Tendon Conditions in the Thumb

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Keywords
Thumb • Tendonitis • Tendinosis • Tenosynovitis • Attrition rupture • Anatomy • Peritendonitis crepitans • Rheumatoid arthritis • De Quervain's syndrome • Trigger thumb

Introduction

Box 2.1: Intrinsic and Extrinsic Control of the Thumb

Intrinsic Muscles to the Thumb

- Adductor Pollicis
- Flexor Pollicis Brevis
- Abductor Pollicis Brevis
- Opponens Pollicis

Extrinsic Tendons to the Thumb

- APL: Abductor Pollicis Longus
- EPL: Extensor Pollicis Longus
- EPB: Extensor Pollicis Brevis
- FPL: Flexor Pollicis Longus

The thumb is the crucial pillar of the hand; the opposable thumb makes the hand a tool. The sliding basal joint, with the hinged metacarpo-phalangeal joint (MCPJ) and inter-phalangeal joint (IPJ), require a balanced set of extrinsic tendons and intrinsic muscles to provide co-ordinated and accurate movement (see Box 2.1). The extrinsic tendons pass towards the thumb across the carpus, constrained by fascial compartments and sheaths. The tendons and surrounding sheaths are prone to pathological processes, not always inflammatory, which are the subject of this chapter.

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Anatomy

Extensor Compartments

The extrinsic extensor tendons to the thumb pass beneath the extensor retinaculum. The extensor retinaculum is a consolidation of the deep dorsal forearm fascia and the fascia between the dermis and tendons over the back of the hand. The retinaculum is secured to the underlying radius with vertically-descending pillars, thus forming individual compartments

- First compartment–EPB, APL
- Second Compartment–ECRB, ECRL
- Third Compartment–EPL

I.A. Trail, A.N.M. Fleming (eds.), *Disorders of the Hand: Volume 3: Inflammation, Arthritis and Contractures*, DOI 10.1007/978-1-4471-6557-6_2, © Springer-Verlag London 2015

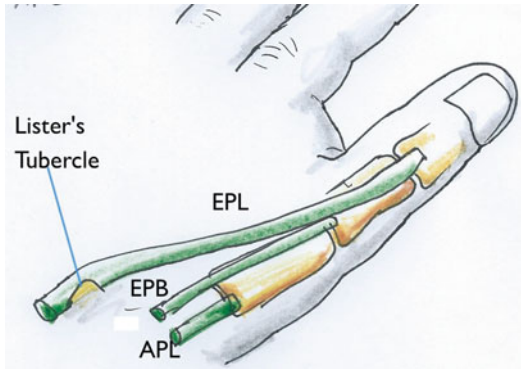

Fig. 2.1 Extensor and abductor tendons of the thumb

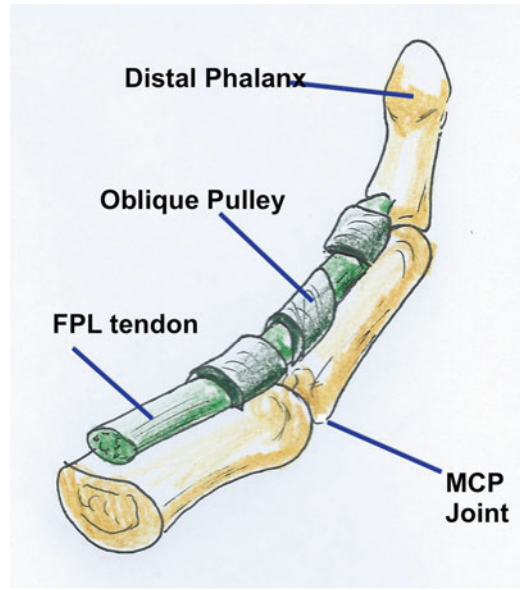

Fig. 2.2 Flexor sheath of the thumb

Extrinsic Extensor Tendons

The APL, EPB and EPL each attach just distal to a separate sequential joint in the thumb-trapeziometacarpal (TMJ), MCPJ and IPJ respectively (Fig. 2.1).

APL moves the metacarpal base into extension and also palmar flexion. It has an essential role in stabilising the thumb base in the position of function (extension-flexion), providing a stable platform for pinch grip.

EPB extends the proximal phalanx of the thumb. It antagonises FPL in power pinch, preventing excessive flexion at the MCPJ. There can be anomalous insertions into the extensor hood or the APL, or even entire absence. The tendon may duplicate, or even triplicate, within the first dorsal compartment [1]; recognition of which is essential to ensure thorough release during a de Quervain's operation.

EPL has a contributory role in extending the distal phalanx of the thumb (the thumb intrinsics have a complimentary role through the extensor hood). EPL predominantly pulls the thumb backwards and ulnarwards such that the palmar-ulnar corner of the thumb IPJ opposes the radial side of the index MCPJ . This position opens the hand in preparation for subsequent opposition and prehension. Even if the EPL is ruptured or denervated, the thumb DIP joint will still extend, animated through the extensor hood by the adductor pollicis (ulnar nerve) and abductor pollicis brevis (median nerve).

FPL primarily flexes the tip of the thumb. To prevent "bowstringing" across the thenar eminence in power-pinch, it runs through a fibrous sheath. The sheath commences at the level of the MCPJ and ends at the level of the IPJ (Fig. 2.2).

The tendon commences in the distal quarter of the forearm, motivated by powerful unipennate muscle fibres. The tendon runs through a fibrous sheath immediately palmar to the scaphoid-trapezoid-trapezium joint, then runs freely through the carpal tunnel radial-dorsal to the median nerve, then between adductor pollicis and the flexor pollicis brevis bellies, to reach the flexor sheath. It attaches distally into the base of the distal phalanx, often through a small sesamoid bone which is visible on a lateral radiograph and easily confused with a small avulsion fracture.

Terminology and Pathology of Thumb Tendon Disorders

Conditions of the tendon system should be named with care to avoid misleading inferences on aetiology or treatment.

Tendonitis: The term *tendonitis* should refer to an inflammatory condition of the tendon itself – a very unusual pathological occurrence.

Tendinosis: The tendon itself may occasionally be affected by a pathological condition, such as gout or abrasion beneath a tight sheath.

Tenosynovitis: this refers to an inflammatory process affecting the synovium. To substantiate this diagnosis, there must be inflammatory cells present, with consequent physical signs of swelling, tenderness and crepitus along the tendon sheath. There may be an inflammatory, infective or depository causes including:

- mycobacterial infection
- fungal infection
- foreign body
- sarcoidosis
- gout
- amyloid

Tendon sheath disorders: these are a separate group – de Quervain's disease and trigger thumb – and are discussed below.

Rheumatoid Arthritis

The FPL and long extensor tendons are surrounded by a synovial sheath and so may be affected by rheumatoid arthritis. Nodules may also form within the tendon. Synovitis and even tendon rupture used to be quite common, both FPL and EPL being particularly vulnerable. Fortunately, these problems are becoming more rare with the advent of effective disease-modifying agents. Trigger thumb may occur from impingement of thickened synovium within the sheath.

Treatment

- medical management of the rheumatoid arthritis
- cortisone injection for synovitis
- synovectomy
- sheath release (trigger thumb, EPL synovitis)
- tendon transfer (e.g. EIP into EPL, FDS (IV)) into FPL or interposition grafting
- fusion (IPJ for FPL rupture or MCP for EPB rupture when grafting or transfer unsuitable or failed).

Attrition Disorders

Surgical fixation is hazardous to the tendons of the thumb.

Kirschner Wires

APL, EPB and EPL are all prone to irritation by Kirschner wires passed percutaneously for stabilisation of the distal radius fracture. This may present with pain, stiffness, infection and even rupture. Careful surgical technique (equally important to avoid cutaneous nerve damage) is essential.

Dorsal Plates

Earlier designs had a prominent distal edge. This was a potent cause of tenosynovitis or tendon rupture of the finger extensors and especially EPL (Fig. 2.3). Lower profile plates with a distal bevel are safer but not infallible. Placing the plate beneath the ECRL and ECRB will preserve EPL, if the fracture repair or osteotomy reconstruction allows.

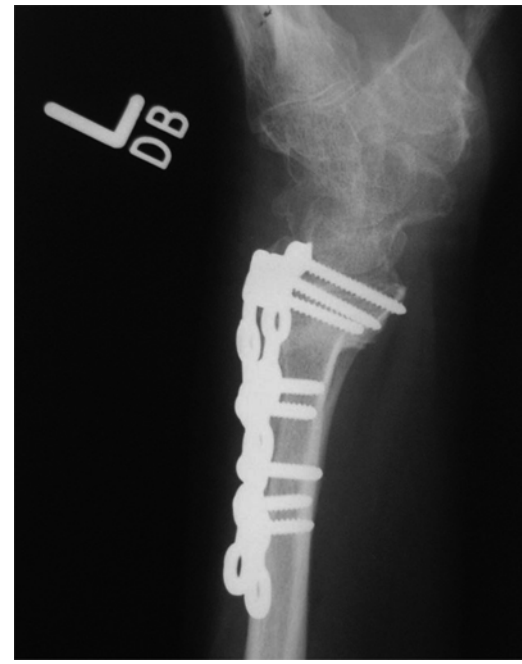

Fig. 2.3 EPL tendon rupture from dorsal plate

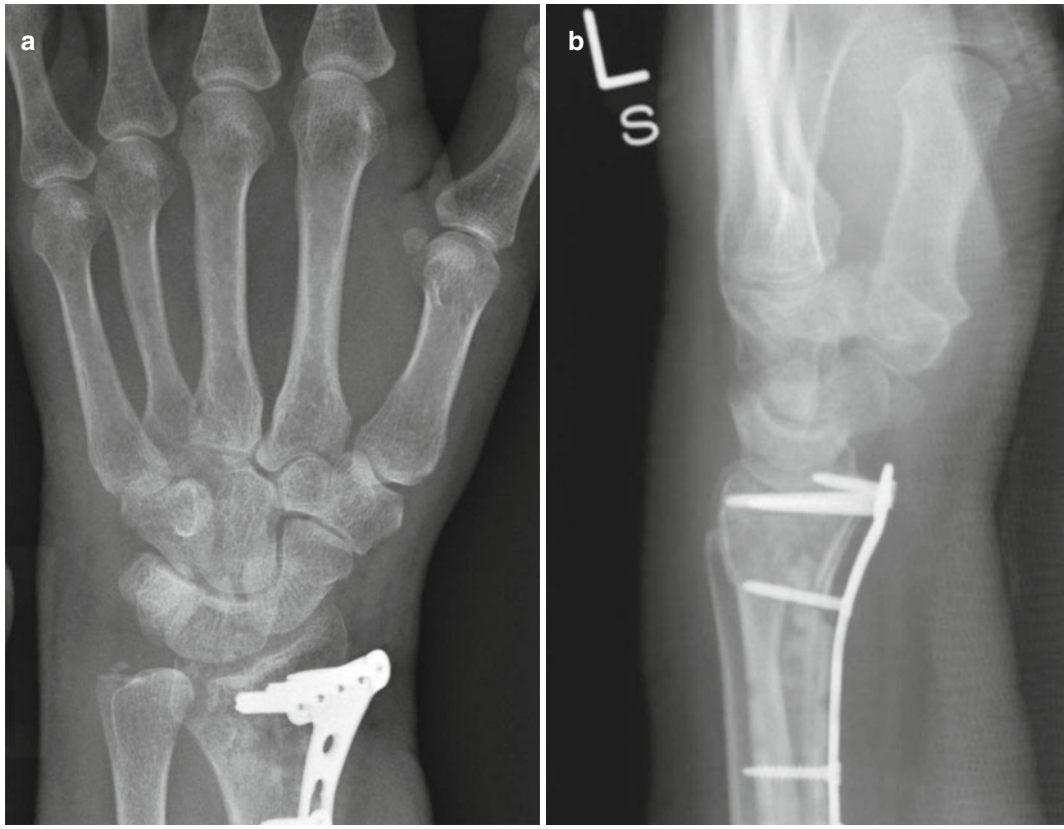

Fig. 2.4 (**a**, **b**) Volar plate causing attrition tendon rupture of APL (**a**) and FPL (**b**)

Volar Plates

The edges of the plate can cause attrition synovitis and rupture of APL/EPB and FPL (Fig. 2.4a, b). A further problem with volar plating is protrusion of the screws dorsally, eroding EPL. A true lateral x-ray may give false reassurance, due to the obliquity of the dorsum of the distal radius either side of Lister's tubercle (Fig. 2.5a–c).

FPL Attrition from STT Arthritis

The FPL is a direct anterior relation of the scaphoid-trapezoid-trapezium joint (STT or Triscaphe joint).

A combination of osteophytes and synovial thickening from this joint may erode the FPL, causing tendinopathy and eventual rupture. There is pain in the wrist on moving the thumb tip and eventually either painful or unexpected painless rupture (Mannerfelt Syndrome). Occasionally, FCR tendon is involved. Radiographs show an advanced STT arthritis (Fig. 2.6). Treatment requires judicious removal of the distal pole of the scaphoid (never more than one fifth, to avoid secondary midcarpal collapse [2]) and interposition grafting.

De Quervain's Disease

Box 2.2: Key Points: de Quervain's

- Usually constitutional changes in sheath
- Finklestein's and Hitch-hiker's tests positive
- Usually responds to injection
- Beware extra tendons and hidden compartments during surgery
- Beware superficial radial nerve during surgery

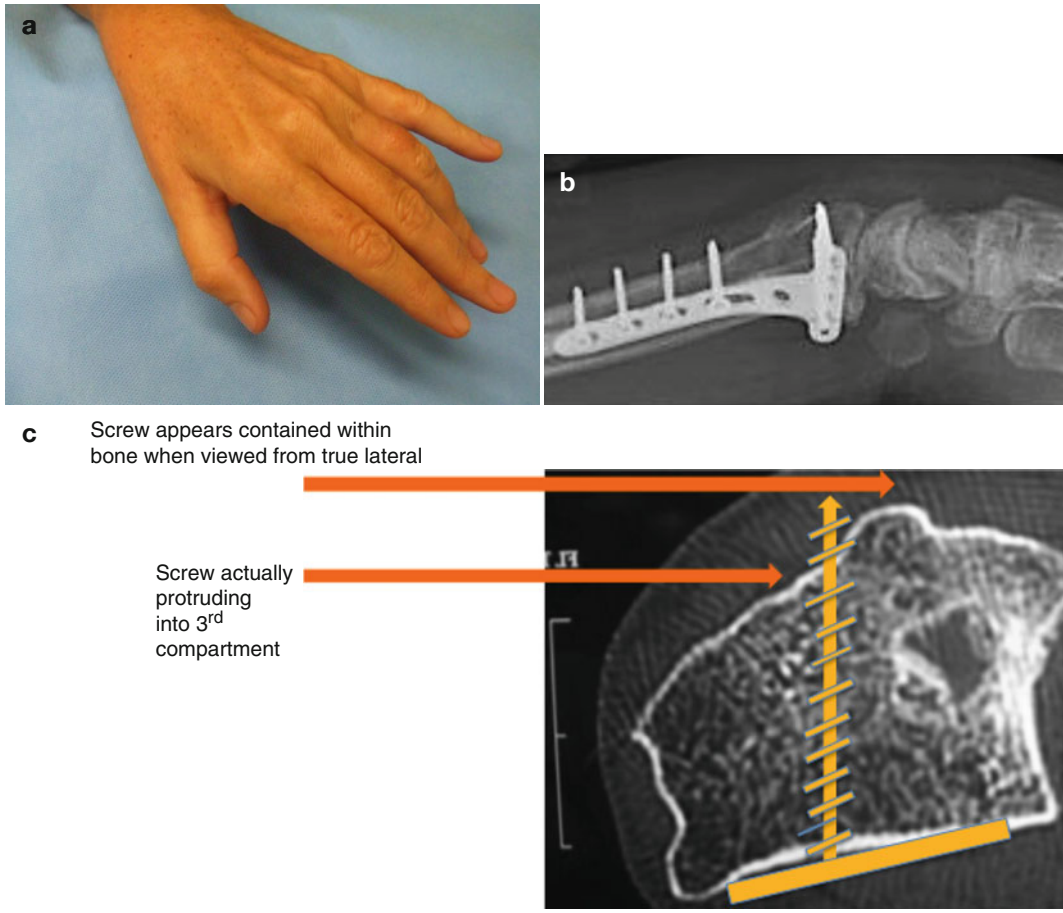

Fig. 2.5 (**a**) EPL rupture; (**b**) parallax error on lateral radiograph; (**c**) oblique radiograph showing long screw impinging in third compartment

Fig. 2.6 STT arthritis

Function of the First Compartment

This condition affects the first dorsal extensor compartment. This contains the Abductor Pollicis Longus (APL) and Extensor Pollicis Brevis (EPB) tendon, which attach to the base of the metacarpal and proximal phalanx respectively. The APL stabilises the thumb base in lateral extension and palmar flexion, preventing collapse on power pinch and enabling some span of the thumb web. EPB extends the MCP joint, considerably opening the span of the thumb web. Together, the tendons put the thumb into the "hitchhiker pose". The first compartment of the extensor retinaculum prevents bowstringing of these tendons in pinch, or in extending the thumb into full span.

Anatomical Variants

APL tendon has many variations, frequently more than one slip within the compartment. Further slips may pass across ulnarwards to the APB or trapezium. The tendon may also fuse with EPB.

The EPB tendon runs in a separate subcompartment of the first compartment in 30–60 %; this must be specifically excluded during surgery to avoid persisting symptoms.

Pathology

The cause is unknown. There is an increase in extracellular matrix, thickening of the collagen fibrils and areas of fibrocartilage metaplasia. The tendon surface may be fibrillated or delaminated. There is no pathological evidence of inflammation – so the term "tenosynovitis" is illogical [3, 4].

Clinical Features

The great majority of cases occur spontaneously.

It is more common in females than males; occurrence in very late pregnancy or soon after delivery is characteristic. It may occasionally follow unaccustomed overuse, but "repetitive strain" as an aetiology is at best speculative.

The typical complaint is pain aggravated by thumb use. The patient points to the tip of the radial styloid. Occasionally there is even triggering of the APL tendon [5] or a small hard tender ganglion over the first compartment.

Physical signs include swelling and tenderness over the tip of the radial styloid, severe pain on resisted active extension of the thumb, loss of ulnar deviation and a positive Finkelstein's test. Finkelstein described reproduction of pain by 'grasping the patient's thumb and quickly abducting the hand ulnarward'. There is another test, which was originally described by Eichhoff but is erroneously attributed to Finkelstein, in which pain is provoked by deviating the wrist ulnarward while the thumb is held in the palm beneath the flexed fingers [6].

The differential diagnosis of de Quervain's includes intersection syndrome (see below), a volar wrist ganglion and degenerative arthrosis of the trapezio-metacarpal, scapho-trapezial, or radio-scaphoid joints.

Treatment

Rest is helpful, if the symptoms have been provoked by a brief period of unaccustomed repetitive and forceful activity. This can be supplemented with a course of oral, non-steroidal, anti-inflammatory *drugs* and a *splint*. A splint can help but is cumbersome.

Physiotherapy (ultrasound, frictions) might help some, but the local pressure can be very uncomfortable.

Cortisone injection can be very effective (80 % success), especially if there is frank tenosynovitis (i.e. crepitus, linear tenderness) [7–9]. Half a millilitre of preparation is administered into the sheath through a fine-bore needle, the skin having been sterilised with alcohol and then frozen with ethyl chloride. The patient should be warned of the tiny risk of damage to the superficial radial nerve, which can provoke a dystrophic response. If there is any neuralgic or severe pain on needle insertion, the compound must not be injected. Instead, the needle should be repositioned. Skin discoloration and subcutaneous fat atrophy may also occur.

Surgery cures the majority. Surgical loupes are mandatory. The arm is exsanguinated and a tourniquet inflated. Under a local anaesthetic, a transverse skin-crease incision is made at the level of the tip of the radial styloid. The subcutaneous tissues are very gently spread with fine tenotomy scissors, sliding the fat containing the superficial radial nerve fibres dorsally and palmarwards on the plane of the retinaculum. The retinaculum is clearly exposed on its outer surface. The retinaculum is divided along its dorsal third, thus preserving an anterior margin to minimise anterior subluxation of the tendons, when the wrist is subsequently flexed. A very careful search is made for one or more hidden compartments. Thirty to sixty per cent have a septum sepa-

rating APL and EPB [10]; multiple tendons are not uncommon. If there is synovitis, this is removed and, if necessary, specimens are sent for analysis. The wound is washed out thoroughly and then the tourniquet deflated. Once haemostasis is secured with gentle pressure (not diathermy, because of the vulnerability of the cutaneous nerves to inadvertent damage), the wound is closed with a continuous subcutaneous soluble suture. Splinting is not advised – early restoration of gliding planes is always recommended in hand surgery.

EPL Tendon

Anatomy

It runs through the 3rd dorsal compartment. Lister's tubercle pulls the tendon ulnarwards. This imparts a vector so that contraction of the muscle pulls the thumb dorsally and ulnarwards – *retroposition*.

Tenosynovitis

The EPL tendon can be affected by an inflammatory tenosynovitis. This is usually provoked by unaccustomed overuse. It presents with the cardinal features of a tenosynovitis – pain, swelling, tenderness and crepitus along the course of the tendon. Colour duplex ultrasonography is a very sensitive test for confirmation.

Treatment involves rest, non-steroidal, anti-inflammatory tablets and an accurate cortisone injection. Surgical release for intractable cases is very rarely needed, but nevertheless likely to be effective.

EPL tendon can be affected in rheumatoid arthritis. This most commonly presents with silent rupture and an inability to retropose the thumb. EIP transfer is very effective [11].

Ischaemic Rupture

EPL tendon can rupture spontaneously following a distal radius fracture. This occurs a few weeks after the injury. Undisplaced fractures are usually affected; EPL rupture is rare after comminuted displaced fractures. The cause is likely to be ischaemia within the tight sheath, provoked by swelling [12].

Peritendonitis Crepitans

Box 2.3: Key Points: Peritendonitis Crepitans

- Provoked by unaccustomed overuse
- Usually responds to rest and steroid injection
- Surgical attention- second dorsal compartment

Pathology

This condition is sometimes known as intersection syndrome, or crossover syndrome (Fig. 2.7). It is a true tenosynovitis around the radial wrist extensor tendons within the second extensor compartment. Although the pathology was previously attributed to a frictional bursitis between the APL/EPB and ECRL/ECRB tendons, this has been revised. Grundberg and Reagan [13] found tenosynovitis in each of the 13 cases in the second extensor compartment; the symptoms were

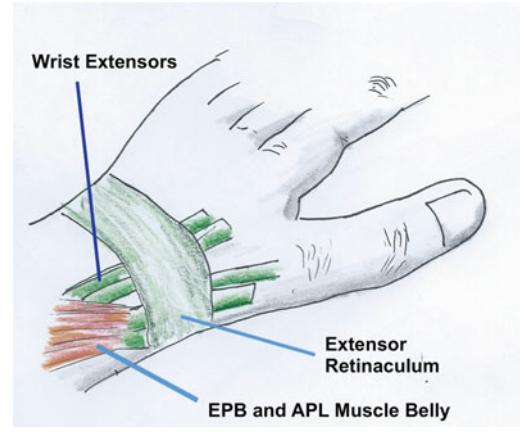

Fig. 2.7 Crossover syndrome (peritendonitis crepitans)

relieved by decompressing only the second compartment decompression alone. The explanation is that the swollen tenosynovium cannot distend the stout 2nd compartment and so presents just proximal, where the EPB and APL cross over.

Clinical Features

This condition usually follows a period of unaccustomed overuse. The patient complains of pain over the back of the distal forearm, pointing to an area proximal to that of de Quervain's. On examination there is pain, swelling and crepitus at the point where EPB and APL run obliquely across the longitudinally orientated second dorsal compartment.

Treatment

Rest, anti-inflammatory drugs and a splint can help, especially if there is an acute onset after overuse. A steroid injection can be very effective.

For persisting cases, surgery is recommended. A longitudinal incision is made over the intersection. The plane between the EPB/APL and underlying wrist extensors is developed. The 2nd dorsal compartment is opened.

Adult Trigger Thumb

Pathology and Aetiology

The pulley system in the thumb differs from the finger. There are two transverse pulleys separated by an oblique pulley. The first transverse pulley is involved in trigger thumb.

The pathology is similar to de Quervain's disease, namely primary stenosis of due to alteration of the sheath [14, 15], The nodule in the tendon is probably secondary to the constriction by the edge of the sheath, rather than primary pathology itself.

It is usually an idiosyncratic, constitutional condition. It is more common in diabetes (due to metabolic alterations in the sheath) [16]. It is also more likely in those with amyloidosis and mucopolysaccharidoses. Several digits may be affected in these groups of patients.

It also occurs in rheumatoid arthritis, due to a thickening of the synovial sheath. Relationship to working activities is controversial. Trigger thumb is not related to occupation [17], although repetitive gripping activities may cause acute transient triggering [18].

Clinical Features

The thumb is affected less commonly than the middle and ring fingers (which are the most usually affected) [19]. The patient may present with locking of the interphalangeal joint during flexion, often more noticeable on awakening. The patient may also complain of significant pain over the front of the thumb. Sometimes the complaint is of an inability to bend the thumb properly, rather than locking.

On examination, there is a tender nodule at the opening of the sheath, directly anterior to the MP joint. Locking may or may not be demonstrable – there may just be a restriction in active flexion.

Treatment

Trigger thumb may resolve spontaneously – patients with early mild symptoms just need reassurance. The thumb can be splinted or taped straight at night. Corticosteroid injection into the tendon sheath cures around 70 %, although is less reliable in type I diabetes [16].

Surgery is almost universally effective [20]. Surgical loupes are mandatory. Under local anaesthetic infiltration, a 1 cm oblique incision is made over the skin crease in front of the MP joint. The digital nerves, which are close to the midline, are gently exposed and meticulously avoided. The thickened opening of the sheath is divided longitudinally under direct vision with a scalpel for about 8 mm. Free excursion is confirmed by asking the patient to actively flex and extend the thumb tip.

Percutaneous release with a needle is an alternative [21]; the proximity of the digital nerves in the thumb, rather than the finger, demands caution.

Trigger Thumb in Children

Box 2.4: Key Points: Trigger Thumb in Children

- Acquired rather than congenital
- May resolve spontaneously by age 3
- Outcome good even if surgery delayed
- Try splinting if tolerated

Pathology and Aetiology

The cause is unknown. The term "congenital" is inappropriate, because children rarely present before the age of 6 months; no case was found amongst 4,719 newborn infants [22]. The differential diagnosis is congenital clasped thumb, in which there is absence or hypoplasia of the thumb extensors.

Clinical Features

This is the commonest surgical hand problem in a child. The parents of a child from 6 months to 3 years notice that the thumb tip is flexed, or that the child cannot bend down the thumb [23, 24]. Proper triggering is not usually reported by the parents. The thickened flexor tendon sheath is palpable at the level of the MP joint ("Notta's node").

Treatment

Trigger thumb may resolve spontaneously in nearly half of children [25–27]. Fifty per cent of thumbs responded to night splintage in extension [28, 29], with only 2 of 43 digits requiring surgery. Cortisone injection can also be effective in children, but would be confined to much older children able to tolerate the injection in an outpatient clinic. Spontaneous improvement after age 3 is uncommon and so surgery might now be considered [30]. However, the results of surgery are still good, even if delayed after 5 years of age [31]. At this age a general anaesthetic is required and exquisite surgical technique is mandatory. Percutaneous release, rather than open surgery, is an option in children [32].

Clinical Pearls

Take great care with distal plate position (FPL) and screw length (EPL) when using a volar locking plate.

Intra-operative dorsal skyline views during volar plate surgery should exclude dorsal screw protrusion

Cortisone injections can solve most tendinopathies in the thumb

Beware the hidden tendon when releasing de Quervain's

The thumb tip will still extend after EPL rupture due to intrinsic pull through the extensor hood. Inability to put the pulp of the thumb against the dorso-radial corner of the index MP joint is the key finding.

Conclusions

The thumb has an array of tendons controlling its precise yet powerful function. These tendons are subject to a range of pathologies and are vulnerable to iatropathic injury. Restoration of function is usually possible with therapy, injections and surgery.

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