Hand Surgery and Rehabilitation xxx (xxxx) xxx–xxx

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Original article

Shortening arthrodesis combined with limited fasciectomy in severe recurrent Dupuytren's disease of the fifth finger

Arthrodèse raccourcissante et fasciectomie limitée dans les récidives des formes sévères de maladie de Dupuytren du cinquième doigt

Bert Vanmierlo [a,b,1], Eduard Van Eecke [a,1,*], Arne Decramer [a], Tim Vanmierlo [c,d], Kjell Van Royen [e,f], Jean Goubau [f,g]

[a] *AZ Delta Roeselare, Department of Orthopaedics and Traumatology, Brugsesteenweg 80, 8800 Roeselare, Belgium*
[b] *Hasselt University, Department of Cardio and Organ Systems, Martelarenlaan 42, 3500 Hasselt, Belgium*
[c] *Hasselt University, Biomedical Research Institute (Biomed), Department of Immunology and Biochemistry, Martelarenlaan 42, 3500 Hasselt, Belgium*
[d] *Maastricht University, Division of Translational Neuroscience, Department of Psychiatry and Neuropsychology, School for Mental Health and Neuroscience (MHeNs), Minderbroedersberg 4-6, Maastricht, the Netherlands*
[e] *OLV Aalst, Department of Orthopaedics and Traumatology, Moorselbaan 164, 9300 Aalst, Belgium*
[f] *UZ Brussel, Department of Orthopaedics and Traumatology, Laarbeeklaan 101, 1090 Brussel, Belgium*
[g] *AZ Maria Middelares, Department of Orthopaedics and Traumatology, Buitenring Sint-Denijs 30, 9000 Gent, Belgium*

ARTICLE INFO

Article history:
Received 3 March 2023
Received in revised form 19 April 2023
Accepted 20 April 2023
Available online xxx

Keywords:
Dupuytren's disease
Recurrence
Shortening arthrodesis
Fasciectomy
Salvage

ABSTRACT

Objective: Management of recurrent Dupuytren's disease of the little finger is challenging. Various treatment modalities have been proposed: external fixation, local skin flap, dermofasciectomy, or even amputation. An alternative surgical technique was introduced by Honecker et al. in 2016 and refined by Raimbeau et al. in 2019, consisting in resection of the middle phalanx and shortening arthrodesis. We modified the technique by combining arthrodesis with a limited fasciectomy of the abductor and/or pretendinous cord in the fifth ray to improve cosmetic and functional outcomes.
Methods: Patients with severe recurrent Dupuytren's disease of the little finger (Tubiana stage III/IV) were treated with proximodistal interphalangeal arthrodesis, combined with limited fasciectomy. Range of motion was assessed preoperatively and postoperatively. QuickDASH and a VAS were assessed to determine overall function and pain respectively. Radiographic evaluation was made at 6 and 12 weeks postoperatively.
Results: Thirteen patients were eligible for inclusion. Mean age was 69 years (range 49–87). Radiographic consolidation was obtained at a mean 58 days (range 27–97). Full extension of the metacarpophalangeal joint was achieved in 11 patients and full adduction in 12. Mean active flexion was 94° (range 90–100). QuickDASH scores decreased from 18 to 12 after surgery. Pain scores were low and unchanged.
Conclusion: By combining proximodistal interphalangeal arthrodesis with limited fasciectomy through a volar approach, finger extension improved, and fixed abduction was also treated. The combined volar and dorsal approach did not induce vascular impairment or other complications.

Abbreviations: DD, Dupuytren's disease; PDI, Pproximo distal interphalangeal arthrodesis; MP, metacarpophalangeal; PIP, proximal interphalangeal joint; DIP, distal interphalangeal joint; DASH, Disabilities of the Arm, Shoulder and Hand; VAS, visual analogue scale.

* Corresponding author.
E-mail address: eduard.van.eecke@hotmail.com (E. Van Eecke).
[1] The authors have contributed equally to the article and share first authorship.

https://doi.org/10.1016/j.hansur.2023.04.005
2468-1229/

Mots-clés :
Dupuytren
récidive
Arthrodèse
raccourcissante
Fasciectomie
Sauvetage

RÉSUMÉ

Objectif. – Le traitement de la récidive de la maladie de Dupuytren du 5 ° doigt est un vrai défi. De multiples modalités de traitement ont déjà été proposées comme la fixation externe, les lambeaux cutanés locaux, la dermo-fasciectomie et même l'amputation. Une technique chirurgicale alternative a été introduite par Honecker et al. en 2016 et affinée par Raimbeau et al. en 2019, consistant en une résection de la phalange moyenne associée à une arthrodèse raccourcissante. Nous avons modifié la technique en combinant l'arthrodèse avec une fasciectomie limitée de la corde abductrice et/ou prétendineuse pour améliorer le résultat cosmétique et fonctionnel.

Méthodes. – Tous les patients ont bénéficié d'un traitement chirurgical associant une arthrodèse interphalangienne proximo-distale de l'auriculaire combinée à une fasciectomie limitée pour récidive sévère de maladie de Dupuytren (stade III/IV de Tubiana). L'amplitude de mouvement et le degré d'abduction ont été évalués en pré- et post-opératoire, ainsi que les échelles de score QuickDASH et VAS pour déterminer la fonction globale et la douleur. Une évaluation radiographique a été effectuée six et douze semaines après l'opération.

Résultats. – Treize patients ont été inclus. L'âge moyen des patients était de 69 ans (49–87). La consolidation radiographique a été obtenue après une moyenne de 58 jours (27–97). Une extension complète de l'articulation metacarpo-phalangienne a pu être obtenue chez 11 patients sur 13, une adduction complète chez 12 patients sur 13. Une flexion active moyenne de 94° a été mesurée (90–100). Les scores QuickDASH ont diminué de 18 à 12 après la chirurgie. Les scores de douleur étaient faibles et sont restés égaux avant et après l'opération.

Conclusion. – En combinant une arthrodèse inter-phalangienne proximo-distale avec une fasciectomie limitée par une approche palmaire, l'extension des doigts s'est améliorée et l'abduction fixe a été maîtrisée. L'approche palmaire et dorsale combinée n'a pas induit de complication, notamment vasculaire.

1. Introduction

Recurrent Dupuytren's disease (DD) is characterized by the presence of nodules and/or cords in an area of the hand that has already endured DD surgery [1]. Recurrent contracture of the small finger may be severe and interfere with activities of daily living and result in hook finger [2]. The management of recurrent DD of the little finger is challenging. Various treatment modalities have been proposed: external fixation, application of local skin flaps, dermofasciectomy, and even amputation [3]. These techniques are challenging because of a combination of severe contracture, impaired soft-tissue quality, and scarring due to previous surgery. Amputation with resection of the fifth ray is frequently a last resort, but can lead to serious complications such as phantom pain and cold intolerance [1]. Hand function is impaired, and cosmetic results are disappointing. As an alternative, Watson et al. introduced a technique consisting in palmar aponeurectomy associated to shortening of the proximal phalanx and arthrodesis of the proximal interphalangeal (PIP) joint in 30° flexion through a dorsal approach [2]. Honecker et al. introduced a technique consisting in complete resection of the middle phalanx and fusion of the shortened finger by proximodistal interphalangeal (PDIP) arthrodesis through a dorsal approach [3]. The technique was later refined by Raimbeau et al. [4]: we modified the technique by systematically associating PDIP arthrodesis to limited fasciectomy of the abductor cord and/or pretendinous cord in the fifth ray. Combining a dorsal approach with a limited volar approach is safe in terms of little-finger vascularization [4], and improves outcome, cosmetically and functionally.

2. Methods

Patients who were treated with PDIP arthrodesis of the little finger combined with limited fasciectomy for advanced DD between 2019 and 2021 were evaluated. All patients experienced severe recurrent DD in the little finger (Tubiana stage III/IV). All had undergone one or more previous surgeries for DD. All procedures were performed by a single senior hand surgeon. A goniometer was applied to assess the range of motion in the affected little finger (metacarpophalangeal (MP) joint and PIP joint) preoperatively, and postoperatively (MP joint) (Fig. 1). Measurements were performed dorsally in maximal extension and maximal flexion. The degree of residual little-finger abduction was assessed. The Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score assessed overall function. Pain was self-assessed on a visual analogue scale (VAS), from 0 = no pain to 10 = worst imaginable pain. Radiographic evaluation consisted of standard PA and lateral finger X-rays at 6 weeks and 3 months postoperatively (Fig. 2). Analysis of comorbidities was also performed.

2.1. Surgical technique

The surgical technique was as described by Honecker et al. and refined by Raimbeau et al. [3,4]. The surgical intervention was performed under regional nerve block on an outpatient basis. Surgery started with a dorsal H-approach, centered over the middle phalanx (Fig. 3). Sharp excision of the middle phalanx was followed by cartilaginous decortication of the head of the proximal phalanx and the base of the distal phalanx. The two phalanges were reduced by intramedullary K-wire on an inside-out technique. The K-wire served as guide for a headless intramedullary compression screw. Subsequently, selective fasciectomy of a pretendinous and/or abductor cord was performed through a volar approach (Fig. 4). Systematic association of volar aponeurectomy to the dorsal approach is not strictly necessary and should be evaluated on a case-by-case basis. In the present series, the volar approach was systematically associated to the dorsal approach, for various reasons. In patients with an abductor cord, it allowed selective aponeurectomy of the cord and correction of the abduction deformity. In patients with severe contracture (Tubiana stage IV), associating selective aponeurectomy allowed additional improve-

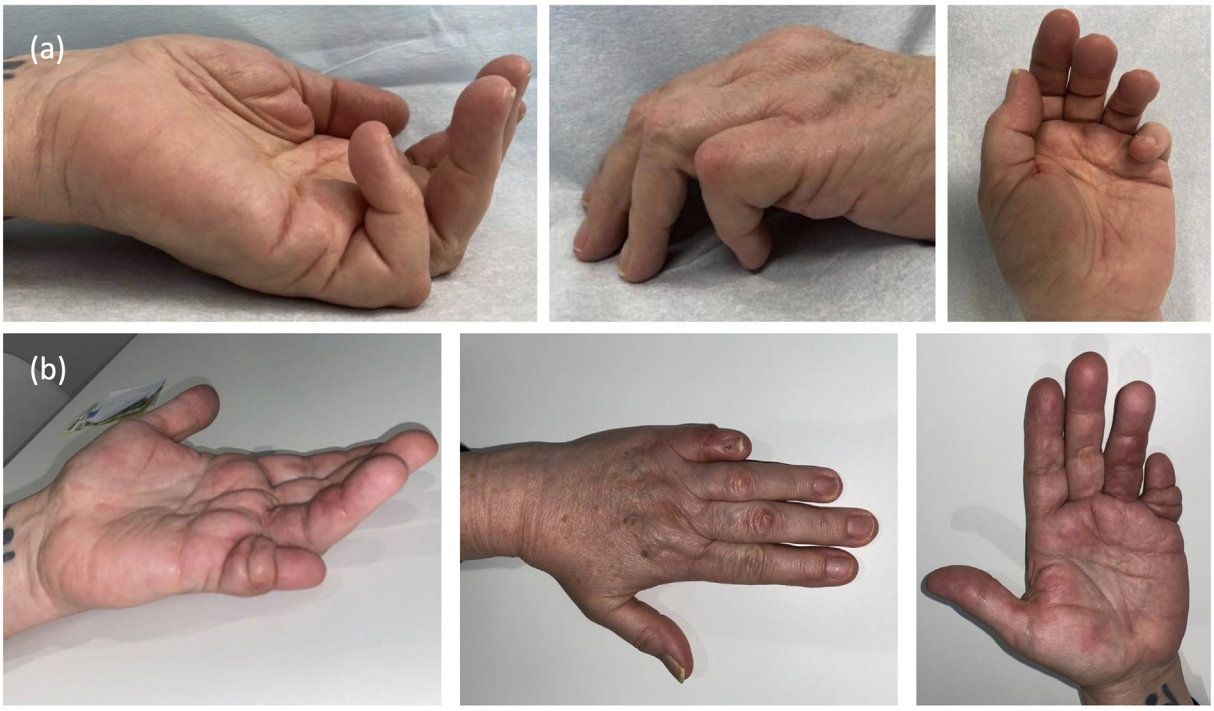

Fig. 1. Clinical findings preoperatively (a) and six weeks postoperatively (b).

Fig. 2. Postoperative radiographs in AP (a) and lateral (b) view.

ment of MP joint extension, when not fully corrected after proximodistal arthrodesis. A Z-plasty provided the additional advantage of dealing with linear skin contractures and/or scarring.

Cosmetic appearance was improved by resection of overlapping distal skin flaps on the dorsum and by the Z-plasty on the volar aspect of the fifth finger. A volar extension splint was used for 1 week, after which physiotherapy was initiated. Early active motion was encouraged. A segmental night splint in extension was applied for an additional month.

3. Results

Thirteen patients underwent the procedure. The male to female ratio was 11:2. Mean patient age was 67 years (range 49–79). Seven patients were diagnosed with Tubiana stage III DD and 6 with stage IV. Six of the 13 patients showed a clear abductor cord. Examination of patients' medical records showed bilateral disease in 10 patients. Severe arterial hypertension was noted in 7 patients, diabetes in 2, significant smoking (>10 pack years) in 4, alcohol

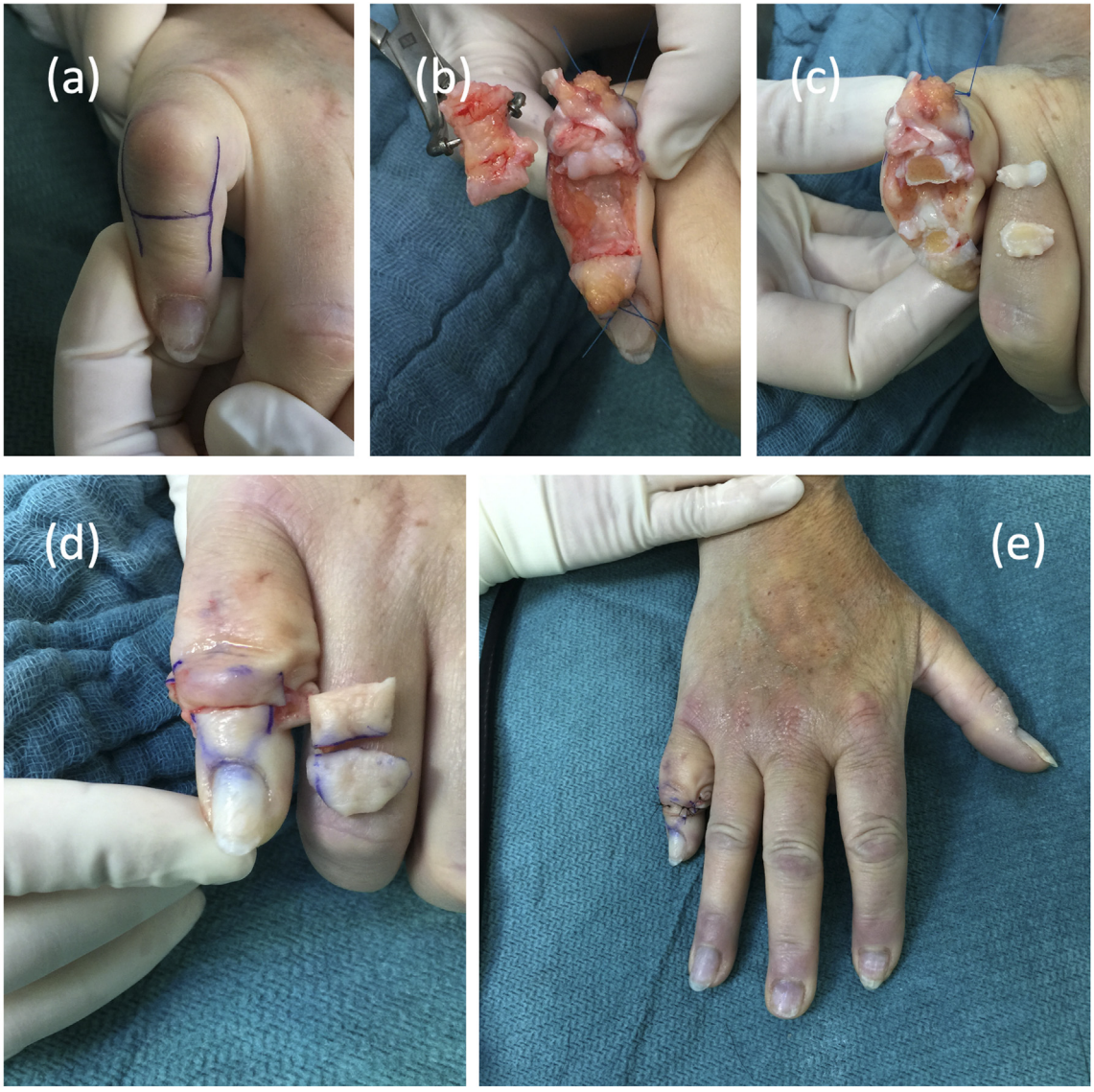

Fig. 3. Dorsal approach. (a) Dorsal H-incision. (b) Complete resection middle phalanx. (c) Resection of the distal articular surface of the proximal phalanx and proximal articular surface of the distal phalanx. (d) Excision of excess skin. (e) End result.

abuse in 4, peripheral arterial disease in 4, malignancy under active treatment in 3, rheumatoid arthritis in 2, and chronic kidney failure in 2.

Mean follow-up was 124 days (range 57–258) (see Table 1). No postoperative infections, wound healing problems, neurovascular injuries, phantom pain, postoperative cold intolerance, etc. were seen. Radiographic consolidation was achieved at a mean 64 days (range 27–132). In all but 2 patients, full MP joint extension was obtained. Mean MP joint active flexion was 93° (range 82–100). In all but 2 patients, full little-finger adduction was obtained; the residual abduction deformity in these 2 patients was ≤10°. QuickDASH score distribution was normal on Kolmogorov-Smirnov test, enabling paired-samples T-testing to compare the pre- and post-operative scores. Mean QuickDASH score decreased significantly from 19.6 preoperatively to 11.6 after surgery. ($p = 0.042$). Pain scores were low and unchanged, although 2 patients reported pain both before and after surgery. The patient who was dissatisfied with the outcome had severe concurrent rotator-cuff disease, thumb-base osteoarthritis and underlying tenovaginitis of the flexor tendons of the long fingers, resulting in a high QuickDash score, unchanged pain and general dissatisfaction. The other patient reporting pain suffered from a frozen shoulder, which resulted in persistent pain, but was satisfied overall (see Table 2).

4. Discussion

Recurrence after surgery for severe DD is common and more frequent when the diathesis is strong. The little finger has poorer prognosis, and recurrence rates after repeated open fasciectomy range from 16.6%–39% [5–7]. Furthermore, the risk of wound-healing complications appears to be higher in these patients [8,9]. Amputation of the fifth finger has been proposed as a surgical alternative. Tonkin et al. performed this procedure in 9.1% of patients in their study of 154 DD procedures in patients with predominant PIP joint involvement [10]. Amputation of the fifth ray incurs considerable morbidity: risk of flexion deformity, loss of grip strength, neuroma-related pain, and/or phantom finger syndrome [11]. As an alternative, Watson and Lovallo described PIP joint fusion, with resection of the distal third of the proximal phalanx [2]. As mentioned above, palmar aponeurectomy was combined to arthrodesis of the PIP joint in 30° flexion, after

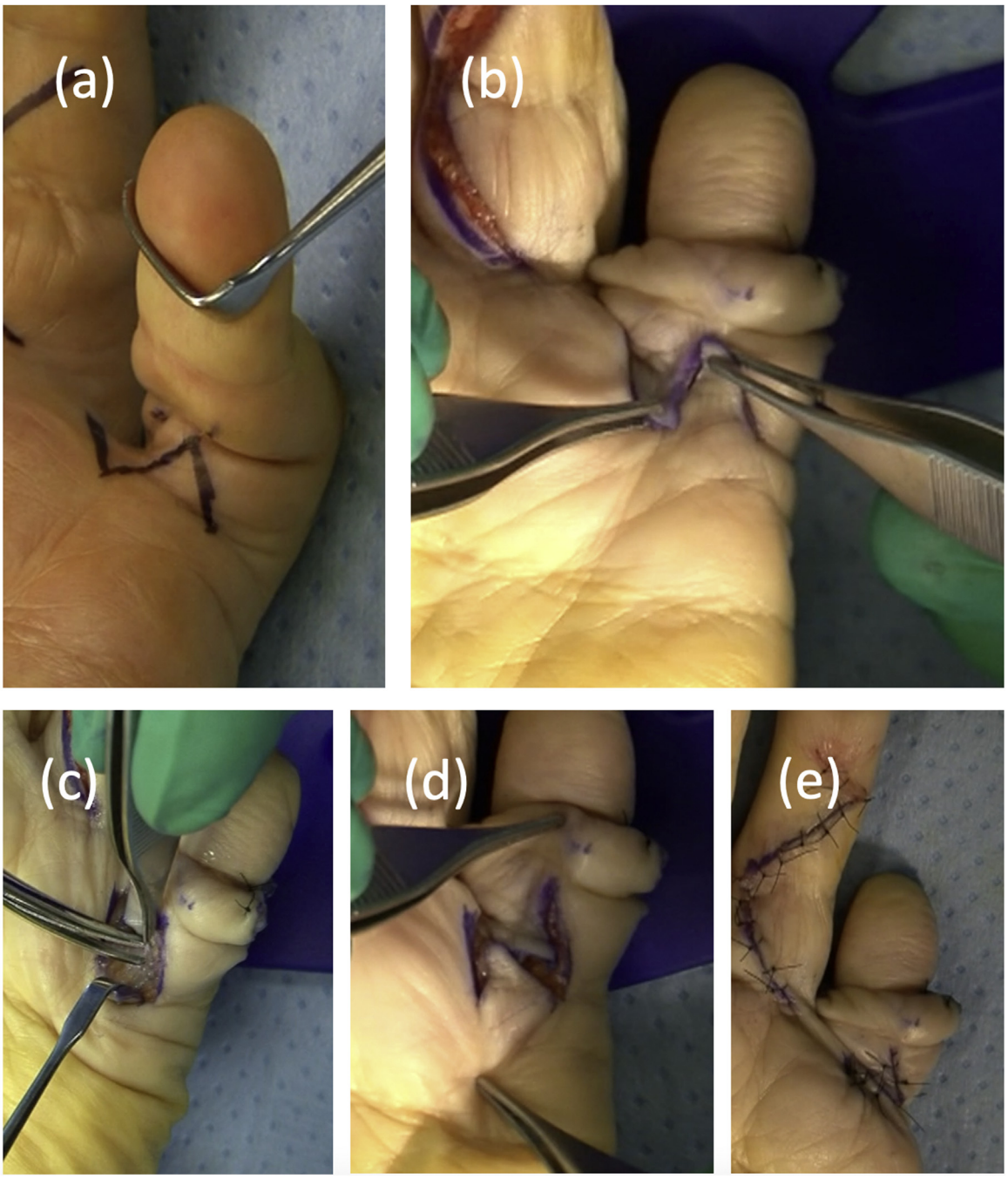

Fig. 4. Volar approach.

shortening the proximal phalanx. The authors reported satisfactory function and cosmesis, but with inability to hold small objects in the ulnar part of the palm. A similar technique was described by Bolt et al. [12]. The authors combined a limited volar approach with PIP joint arthrodesis in a functional position. Conserved little-finger length and the functional position of the PIP joint likely increased dexterity and grip strength. We agree with the authors that this technique is suitable for severe recurrent PIP contracture, most likely Tubiana stage III. But, in our opinion, the technique is less suitable for patients with severe recurrent stage IV DD, especially in case of severe scarring and poor skin quality. In these patients, it is impossible to conserve length and adequately correct contracture without wound closure issues, skin healing problems and early recurrence of the contracture. Based on this technique, Honecker published the results of a case series of 7 proximodistal arthrodeses of the little finger for a variety of pathologies, including 4 patients with Tubiana stage III DD [3]. The technique comprised a dorsal approach, complete resection of the middle

Table 1
Patient demographics.

Factors	N
Sample size	13
Follow-up (days)	124 (range 57–258)
Age (years)	69 (range 49–79)
Gender (male/female)	11/2
Tubiana stage (III/IV)	7/6
Abductor cord (Y/N)	6/7

Table 2
Pre-operative and post-operative data.

Age	Gender	X-ray: fusion (days)	Contracture preop° (MP-PIP-DIP)	Total flexion contracture (°)	Tubiana stage	Post-op contracture (°)	Residual abduction (°)	Active flexion (°)	Follow-up (days)	QUICK-DASH preop	QUICK-DASH postop	VAS preop	VAS post-op	Diameter headless compression screw (mm)	Satis-faction	Fusion
79	M	57	60 + 66	126	III	12	8	96	57	4.5	0	0	0	2.0	yes	yes
72	M	97	30 + 90	120	III	0	0	90	97	4.5	4.5	0	0	2.5	yes	yes
66	M	85	85 + 82	167	IV	20	0	90	85	25	2.3	0	0	2.5	yes	yes
74	M	41	90 + 56	146	IV	0	0	98	84	15.9	11.3	0	0	2.5	yes	yes
64	M	56	25 + 90	115	III	0	0	94	210	22.7	9.1	0	0	2.0	yes	yes
65	M	96	40 + 80	120	III	0	0	90	188	29.5	50	6	6	2.0	no	yes
49	M	36	0 + 91	91	III	0	0	96	167	11.4	4.5	0	0	2.5	yes	yes
59	M	27	60 + 45	125	III	0	0	95	258	21.7	20	0	0	2.5	yes	yes
69	F	35	90 + 52	142	IV	0	0	100	89	9.1	9.1	2	1	2.2	yes	yes
70	M	81	66 + 83	149	IV	0	0	90	81	36.7	16.7	0	0	2.5	yes	yes
68	F	32	0 + 91	91	III	0	0	95	101	38.3	8.33	7	3	2.5	yes	yes
65	M	132	67 + 87	154	IV	0	0	90	132	16.67	8.33	0	0	2.5	yes	yes
69	M	63	66 + 83	149	IV	0	10	82	63	19.6	7.1	0	2.5	2.5	yes	yes

phalanx and axial application of 1 self-breaking screw-pin (Percufix®). There were no major complications, and satisfactory outcome was obtained in all patients. Teboul et al. described a case of successful simple complete excision of the middle phalanx. Eiriksdottir et al. also performed complete excision of the middle phalanx, with subsequent ligament reconstruction and creation of a neo-interphalangeal joint [1,13]; their 2 patients showed active flexion of respectively 35° and 60°; residual extension deficit was not discussed. Raimbeau et al. published the results of a retrospective analysis of 36 cases, 30 of which encountered recurrent DD of the little finger [4]. Twenty-two were treated by PDIP arthrodesis using K-wire fixation. The non-union rate was 14.7%, none requiring surgical revision. Volar fasciectomy was associated in 5 cases. Recurrence developed in 5 cases. Overall satisfaction was high. The dorsal H-incision, as used in all our patients, was advocated in this manuscript; it is centered over the middle phalanx and provides easy access to the middle phalanx and, in extension, to the PIP and DIP joints. The authors suggested simple suturing of flaps at end of procedure. In the first 5 patients, we adopted this suggestion, which created a bulky and esthetically unappealing finger. In the last 8 patients, skin and extensor tendon resection was performed to improve the esthetic outcome, without wound healing problems (Fig. 5). Ito reported 2 cases of PDIP arthrodesis in the little finger for recurrent DD, with additional

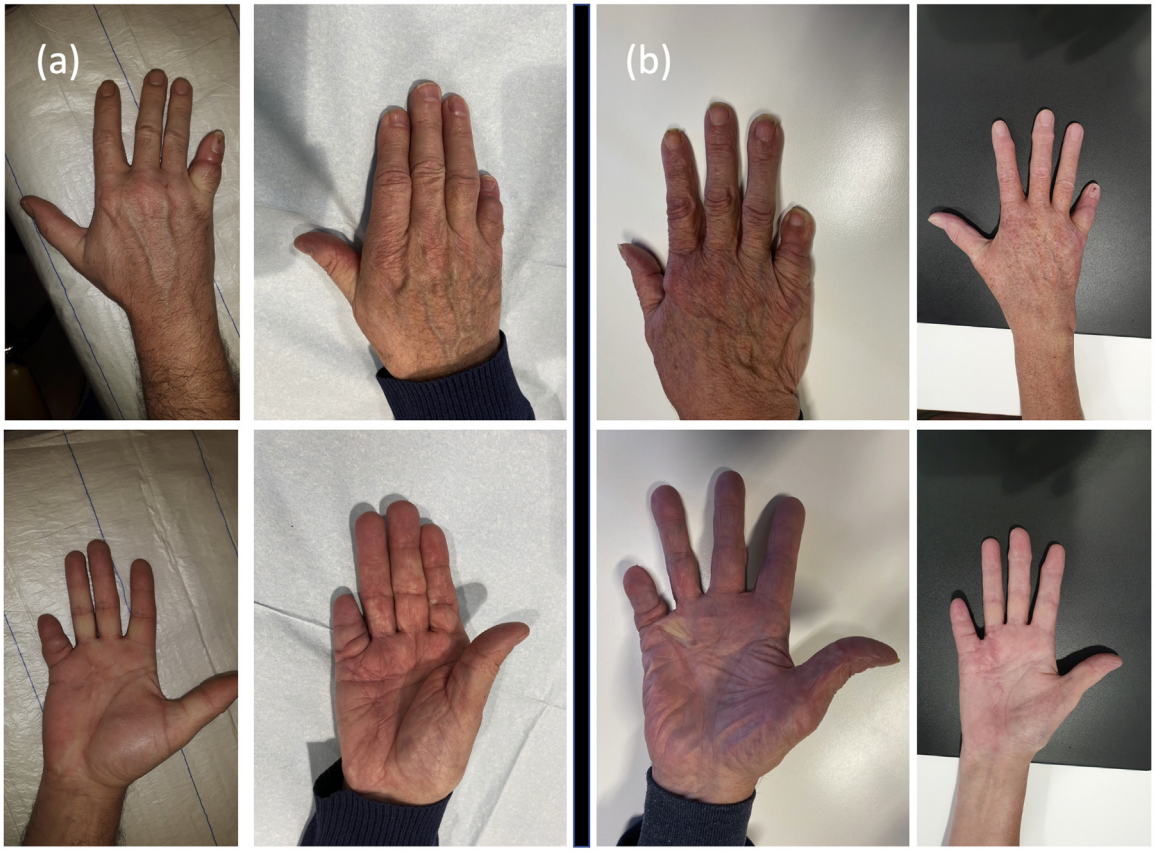

Fig. 5. (a) Outcome without skin excision: bulky and esthetically unappealing little finger. (b) Outcome with skin excision: more esthetically pleasing result.

percutaneous fasciectomy [14]. This reduced flexion contracture of the finger even more. No complications were reported. In our series, proximodistal arthrodesis was systematically combined with selective fasciectomy of the pretendinous and/or abductor cord in the fifth finger. This was performed through a small palmar incision and closed with one or more Z-plasties to gain additional length. As in Ito's case reports, it provided additional reduction of the flexion contracture in the more severe cases and correction of the residual abduction contracture of the fifth finger, which is often present due to the abductor cord. The main interest of proximodistal arthrodesis as a salvage procedure lies in the conservation of a sensitive digital pulp and a nail which is both functional and esthetic. Associating a volar approach has the advantage of improving little-finger motion, but incurs inherent risk of damage to neurovascular structures and possible postoperative complications. There are several simple measures to prevent complications. Firstly, it must be taken into account that the patient has already undergone one or more previous surgical interventions for DD. Thorough preoperative clinical examination, including Weber 2-point discrimination testing of both hemipulpae of the little finger, reveals previous nerve damage. Allen digital testing is an excellent simple means of detecting vascular damage. Secondly, careful dissection of DD tissue is mandatory, to avoid neurovascular damage. Thirdly, the volar approach uses a small incision, and aponeurectomy should be limited to what is needed to straighten the MP joint. Extending the approach with soft tissue dissection is possible but increases the risk of perioperative complications. In our series, no vascular damage in the fingertip of the fifth finger occurred, thanks to sufficient distance between the volar and dorsal skin incisions. Furthermore, systematically using a headless compression screw for arthrodesis enabled early active mobilization. Early consolidation was achieved in all patients.

5. Conclusion

Recurrence is frequent after surgery for severe DD and management is challenging. PDIP arthrodesis as described by Honecker et al. and refined by Raimbeau et al. is a straightforward procedure with better functional and cosmetic outcomes than other salvage procedures such as fifth ray amputation. On the other hand, PIP arthrodesis (Watson et al.; Bolt et al.) may be preferred in recurrent Tubiana stage III PIP contracture, conserving digital length and grip strength. In Tubiana stage IV, however, it is likely to be insufficient and combined PDIP arthrodesis and limited fasciectomy through a volar approach seems a better option. This technique provides excellent finger extension and any fixed abduction is also resolved. Furthermore, the combination of a dorsal and a volar incision did not induce vascular damage or other complications. Systematic use of headless compression screws instead of less stable K-wires, with early mobilization and physiotherapy, ensured very high patient satisfaction.

Financial support and sponsorship

None.

Conflicts of interest

The authors declare that they have no competing interests.

References

[1] Teboul F, Sabri E. Case report: middle phalanx resection as an alternative treatment to amputation of recurrent Dupuytren's contracture of the fifth digit. Eur J Plast Surg 2012;35:901–3.
[2] Watson HK, Lovallo JL. Salvage of severe recurrent Dupuytren's contracture of the ring and small fingers. J Hand Surg Am 1987;12:287–9.
[3] Honecker S, Hidalgo Diaz JJ, Naito K, Pire E, Prunières G, et al. Proximodistal interphalangeal arthrodesis of the little finger: a series of 7 cases. Hand Surg Rehabil 2016;35:262–5.
[4] Raimbeau G, Bigorre N, Balti W, Rabarin F, Jeudy J, Fouque PA, et al. Middle phalangectomy with shortening fusion of the fifth finger in Dupuytren's digital hooks. Hand Surg Rehabil 2019;38:108–13.
[5] Tropet Y, Deck D, Vichard P. Lesions of the little finger in Dupuytren's disease. Ann Chir Main Memb Super 1994;13:101–6.
[6] Goubier JN, Le Bellec Y, Cottias P, Ragois P, Alnot J, Masmejean E. L'atteinte isolée du cinquième rayon dans la maladie de Dupuytren. Chirurgie de la Main 2001;20:212–7.
[7] Van Giffen N, Degreef I, De Smet L. Dupuytren's disease: outcome of the proximal interphalangeal joint in isolated fifth ray involvement. Acta Orthop Belg 2006;72:671–7.
[8] Denkler K. Surgical complications associated with fasciectomy for dupuytren's disease: a 20-year review of the English literature. Eplasty 2010;10:e15.
[9] Könneker S, Broelsch GF, Krezdorn N, Dastagir K, Kuhbier JW, Paprottka FJ, et al. Multiple recurrences in aggressive forms of Dupuytren's disease-can patients benefit from repeated selective fasciectomy? Plast Reconstr Surg Glob Open 2017;5:e1247.
[10] Tonkin MA, Burke FD, Varian JP. The proximal interphalangeal joint in Dupuytren's disease. J Hand Surg Br 1985;10:358–64.
[11] Jensen CM, Haugegaard M, Rasmussen SW. Amputations in the treatment of Dupuytren's disease. J Hand Surg Br 1993;18:781–2.
[12] Bolt AM, Giele H, McNab ISH, Spiteri MJ. Outcome of arthrodesis for severe recurrent proximal interphalangeal joint contractures in Dupuytren's disease. Hand Surg Eur Vol 2021;46:403–5.
[13] Eiriksdottir A, Atroshi I. A new finger-preserving procedure as an alternative to amputation in recurrent severe Dupuytren contracture of the small finger. BMC Musculoskelet Disord 2019;20:323.
[14] Ito Y, Naito K, Nagura N, Sugiyama Y, Obata H, Kaneko A, et al. Finger shortening for Dupuytren's disease-induced severe PIP joint flexion contracture of the little finger: a report of two cases. SICOT J 2021;7:11.