Dystrophy, Recurrence, and Salvage Procedures in Dupuytren’s Contracture

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Many potential pitfalls may offset the benefits of operations for Dupuytren’s contracture. In this article, the postoperative complications, reasons for surgical failure, and the salvage procedures available are reviewed.

**POSTOPERATIVE COMPLICATIONS**

**Wound Healing**

The palmar skin is dependent on vertical vessels arising from the common digital arteries. This blood supply is compromised by the presence of dermal nodules and palmar cords. Extensive undermining, which disrupts these vessels, can result in skin necrosis. The digital skin has a better blood supply, and skin flaps in this region have an increased chance for survival. Separation of nodules that are intimately attached to the dermis can result in thin flaps that tend to necrose. Flaps should therefore be raised so that normal skin is preserved at the base and the involved skin is at the apex. Thus, necrosis of the “at-risk” portion of the flap is located distally. When dealing with a large, adherent nodule, it is better to plan the incision so that the distance from the incised edge of skin to good blood supply is minimal, even if the nodule is in the center of the incision. An incision along one side of the nodule means a long distance to a good blood supply for one side of the flap, and this is to be avoided.

Dehiscence can be expected if wounds are closed under tension. The correction of contracture frequently requires shifting skin flaps to gain coverage in the extended joint position. Z plasties can help effect closure, but are less effective than Y-V plasties.13 Once a Z plasty is cut, it can only be closed in the transposed position or closed in the original position. Y-V flaps are infinitely variable and provide more options. The Z plasty requires complete elevation of each flap for transposition. The Y-V flap need not be completely elevated to attain closure. The skin can thus be effectively “lengthened” by employing the Y-V principle.

One of the best incisions for Dupuytren’s is a series of Y-V incisions (Fig. 1). The usual number of flaps for the palm is four, with

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Figure 1. A, Advancing the wedge of skin into the backcut of a Y-V plasty allows length gain in the direction perpendicular to flap advancement. B, Y-V plasty incisions are marked out over the contracture, centering skin flaps evenly over the fascial cord. C, The advanced flaps draw skin from laterally and move it distally.

approximately 90° at the apex of each flap. The distal-most palmar incision crosses the proximal finger crease obliquely so that the apex of the next flap always lies just distal to the proximal finger crease. The next incision extends to the opposite side of the finger at the level of the middle joint crease. The last incision then crosses back, so that the apex of the last flap lies at the distal joint on the opposite side. Although rarely necessary, a final incision can be carried a centimeter into the pulp of the finger. The proximal digital skin crease is almost entirely in one flap. In the palm, the length of the backcuts equals approximately one third the length of the side of the flap. The longest backcut and the maximal skin gain always lies with the flap whose apex is just distal to the proximal finger crease. Incisions should be planned so that flexion creases are not crossed at perpendicular angles. Otherwise, flexion deformities would develop as the skin scars contract.

Infection

Wound infections are rare. They usually occur as a result of skin necrosis and loss of the natural protective barrier. Kirschner (K) wires used to maintain joint extension may also introduce infection. These can be cut below the level of the dermis if they are to be left in for more than 2 weeks. K wires are almost never indicated. Once the diseased tissue is excised, skin circulation becomes the prime concern in the early postoperative period. The joints should be immobilized in some degree of flexion.

Hematoma

Hematomas can occur from inadequate dressing technique. A good postoperative dressing is mandatory. Simply wrapping the hand with gauze or bias cut stockinette produces pressure
only on the radial side of the index metacarpal and the ulnar side of the small finger metacarpal. The principle behind a bulky hand dressing is that the anteroposterior diameter is built up with gauze fluffs until it just exceeds the width of the metacarpals (Fig. 2). When this volume is wrapped, the pressure is then distributed in an anteroposterior axis. Ace or elastic bandages are not used in our experience because they can tighten with time. A gauze bandage is also not used because this will gradually loosen. The ideal dressing bandage is a “bias-cut stockinet” that has elastic properties but will not tighten or loosen with time.

A dorsal plaster slab is used to keep the wrist in 30° extension, and the MP and IP joints flexed. Finger extension is contraindicated in the postoperative dressing because this provides no benefit and can lead to considerable skin tension. This dressing is removed in 48 hours, and active mobilization is begun. Hematomas are rare with this regimen, but can be aseptically evacuated, if necessary. Some advocate pin-point electric coagulation during surgery and tourniquet release prior to application of the dressing to evaluate hemostasis. Others have used suction drainage. We prefer no cautery, no vessel ties, no drains, and tourniquet release only after bulk dressing in all cases.

**Neurovascular Bundles**

Because of the variable and intimate relationship of the neurovascular bundles to the digital cords, they are at risk during surgery. Proper exposure and direct identification are necessary to prevent injury. Division of an artery by itself can compromise wound healing because of the already precarious nature of the blood supply to the skin. It can also result in cold intolerance from decreased blood flow to the digit. Loss of both arteries can result in necrosis of the entire finger and at least one vessel should be repaired. Division of the digital nerve can lead to neuroma formation and hypesthesia. When recognized, primary repair should be performed. If recognized late, resection of the neuroma and primary repair is still the procedure of choice. If too large a gap exists, a nerve graft may be used. If the distal end is absent or damaged, resection of the neuroma and relocation of the primal nerve stump within healthy soft tissue by retraction or transposition is indicated. Another option for irreparable digital neuromas is placement of the nerve end over the mid-dorsum of the finger.

**Stiffness**

Joint stiffness can be more disabling than Dupuytren’s disease itself because loss of flexion is more difficult to manage than flexion contractures and loss of extension. Stiffness is enhanced by postoperative edema and lack of early mobilization. Prolonged postoperative edema can be precipitated by skin necrosis, infection, he-

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Figure 2. The AP diameter of the dressing is built up with gauze to exceed the transverse diameter. The pressure of the compression dressing is then favorably directed to the palm and the dorsum of the hand.
matoma, and extensive dissection. This edema will also lead to fibrin deposition and periartricular adhesions. It is extremely important to begin active mobilization early. External intermittent pneumatic compression has also been used to decrease edema.  

Active exercise and dynamic splinting are initiated 2 to 3 days after surgery. Extension splinting may include the use of a Joint Spring (Joint Jack Co., East Hartford, Connecticut) for a dynamic extension force to all joints, the Joint Jack for isolated extension of the proximal interphalangeal joint, or both (Fig. 3). When multiple fingers are involved, static thermoplastic splinting may be used initially and at night in conjunction with pressure techniques for scar management. Daytime splinting is generally limited to three 1-hour sessions to encourage active use of the hand. Serial plaster casting is occasionally used to correct PIP joint contractures, especially of the small finger.

**Reflex Sympathetic Dystrophy**

Disproportionate edema, pain, and stiffness can be "predystrophy" or full-fledged reflex sympathetic dystrophy (RSD). It is important to detect dystrophy early to prevent permanent stiffness. The primary clinical manifestations of RSD include pain, swelling, stiffness, and discoloration. The secondary signs are osseous demineralization, sudomotor changes, trophic changes, vasomotor instability, and palmar fibromatosis. Late radiographs will demonstrate a washout pattern compared with the unaffected extremity (Fig. 4). Postoperative Dupuytren's...
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frequently demonstrates some, but not all, of the criteria of full blown reflex sympathetic dystrophy. We term this a “predystrophy” state, recognize it for the potential problem it is, and treat it with the “dystrophile” program. This predystrophy state is common and responds rapidly to the dystrophile loading technique.

Dystrophile Program for Reflex Sympathetic Dystrophy

Dystrophy is a two-part condition: The first part is the destructive dystrophy process whose complete cause is not clear. It may represent a lack of neurovascular control at the capillary level, with interchanging areas of normal vascularity, hypervascularity, and hypovascularity. The second part is the resultant fibrosis and periarticular scarring that follows cell death from the active dystrophy process. Dystrophy must be seen as an active destructive process much like an infection. The longevity and severity of the active process predicts the degree of permanent damage and contracture. Our sole treatment for dystrophy, either the predystrophy state or full blown reflex sympathetic dystrophy, has been the dystrophile program. This program consists of loading of the extremity without other therapy measures. Range of motion is contraindicated. The first stage of the program is comprised of compression loading. The patient mimics scrubbing the floor with a brush for a series of three times a day at a maximum tolerable pressure beginning at 1 to 3 minutes each time and progressing to 10 minutes three times a day. A simple scrub brush will suffice. A more structured program is achieved with Dystrophile (Joint Jack Co., East Hartford, Connecticut), which allows presetting of the load and determination of time spent at that load level (Fig. 5). The second stage of the program is the traction loading achieved by having the patient carry a bag with the maximum weight possible. The bag is carried at all times when awake. Frequently, a patient with full blown dystrophy will be able to compress the dystrophile at its lowest setting for no more than 1 minute three times a day, and the weight carried may be less than 0.5 pounds. Again, it is important that the patient avoid range of motion exercises. Range of motion exercises are not as effective in stimulating change in the abnormal neurovascular status, and they increase the work load on injured cells, particularly synovial tissue. Diathermy, heat in any fashion, and analgesics are generally avoided.
We have not found it necessary to use ganglionic blocks, intravenous medications, or other invasive techniques.

**PERSISTENT FLEXION DEFORMITIES**

Persistent flexion deformities are the result of inadequate surgery. After resection of the diseased fascia, there may still be persistent joint contractures. This result is due to secondary changes in the joint from longstanding contracture. These should be fully evaluated and corrected at the initial operation.

**MP Joint**

Secondary flexion contracture of the MP joint usually does not develop because of the difference in anatomy as compared with the PIP joint (Fig. 6). The MP volar plate is like a collapsible child's stair gate or traction finger trap with angular fibers collapsing to a parallel orientation on flexion of the joint. The MP volar plate changes length by a factor of 50% while the PIP volar plate changes less than 10% of its length between full extension and full flexion. The MP volar attachments are mobile and even allow passive hyperextension as opposed to the PIP attachments that can form checkreins that restrict motion (see the section on the PIP joint). The cam and volar flare shape of the metacarpal head places the collateral ligaments in greatest tension during flexion, and the ligaments do not become contracted and adherent in this position.

Full passive correction of MP flexion usually results after excision of diseased fascia. Rarely, there may be lack of active extension. This result is due to subluxation of the extensor tendon and may be secondary to abductor digiti minimi (ADM) involvement; therefore, ADM division is required to allow the tendons to relocate. If a flexion deformity persists despite this, the extensor tendon should be relocated by tightening of the attenuated elements.

**PIP Joint**

During release of a PIP joint contracture, one can systematically evaluate the causes of persistent flexion contracture in a volar to dorsal approach and address these individually.

The palmar skin may be shortened from involvement with diseased fascia or as a result of scar contracture from previous surgery. It can be lengthened through the use of multiple Y-V advancement flaps or possibly Z plasties. Other alternatives include applying a full thickness skin graft with its lower propensity for contracture than a split thickness skin graft, using a cross-finger flap or leaving the wound open.

The flexor sheath may be infiltrated by disease. A portion can be excised to release the contracture. The exposed flexor tendon will leak synovial fluid, and an overlying skin graft may have difficulty. Y-V flaps, a transposition flap, or cross-finger flap should be considered in this situation.

There can be shortening of the flexor muscle mass. The joint flexion deformity is passively correctable by wrist and MP flexion. Tubiana et al advise temporary fixation of the PIP joint in extension with K wires for preoperative contractures of more than 80°. No joint should be pinned in extension under pressure because this can cause acute cartilage necrosis and destroy the joint. A pin may be used only if the

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*Figure 5. A structured program for reflex sympathetic dystrophy is achieved with the dystrophile and allows presetting of the load and time spent at the load level.*
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Figure 6. A. The volar plate of the MP joint is composed of multiple crisscrossing fibers that have the ability to collapse from the fully extended to the fully flexed position. In flexion, the volar plate collapses up to half its length. B. The IP volar plate is thick and homogenous with minimal collapsibility between full flexion and full extension. (From Green D (ed): Operative Hand Surgery, ed 2. New York, Churchill Livingstone, 1988; copyright © by Elizabeth Roselius; used with permission.)

Joint easily attains the extension position desired. Previous surgery may have rendered the sublimis tendon adherent to the proximal phalanx and volar plate requiring tenolysis.

In longstanding flexion contractures, checkreins (thick collagen bands) develop running from the volar plate to the proximal phalanx. In our published series, we achieved full extension in 110 of 115 middle joint contractures by resecting these checkreins without entering the joint capsule. Care must be taken to preserve the communicating vessel that runs beneath the checkreins and merges in the midline because this provides the major vascular supply to the tendon vincular system (see the article on pathologic anatomy by Drs. Watson and Paul).

The oblique retinacular ligament of Landsmeer may become tight. It passes volar to the axis of rotation of the PIP joint and when involved in the fibrotic process produces extension (hyperextension) of the DIP. A Boutonniere deformity then results. In these circumstances, transection of the oblique ligament of Landsmeer is indicated. Frequently, this problem is associated with tight, volarly displaced lateral bands. The lateral bands must be freed and the dorsal expansion replaced dorsal to the axis of rotation to restore flexion and
extension. If necessary, the bands can be excised.

Rarely, complete release of all volar structures fails to restore full extension. Field and Hueston have shown that intra-articular changes occur in longstanding flexion. There is loss of articular cartilage and subchondral bone from the portion of the proximal phalanx no longer in contact with the middle phalanx. The extensor tendon then becomes fixed by adhesions to the exposed eroded bone matrix.

DIP Joint Extension

Hyperextension of the DIP is usually secondary to involvement of the lateral bands or the oblique ligament of Landsmeer. Release or transection of the lateral bands at the proximal phalanx level will usually resolve the problem, although occasionally a dorsal Fowler total tenotomy may be indicated.

RECURRENT

Recurrent Disease

Dupuytren's disease, with its cause in the patients' genome, has a proclivity for recurrence and for progression. Recurrent disease is defined as the appearance of new lesions in an operated field. It is seen more often in young patients with a strong diathesis, in patients with epilepsy, alcoholism, diabetes, bilateral disease, and ectopic lesions. It occurs chiefly in the fingers, rarely in the palm, and most often involves the little finger. Recurrence results from failure to remove all diseased tissue and from remaining tissue continuing to respond to the factors that initiated the pathologic changes. Progression of disease, or extension, is the development of lesions outside of the area of radical fasciectomy. Hakstian reported a 51% recurrence rate in 67 hands, two thirds of which required reoperation. Hueston noted 67 recurrences in 237 patients with 29 of those requiring reoperation. Other authors have reported comparable results, indicating that recurrence is a significant problem. When evaluating a patient with recurrent disease, the problem is usually seen at the middle joint. The degree of contracture may be well tolerated and, therefore, not require intervention. Boswick and Watson state that they reoperate only for a 40° contracture, but this policy needs to be individualized to the patient.

Reoperation is difficult because scar tissue is intimately intertwined with disease. The neurovascular bundle may be displaced or injured by previous surgery. Preoperative evaluation of the neurovascular status of the finger is mandatory. Doppler ultrasound has been used to map the course of the digital artery preoperatively. The best approach at the time of surgery is to identify the nerve proximal and distal to the most involved area and progress along an identified protected nerve or artery. In longstanding contractures, there may be foreshortening of the bundle and, hence, vascular compromise when the digit is fully extended.

Hueston has shown that recurrence can be prevented by dermofasciectomy and the application of a full thickness skin graft. Hand function is not impaired. It has also been observed by several other authors that Dupuytren's disease does not recur beneath a skin graft. This may be the procedure of choice for young patients with a strong diathesis and is very useful in recurrent disease. The lateral margins of the skin graft should extend below the mid-lateral stationary line of the finger. Otherwise, scar contracture anterior to that axis can produce flexion deformity. Hueston also recommended "firebreak" grafts, i.e., placing skin grafts in strategic areas to prevent deformities.

SALVAGE PROCEDURES

It is occasionally necessary in Dupuytren's disease to give up on the basic plan of excision and correction. A multioperated fixed PIP joint contracture with severe neurovascular involvement and probably shortened neurovascular bundles will frequently be made worse by a standard volar attempt at excision and correction.
Osteotomy

Moberg described a dorsal wedge osteotomy of the proximal phalanx. Up to 90° dorsal angulation can be used. Motion is retained in the joint with the arc of motion shifted dorsally. The proximal phalanx is shortened to adjust to tightening of palmar structures. There is little clinical deformity associated with this procedure.

Arthrodesis

Arthrodesis can provide a stable joint in a more functional position. Moberg recommends resecting the PIP joint and using a quadrangular bone peg from the proximal ulna to leave the finger in 25° flexion. The flexion at the MP joint makes the loss of PIP flexion less important. Other authors have used K wires or interosseous wiring.

In our experience, a concave-convex arthrodesis is the salvage procedure of choice (Fig. 7). It is reserved for when a palmar approach does not provide adequate release or will compromise the digit. Usually, the patients will have had previous surgery with significant scarring, a flexion contracture greater than 70°, loss of one or both digital nerves or arteries, and pseudomotor changes. The procedure gives union in 6 to 7 weeks and avoids amputation. Patients are happier with a slightly shorter fused digit than with an amputation (Figs. 8 and 9).

Silastic Implant

Replacement arthroplasty with a silastic prosthesis has been reported to produce a 40° arc of motion. Full extension is often not possible because volar structural problems can not be resolved. With the implant, motion as well as some deformity correction can be achieved. This procedure is not reliable because of the potential for further volar shortening.

Amputation

Tonkin et al reported a 9% amputation rate for Dupuytren's contracture. These amputations occurred chiefly in patients with a strong disease diathesis. This high rate emphasizes the difficulties in management of persistent PIP deformity. The deep structures are so heavily involved with scar, that soft tissue release is not possible. The finger can be a functional disabil-

Figure 7. Correction of contracture is achieved by bony resection with shortening of the proximal phalanx (hatched areas) rather than soft tissue release (distance $A_1 - A$ remains constant).
Figure 8. A 72-year-old man had an amputation of the right little finger for severe recurrent Dupuytren's disease, but he much prefers the shortening and arthrodesis that was later carried out on the opposite side.

Figure 9. A. Severe recurrent contracture, with shortening of the neurovascular structures, is often unresponsive to further volar surgery. B. 1 year after surgery, the shortening of the bone has allowed extension of the finger and arthrodesis has provided permanency.
ity, catching in trousers, preventing extension in preparation for grasp, and interfering with glove wearing. There may have been previous division of one or both neurovascular bundles, giving rise to numbness and cold intolerance.

Amputation at the level of the mid-proximal phalanx maintains the continuity of the palm. It should be noted that an MP disarticulation leaves a hole in the palm as the proximal finger phalanx maintains the continuity of the palm. This amputation preserves the width of the palm, which is important for strength, for grasp and for pronation and supination.4,5

**SUMMARY**

Postoperative complications can jeopardize the results of surgery. These can be avoided by Y-V plasties that allow for efficient skin "lengthening" and wound healing. Proper dressing techniques can prevent hematoma formation. The patient must be started on early active motion to prevent stiffness, and the physician must monitor for reflex sympathetic dystrophy. If RSD should occur, the dystrophic program is the most effective means of treatment.

Fasciectomy alone is not always successful in correcting Dupuytren's contracture, especially in longstanding cases. The surgeon should be prepared to correct other entities such as checkreins, sheath fibrosis, and tendon adhesions. Occasionally, a severely compromised finger is not amenable to correction. In this case, salvage procedures are available, such as the concentric arthrodesis that preserves the length of the volar structures. Only when all other attempts fail should one resort to amputation.

**REFERENCES**


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Comment on “Dystrophy, Recurrence, and Salvage Procedures in Dupuytren’s Contracture”

It is impossible to overemphasize the need for technical facility and care in Dupuytren’s contracture. The author’s experience is clear in the opening section of this article, in which the surgeon is well recognized as one of the causes of complications. Younger surgeons will glean much from the technical tips proffered here.

The discarding of dressings and the commencement of active movements after 48 hours is not a universal practice, and some patients are more apprehensive, even “pain prone.” than others. The “reflex” of RSD must not be forgotten to have an initiating event. This stimulus of the reflex arc may well be a tender or painful part of this exposed recent wound area. It must be the surgeon himself who first dresses the wound, assesses it along with the personality type of the patient, and advises on early movements or “not just yet.” A similar situation as for the open palm technique relationship. A surgical operation is a personal contract between the patient and the surgeon and must be honored as such.

The concept of RSD as “an active destructive process much like an infection” is novel and difficult to accept. I am not aware of the demonstration of “cell death from active dystrophy process.” Perhaps we surgeons have too often guarded these adverse physiologic vascular phenomena too closely to ourselves and have not often enough invited adequate objective academic study.

A totally detached academic investigator, whose previous experience may have been limited to animals, could perhaps see or seek basic physiologic processes at work in RSD hands if invited to view them dispassionately. The value of academic detachment, free of clinical responsibility, cannot be too much stressed. Such an investigator must not be invited to “treat” the condition, merely to explain it.

The dystrophile program outlined here reads like a logical resumption of normal use of the hand: from scrubbing floors to carrying bags. It is interesting to note the vehemence of refusal of the range of movement exercises, the mainstay of many hand therapists.

“Better a live dog than a dead lion” is sound thinking in PIP flexion deformities, and the valor of achieving full passive extension during surgery is often better forfeited for the discretion of accepting defeat, even up to 45° flexion, provided MP release will allow such hyperextension as to accommodate the residual PIP deformity. The neologism “checkreins” is used for what was described, along with the vincular branches of the digital arteries so helpful in identifying them, in my 1963 monograph. Again, limited correction can be acceptable and, after this extra-articular release, can be followed by progressive improvement with normal use and night splinting.

We see acceptance also of the impossibility of fully excising recurrent Dupuytren’s contracture tissue, particularly when intimately involving segments of the neurovascular bundle or when the tendon sheath is so infiltrated that catastrophe would follow pursuit of perfection of either of these sites. This limitation is now easier to bear. The perfectly reasonable fear of leaving behind these local blocks of proven hyperactive infiltrative tissue is lessened, now that a method of inducing their resolution is at hand.
Not only does resurfacing a digit with a Wolfe graft prevent recurrence, but the resurfacing of active residual areas of Dupuytren's tissue has been found to induce resolution and even disappearance of this tissue. Of course this recurrent tissue is alive, vascular, and can accept skin grafts.

All hand surgeons must be proficient in all techniques of skin replacement. Their surgical repertoire is incomplete and the possibilities of extending their therapeutic regime are severely limited without this facility.

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Guest Editor