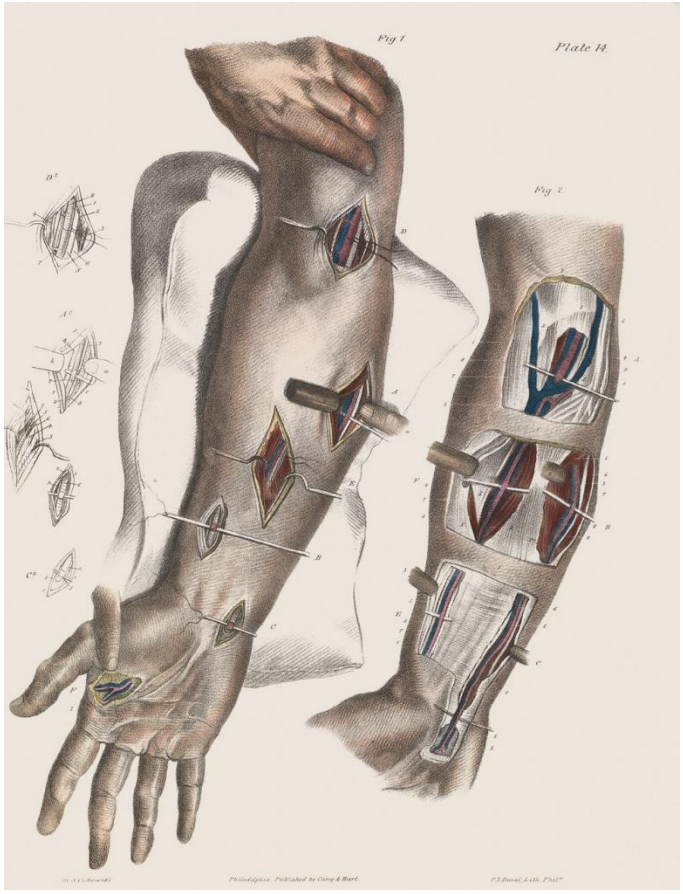
ICP-1/2

CLINICAL SKILLS LABORATORY COURSE GUIDEBOOK



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HAND HYGIENE

Definition of terms

Hand hygiene: A general term referring to any action of hand cleansing.

Hand hygiene products:

- Alcohol-based (hand) rub: An alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to reduce the growth of microorganisms.
- Antimicrobial (medicated) soap: Soap (detergent) containing an antiseptic agent at a concentration which is sufficient to reduce or inhibit the growth of microorganisms.
- Antiseptic agent: An antimicrobial substance which reduces or inhibits the growth of microorganisms on living tissues. Examples include alcohols, chlorhexidine gluconate, chlorine derivatives, iodine, chloroxylenol (PCMX), quaternary ammonium compounds, and triclosan.
- Detergent (surfactant): Compounds that possess a cleaning action. Although products used for handwashing or antiseptic handwash in health care represent various types of detergents, the term "soap" will be used to refer to such detergents in these guidelines.
    - Plain soap. Detergents that do not contain antimicrobial agents, or that contain very low concentrations of antimicrobial agents effective solely as preservatives.
    - Waterless antiseptic agent. An antiseptic agent that does not require the use of exogenous water. After application, the individual rubs the hands together until the agent has dried. The term includes different types of handrubs (liquid formulations, gels, foams).

Hand hygiene practices:

Antiseptic handwashing: Washing hands with water and soap or other detergents containing an antiseptic agent.

Antiseptic handrubbing (or handrubbing): Applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices.

Hand antisepsis/decontamination/degerming: Reducing or inhibiting the growth of microorganisms by the application of an antiseptic handrub or by performing an antiseptic handwash.

Handwashing: Washing hands with plain or antimicrobial soap and water.

Hand cleansing: Action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material or microorganisms. Hand disinfection is extensively used as a term in some parts of the world and can refer to antiseptic handwash, antiseptic handrubbing, hand antisepsis/decontamination/degerming, handwashing with an antimicrobial soap and water, hygienic hand antisepsis, or hygienic handrub.

Hygienic hand antisepsis: Treatment of hands with either an antiseptic handrub or antiseptic handwash to reduce the transient microbial flora without necessarily affecting the resident skin flora.

Hygienic handrub: Treatment of hands with an antiseptic handrub to reduce the transient flora without necessarily affecting the resident skin flora. These preparations are broad spectrum
and fast-acting, and persistent activity is not necessary.

Surgical hand antisepsis/surgical hand preparation: Antiseptic handwash or antiseptic handrub performed pre-operatively by the surgical team to eliminate transient and reduce resident skin flora. Such antiseptics often have persistent antimicrobial activity. Surgical handscrub(bing)/presurgical scrub refer to surgical hand preparation with antimicrobial soap and water. Surgical handrub(bing) refers to surgical hand preparation with a waterless, alcohol-based handrub.

Background and rationale for hand hygiene

The *resident flora* consists of microorganisms residing under the superficial cells of the stratum corneum, and can also be found on the surface of the skin. *Staphylococcus epidermidis* is the dominant species, and oxacillin resistance is extraordinarily high, particularly among health care workers (HCWs). Other resident bacteria include *Staphylococcus hominis* and other coagulase-negative staphylococci, followed by coryneform bacteria. Among fungi, the most common genus of the resident skin flora, when present, is Pityrosporum (Malassezia) spp. Resident flora has two main protective functions: microbial antagonism and the competition for nutrients in the ecosystem. In general, resident flora is less likely to be associated with infections, but may cause infections in sterile body cavities, in the eyes, or on non-intact skin.

Transient flora, which colonizes the superficial layers of the skin, is more amenable to removal by routine handwashing. Transient microorganisms do not usually multiply on the skin, but they

survive and sporadically multiply on skin surface. They are often acquired by HCWs during direct contact with patients or contaminated environmental surfaces adjacent to the patient, and are the organisms most frequently associated with health care-associated infections (HCAIs). Some types of contact are more frequently associated with higher levels of bacterial contamination of HCWs hands during routine neonatal care: respiratory secretions, nappy/diaper change and direct skin contact. The transmissibility of transient flora depends on the species present, the number of microorganisms on the surface, and the skin moisture. The hands of some HCWs may become persistently colonized by pathogenic flora such as S. aureus, Gram-negative bacilli, or yeast.

Transmission of pathogens on hands:

Transmission of health care-associated pathogens from one patient to another via HCWs' hands requires five sequential elements: (i) organisms are present on the patient's skin, or have been shed onto inanimate objects immediately surrounding the patient; (ii) organisms must be transferred to the hands of HCWs; (iii) organisms must be capable of surviving for at least several minutes on HCWs' hands; (iv) handwashing or hand antisepsis by the HCW must be inadequate or entirely omitted, or the agent used for hand hygiene inappropriate; and (v) the contaminated hand or hands of the caregiver must come into direct contact with another patient or with an inanimate object that will come into direct contact with the patient.

Impact of improved hand hygiene

There is convincing evidence that improved hand hygiene can reduce infection rates. Failure to perform appropriate hand hygiene is considered to be the leading cause of HCAI and spread of multiresistant organisms, and has been recognized as a significant contributor to outbreaks. Several hospital-based studies of the impact of hand hygiene on the risk of HCAI have been published between 1977 and 2004. Despite study limitations, most reports showed a temporal relation between improved hand hygiene practices and reduced infection rates.

In 2000, a landmark study by Pittet and colleagues demonstrated that implementing a multidisciplinary programme to promote increased use of an alcohol-based handrub led to increased compliance of HCWs with recommended hand hygiene practices, and to reduced prevalence of HCAI.

The beneficial effects of hand hygiene promotion on the risk of cross-transmission have also been reported in surveys conducted in schools or day care centres, as well as in a community setting.

Glove wearing policies

Please check http://www.who.int/gpsc/5may/GloveUseInformationLeaflet.pdf

Glove wearing by HCWs is recommended for two main reasons: (i) to prevent microorganisms which may be infecting, commensally carried, or transiently present on HCWs' hands from being transmitted to

patients and from one patient to another; and (ii) to reduce the risk of HCWs acquiring infections from patients.

Gloves should be worn during all patient-care activities that may involve exposure to blood or body fluids that may be contaminated with blood. In addition, gloves should be worn in activities that include contact with potentially infectious material other than blood, such as mucous membranes, and non-intact skin, or during outbreak situations, as recommended by specific requirements for Personal Protective Equipment. Gloves used by HCWs are usually made of natural, rubber latex or synthetic non-latex materials such as vinyl, nitrile and neoprene (polymers and copolymers of chloroprene). Because of the increasing prevalence of latex sensitivity among HCWs and patients, the FDA has approved a variety of powdered and powder-free latex gloves with reduced protein contents, as well as synthetic gloves that can be made available by health-care institutions for use by latex-sensitive individuals. It is appropriate to have more than one type of glove available, allowing HCWs to select the type that best suits their patient-care activities. Although recent studies suggest that improvements have been made in the quality of gloves, the laboratory and clinical studies cited above provide strong evidence that hands should still be decontaminated or washed after glove removal. Preventing gross contamination of the hands is considered important because hand washing or hand antisepsis may not remove all potential pathogens when hands are heavily contaminated. Furthermore, several studies provide evidence that wearing gloves can help reduce transmission of pathogens in health-care settings. HCWs should be informed that gloves do not provide complete protection against hand contamination. Bacterial flora colonizing patients may be recovered from the hands of up to 30% of HCWs who wear gloves during patient contact. These studies provide definitive evidence that gloves must be removed after care of a single patient and during the care of a patient, when moving from a contaminated to a clean body site or procedure within the same patient, and that hand cleansing must be performed after glove removal. HCWs should be reminded that the failure to remove gloves between patients or between different body sites of the same patient may contribute to the transmission of organisms.

Key recommendations on glove use are shown in figure 1. It is important that HCWs are able to select correctly the most appropriate type of gloves to be worn and to differentiate between specific clinical situations when gloves should be worn and changed and those where their use is not indicated.

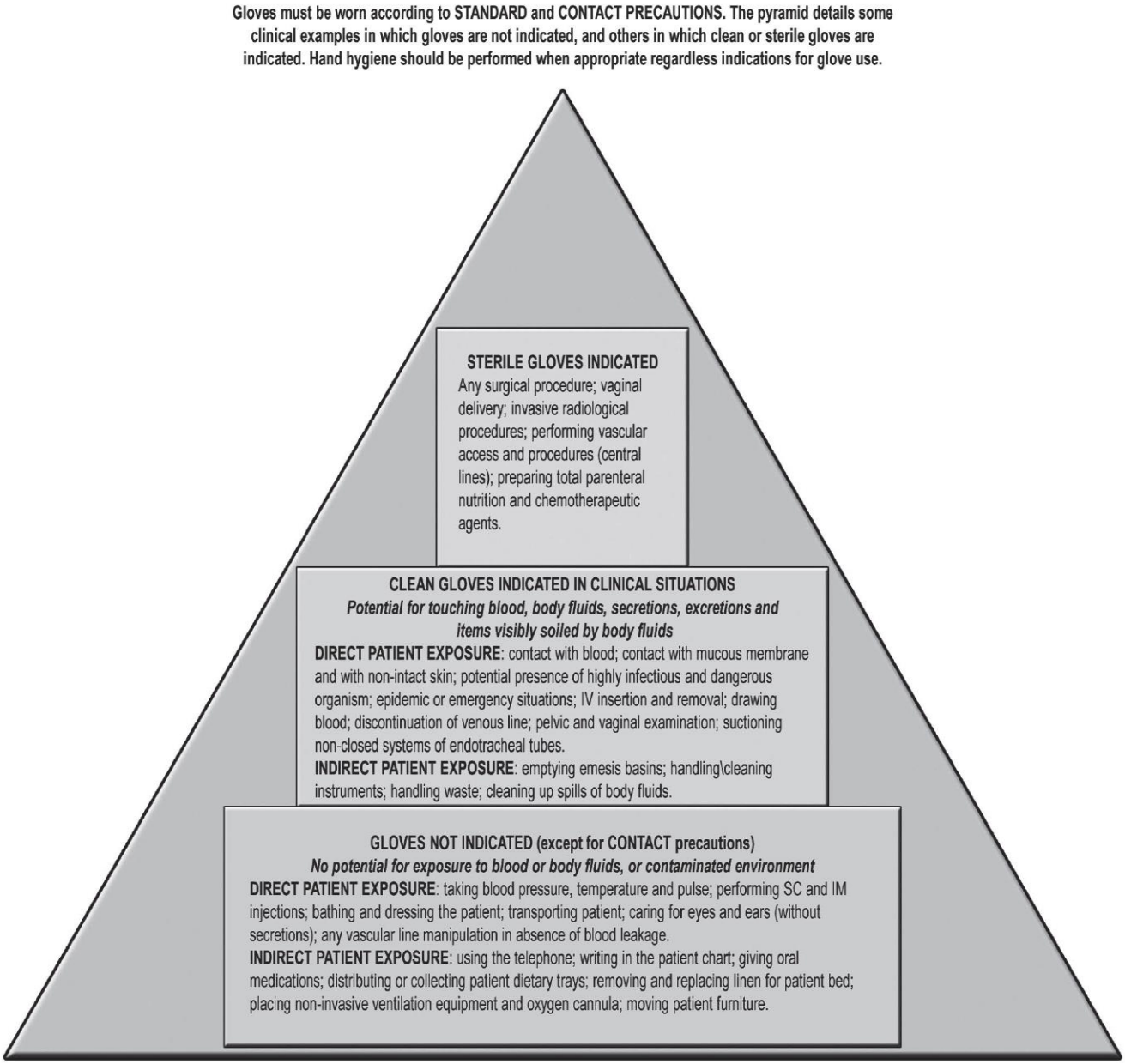


Figure I.20.1: Key recommendations on glove use

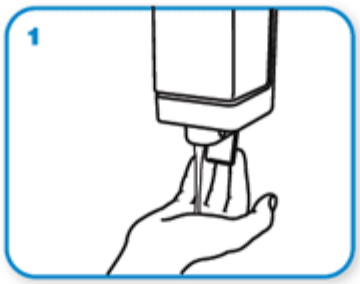
Skill sequence:

Hand Washing

Video link: http://www.nejm.org/doi/full/10.1056/NEJMvcm0903599#t=article

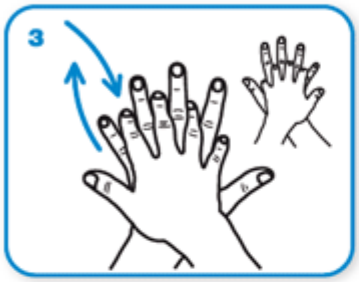
1) Gather the necessary supplies. Stand in front of the sink.
2) Do not allow your clothing to touch the sink during the washing procedure.
3) Remove jewelry, if possible, and secure in a safe place.
4) Turn on water and adjust force.
5) Wet the hands and wrist area. Keep hands lower than elbows to allow water to flow toward fingertips.
6) Use about 1 teaspoon liquid soap from dispenser lather thoroughly.
7) Cover all areas of hands with the soap product.
8) With firm rubbing and circular motions, wash the palms and backs of the hands, each finger, the areas between the fingers, and the knuckles, wrists, and forearms.
9) Wash at least 1 inch above area of contamination. If hands are not visibly soiled, wash to 1 inch above the wrists.
10) Continue this friction motion for at least 15 seconds.
11) Use fingernails of the opposite hand or a clean orangewood stick to clean under fingernails.
12) Rinse thoroughly with water flowing toward fingertips.
13) Pat hands dry with a paper towel, beginning with the fingers and moving upward toward forearms, and discard it immediately.
14) Use another clean towel to turn off the faucet. Discard towel immediately without touching other clean hand.

Wet hands with water

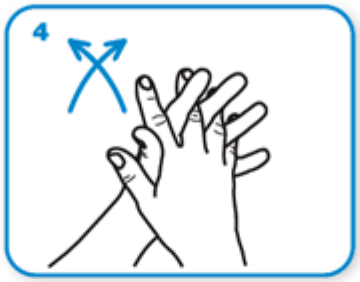


apply enough soap to cover all hand surfaces.

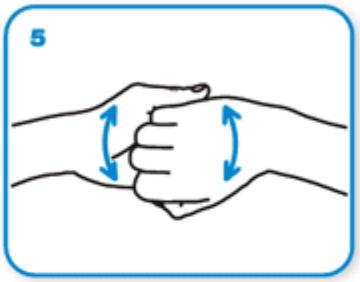
Rub hands palm to palm



right palm over left dorsum with interlaced fingers and vice versa

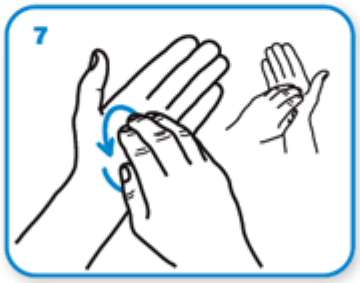


palm to palm with fingers interlaced

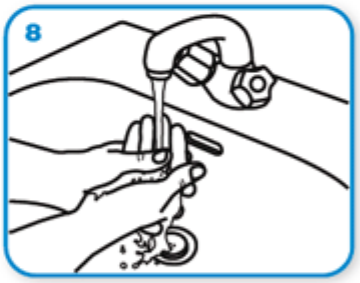


backs of fingers to opposing palms with fingers interlocked

rotational rubbing of left thumb clasped in right palm and vice versa

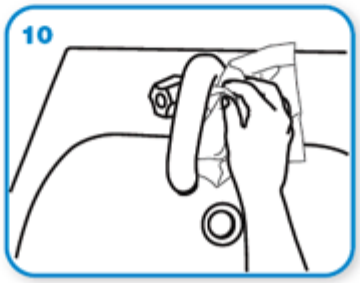


rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.



Rinse hands with water

dry thoroughly with a single use towel



use towel to turn off faucet

...and your hands are safe.

Skill sequence:

Wearing sterile gloves

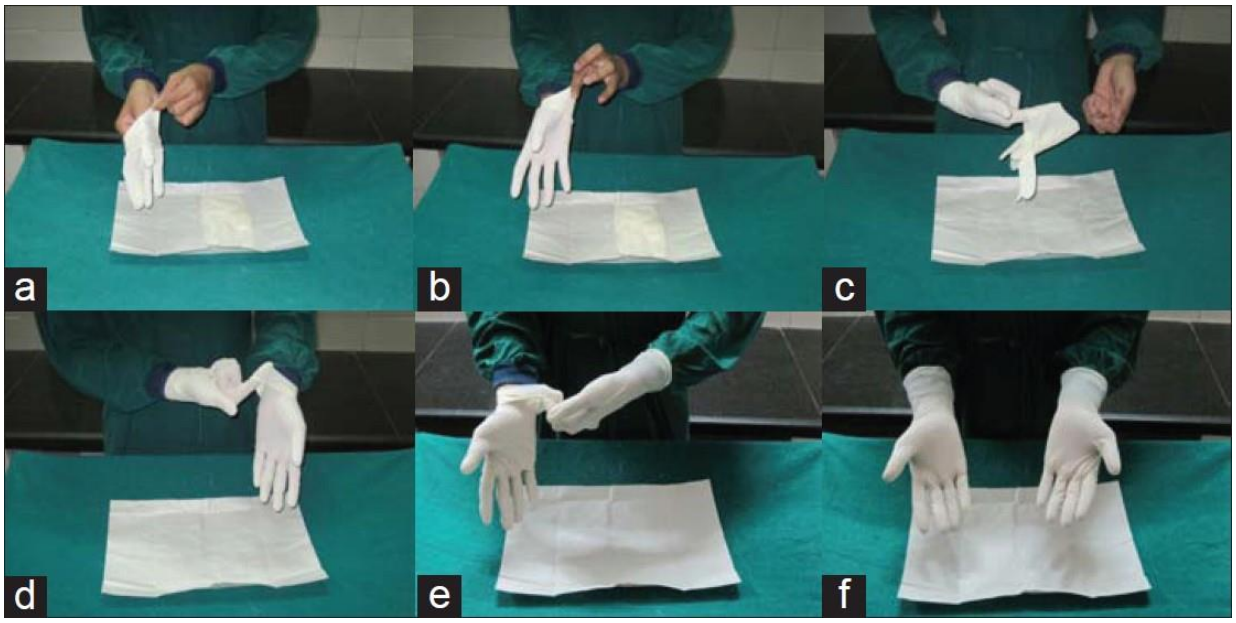
Video link:

https://www.youtube.com/watch?v=Q1J9CsGkM1Y/photo

1. Perform thorough hand hygiene.
2. Remove outer glove package wrapper by carefully separating and peeling apart sides.
3. Grasp inner package, and lay it on clean, flat surface just above waist level. Open package, keeping gloves on wrapper's inside surface.
4. Identify right and left glove. Glove dominant hand first.
5. With thumb and first two fingers of non-dominant hand, grasp edge of cuff of glove for non- dominant hand, grasp edge of cuff of glove for dominant hand. Touch only glove's inside surface.
6. Carefully pull glove over dominant hand, leaving cuff and being sure cuff does not roll up wrist. Be sure thumb and fingers are in proper spaces.
7. With gloved dominant hand, slip fingers underneath second glove's cuff.
8. Carefully pull second glove over non-dominant hand. Do not allow fingers and thumb of gloved dominant hand to touch any part of exposed non-dominant hand. Keep thumb of dominant hand abducted back.

Removing Gloves

1. Grasp outside of one cuff with other gloved hand. Avoid touching wrist.
2. Pull halfway down palm of hand. Take thumb of half ungloved hand, and place under cuff of the other glove.
3. Pull glove off, turning it inside out.
4. Discard in designated container.
5. Take fingers of bare hand and tuck inside remaining glove cuff.
6. Peel glove off inside out.
7. Discard in designated container.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PHLEBOTOMY / DRAWING BLOOD

Background:

Phlebotomy (the drawing of blood) is one of the most common invasive procedures in health care. Each step in the process of phlebotomy affects the quality of the specimen and is thus important for preventing laboratory error, patient injury and even death. For example, the touch of a finger to verify the location of a vein before insertion of the needle increases the chance that a specimen will be contaminated. This can cause false blood culture results, prolong hospitalization, delay diagnosis and cause unnecessary use of antibiotics.

If a blood sample is poorly collected, the results may be inaccurate and misleading to the clinician, and the patient may have to undergo the inconvenience of repeat testing. The three major issues resulting from errors in collection are haemolysis, contamination and inaccurate labelling.

Factors that increase the risk of haemolysis include:

• use of a needle of too small a gauge (23 or under), or too large a gauge for the vessel;

• pressing the syringe plunger to force the blood into a tube, thus increasing the shear force

on the red blood cells;

• drawing blood specimens from an intravenous or central line;

• underfilling a tube so that the ratio of anticoagulant to blood is greater than 1:9;

• mixing a tube too vigorously;

• failing to let alcohol or disinfectant dry;

• using too great a vacuum; for example, using too large a tube for a paediatric patient, or using too large a syringe (10–20 ml).

Serious adverse events linked with phlebotomy are rare, but may include loss of consciousness with tonic clonic seizures. Less severe events include pain at the site of venepuncture, anxiety and fainting. The best documented adverse events are in blood transfusion services, where poor venepuncture practice or anatomical abnormality has resulted in bruising, haematoma and injury to anatomical structures in the vicinity of the needle entry. Nerve injury and damage to adjacent anatomical structures occurred infrequently, and syncope occurred in less than 1% of individuals. Vasovagal attacks occurred occasionally.

Phlebotomy also poses risks for health workers.

Dangerous practices include:

• recapping used needles using two hands;

• recapping and disassembling vacuum-containing tubes and holders;

• reusing tourniquets and vacuum-tube holders that may be contaminated with bacteria and

sometimes blood;

• working alone with confused or disoriented patients who may move unexpectedly, contributing to needle-sticks.

Phlebotomy involves the use of large, hollow needles that have been in a blood vessel. The needles can carry a large volume of blood that, in the event of an accidental puncture, may be more likely to transmit disease than other sharps. Bloodborne organisms that have been transmitted after needle-sticks include viruses such as hepatitis B and human immunodeficiency virus (HIV), bacteria such as syphilis and parasites such as malaria Therefore; education and training is necessary for all staff carrying out phlebotomy. This education should include an understanding of anatomy, awareness of the risks from blood exposure, and the consequences of poor infection prevention and control.

Accidental exposure and specific information about an incident should be recorded in a register. Support services should be promoted for those who undergo accidental exposure. Post-exposure prophylaxis (PEP) can help to avert HIV and hepatitis B infections. Hepatitis B immunization should be provided to all health workers (including cleaners and waste handlers), either upon entry into health-care services or as part of PEP. For further information refer to the reference document listed below.

Tourniquets are a potential source of methicillin-resistant Staphylococcus aureus (MRSA), with up to 25% of tourniquets contaminated through lack of hand hygiene on the part of the phlebotomist or reuse of contaminated tourniquets. In addition, reusable finger-prick devices and related point-of-care testing devices (e.g. glucometers) contaminated with blood have been implicated in outbreaks of hepatitis B (4, 5, 36). To avoid contamination, any common-use items, such as glucometers, should be visibly clean before use on a patient, and single-use items should not be reused.

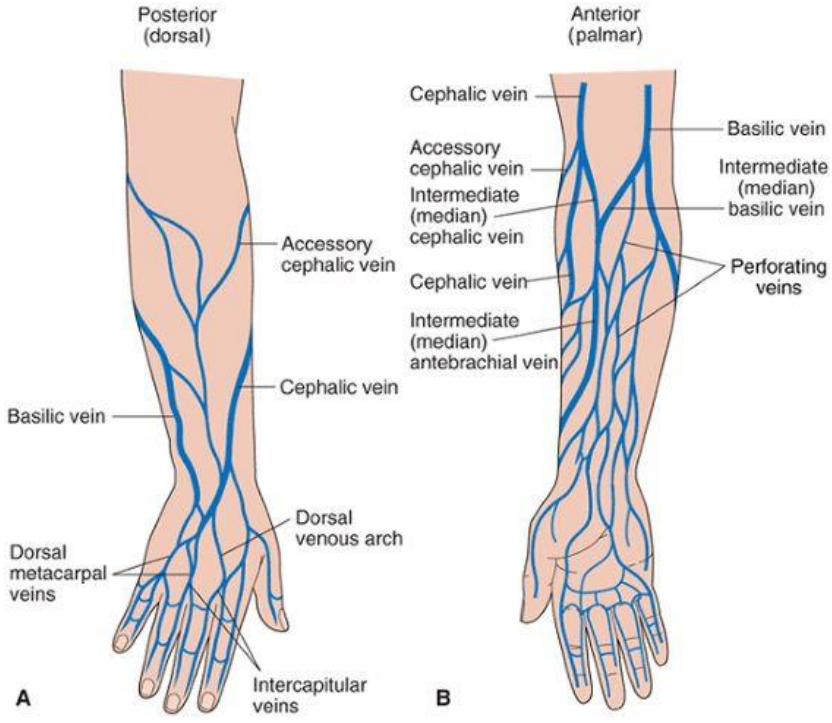
Before performing phlebotomy; correct identification of the patient Identification should be through matching to the laboratory request form and after samples have been taken from a patient a system of identification and tracking is essential to ensure that the sample is correctly matched with the result and with the patient.

http://www.euro.who.int/__data/assets/pdf_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf?ua=1

Venepuncture

Necessary equipment: sampling tubes, non-sterile gloves, blood-sampling device, a tourniquet, alcohol hand-rub, 70% alcohol swabs for skin disinfection, gauze or cotton-wool ball, laboratory specimen labels, writing equipment, leak-proof transportation bags and containers, a puncture-resistant sharps container (Fig a).

Fig a: Equipment for venipuncture.



Skill sequence:
https://www.youtube.com/watch?v=Yf8QSfpGbK0#t=146.537661

1. Prepare the equipment.
2. Introduce yourself to the patient, check the patient's identity.
3. Explain the procedure and reassure the patient.
4. Make the patient comfortable in a supine position (if possible).
5. Discuss the test to be performed and obtain verbal consent.
6. Extend patient's arm and inspect the antecubital fossa or forearm.
7. Locate a vein of a good size that is visible, straight and clear. The median cubital vein is usually the most commonly used.
8. Apply the tourniquet about 4–5 finger widths above the venepuncture site and re-examine the vein.
9. Perform hand hygiene
10. Put on non-sterile gloves.
11. Clean the site with a 70% alcohol wipe (not povidone iodine except for blood culture) in downward strokes and allow to dry completely (30 seconds).
12. Ask the patient to form a fist so the veins are more prominent.
13. Remove the grey cap from the needle.
14. Attach the needle to the needle holder.
15. Remove the other cap to reveal the needle.
16. Anchor the vein by holding the patient's arm and placing a thumb below the venepuncture site.
17. Enter the vein swiftly at a 30 degree angle or less, and continue to introduce the needle along the vein at the easiest angle of entry.
18. Once in the vein, attach a bottle and let it fill, changing if more than one bottle is required.
19. Once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle.
20. Withdraw the needle gently and apply gentle pressure to the site with a clean gauze or dry cotton-wool ball.
21. Ask the patient to hold the gauze or cotton wool in place, with the arm extended and raised. Ask the patient NOT to bend the arm, because doing so causes a haematoma.
22. Carefully dispose of the needle in the sharps bin.
23. Invert the tubes 3 times to ensure full mixing with any additives in the tubes.
24. Complete all of the patient details required on the bottles.
25. Apply the flaster on the puncture site.
26. Remove and dispose the gloves along with the remaining equipment in the clinical waste bin.
27. Perform hand hygiene.

There are two main reasons to prescribe an injection. The first is because a fast effect is needed, and the second is because the injection is the only dosage form available that has the required effect. A prescriber should know how to give injections, not only for emergency and other situations where it might be necessary, but also because it will sometimes be necessary to instruct other health workers (e.g. a nurse) or the patients themselves.

Many injections are prescribed which are unnecessarily dangerous and inconvenient. Nearly always they are much more expensive than tablets, capsules and other dosage forms. For every injection the prescriber should strike a balance between the medical need on the one hand and the risk of side effects, inconvenience and cost on the other.

When a drug is injected certain effects are expected, and also some side effects. The person giving the injection must know what these effects are, and must also know how to react if something goes wrong. This means that if you do not give the injection yourself you must make sure that it is done by someone who is qualified.

A prescriber is also responsible for how waste is disposed of after the injection. The needle and sometimes the syringe are contaminated waste and special measures are needed for their disposal. A patient who injects at home must also be aware of this problem.

INJECTABLE MEDICATION ADMINISTRATION

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General practical aspects of injecting:

Apart from the specific technique of injecting, there are a few general rules that you should keep in mind:
1. Check the expiry dates of each item including the drug.

2. Make sure that the vial or ampoule contains the right drug in the right strength.

3. During the whole preparation procedure, material should be kept sterile.
Wash your hands before starting to prepare the injection.
Disinfect the skin over the injection site.

4. Make sure that there are no air bubbles left in the syringe.
This is more important in intravenous injections.

5. Once the protective cover of the needle is removed extra care is needed. Do not touch anything with the unprotected needle. Once the injection has been given take care not to prick yourself or somebody else.

6. Make sure that contaminated waste is disposed of safely.

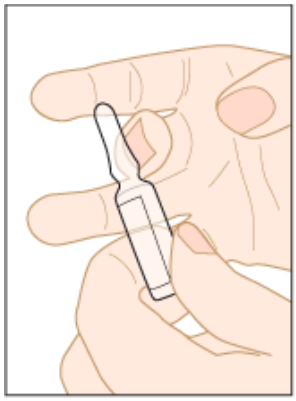
Aspirating from ampoules

Skill sequence:

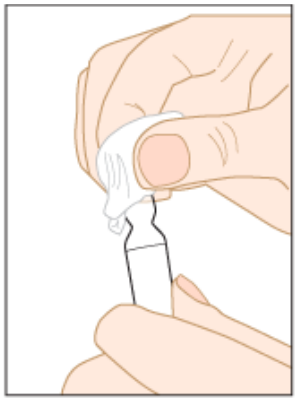
Check: https://www.youtube.com/watch?v=Vs8nuO8N4Fs

1. Wash your hands.
2. Put the needle on the syringe.
3. Pull and push the piston of the syringe 2-3 times.
4. Remove the liquid from the neck of the ampoule by flicking it or swinging it fast in a downward spiralling movement.
5. File around the neck of the ampoule.
6. Protect your fingers with gauze if ampoule is made of glass.
7. Carefully break off the top of the ampoule (for a plastic ampoule twist the top).
8. Aspirate the fluid from the ampoule.
9. Remove any air from the syringe.
10. Clean up; dispose of working needle safely; wash your hands.

Reference: http://apps.who.int/medicinedocs/pdf/whozip23e/whozip23e.pdf



Tapping moves fluid down neck



Gauze pad placed around neck of ampule

Neck snapped away from hands

Dissolving dry medicine

Skill sequence:

1. Wash hands.
2. Disinfect the rubber cap (top) of the vial containing the dry medicine.
3. Insert the needle into the vial, hold the whole upright.
4. Suck up as much air as the amount of solvent already in the syringe.
5. Inject only the fluid into the vial, not the air!
6. Shake.
7. Turn the vial upside-down.7
8. Inject the air into the vial (creating pressure).
9. Aspirate the total amount of solution (no air).
10. Remove any air from the syringe.
11. Clean up; dispose of waste safely; wash hands.

Reference: http://apps.who.int/medicinedocs/en/d/Jwhozip23e/7.4.4.html

Aspirating from a vial

Skill sequence:

Check: https://www.youtube.com/watch?v=4y7RF4xctnE

1. Wash your hands.
2. Disinfect the top of the vial.
3. Use a syringe with a volume of twice the required amount of drug or solution and add the needle.
4. Suck up as much air as the amount of solution needed to aspirate (fig a).
5. Insert needle into (top of) vial and turn upside-down.
6. Pump air into vial (creating pressure) (fig b).
7. Aspirate the required amount of solution and 0.1 ml extra. Make sure the tip of the needle is below the fluid surface (fig c).
8. Pull the needle out of the vial.
9. Remove possible air from the syringe.
10. Clean up; dispose of waste safely; wash your hands.

Reference: http://apps.who.int/medicinedocs/en/d/Jwhozip23e/7.4.3.html

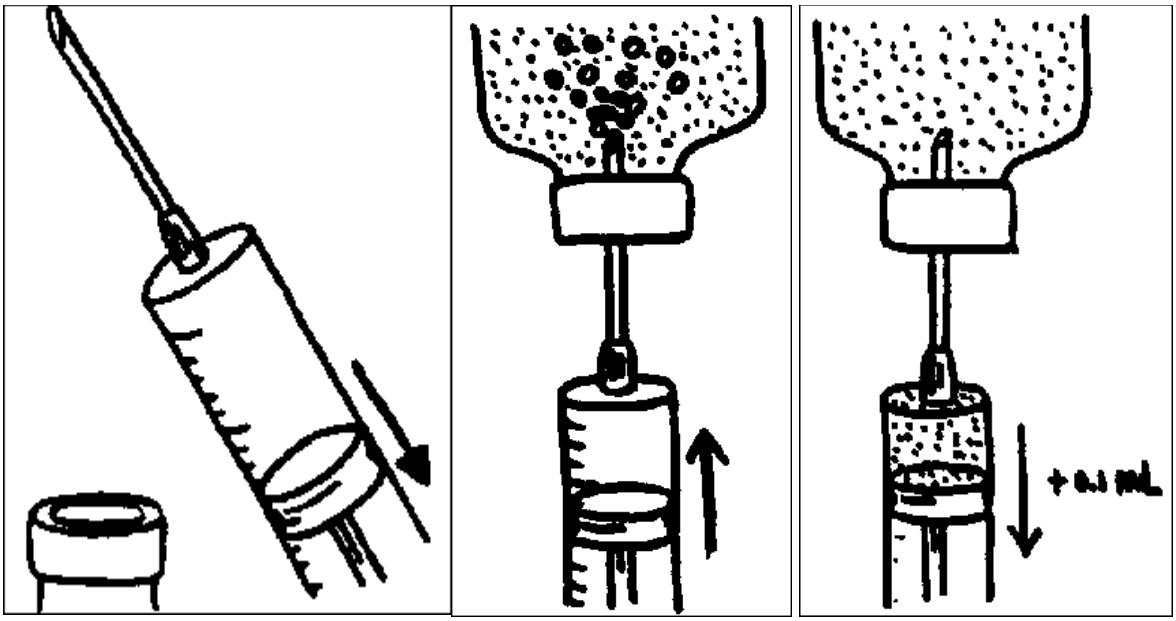


Fig a Fig b Fig c

Discarding used needles, syringes and other materials

Skill sequence:

1. Introduce the needle into the center of the needle disposal box opening.
2. Tilt needle to the side, then pull the syringe sharply upwards to disconnect the needle
3. Discard syringe, empty vial or ampoule in designated container.

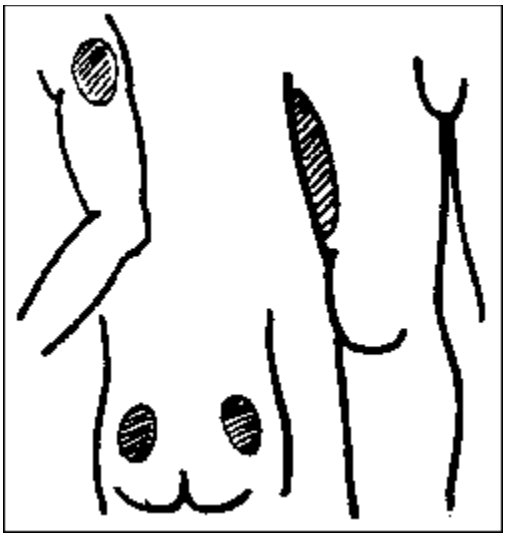
Intramuscular Injection

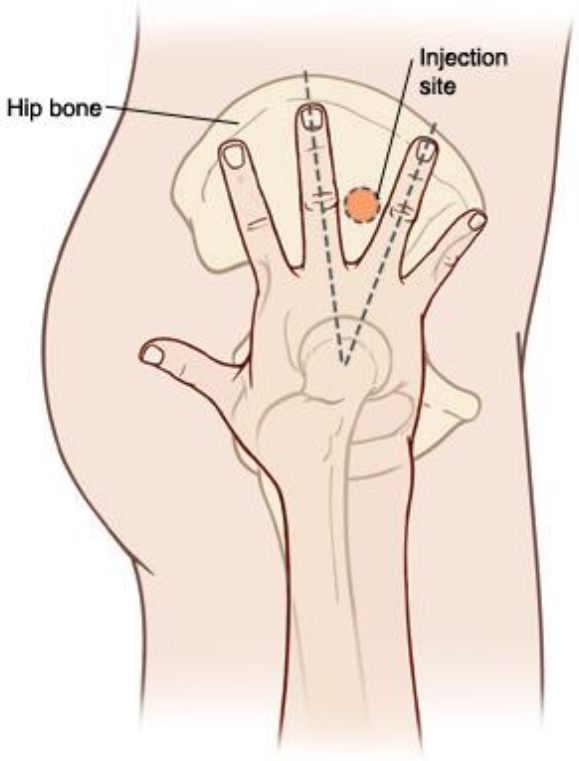
Skill sequence:

Check: https://vimeo.com › Ivy Tech Northeast Multimedia › Videos

1. Perform hand hygiene.
2. Select appropriate syringe and needle, considering volume and type of medication, and patient's muscle mass.
3. Prepare the medication.
4. Reassure the patient and explain the procedure.
5. Wear non- sterile gloves.
6. Select a preferred site for injection and locates site correctly. If patient has received other injections, rotates sites.
7. Position patient so the injection site is accessible and the patient is able to relax the appropriate muscles.
   a. Deltoid site: Position patient with arm relaxed at side or resting on firm surface an completely expose upper arm (fig a).
   b. Ventrogluteal site: Position patient on side with upper hip and knee slightly flexed (fig b).
   c. Vastus lateralis: Position patient supine or sitting.
   e. Dorsogluteal (because the sciatic nerve and major blood vessels are located near this site, use only if all other sites, including the rectus femoris, are inaccessible and no other route feasible) (fig a).
8. Palpate skin for induration or tenderness.
9. Clean injection site with alcohol swab by circling from the center of the site outward. Allow the site to dry before administering the injection.
10. Remove the needle cap.
11. With non-dominant hand, stretch skin taut between thumb and index finger.
12. Holding the syringe between thumb and fingers of the dominant hand like a pencil or dart, insert the needle at a 90° angle to the skin surface.
13. Stabilize syringe and aspirate by pulling back on the plunger. If there is a blood return, remove the needle, discards, and prepare the medication again.
14. Still stabilizing syringe, use thumb or index finger of non-dominant hand, press plunger slowly to inject the medication (5 to 10 seconds per mL).
15. Remove the needle smoothly along the line of insertion.
16. Gently massages site with a gauze pad and apply band-aid as needed.
17. Check the patient's reaction and give reassurance if necessary.
18. Engage safety needle device, and disposes in biohazard container.

Reference: http://apps.who.int/medicinedocs/en/d/Jwhozip23e/7.4.6.html#Jwhozip23e.7.4.6

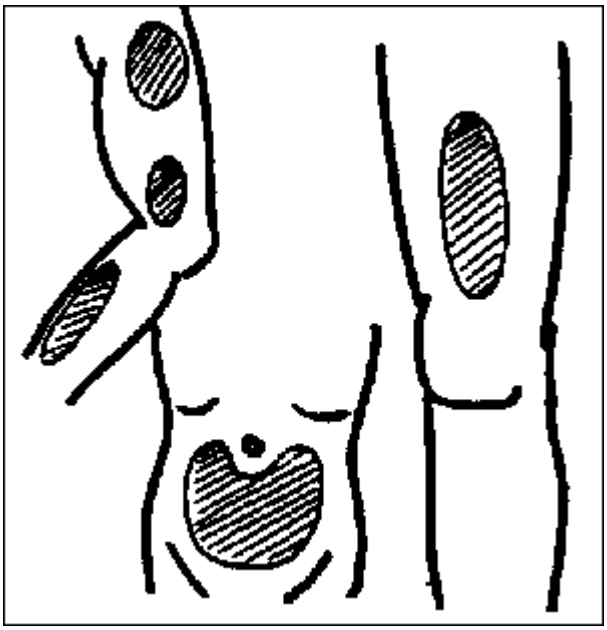



Injection site
Hip bone

Subcutaneous Injection

1. Perform hand hygiene.
2. Select appropriate syringe and needle, considering volume and type of medication, and patient's muscle mass.
3. Prepare the medication.
4. Reassure the patient and explain the procedure.
5. Wear non- sterile gloves.
6. Uncover the area to be injected (outer aspect of the upper arms, abdomen, anterior aspects of the thighs, and the scapular area on the upper back) (fig a).
7. Disinfect skin.
8. 'Pinch' fold of the skin.
9. If client is obese or "pinch" of adipose tissue is greater than 2 inches, use a 90° angle. If client is average size or "pinch" is less than 1 inch, use 45° angle.
10. Holding the syringe between thumb and index finger of the dominant hand like a pencil or dart, insert the needle at the appropriate angle into the pinched-up skinfold.
11. Stabilizes the syringe.
12. Release skin.
13. Aspirate briefly; if blood appears: withdraw needle, replace it with a new one, if possible, and start again from point 4.
14. Inject slowly (0.5 - 2 minutes!).
15. Withdraw needle quickly. Press sterile cotton wool onto the opening. Fix with adhesive tape. Do not massage the site.
16. Check the patient's reaction and give additional reassurance, if necessary.
17. Clean up; dispose of waste safely; wash hands.

Reference: http://apps.who.int/medicinedocs/en/d/Jwhozip23e/7.4.5.html



Catheter insertion

Skill sequence:

1. Perform clinical hand hygiene. Don non-sterile or sterile gloves.
2. Prepare the equipment.
3. Introduce yourself to the patient, check the patient's identity.
4. Explain the procedure and reassure the patient.
5. Make the patient comfortable in a supine position (if possible).
6. Uncover arm completely.
7. Have the patient relax and support his arm below the vein to be used.
8. Apply tourniquet and look for a suitable vein.
9. Wait for the vein to swell.
10. Clean injection site with alcohol swab by circling from the center of the site outward. Allow the site to dry before administering the injection.
11. Stabilize the vein by pulling the skin taut in the longitudinal direction of the vein.
12. Insert cannula using aseptic technique with flashback of blood advances the catheter over the needle.
13. Remove tourniquet to release pressure on vein.
14. Using one finger to put pressure at the end of the catheter to stop blood flow, remove the needle.
15. Dispose of needle in sharps container.
16. Attach extension tubing.
17. Flush IV cannula and dress and secure cannula.
18. Dispose of waste into the appropriate waste bin.
19. Check the patient's reactions and give additional reassurance, if necessary.
20. Clean up; dispose of waste safely; wash your hands.

WOUND CLOSURE AND SKIN SUTURING

The goals of wound management are; to avoid wound infection, assist in hemostasis, and to provide an esthetically pleasing scar.

Background:

Healing process of skin:

The healing process of skin occurs in several stages:

- Coagulation; begins immediately following the injury. Vasospasm as well as platelet aggregation and fibrous clot formation occur. During the inflammatory phase, proteolytic enzymes released by neutrophils and macrophages break down damaged tissue.
- Epithelialization; occurs in the epidermis, which is the only layer capable of regeneration. Complete bridging of the wound occurs within 48 hours after suturing.
- New blood vessel growth peaks four days after the injury.
- Collagen formation is necessary to restore tensile strength to the wound. The process begins within 48 hours of the injury and peaks in the first week. Collagen production and remodeling continue for up to 12 months.

Wound Management:

The first step to wound management is assessment. The assessment of minor wounds includes the following:

- determination of allergies (eg, to local anesthetics, antibiotics, or latex),
- status of tetanus immunization,
- mechanism of injury,
- presence of foreign body,
- extent of the wound, neurovascular or tendon injury, and cosmetic significance of the wound.

Tetanus immunization: Appropriate tetanus prophylaxis should be administered as soon as possible following a wound, but should be given even to patients who present late for medical attention. This is because the incubation period is quite variable; most cases occur within eight days, but the incubation period can be as short as one day or as long as several months.

Tetanus toxoid may have been administered as diphtheria-tetanus toxoids adsorbed (DT), diphtheria-tetanus-pertussis (DTP), diphtheria-tetanus-acellular pertussis (DTaP), tetanus-diphtheria toxoids adsorbed (Td), booster tetanus toxoid-reduced diphtheria toxoid-acellular pertussis (Tdap), or tetanus toxoid (TT).

The preferred vaccine preparation depends upon the age and vaccination history of the patient:

- <7 years: DTaP
- Underimmunized children ≥7 and <11 years who have not received Tdap previously: Tdap.
- Children who have received Tdap between age 7 and 11 years do not require revaccination at age 11 years.
- ≥11 years: A single dose of Tdap is preferred to Td for all individuals in this age group who have not previously received Tdap.
- Pregnant women should receive Tdap during each pregnancy.

Td is preferred to TT for those who received Tdap previously and when Tdap is not available

Table 1 Wound management and tetanus prophylaxis

Previous doses of tetanus toxoid	Clean and minor wound		All other wounds	
	Tetanus toxoid-containing vaccine*	Human tetanus immune globulin	Tetanus toxoid-containing vaccine*	Human tetanus immune globulin**
<3 doses or unknown	yes	no	yes	Yes
≥3 doses	Only if last dose given ≥ 10 years ago	no	Only if last dose given ≥5 years ago***	No

* 250 units intramuscularly at a different site than tetanus toxoid; intravenous immune globulin should be administered if human tetanus immune globulin is not available.
** The vaccine series should be continued through completion as necessary.
***Booster doses given more frequently than every five years are not needed and can increase adverse effects.

Mechanism of injury: Clarification of the mechanism of injury helps to determine the presence of a foreign body and the prognosis for development of infection or scarring. A simple cut through the skin by a sharp object causes minimal damage to the surrounding tissues and has a relatively low risk for infection or significant scarring. Tearing of the skin, as occurs when the chin strikes the floor, produces irregular wound margins and damage to the surrounding tissues; these lacerations have a moderate risk of infection and scarring. Direct compression injuries, as occur from a blow to the head, split the skin, injure the adjacent soft tissues, and classically cause a stellate laceration; these wounds have the highest risk of infection. Bite wounds must be evaluated for associated injuries and risk of infection. Crush injuries may involve devitalized tissue that must be debrided to decrease the risk of infection. Stab wounds should be evaluated for depth; surgical consultation may be necessary if underlying structures (eg, fascia) have been penetrated or damaged.

Foreign body: Identifying and removing foreign bodies is important because retained foreign bodies increase the risk of delayed wound healing and infection. Any foreign body that can be easily seen should be removed. If the object can be reliably palpated, the wound can be minimally extended to remove it, provided there is no risk to underlying structures. A nonirritant foreign body, such as glass or metal that is not in a critical area (eg, a joint space) or adjacent to a vital structure (eg, major blood vessel) and will not cause ongoing irritation may be left in place if unable to be removed, and the wound sutured. Irritant material, such as wooden splinters, can be a source of later infection and should be removed.

Extent of wound: The base of the wound must be identified whenever possible. Injury to underlying structures, such as a fracture beneath a laceration or penetration of a joint space in a finger laceration, has significant implications for management.

Neurovascular or tendon injury: Careful assessment of circulation and sensation, including two-point discrimination in hand injuries, will identify neurovascular injury. Any wound overlying a tendon should be assessed for tendon function and the base of the wound should be carefully explored.

Cosmetic significance: Wounds that are located in cosmetically sensitive areas, such as large wounds that involve the vermilion border of the lip, cartilaginous regions of the nose or ear, or facial lacerations that have tissue missing will present a challenge to good cosmetic outcomes. Consultation with an appropriate surgical specialist is appropriate when the managing physician has limited experience with repairing such wounds.

Type of closure: The decision of whether to perform primary closure, allow a wound to heal by secondary intention, or perform a tertiary (ie, delayed primary) closure is dependent upon the age of the injury as well as the mechanism and degree of contamination. Absolute contraindications to wound closure are signs of inflammation (redness, warmth, swelling, pain). In the absence of these findings, the decision to close a wound must be made based upon clinical judgment.

Primary closure: Wounds caused by clean, sharp objects that may undergo primary closure at any time up to 12 to 18 hours from the time of injury; location on the trunk or proximal extremity and the patient's lack of other risk factors (see above) favor success in later closure. Wounds of the head and neck may be closed up to 24 after injury because of the rich vascular supply of the face and scalp.

Secondary intention: Indications for secondary closure (ie, by granulation) include:

- Deep stab or puncture wounds that cannot be adequately irrigated
- Contaminated wounds
- Small non-cosmetic animal bites
- Abscess cavities
- Presentation after a significant delay

Delayed primary closure: Delayed primary closure should be considered for uncomplicated wounds that present after the safe period for primary closure. Delayed primary closure involves initial cleaning and debridement of the wound followed by at least a four- to five-day waiting period. The waiting period allows the host defense system to decrease bacterial load. Antibiotics may be administered to further diminish the risk of infection in wounds that will not be immediately closed. Additional debridement may be needed and excessive accumulated granulation tissue trimmed back to the wound margins at the time of closure.

Debridement has been considered by many to be equally or more important than irrigation in the management of the contaminated wound. It removes permanently devitalized tissue which, if retained, impairs the wound's ability to resist infection. Consideration of the relationship to the relaxed skin tension lines (RSTL) is essential. Lacerations that are oblique or perpendicular to these lines are at increased risk of scarring. Therefore, any excision should be parallel to the RSTL.

Hemostasis is necessary for adequate inspection of the wound and typically is accomplished by the application of direct pressure for 10 to 15 minutes with a gauze pad. Persistent bleeding may require the use of 1 percent lidocaine with epinephrine either injected or applied directly to the wound.

Hair removal: Hair need not be removed unless it interferes with wound closure or knot formation. Lubrication to comb the hair away from wound margins or simple clipping with scissors is all that is necessary in most cases.

Irrigation is the most important means of decreasing the incidence of wound infection because soil or small foreign bodies that remain in a wound reduce the inoculum of bacteria required to cause infection. However, irrigation may not be necessary for all low-risk wounds, particularly those in well-vascularized locations.
Irrigation is performed after adequate local anesthesia has been administered or peripheral nerve block has been performed. Isotonic (normal) saline is frequently used for uncomplicated wounds.

Suture materials

Terminology — A number of terms are used to describe the properties of various types of sutures.
●The physical configuration of a suture describes whether it is monofilamentous or multifilamentous. Multifilamentous sutures come in braided and twisted types. Braided types are usually easier to handle and tie, but can harbor bacteria between strands and cause higher infection rates.
●Tensile strength is defined as the amount of weight required to break a suture divided by its cross sectional area. The designation for suture strength is the number of zeros. The higher the number of zeros (1-0 to 10-0), the smaller the size and the lower the strength.

●Knot strength is the measure of the amount of force required to cause a knot to slip and is directly proportional to the coefficient of friction for a given material.
●Elasticity refers to the suture's intrinsic ability to hold its original form and length after being stretched. This allows the suture to expand with wound edema or to retract and maintain wound edge apposition during wound contraction. Plasticity refers to a material that, when stretched, does not return to original length.
●Memory is closely related to plasticity and elasticity. It refers to the inherent ability of a material to return to its former shape after being manipulated, and is often a reflection of its stiffness

Absorbable sutures — An absorbable suture is generally defined as one that will lose most of its tensile strength within 60 days after implantation beneath the skin surface. The most commonly used today are the synthetic sutures (polyglactin 910 [Vicryl], polyglycolic acid [Dexon], polydioxanone [PDS], and polytrimethylene carbonate [Maxon]. Catgut is still used frequently in pediatric wound closures.

Nonabsorbable sutures — Knot security, tensile strength, tissue reactivity, and workability of the various nonabsorbable sutures used for skin closure are provided in the table 2.

Table 2:

Suture material	Knot security	Wound tensile strength	Tissue reactivity	Workability	Anatomic site
Nylon	Good	Good	Minimal	Good	Skin closure any where
Polybutester	Good	Good	Minimal	Good	Skin closure any where
Polypropylene (Prolene)	Least	Best	Least	Fair	Skin closure anywhere, blue color is an advantage
Silk	Best	Least	Most	Best	Rarely used

Needles Choosing the proper needle can be confusing because of varying nomenclature.
●The eye is the end of the needle attached to the suture. All sutures used for acute wound repair are swaged (ie, the needle and suture are connected as a continuous unit).
●The body of the needle is the portion that is grasped by the needle holder during the procedure. The body determines the shape of the needle and is curved for cutaneous suturing. The curvature may be one-fourth, three-eighths, one-half, or five-eighths circle. The most commonly used curvature is the three-eighths circle, requiring only minimal pronation of the

wrist for large and superficial wounds. The one-half and five-eighths circles were devised for suturing in confined spaces, such as the oral cavity.

●The point of the needle extends from the extreme tip to the maximum cross section of body. For soft tissue and fascia, the taper needle, round in cross section, is ideal.

Needle points are also available in cutting, conventional cutting, or reverse cutting form:

●Cutting – Cutting needles have at least two opposing cutting edges. Cutting needles are ideal for skin sutures that must pass through dense, irregular, and relatively thick dermal connective tissue.

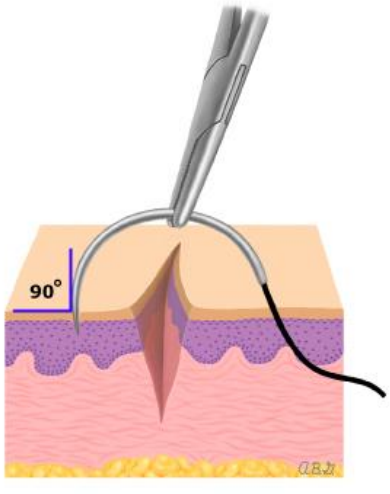
●Conventional cutting – Conventional cutting needles have a third cutting edge on the inside concave curvature of the needle. This needle type may be prone to cutout of tissue because the inside cutting edge cuts toward the edges of the incision or wound.

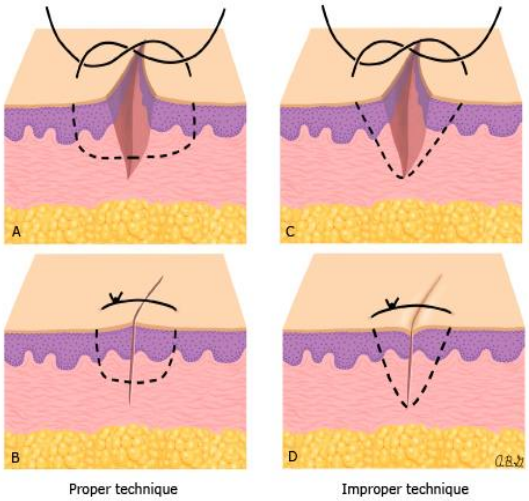
●Reverse cutting – Reverse cutting needles have a third cutting edge located on the outer convex curvature of the needle, which theoretically reduces the danger of tissue cutout. Reverse cutting needles should be used for thick skin like the palm and soles.

Suturing techniques

Percutaneous skin closure — The simple interrupted suture is used to close most uncomplicated wounds. For proper healing, the edges of the wound must be everted. This is best accomplished using the following technique:

1) The needle should penetrate the skin surface at a 90 degree angle.
2) The suture loop should be at least as wide at the base as it is at the skin surface.
3) The width and depth of the suture loop should be the same on both sides of the wound.
4) The width and depth of the suture loop should be similar to the thickness of the dermis and will therefore differ from wound to wound, according to the anatomic location.





The number of sutures needed to close a wound varies depending upon the length, shape, and location of the laceration. In general, sutures are placed just far enough from each other so that no gap appears in the wound edges.
Dermal closure — The dermal or buried suture approximates the dermis just below the dermal-epidermal junction, which minimizes skin tension and closes dead space. Removing tension from a wound allows percutaneous sutures to be tied loosely and removed sooner, thereby improving the cosmetic result.
Absorbable suture material must be used for dermal or buried sutures.

Alternative suture techniques
Running suture — A running suture is used for rapid percutaneous closure of longer wounds. It provides even distribution of tension along the length of the wound, preventing excess tightness in any one area. This technique is best reserved for wounds at low risk of infection with edges that align easily. A disadvantage to this suture is if the stitch breaks or if the physician wants to remove only a few sutures at a time.
Subcuticular running suture — The subcuticular running suture is often used by plastic surgeons to close straight lacerations on the face. An absorbable suture, such as Monocryl or Vicryl, is used.
Vertical mattress — The vertical mattress suture is recommended for wounds under tension and for those with edges that tend to invert (fall or fold into the wound). It acts as a deep and superficial closure all in one suture.
Horizontal mattress — A horizontal mattress suture can also be used to achieve wound eversion in areas of high skin tension.

Aftercare

The dressing should be left in place for 24 hours, after which time most wounds can be opened to air. Wounds closed with non-absorbable suture may be gently cleaned with mild soap and water or half-strength peroxide after 24 hours to prevent crusting over the suture knots. In contrast, absorbable sutures rapidly break down when exposed to water and should be kept dry.
We recommend that healthy patients with minor wounds, other than bite wounds, who undergo laceration repair with sutures not be prescribed prophylactic antibiotics.
Suture removal — The timing of suture removal varies with the anatomic site:
- Eyelids – Three days
- Neck – Three to four days
- Face – Five days
- Scalp – 7 to 14 days
- Trunk and upper extremities – Seven days
- Lower extremities – 8 to 10 days

Follow-up visits — Most clean wounds do not need to be seen by a physician until suture removal, unless signs of infection develop. Highly contaminated wounds should be seen for follow-up in 48 to 72 hours. It is imperative that clear discharge instructions are given to every patient regarding signs of wound infection.

Skin suturing

Skill sequence:

https://www.youtube.com/watch?v=e1jThI5wbVw

1. Check room for additional precautions. Introduce yourself to the patient.
2. Ask the patient to lie down, position him/her appropriately and explain him/her the procedure.
3. Perform hand hygiene. Put on non-sterile gloves and inspect the wound.
4. Clean incision site and irrigate the wound bed with saline solution by the help of a syringe.
5. Pour povidone iodine on a sterile gauze and thoroughly clean around wound from the center to the periphery.
6. Withdraw local anesthetic to an injector.
7. Apply local anesthesia to the edges of the wound subcutaneously.
8. Open-up sterile package and add the needed equipment (Fig a: clamp, toothed penset, scissors, needle-holder, scalpel if needed, suture and sterile gloves) on the sterile field by using non-touch method.
9. Remove non-sterile gloves and perform hand hygiene.
10. Put on sterile gloves.
11. Drape the wound with a sterile fenestrated drape.
12. Grasp needle 2/3 from tip of needle with needle holder (not fingers) (fig b).
13. Hold the small-toothed penset in the first three fingers as one would hold a pen (fig b).
14. Hold the needle-holder in the palm or by partially inserting the thumb and ring finger into the loops of the needle holder and place the index finger to maintain stability (fig c).
15. Place the first suture to enhance good approximation (in middle of wound).
16. Grasp and slightly evert the skin edge with the small toothed penset.(fig d).
17. Rotate dominant hand into pronation so that the needle pierce the skin at a 90-degree angle.
18. Penetrates dermis and epidermis 3-4 mm from wound edge.
19. The needle is driven through the full thickness of the skin by rotating the needle.
20. holder (supinating) (fig e).
21. Pull the needle through wound with needle holder whilst supporting skin with forceps.
22. Rotate dominant hand again to penetrate the other edge of the wound (fig f).
23. Pull suture filament through wound so that 3 cm tail remains on entry side.
24. Hold filament with nondominant hand, allowing needle to rest on sterile drape (preventing contamination).
25. Hold the needle holder parallel to the wound.
26. Wrap suture OVER needle holder twice times (into the “L”) (fig g).
27. Rotates needle holder 90 degrees, grasp 3 cm tail and pull it to opposite side (knot needs to lie flat.
28. Repeat process to complete SECOND and THIRD THROW33.
29. After final throw, pulls knot to one side of laceration.
30. Cut suture with scissors, leaving tails of approximately 1 cm.
31. Remove the drape.
32. Clean the wound with saline solution and povidone iodine from center to periphery.
33. Cover the wound with sterile gauze and tape.

Figure a: Equipment; penset, neddle-holder, small toothed penset, Scissors

Figure b and c: Handling of needle holder and small toothed penset

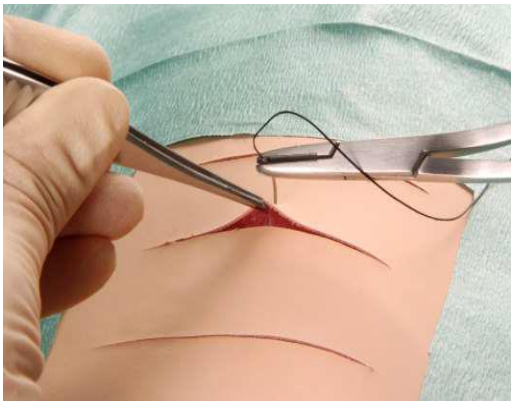


Fig d: Everting the skin.

Fig e: Penetrating the skin

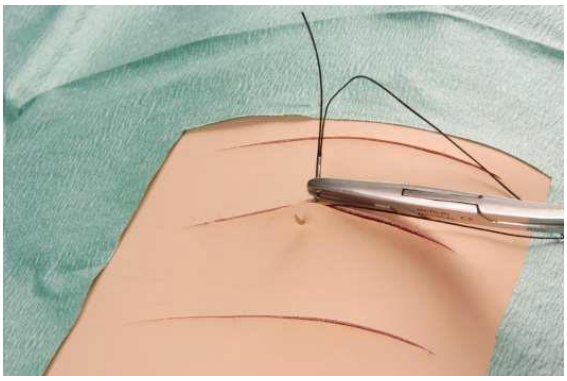


Fig f: Penetrating the other edge of the wound

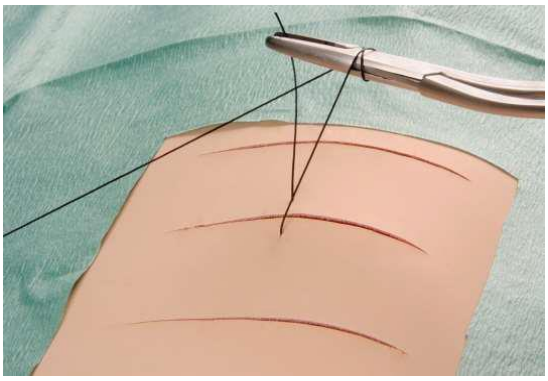


Fig g: Knotting the suture

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