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REVIEW

Morbidity of interventions in previously untreated Dupuytren disease: A systematic review

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Abstract

Treatment morbidity in previously untreated, or primary, Dupuytren disease has limited representation in the literature. Despite the clinical importance of stratifying risk of intervention based on treatment history, most articles addressing management complications pool both primary and recurrent disease. The aim of this systematic review was to quantify interventional morbidity in primary Dupuytren disease only and isolate the complication profiles of established interventions in previously untreated patients. A literature search was conducted using keywords on Medline and bibliographic linkage. Excluded papers did not address primary Dupuytren disease complications or did not include separate, primary-only complication data. Rates of morbidity were calculated from pooled data extracted from the included studies. Thirty-five papers met the criteria for inclusion. The review has quantified that open procedures carry higher complication rates than closed in the context of primary Dupuytren disease treatment. Amongst closed procedures, the only rate of skin split was high. It is noteworthy that this review has identified the limited isolated primary disease complication data available in the literature, which should prompt further targeted research. This systematic review addresses quantification of complication rates following treatment of primary Dupuytren disease and demonstrates that open interventions carry greater morbidity than closed. Whilst this study highlights the need for a future investigation, the complication data presented should nonetheless facilitate informed decision-making for clinicians and patients when considering initial treatments for primary Dupuytren disease.
Level of Evidence: Level IV, therapeutic study.

Keywords Dupuytren's contracture · Complication · Fasciotomy · Collagenase · Fasciectomy · Dermofasciectomy

Introduction

First described in the nineteenth century, Dupuytren disease has multiple treatment options, both surgical and non-surgical. Given the nature of the disease and its progressive pattern, the literature reflects that each of these techniques carries a different rate of efficacy and risk of disease recurrence. Furthermore, each of these interventions is not without the potential for morbidity, and these are important considerations for the patient when faced with a range of treatment options. Whilst efficacy of intervention and recurrence rate are common outcome measures in papers investigating Dupuytren disease treatment, there is a scarcity of research addressing the complications associated with intervention in previously untreated, primary, Dupuytren disease. Comparatively, recurrent Dupuytren disease, most often defined as the reformation of disease in an area which has been previously treated, can carry a higher risk of complication when retreated due to the potential disruption or displacement of local structures during or following prior intervention. Related systematic reviews [1–3] published within the last

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decade have considered specific interventions or groups of interventions, but there has been no comprehensive, quantitative systematic review of morbidity of all established interventions for primary Dupuytren disease. The aim of this systematic review was to collate and synthesise information in such a way that patients and clinicians exploring interventions for primary, previously untreated Dupuytren disease can utilise the findings of this paper to inform their decisions.

Materials and methods

This manuscript comprises an analysis of the current literature on morbidity of established interventions for primary Dupuytren disease, in accordance with PRISMA guidelines (Fig. 1) [4]. A search of the literature was conducted using Medline. Terms utilised were a combination of 'Dupuytren', 'radiotherapy', 'fasciotomy', 'collagenase', 'aponeurotomy', 'fasciectomy', 'dermofasciectomy', 'intraoperative complications', 'postoperative complications', 'complication' and 'morbidity'. We limited our search to English studies conducted in humans and published between May 1997 and May 2017. In total, 283 articles were screened after the removal of duplicates. We also identified relevant articles through bibliographic linkage. Following the full-text appraisal, we included 35 articles in the systematic review. Excluded articles did not address complications of treatment of primary Dupuytren disease, or did not include separate, isolated, primary disease complication data. Two independent reviewers analysed each article for inclusion, and discordant

Fig. 1 PRISMA attrition diagram

decisions were discussed with a third party before inclusion or exclusion. Reported complications were divided into *major* or *minor*, based on the necessity for complication treatment and the persistence of the complication.

Results

Demographics

The number of articles ultimately included in the review was low due to the particularly focused nature of this paper's aims, to address treatment complications in primary, previously untreated Dupuytren disease only. A large number of articles addressing Dupuytren disease treatment morbidity were found to pool both primary and recurrent disease when reporting their findings and thus could not be included. Within the 35 studies meeting inclusion criteria, there was a total of 3104 participants, where the mean age was 64 years (range 52–71 years). Further study demographic information can be found in Table 1.

Eight Dupuytren disease treatment modalities were identified in the sample, four being the established and widely used techniques of limited fasciectomy, percutaneous needle fasciotomy (PNF), collagenase and dermofasciectomy; the remaining procedures were either novel treatments or variations of the established interventions (Fig. 2). No papers on radiotherapy addressed treatment complications in only primary disease or separated findings into primary and recurrent disease, and hence, this intervention was unable to be included in our review. The most common intervention was limited fasciectomy, followed by PNF (Fig. 2). There was an uneven distribution of papers per intervention (range $n = 1$ to 17), where dermofasciectomy, steroid injection and the so-called total fasciectomy were represented by only one study each. Therefore, the most robust data was from the best-represented techniques in the sample: limited fasciectomy and percutaneous needle fasciotomy, which is reflected in the following results. Data on a total of 26 complications was extracted from the included studies; the complications that are reported by more than five studies are shown in Table 2. Notably, there was some disparity in the definitions and level of detail of complications between papers. Morbidity data was nevertheless pooled across relevant studies, and complication rates calculated for the four established interventions of PNF, limited fasciectomy, collagenase and dermofasciectomy (Table 3). The unconventional techniques ($n = 8$ studies), including established interventions plus adjuncts, were excluded from the final analysis, as we deemed these to be too dissimilar for results to be combined.

Table 1 Demographics of included studies

Participants	
Total	3104
Mean	76 per study
Range	8–474
Follow-up	
Range	1 month–7.3 years
Mean	21.5 months
Study type	
Retrospective cohort	20
Prospective cohort	9
RCT	6
CEBM* level of evidence (OCEBM Levels of Evidence Working Group, 2011)	
Level II	6
Level III	10
Level IV	19

*Oxford Centre for Evidence-Based Medicine Levels of Evidence

RCT randomised controlled trial

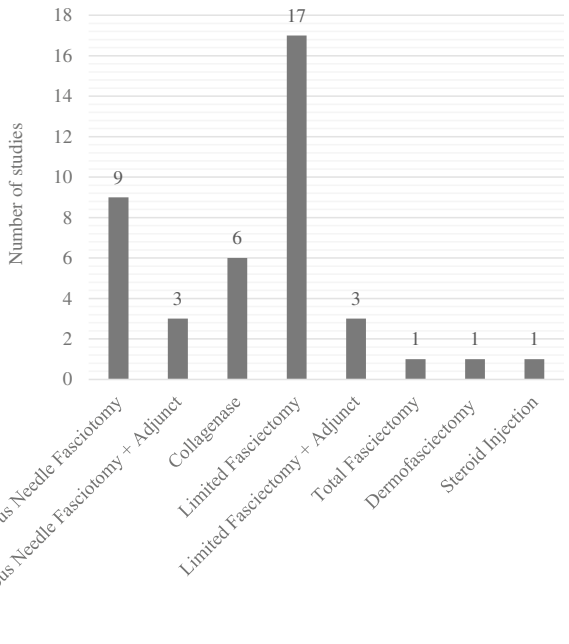

Fig. 2 Bar chart showing the distribution of interventions within included studies

Table 2 Number of studies analysed per complication

Major		Minor	
Complication	No. of studies	Complication	No. of studies
Infection	20	Neurapraxia	7
CRPS	11	Skin split	9
Nerve injury	21	Haematoma/bruising	10
Neuropathy	6		
Skin flap necrosis	7		
Arterial injury	6		
Tendon injury	8		

CRPS complex regional pain syndrome

Infection

Twenty studies [5–24] reported infection data which contributed to our analysis. Rates of infection were generally higher in open procedures such as limited fasciectomy, compared to closed procedures, such as percutaneous needle fasciotomy. Whilst collagenase and dermofasciectomy had 0% infection rates within the included sample, this data was drawn from two studies only (Table 4).

Nerve injury, chronic regional pain syndrome, neuropathy and neurapraxia

Rates of nerve injury were higher in open interventions compared with closed, that is, limited fasciectomy [6, 11–14, 16–18, 21, 22, 25–27] versus percutaneous needle fasciotomy [5–7, 9, 10, 24, 28]. Further, complex regional pain syndrome (CRPS) and neuropathy were both also more commonly seen in open, more invasive procedures [5–7, 9–11, 14, 18–20, 22, 25–27, 29]. However, it must be noted that minimally invasive techniques were generally less likely to report long-term outcomes, and the potential non-recording of long-term morbidity in the data may lead to a falsely low calculated rate. Rates of neurapraxia were generally low across interventions, except in van Rijssen et al.'s randomised controlled trial, [6] where paraesthesia was a specific outcome measure at 1 week. As illustrated in Table 5, it is important to note that data on nerve injury and neuropathy in collagenase, as well as a nerve injury in dermofasciectomy, were extracted from only one study each. In addition, neuropathy and neurapraxia data were relatively limited, potentially impacting the validity of these particular complication rates.

Table 4 Rates of infection, by intervention

	No. of studies	Pooled sample size (*n*)	Rate (%)
Limited fasciectomy	14	752	6.3
PNF	7	1305	0.8
CCH	1	36	0
Dermofasciectomy	1	4	0

PNF percutaneous needle fasciotomy, *CCH* Collagenase *Clostridium histolyticum*

Table 3 Summary of complication rates (%), by intervention

	PNF	CCH	Limited fasciectomy	Dermofasciectomy
Infection	0.8	0*	6.3	0*
Haematoma/bruising	0	89^	2.8	No data
Nerve injury	0.3	0*	3.5	0*
Neurapraxia	1.6	0*	11	No data
Skin split	11	13	Not applicable	Not applicable
Skin necrosis	0*	No data	1.5	No data
CRPS	0.1	No data	6.5	No data
Neuropathy	0.5	0*	1.5	No data
Arterial injury	No data	0*	1.1	No data
Tendon injury	0.2	0	0*	No data

CRPS chronic regional pain syndrome, *PNF* percutaneous needle fasciectomy, *CCH* collagenase *Clostridium histolyticum*

Rates marked with an * draw data from only one study

^Data from a single study characterising bruising as haematoma

Table 5 Rates of nerve-related complications, by intervention

	Nerve injury			CRPS			Neuropathy			Neurapraxia		
	No. studies	Pooled sample size (*n*)	Rate (%)	No. studies	Pooled sample size (*n*)	Rate (%)	No. studies	Pooled sample size (*n*)	Rate (%)	No. studies	Pooled sample size (*n*)	Rate (%)
Limited fasciectomy	13	926	3.5	9	617	6.5	2	263	1.5	3	131	11.5
PNF	7	1834	0.3	3	713	0.2	4	749	0.5	4	1053	1.6
CCH	1	8	0	No data	No data	No data	1	36	0	1	8	0
Dermofasciectomy	1	4	0	No data	No data	No data	No data	No data	No data	No data	No data	No data

PNF percutaneous needle fasciotomy, *CC*, collagenase *Clostridium histolyticum*

Arterial injury

There was minimal reporting of arterial injury within the included studies. Given the complication's relatively uncommon occurrence irrespective of intervention choice, the possibility exists that researchers do not often choose to assess arterial injury as an outcome when conducting studies, especially retrospectively. Despite this, the severity of such a complication can be great, and quantification of morbidity rates will facilitate thorough patient counselling. Data from five studies [14, 17, 21, 22, 30] demonstrated a 1.1% rate of arterial injury in limited fasciectomy, and from one study [31], a 0% rate in collagenase. Whilst limited study numbers restrict interpretation of these rates, one could theoretically expect a higher rate of arterial injury in an open procedure, which prompts the need for further investigation and quantification of this comparison.

Tendon injury

As with arterial injury, injury to tendons was not a commonly reported outcome measure within the included studies. Data from three studies [5, 7, 10] indicated a 0.2% rate of tendon injury in PNF; four collagenase studies [31–34] indicated a 0% tendon injury rate. Only one study reported a 0% rate for limited fasciectomy [22].

Wound complications

Skin split is a complication relevant only to closed techniques, PNF and collagenase, and occurs due to stretching of tightened skin during post-procedural manipulation to disrupt the fibrous contracture. Rates of skin split were relatively equal between PNF and collagenase [5–7, 9, 10, 28, 32, 34, 35] and were also quite high (Table 6). However, the severity of this complication is minimal, and these figures may play a role in patient awareness and counselling. Contrastingly, skin necrosis carries the potential for a more serious outcome, and our analysis showed low skin necrosis rates for limited fasciectomy [12–15, 20, 27] and PNF [28].

Haematoma and bruising

Haematoma was reported by nine studies [5–7, 12, 16, 20, 26, 28, 34] and bruising by one [33] (see Table 7). The rate of haematoma was highest in collagenase-treated

Table 6 Rates of wound complications, by intervention

	Skin split			Skin necrosis		
	No. studies	Pooled sample size (*n*)	Rate (%)	No. studies	Pooled sample size (*n*)	Rate (%)
Limited fasciectomy	Not applicable	Not applicable	Not applicable	6	477	1.5
PNF	6	1729	11	1	44	0
CCH	4	150	13	No data	No data	No data
Dermofasciectomy	Not applicable	Not applicable	Not applicable	No data	No data	No data

PNF percutaneous needle fasciotomy, *CCH* collagenase *Clostridium histolyticum*

Table 7 Rates of haematoma/bruising, by intervention

	No. studies	Pooled sample size (*n*)	Rate (%)
Limited Fasciectomy	5	179	2.8
PNF	4	757	0
CCH	2	46	89
Dermofasciectomy	No data	No data	No data

PNF percutaneous needle fasciotomy, *CCH* collagenase *Clostridium histolyticum*

patients; however, this data was from one study [34], which defined even minor bruising as a haematoma. Consequently, this rate should be interpreted with caution; nevertheless, the combined rate of haematoma or bruising following CCH was 89% [33, 34]. In comparison, van Rijssen [6] reported only haematomas that required intervention, which highlights the variability of complication definitions within the studies collated for this review. Nevertheless, regarding other interventions with more robust data, limited fasciectomy had slightly higher rates of haematoma than PNF, quantifying the concept that a more invasive technique equates to a higher chance of haematoma.

Discussion

This review has identified that open procedures carry higher morbidity from major complications than closed procedures, mostly in reference to percutaneous needle fasciotomy and limited fasciectomy. Closed interventions were shown to have high complication rates only in the minor adverse event of skin split. Whilst the initial aim of this review was to synthesise morbidity rates of common interventions for primary Dupuytren disease, it became clear in the course of our research that there is very little of isolated primary disease data available in the current literature. A large majority of screened papers which addressed morbidity of Dupuytren disease interventions pooled complication data for primary and recurrent disease, despite our view that these represent clinically distinct entities, ultimately leading to few studies meeting our inclusion criteria. Given that a large portion of primary disease data is not present in its isolated form within the literature, it is of note that there are several newly quantified morbidity rates to be drawn from our results. In addition, restriction of our search to the past two decades may have eliminated a number of dermofasciectomy papers, as this older technique was more heavily researched prior to 1997; it is also a technique that is commonly reserved for recurrent disease, or severe primary disease. Collagenase interventions are underrepresented in this study despite the extensive research that has accompanied its introduction. Several large collagenase trials were excluded as they often pooled recurrent and primary complication data. Other limitations of this review lie in the variation in complication definitions and the lack of long-term complication data, which may be addressed with future targeted research. This review has highlighted the necessity for further research into the morbidity of intervention in primary Dupuytren disease, in order to comprehensively and quantitatively define complication rates of treatment and facilitate the best practice when counselling patients.

Further, we understand that the treatment of Dupuytren disease is stage-dependent. Simple, primary Dupuytren disease can be managed with an array of treatment options, whereas advanced, primary disease is more likely to demand more invasive techniques. Notwithstanding this, along with others [31, 36, 37], we support the concept of treating Dupuytren disease early by less invasive techniques, to minimise morbidity. The data available does not allow us to consider a selection hierarchy according to the type and staging of disease, patient background, comorbidities and patient preference. We do, however, know that patient's priorities are to correct contracture, recover the quality of life and minimise complications from treatment [38–40]. This paper has endeavoured to address the latter, though it has become apparent that targeted research, rather than retrospective literature review, would yield the most valuable results in the area.

Conclusion

This systematic review addresses quantification of complication rates following treatment for primary Dupuytren disease and demonstrates that open interventions carry greater morbidity than closed. Furthermore, our analysis of the literature has revealed a lack of isolated primary disease complication data for Dupuytren disease treatments and emphasised the need for further investigation.

Compliance with ethical standards

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Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of interest Rachael Leung, Robert Capstick, Angela Lei, David Nour, Warren Rozen and David Hunter-Smith declare that they have no conflict of interest.

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