PURULENT DISEASES OF HAND



Lecture for general surgery Chorna I.O. Poltava

Introduction

The hand can easily be injured during everyday activities. Any trauma to the hand, particularly a penetrating trauma, may introduce damaging pathogens. The hand's compartmentalized anatomy may contribute to the development of an infection. If an infection is not appropriately diagnosed and treated, significant morbidity can result.

Let's remember we hands anatomy...

- Here these anatomic features of a hand us interest
- synovial vaginas
 fatty spaces
 innervations
 blood supply



Bones of hand Anatomy



There are 27 bones within the wrist and hand

Joints of hand Anatomy

-Phalanges

MCP Joints

Metacarpophalangeal joints Metacarpals IP Joints Distal interphalangeal joints

Proximal interphalangeal joints

©MMG 2003

©MMG 2003

Articulationes
 interphalangeae
 manus,

Ligamentum
 of hand



Bony Anatomy

- Phalanges: 14
- Sesamoids: 2
- Metacarpals: 5
- Carpals
 - Proximal row: 4
 - Distal row: 4
- Radius and Ulna

anterior-posterior: adult hand

> fingers (phalanges)

metacarpals

sesmoid

carpals

Lister's tubercle

radius

ulna





ANATOMY

Muscles /Tendons Volar wrist- 6 Dorsal wrist- 9 6 compartments Volar hand- 10 Dorsal hand- dorsal interossei Nerves - 3 Median Ulnar Radial Arteries - 2





All of the nerves that travel to the hand and fingers begin together at the shoulder: the radial nerve, the median nerve, and the ulnar nerve.





The scheme innervations of hand



Red color n. radialis; green — n.medianus; blue — n.ulnaris; yellow — n.cutaneus antebrachii medialis; pink — n.cutaneus antebrachii lateralis.

Sensation Testing Dorsal hand Radial hand



Blood Vessels



Anatomical and physiological peculiarities

Skin on palm has well developed epidermis due to corneal layer, which makes difficulties for pus to go outside.

Subcutaneous fat has lobular structure due to connective tissue trabecules, which go to periosteum or aponeurosis. Such structure in inflammation helps for pus to go towards bone, and also high pressure in inflammation is made. It leads to disorders of blood supply in small vessels situated in connective tissue trabecules and also to necrosis.

It requires providing of urgent operations in APD; the purpose is to avoid tissue necrosis. On palm skin cannot be taken in fold, hair follicles and fat glands are absent what excludes a possibility of furuncle or carbuncle development. On dorsal part of hand there are hair follicles and fat glands, well developed subcutaneous fat, rich lymphatic and venous net, there are no connective tissue trabecules, that's why skin is movable and can be taken into fold. Spreading of purulent process takes place in all directions.

- Well-developed superficial and deep net of lymphatic and venous vessels makes conditions for development of large swelling, fast spreading of infection, and intensive absorption of toxins.
- Arterial system on hand is well developed and consists of superficial and deep arterial palmary arch. Blood supply is better on palmary side, but in inflammatory swelling there takes place acute compression of vessels with next trophic changes of tissues.







Tendons of short fingers' flexor in distal parts attach to lateral surfaces of middle phalanges. Between divisions of tendons of short fingers' flexor are tendons of long fingers' flexor, which attach to basis of nail phalanges, that's why there may not be tendovaginitis in area of distal phalanges.

Tendons are covered with tendinous vaginas with mucous fluid, which helps the joints to move. On thumb and V fingers tendinous vaginas are situated from basis of nail phalanges to distal third of forearm where in Pirogov's space almost always join each other. Superficial palmar branch of radial artery and recurrent branch of median nerve to thenar muscles

> Ulnar artery and nerve

 Common palmar digital branches of median nerve

 Hypothenar muscles

Common flexor sheath (ulnar bursa)

5th finger (synovial) tendinous sheath

Midpalmar space (deep to flexor tendons and lumbrical muscles)

Insertion of flexor digitorum superficialis tendon

Insertion of flexor digitorum profundus tendon

Proper palmar digital nerves of thumb

Fascia over adductor pollicis muscle

Thenar space (deep to flexor tendons and 1st lumbrical muscle)

1st dorsal interosseous muscle

Probe in dorsal extension of thenar space deep to adductor pollicis muscle

> Septum separating thenar from midpalmar space

Common palmar digital artery

Proper palmar digital arteries and nerves

Annular and cruciform parts of fibrous sheath over (synovial) flexor tendon sheaths Cellular Pirogov's space is situated between III and IV layers of muscles of distal forearm part, meaning between long fingers' flexor and pronator quadratus. It has meaning for spreading of pus in tendovaginitis of thumb and V fingers.

Cellular Pirogov's space



On II-III-IV fingers synovial vaginas are situated only on fingers. From tendons toward phalangeal bones there is situated mesenterium of tendons with small and rare vessels, which supply tendons. That's why in drainaging of tendovaginitis drainages are provided in front of tendons (closer to palm skin).



Carpal Tunnel



- The carpal tunnel is formed between the carpal bones of the wrist and the transverse carpal ligament.
- The ligament is an unyielding thick fibrous tissue which does not allow for changes in volume within the carpal tunnel. [1]

On palm muscles and tendons are situated in three bone-fascial spaces, which are formed due to going of two fascial laminas from palmar aponeurosis to III and V bones.
 There are spaces of thenar, hypothenar, and medium space, which

is divided on to superficial and deep.

 Superficial medium cellular space is situated under palmary aponeurosis, and deep – between tendons of fingers' flexors, fascial lamina that covers interosteal muscles. Palmary aponeurosis is formed due to joining of long palmary muscle fibers to palmary fascia. In finger basis palmary aponeurosis forms three comissural **openings** through which vessels and nerves go, and also pus can go to medium cellular space. With medium space (deep) the cellular tissue of Pirogov-Paron space is connected.

On dorsal part of hand there are two cellular spaces: superficial – between skin and self-fascia and deep – between tendons of fingers' extensor and bones.

Etiology of purulent processes on hand and

fingers

For development of infection help: overtiredness, overcooling, vibration, and disorders of microcirculation. Ways of infection penetration:

micro traumas – more often, hematogenic, and lymphatic way, through excretory ducts of sweat glands, contamination by highly virulent flora. Coming from particulars of course it is necessary to define: acute purulent diseases of fingers, acute purulent diseases of hand. **Course** of inflammation on fingers and hand has such stages: serous-infiltrative purulent-necrotic.



Panaritium (felon) (lat. panaricium hormoega)

Purulent inflammation of soft tissues of a finger. Allocate the following types of a (Panaritium) felon:

(1) skin; (2) nail:

paronychium;

- under the nail;
- near nail.
- (3) lymphatic (lymphangoitis)
- (4) subcutaneous
- (5) tendinous (tendovaginitis)
- (6) bone (bone-joint)
- (7) joint
- (8) pandactilitis





Types of panaricium: 1) under the nail; 2) paronychium; 3), 4) paronychium with break under the nail; 5) skin; 6) subcutaneous; 7) subcutaneous like cuff-link; 8) tendinous; 9) joint; 10), 11) bone; 12) pandactilitis;



Schematic image of various forms of a felon:
 a — skin (dermal); б— hypodermic; в— tendous; г— osteal; д — joint; е — like a cuff link (типа запонки).



Felon near nail (a paronychia streptococcal) – an inflammation of dermal tissues of a nail phalanx because of a streptococcal infection are.

Hyponychial felon (paronichia)



Progression of the local reaction on the left hand after accidental needlestick inoculation with vaccinia virus: thumb (A, day 4; B, day 11; C, day 12; D, day 20; fourth and fifth fingers (E, day 7, F, day 11; G, day 12; H, day 20). Lesions were surgically excised to remove necrotic tissue on day 11. Arrows indicate the lesion areas.
Joint fellon



Pyogenic flexor tenosynovitis. Appreciable pain along the tendon sheath with passive extension of the digit often is the first clinical sign of this hand infection. swollen tendon



bent finger

Tendous felon V finger left hand, the complicated ulnar tendobursitis and phlegmon of space of Pirogov — Parana.





The scheme of diffusion of pus at a hypodermic felon in a phalanx bone, in an interfalangeal joint and in a tendous vagina.



The finger X-ray at an osteal and joint felon: destruction of the joint surface with a dislocation in a joint.



Pandactylitis of the I finger of the right hand: on operation the destruction of a bone of the main phalanx and a metacarpophalangeal joint, a necrosis of soft tissues is visible. In operations on fingers the most frequent is usage of conductive anesthesia by **Lukashevich A.I.** – 1% solution of lidocainum or novocainum is injected from dorsal part of hand in basis of proximal phalanx of finger. But *it* shouldn't be used in case of repeated operations, complicated forms of panaricium, localization of process on proximal phalanx.



 Schematic images of anesthesia of Oberst — Lucashevich.

ANESTHESIA OF FINGER BY OBERST-LUCASHEVICH





The incisions recommended for opening of purulent processes on fingers: \blacksquare 1, 2, 7 — incision for palm surfaces of fingers; 3, 9 — middle-laterals cuts; 4 — T-lice incision; 5 — semi-lunar incision; 6 — double anterio-side incision; 8 — transversal ellipseshaped incisio with removing of wounds margins.

Volar Iongitudinal Incision

> Starts 3 to 5 mm from the distal interphalangeal joint

> > в





© 2003 RENEE L. CANNON

Felon drainage. The incision location should avoid injury to the flexor tendon sheath, digital neurovascular structures, and nail matrix.

А



Drainage by a rubber window drainage at a hypodermic felon of an average phalanx: a — window of drainage ; σ — introduction of drainages into wounds cannel; в washing of wounds through drainages; г — removing of drainages.

Purulent processes of hand

Depending on the localization and spreading purulent processes on hand are classified:

Phlegmon of palmary part of hand

- callosity abscess(a)
- inter-finger comissural phlegmon (b)
- 3. phlegmon of tenar(в)
- 4. phlegmon of hypotenar

 phlegmon of medium palmar cellular space superficial; deep

1. V-like phlegmon

2. phlegmon of Pirogov-Paron space



phlegmon of tenar







phlegmon of medium palmar cellular space (Incisio for Kanavel)

phlegmon of hypotenar





inter-finger comissural phlegmon





 phlegmon of dorsal part of hand: superficial (subcutaneous); deep (subfascial).







Localization of phlegmon:

1) subcutaneous; 2) palmanary above-tendous;

- undertendous; 4) phlegmon of tenar; 5) phlegmon of hypotenar;
- 6) superficial phlegmon of dorsal part of hand; 7) subfascial phlegmon of dorsal part of hand;



Рис. 1.141.1. Флегмона ладонной и тыльной поверхности кисти с распространением гнойного процесса на пространство Пирогова—Парона



Рис. 1.141.2. Вид верхней конечности с тыльной стороны



Рис. 1.141.3. Раны предплечья зажили первичным натяжением после первичноотсроченной пластики местными тканями



Рис. 1.141.4. Результат лечения на тыльной поверхности кисти

In process of *INVESTIGATION* attention must be paid also to:

- Place of noticeable_swelling which not always corresponds to epicentre of inflammation (injury on palm – swelling on dorsal part of hand, spreading of swelling goes by veins and lymphatic vessels).
- Presence of <u>fluctuation</u> and its absence on palm. But absence of fluctuation does not exclude purulent injury of tissues.
- Determination of place of <u>highest painfulness</u> (by help of spheric sound), which corresponds, to localization of process, its epicentre.

Data of **dactyloscopy**, which have value in diagnosis of localization of deep inflammatory forms.

1.



2. Functional ability – amplitude of flexing and extension movements, presence of active movements, level of pain and tactile sensitivity, increase of pain in passive movements.





3. X-ray examination as true method of examination. Changes in bones are revealed in late terms (10-12 days after onset of the disease). In early stages films must be done in low tension, which helps to reveal infiltration of soft tissues.





4. Termography – it reveals the borders of

process







© Meditherm

5. Computer tomography.



6. Densitometry, which reveals level of demineralization

A bone density scan is a low-dose x-ray which checks an area of the body such as the hip, hand or foot for signs of mineral loss and bone thinning

@ADAM, I







<u>ANESTHESIA in surgical treatment of purulent-</u> <u>inflammatory diseases of fingers and hand</u>

- In operations on hand the most frequent is usage of Conductive anesthesia by Usoltseva.
- Solution of novocainum is injected into interosteal spaces on dorsal part of hand in projection of division of general finger nerves (by horizontal line from bone-phalangeal joint of 1st finger).
- Conductive anesthesia of median, ulnar and superficial branch of radial nerve
 It is provided in erec of provimed forcers on
- It is provided in area of proximal forearm on anterior surface of forearm by line of medium skin fold in projection of named nerves.

Intraosteal anesthesia.

There is applied cuff of tonometer on forearm; the limb is compressed to absence of pulse on radial artery. It is injected to 20 ml of 0.5% solution of novocainum above the distal epiphysis of radial bone. After injection of novocainum skin becomes white. Injection of novocainum stops and we must wait for presence of anesthesia.

Intravenous anesthesia

 After applying of cuff (jute) on shoulder into ulnar veins of dorsal veins of forearm anesthetic is injected.

 Conductive anesthesia on fingers might be executed by injection of 1% solution of novocainum and into interfinger spaces, in area of interfinger pillows.

GENERAL PRINCIPLES OF TREATMENT OF ACUTE PURULENT PROCESSES ON FINGERS AND HAND In treatment of acute purulent diseases of fingers and hand there may be defined three periods: **period** – is before usage of antibiotics. Firstly the main meaning was given to quality of operations with usage of wide sections. **II period** – usage of antibiotics. Firstly it helped to decrease severity of inflammatory processes and effective treatment of severe forms. With time passed effectiveness of antibiotics' usage decreased because of microbes' resistance to antibiotics. **III period** – search and usage of new antibiotics and new ways of their introduction (intraarterial and intravenous), new methods of operative invasions and active methods of drainaging with usage of modern antiseptics (dioxidin, chlorhexidine, dimexid).

<u>Treatment</u> of acute purulent diseases of fingers and hand depends on stage of inflammatory process.

- In 1st stage serous-infiltrative conservative treatment is indicated:
- Antibacterial therapy introduction of antibiotics intramuscularly, Intravenously under jute (retrograde) or blocade in finger basis (novocainum with antibiotics);
- Anti-inflammatory therapy –usage of CaCl2, sulphanilamides;
- X-ray radiation helps to increase immunological processes. Limiting of inflammatory seat, 1-time dose is 10-20 X-rays;

1. **Proteolytic enzymes** which have:

- anti-inflammatory;
- anticoagulant;
- dehydrating action;
- intensify action of antibiotics;
- clean wounds.

Proteolytic enzymes are used locally in solutions, with the help of electrophoresis, with solutions of dimexid, desensebilizing therapy (antihistaminic preparations).

In II stage – purulent-necrotic – the absolute indication is operation.

<u>Volume and technology of operation</u> depend on: form of inflammation (superficial or deep the process is), character of disease – different kinds of panarises and phlegmones.

Operative treatment

Opening of panaricium is serious operation and it demands from surgeon good skills and experience. **Operative accesses** are provided with taking into consideration anatomical and physiological peculiarities of fingers and hand and they must ensure: removal of tissue tension, prevention of connection of wound edges, removal of pus, providing of radical necrectomia. In particular cases before the operation with the aim of limitation of inflammatory process, stimulation of local barrier reactions it makes sense to make X-ray therapy.

Opening of hands flegmones







1. Way of Peak
2. Incisio for Izelen
3. Incisio on Kanavela

Postoperative treatment

1. Opened method of treatment.

- Execution of postoperative treatment of the wound by opened way may be divided onto three stages:
 - treating of postoperative wound, cleaning by antiseptic solutions, antibiotics;
 - wound drainaging. It is necessary to remember that successful treatment mainly depends on good exit of wound secretions; tampons are almost not used. We may use resin stripes, silk or capron threads, fenestrated drainages from conservation intestines of cattle;
 - treating influence on wound process in postoperative period (usage of antiseptics, enzymes, ointments on water soluble basis).
Postoperative treatment must include: immobilization of hand, to change a dressing, general and local drug-induced treatment, physiotherapeutic treatment meaning that there must be used antibiotics, inhibitors of proteases, UVR, electrophoresis with Ca.

2. Closed method of treatment.

Applying of stitch on the wound is explained by appearance of the last generations of antibiotics, radical of operation (necrectomia), possibility of connection of wound edges.

Tight stitch must be used in localized forms of inflammatory process without revealed perifocal features.

Advantages of closed treatment of wounds: better consequences of disease treatment, easier postoperative period, painlessness of bandage changing.

In such treatment it makes sense to provide rational drainaging with constant or fractional wetting with antiseptics and antibiotics during first 3-5 days.

Mistakes

Mistakes during treatment of purulent-inflammatory processes of fingers and hand may diagnostic and tactic. The reason of mistakes is atypical course of purulent processes in conditions of antibiotic therapy, not attentive attitude to patient, superficial examination, incorrect evaluation of symptoms (often treatment is given to young inexperienced doctors), usage of conservative treatment in purulent-necrotic stage when operative treatment is indicated. It is necessary to notice that in old people course of inflammatory process has some considerable differences. They are: fast progressing of the purulentnecrotic process, less effectiveness of conservative therapy, correspond ness of clinic and morphological changes (the last are more revealed than clinical signs).

Mistakes in operative treatment

- Insufficient and incorrect opening of abscesses, not enough anesthesia does not give a possibility to wide the incision and revise it, to treat purulentnecrotic cavity, not attentive attitude of surgeon, not enough keeping of asepsis and antisepsis, operation without assistant, providing of small, insufficient incisions, super radical, traumatic operations with injury of ligaments, joints connected with insufficient knowledge about anatomical and physiological features of fingers and hand.
- Taking into consideration functional peculiarities it is not indicated to provide incisions of working palmary area of hand, careful attitude to bone in bone-form of panaricium, do not use biters and to use saw of Dgigli.

Mistakes in postoperative period

Treating of wound without taking into consideration of particulars of wound process; tactic mistake are rare change of bandage; absence of immobilization; usage of antibiotics without peculiarities of their indication.

Thanks for your attention



