

ON THE DIAGNOSTIC AND THERAPEUTIC EMPLOYMENT
OF NOVOCAIN INJECTIONS IN TRAUMATIC
REFLEXIVE CONTRACTURES

BY

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The use of novocain injections as a diagnostic aid is not unknown. That these injections may have a healing effect in some cases is perhaps not so universally appreciated.

On three occasions during the last six months we have had the opportunity to employ novocain injections as an aid in diagnosis of different contractures. I therefore thought that it might be of interest to publish these case records in order possibly to stimulate the interest in this question.

Case No. 1. *The Cripples' Clinic*. 2858/30 Nov. 8th, 30. ♀ aged 12 years. In July 1930 the patient fell and got a fracture of the right forearm. The patient was treated immediately in the local hospital with plaster-of-Paris bandage for 11 days. As a swelling of the hand occurred the bandage was removed and a pressure wound was found in the centre of the proximal part of the palm. The mobility of the 1st finger had decreased very much and gradually the finger became almost immobile. The patient seeks advice at the clinic because the 2nd finger owing to the position of the thumb cannot be placed into the hollow of the hand without abduction of the 1st finger by means of the other hand. Moreover the patient complains of pain, diminution of power and coolness of the *whole* hand, symptoms that are aggravated in cold.

On objective examination the right hand is found to be cool, cyanotic, and slightly atrophic. The fingers are pointed, the

skin is smooth — »glossy skin«. Trophic transverse lines are seen on the nails. In the palm, $\frac{1}{2}$ cm. distal to the lig. carpi transversum in the thenar border, there is an irregular cicatrice, the size of a penny piece, that is slightly adherent at



Fig. 1.

the bottom and has a few painful spots. The 1st finger is fixed in adduction and supination opposite the 2nd finger. Fig. 1. Actively the finger can only be moved a little. The space between the two fingers is about 1 cm. It is with difficulty that the 1st finger passively can be moved so much to the radial side that

the 2nd finger can be flexed. The mobility in the interphalangeal joint of the 1st finger is completely free. The thenar muscles are slightly atrophic; in the deep layer a tightening corresponding to the m. adductor pollicis is palpated. The mobility in the

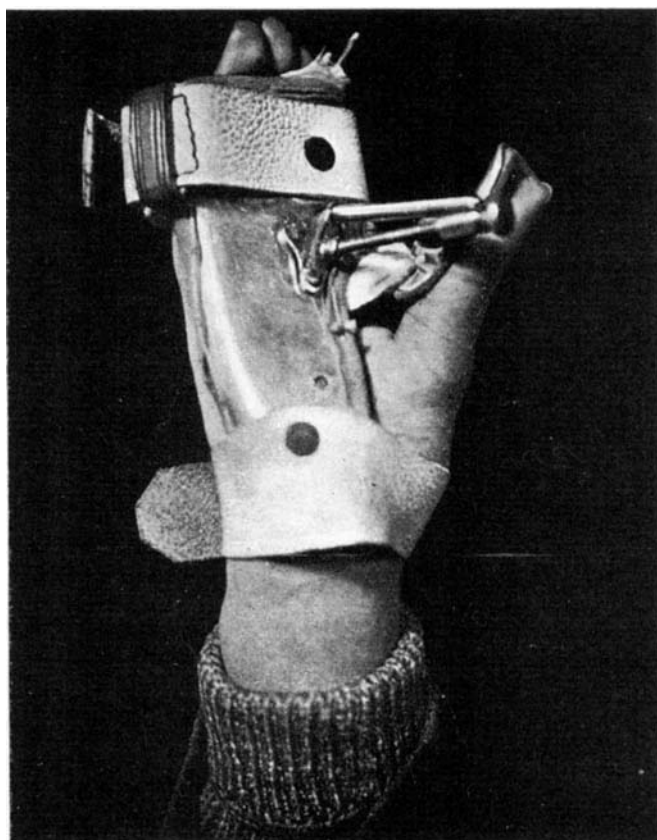


Fig. 2.

other finger joints as well as in the wrist and the elbow joint is unimpaired. No traces of fracture can be demonstrated in the forearm. Examination of the sensibility shows nothing abnormal. On X-ray examination no pathologic signs are found apart from a marked osteoporosis of all the bones of the fingers

and the wrist. In the distal third of the antibrachium a healed fracture is seen in a blameless position. There is no osteoporosis of these bones.

Diagnosis:— contracture of the 1st finger, partly owing to tightening cicatricial tissue in the deeper parts, partly as a consequence of ischaemic alterations in the m. adductor pollicis.

We tried a treatment with redressing splint, Fig. 2., whereby the mobility of the finger was somewhat improved, whilst the vasomotor disturbances and the halisteresis of the bones remained unaltered. As the condition seemed to be stationary on Feb. 3rd, 31, a few ccm of 2 per cent novocain without adrenalin were injected into the cicatrice in the palm in order thus to elucidate, if possible, whether the contracture might be determined by reflexes produced by the pressure of the cicatricial tissue on the r. muscularis n. medianus. A few minutes after the novocain injection the hand became red and warm the hyperæmia lasted for 5 hours, but the mobility of the 1st finger was quite uninfluenced. On Feb. 5th, 31, it was decided to extirpate the cicatricial tissue in order thus to remedy the vasomotor disturbances, if possible, the latter being invaliding to no small extent. At the same time it was hoped to bring about better conditions for the redressing orthopedic treatment.

Under ether anæsthesia (bloodless area — *Esmarch's* bandage on the forearm) the cicatricial tissue is extirpated. An attempt is made to spare the r. muscularis n. medianus, which is embedded in and adherent to the cicatricial tissue. The attempt is, however, not entirely successful as the disconnection of the nerve branches is extremely difficult. Examination of the thenar muscles shows that all these muscles except the adductor pollicis are natural and react normally to electrical irritation. The m. adductor pollicis has undergone a fibrous alteration and is highly shrivelled with few remaining muscular strands. In order to lengthen the adductor muscle zigzag incisions are made, however without any effect worth mentioning. Immediately after the operation the hand is red and warm. After bandaging for 12 days with the hand in a position of dorsiflexion the mobility is free in all the joints. The mobility

of the 1st finger only is unaltered; the hand is still warm and red. On Feb. 26th, 31, the 2nd finger can be put into the hollow of the hand, the 1st finger not impeding this movement. Fig. 3. The patient continues the treatment with redressing splint worn during the night. On Sept. 26th, 31, the condition is unaltered. There are no vasomotor disturbances, no pain in the hand but atrophy of the thenar muscles. A faint, active contrac-

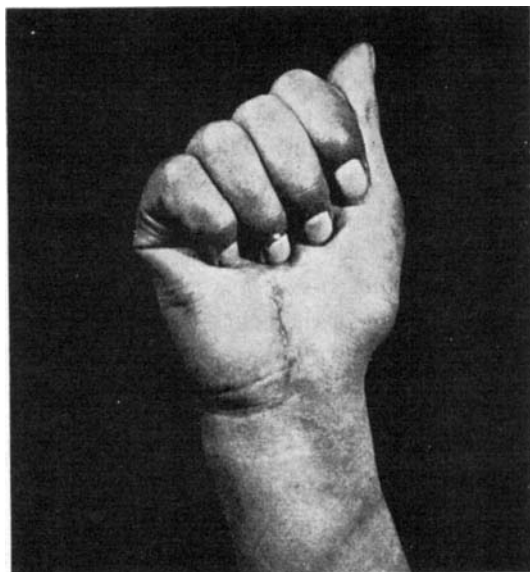


Fig. 3.

tion of the muscles can, however, be demonstrated and the patient has the impression that the power of the finger is improving.

Epicrisis:— a girl, aged 12 years, gets after bandaging of hand and forearm a pressure wound in the palm with an ensuing cicatrice formation. The hand becomes painful, cyanotic and cool with marked halisteresis of the bones of the hand. The thumb occupies a position of adduction contracture but there are no signs of paresis of the thenar muscles. This is the condition 7 months after the trauma. After injection of a few ccm

of novocain in the cicatrice the hand immediately becomes red and warm, only the contracture of the thumb is not influenced.

From this I conclude that the cicatricial tissue in the hand exercises an irritating effect on the motor branch of the n. medianus to the thenar muscles, and probably through a central sympathetic reflex a vascular spasm of the *whole* hand is engendered. The fact that the contracture is not obviated indicates that it cannot be determined by a reflex, nor can it be functionally determined, but it must be due to alterations in the muscles themselves, probably of a trophic nature. The cicatricial tissue was extirpated; the organic alterations of the m. adductor pollicis were of the same type as is seen in *Volkmann's* ischæmic contracture. On disconnection of the r. muscularis n. medianus we did not succeed in keeping it completely intact. The course after the operation was as expected: the hand is still warm, the colour of the skin is natural, and the pain has ceased. The fingers are now natural, not pointed, atrophic. The halisteresis of the bones has disappeared completely. The adduction contracture of the thumb has improved so much through the orthopedic redressing treatment that the fingers can be flexed now without difficulty.

By means of the novocain injection we have thus ascertained that it was the cicatricial tissue that was the factor engendering the vasomotor and the trophic disturbances and have thus obtained a possibility of carrying through a rational therapy.

It would perhaps be practical to mention in a few words the routes through which the pressure of the cicatricial tissue on the nerve tracts might be supposed to engender trophic alterations in the hand. The following possibilities must be supposed to be present:—

- 1) An effect that is localised to the area of distribution of the nerve is seen in case of direct pressure on the nerve.

- 2) A central vegetative reflex effect that — according to our present knowledge of the function of the vegetative nervous system — will always be of a regional delimitation.

- 3) A central sensory-motorial reflex cannot be imagined to be localised to the area of distribution of a single nerve trunk

but will be traced as partial alterations in the area of distribution of several nerve trunks. As an example of this the fact can be referred to that the first muscle that contracts when an attempt is made at engendering Babinski's phenomenon by scratching the sole of the foot is nearly always the m. tensor fasciæ latæ.

Case No. II. *The Cripples' Clinic*. 770/31. March 26th, 31. A shoemaker, aged 27 years. One night in June 1930 the patient in his sleep broke a water-basin to pieces thereby getting an incised wound on the volar aspect of his left forearm with cutting of the tendon from the m. flexor carpi radialis and of the art. ulnaris. The patient was treated in the local hospital with tendon suture. The patient states that after the operation the fingers were bandaged in a highly flexed position. When the wound had healed the active mobility of the III—V fingers was abolished and gradually the fingers became completely fixed in a flexed position. Moreover the patient complains of marked cold in the hand making it necessary for him always to wear a glove. The flexed fingers interfere so much with his work that an amputation has been recommended.

On objective examination an oblique, crossing cicatrice is found, beginning in the median line one finger's breadth above the wrist and running obliquely upwards and towards the ulnar side. The cicatrice is only fixed in the deep layer in a small area of the ulnar part, otherwise it is mobile and free from pain. The wrist, the thumb, and the II' finger move freely and with good power. The III—IV—V fingers are flexed towards the palm and cannot be actively extended. Fig. 4. Passive extension, on the other hand, is possible although it is difficult. There is no tendinous contracture or other contracture of the soft parts worth mentioning. The flexor tendons act comparatively well and with rather good force. There is atrophy of the mm. interossei and of the muscles of the hypothenar and the thenar. The III—IV—V fingers cannot be parted or drawn together. There are no sensory disturbances to pricking, cold or heat. There is no hyperhidrosis. The whole hand is slightly cyanotic and cool. The colour of the skin and the temperature

of the forearm are natural. A hot hand-bath does not change the appearance of the hand.

In order to examine whether the cicatrice engenders the contracture irritatively 10 ccm of 1 per mille percaïn are injected experimentally into the cicatrice. 3—4 minutes after the patient states that he has a sensation of heat in the III—V

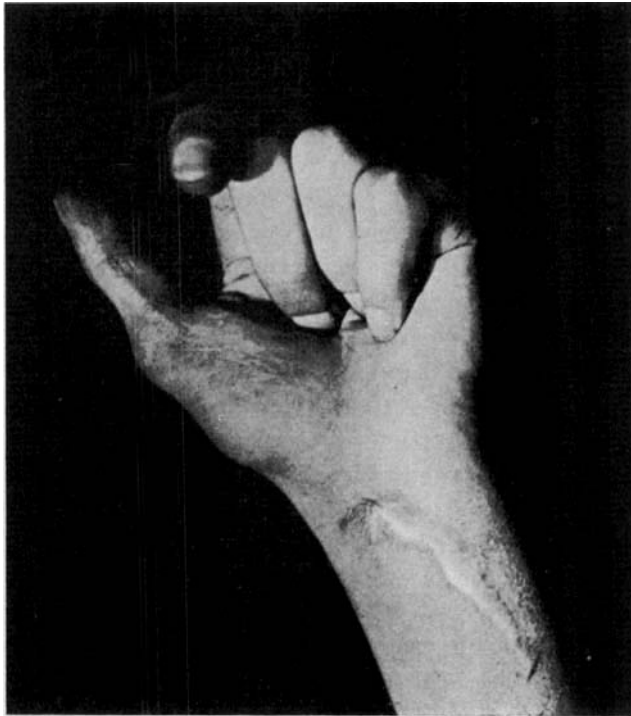


Fig. 4.

fingers. The hand and all fingers become vividly red and all the fingers can now move actively to almost the normal extent. There is, however, some tightening of the fascia palmaris preventing complete extension. Fig. 5. Strange to say anæsthesia corresponding to the area of the ulnaris cannot be demonstrated. 12 hours after the injection the condition is unaltered. The patient was now sent for a neurological examination to Dr.

Wernöe, who states that »there is a remaining contracture of »the V and IV fingers of the left hand, moreover atrophy of »the hypothenar and of all the mm. interossei. Moreover hyper- »algnesia corresponding to the area of the ulnaris and a slight



Fig. 5.

»acrocyanosis of both hands, on the left hand with a pink »colouration of the ulnar half of the hand. Otherwise nothing »abnormal on neurological examination. The case is perceived »as a traumatic ulnaris paresis with concomitant symptoms in »the shape of atrophy of the interossei and irritative phenomena

»in the shape of the contracture now obviated, hyperalgesia
»and vasomotor alterations in the whole area of the ulnaris.
»The percain seems to have obviated the irritative factor.«

When the patient was discharged on March 31st, 31, the mobility of the fingers was satisfactory and he got a splint to be worn during the night in order to counteract a reproduction of the contracture.

On Sept. 19th, 31, the patient states that the fingers still move freely, that they can be parted and drawn together but with diminished power, that the sensation of cold in the hand and the pain corresponding to the cicatrice are uninfluenced.

Epicrisis: 9 months before he sought advice at the clinic a man, aged 27 years, got an incised wound in the left forearm with cutting of the tendon of the flexor carpi radialis and of the art. ulnaris. No lesion of the n. ulnaris was observed at the hospital. After tendon suture and bandaging of the fingers in a markedly flexed position a contracture of the II—V fingers and vasomotor disturbances of the whole hand develop.

As the contracture position of the fingers was characterized throughout by the fingers being flexed to the greatest possible extent in the metacarpophalangeal joints and as there was no adductor paresis I believe that there has been no interruption of transmission in the n. ulnaris. Therefore it appears to me to be reasonable to explain the muscular atrophy and the hyperalgesia as an implication of an irritative condition of the n. ulnaris. After a percain injection into the cicatrice the contracture disappeared and the functional result has now been satisfactory for 7 months. Therefore the vasomotor disturbances only showed a transient improvement. This contracture thus seems to have been engendered by an irritative influence originating from the cicatricial tissue which influences the n. ulnaris partly direct (neuritis in the area of the ulnaris) and partly through reflexes, viz. through a *central* sensory-motorial reflex (the contracture) and through the sympathetic tracts (vasomotor disturbances). This form of contracture corresponds entirely to the type described by *Babinski* and *Froment* in 1916. The characteristic feature of these contractures is that they

are frequently engendered by irritative influence of a nerve area, as a rule through influence of a nerve trunk; in such cases the contracture thus depends entirely on reflexes. But it not infrequently happens that it is impossible, when the trauma was slight, to demonstrate the part from which the irritation is released. The mechanism of the contracture is thus inexplicable; therefore *Babinski* suggested the term physiopathic contractures. The perception of this *facies morbi* has varied in the course of time. *John Hunter* (1839), *Vulpian*, and *Charcot* perceived the contracture as being determined by reflexes through the sensitive tracts by means of an influence on the cells of the anterior horns. Later on, when so many peculiar, traumatic contractures were observed, the perception lay in the direction of considering them as being hysterically determined.

It was only in 1916 when *Babinski* and his assistant *Froment* and the German *Oppenheim* got the opportunity of examining the war lesions that the original perception of the organic nature of the disease again asserted itself. Judged by the literature such cases are rather rare in the surgery of times of peace, but I believe that Dr. *Haagen Jessen*, who especially has taken up this question — among other things in an excellent paper read in the *Jysk Medicinsk Selskab*¹⁾ — is right in saying that there are doubtless cases within the traumatic surgery of times of peace that have not been diagnosed.

In this case the novocain injection solved the riddle. Immediately after the injection the hand became red and warm and the fingers could be moved actively almost to the normal extent. Of course it cannot be excluded that a psychogenous component possibly may have aggravated the condition, but it appears to me that we have a certain knowledge that there is an organic core in the *facies*, as the novocain injection obviated the vasomotor disturbances for some time. The fact that the contracture of the fingers did not recur might perhaps indicate that the contracture was functionally determined. I believe, however, that this was not the case, as I perceive the

¹⁾ Hospitalstidende 1930. 75. No. 32, 46.

effect of the novocain in this manner that it discontinues the reflex arc through which the irritative factor influences the mm. interossei, whereby the normal balance is re-established. It would then be natural to ask why is the contracture not reproduced when the effect of the percaïn wears off, as is seen in the case of vasomotor reflexes. The reason is perhaps that the irritative element of the cicatricial tissue is so weak as compared with the normal muscular innervation that it cannot prevail when this innervation is intact again. We have a parallel of this facies in the effect of the novocain injection on contracted flat-foot. In such cases it is not infrequently seen that a single novocain injection into the mm. peronæi completely and permanently obviates the contracted condition.

Case No. III. *The Cripples' Clinic*. 1992/31. July 9th, 31. A mechanic, aged 27 years. Three years ago his right hand was struck by a rotating aircraft propeller. The dorsum of the hand was heavily injured with fracture of the II and III metacarpal bones and the basal phalanx of the thumb. When the wound had healed the patient was treated with massage, also of the fractured parts (!), for a long period. Despite pain and diminution of the power of the hand he resumed work 3 months after the accident.

During the following year the pain became more intense and the power diminished so that the patient had to give up his work as a mechanic.

On objective examination the right hand is found to be natural. The colour of the skin and the temperature of both hands are identical. On the dorsal aspect of the hand there is a tender cicatrice, which can be moved and which covers the tender painful site of the fracture in the middle of the II metacarpal bone. There is a distinct angle formation. The III metacarpal bone seems to have healed in a satisfactory position with only slight traces of fracture and slight tenderness. There is some increase of breadth over the base of the basal phalanx of the thumb and tenderness at the site of the fracture. When the hand is held in a middle position the thumb is inclined to abduct in the metacarpophalangeal joint. The patient

cannot actively adduct in this joint but passively it is possible to the full extent, but the patient then complains of severe pain radiating up into the forearm. The thumb can be moved actively to a distance of $4\frac{1}{2}$ cm. from the metacarpophalangeal joint of the IV finger. The II and III fingers can actively be flexed to $4\frac{1}{2}$ cm. and 3 cm. from the hollow of the hand, but the IV and V fingers can be moved freely and with good power. The II and III fingers can passively be taken completely into the hollow of the hand, but the movements are accompanied by pain localised to the site of the fracture on the II metacarpal bone. Hand-grip measured by means of dynamometer: left hand 53, right hand 0. There is no sensory disturbance. The wrist can be dorsiflexed to about 15° and volarflexed to about 80° . 5 ccm of 1 per cent. novocain without adrenalin are injected experimentally into and round the site of the fracture, which is extraordinarily tender. A few minutes after the injection the movements of the fingers are completely free and the force of the hand-grip is considerably increased. Dynamometer: right hand 12 kgm. The wrist is now moved freely and with good power. The hand is red and warm. The patient did not appear at the clinic later on as he had got a job.

Only on Sept. 24th, 31 did he appear again, having been invited to do so. He states that the effect after the injection remained for about a fortnight. But then there was a gradual decline. He believes, however, that the condition still is better than before the novocain injection. The mobility of the fingers is as bad as before the novocain injection, but *the mobility of the wrist is still free*. This might indicate that the defective extension of the wrist denoted a restrictive reflex originating from the osseous tissue.¹⁾ After an injection of novocain round the site of the fracture the fingers are moved again with good power. If the effect does not last it is the intention either to try an injection of alcohol at the site of the fracture or by operation to remove the painful callus.²⁾

¹⁾ Wernöe, Act. psychiatric. et neurologic. 1930. VI I, 107.

²⁾ In December 1931 osteotomy was performed at the site of the fracture of the II metacarpal bone. A satisfactory position was obtained

Epicrisis: this is a case of an averting contracture determined by pain. The pain-determining irritative factor was obviated after a novocain injection at the site of the fracture. That the effect is of so long a duration is strange, as the true anæsthetic effect wears off 6—8 hours after the injection. Perhaps the explanation is that even if the sense of pain gradually recurs it is possible, to begin with, by an effort of will to force on the flexion despite the pain, but gradually the pain impulse becomes so irksome that the original contracture is reproduced.³⁾

Orthopedic surgery has been characterized as the discipline within the medical science that begins to exercise its craft when the other disciplines have given up. These three patients are orthopedic patients in this respect. The first patient was

on bandaging on a volar hand splint with wire-extension through the pulpa of the II finger (U. f. L. 1930. 347. Fig. 3.).

3 months after the operation there was almost free mobility with rather good power and without pain. The patient is now working as a mechanic.

³⁾ In the *Dansk Kirurgisk Selskab* 1931 *Holger Rud* has reported a similar case in which osteoporosis, arteriospasm, and contracture of wrist and fingers occurred in association with fracture of the radius.

After periarterial sympatheticectomy on the art. brachialis the condition improved slowly and the rarefaction of the bones disappeared. Thus in the manner of *Leriche*, *Floresco*, *Sudeck* a. o. Dr. *Rud* chose to interrupt the reflex arc above the place from which it must be supposed that the irritative factor was released — the site of the fracture.

That the effect after sympatheticectomy is so insecure is perhaps among other things due to the fact that the tracts along which the reflex passes are not localised solely to the part where the sympatheticectomy is performed.

During recent years ramisection has therefore been recommended as a better operation — although far from secure. It appears to me to be more rational if the treatment aimed at obviating the irritative factor — searching out the starting point of the reflex. In such cases the novocain injections will be of diagnostic importance, and the treatment can then eventually be directed against the site of the fracture.

Recently I have treated some fractures associated with reflex circulatory disturbances on the basis of these view-points, the results seem to be promising. It is my intention to publish the results when the material is sufficiently large.

sent to us in order to get a bandage that could redress the position of the thumb. But it had not been noticed that the real invaliding factor was the trophic disturbance, the atrophic, cool and painful hand, which after the operation became a natural, pain-free hand capable of acting.

The second patient sought advice in order to avoid having the three fingers amputated. After novocain injection into the cicatrice he has been entirely fit for working for 7 months and thus saved the fingers.

The third patient, who had been treated by several doctors and had obtained a compensation of about 30 per cent., sought advice here because he thought that his last resort was to get a bandage. In this case, too, we have a hope that we shall be able to help the patient, the novocain injection at any rate has had the effect that the young man, who was highly depressed owing to the invalidism, recovered his spirits.

I ask Dr. *Th. B. Wernöe* to accept my best thanks for valuable guidance with regard to neurological considerations.

SUMMARY

Casuistic communication of 3 case records with contractures of the fingers after trauma. The cases show the ischæmic, the reflexive (*Froment*), and the pain-determined contracture. The importance of the novocain injection to diagnosis and therapy is illustrated.

RÉSUMÉ

Communication casuistique, comptant 3 observations sur des contractures digitales par suite de traumatismes. Les cas men-

tionnés représentent la contracture ischémique, réflexive (Froment) et celle déterminé par la douleur.

L'auteur donne des exemples de la valeur que peut avoir l'injection de novokaine pour le diagnostic et la thérapie.

ZUSAMMENFASSUNG

Kasuistische Mitteilung von 3 Fälle von traumatischen Fingerkontrakturen.

Die Fälle zeigen 1) die ischiämische, 2) die reflexive (Froment) und 3) die von Schmerzen bedingte Kontraktur.

Die Bedeutung der Novokaininjektion für die Diagnose und die Therapie wird dargestellt.