digits, especially at the MCP and PIP joints.[1] These contractures range from mild contractures that hardly hamper hand function to severe debilitating contractures. Typical activities during daily life that become troublesome to patients include shaking hands, washing their face, wearing gloves, and reaching for objects in narrow spaces.

The disease is more prevalent in the northern part of Europe. Men are more affected than woman, and it occurs more frequently in older patients.[2,3] Genetic research has displayed genetic pathways and subsequently family predisposition for DD.[4] Prevalence varies considerably from 0.2% to 25% depending on country and inclusion criteria.[5]

Previous reported risk factors for DD include trauma, vibrating forces, and diseases like diabetes and epilepsy as well as intoxicating agents like alcohol consumption and smoking.[5–7]

The diathesis or severity of the disease in patients is important. In the moderate diathesis, patients are typically in their sixth decade, and the disease starts in a majority of cases in the ring and/or small finger. In patients with severe diathesis, every ray may be affected. In these patients there is typically:

1. Bilateral hand involvement
2. Ectopic disease
3. Early onset of the disease

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4. A positive family history of DD[8]

Severe diathesis is associated with a higher incidence of recurrent disease after treatment.[1,8]

PATHOPHYSIOLOGY

The exact mechanism underlying the trigger to form nodules and cords at a later age is not fully understood. Millesi[9] holds the view that cellular proliferation is preceded by fibrosis of existing collagen fibers. The pathology starts with changes in the viscoelastic properties of the palmar fascia. The trigger could be the longitudinal stress of the fibers due to incomplete relaxation, which then stimulates the formation of collagen, leading to fibrosis.[9] Mechanical stress seems important, because myofibroblasts disappear in the late stages of DD when the tension is released by operation.[10]

Gabbiani and Majno[11] depicted the role of the conversion of fibroblasts in the palmar area in DD into active myofibroblasts causing contractile forces. Myofibroblasts characteristically express α-smooth muscle actin, which is the actin isoform typical of vascular smooth muscle cells and is important in wound contraction.[12] The conversion can be caused by different environmental factors, including exposure to a variety of different growth factors and cytokines, cell-to-cell interactions, and high extracellular stress from the mechanical properties of the extracellular matrix.[13]

These densely packed myofibroblasts, next to the extracellular matrix, are very active in the nodules in the palm of the hand and fingers, give rise to pits and contracted skin, and eventually mature into cords.[14] In the active nodules, collagen type 1 is converted into type 3, which resembles scar tissue. Cords contain far fewer myofibroblasts and are nearly acellular.[15,16] In DD, the myofibroblast expression is persistent, in contrast to ordinary scar tissue.[17] The myofibroblast in DD is 30% less mobile than in normal palmar fascia; this reduced migration gives rise to mature focal adhesions, which exert greater stress with consequent development of fibrosis.[18,19] The fibrotic process is complex and still not fully understood. The only way to develop new strategies is through improved understanding of the underlying pathophysiologic processes.

TREATMENT

DD is a chronic and progressive disease. Because no curative treatment exists, the primary treatment goals remain to fully straighten the affected ray(s) with a short convalescence period, while reducing the risk of recurrence and avoiding complications.

Treatment options vary widely for DD. Currently there is a jungle of treatment possibilities out there, often without any physiologic background. Indications for treatment are flexion contractures of MCP joints and/or PIP joints. Often 30° is used as a parameter; however, this threshold is not an exact science and should be adjusted depending on the individual needs, impairment, and expectations of the patient.

Nonsurgical treatment includes splinting, medication, and radiotherapy. There is no evidence that splinting alone can prevent the development of contractures. Medication is beyond the scope of this article, but is discussed in more detail in Paul M.N. Werker and Ilse Degreef's article, "Alternative and Adjunctive Treatments for Dupuytren Disease," in this issue. Radiotherapy has been used in DD in the early stages to prevent or delay further progression.[20,21] Results in the literature are variable, with some showing no difference compared with controls and others reporting a delay in the development of contractures in the irradiated group.[22,23]

More invasive treatment can consist of interrupting the cord with or without interposition of a skin graft or other biomaterial or attempting to remove as much as pathologic tissue as possible, also with or without the use of skin graft or even flaps. Four guiding theories underlie this. The first is to treat the cord very locally. The second is trying to excise the cord partially and inserting a full-thickness skin graft or a cellulose implant with the idea of creating a fire break. A third approach is fully excising all pathologic tissue, much akin to treating a tumor. A fourth approach is combining extensive surgery with a skin graft or flap with the assumption that recurrence rarely, if ever, comes back under the graft. When considering these approaches, it is important to take into consideration the diathesis of the patient and whether it is a primary or secondary case. Comparisons of long-term outcomes of the different approaches is hardly possible, because of different definitions for outcomes, such as recurrence, across the studies describing each technique. Nevertheless, there are certainly trends that can be detected looking at the published literature.

The most commonly used surgical procedure remains limited fasciectomy (LF) with primary closure. This has not changed for decades. Assessed after a minimum of 5 years' follow-up, reported recurrence rates range from 20.9% to 46.5%.[24,25] Complications after LF include edema, hematoma, infection, paresthesias, neurovascular injuries, pain, tendon ruptures, and complex regional pain syndrome (CRPS). In a previously