

THE TREATMENT OF OPEN WOUNDS

General Considerations

The aim is to-

- 1) Avoid meddlesome first aid.
- 2) Transport the patient to a point where definitive care can be given as quickly as possible.
- 3) Convert an open into a closed wound at the earliest moment compatible with safety to the patient.

Factors which interfere with wound healing-

A Local-

- 1) Infection-places extra strain on tissues attempting repair
- 2) Damaged tissue- must be absorbed or extruded; good culture medium for bacteria.
- 3) Foreign bodies- including blood clots.
- 4) Motion and activity-interferes with rest of part.
- 5) Interference with blood supply-causes further tissue damage; favors infection.
- 6) Frequent disturbance of wound- needless inspections and dressings.

B General-

- 1) Advanced age.
- 2) Constitutional diseases- diabetes, nephritis etc.
- 3) Vitamine deficiencies- especially A and C.
- 4) Protein deficiency.
- 5) Distant infection.
- 6) Dehydration.

THE CARE OF THE EARLY WOUND (6-8 hours).

The prevention of wound contamination is a most important part of all wound treatment (see section on wound contamination).

FIRST AID Should be as simple as possible.

- 1) Apply large sterile dressing over wound. Avoid touching with fingers the surface coming in contact with wound. Dressing should be as voluminous as possible and should extend over large area around wound.
- 2) Bandage dressing ~~on~~ firmly and snugly.
- 3) If an extremity is involved- apply splint whether a fracture present or not.
- 4) Control hemorrhage- resilient pressure dressing and elevation of part almost always suffice,
seldom necessary with severe bleeding.

The Tourniquet-

Indications-

- 1) While waiting for dressing.
- 2) If dressing not available.
- 3) Torrential hemorrhage.

Dangers-

- 1) If too tight may injure nerves and blood vessels
- 2) If too loose may merely compress veins and increase bleeding.

Technique-

Should be 3-4 inches wide and firmly applied. Blood pressure cuff preferable for upper extremity (pump up to 250-270 mm. Hg.) The pressure dressing is then applied and the tourniquet is

released, unless there is no doubt that the bleeding will recur. The tourniquet is then released every $\frac{1}{2}$ hour and re-applied only if necessary (it very rarely is).

DEFINITIVE CARE-

Preliminary orientation-

- 1) X-ray to locate fractures and foreign bodies.
- 2) Inspection of wound under aseptic precautions (masking and sterile instrument technique) to determine extent of injury.

Tourniquet- Often desirable to control bleeding during surgical care of extremity wounds:

- a) Upper extremity- blood pressure cuff.
- b) Lower extremity- Martin bandage.

Cleansing of the Wound and Field of Operation-

This removes not only some of the contaminating bacteria but also dirt and much other foreign material.

Equipment-A two identical set-ups are prepared as follows:

- 1) Sterile basin (2 quart capacity).
- 2) 1 dozen 6 by 6 inch cotton squares (sterile).
- 3) Sterile water.
- 4) Cake of plain white soap.

One set up is used for scrubbing the area around the wound and the other for the wound itself.

B A large irrigating can of 1-2 gallon capacity filled with sterile physiological salt solution and fitted with a long rubber tube and irrigating nozzle.

Technique-

Scrub as for operation. Place one set-up on sterile table. Fill basin $\frac{3}{4}$ full with sterile water and drop in cake of soap. A Washing of area about wound-

- 1) Remove first aid dressing exposing wound.
- 2) Cover wound with square of gauze to protect it from scrub water from skin.
- 3) Wash thoroughly a large area around the wound. Make generous suds and be careful that none of the water gets into the wound. This procedure takes 10-20 minutes.
- 4) Irrigate the area washed with solution from the irrigating can.

B Washing of wound itself-

- 1) Remove dressings from wound.
- 2) Set out second scrub set.
- 3) Change gown and gloves.
- 4) Wash wound thoroughly but gently with soap and water, taking care to see that all cracks and corners of wound are exposed and cleansed. This procedure takes 10-20 minutes.
- 5) Irrigate wound with several quarts of sterile saline.

Excision of Devitalized Tissue-

The purpose of this is to remove tissue which is necrotic or destined to become so.

- 1) After the washing is completed drape the wound. No antiseptics are applied to the skin.
- 2) ~~Start the excision through~~ the skin and proceed through the wound layer by layer.

- 3) Nerves and blood vessels must be spared wherever possible.
- 4) Loose fragments of bone are removed. Soiled ends are cleansed with chisel and rongeur.
- 5) Explore every crevice carefully and gently.
- 6) Remove foreign bodies (previous X-ray is of great value here

During the excision keep irrigating the wound with physiologic saline to remove debris and to keep the tissues moist
Sacrifice facial skin only if absolutely necessary (it is very apt to survive).

Hemostasis-

A dry wound is essential for primary healing.

Hemorrhage causes a separation of tissue planes, and a disturbance of blood supply by pressure. Blood clots are a good culture medium.

- 1) Oozing- is controlled by gauze sponges wrung out in warm physiologic saline.
- 2) Bleeders- clamp only the tip of the vessel and don't include surrounding tissue in ligature. Use fine silk or 000 or 0000 chromic catgut and keep number of
- 3) ligatures at a minimum, because they act as a foreign body.
- 3) Avoid damage to vessels which may still be functional.
- 4) On completing excision- remove tourniquet and control bleeding
- 5) The resilient pressure dressing and elevation in wounds of the extremities will control much bleeding. The pressure dressing at the end of the operation also helps in maintaining hemostasis by supporting venous return.

Avoidance of further damage during definitive treatment-

- 1) Avoid rough handling of tissues.
- 2) Avoid antiseptics in wound
- 3) Avoid use of cautery.

Restoration (as nearly as possible) of normal positional and pressure relationships of the tissues-

- 1) Obliterate dead spaces- (these collect serum and breed bacteria). Do this by pressure dressing or by opening wide for drainage to the outside.
- 2) Reduce fractures.
- 3) Repair soft tissue.
- 4) Close skin.

Primary repair of deep structures-such as tendons and nerves is usually not advisable in war wounds because of contamination, time interval since injury, lack of preliminary rest, and lack of time for observation. (For technique see separate sections dealing with various tissues and regions).

Primary closure- indicated only if

- 1) Wound has been seen early.
- 2) First aid has been satisfactory.
- 3) Surgeon has adequate time and facilities.
- 4) The patient may be watched carefully in case of sizeable wounds.

Special cases-

- 1) Facial wounds- close up to 24 hours.
- 2) Joint wounds- close loosely to skin; leave skin open after 8 hours.
- 3) Abdominal wounds- close regardless of time interval.

Method of closure-

- 1) By suture- must be without tension.
- 2) By skin graft- Where possible use thick split grafts (intermediate thickness graft). Full thickness graft and pedicled flap seldom feasible.

Open dressing of wound-indicated where primary closure not possible or contraindicated. Line wound with a layer of fine mesh gauze saturated with vaseline. Then pack lightly with gauze and apply resilient pressure dressing.

Application of splint or cast- to put part at rest. Indicate a window over the site of the wound at the time of operation. The latter is out and removed at the time of the first dressing. The outer saturated dressings are removed; fresh ones are applied; and the site is bandaged snugly with a resilient pressure dressing which gives adequate support. Splints may be incorporated in the dressings if they are sterilizable (aluminum).

After dressings-(see chapter on surgical dressings). Should be done as infrequently as possible. Leave dressing on 10-14 days unless special indication arises. Change thereafter only as wound conditions indicate.

General care- support constitutional condition of patient by adequate protein intake in diet and by vitamin administration.

TREATMENT OF THE LATE WOUND (over ²⁴~~6-8~~ hours) *and frankly infected*

Such a wound must be treated as if it were frankly infected,

- 1) Prevent further wound contamination (see above).
- 2) Cleansing of the wound by washing is contraindicated.
- 3) Excision is contraindicated- when the extension of the process has stopped one may cautiously excise necrotic bits through the line of demarcation, (see treatment of gas gangrene).
- 4) Avoid further wound damage (as in early wound).
- 5) Foreign bodies-
 - A If not causing reaction leave alone until wound has healed.
 - B If healed and causing no harm leave alone.
 - C In frankly infected wound if foreign body seems at fault and inadequate drainage is present- gently search for it under anaesthesia.
 - ~~D In intermediate wound (8-24 hours) cautiously remove foreign body unless such removal is hazardous.~~
- 6) Keep foreign material out of wound- Avoid ligatures as much as possible.
- 7) Restoration of normal tissue relationships-
 - A Deep tissue repair is out of the question.
 - B Fractures- merely as good apposition as possible by external fixation
 - C Soft tissues- loose approximation if at all. No suturing permitted.
- 8) Closure- forbidden. Leave wound open or even enlarge. Deep wounds are packed open with gauze, the inner layer of which is saturated with vaseline.
- 9) Control of hemorrhage- Bleeding in late wound is usually secondary (deep infection and erosion of vessels). Control by packing and pressure. If this fails proximal

*if
whether the foreign bodies
subinf. or not.*

- ligation is done, or if not successful- amputation.
- 10) Promotion of good blood supply- by elevation and warm moist packs.
- 11) Absolute immobilization- by plaster or splint- aluminum splints may be incorporated in warm moist packs.
- 12) General care- adequate intake of proteins and vitamins.

over

Anaesthesia in Wound R.

~~In extensive injury treatment~~
~~more~~ Choice of anaesthesia will depend on
~~its extent~~ nature of wound, its location, and
the anaesthetics available.

General anaesthesia - allows more
rapid and thorough ^{treatment} R. in extensive wounds

- ① Nitrous oxide - for short cases
- ② Ether - probably most generally ^{useful and available} used ~~and most helpful~~

Local anaesthesia -

~~Infiltration~~ in small superficial

- ① Small superficial wounds - if seen early and ^{not} infected
- ② Head wounds - may use avertin + local

Infiltration dangerous if infection present

Intra-tracheal -

- ① Head and neck cases
- ② Chest cases.

Intravenous

- ① Short cases
- ② Contra-indicated - ^{see} ~~text~~

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- 2) Bandage dressing firmly and snugly.
- 3) If an extremity is involved - apply splint whether a fracture is present or not.
- 4) Control hemorrhage - resilient pressure dressing and elevation of part almost always suffice, even with severe bleeding.

The Tourniquet - seldom necessary.

Indications:

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- 5) Explore every crevice carefully and gently.
- 6) Remove foreign bodies (previous x-rays are of great value here).

During the excision keep irrigating the wound with physiologic saline to remove debris and to keep the tissues moist. Sacrifice facial skin only if absolutely necessary (it is very apt to survive).

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After dressings--(see chapter on surgical dressings). Should be done as infrequently as possible. Leave dressing on 10-14 days unless special indication arises. Change thereafter only as wound conditions indicate.

General Care: support constitutional condition of patient by adequate protein intake in diet and by vitamin administration.

Treatment of intermediate wound over 6-8 hours but under 24 hours:

Such a wound, unless under exceptional circumstances is contaminated with virulent organisms and infection may already be starting.

A., Some of these wounds will be amenable to cleansing and careful gentle excision.

B. Some will be frankly infected and must be so treated (see below), Treatment of Late Wounds. None (except an occasional wound of the face) should be closed by suture.

1. No Frank Infection Present:

Cleanse surrounding area and wound gently with soap and water and normal saline irrigation.

Excise devitalized tissues and remove foreign bodies.

Provide adequate drainage; by leaving wound open, by enlarging if area of damage is covered.

Pack any defect gently with vaseline lining of fine mesh; fluffed gauze.

Do not perform primary suture; apply resilient pressure dressing.

Apply splint: Plaster of Paris ~~caement~~; wood or metal splint to put part at rest.

2. If frankly infected treat as outlined below.

TREATMENT OF LATE WOUND (over 24 hours) and frankly infected.

Such a wound must be treated as if it were frankly infected whether it evidences subcutaneous infection or not.

- 1) Prevent further wound contamination (see above).
- 2) Cleansing of the wound by washing is contra-indicated.
- 3) Excision is contra-indicated when the extension of the process has stopped one may cautiously excise necrotic bits through the line of demarcation. (see treatment of gas gangrene).
- 4) Avoid further wound damage as in early wound.
- 5) Foreign bodies:
 - a. If not causing reaction leave alone until wound has healed.
 - b. If healed and causing no harm leave alone.
 - c. In frankly infected wound if foreign body seems at fault and inadequate drainage is present, gently search for it under anesthesia.
- 6) Keep foreign material out of wound. Avoid ligatures as much as possible.
- 7) Restoration of normal tissue relationships:
 - a. Deep tissue repair is out of the question.
 - b. Fractures, merely as good apposition as possible by external fixation.
 - c. Soft tissues, loose approximation if at all. No suturing permitted.
- 8) Closure: forbidden. Leave wound open or even enlarge. Deep wounds are packed open with gauze, the inner layer of which is saturated with vaseline.
- 9) Control of hemorrhage; bleeding in late wound is usually secondary (deep infection and erosion of vessels). Control by packing and pressure. If this fails proximal ligation is done, or if not successful, amputation.
- 10) Promotion of good blood supply, by elevation and warm moist packs.
- 11) Absolute immobilization, by plaster or splint: Aluminum splints may be incorporated in warm moist packs.
- 12) General care - adequate intake of proteins and vitamins.

Anesthesia in Wound: Choice of anesthesia will depend on the nature of the wound, its location, and the anesthetics available.

General Anesthesia: allows more rapid and thorough treatment in extensive wounds.

- 1) Nitrous oxide - for short cases
- 2) Ether - probably most generally useful and available.

Local anesthesia:

- 1) Small superficial wounds; if seen early and not infected.
- 2) Head wounds; may use avertin and local. Infiltration dangerous if infection present.

Intra-tracheal:

- 1) Head and neck cases
- 2) Chest cases

Intravenous:

- 1) Short cases
- 2) Contra-indicated - lesion; face, neck.

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- 1) ...
- 2) ...
- 3) ...
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