



PERCUTANEOUS NEEDLE APONEUROTOMY AND LIPOGRAFT FOR DUPUYTREN'S DISEASE- OUR EXPERIENCE IN FOUR WEEKS FOLLOW UP.

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ABSTRACT

Background: Dupuytren's disease is progressive disorder, which affects the palmar fascia and results in irreversible flexion posture of the fingers. Etiology is unknown and significant risk factors include old age, male sex, white northern European extraction, presence of positive family history of Dupuytren's disease, and diabetes mellitus.[1] Treatment is mainly surgical resection but it carries a long recovery period and significant rate of complications.

Objective: To present our experience with a minimally invasive technique of percutaneous needle aponeurotomy (PNA) and lipografting

Methods: The procedure of PNA and lipografting consists of percutaneous needle aponeurotomy, which is Lermisiaux modified technique and subdermal lipofilling. After the contracture release using a small hypodermic needle we inject the space between subcutaneous tissue and fascial cord with autologous lipoaspirate. We treated 15 patients with 22 rays. Primary outcome measures were total passive extension deficit improvement at one week and 4th weeks.

Results: The average total passive extension deficit (TPED) before treatment measured 86,33° at ray and post-operative mean TPED measured 22,13°. Immediately after release the mean flexion contracture correction of metacarpophalangeal (MCP) joint was from 44,33° to 1,38° degrees with 100% improvement rate. For proximal interphalangeal (PIP) joint the mean flexion contracture correction was from 51,25° to 23,75°. Patients were able to return to their normal activities after one week. We met only minor complications.

Conclusion: The procedure is minimally invasive and has short recovery time. It provides the possibility of treating multiple rays 's and the hand as a whole with no major complications.

Keywords: Dupuytren's disease, contracture, percutaneous needle aponeurotomy, lipograft,

INTRODUCTION

Dupuytren's disease is progressive disorder, which affects the palmar fascia and results in irreversible flexion posture of the fingers. Patients face difficulties in performing simple activities in their everyday life such as washing face, cutting food, shaking hands. Etiology is still unknown and

significant risk factors include old age, male sex, white northern European extraction, presence of positive family history of Dupuytren's disease, and diabetes mellitus. [1] Treatment of the condition is challenging and is directed toward correction of the contractures, not by the disease itself. Long term results are often disappointing and associated with complications and recurrences.

The most used treatment approach is surgical resection of the fibrous tissue by limited fasciectomy, but it carries a long recovery period and significant rate of complications. [2] Recurrences are not rare and according to different authors the result is between 12% to 73%. [3]

Many noninvasive treatment options are used but the results are controversial.

Collagenase injections are less invasive option which is popular in the US and some European countries. In series of studies, it was tested for the optimal effective dose and safety after application. [4, 5]. Long term results and comparison with other techniques are still lacking. Complications include edema, pain, injection site hematoma and lymphadenopathy. A great disadvantage is that it is not widely available and the price is high.

Percutaneous needle aponeurotomy is minimally invasive needle technique with perfect short term results and fast recovery period but in long term is associated with high recurrence rate. [6]

Hovius and Khouri presented a novel approach towards treatment of Dupuytren's disease which combines the benefits of the minimally invasive percutaneous needle release and fat grafting. Their results are promising in correction of the contracture and maintaining the achieved correction in 44 weeks. [7]

We represent our experience and preliminary results after percutaneous needle aponeurotomy and lipografting in the treatment of 15 patients and follow up in 4 weeks.

MATERIALS AND METHODS

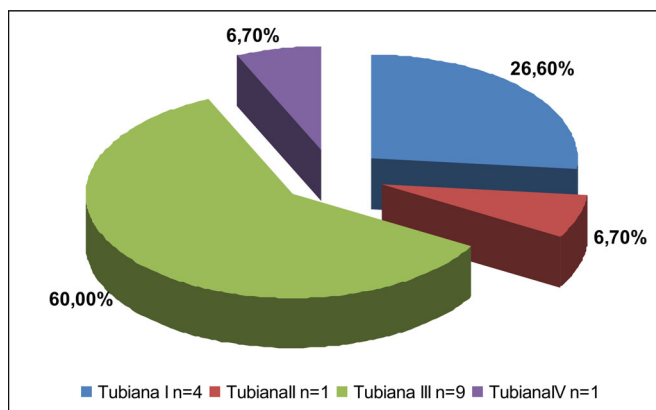
Patients

We performed percutaneous needle aponeurotomy in 15 patients and 22 rays, 6 right hands and 9 left hands. Ten patients present bilateral involvement. Recurrent disease was noted in four patients. Fourteen were men and one woman. Fourteen of them were Bulgarian and one was from Vietnam. Average age of the patients in the group was 63, 4 y.

A detailed history and clinical examination of the

hands were taken. We used Hueston table top test for preliminary evaluation of the contracture. Positive test indicates the presence of flexion contracture of the fingers. Contractures were measured with goniometer, placed on the dorsal aspect of the joint and results were recorded preoperatively, immediately postoperatively and in the follow-up period. During the examination the passive extension deficit of the MCP, PIP and DIP joints was quantified in degrees and translated into total passive extension deficit (TPED) and classified according to Tubiana classification. (Graph.1)

Graph. 1. Distribution of the patients in the Tubiana classification



To evaluate the functional deficit we used the quick DASH score. We measured the satisfaction with the treatment with visual analogue scale (VAS).

Clinical photographs of the hands were taken. Complications and satisfaction with the operation were scored and the patients were asked if they would choose the same procedure again and recommend it to a close person.

For the purpose of this study we used the following inclusion criteria:

1. Positive Hueston table top test
2. Extension deficit of the Metacarpophalangeal joint (MCP) of at least 30
3. Extension deficit of the Metacarpophalangeal joint (MCP) of at least 20 and flexion contracture of Proximal interphalangeal joint (PIP) at any degrees.

4. The presence of well-defined palmar cord
5. Reported functional deficit
6. Willingness to participate in the study

The exclusion criteria were:

1. Patients generally unfit to have surgery
2. Patients who were not allowed to stop their anticoagulants
3. Patients who were not willing to participate in the study.

Surgical technique

Percutaneous needle aponeurotomy and lipografting includes three separate procedures of fat harvesting, percutaneous needle release and lipofilling. It is performed in an operating theater under sterile conditions.

For donor sites for fat harvesting we use the region of abdomen, medial knee and thigh. After preparation of the

surgical field, through two to three puncture wounds with epidural needle, we inject the subcutaneous fat with tumescent solution containing lidocaine and epinephrine. The solution is prepared with 5 x 10ml Lidocaine 2% , 1ml Epinephrine 0,1% in 1l of physiologic solution. (Fig. 1)

We perform fat harvesting by manual liposuction with 10cc luer lock syringe connected with 12G (2,5mm) 7 hole cannula for fat harvesting. The collected lipoaspirate is allowed to settle for a while. (Fig. 2)

Percutaneous needle aponeurotomy is performed on cleaned and draped hand. The planned portals are marked with surgical pen over the cord. (Fig. 3) For anesthesia we use Lidocaine 2%, injected only superficially in the skin of the planned portals. We prevent deeper infiltration of the anesthetic by using a very small needle 30G, 5mm. The cord is sectioned at many levels progressing from proximal to distal with 25G needle and under maximal tension. After each release a passive extension of the digit is performed to obtain maximal correction of the contracture. Then we prepare the subcutaneous space for lipofilling by division of the dermal attachments with epidural needle.

We inject the through two or three portals the supernatant of the lipoaspirate using epidural needle. The quantity per ray is from 5 to 10 ml. (Fig. 4 and fig. 5)

Postoperative care includes dressing and cast immobilization for 5 days. After this period the patient is allowed to return to his everyday life.

Fig. 1. Infiltration of the subcutaneous fat tissue with tumescent solution



Fig. 2. Fat harvesting with 12 G cannula and 10cc luer lock syringe



Fig. 3. Surgical portals are planned and marked

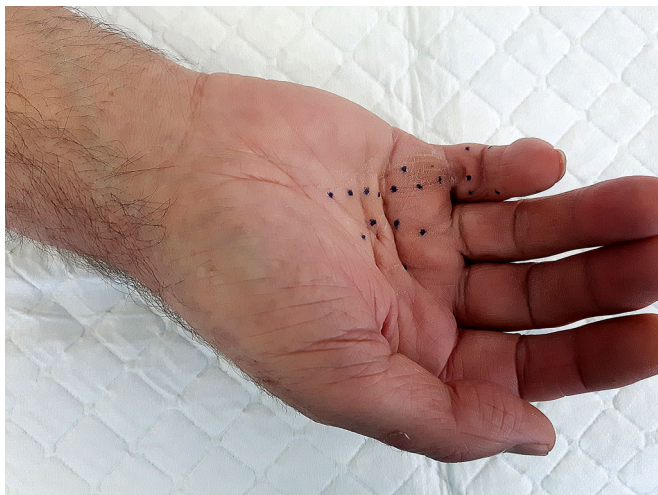


Fig. 4. After sedimentation and removal of the lowest level which contain mainly blood and tumescent solution the lipoaspirate is ready to be injected

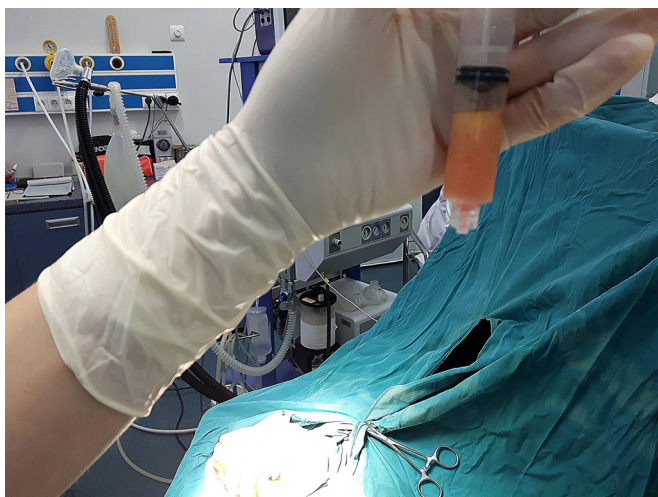


Fig. 5. Lipofilling after the contracture release with epidural needle



Statistical analysis

We used the tools of descriptive statistics and X² test to analyze statistical interaction between the presented risk factors and the degree of contracture.

RESULTS

We analyze the presented risk factors in the group for interactions with the degree of the contracture. It was not established a statistical significant relationship between preoperative values of TPED and the mentioned risk factors. (Table1)

For evaluation of the flexion contraction we used the TPED of the most severely affected ray. Preoperatively the mean TPED measured 86, 33 and after treatment measured 22, 13 with mean improvement rate of 79% and difference in degrees from the preoperative value with 66, 06. The difference in preoperative and postoperative values of TPED is statistical significant (Table 2) Significance was set at p value of less than 0, 05.

Immediately after release, the mean flexion contracture correction of the MCP joint was found from 44, 33° to 1, 8° degrees with 96, 03% improvement rate. Proximal interphalangeal joint contracture was reduced to 23, 75 residual contracture from preoperative value of 51, 25 and improvement rate of 56, 88%. (Table 3)

The registered difference in distribution of patients in stages according to Tubiana classification is statistical significant (X² = 8.400, p<0.05). After surgery 13 patients achieved Tubiana stage I.

Table 1. A list of presented risk factors and their statistical significance

Risk factor	X ² test	P-value
Smoking	22,095	0,228
Alcohol consumption	21,444	0,258
Manual labor	9,75	0,371
Trauma	9,231	0,416
Diabetes	15	0,091
Family history	9,231	0,416

Table 2. Preoperative and postoperative results of TPED

TPED	N	Mean	St.dev	Max	Min	Rate of significance
TPED preoperative	15	86,33	35,93	135	30	P<0,05
TPED postoperative	15	22,13	6,97	80	0	

Table 3. Preoperative and postoperative results of MCP and PIP joint

	Preoperative measurements	SD	Postoperative measurements	SD	Improvement rate	Measurements after 4 weeks	Follow up period
MCP joint	44,33°	21,537	1,8°	5,212	96,03%	0,8°	4 weeks
PIP joint	51,25°	16,53	23,75°	15,972	56,88%	17,8°	4 weeks

Function deficit was assessed with quick DASH score. The mean preoperative value was 39, 54 and postoperative result 13, 18. Despite the lack of specificity to Dupuytren’s disease, the difference between preoperative and postoperative result is significant.

Patients were able to return to their normal activities after one week. We met only minor complications in 3 patients, which included small skin fissures and ruptures and healed on the 7th day postoperatively. There were no tendon or nerve injuries.

Fourteen patients are satisfied with the results and would recommend the same procedure to a close person. When asked if they would choose the same treatment 14 answered that they would do so. Eight patients answered that they would not wait so long if they knew earlier for the treatment. Satisfaction was measured by using the VAS. (Graph. 2)

Graph. 2. VAS, Thirteen patients were completely satisfied with the treatment with answers below 2 cm.

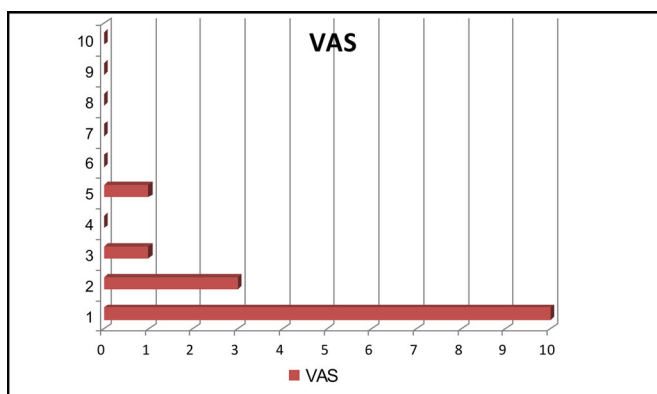


Fig. 6. preoperative photographs of the left hand in a patient with flexion contracture of the 3-rd, 4-th and 5-th ray for several years.



Fig. 7. Positive Hueston table top test, preoperative photograph of the same patient



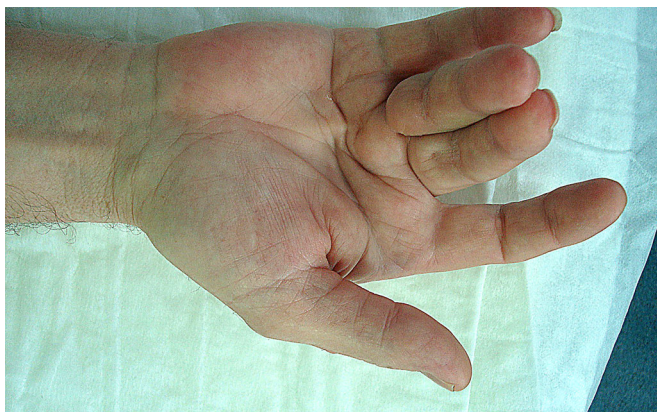
Fig. 8. Immediate postoperative photograph



Fig. 9 and 10. Clinical photographs on the 5-th day after treatment, right hand is also involved with evident flexion contracture of the fourth finger.



Fig. 11, 12, 13. Preoperative photograph on the right hand, flexion contracture of the 3-rd, and 4- th finger, photograph on the 7-th day and after one month follow up.



DISCUSSION

The aim of this study is to present our experience in 4 weeks follow up with the technique of percutaneous needle aponeurotomy and lipograft. We investigated the benefits of the method such as minimal invasiveness, quick functional recovery, effectiveness, patient satisfaction and low rate complications.

The selected patient population was relative homogeneous, as most of the patients were found in the 50-70 age interval. Fourteen of the patients were men and one woman at the age of 76 which is consistent with the data in the literature. It is well known that Dupuytren's disease affects men predominantly and increases with aging. Women are affected later in life than men and have less

severe disease. [8]

Etiology and pathophysiology of the disease is obscure but there are some risk factors which are often connected with the condition. Recent study of Descatha aims to determine the relationship between smoking, alcohol and manual labor and the presence of Dupuytren's contracture. They confirmed connection between high levels of alcohol consumption, work with vibrating tools and the presence of the disease in men. Smoking was not confirmed as a risk factor. [9]

In the presented group, we found history of heavy smoking, defined as at least a pack per day, in 64%, and 60% of the patients reported consumption of different kind of alcohol beverages, daily. However statistical analysis was negative for significant interactions. (Table 1)

We treated 11 patients with primary contracture and 4 recurrences. Our results were better as regards the MCP joint with 96, 03% improvement rate, but PIP joint corrected to lesser extent with 56,88%. Most of the patients (67%) were in Tubiana III and IV grade with contractures more than 90 degrees. In two of them we could not achieve Tubiana I grade, because of the long standing contracture of PIP joint on the little finger. A disadvantage of the minimal invasive technique is inability to correct the arthrogenic component of the contracture. Nevertheless in a report from 1996, the authors compared the functional results after severe flexion contractures of the PIP joint, with and without capsuloligamentous release. No improvement was shown statistically in the capsulotomy group, and with 27% complications compared to 19% in the control group. [10]

Our results are consistent with these found in the literature. Although there are differences in the techniques, Hovius et al. reported contracture correction from 61 degrees to 27 degrees with 34 degrees improvement for the PIP joint. For MCP joint the correction from 37 degrees to -5 degrees was noted. [7]

In a randomized control trail, van Rijsen reported 63% improvent rate of TPED compared to 79% in the limited fasciectomy group. The MCP joint improved with 67%, and reduction of the passive extension deficit of the PIP joint was 34%. [11] The reported recurrence rate in the percutaneous group, however was 85% after 5 years of follow up period. [6]

The percutaneous release offers excellent results in short term period but obviously in a long term is not so effective. Lipografting is an essential part of the presented procedure. It restores the subdermal fat pad which is often

reduced in patients. Dupuytren's disease is not confined to the palmar fascia only. The subcutaneous fat tissue in men and women with Dupuytren's disease is measured reduced. [12] It has been found differences in the cell activity and the expression of genes in the perinodular fat tissue compared to a control group. [13]

The lipograft is known to be a rich source of adipose derived stem cells. One gram of adipose tissue contains 5×10^3 stem cells, which is 500 times more than 1g.bone marrow. [14] The regenerative potential is confirmed in many recent studies. [15-17] Moreover, the adipose derived stem cells are reported to have an inhibitory effect on contraction and proliferation of myofibroblasts. [18]

Lipograft is considered to prevent recurrences as it works like an adhesion barrier between the skin and the underlying diseased fascia. The application of adhesion barriers is well- known practice in hand surgery and neurosurgery. Degreeef et al. investigate the role of cellulose implants in preventing recurrences of Dupuytren's disease and reported significantly better outcome after surgical release. [19]

Percutaneous needle aponeurotomy and lipografting combines the inherited benefits of the percutaneous technique- minimal invasiveness and low complication rate and the regenerative potential of the autologous lipoaspirate. It offers a novel regenerative approach towards an incurable and disabling disease, which is known to be Dupuytren's disease. Further studies are needed to establish the role and the place of the method in the clinical practice.

CONCLUSION

Percutaneous needle aponeurotomy and lipografting is fast, effective and has a low complication rates. It provides the possibility of treating multiple rays and the hand as a whole. Patient satisfaction is high and it is accepted very well. The procedure is minimally invasive and with short recovery time.

Abbreviations:

TPED - total passive extension deficit
PNA - Percutaneous needle aponeurotomy
MCP - metacarpophalangeal
PIP - proximal interphalangeal
DIP - distal interphalangeal
VAS - Visual analogue scale

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