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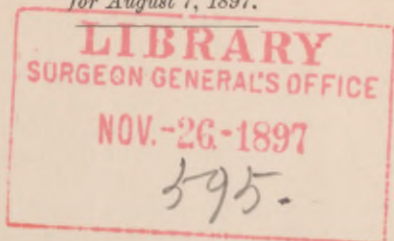
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## WOUNDS OF THE HAND.

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FOR several years past my attention has been particularly called to wounds of the hand. When we consider how extremely common these wounds are, and that they occur principally in the laboring class, whose daily bread largely depends on the usefulness of their hands, we arrive at a just estimate of the importance of such accidents. Too much can not be said in regard to the necessity for the early recognition and radical treatment in an injury of this region. I have had under my care patients that have been treated daily in the surgical dispensary for weeks and months, suffering from the effects of a palmar abscess. Palmar abscess is apt to produce disastrous results. Suppurative teno-synovitis arising from wounds of the fingers and palm leads in some instances to palmar abscess, agglutination of the flexor tendons, and suppurative cellulitis of the forearm. The following cases are typical of these conditions:

CASE I.—In November, 1892, a Jewess came to the Jefferson Hospital complaining of severe pain in the

little finger and palm of the left hand. She said one week previously she had been pricked in the little finger by a splinter. When she was admitted, the finger was of almost twice its normal size, was hot and red, the palm somewhat elevated, and the pain was severe. A diagnosis was made of pyogenic infection of the finger followed by a palmar abscess. She was told of her danger, was advised to go home and bring a relative or friend, and at once be anæsthetized and have the abscess opened. Instead of coming back that day, as requested, she did not return until the afternoon of the next day, when I discovered just above the annular ligament a swelling of the size of an English walnut. The lower fourth of the forearm was red, swollen, and œdematous, and the axillary glands were beginning to enlarge. This case not only demonstrates the danger of a punctured wound of the little finger, however small it may be, but also shows the progress infection is capable of making in a short time, and the necessity for the earliest possible interference. She was anæsthetized, and at once an incision half an inch in length was made to the bone, in the long axis of the little finger. The palmar abscess was opened over the deep palmar arch by Hilton's method, a counter opening was made just above the wrist, and a piece of iodoform gauze was passed from this opening into the palmar incision. After soaking the hand in a bichloride solution (1 to 1,000) for five minutes, the incision in the finger was swabbed with pure carbolic acid and the hand was dressed with wet bichloride dressings. The area of cellulitis of the forearm was painted with iodine and alcohol, equal parts, and covered with lint saturated with lead water and laudanum. An internal angular splint immobilized the arm and hand. The girl made a rapid and good recovery, and went to work in two weeks with a good hand.

CASE II.—In June, 1894, an employee on the Baltimore and Ohio Railroad presented himself at the dispensary with a palmar abscess and cellulitis of the forearm, caused by a slight contusion of the palm. He

was advised by his family physician to put on a flaxseed poultice and wait for the abscess to point. He waited for four nights. During the fourth night he became frantic with pain, plunged the blade of his pocket knife into the palm, and let out the pus. This man was prevented from performing his daily work for three months, and still has stiffness of the flexors.

CASE III.—In May, 1894, a seamstress was admitted to the dispensary with a broken needle lodged in the palm near the thenar eminence. Dr. M. H. Williams, of the department, made an incision and extracted the piece of rusty needle, which had been there for five days. An ounce of green pus escaped which had been concealed by the tense, unyielding palmar fascia. No sign of pus existed except pulsatile pain, and there was hardly enough swelling to be noticeable. This was one of the worst abscesses that any of us had seen; still there was only one sign, and that was pulsatile pain. This patient was prevented from doing her daily work for ten weeks, and her arm was saved with great difficulty.

CASE IV.—In February, 1895, A. B., aged sixty-four years, shoemaker by occupation, applied at the dispensary, and stated that in 1864 he had received a lacerated wound on the posterior surface of his hand just below the annular ligament of the wrist joint. For thirty years this wound was continually dressed with flaxseed poultices and salves, and as a result he was found to have lost all power of flexing the hand. The flexor tendons had sloughed away. He carried with him a two-ounce bottle half full of the sloughed tendons, the pieces varying in length from an eighth to half an inch. This man has a permanently useless hand.

CASE V.—L. S. was placed under my care by Dr. Erwin, August, 1896. The patient stated that a month before his appearance at the hospital he noticed that his index finger began to swell and pain him. He consulted a barber, who advised him to apply pitch. After a month of the pitch treatment it was found that the tissues as well as the bones of the finger had undergone ne-

crisis, and nothing short of an amputation would do any good (see Photograph No. 1).



Photograph No. 1. Case V.

CASE VI.—In August, 1896, W. J., carpenter, appeared at the dispensary and stated that while at his work he struck the middle finger of his right hand against a



Photograph No. 2, Case VI, palmar surface.

board. That night the finger began to pain and swell. Three days after the traumatism he consulted an old army surgeon, who advised him to put on slippery-elm

poultices, which he did for one week. At the expiration of that time the finger felt as though it was getting worse, so he consulted him a second time, when the doctor told him to discontinue the slippery-elm poultice and try a flaxseed poultice. After five visits and three weeks of poulticing he came to the dispensary. When admitted he had symptoms of septic infection. The tissues on the palmar surface of the middle finger had sloughed and were discharging pus. The finger measured six inches in circumference at the middle of the middle phalanx. The palm was tense, swollen, and painful. Photo-



Photograph No. 3, Case VI, dorsal surface.

graphs 2 and 3, which were taken five days after the operation, show the condition of the dorsal and palmar surfaces. He was anaesthetized, and multiple incisions were made on the dorsal and palmar surfaces of the finger and hand in the direction of the tendons down to the bones. The necrosed tissue was removed and the hand soaked in bichloride-of-mercury solution (1 to 500). The incisions were swabbed with pure carbolic acid, and a large tube was passed from the palmar to the dorsal surface, between the third and fourth metacarpal bones. Iodoform was dusted on, and the hand was dressed with

hot antiseptic fomentations and placed on a splint. The constitutional symptoms were treated by a saline purge, light diet, two milk punches a day, quinine sulphate, five grains three times a day, and tincture of chloride of iron, fifteen drops three times a day.

This patient, after being treated for three weeks, discontinued his visits. When last seen his hand was in good condition. This hand, and particularly the finger, looked hopeless. Through the courtesy of Professor Brinton I operated on a similar case last winter before the clinic at the Jefferson Hospital that made a good recovery, and now has a useful hand.

CASE VII.—In April, 1895, J. A., a blacksmith by trade, while at his work received a small punctured wound of his little finger. He paid no attention to it and went on with his work. At the expiration of three days he had a suppurative teno-synovitis, a palmar abscess, and beginning lymphangitis of the forearm. The abscess was opened by Hilton's method; a counter opening was made above the wrist, and connected with the palmar incision. The hand was soaked in a hot bichloride solution (1 to 1,000), and drained with iodoform gauze passed from the counter opening into the palmar incision. The hand was dressed with a hot antiseptic fomentation, covered with a rubber dam, and placed upon a splint. This man made a rapid recovery with no impairment to the use of his hand.

CASE VIII.—In May, 1896, M. M., a woman, applied to the dispensary for the treatment of a sinus which followed an amputation at the middle third of the arm. She said that six months previously she had been pricked in the thumb by a splinter; this was followed by intense pain in the thumb, and to ease it she put on a poultice. Three days later swelling appeared in the palm, and was opened, but in spite of the treatment the infection extended up the arm and her doctor amputated at the middle third to save her life (see Photograph No. 4).





Photograph No. 4, Case VIII.

If one considers the anatomy of the hand, it becomes evident that by the arrangement of the two lateral portions of the palmar fascia wounds of the little finger and thumb must be more dangerous than wounds of the other fingers. The palmar fascia is a common sheath which invests all the muscles of the hand. It consists of a central and two lateral portions. The central portion is triangular in shape; the apex above is attached to the annular ligament. The base is expanded, and opposite

the heads of the metacarpal bones divides into four slips for the four fingers. Each slip divides into two processes, which inclose the tendons of the flexor muscles. The tendons with their sheaths and with their slips are attached laterally to the fibrous structures on either side of the metacarpo-phalangeal joints. Opposite the heads of the metacarpal bones there are numerous strong transverse bands which bind the tendons down and at the same time hold down the integument, thus serving to cut off the communication of the three middle fingers with the palm. This is why thecitis in these three fingers is generally arrested at the level of the web. In considering the anatomical relations of the two lateral portions of this fascia we have a different state of affairs. These lateral portions are composed of thin fibrous layers, one going to cover the muscles of the little finger, the other going to cover the muscles of the thumb. These layers practically form drainage-tubes, and are continuous with the palmar and dorsal fascia. There are no transverse bands as in the three middle fingers. By this one can see how easily infection may spread from either the thumb or little finger to the dorsal or palmar surface of the hand by the path of least resistance, and how when once present this hidden enemy will cause widespread disaster if not immediately removed. The diagnosis of this trouble is comparatively easy. There will be a wound on the finger or palm, which may be followed by teno-synovitis; if so, there will be pain and tenderness, with distinct moist crepitus along the tendon sheaths, due to inflammatory roughening. This crepitus will increase as the inflammation decreases, and will decrease as the inflammation increases, because severe inflammation means copious fluid effusion. If it

is suppurative, and the lesion is of any of the three middle fingers, there will be pulsatile pain, swelling, and dusky discoloration extending to the lower part of the web, and if of some duration there may be rupture of the integument. If the traumatism is of the thumb or little finger, there will be the same symptoms, but rupture of the integument is rare. There will be intense pulsatile pain in the palm, slight swelling (palmar abscess), and constitutional disturbance. Do not depend upon fluctuation, discoloration, or great tumefaction, as these symptoms are often absent. If this condition is not immediately relieved, the pus will dissect the structure of the palm, and may reach the dorsum, but most probably will work its way beneath the anterior annular ligament of the wrist into the connective tissue of the forearm, and will then spread like wildfire, and a burning sensation, pulsatile pain, swelling, dusky discoloration, and œdema will be prominent. If with this you find small hard, red streaks running up the arm, with enlargement of the associated lymph glands, you may be confident that you are dealing with beginning constitutional sepsis, and, if not acted upon by this time, the patient is liable to lose his arm or life, and it may be both. The very best prognosis will often be that of a useless arm.

*Treatment of Contusions.*—Contusion of the hand is best treated as follows: First clean with soap and water, then rub well with soap liniment; if the skin is not broken, apply a number of small pieces of lint saturated with lead water and laudanum. If there are abrasions, wash them with bichloride of mercury (1 to 1,000), cover with wet bichloride gauze, over which put a rubber dam. The dam will not only keep the exposed surface

aseptic, but will prevent the absorption of the lead water and laudanum, which must be put on lint and applied after the exposed surfaces have been protected. The hand must be supported on a well-padded palmar splint, with plenty of cotton under the palm, and must be held in place by a firm but not too tightly applied bandage, beginning at the finger tips and extending to the elbow. Bandaging of the fingers is necessary to prevent swelling. Under this treatment any ordinary contusion will moderate in a short time; but if it persists, multiple punctures are employed to relieve the congestion, the wounds are dressed with acetanilide, and an antiseptic fomentation is applied. This is made by wringing out gauze in a hot 1-to-1,000 solution of bichloride of mercury and placing on while hot, covering with rubber dam, and changing often. If the condition assumes a chronic form, with stiffness of the flexors, thickening of the tissues, and pain on motion, employ hot- and cold-water douches night and morning, the water being poured from a distance of three feet, and between the douches use fifteen grains of an ointment composed of two drachms of ichthyol and half an ounce of lanolin. Apply this ointment twice daily. If the contusion is severe, put the patient to bed and immobilize the arm as well as the forearm and hand by applying an internal angular splint. After a contusion watch closely for such sequelæ as sloughing, periostitis, bone necrosis, palmar abscess, and gangrene. If a slough forms, promote the separation of the necrosed tissue, and encourage the vitality of the tissues whose recovery is possible by hot fomentations. When the sloughs are well removed, dress with acetanilide and iodoform (equal parts), and suppress exuberant granulations by removing them with scissors

or by applying nitrate of silver. If there are heat and pulsatile pain at the end of a finger, and the pain is increased by motion of the finger, a deep felon should be suspected, and an incision should be made at once to the bone, followed by washing out with bichloride, packing in a small piece of iodoform gauze, applying hot antiseptic fomentations, and putting the finger on a splint. The incision should run in the long axis of the finger and by the side of the tendon. Osteitis or periostitis will be manifested by severe pain, boring or aching in character, deep-seated, and worse at night. Good results can be obtained by applications of lead water and laudanum or inunctions of ichthyol, and rest on a splint. If these means fail, apply equal parts of alcohol and iodine, and cover the part with lint containing a thick layer of unguentum hydrargyri. In severe cases, incising the periosteum to relieve the tension gives good results. If the probe elicits evidence of necrosed bone, open, remove the detached fragments, curette, scour with gauze dipped in hot bichloride solution (1 to 1,000), swab with pure carbolic acid, and dress as usual. Severe pain in the palm should make us suspect a palmar abscess. Do not wait for the cardinal signs of an abscess. The integument is thick, and, as it has between it and the pus the tense fascia, it will not in the majority of cases become discolored. The dense fascia prevents much swelling, and fluctuation does not occur until the abscess is very large. Never treat such a condition with a poultice; open as quickly as possible, irrigate with bichloride (1 to 1,000), pack in a small piece of iodoform gauze, put on hot antiseptic fomentations, cover with wax paper or rubber dam, and put the hand on a splint. In many cases considerable damage has taken

place before the surgeon sees the case. There may be an accumulation of pus, which has formed in the palm, traveled up the arm, causing pain, œdema, and discoloration above the annular ligament, with cellulitis of the lower fourth of the forearm and constitutional symptoms. The patient, after being told of the impending danger, should be anæsthetized, and the pus evacuated by a free opening. An incision running toward the tips of the fingers, beginning at a point below a transverse line from the web of the thumb across the palm, will clear the palmar arches and do little or no harm to the tendons and blood-vessels. This incision just penetrates the palmar fascia. Through this incision introduce a blunt forceps, and force it gently in several directions, retracting with the blades open (Hilton's method). The blunt points will affect a good opening and push aside important structures without damaging them. A counter opening above the wrist should be made and connected with the palmar incision. Irrigate from above downward with bichloride (1 to 1,000), and drain with iodoform gauze passed from the counter openings into the palmar incision. Paint the forearm with alcohol and tincture of iodine, equal parts, cover it above the wound with lint saturated with lead water and laudanum, and keep moist. Dress the entire hand with a hot antiseptic fomentation. Provide rest to the part by placing it upon a well-padded splint.

The constitutional symptoms should be treated by rest in bed, light diet, a saline purge, free stimulation, five grains of quinine a day, and fifteen drops of the tincture of chloride of iron three times a day. If from loss of tissues or gangrene an amputation be demanded, spare as much as possible, particularly of the index fin-

ger and thumb. If it is necessary to amputate above the middle of the middle phalanx, the flexor tendon must be anchored to the periosteum, otherwise the extensor tendon will pull the stump directly backward. After an amputation of a finger the fibrous tendon sheath known as the theca must be closed to prevent the transmission of infection. This is best effected by pushing back the periosteum for a distance of an eighth of an inch and passing catgut sutures vertically through the theca and the periosteum. In a workingman avoid, if possible, cutting off the head of a metacarpal bone, as it weakens the hand. Sew the flaps with few stitiches, so as to allow drainage between them. Most of the bad results so often seen following amputation of the fingers are due to the non-closure of the theca and an excessive number of stitches in the flaps.

*Incised Wounds.*—Incised wounds are the most common but the least dangerous injuries, as the free bleeding washes out most of the infectious material. Union by first intention should be sought for; in the majority of cases this can be accomplished by thoroughly scrubbing the parts with soap and water, following with the free use of bichloride (1 to 500), and follow this by lukewarm boiled water, dusting with acentanilide, sewing with as few stitches as possible, dressing with bichloride gauze (moist), covering with rubber dam, and putting the hand on a splint. Not a few of these cases are complicated by severing of the tendons and a severe hæmorrhage. If the tendons be cut, make the part bloodless, approximate the ends, and sew them with a curved needle threaded with fine silk. Photographs 5 and 6 show extension and flexion of the same hand, which followed suturing the flexor tendon of the little finger; this tendon was

divided in an accident and was sutured by Dr. J. Chalmers Da Costa.



Photograph No. 5.

If the wound is not very recent, and the tendons are contracted to such a degree that it is found impossible to bring the ends together, then resort to Czerny's method of tendon lengthening. If the gap can not be satisfactorily filled by a portion of the divided tendon, bridge over with catgut or graft in a tendon from the lower animals. If a flexor tendon of the wrist is cut, it is with difficulty that the proximate end is isolated, owing to its retraction. This can be accomplished in some cases by flexing the finger of the cut tendon and extending the rest (*Manual of the Modern Surgery*, J. Chalmers Da Costa). If only one end can be found, stitch it with fine silk to the nearest tendon of like anatomical function. After suturing tendons, dress with gauze and apply plaster of Paris. The finger of the cut tendon



should be partly flexed, the others extended. Passive motion should be begun after two weeks.



Photograph No. 6.

*Lacerated Wounds.*—Lacerated wounds require a thorough scrubbing with Johnson's ethereal soap, followed by immersing the hand into bichloride (1 to 1,000), and scrubbing with a brush while the hand of the patient is in the solution. Suture the tendons, ligate the bleeding vessels, and with a pair of scissors trim the edges and treat the case as an incised wound, immobilizing on a splint if the wound is slight, but confining the patient to bed if the wound is severe.

*Punctured Wounds.*—Punctured wounds are the most dangerous, since infection is almost inevitable. They should be incised to the very bottom the moment they are seen. Foreign bodies should be removed, free bleeding encouraged, and the wound should be syringed out with peroxide of hydrogen, followed by bichloride (1 to 500), then dusted with acetanilide, and drained with iodo-

form gauze. If the wound is inflamed, accompanied by a cellulitis of the adjacent parts and lymphangitis of the forearm, it should be opened, curetted, swabbed out with pure carbolic acid, and drained with iodoform gauze. The cellulitis should be treated with alcohol and iodine, equal parts, applied locally, and covered by lint saturated with lead water and laudanum. If there is no response to this treatment, multiple incisions should be made.

*Hæmorrhage.*—Contused, lacerated, and punctured wounds are accompanied by very little hæmorrhage, unless the palmar arches have been severed. Incised wounds bleed freely. Bleeding from the digital vessels can be controlled by a dressing held in place by a firm bandage extending from the tips of the fingers to the web and ending by a figure eight of the wrist and root of the finger. The interosseous arteries should be ligated when they bleed. If necessary, enlarge the primary incision; a small semicurved needle, threaded with moderately fine catgut, should be passed above and below the bleeding point and the ligature tied. In the majority of cases this will arrest the hæmorrhage; if it does not, then try hot water, 120° to 130° F., followed immediately by a graduated compress of iodoform gauze, over which place a small pad; put a gauntlet on the hand and bind firmly to a well-padded palmar splint. The ends of the fingers should be exposed to ascertain the condition of the circulation. The dressings should be changed and the packing removed at the end of three days, when the splint may be omitted, unless the original traumatism counterindicates it. Hæmorrhage from the palmar arches is troublesome and dangerous. Under no circumstances should styptics be applied to check the

bleeding. Professor Keen reports a case, in the *Annals of Anatomy and Surgery*, Brooklyn, 1888, vol. v, in which an aneurysm of the superficial arch, of the size of a cherry, formed, following a traumatism. The physician in charge injected ten drops of undiluted Monsel's solution into the sac. As soon as this was injected the whole hand became blanched, and soon well-marked gangrene followed. It was necessary to amputate above the wrist. In the *Philadelphia Medical Times*, September 10, 1881, p. 795, is related a case in which a few drops of nitrate of silver injected into a nævus caused gangrene of two fingers. The same styptics applied to open wounds of the arch might produce the same results. If the blood is bright red, and comes out in jets in the vicinity of a transverse line running across the palm from the root of the thumb while hyperextended, hæmorrhage from the superficial arch should be suspected. An Esmarch elastic bandage or something equivalent should be applied to allow a dry dissection. The primary wound is then to be enlarged, and on a line with the arch the divided ends are found and are to be tied with silk ligatures. A blunt-pointed instrument should be used in the dissection to avoid injuring the divisions of the median and ulnar nerves which lie beneath the arch. The deep palmar arch when divided bleeds profusely. The divided ends should be sought for even by an extensive dissection, if necessary, before ligating the radial and ulnar arteries. The Esmarch bandage will be of great assistance. A good method for gaining access to the arch is to make a skin flap with its convexity downward, starting over the middle of the shaft of the metacarpal bone of the thumb, running downward and inward, keeping a quarter of an inch above the line of the superficial arch and ending on

the ulnar side of the hand an inch below the pisiform bone. This will also give access to the superficial arch. Dissect this flap upward for an inch and a half and ample room will be afforded to work with a blunt instrument. The tendons should be drawn to the sides by small blunt retractors. If the original injury has not opened widely the palmar fascia, this should be done by a blunt pair of scissors and the margins drawn to each side. An assistant now relaxes the Esmarch bandage and by the bleeding the exact site of the vessels may be seen. Both ends of the arch should be ligated with silk. J. Chalmers Da Costa has suggested that the arch might be ligated readily by the incision that Mynter employs in resecting the wrist, that is, an incision separating the metacarpal bones and the bones of the carpus. If this does not control the hæmorrhage the ulnar and radial arteries must be ligated in the lower third of the forearm. It may in rare cases, especially in secondary hæmorrhage, be necessary to ligate the brachial just above the bend of the elbow or to amputate above the wrist. In 1893 Professor Brinton had under his care at the Jefferson Hospital a patient who received a lacerated wound of the palm and a laceration of the deep palmar arch. The graduated compress failed to restrain the hæmorrhage. Ligation of the radial and ulnar arteries failed. Ligation of the brachial artery at the bend of the elbow failed. Amputation of the hand was necessary.

The photographs used in this article were taken by Dr. T. G. Buchanon.







