Surgical treatment of degenerative osteoarthritis of the fingers

Traitement chirurgical des arthroses primitives des doigts

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Abstract

Degenerative osteoarthritis of the long fingers is rare and surgical management is often necessary if there is joint pain, however this indication should not only be based on radiographic imaging. The specific anatomical problems of the metacarpophalangeal (MCP), proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are described. The surgical approach for each joint is described as well as functional management, in particular that of the extensor apparatus. Mobility should always be preserved for the MCP, arthroplasties are recommended for the PIP except for the index, and arthrodesis for the DIP. The different and most frequently used implants are described as well as the indications and expected results. The indications are discussed in relation to the limited results in the literature as well as the preferences of a panel of French hand surgeons.

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Résumé

Les arthroses primitives des doigts longs sont rares, elles nécessitent une prise en charge souvent chirurgicale, si les articulations sont douloureuses ; l’indication ne doit pas être posée sur la seule image radiographique. Sont évoqués les problèmes anatomiques spécifiques à chaque articulation métacarpo- phalangienne (MCP), interphalangienne proximale (IPP) et interphalangienne distale (IPD). Pour chaque type d’articulation, les voies d’abord sont décrites, ainsi que les impératifs fonctionnels, en particulier par rapport à l’appareil extenseur. La mobilité est toujours conservée pour les MCP, les arthroplasties pour les IPP sont préférées, sauf pour l’index, et les arthrodeses pour les IPD. Les différents types d’implant les plus utilisés sont décrits, ainsi que les indications et les résultats que l’on peut attendre. Ces indications sont discutées par rapport à la littérature assez pauvre et selon les préférences d’un panel de chirurgien de la main français qui nous ont décrit leurs préférences.

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1. Introduction

The subject of this study is limited to the surgical treatment of primary degenerative osteoarthritis of the long fingers. From a pathological point of view, this excludes carpometacarpal osteoarthritis, especially that of the thumb (CMC1 or basal osteoarthritis).

This also excludes secondary, post-traumatic osteoarthritis involving fingers that have already undergone emergency surgery with associated soft tissue injuries that make these cases of sequelar osteoarthritis much more complex, with poorer therapeutic results, in particular for implants.

Finally, rheumatoid arthritis, which associates long finger and thumb involvement, mainly in the proximal interphalangeal (PIP) and metacarpophalangeal (MCP) joints, with involvement of the radiocarpal, midcarpal and distal radioulnar joints and the upper and lower limbs, is excluded as well.
2. The difficulties associated with degenerative osteoarthritis of the fingers

From an epidemiological point of view, osteoarthritis of the hand is ranked third of all types of osteoarthritis, and in particular the PIP joint is the third most frequently involved joint of the hand [1]. This illustrates the high frequency of osteoarthritis of the fingers.

Clinically, most patients consult for pain, and we believe that this is the only real indication for surgery. Pain can be extremely severe, and result in loss of function. Malalignment of the fingers is sometimes observed in particular on the frontal plane such as clinodactyly, generally with ulnar deviation, and especially in the index finger because of the stresses and strains created during pinch grips.

When it is severe and overall hand function is affected, deformity, in particular of the index finger, is the second most frequent cause of consultation. These deformities are usually associated with significant pain. If function is preserved and there is no pain in the hand, there is no indication for surgery. This important rule should be remembered: one is not operating on an X-ray, one must take into account all of the patient’s symptoms (a large majority of these cases involve women).

The bibliographic study and the concepts of evidence-based medicine show that: the results published in the literature are limited, there are very few publications on degenerative osteoarthritis of the long fingers, MCP involvement is very rare and the two problems associated with surgery are mainly:

- the long-term stability of PIP arthroplasty and;
- the difficulty of obtaining union in distal interphalangeal (DIP) arthrodeses [2].

The surgical technique, the surgical approach and especially the implants used are extremely important in both cases and recent progresses have made it possible to improve results.

Surgical treatment of primary degenerative osteoarthritis of the long fingers has several advantages:

- first, the relatively normal ligaments to be preserved. In degenerative osteoarthritis (except in the presence of trauma, or an inflammatory disease), the structure of the ligaments is supposed to be normal or fairly well preserved. This makes it possible to use unconstrained prostheses because stability is preserved, especially in the frontal plane. However, this means that when certain surgical approaches are used – such as lateral approaches – collateral ligaments must be repaired and reinserted;
- to ensure good tissue trophicity, it is extremely important that there be no existing scar from prior surgery on the site where the incision is to be made to treat degenerative osteoarthritis of the fingers.

Finally, when osteoarthritis involves both the PIP and DIP joints, the choice of treatment is simplified: a PIP implant should be associated with DIP arthrodesis, while in rheumatoid arthritis in which PIP involvement is often associated with MCP involvement, a MCP prosthesis associated with PIP arthrodesis is recommended.

3. Anatomical bases for surgery of the long finger joints

It is impossible to consider surgical treatment of these specific articular diseases from an osteoarticular point of view alone, without considering the surrounding soft tissues. This is why the digital chain, which is so dear to authors such as MA McConaill or JM Landsmeer, must be kept in mind. The digital chain is perfectly balanced thanks to the participation of the following structures:

- the intrinsic structures;
- the two flexor tendons;
- the so-called dorsal aponeurosis and;
- the diagonal systems called intrinsic muscles which are the dorsal and palmar interossei muscles, the lumbrical muscles, and ligaments, in particular the oblique retinacular ligament.

Joint stability is also ensured by the two collateral ligaments which function totally differently for the MCP or the PIP. Moreover, the palmar ligament (palmar plate), which limits extension of the PIP beyond 0° should also be taken into consideration both to stabilize an implant which is placed by dorsal approach or when a strict palmar approach is used.

The extensor tendon is especially important when dorsal approaches are used. This is not a tendon in the strict sense of the word, but a flattened aponeurosis which takes the shape of the transverse dorsal convexity of the phalanxes with the tendinous bands of the extensor, reinforced by the intrinsic muscle expansions. There is the median band that ends at the base of the middle phalanx and the lateral bands, which pass on either side of the proximal phalanx and stretch in a band that terminates by attaching to the base of the distal phalanx. It is very important to also consider the interossei expansions, which insert directly onto the median band or the lateral bands.

Whatever surgical approach is used to section the extensor apparatus, repair and restoring a balanced length after the prosthesis has been implanted are very important. The vascularization of the palmar plate must be taken into account with its collateral branches coming directly from the proper palmar digital arteries on both sides, which run under the palmar ligament expansions or check reins to limit hyperextension, then insert much further onto the palmar side of the proximal phalanx. This is important to consider in palmar approaches, because this vascularization is systematically destroyed. Finally, dorsal vascularization does not present any particular problem, except for the need to preserve the veins in certain types of fragile skin in elderly patients.

For dorsal approaches, the extensor apparatus is sometimes a problem. Indeed, which direction should be taken? Can this dorsal aponeurosis be completely sectioned in a transverse
incision proximal to the base of the middle phalanx? Is a distal V-flap enough as in the so-called Chamay approach? Can a lateral approach be used, requiring detachment of a collateral ligament, subluxation of the extensor aponeurosis to the other side, as well as cutting the transverse retinacular ligament?

Certain authors prefer a strictly longitudinal approach in the center of the axis of the extensor aponeurosis with detachment of the central slip towards both sides. Nevertheless, it is important to preserve its insertion at the base of the middle phalanx. During repair, a certain balance must be restored. The median band must be stable to prevent boutonniere deformities even if in this type of repair, flexion is more important than extension.

4. Surgical treatment of metacarpophalangeal osteoarthritis

There are certain sayings about the MCP found in the literature [3–5]. First, never perform arthrodesis in this joint, which must remain perfectly flexible, which has two degrees of freedom, even if it is not always possible to recover abduction-adduction with available implants. As for the choice, surgeons should use the prostheses that they are familiar with and take the surgical approach that they have learned. If the surgeon wants to use an unconstrained prosthesis, care must be taken to make sure that the ligaments are preserved and preservable. The results of our colleague and rheumatologist E. Maheu are of concern because osteoarthritis of the fingers seems to begin with these ligaments: if osteoarthritis of the fingers is progressive, then we can understand certain poor long-term outcomes in unconstrained implants even though the ligaments were preserved, which is paradoxical (Fig. 1). Arthroplasties are always used, constrained implants, usually. Arthrodesis is never proposed.

4.1. Surgical approaches

We use either a dorsal approach with a simple zigzag incision on one finger, or a V-incision for adjacent fingers. The advantage of the V-incision is that it can be extended to a Y, especially in arthritic hands with retracted skin and stiffness during extension. After protecting the veins and subcutaneous dissection, an approach is taken which uses a section of the radial sagittal band as long as the extensor apparatus is perfectly centered.

4.2. The implant

Arthroplasties can be constrained or unconstrained, metal on metal, metal on polyethylene, pyrocarbon on pyrocarbon. We systematically choose hard silicone Neuflex® type spacers which are extensively used both in the literature and by the colleagues that we questioned in our investigation among the members of the French Society of Hand Surgery (Société française de chirurgie de la main [SFCM]). However, MCP involvement is extremely rare, is usually found in elderly patients who may suffer from hemochromatosis and it affects one or two joints, usually the radial fingers. This was also found in the literature.

5. Surgical treatment of degenerative osteoarthritis of the proximal interphalangeal joints

There are many more possible treatment options in these cases. The primary treatment option is arthroplasty. Prostheses can be constrained or not; unconstrained implants may be silicone spacers or actual prostheses with no connection between the two components [6–11]. Constrained implants are more complex and can require slightly aggressive phalangeal preparation. PIP arthroplasty is preferred by a large majority of authors compared to arthrodesis, which is often only indicated for certain fingers, in particular the index to obtain a strong, stable pinch grip [12].

5.1. The surgical approach

There are a variety of surgical approaches: the Chamay V-shaped flap (Fig. 2), a simple longitudinal approach, a transverse approach or a lateral approach: the joint is then opened like a book on the opposite hinge. It is important to choose this hinge. Indeed for arthroplasty of the index, an approach on the ulnar side of the finger is recommended.

Although this review mentions the rare studies published in the literature, we also provide the results of our investigation of 22 colleagues from public or private practice with experience in this type of surgery. The implants chosen for PIP joint arthroplasties by 17 colleagues who responded to our investigation were:
5.2. The implants

To get an idea of the history of the implants proposed for these joints, and three generations of implants, we recommend consulting the excellent article by Condamine [20].

In our series, we analyzed the results of 19 Neuflex® spacers in pure primary degenerative PIP osteoarthritis in 13 patients after a mean follow-up of 5 years [7,11,15,19,21,22]. At the final follow-up, patients had no pain in 13 cases out of 19, with notable pain in only one patient. The complication rate was 10 % requiring revision surgery in one case.

The longest published series by Swanson in 1994 reported revision surgery in 11 %. Thus, our figures are comparable to those in the literature. The complication rate of other articular implants is much higher, more than 25 % in all series (Figs. 4, 5).

5.3. The other alternatives

We will not describe free vascularized joint transfer, which we find extremely invasive, and which is not indicated in primary degenerative osteoarthritis [23].
6. Surgical treatment of distal interphalangeal osteoarthritis

In this series, we were surprised to find that four of our colleagues had tried DIP prostheses, and one was enthusiastic. The surgical approach is always dorsal, whatever the type of surgery; on the other hand the incisions varied. An S incision is possible but we strongly prefer an H-shaped incision with the small transverse incision above the joint but largely below the nail matrix. This reduces the development of ungual dystrophy (Fig. 6). After complete sectioning of the extensor apparatus, there is free access to the joint, with the distal phalanx completely flexed in the shot-gun position. The reference treatment is arthrodesis. In our investigation, K-wires were used by six surgeons, headless screws by six colleagues and shape memory Xfuse® type staples by four surgeons. The results were satisfactory as long as union was obtained or the material that was used was solid enough to resist stress and give an impression of joint stability even if union had not yet been obtained. K-wires have the disadvantage of being left under the skin, with possible problems or even expulsions; poorly designed implants can be the cause of non-union. The double threaded screw or headless screw, such as those used for the scaphoid, has the inconvenience of needing to be placed in the DIP in a straight position (Fig. 7). Indeed, the result is often highly stable arthrodesis with good union but with a DIP in 0° extension. This is fairly unattractive and can be a problem even if the proximal part of the screw does not bother the pulp. This problem is avoided with Xfuse® staples because these implants allow up to 35° flexion for arthrodesis in different positions according to the patient’s choice or the finger being treated (Fig. 8). Nevertheless, the implant is still expensive. We no longer use K-wires for DIP arthrodeses. In the literature, the recommended angle of the arthrodesis is usually straight for the radial fingers (in this case, axial screws are used) and with slight flexion of the ulnar fingers (in this case shape memory staples seem to be a good option).

Finally, joint denervation has been proposed by Wavreille et al. [16] for very painful DIP without significant degeneration.
Disclosure of interest

The author has not supplied his declaration of conflict of interest.

References


Fig. 8. Distal interphalangeal (DIP) arthrodesis with a shape memory staple.