

THE LOCATION OF PUS IN THE HAND.

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It is generally recognised that infection of the finger or of the skin of the hand itself is often followed by collections of pus in the deeper parts of the palm; but there is no general appreciation of the fact that there exist, independently of the tendon sheaths, definite spaces in which these collections tend to form. In most surgical text-books it seems to be taken for granted that when pus is present in the hand the tendon sheaths are necessarily affected, while in others in which extrathecal abscesses are recognised, the incisions given for their treatment would give rise to infection of the tendons or their sheaths. In my experience of septic hands in a large outpatient department, pus is found more frequently outside the tendon sheaths in the palm than within. The usual incisions recommended for palmar abscesses are placed in the line of the metacarpal bones, in order to avoid the digital vessels and nerves. My object in this communication is to demonstrate the potential spaces in the hand, in which pus usually collects, and to show that any incision for the evacuation of the pus in the line of a metacarpal bone is surgically unsound. My work is practically a repetition on a smaller scale of that of Kanavel, of Chicago, to whose publications on the subject I am deeply indebted.

Let me first describe the clinical conditions present in the collections of pus in the fascial spaces.

CASE I.—A man, aged twenty, was wounded in the hand by the explosion of a blank cartridge on January 10th, 1913. Ten days after the accident he came to hospital with his hand swollen and painful; the normal hollow of the palm was obliterated and there was a swelling at the base of the little finger on its radial side, where the pus was obviously pointing. There was a considerable amount of œdema on the dorsum. Active flexion and passive extension of all the fingers could be carried out without any increase in the pain.

In this case there was pus in the hand without involvement of any of the tendon sheaths. When I opened the hand under an anæsthetic, I found that the pus lay deep to the tendons, and had spread downwards along the course of the lumbrical muscle of the little finger to the radial side of the latter. The hand was opened and drained in the manner which I shall describe below. The patient progressed favourably for some days, but returned on January 31st, complaining of pain in the ring finger. This finger was swollen, red and tender, chiefly upon its radial side; but, again, though active flexion was impaired, passive extension could be performed without undue increase of pain. I incised the finger and found pus lying altogether subcutaneously. After this recovery was rapid, and one month after the accident everything had healed, and the patient had good movement in both ring and little fingers. The pus in this case lay deep to the tendons in the middle of the palm, and had spread downwards to the subcutaneous tissue of the fingers along the course of their respective lumbrical muscles.

That this distribution of the pus is along definite anatomical lines is shown by Fig. 1, which is an *x*-ray

photograph of a dead hand, into which red lead has been injected through the palmar fascia, and deeply between the tendons of the ring and middle fingers. It can be seen that the mass overlies the metacarpal bones of these two fingers and is prolonged downwards along the radial side of the ring, and to a lesser degree towards the same sides of the middle and little fingers. After obtaining the *x*-ray photograph, the hand was cut into sections to demonstrate the exact distribution of the injection. Fig. 2 represents a transverse section of the hand just

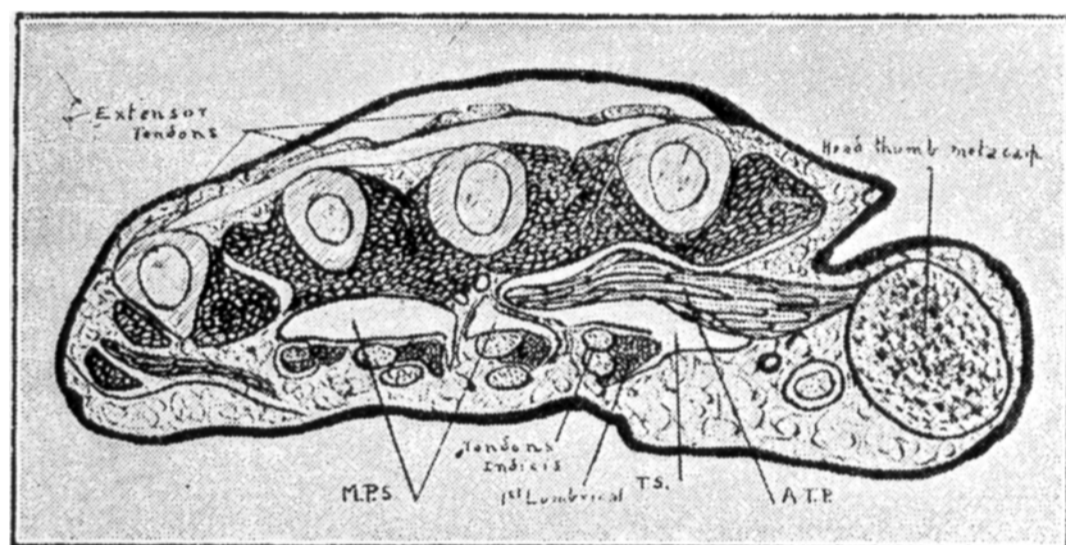


FIG. 2.

proximal to the web of the thumb, through the head of the thumb metacarpal bone. In relation to the metacarpal bones of the middle and ring fingers there is a definite space which lies deeply between the flexor tendons and the interosseous muscles. To this space Kanavel has given the name *Middle Palmar Space* (M.P.S.) It is subdivided at one point by a septum. A section taken at a slightly higher level in the hand shows that these two subdivisions become continuous. It should be noted that the lumbrical muscles of the ring and middle fingers project into the space; the little finger lumbrical usually shows a like relationship. This middle palmar space was the site of the pus in the case I have described. Its pro-

gression downwards towards the radial sides of the fingers can be understood by taking serial sections distal to this plane. As the middle palmar space is followed downwards it is seen to be continued along the inner three lumbrical muscles and to constitute definite tunnels in which these muscles lie.

When it is remembered that the lumbrical muscles are inserted into the superficial aspect of the dorsal expansion of the extensor tendons on the fingers, it can be readily understood that pus travelling along the lumbrical tunnels will reach the subcutaneous tissue of the fingers.

The extent of the middle palmar space and its lumbrical prolongations is shown in Fig. 3.

Red lead was injected along the lumbrical tunnels of the middle and little fingers, and the hand dissected to observe the distribution of the mass. The three inner flexor tendons and their lumbrical muscles were cut in order to expose the injection lying deep in the tendons and filling the middle palmar space. Just as pus formed in the M.P.S. tends to travel to the subcutaneous tissue at the base of the three inner fingers, so also may infection of these fingers spread to the middle palmar space by the same channels—the lumbrical tunnels.

We have seen that the middle palmar space is related only to the inner three fingers. The index finger has, however, an extremely important relationship to another space.

CASE II.—In September of last year a boy, aged nineteen, came to hospital, complaining of a painful and swollen hand. On examination he was found to have a small septic wound on the radial side of the index finger, but the chief feature of the case was the great distension of the thenar eminence, which rose almost perpendicularly from the palm,

along the line of the adduction groove of the thumb. The swelling was continued downwards to the radial side of the index finger. There was relatively free movement of the thumb and index finger, which was certainly not accompanied by the acute pain of a teno-synovitis. An incision about an inch long was made along the radial side of the head and shaft of the index metacarpal bone, and a sinus forceps passed inwards and upwards towards the wrist. A quantity of pus escaped, and inside a week the wound had healed and the hand was restored to good functional ability.

The site of the pus in this case is indicated in Fig. 4, which represents a hand from the cadaver, in which red lead was injected along the lumbrical muscle of the index finger. The injection extends to the middle metacarpal bone. On dissecting the specimen afterwards the mass was found to occupy the space represented in Fig. 2 (T.S.), and termed the *Thenar Space* by Kanavel. It lay in front of the adductor transversus muscle, and by the relationship of the lumbrical muscle to the space one can readily appreciate its course. Fig. 3 shows how the lumbrical tunnel conducts the pus anterior to the adductor transversus. We see, therefore, that there are two definite spaces, the middle palmar space and the thenar space, lying deep in the flexor tendons, and that they may be infected without involvement of the latter. It can be readily understood, however, that infection might easily spread from spaces to tendon sheaths, or *vice versâ*, but not before a diagnosis can be made and treatment instituted.

It is of importance to remember the cardinal signs of pus in these spaces. When the middle palmar space is affected, the most important signs are (1) obliteration of the hollow of the palm, amounting, in severe cases, to a definite convexity; (2) tenderness over this area; (3)

fulness along the line of one or other of the inner three lumbrical muscles; (4) some limitation of movement of the fingers, unaccompanied by acute pain on passive extension.

The chief symptoms indicating thenar space involvement are ballooning of the thenar eminence, and some limitation of movement of the thumb and index finger.

With regard to treatment, it is obvious that pus in these spaces cannot be reached by incisions along the line of the metacarpal bones without definite injury to the tendons or their sheaths, while an incision placed between the tendons would pass through the digital vessels and nerves. The vessels should be avoided, otherwise troublesome secondary hæmorrhage may result, whilst involvement of nerves in scar tissue does the surgeon little credit with his patient. Kanavel places his incision along the course of the lumbrical muscles—that is, along a line a little to the radial side of the neck of the metacarpal bone, but this incision also exposes the digital vessels and nerves. In the case of the middle palmar space infection first described, this was the incision employed, because there was already a wound in the palm. The digital vessels were divided by the incision and required ligation. In subsequent cases I decided to attempt drainage of the middle palmar space at the site at which the pus usually pointed—that is, at the radial side of the finger *behind* the web. In order to decide on the most effective site, the hand of a cadaver was obtained, and the tendon of the lumbrical muscle exposed on the radial side of the middle finger. A sinus forceps was passed along the muscle deeply into the palm, and a dissection made of the digital vessels and nerves. Fig. 5 shows the relationship of the forceps to these structures. This incision has been em-

ployed in several cases, and in all drainage was efficient. It is necessary, however, to insert a drainage tube to keep the opening from becoming occluded too soon. If the drainage afforded by one incision does not appear sufficient, or if there be any indication that pus has travelled along more than one lumbrical tunnel, another incision is made in a similar fashion behind the web of the other fingers and another tube inserted. In this manner the middle palmar space can be drained along the lumbrical muscles of the inner three fingers or along any one of them.

Drainage of the thenar space is carried out in the manner recommended by Kanavel. An incision is made to the radial side of the neck of the index metacarpal bone, and a forceps passed upwards and inwards in front of the adductor transversus pollicis. In this case no drainage tube is necessary.

The anatomical specimens which I have prepared fully confirm Kanavel's work on this subject, and the results of treating septic conditions of the hands on the principles enunciated by him, with the modifications indicated above, are better than can be achieved by any other method.

In conclusion I wish to express my thanks to Professor A. F. Dixon for the facilities afforded me for carrying out the anatomical part of this work, and to Dr. W. G. Harvey for taking the *x*-ray photographs.

DR. KEEGAN congratulated Mr. M'Connell on his interesting contribution. The subject was one of which very little had been said, yet one could not pass a week without seeing many cases. There was no doubt that the anatomical lines

which should be followed for the correct treatment of cases of the kind was clearly pointed out, and he thought the diagrams shown demonstrated the many reasons why failure was met with in the early convalescence of such cases.

PROFESSOR DIXON said that the anatomical points raised were of great interest. For some time past the greatest difficulty had been felt in demonstrating the old-fashioned treatment for the palm of the hand. He had an opportunity of seeing the excellent preparations which Mr. M'Connell had made, and these preparations were even more convincing. The arrangements of the septum which he has described are very easily shown even without injections.

DR. ADRIAN STOKES asked if the pus had progressed further than it should have done would the incision suggested be still sufficient to drain the palm of the hand, or did he suggest that the other incision spoken of would give better drainage?

MR. GUNN said he thought all the members of the Academy had learned a great deal from what had been said. He felt for a long time that in hospital practice septic fingers and hands were left very much to the residents and house surgeons, and that very disastrous results were often experienced where incisions are possibly made in wrong positions. There were few subjects of more importance than this, and he thought it deserved a great deal more attention.

MR. CRAWFORD said that a point of importance was that this method of making an incision of the web of the finger was a new one, and had been performed only by Mr. M'Connell himself. He had only one case of the kind since he had learned the method from Mr. M'Connell, and in that case, although the whole hand was œdematous, he determined to try drainage through incision of the web of the little finger, and the result was very good, all the symptoms having subsided in three or four days.



FIG. 1.



FIG. 4.



FIG. 3.



FIG. 5.