

## A New Therapeutic Approach to Dupuytren's Contracture / Disease (DD)

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### Introduction

The cause and the mechanism that triggers DD have not yet been elucidated. After more than 180 years since Dupuytren described the disease, despite all valuable research studies worldwide, its cause and physiopathology have not been determined. Moreover, the treatment has not been challenged in the last 40 years.

The purpose of this article is to present "a chain of medical and surgical approaches" to DD which is based on my 12 year research on DD patients before surgery and then every month for 6 months after surgery. The article refers exclusively to issues that have not been discussed in the specialized literature.

My vast experience in hand surgery and reconstructive microsurgery allowed me "to establish the stage of the DD" which is a consequence of "the sequence of the seriousness of DD"; "to establish the moment of surgery"; "to complete the standard aponevrectomy in relation to the stage of the DD", so that "the decision" and "the surgical indication" should be best suited to each individual patient. In this way an efficient surgical treatment is obtained, which has "a result that can be controlled and which is most often, definitive".

### Medical and Surgical Attitude

After the positive, differential and associated-illnesses diagnosis is obtained, the inclusion into "the stage of the DD" refers to two key situations:

A) In order to admit a patient for DD surgery, he must be in the right "moment of surgery" which is equivalent with the stationary/plateau/ evolution pause of DD as a whole, irrespective of the affected segment. The surgeon should do everything in his power to obtain the information necessary to answer the question: "Is DD in evolution= active orin plateau=evolution pause?". If the moment of surgery is not well defined, the surgery fails. A conscious patient should have a useful conservation system so he can give precise answers. If his answers and all the indices show that DD is in "the plateau stage", the patient is considered to be in the right "moment of surgery".

B) Inclusion in "the stage of DD" and "prognosis" is done by taking into account the aspect of the hand and fingers in relative pause,

in extension, in maximum digital abduction, as well as by feeling the palm and the fingers. The surgeon's senses "draw out" the general contour of the disease and give him information on the skin quality by permanently comparing the two hands. The surgeon's findings are completed when the surgeon tries to extend the patient's fingers, with the latter keeping his hand relaxed. If the hand and fingers are in maximum flexion from radio-carpal joint and the delicate extension of one or several (but never all) fingers is not possible, the supposition of some marked modifications in the proximal inter-phalangeal joint and destruction of extensor aponeurosis is confirmed. If, when the hand and fingers are in maximum flexion from radio-carpal joint, the delicate extension of one or several fingers is possible, after aponevrectomy the hand and fingers will benefit of a function, which is equal or almost equal to what it used to be before DD.

For the decision and surgical indication to be optimal to the patient so as to obtain the maximum stable results, the patient should be included in the "the stage of DD" which depends on and is a consequence of "the sequence of DD seriousness". It is stated morphologically that in DD there is a progressive hypertrophy and tridimensional retraction of palmar aponeurosis. To this statement, I have to add that in time, after a number of years, progressive hypertrophy and tridimensional retraction of palmar aponeurosis have regressive consequences on the anatomic-functional elements, which are "drowned" in and then strangled by fibrosis.

In progressive order these are:

- Progressive palmar-digital regression of the skin, which turns basically corneous, and also infectious [Figure 1, 14].
- Retraction in finger flexion of the digital pulps toward the palm, which is not passively reductible.[Figure 1, 14].
- Annihilation of finger extension [Figure 4, 5, 14].
- Joint stiffness, dislocation with loss of proximal inter-phalangeal home [Figure 1, 4].
- Blockage, fibrosis, shortening of the superficial flexors [Figure 4, 5, 8, 14].
- Gradual annihilation of the lumbrical muscles (which start flexion). [Figure 5, 14].
- Insufficiency of the blood vessels and peripheral nerves by deviation and strangulation [Figure 3, 4].

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- Marked arterial and venous illness and secondary paralysis of the intrinsic muscles (interosseous and lumbrical), which explains the incapacity of the metacarpophalangeal abduction [Figure 5, 14].
- Obvious suffering in the carpal tunnel, which is "suffocated" [Figure 3, 4, 5].
- A vicious circle is created in which the sufferings at 1,2,3,4,5,6,7 are cumulated with those of the carpal tunnel syndrome +/- Guyontunnel [Figure 5, 16, 17]. The above-mentioned sufferings are aggravated or even "fixed", eventually annihilating any function of the hand and fingers, which are alsodetermined by proximal lesions in the carpal tunnel, low paralyzes of median +/- ulnar nerve.



Figure 1: DD stage III/IV in young patient



Figure 2: Incision dictated by the DD stage, from 1/3 distal of forearm, centered on the metacarpal IV, with observance of flexion folders, prolonged on F1 median, fingers III and IV.

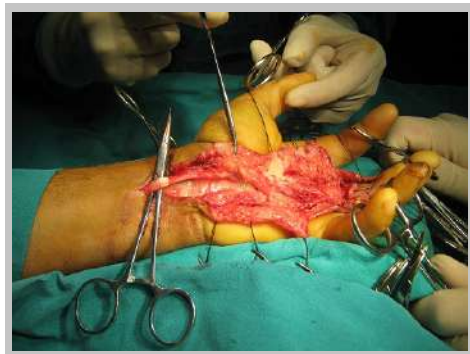


Figure 3: Making evident Palmaris Longus, section of the carpal tunnel and decompression of the median nerve, the Aponeurosis palmaris.

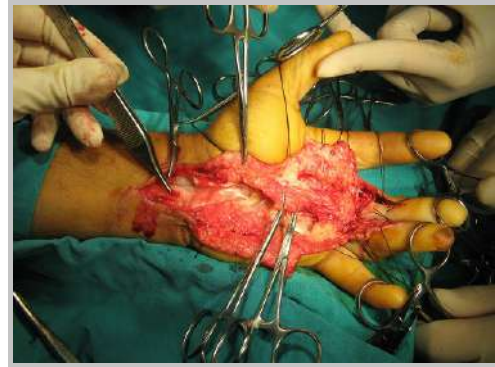


Figure 4: Palmaris Longus sectioned and caught in forceps, forceps on Aponeurosis palmaris, median nerve exposed with "continuity lesion", retraction in flexion finger 4, luxation F2 on F1 at 90 degrees

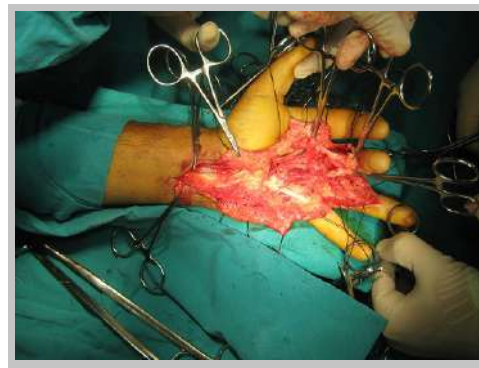


Figure 5: Palmar aponevrectomy from proximal to distal, performed palmarly, Aponeurosis palmaris excised on F1 fingers 4, 5, allowed for the annihilation of the retraction in flexion fingers 4, 5, and the reduction of the luxation F2 on F1, 3 forceps on Aponeurosis palmaris, traction in distal direction toward F1 finger 3; carpal tunnel is open, the median nerve with "continuity lesion" exposed, vascularization of the epinerve of the median nerve obviously suffering.



Figure 6: Sectioned Palmaris longus tendon caught in forceps, sectioned carpal tunnel, external neurolysis of the median nerve, tortuous vascularization of the epinerve of the median nerve; delimitation of the palmar aponeurosis from the palmar vascular and nerve packs 5,4,3,2; aponevrectomy up to level MPJ 2,3.





**Figure 7:** Pulley A1 finger 3, exposed in scissors, will be advanced from the proximal to the opposite side of the scissors.



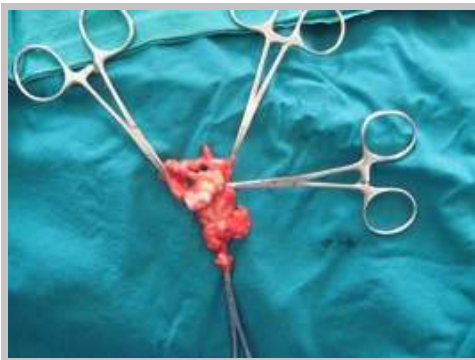
**Figure 11:** Immediately after the removal of the elastic rubber band from the forearm.



**Figure 8:** Setting free finger 3 post-aponevrectomy and the section of the lateral bandelets of the superficial flexor tendon, which is caught in forceps, which allowed the extension of finger 3.



**Figure 12:** Local plasty with cross triangular figures.



**Figure 9:** Aponeurosis palmaris excised is sent to histopathological exam.



**Figure 13:** DD stage IV. Decision: aponevrectomy should be supplemented with the most suitable selection of several of the following surgical procedures.



**Figure 10:** Postsurgical aponevrectomy plague, forearm, palm and fingers, arcus palmaris superficialis, aa digitales palmares communes, digital common nerves, lumbrical muscles 2,3,4,5.



**Figure 14:** Incisions: from 1/3 median distal forearm, prolonged on the flexion fold of the thumb, then median palmar with observance of flexion folds, then axial on F1 finger 3, 4.



**Figure 15:** Making evident Palmaris Longus (at the tip of the scissors), delimitation and section of aponeurosis palmaris, ulnar palmar board.



**Figure 16:** Opening the carpal tunnel through longitudinal section of retinaculum flexorum, decompression of median nerve. Section of palmaris longus tendon at the insertion on retinaculum flexorum.



**Figure 17:** Opening the Guyon tunnel.

The “sequence of seriousness of DD” is the imprint of each above-mentioned physiopathological step translated into the deformation of the hand. The “sequence of seriousness of DD” points out how important it is to perform surgery in the early stages of the disease.

#### Additional comments

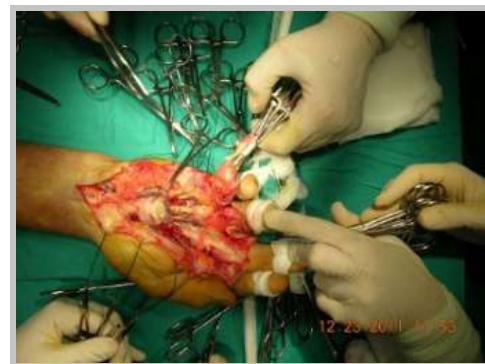
- Is DD in plateau? Yes, then we can perform surgery.
- Both hands are affected. In this case, you should not operate both hands in the same surgical moment. In the plateau stage you operate the dominant hand or the hand which is most useful to the patient, not necessarily the most damaged hand. After 6 months, also in the plateau stage, you can operate the other hand.

- From a histological viewpoint, DD presents three stages: proliferative, involute and residual. In fact, DD presents a chain of such stages, and you, as surgeon, have to hit “the residual”, which I called “plateau”.
- The greatest difficulty in establishing the surgical moment is given by DD associated with metabolic and degenerative diseases, especially in the case of type II diabetes (DZ). In this case, the surgeon knows from the very beginning that he is on running sands. I have in mind those cases in which DZ is in an advanced stage at the moment of diagnosis, knowing that, in general, we have to add 7 years to the moment of DZ diagnosis. Fortunately, there have been extremely few patients with DD and type I diabetes.

#### The surgical treatment of DD

The classical types of surgery in DD are: aponeurotomy, aponevrectomy, dermofasciectomy, arthrotomy, arthrodesis, and finger amputation.

If the surgical treatment of DD has as its purpose the recovery of the function of the hand, the useful DD treatment is surgery, aponevrectomy, which, in my opinion, must be by all means supplemented with additional surgical acts adapted to each patient according to his “stage of DD” [Figures 1-35].



**Figure 18 and 19:** Continuation of aponevrectomy from proximal to distal; Aponeurosis palmaris is caught in forceps with constant traction, so as to help its delimitation and that of arcus palmaris superficialis, aa digitales palmares communes, the common digital nerves, the flexor tendons and the lumbrical muscles.

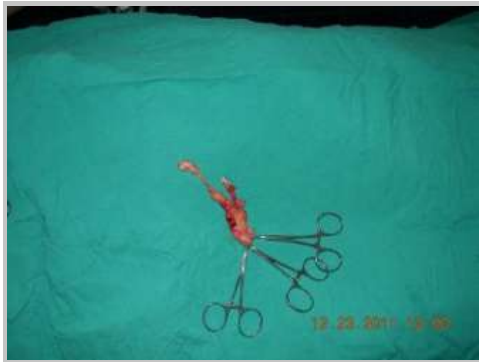




**Figure 20:** Making evident pulley A1 finger 3, completed aponeurectomy for radius 2 and 3.



**Figure 23 and 24:** Completed palmar and digital aponeurectomy .



**Figure 21:** Excised palmar aponeurosis is sent to histopathology to establish if the patient is in an active or plateau stage.



**Figure 25:** Excised palmar aponeurosis and the lateral bands of the superficial flexor finger 4.



**Figure 22:** Completed palmar-digital aponeurectomy (radius 2,3,4,5). Advance of pulley A1 finger 4 and the section of lateral bands of the superficial flexor tendon 4 at level F1, distal from pulley A1, bandelets caught in forceps.



The selected incision or incisions are in fact the stamp of the stage of DD and the difficulty of the completed surgery. Giving back, the function of the hand with palmar-digital scars should not produce retractile scars to be later on taken for the relapse of the disease.

The surgical treatment of DD depends on several factors:

1. The degree of the patient's awareness of himself
2. The level of the first medical line that observes the patient and sends him to the specialist, as well as the level of the health education of the population.
3. Associated illnesses
4. The moment when the patient sees the specialist
5. The specialist's precise evaluation of the surgical moment and the stage of DD
6. The quality of the surgery
7. The observance of the surgeon's obligation not to operate both hands at the same time
8. The quality of the post-surgery assistance
9. Regular post-surgery evaluations and after removal of the cast
10. The degree of the patient's collaboration with the surgeon regarding points [1-9].

"The moment of surgery" is the most important component of the post-surgery result in a period of months or in a lifetime. That is why "the moment of surgery" should be paid the greatest attention and the highest degree of professionalism.

The patient should be asked a basic question: How long is it since nothing changed about his hand? How long is it since he is not concerned about his hand? Some additional questions can be used: How long is it since he started massaging his hand or started feeling uneasy about his hand or feeling the need to stretch his fingers with his other hand. Any question that can indicate the evolution of the disease or its plateau stage is relevant.

In a border situation, as in the case of the diabetes (especially DZII), although the diabetes is controlled theoretically and practically in most of the patients, it remains an illness which I always compare with the dampness of a house. It digs slowly, surely and continuously. It is a situation in which "the stabilization of an optimal value of glycaemia, Triglyceride, Hbg (Hb glycosylate), etc., should not be translated as meaning that the disease allows for the plateau stage. I consider that diabetes in an advanced stage does not practically allow of a plateau. In such cases, the surgical moment is almost "a Russian roulette" for both the patient and the surgeon, knowing that the post-surgery result cannot be the same as in the absence of DZII.

"The moment of surgery" is useful in the plateau stage and, as with all diseases, it is normal that the surgery be performed at the debut of the disease and in the plateau phase. It is not normal to wait for the annihilation of the supra- and subjacent anatomic structures. It is not normal to prefer an operation on skin which is already significantly degraded (corneous layer at the expense of the epidermodermic one), which cannot protect itself and which presents mycosis. It is not normal to wait for stages II/III, III/IV, when there are already retractions, deviations and strangulations of the digital-palmar vessels and nerves, shortenings of muscles and tendons, damage of digital joints-precious mechanisms that once lost can no longer be reconstructed.

It is advisable to perform surgery under general anesthesia. For many reasons I do not favor regional plexus anesthesia. The mere injection in the brachial plexus, which in theory is an injection in the "sheath" of the brachial plexus, is a "barbarian", traumatic and predictably traumatic act. A reconstructive microsurgeon, who performed reconstructive microsurgery in the post-traumatic paralysis of the brachial plexus, will not accept this type of anesthesia. Plexus anesthesia is traumatic and it has severe consequences, which, unfortunately, stay with the patient after he leaves the hospital. This type of regional anesthesia produces a temporary paralysis in the anesthetized extremity, during which a long venous stasis occurs and which explains the post-surgery edema of the operated hand. A hand operated on with other types of anesthesia, never has an edema. We should always avoid an edema, since it is a factor of fibrosis, ischemia, with long-term effects on the functions of the hand. The comfort of the patient, the surgeon and the anesthetist is greater in the case of the general anesthesia, so why should one insist on an anesthesia with peripheral risks, which requires an extensive pre-surgical time, a more expensive medication, and which is injected "blindly". No wonder that, in such cases, I have seen far too many complications with lesions of the peripheral nerves.

When DD is in an optimal phase, that is in low 0/I, I/II stages and sometimes even in II/III stages, if general anesthesia cannot be performed, intra-osseous anesthesia under elastic rubber band [Figure 2] is recommended. It is the simplest form of anesthesia, it is performed by the surgeon, who needs an elastic rubber band, 16ml xylene 1% or procaine 1% and the patient remains conscious. This anesthesia is to be used for surgery which lasts up to one hour. If the

patient is not allergic, when the rubber band is removed, the hand does not present any post-surgical edema. This type of anesthesia is by far more useful than plexus anesthesia, not to mention the low cost, the simple performance and the bilateral "comfort" of both patient and surgeon. This anesthesia can be also used in all hand emergencies that do not last more than one hour and it is affordable to all countries irrespective of their economic development.

Surgery is performed under elastic rubber band placed either at upper  $1/3$  or at  $1/2$  of the forearm. The elastic rubber band ensures a bloodless surgical field, so that surgery can be totally performed in plain view, without collateral damages to vessels, nerves, which are often caught in fibrosis, strangled and deviated from their natural trajectories.

After surgery is completed and, the rubber band is removed, the surgeon places a humid compress with physiological saline on the plague and waits for a few minutes, that is long enough for the remaining anesthetic solution and the stasis toxins to be eliminated. If he follows these steps, the surgeon no longer needs to perform any kind of hemostasis. Bleeding can also be avoided by avoiding the permanent tamponing of the surgical field.

### **Surgery depends on the stage of the DD**

The Incision of surgical approach depends on the stage and seriousness of the DD lesions.

1. In case of a simple nodule, or a simple cord in the stationary plateau 0/1, I/II stage, the incision will be oriented on the projection of the cord, but observing the flexion folds of the palm and fingers, if the cord is placed on the 5th metacarpal radius, the incision will be performed on the 4th radius, having access to the 5th radius and it allows for extensive aponevrectomy.
2. In case of several cords, in the II/III stage, the main axis of the incision is towards or on the median palmar line, observing the flexion folds of the palm and fingers, with digital extension on fingers II, III, which are completed with local triangular figures that intercross after aponevrectomy has been performed. The ideal triangular figures are 60/60 degrees on fingers and the length of 1.2-1.8cm, depending on the size of the fingers.
3. In case of a tight cord, which retracts one or two fingers, in stage III/IV, the palmar incision is completed with one or two series of local triangular figures (45/45 degrees and length of 2.5-3cm), that will intercross, adapted to the flexion folds of the palm and fingers. The surgeon should pay more attention to pyramidal delimitation of triangular figures in order to secure their vascularization, after aponevrectomy.
4. In case of DD in a very advanced stage, stage IV, palmar teguments offer no post-aponevrectomy support, being "worn out" by the stage and the neglect of the disease. The skin consists almost exclusively of corneous tissue. Two solutions are available: 1) A remaining skin defect is deliberately left over for controlled elimination of a hematoma and 2) peripheral epithelization. If the defect is more than 2-3 cm<sup>2</sup>, a skin graft is applied but leaving a very small room for drainage.
5. In case of a DD in an extremely advanced stage, stage IV, in which there are some old homeless luxations of F2 on F1, in which the complex systems of the articular function are "canceled" and after aponevrectomy there results a flexion of the finger, which is not fixed but without possible extension, in

which the proximal interphalangeal joint (PIJ) is practically annulled, after aponevrectomy one of the following variants are used:

- a) Arthroplasty PIFJ: The surgeon cuts off from the epiphysis of the distal end of F1, the continuity of the extensor aponeurosis is reconstructed using the median band of the extensor aponeurosis on its former location as well as the collateral bands of the extensor aponeurosis, "bringing them together" towards the posterior median, but not on the median extensor band, through several unresorbed 4/0 threads.
  - b) In "expired" cases in which the rigidity of joints and the contracture in flexion is fixed, without possibility of passive mobility and in which the fixed adduction of metacarpals are evident, the patient is explained that for a hand the global function is important, that at his age . He has a vital need to rely on his hands, that the most useful thing would be to give up the finger which cannot be recuperated functionally, which by its fixed retracted posture will cancel or impede significantly the function of the hand/fingers. But if that finger were amputated from level X, it would allow the rest of the hand and fingers to be extremely useful. The amputation of the finger with maintaining the F1 or part of it should be made so as not to allow the unbalance of the other fingers; at finger 5, F1 is vital in stabilizing the force of the hand.
6. I came to the conclusion that starting with stages II/III, III/IV and IV depending on the particular situation, surgery /aponevrectomy should be supplemented with the most suitable selection of several of the following surgical procedures:
- a) Advancing one or two pulleys, most often A1 and seldom A2 [Figures 7, 9, 20, 22].
  - b) Giving up one or two superficial flexor tendons, at the level of lateral straps – usually when there is a significant digital retraction and where the advancing of pulleys was necessary. In this way, the retraction in flexion from the proximal interphalangeal joint (PIFJ) is reduced significantly and open road is ensured for the profound flexor tendons [Figures 4, 5, 8, 22].
  - c) After aponevrectomy, the opening of the carpal tunnel, and seldom of the Guyon tunnel as well, is recommended and has to be done, because even in the intra-surgery stage, the surgeon will see the suffering of the median nerve and seldom of the ulnar nerve, with evident aspect of "continuous lesion" and with the vascularization of the epinerve obviously compromised. [Figures 3-6].
  - d) Section of the Palmaris Longus tendon at the junction of the carpal tunnel. [Figure 3, 4].

### Completed Surgery

Skin suture is made with atraumatic needle 4-6, ideally monofilament with qualitative structure similar to those used in reconstructive microsurgery [Figure 12]. A pile of 10/10 cm compresses of 100% cotton is placed in the palm, so as when the gauze is rolled from the distal to the proximal, a controlled pressure is created on the affected palm skin. After the first gauze layers, a light cast splint is applied, so that the fingers be kept in repose. In the end, the tip of the fingers are "fixed" with adhesive band on the splint, so that the patient be cautioned not to move his fingers.

Ideally, the gauze should not be removed before the 14th or 16th day. I cannot impose this finding, but I can argue in favor of it. The palmar skin is precarious and also decollated. It hardly "flickers". If we keep dressing the operated hand, in the case of DD, the skin is mathematically destroyed because it loses step by step the chance of revascularization from the bed on which it is applied.

In all operated hands, the postsurgical medication consists of light antihistaminic in the morning and evening, injectable penicillin or ampicillin in unique dose plus the treatment of associated illnesses according to the patient's scheme. If the patient had mycoses in the hand to be operated on or at other extremities, their treatment was done two months before surgery.

The patient is instructed pre- and post-surgery that there will be three weeks in which the operated hand will be in repose and elevated "at the level of the naval", that he should not move his fingers so as to destroy the skin, that, if everything goes well, in 14-16 days the sutures will be removed; then the flexion and extension of the fingers will start gradually and gently and then actively, coordinated by the mind, but not in force. From the fourth week the patient uses his hand normally, almost for everything he used to do before DD, starting with personal care. Between the first and the second month, in case of the most serious form of DD, the patient should be apt to do the complete flexion and extension of the fingers, but not in force. He will not be allowed to make exercises of flexion and extension from the fist joint. After two months he is free to do whatever he wants except for a sport which involves hanging from the hands or similar movements. The patient must be reintegrated in normal life naturally, within six months.

The so-called treatment of physiotherapy recovery for the operated hand is not recommended. One should not forget this category of hands must not be treated for lesions of tendons, bones, nerves, vessels and muscles. The patient will be informed that his hand has a "complete" functional inventory.

Postsurgical result of the hand with operated DD is evaluated through monthly tests of mobility, sensitivity and the useful functioning of the hand; the complete prehension of the hand fingers; the extension of hand and fingers and the abduction of the fingers; the checking up of the peripheral nerves functions.

Depending on the DD seriousness, the time which passed since the debut of the disease, if the moment of surgery was set correctly, if the most efficient surgical solution was selected, if the patient observed the pre- and post-surgical recommendations, within six months after surgery, the patient can forget that he ever had DD.

Both hands are photographed and filmed comparatively: aspect, posture of repose, abduction and extension and prehension, as well as palmar-digital scars.

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