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Living Textbook of Hand Surgery

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Percutaneous needle fasciotomy/needle aponeurotomy (PNF/NA)

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Introduction

Percutaneous needle fasciotomy (PNF), also called needle aponeurotomy (NA), is a technique performed under local anaesthesia with a needle to divide the cords responsible for Dupuytren's contracture. Lermusiaux, a rheumatologist from Paris deserves credit for popularizing it and for training many physicians who have spread the technique worldwide [1]. During the procedure the skin is only punctured and not incised as in Open Fasciotomy. The essential difference with other surgical techniques is that with this technique no fascia is removed.

Benefits of PNF/NA:

- limited invasiveness,
- low complication rate,
- short recovery period.

The most important drawback is its earlier and higher rate of recurrence compared to the other techniques [2].

Classic technique [1], [3]

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Video 1: Needle aponeurotomy patient information video (© Copyright The Audio Visual Suite, Derby Hospitals NHS Foundation Trust 2013)

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Video 2: Needle aponeurotomy vs. fasciectomy for Dupuytren's contracture

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Video 3: Needle aponeurotomy (NA) for Dupuytren's contracture

PNF/NA is an outpatient procedure and can be performed in a treatment room. Following disinfection, the skin is numbed only at the puncture site, using very small aliquots (0.1–0.2cc) of local anesthesia. Lidocaine 1% + adrenalin 1:100.000 will suffice, since the Dupuytren cords are insensate and the nerves must be kept sensate to warn of proximity of the needle. A 25–27G needle is mounted on the same syringe holding the local anaesthetic. Then the bevel of the needle is lined up with the markings on the syringe. In this way its orientation is always clear and its effectiveness as a mini-blade the highest. PNF/NA is best performed where the cord is not attached to the skin and on the convex side of a dimple. A cord can either be divided using an up-and-down or reciprocal movement, or by a sagittal cutting movement. Although not tested, the former technique seems to have a smaller chance of damaging digital nerves.

Treatment is safest from distal to proximal at as many points necessary, since in the finger, cords may be very close to the digital neurovascular bundles and the patient should be able to warn if a tingling sensation occurs. During the treatment, on a regular basis the sensibility of the tip of the finger should be checked and if lost, treatment at risky areas should be postponed. Finger flexion-extension should

10.5680/lhhs000014

also be tested regularly and the needle should be withdrawn if it is moving during flexion-extension because this suggests that the needle is too close to the flexor tendons. Once a cord has been divided, the treated finger should be passively extended to achieve the maximal release. If very painful, local can be injected into the PIP joint [3]. However, one should be aware that lidocaine causes apoptosis of chondrocytes and as such may cause cartilage damage [4]. To prevent skin tears especially in recurrent cases, the cords should be released from the skin. For this maneuvre, also named *subscission*, more local anesthesia and a thicker needle may be employed. In the classic Lermusiaux technique steroids are mixed with lidocaine and injected simultaneously [1], [5]. There is no high level evidence that this is beneficial [6], [7].

After care

The treated hand is put in a very light dressing that can be removed by the patient within a day or two after the treatment. The patient is thereafter allowed to resume use of the hand as long as this is not painful. Heavy labor should be avoided for the first two weeks. Full use of the hand is usually possible within one to two weeks. Some advocate the use of night splints for cases with residual contracture, but their benefit is unproven.

Complications

The number and severity of complications after PNF/NA is low, and consists mainly of skin fissures [9], [12], [13]. Nerve and artery injury are very rare [8]. Tendon injury has been reported, but is also scarce [8].

Summary of short and long outcome after PNF/NA

The effectiveness of PNF/NA is high and comparable to that of limited fasciectomy and collagenase, especially in the lower Tubiana grades (I-II); results are better at MCP level than at PIP level [9], [10], [11]. In the long run, recurrences after PNF/NA are frequent (up to 85% after 5 yrs.) [2], [12], [13]. Younger people get a recurrence earlier than older [2], [14]. Notwithstanding this, patients are satisfied and ask for PNF again, which is possible with the same effectiveness [2], [14], [15], [16].

Results of individual cohort studies

Badois in 1993 studied immediate and long term results of PNF/NA in 123 hands in a cohort of 90 patients [13]. The mean percentage of immediate good results (improvement to Tubiana 0 or I) was 81%: 92% for cases at initial Tubiana stage I, 89% stage II, 83% stage III, and 48% stage IV. Sixty-six percent of patients were followed for 5 years after one to three NA sessions. At 5-year assessment the mean Tubiana score remained low, at 0,99; the mean rate of good results was 69%: 92% for stage I, 74% stage II, 57% stage III and 38% stage IV. Five-year recurrence (definition not specified) was 50% for all cases: 43% for stage I, 48% stage II, 53% stage III and 61% stage IV. Adverse events included skin fissure in 16% of hands, transient dysesthesia in 2% and local infection in 2%. The rate of adverse events was therefore 20%.

Lermusiaux in 1997 headed a multicenter study, performed by 14 physicians [5]. They prospectively enrolled 799 patients with 992 affected hands, for which 1557 PNF/NA sessions and 3,736 PNF/NA procedures were performed. Short-term improvement of total extension deficit and adverse events were reported. Good results (corresponding to ≥70% improvement) were observed in 81% of all hands. Values were 93% for cases at stage I, 78% stage II, 71% stage III, and 57% stage IV. The rate of adverse events was 14% of hands. Skin fissure was observed in 8% of hands, transient dysaesthesia in 3%, local infection in 0.7%, and flexor tendon rupture in 0.2%. Long term results were not reported.

Foucher et al. in 2003 reviewed the charts of 211 patients treated consecutively on 261 hands and 311 fingers with PNF/NA [12]. The first 100 patients were evaluated with a mean follow up of 3.2 years to assess the rate of recurrence and extension of the disease. Division of the cords was performed only in

the palm in 165 cases, in the palm and finger in 111 and purely in the finger in 35. Complications were scarce (no infection or tendon injury) but one digital nerve was found injured during a second procedure. Postoperative gain was best at metacarpophalangeal joint level (79% versus 65% at interphalangeal level). The reoperation rate was 24%. In the group assessed at 3.2 years follow up, the recurrence rate was 58% and disease “activity” 69%. Fifty nine hands needed further surgery.

Van Rijssen et al., 2006 reported the outcome of a pilot study using PNF/NA on 74 fingers [10]. Immediate outcome was excellent with an average improvement of 77%. After 32 months 55 rays could be reviewed. Their recurrence rate was 65%, defined as an increase in TPED of more than 30^{o}. Two patients experienced a slightly diminished sensibility on one side of the finger.

Pess et al., 2012 reported a retrospective study of the results of PNF/NA for the treatment of Dupuytren’s contracture in 474 patients with 1,013 fingers treated [14]. The average age at treatment was 62 years (range, 33–92 y). The MCPJ contracture before the procedure averaged 35° (range, 15–95°) and PIPJ 50° (range, 15–110°). Immediately after the procedure and at least 3 years after treatment (range, 3.0–6.2 y), MCPJ and PIPJ were measured and records reviewed for complications. MCPJ contractures were corrected an average of 99% and PIPJ contractures an average of 89% immediately after the procedure. At final follow-up, 72% of the correction was maintained for MCPJ and 31% for PIPJs. The. difference between the final corrections for MCPJ versus PIPJ was statistically significant. Comparison of the final results of patients age 55 years and older versus under 55 years, revealed a statistically significant difference at both MCPJ and PIPJs, with greater correction maintained in the older group. Gender differences were not statistically significant. PNF/NA provided successful correction to 5 or less contracture immediately after the procedure in 98% (791) of MP joints and 67% (350) of PIP joints. There was recurrence of 20 or less over the original correction after the procedure in 80% (646) of MCPJs and 35% (183) of PIPJs. Complications were rare except for skin tears, which occurred in 3.4% (34) of digits.

Results of individual randomized clinical trials

Van Rijssen et al., 2006: This is the first paper on a randomized controlled trial designed to compare the outcome of PNF/NA and limited fasciectomy (LF) [9]. 166 rays were randomly assigned to the treatment groups: 88 for PNF/NA and 78 for LF. In the PNF group TPED improved by 63% versus 79% in the LF group; this difference was statistically significant. Results at the PIPJ were worse than those at the MCPJ and DIPJ for both the PN/NA and LF groups. The rays classified before surgery as Tubiana stages I and II showed no difference between these treatments, but for rays higher than stage II LF clearly was superior to PNF/NA as a treatment modality. In the LF group one nerve was damaged (5%) versus 0% in the PNF/NA group. Patient satisfaction was almost equal. Hand function after treatment was found to be better in the PNF/NA group, as was the degree of discomfort that patients experienced. This was underscored by the disabilities of the arm, shoulder, and hand scores in the PNF/NA group, which were significantly lower than those in the LF group at all time points measured.

Van Rijssen et al., 2012: This article describes the 5-year follow-up results of the just mentioned randomized controlled study that compared PNF/NA and LF [2]. One hundred eleven patients with 115 affected hands with a minimal passive extension deficit of 30 degrees were assigned randomly to the two groups. Follow-up examinations were performed at 6 months; and 1, 2, 3, 4, and 5 years. Outcome parameters were total passive extension deficit, patient satisfaction, flexion, and sensibility. Furthermore, disease extension was recorded. The primary endpoint was recurrence, defined as an increase of total passive extension deficit of greater than 30 degrees. Ninety-three patients reached this endpoint. The recurrence rate after 5 years in the needle fasciotomy group (84.9 percent) was significantly higher than in the limited fasciectomy group (20.9 percent) ($p<0.001$), and occurred significantly sooner in the needle fasciotomy group ($p<0.001$). Older age at the time of treatment decreased the recurrence rate ($p<0.005$). No other diathesis characteristics influenced recurrence. Patient satisfaction was high in both groups but was significantly higher in the limited fasciectomy group. Nevertheless, many patients (53 percent) preferred percutaneous needle fasciotomy in case of recurrence.

Van Rijssen, 2012: 30 patients with recurrent Dupuytren's Disease in 40 fingers, were treated by PNF/NA with a mean follow-up of 4.4 years [15]. Primary outcome measures were total passive extension deficit reduction and interval to a second recurrence, defined as an increase of more than 30° compared with the result at the end of the previous treatment. Complications were noted. Total passive extension reduction was 76%. PNF/NA was especially effective for the MCPJ, with an average reduction of 93%, whereas the average reduction in the PIPJ was 57%. A total of 50% of patients did not develop a secondary recurrence during follow-up. The other 50% did, and was treated again within an average of 1.4 years after PNF/NA. By means of PNF/NA, tertiary treatment was postponed for an average of 2.9 years starting from the initial treatment for Dupuytren's Disease. All secondary recurrences were successfully treated by limited fasciectomy, according to patients' wishes. No major adverse effects occurred.

Results of a specific comparison of PNF and collagenase

Nydick et al. have compared PNF/NA with collagenase injection in the treatment of Dupuytren'scontracture [11]. They performed a retrospective review for this purpose. Range of motion, patient satisfaction, and complications were recorded. There were 29 patients in the collagenase group with mean baseline contractures of 40° for 22 affected MCPJ and 50° for 12 affected PIPJs. The PNF/NA group was composed of 30 patients with mean baseline contractures of 37° for 32 affected MCPJs and 41° for 18 affected PIPJs. All patients were observed for a minimum of 3 months. Clinical success (reduction of contracture within 0° to 5° of normal) was accomplished in 35 of 50 joints (67%) in the PNF/NA group and in 19 of 34 joints (56%) in the collagenase group. Patient satisfaction was similar between groups. Only minor complications were observed, including skin tears, ecchymosis, edema, pruritus, and lymphadenopathy. In the short term, both PNF/NA and collagenase have similar clinical outcomes and patient satisfaction.

Cost-effectiveness of PNF/NA versus collagenase and LF

In a study by Baltzer and Binhammer it was found that PNF/NA is the most cost-effective treatment for a single digit DD contracture [17]. In Canada, Dupuytren's contracture is managed with limited fasciectomy or PNF/NA. They state that the optimal management of Dupuytren's contracture is controversial and trade-offs exist between the different methods. Using a cost-utility analysis approach, the aim of the authors was to identify the most cost-effective form of treatment for managing Dupuytren's contracture and define the threshold at which collagenase is cost-effective. They developed an expected-value decision analysis model for Dupuytren's contracture affecting a single finger, comparing the cost-effectiveness of LF, PNF/NA and collagenase from a societal perspective. Cost-effectiveness, one-way sensitivity and variability analyses were performed using standard thresholds for cost effective treatment ($50,000 to $100,000/QALY gained). PNF/NA was the preferred strategy for managing contractures affecting a single finger. The cost-effectiveness of primary PNF/NA improved when repeated to treat recurrence. LF was not cost-effective. Collagenase was cost-effective relative to and preferred over PNF/NA at $875 and $470 per course of treatment, respectively. This model supports the trend towards non-surgical interventions for managing Dupuytren's contracture affecting a single finger. Injectable collagenase will only be feasible in the Canadian publicly funded healthcare system if it costs significantly less than current United States pricing.

Chen et al., 2011: The authors undertook a cost-utility analysis to compare LF for Dupuytren with 2 new treatments, PNF/NA and collagenase injection [18]. They constructed an expected-value decision analysis model with an arm representing each treatment. A survey was administered to a cohort of 50 consecutive subjects to determine utilities of different interventions. They conducted multiple sensitivity analyses to assess the impact of varying the rate of disease recurrence in each arm of the analysis as well as the cost of the collagenase injection. The threshold for a cost-effective treatment is based on the traditional willingness-to-pay of $50,000 per quality-adjusted life years (QALY) gained. The cost of LF was $820,114 per QALY gained over no treatment. The cost of PNF/NA was $96,474 per QALY gained versus no treatment. When they performed a sensitivity analysis and set the success rate at 100%, the cost of PNF/NA was $49,631. When PNF/NA was performed without surgical center or anesthesia costs

and with reduced hand therapy, the cost was $36,570. When a complete collagenase injection series was priced at $250, the cost was $31,856 per QALY gained. When the injection series was priced at $945, the cost was $49,995 per QALY gained. At the market price of $5,400 per injection, the cost was $166,268 per QALY gained. They conclude that in the current model, LF is not cost-effective. PNF/NA is cost-effective if the success rate is high. Collagenase injection is cost-effective when priced under $945.

Herrera et al. compared the immediate direct costs of open fasciectomy to percutaneous needle aponeurotomy (NA) for the surgical treatment of Dupuytren's contracture [19]. A retrospective review was performed comparing patients treated with open fasciectomy (group 1) to patients treated with percutaneous NA (group 2) from 2008 to 2010. Financial and medical records were reviewed. Direct cost of treatment was calculated from hospital billing records, including surgical, anesthesia, and facility fees. Statistical analysis was performed using unpaired t test. Twenty-four patients received open segmental palmar and/or digital fasciectomy (group 1). Group 2 consisted of 24 patients. Immediate postoperative contracture correction was similar between both. Two complications occurred in group 1 (wound dehiscence and nerve injury); no complications in group 2. Mean cost for group 1 was $11,240 and mean cost for group 2 was $4,657 ($p<0.0001$).

Conclusions

Percutaneous NA is associated with decreased direct costs in the short-term compared to traditional open fasciectomy with comparable deformity correction.

Websites with info on PNF/NA

- From the group of French rheumatologists that have popularized the technique: http://f.badois-dupuytren.pagespro-orange.fr/html/gbsommaire.html
- Website of Dr. Charles Eaton, MD, from Jupiter, FL, one of the pioneers of NA in the USA: http://www.handcenter.org/newfile14.htm
- Website of Dupuytren Society, a patient based information channel about all aspects of Dupuytren's Disease: http://www.dupuytren-online.info/needle_aponeurotomy.html
- Website of Dupuytren Foundation. Offers similar information as that of Dupuytren Society: http://www.dupuytrenfoundation.org/

References

1. Beaudreuil J, Lellouche H, Orcel P, Bardin T. Needle aponeurotomy in Dupuytren's disease. Joint Bone Spine. 2012 Jan;79(1):13-6. DOI: 10.1016/j.jbspin.2011.03.003
2. van Rijssen AL, ter Linden H, Werker PM. Five-year results of a randomized clinical trial on treatment in Dupuytren's disease: percutaneous needle fasciotomy versus limited fasciectomy. Plast Reconstr Surg. 2012 Feb;129(2):469-77. DOI: 10.1097/PRS.0b013e31823aea95
3. Eaton C. Percutaneous fasciotomy for Dupuytren's contracture. J Hand Surg Am. 2011 May;36(5):910-5. DOI: 10.1016/j.jhsa.2011.02.016
4. Grishko V, Xu M, Wilson G, Pearsall AW 4th. Apoptosis and mitochondrial dysfunction in human chondrocytes following exposure to lidocaine, bupivacaine, and ropivacaine. J Bone Joint Surg Am. 2010 Mar;92(3):609-18. DOI: 10.2106/JBJS.H.01847
5. Lermusiaux JL, Lellouche H, Badois JF, Kuntz D. How should Dupuytren's contracture be managed in 1997? Rev Rhum Engl Ed. 1997 Dec;64(12):775-6.
6. McMillan C, Binhammer P. Steroid injection and needle aponeurotomy for Dupuytren contracture: a randomized, controlled study. J Hand Surg Am. 2012 Jul;37(7):1307-12. DOI: 10.1016/j.jhsa.2012.04.026
7. Broekstra DC, Werker PM. Steroid injections in combination with needle aponeurotomy as a treatment method for Dupuytren disease: suggestions for increasing the research evidence. J Hand Surg Am. 2012 Nov;37(11):2429-30; author reply 2430-1. DOI: 10.1016/j.jhsa.2012.08.037
8. Symes T, Stothard J. Two significant complications following percutaneous needle fasciotomy in

a patient on anticoagulants. J Hand Surg Br. 2006 Dec;31(6):606-607.
9. van Rijssen AL, Gerbrandy FS, Ter Linden H, Klip H, Werker PM. A comparison of the direct outcomes of percutaneous needle fasciotomy and limited fasciectomy for Dupuytren's disease: a 6-week follow-up study. J Hand Surg Am 2006 May-Jun;31(5):717-725.
10. van Rijssen AL, Werker PM. Percutaneous needle fasciotomy in dupuytren's disease. J Hand Surg Br. 2006 Oct;31(5):498-501.
11. Nydick JA, Olliff BW, Garcia MJ, Hess AV, Stone JD. A comparison of percutaneous needle fasciotomy and collagenase injection for dupuytren disease. J Hand Surg Am. 2013 Dec;38(12):2377-80. DOI: 10.1016/j.jhsa.2013.08.096
12. Foucher G, Medina J, Navarro R. Percutaneous needle aponeurotomy: complications and results. J Hand Surg Br. 2003 Oct;28(5):427-431.
13. Badois FJ, Lermusiaux JL, Massé C, Kuntz D. [Non-surgical treatment of Dupuytren disease using needle fasciotomy]. Rev Rhum Ed Fr. 1993 Nov 30;60(11):808-13.
14. Pess GM, Pess RM, Pess RA. Results of needle aponeurotomy for Dupuytren contracture in over 1,000 fingers. J Hand Surg Am. 2012 Apr;37(4):651-6. DOI: 10.1016/j.jhsa.2012.01.029
15. van Rijssen AL, Werker PM. Percutaneous needle fasciotomy for recurrent Dupuytren disease. J Hand Surg Am. 2012 Sep;37(9):1820-3. DOI: 10.1016/j.jhsa.2012.05.022
16. Beaudreuil J, Lermusiaux JL, Teyssedou JP. Multi-needle aponeurotomy for advanced Dupuytren's disease: a 16-month follow-up study (MNA 2 Study). J Hand Surg Eur Vol. 2012 Oct;37(8):795-6. DOI: 10.1177/1753193412439170
17. Baltzer H, Binhammer PA. Cost-effectiveness in the management of Dupuytren's contracture. A Canadian cost-utility analysis of current and future management strategies. Bone Joint J. 2013 Aug;95-B(8):1094-100. DOI: 10.1302/0301-620X.95B8.31822
18. Chen NC, Shauver MJ, Chung KC. Cost-effectiveness of open partial fasciectomy, needle aponeurotomy, and collagenase injection for dupuytren contracture. J Hand Surg Am. 2011 Nov;36(11):1826-1834.e32. DOI: 10.1016/j.jhsa.2011.08.004
19. Herrera FA, Benhaim P, Suliman A, Roostaeian J, Azari K, Mitchell S. Cost comparison of open fasciectomy versus percutaneous needle aponeurotomy for treatment of Dupuytren contracture. Ann Plast Surg. 2013 Apr;70(4):454-6. DOI: 10.1097/SAP.0b013e31827e531d

Videos

Video 1: https://www.youtube.com/embed/cGvFbY0mneQ
Video 2: https://www.youtube.com/embed/cpHfRXgi6D8
Video 3: https://www.youtube.com/embed/pg6plahMem0

Citation note: Werker PM. Percutaneous needle fasciotomy/needle aponeurotomy (PNF/NA). Version 2016-04-27. In: Handchirurgie Weltweit e.V., Böttcher R, editors. Living Textbook of Hand Surgery. Cologne: German Medical Science GMS Publishing House; 2014-.DOI: 10.5680/lhhs000014