MILITARY FIRST AID

I. INTRODUCTION

First aid is the immediate, temporary treatment given in case of accident or sudden illness, before the services of a medical officer can be obtained. In many cases this temporary service saves a life and in all cases, one of the primary aims of intelligent first aid is the relief of mental and physical suffering which reduces the possibility of shock and places the patient in the medical officers hands in a much better condition to receive further treatment. In the present type of warfare, in which patients must often be transported hundreds of miles before definitive treatment can be given, or in jungle warfare where the distances may not be great but evacuation may nevertheless take many hours or even days, it is especially important for technicians to apply proper first aid in order to enable wounded men to survive the arduous trips.

There are certain general principles to remember in the first aid care of an injured person.

A. Keep the patient lying down with the head level until the patient's injuries have been determined. Many injured people attempt to sit up or walk, and this may cause serious complications if the patient has a fracture, severe hemorrhage or any type of serious injury. Certain conditions call for particular positions of the patient, and these will be taken up later.

B. Examine the patient for hemorrhage, cessation of respiration and evidence of poisoning. These conditions take precedence in this order over everything else and demand immediate treatment. Another war injury requiring immediate attention is a sucking wound of the chest - this will be discussed later. Other injuries to be looked for, include wounds, burns, fractures and dislocations.

C. Remove enough clothing to get a clear idea of the extent of the injury, preferably ripping the clothing along the seams, but cutting it if necessary. Removing clothing in the usual way may do great harm, especially in fractures. Do not remove too much clothing - exposure to cold may precipitate the condition of shock.

D. Do not get excited. Act quickly but efficiently. Decide as soon as possible what has to be done and which of the patient's injuries needs attention first.

E. Keep the patient warm. This can often be done while the patient's injuries are being cared for. A blanket over the patient may do him as much good as the dressing you apply to his wounds.

F. Do not let the patient see his own injury, if possible, and re-assure him. Try to convince him that his injury is not serious and that he will recover. In some cases a cigarette will make a patient feel better, and these little things are important in determining a patient's

final outcome and preventing shock.

G. Keep bystanders away from the injured.

H. Do not touch open wounds or burns with your fingers or dirty objects. This will cause serious infections and may cost the patient his life.

I. Do not give an unconscious patient liquids. They may strangle him or else may run down into his lungs and cause pneumonia or lung abscesses.

J. Finally, do not move a patient until the full extent of his injuries has been determined. This is especially important in case of fractures. Remember that fractures should be splinted where they lie. Likewise, hemorrhage must be controlled before the patient is moved.

II. CONTUSIONS

One of the simplest types of injury you will deal with is the contusion or bruise. A common example of this injury is the ordinary "black eye". It is a subcutaneous or closed injury in which the skin is not broken. There is little danger of infection, but swelling and black and blue discoloration may occur as a result of blood leaking from the injured capillaries. Later this blood breaks down and the color changes to a greenish yellow. In some cases, where a larger blood vessel is broken the blood may collect in a pocket which may contain as much as a cupful or more. Such collections of blood within the tissues are known as hematomas.

The first aid treatment is directed at the control of subcutaneous bleeding. This is done by applying a cold or iced compress with firm even pressure, or a pressure bandage. The part should also be elevated to decrease the blood pressure within the vessels. Later when the bleeding has ceased, hot compresses will hasten the absorption of the blood. Light massage at this stage is also helpful.

III. WOUNDS

A wound is a break in the skin or in the mucous membrane lining one of the body cavities. They may be classified into four chief types.

A. Abrasions - In these the skin or mucous membrane has been rubbed off and a common example is the "mat burn" or "floor burn". These wounds do not bleed very much, but because of the large area involved, are liable to infection. They should be cleaned well with soap and water and painted with an antiseptic such as 1% gentian violet. Sulfanilamide powder can be used on these w ounds also, and a sterile dressing applied.

B. Incised Wounds - These are produced by sharp cutting instruments such as knives, razors or broken glass. They tend to bleed freely especially when arteries are cut. A blood vessel which is cut cleanly across, bleeds more freely than a vessel which is lacerated or torn. This is due to the fact that blood clots more rapidly on a rough, uneven surface. Because of the bleeding in incised wounds, most of the bacteria may be washed out of the wound, and so they are less likely to become infected.

C. Lacerated or Torn Wounds - such as produced by a shell fragment. Here the chief danger is infection, due to the fact that dirt and bacteria are often ground into the wound. Some of the tissue may be torn away from its blood supply and killed, and this dead tissue acts as a good culture media for bacteria. There may also be pockets in such wounds which are sealed off from the entrance of air, and in these pockets anaerobic bacteria, such as those of gas gangrene and tetanus, may grow.

D. Puncture Wounds - These may be caused by any penetrating instrument, such as nails, wire, bullets etc. The opening of the wound seals off and as a result anaerobic infections such as tetanus and gas gangrene are the chief dangers.

In general, war wounds differ from the majority of wounds seen in civilian life by their multiplicity, the frequent occurrence of severe shock and the serious extent of tissue disruption. The last mentioned factor, especially, predisposes to early and virulent infection. The velocity of aerial bomb particles, for example, is about 5,000 feet per second. Such a fragment may make a small wound of entrance but cause extensive tissue destruction when its kinetic energy is suddenly reduced by impinging on bone, and in the worst cases there may be a small skin wound, with effects on deeper structures resembling what might be expected from an internal explosion. In the case of bullets, the severity of the wound may depend on the distance from the firing point to the wounded individual, since at the beginning and end of the trajectory a bullet develops a wobble which increases its destructive power when it strikes. Bullets may also disintegrate within the body and the fragments produced will cause many times the damage one would expect. Another thing to remember about projectile injury is that damage may not be confined to the point of impact. For example, a bone may fracture a considerable distance from where it is hit.

IV. FIRST AID TREATMENT OF A WOUND

A. Stop hemorrhage. (This is discussed later).

B. Frost the wound with sulfanilamide powder. This powder is supplied in sterile paper shaker packages. It should not be applied too thickly because it may then delay wound healing. The former treatment of the wound by painting it with mild tincture of iodine is seldom used now because of tissue damage and blistering which it produces. If used, it should always be washed off with alcohol before bandaging.

C. Apply a sterile gauze dressing, covering the entire wound and binding the edge of the dressing down snugly so that dirt can not work into the wound.

D. Splint if there is any possibility of a fracture being present. Large flesh wounds should also be splinted whether or not fracture is present.

E. The wounded man is to take orally the sulfa drug which he carries with him. This is either 90 grains of sulfanilamide or 60 grains of sulfadiazine. The tablets are to be taken one at a time with water. They are not administered if the soldier is unconscious or if he is suffering from a penetrating abdominal wound.

F. Morphine grains 1/4 is given hypodermically for pain. If the patient has a head wound, is unconscious, or severely shocked with shallow respiration, this should be omitted.

G. Treat the patient for shock. This will be described in detail in a later section.

H. Evacuate as soon as possible. The wounded soldier must be in the hands of a surgeon within 6 to 8 hours if severe infection is to be prevented.

V. DEBRIDEMENT

The first 6 to 8 hours after a wound is inflicted, has been considered the period of contamination, although some men consider it as short as one hour. During this stage, bacteria are in the wound but have not invaded the tissues to cause infection. It is believed that by the use of sulfa drugs, this period can be lengthened to between 12 and 24 hours. The aim of the first aid man is to get his patient to a surgeon before this "golden period" elapses, for during this period, the surgeon can clean out the w ound by the operation known as debridement, and prevent infection. Once infection occurs in a wound, this operation can not be done. In a debridement (usually performed in evacuation hospitals or by mobile surgical units) the following things are done:

A. Dead tissue is excised, the wound usually being opened by incision.

B. Foreign bodies such as shell fragments or bullets, dirt, stones, shreds of clothing etc. are removed.
C. Dead space or blind pockets in the wound are obliterated.
D. Loose bone fragments are removed.
E. The wound is irrigated with saline.
F. Sulfa drug is placed in the wound and in most cases the wound is packed open with sterile vaseline gauze.
G. If the wound is of a limb, a plaster cast is then applied with padding over bony prominences.

Precautions against tetanus and gas gangrene are taken at the earliest opportunity. This consists of a "booster shot" of 1cc. of tetanus toxoid and 10-15 thousand units of gas gangrene antitoxin.

VI. HEMORRHAGE

Hemorrhage is one of the most serious complications of wounds and is responsible for most of the deaths on the battlefield. The most serious is arterial hemorrhage - bleeding from the pulmonary artery or aorta for example may cause death in 15 to 30 seconds.

A. Arterial Hemorrhage - In this type of bleeding, the blood is bright red in color and spurts with each beat of the heart. If nothing is done for this type of bleeding, the hemorrhage may still stop as a result of the fall in blood pressure due to loss of blood and shock, and the formation of a clot over the opening in the vessel. Often the artery itself will contract and so limit the loss of blood. Should the patient recover from shock, receive a stimulant, or move about, the blood pressure may rise and the clot may be dislodged with recurrence of bleeding known as intermediate hemorrhage as contrasted with primary hemorrhage which occurs immediately on receipt of the wound.

A third type of arterial hemorrhage is the secondary type which may occur a day or more later due to slipping of a ligature, or extension of wound infection into the arterial wall.

In the control of arterial hemorrhage, there are several means available. These are:
a. Pressure points.
b. Pressure bandage.
c. Tourniquet.
d. Hemostat and ligature.
Arterial pressure points are points where large arteries

can be compressed against a bone. The main pressure points are the following:

1. Temporal - located just in front of the ear. Pressure here controls arterial bleeding above the eye and the scalp.
2. Facial - located about one inch in front of the angle of the lower jaw. Pressure here controls arterial bleeding in the face below the level of the eye.
3. Carotid - the fingers are placed against the side of the larynx, the thumb behind the neck and pressure exerted between them. This controls hemorrhage from the branches of the carotid artery, such as those in the floor of the mouth and throat.
4. Subclavian - pressure is exerted behind the inner third of the collar bone down against the first rib. This controls hemorrhage from the extreme upper part of the arm, the arm pit or shoulder.
5. Brachial - pressure is applied along the inner side of the arm about half-way between the shoulder and elbow. This is used for arterial hemorrhage in the hand, forearm, and arm.
6. Femoral - apply pressure just below the middle of the groin with the heel of the hand. This is used for hemorrhage from the thigh, leg or foot.
7. Popliteal - located behind the knee. This pressure point is not as satisfactory as the others but can be used in hemorrhage from the leg or foot.

The pressure points listed above will control most severe arterial hemorrhages except those in the chest and abdomen. However, since the medical department soldier will probably have other men to treat, he must devise some other method of controlling the hemorrhage more permanently. This is done either with a pressure bandage or a tourniquet. The pressure bandage is preferred if it is effective. It consists simply of a thick gauze pack, thick enough to fill the wound cavity and still protect above the surface of the wound, so that a tight circular bandage around the extremity will exert strong pressure at the base of the wound where the bleeding artery is located. This is always worth trying before a tourniquet is applied since a tourniquet is a dangerous instrument and requires more attention.

A tourniquet is a constricting band and there are various types. The principle of all tourniquets is a pad over the artery to bring the pressure on the artery and take it off the veins, a band around the limb and over the pad, and some means of tightening the band. The common improvised tourniquet is the so-called Spanish windlass, in which any smooth, hard object such as a padded stone or a roller

bandage is used as a compress; for the band, a handkerchief a waist belt or a bandage may be used. To tighten the band, a stick, bayonet or scabbard is passed under the band and twisted until bleeding ceases, and the ends tied to the limb to prevent the band from becoming untwisted. Applying a tourniquet may be a dangerous procedure and should not be used if bleeding can be stopped by any other means. The dangers of a tourniquet are that if applied tightly enough to control arterial hemorrhage it will cause pain and swelling of the limb and if left on long enough, may cause gangrene or death of the part below the constricting band. It should therefore, be watched and released at about half hour intervals. The tourniquet itself should be at least an inch wide. If on loosening the tourniquet, bleeding starts again, tighten it. Never cover a tourniquet with a bandage or a splint as it may be forgotten. When the bleeding stops and not until then, should stimulants be given. The best places to apply tourniquets are:

a. Around the upper arm about a hands broadth below the armpit.

b. Around the thigh about the same distance below the groin.

B. Venous Hemorrhage - The bleeding here comes in a steady stream and is dark in color. Because of the low pressure in the veins it is easier to control. The part should be elevated and a pressure bandage applied. Tight clothing constricting the flow of blood from the part to the heart should be removed or loosened. In laceration of veins in the neck, often there is enough suction produced by negative pressure in the chest, to suck air into the veins. This may cause death in a short time unless compression is promptly applied.

C. Capillary Hemorrhage - In this type of bleeding there is steady oozing of red blood from the wounded surface. This bleeding usually stops by formation of clot within a few minutes. It can be aided by application of a gauze dressing, the rough surface of the gauze speeding up the formation of a clot.

D. Special Types of Hemorrhage -

1. Nosebleed or epistaxis - this is usually a form of capillary hemorrhage and the bleeding in most cases comes from a small area on the upper, anterior portion of the nasal septum. The patient should sit up and cold applications placed on the back of the neck and over the root of the nose. A cold compress between the upper lip and gum is also helpful. Constricting clothing around the neck should be loosened. If this does not check the bleeding, a small gauze compress placed inside the nose and held against the bleeding area by pressure on the outside of the nose should be tried. If none of these measures are successful, a medical officer will have to cauterize the bleeding vessel or pack the nose.

2. Bleeding from tooth-socket, following an extraction may be excessive. Fill the tooth socket with a small gauze pack and have the patient bite down on a gauze compress, or bandage the jaws together for 20 minutes.
3. Bleeding from the lips - grasp lips between thumb and fingers on each side of the wound, as the arteries to the lips come from both sides.
4. Bleeding from the scalp is often excessive even though only capillary in type. Apply pressure over the wound with a compress, and bandage.
5. Bleeding from the lungs - the blood coughed up is bright red and frothy. Keep the patient perfectly quiet in a semi-recumbent position and apply ice bags to the chest. In some cases morphine is indicated.
6. Bleeding from the Stomach - blood that has been in the stomach for some time takes on the appearance of coffee grounds. Remember that blood in the vomitus might originally have come from a nose bleed and been swallowed. Keep the patient quiet and apply an ice bag. Morphine is often indicated to quiet the patient.
7. Blood in the stools. Blood which comes from the stomach and small intestine is usually black and tarry in color. Blood from the upper part of the large intestine is dark red in color and mixed with the stool. In hemorrhoids or piles, the blood is usually bright red and streaked over the surface of the stool. The treatment is the same as given for hemorrhage of the stomach.

In severe bleeding, patients usually become very restless and apprehensive, become very thirsty, and soon develop air hunger and extreme pallor. If the hemorrhage is not stopped, circulatory failure and shock occur and the patient may soon die. In cases of internal bleeding, these symptoms are very important in making the diagnosis.

VIII. SHOCK

A. Definition - Shock is a profound depression of all physical and mental processes due to decrease in the circulating plasma and usually resulting from injury or severe bleeding. There are two types of shock, the neurogenic type and the circulatory type. In the neurogenic type, the symptoms are milder, and this type usually responds to simple remedies such as heat, shock position, stimulants, or morphine for the relief of pain. The type we are especially interested in is the circulatory type, since this is very often fatal unless it is promptly treated. Shock is especially important as a cause of death in burns and fractures. Chest and

abdominal wounds likewise are often complicated by shock, and any other injury is apt to produce this condition. Profuse bleeding and exposure to cold always add to the seriousness of shock. Certain individuals seem to be predisposed to shock, even from slight injuries.

B. Mechanism of Shock - the exact mode of onset of shock is not completely understood. One theory contends that as a result of the injury, there is an "insult" to the nervous system. As a result, the nerves lose their control over the blood vessels, and the blood vessels in the abdomen and the muscles all over the body dilate. This results in a stagnation of a large volume of blood in these regions and a fall in the blood pressure. This blood that is pooled in the abdomen and muscles moves sluggishly and does not return to the heart in sufficient amounts and as a result the heart beats faster and the pulse is weak. Because of the poor circulation, the blood does not carry a sufficient supply of oxygen to the tissues and as a result the capillary blood vessels are damaged. This causes them to leak; the fluid part of the blood, or plasma, oozes out of these capillaries, while the red blood cells remain behind and consequently the blood becomes thicker, the hematocrit (that is, the percentage of the blood that consists of red corpuscles) increases. This further slows up the circulation, and thus the anoxia increases. Thus a vicious cycle is set up and unless proper treatment is given to break this cycle, the patient will succumb. The two organs first affected by shock are the brain and heart which under ordinary conditions require a large amount of oxygen.

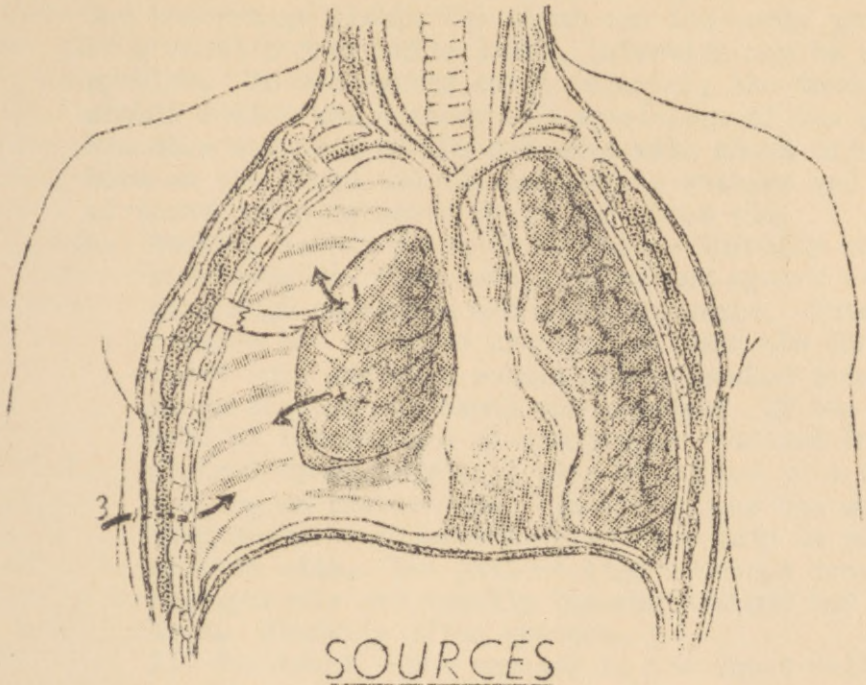
C. Symptoms of Shock -

1. Patient lies in a drowsy condition with limbs limp, but generally is not totally unconscious.
2. The face is pale and cold. The lips, finger nails and ears may have a bluish tinge.
3. The eyes are glassy, pupils may be dilated.
4. Cold perspiration of forehead and palms is present.
5. Pulse is rapid and weak. Respirations are shallow and sighing.
6. A chill may develop.
7. Nausea and vomiting may be seen.
8. The veins of the skin are collapsed and when emptied, fill slowly.
9. The sensibility of a patient in shock is lowered and pain is not felt as acutely as in a normal condition. He may not complain although he is severely injured.

D. Treatment of Shock -

1. Heat - the patient should be kept comfortably warm. This can be done by the use of blankets, hot water bottles, chemical hot water bottles, laterns placed under a litter and other means. Remember, the skin of a patient in shock burns easily, and any hot applications used should be well padded. Excess heat is harmful. The best index of the amount of heat to apply is the patients own comfort. The rectal temperature may also be checked.
2. Position - the shock or Trendelenberg position is one in which the body is tilted so that the head is 18 inches below the level of the feet. This increases blood flow to the vital organs.
3. Stimulants - the usual first aid stimulant is aromatic spirits of ammonia, about one teaspoon in a half glass of water. Coffee and tea contain caffeine and are of value. In hospitals, hypodermic stimulants such as caffeine sodiobenzoate, coramine or adrenalin are used.
4. Morphine - this should be given for the relief of pain. In severe shock, where the patient is unconscious, and breathing poorly it is best not to administer it.
5. Oxygen - by face mask or nasal tube is an excellent aid in the treatment of shock. It combats the anoxia which is one of the main factors in shock.
6. Plasma - this is probably the most effective of the remedies for shock. It restores the blood volume, dilutes the thickened blood and raises the blood pressure. Plasma is probably chiefly responsible for the low mortality rate that we now see in battle casualties. It is used extensively as a preventive of shock, and makes possible earlier and safer operations on wounded soldiers.
7. Saline, glucose or blood intravenously are also used but their effect is not as prolonged as that of plasma. These solutions quickly leak out of the damaged capillaries and may be completely lost from the blood stream within an hour.

PNEUMOTHORAX
CAUSES AND EFFECTS

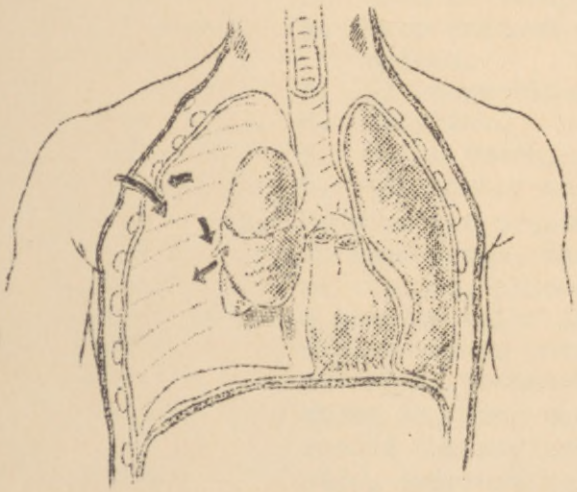


SOURCES

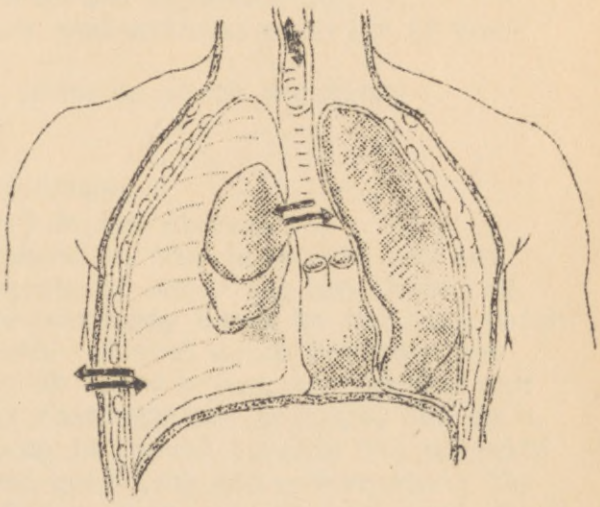
1 LUNG PUNCTURE BY RIB FRAGMENT

2 TEAR OF ADHESIONS (SPONTANEOUS PNEUMOTHORAX)

3 PENETRATING WOUND (CHEST WALL AND OR LUNG)



VALVULAR OR TENSION PNEUMOTHORAX



OPEN OR SUCKING PNEUMOTHORAX

VIII. WAR INJURIES OF THE CHEST.

Injuries of the chest take precedence in first aid treatment over any other injury except hemorrhage elsewhere in the body. Mechanical derangement of the thoracic organs and hemorrhage within the chest are the early consequences of a chest injury while later, infection may be a serious problem. To understand chest injuries, the technician should review the anatomy and physiology of the chest. Remember that 25% of the patients with chest injuries die between the field and the collecting station and many of these could be saved by proper first aid.

A. Sucking wound of the Chest Wall - Normally on respiration, the ribs move outward and upward and the diaphragm contracts and moves downward. This increases the negative pressure between the lungs and chest wall and as a result air is sucked into the lungs through the mouth and trachea. If the chest wall is injured and an opening is produced into the pleural space, air will also be sucked into this opening on inspiration. This produces the condition known as pneumothorax and the lung is collapsed on that side. The patient then develops dyspnoea and cyanosis and usually becomes anxious and restless. Shock is often present.

   1. Treatment - The opening in the chest wall should be plugged immediately. Sulfanilamide powder and a gauze pack is covered with an airtight material such as a piece of rubber raincoat, sealed with adhesive tape, or simply by adhesive tape if nothing else is available. The entire chest wall should then be strapped on the injured side.
   2. Prop patient in a semi-sitting position if conscious.
   3. If unconscious, place in shock position.
   4. Morphine.
   5. Treat Shock.
   6. Administer sulfa drugs.

B. Tension (or pressure) Pneumo thorax.
In some cases, the wound in the chest wall may act as a valve, allowing air to enter but not leave. Or a similar valve like wound may occur in the lung which allows air to enter the pleural space but does not permit it to leave. In these cases, air accumulates about the lung under considerable pressure, and as a result the mediastinum is forced towards the opposite side, compressing the good lung and embarrassing the the heart action. Severe dyspnoea, cyanosis and shock result.

Treatment: as for sucking wound. In addition a needle must be inserted into the pleural space to let out the air, and left in place anchored by adhesive tape. The 2nd or 3rd interspace, lateral to mid-clavicular line is best.

C. "Stove - in chest" - This injury consists of multiple rib fractures, often on two planes, anteriorly and laterally, or anteriorly and posteriorly, usually limited to one side of the chest. The crushed side, because of its loss of rib support, cannot enlarge with inspiration and in fact is sucked in with inspiration. As a result the unoxygenated air in the lung of the injured side is sucked into the functioning lung. The reverse occurs in expiration. This produces marked dyspnoea and cyanosis, and the severe pain on breathing also lessens the depth of respiration and lessens the oxygen supply.

Treatment:

1. Morphine.
2. Strap chest with a completely encircling wide adhesive bandage at the level of the costal margin, or if this is not effective, a tight adhesive band applied in expiration around the injured side of the chest, extending 3 inches beyond the midline anteriorly and posteriorly.
3. Sulfa drugs by mouth to prevent pneumonia.
4. Aspirate secretions in the trachea.
5. Treat Shock.
6. Semi-sitting position, or patient lying on injured side.

D. Hemothorax - Because of the large number of vessels within the chest, considerable bleeding may occur internally in chest wounds. A collection of blood in the chest cavity is known as hemothorax. In some cases, after a considerable amount of blood collects, it compresses the bleeding vessel and the hemorrhage stops. The symptoms are those of severe hemorrhage, shock and some respiratory distress.

Treatment: Morphine, absolute rest, external heat. Aspiration of blood is usually done when the patient reaches a hospital. The blood stays liquid for four days and the chest is not aspirated before that time unless cardiac or respiratory distress makes it necessary. Early evacuation of these patients is essential.

E. Traumatic asphyxia - Crushing injuries of the chest wall causes collapse of the veins within the chest and blood is forced back from the right side of the heart into the veins of the neck and face. The head and neck show a deep violet-blue discoloration, with swelling of eye

lids, and lips and small hemorrhages in the skin and conjunctivae. The skin is dry and hot. Respirations are stertorous. Pulse is strong. Temporary or permanent blindness may result.
Treatment: Morphine, absolute rest, head and shoulders elevated, oxygen.

F. Blast Injury - This injury occurs in persons who are in the vicinity of an exploding bomb. This injury may occur 100 feet or more from the bomb, and is not due to bomb fragments but is caused by the wave of positive air pressure, followed by a wave of low pressure, which strike the chest wall. Heavy clothing or a partition such as a wall often protect from this injury. Patients may show no external evidence of injury other than bloody froth at the mouth and nostrils. Shallow respiration, prostration and grave shock are also seen. The injury to the lungs consists of scattered hemorrhages throughout the lung tissue. (Similar injuries may be produced in water by explosion of bombs or mines nearby. In water, the injuries may be produced at greater distances and are more liable to involve abdominal organs). Rupture of the eardrums is commonly associated.
Treatment: Morphine, semi-sitting position, oxygen. No intravenous fluids except concentrated blood serum.

G. Emphysema - Following chest injuries, bronchial communications may exist between torn lung and subcutaneous tissues or mediastinum. The most serious type is mediastinal emphysema. Air may collect here under pressure and cause dyspneoa, inability to swallow, cyanosis, cardiac compression and blockage of the veins. The air eventually appears in the neck and the contaminating bacteria in this air may cause serious infection.
Treatment: If symptoms are severe, surgical incision in the neck to release air, or surgical repair of the torn lung.

H. Cardiac Tamponade - Injury to surface of the heart of pericardium may cause blood to collect around the heart under pressure and compress the heart.
Symptoms: Cyanosis, weak pulse, falling systolic and rising diastolic blood pressure, and engorged veins in the neck, shock.
Treatment: Immediate aspiration of blood from pericardial sac.

IX. ABDOMINAL INJURIES

Abdominal wounds are among the most serious seen in wartime. These may be caused by bullets, shrapnel, bayonets or knives, and a great variety of other objects. There are two chief types of abdominal wounds; those that penetrate only the abdominal wall and do not injure internal organs or large blood vessels, and those that enter the peritoneal cavity and may in addition injure vital organs and large vessels. The first type is not as serious as the second, and the treatment is as outlined under the first aid treatment of wounds. The second type is often fatal and requires special care. These patients almost always require surgical operation to repair the internal damage, and one of the chief factors that determines the eventual outcome is the length of time that elapses before surgical operation is done. Of the patients who do not die immediately after the injury, it is estimated that 95% or more will survive if operated on in one hour, whereas if operation is delayed 10 hours or longer, less than 60 % will recover. The mortality increases as this period is lengthened, and the chief factor causing death is peritonitis. The value of mobile surgical units which can reach these men within a short time after injury is quite evident.

The chief complications in abdominal wounds are:

A. Hemorrhage which is difficult to control except by operation.

B. Shock which is very severe and difficult to control especially if hemorrhage is present.

C. Peritonitis - which occurs later and is the cause of death in most of the patients who survive the period immediately after the injury. Infection of the peritoneum can occur from bacterial contamination introduced by the bullet, shrapnel or bayonet from outside the body. The bullet or shrapnel itself may be sterile because of the intense heat produced when firing occurs, but may carry contaminated shreds of clothing or other foreign material into the wound. Infection may also result from perforation of one of the hollow organs within the abdominal cavity, such as the stomach, large or small intestine, gall bladder or bile ducts, the contents of which are hardly ever sterile. The large intestine in particular is always loaded with bacteria. Lacerations of the bladder or urinary passages may cause extravasation of urine which is irritating and causes inflamation and may become secondarily infected. It is obvious that a soldier who empties his large intestine and his bladder, and who eats only a small meal before going into combat, decreases the size of his stomach, large intestine and bladder and so lessens the possibility of an injury

to these three organs. The small intestine and liver however, cannot be protected in this way and wounds of these organs are very common. The liver when injured, bleeds freely and produces severe shock.

First Aid Treatment of Abdominal Wounds -

1. Treat for shock.
2. Keep patient quiet as possible.
3. Morphine grs. 1/4 for pain and restlessness.
4. Absolutely nothing by mouth, not even sulfa drugs. This rule is laid down for two reasons. First, anything given by mouth may leak into the peritoneal cavity through lacerations of hollow organs, and so spread infection. Second, since these patients will require an anesthetic for surgical operations within a short time, it is better to keep the stomach empty.
5. If any abdominal organ protrudes, cover it with a warm, wet cloth; preferably sterile saline solution on a sterile gauze pad and keep it moist. Sulfanilamide powder should be frosted over the protruding organ.
6. An ice bag to the abdomen may help arrest internal hemorrhage.
7. Evacuate as soon as possible. If possible, plasma should be given early.

X. BURNS

At Pearl Harbor, about one half of the casualties seen were suffering from burns. The technician will see or hear about a great number of methods of treating burns, all of which have their merits and their disadvantages. Various local applications such as tannic acid, gentian violet, triple dye, sulfadiazine spray, tannic or gentian violet ointments, and others have enjoyed popularity. Much emphasis has been placed, in the past, on the local application used, but it is now realized that the general treatment of the patient, particularly the treatment of shock, is of the greater importance, while local treatment should be aimed at the prevention of infection; and mild applications which do not harm the regenerating skin, should be used.

A. Classification of Burns.
   1. First Degree - Skin is reddened. Simple sunburn is a good example.
   2. Second Degree - Skin is blistered.
   3. Third Degree - Destruction of tissue occurs.

B. Complications of severe Burns.
   1. Shock - This is responsible for 60% of all deaths from burns and consequently first aid treatment must be primarily directed at this complication.

2. Infection - This accounts for most of the remaining deaths. A large proportion of burns are sterile or nearly sterile when they occur. Infection in most cases is due to improper handling of these cases, much of it due to contamination from the nose and throat of attendants.
3. Toxemia.
4. Anuria.
5. Duodenal ulcer.
6. Hepatitis and Jaundice.
7. Scarring and contractures - this can be minimized by proper treatment.
8. Tetanus and gas gangrene.

C. First Aid Treatment.

1. Treatment of Shock. This should be treated promptly. The important measures have already been discussed under shock. In burns there may be loss of considerable serum through the injured skin or into the damaged tissue, resulting in a concentration of the blood , for this reason, intravenous plasma is of the greatest importance and often as much as 12 units (3600 cc) may be required in the first 24 hours. Patient with 10% of his body burned needs about 1000 cc of plasma, with 20% burned, he needs 2000 cc. Another method used for estimating plasma need is based on the hematocrit. The hematocrit is a simple estimation of the percent of the blood which consists of red cells. The normal is 45%. In general, a patient should receive 100 cc of plasma for each point the hematocrit is above normal. Concentrated human serum albumin is often used in place of plasma. Whole blood may be required in patients who develop anemia. 5% glucose in sterile distilled water is recommended and saline solution is given in cases where minerals are lost through the skin or by vomiting.
2. Local First Aid Treatment.
   a. Cover the burned surface with boric acid ointment, sterile vaseline or 5% sulfadiazine ointment.
   b. Cover this with strips of 44 mesh gauze.
   c. Over this place a smooth thick layer of sterile gauze dressing or similar sterile padding. (sterile mechanics waste can be used.)
   e. Firmly apply a gauze or muslin bandage.

Care should be taken that the burned surface is not contaminated by the hands of the first aid man, or by the breath. If possible a mask or handkerchief should be worn over the nose and mouth, or at least, the mouth

should be kept closed. If the patient can be taken to a hospital or dressing station promptly, it is sufficient to cover the burned surface with sterile dressings or triangular bandages and confine your efforts to the treatment of shock.

3. Relief of Pain -
Burns are the most painful type of injury a person can sustain. For this reason morphine should be given in adequate dosage, and an initial dose of 1/2 grain is recommended. In the presence of pronounced anoxia, large doses are dangerous, and in such a case 1/4 grain is sufficient. Where the respirations are fourteen and above, morphine may safely be given in most cases.

4. Prophylaxis Against Infection.
   a. Sulfadiazine is the drug of choice with an initial dose of 60 grains. Sulfanilamide can be used in a dose of 90 grains. Subsequent doses are given under the direction of a medical officer, since the kidneys may be damaged in these cases by sulfa drugs.
   b. Tetanus toxoid 1 cc in all patients with 2nd or 3rd degree burns.
   c. Gas bacillus antitoxin may be given.

The treatment outlined above applies to all burns whether due to heat, chemicals or electricity. In chemical burns, the chemical should of course be neutralized or removed from the skin before the above treatment is applied. In chemical burns the first attempt should be to dilute the chemical with copious amounts of water, and then a weak neutralizing agent. Minor first degree burns may require simply local application of boric ointment, vaseline, baking soda paste, butysin picrate ointment or numerous other similar remedies.

XI. HEAT STROKE, HEAT EXHAUSTION AND HEAT CRAMPS

Troops exposed to temperatures of 90° F or over are subject to these conditions. Heat stroke is a condition in which the temperature regulating mechanism of the body fails and the body temperature rises to high levels. In heat exhaustion the condition is similar to shock and is due to loss of salt because of excessive perspiration. Combinations of the two conditions may be seen. Heat cramps are also due to salt loss. Troops brought to a hot climate should be given a 4 - 7 day period for acclimatization with gradually increasing amounts of work and limited exposure during the mid-day hours. Such a schedule of work would be as follows:
When maximum air temperature is 105° F or over.

First Day	0700 - 0900 and 1500 - 1600
Second Day	0700 - 1000 and 1500 - 1600
Third Day	0700 - 1000 and 1400 - 1600
Fourth Day	0700 - 1000 and 1330 - 1630
Fifth Day	0700 - 1100 and 1330 - 1630
Sixth Day	Regular Duty.

The working period should consist of alternating one half hour periods of work and rest. The work should be the equivalent of marching with a 20 lb. pack 2.5 miles per hour.

For one week before and after entry into a hot climate, troops should be given adequate rest and alcohol should be prohibited. Restriction of water intake in a hot climate is not good policy, and the requirement per man will range from 2 quarts per 24 hours when working at night in the cold season to 2 1/2 to 3 gallons per 24 hours when working by day in the hot season.

Salt intake should be increased when working in hot climates. This is best done by taking extra salt on food, or adding salt to drinking water to make a 1% solution as follows:

a. 1 lb. salt to 100 gals. water.
b. 0.3 lb. salt to a Lyster bag.
c. 1/4 Teaspoonful to a canteen of water.
d. Two 10 grain salt tablets in one quart of water.

1. Heat Stroke or Sun Stroke.

   A. Symptoms.

      This condition often appears with dramatic suddenness, characterized by collapse, delirium, unconsciousness or coma.

      Certain symptoms and physical findings are characteristic.

      (1) Diminished sweating.
      (2) Headache.
      (3) Dizziness.
      (4) Irritibility.
      (5) Visual disturbances such as dim or purplish vision.
      (6) Nausea and vomiting.
      (7) Dryness of skin, which is very hot, face is flushed.
      (8) Elevated body temperature (106° to 110° F rectally).
      (9) Rapid pulse (160 - 180).
      (10) Increased depth of respiration.

   B. Treatment -

      The single, most important objective in treatment is the lowering of the body temperature and this must be initiated immediately and continued during the transfer of the patient to a hospital.

      (1) Remove all the patients clothes except for shorts and sprinkle the entire body with cool or tepid water. Ice water should not be used.

      A hand spray such as a Flit gun is good for this purpose, since with a fine spray the

water evaporates more rapidly and produces a better cooling effect. The patient should be placed in the shade during treatment.

(2) Fan the patient. During transportation, the door of the ambulance should be left open so that the current of air passing over the patient's body evaporates the water. Electric fans are best.

(3) Briskly rub the arms, legs and trunk to increase circulation to the skin. An ice bag can be applied to the head.

(4) The rectal temperature should be checked every ten minutes. When it reaches 102° F, the cooling treatment should be stopped since often the temperature will continue to fall and may reach dangerously low levels. If the rectal temperature should fall below 94° F, the patient should be cautiously warmed until the temperature is normal.

(5) Saline solution should be given intravenously or subcutaneously. When the patient is able to drink, .1% salt solution should be given freely by mouth.

(6) If cyanosis is present, oxygen should be given by face mask. In some cases, artificial respiration may be necessary.

(7) Stimulants are not given. If sedatives are necessary, barbiturates can be given. These are also given in case of conculsions.

(8) Patients who survive to the second day usually recover, though a rectal temperature of 102° to 103° F may persist for several days, along with such symtoms as mental disturbance, excitement and delusions. Headache may last for several weeks. Relapses can occur during the first few days, so the patient must be carefully watched and his temperature frequently checked.

(9) One attack of heat stroke predisposes the individual to a second attack, so the patient should be careful about further exposure to excess heat.

B. Heat Exhaustion - Symptoms -

a. Headache.
b. Loss of appetite.
c. Drowziness.
d. Extreme weakness.
e. Visual disturbances.
f. Dizziness.
g. Inability to walk.
h. Cramps of limb and abdominal muscles.
i. Faintness or unconsciousness.

2. Physical findings:
   a. Skin is cold and clammy. Profuse perspiration.
   b. Pupils dilated.
   c. Face is pale.
   d. Rectal temperature is normal or slightly elevated, 99 - 101°F.
   e. Blood pressure is lowered. Pulse is weak and rapid.
3. Treatment -.
   The most important thing in treatment is administration of salt.
   a. Remove the patient to a cool place where he may rest and receive large quantities of salt solution.
   b. .1% Saline solution (made up as described earlier) by mouth.
   c. If the collapse is severe, physiological saline solution should be given intravenously.
   d. In some cases, the temperature may be subnormal, and external heat may be necessary.
   e. Stimulants can be given.
   f. Keep the patient lying down with head level or low until he recovers.

C. Heat Cramps

This condition is due to a deficit of salt in the body, and consists of painful spasms of the voluntary muscles in the extremities and abdominal wall. They may be excruciating and completely disabling. The treatment consists of administration of physiological saline solution intravenously and .1% salt solution by mouth.

XII. FROST BITE AND IMMERSION FOOT

A. FROST BITE

This occurs most commonly at temperatures below -10°C (14°F) especially when a strong wind is blowing.

1. Symptoms -
   a. Skin assumes a dull, yellowish pallor.
   b. Numbness or a prickling sensation associated with formation of ice crystals in the tissues.
   c. If deeper tissues are not also frozen, there is a sensation of a moveable plaque or coin buried in the skin. With deep freezing the tissues are solid and immovable.
   d. Edema and hemorrhage may occur in severe cases when the part is thawed. Often the skin on thawing resembles a severe burn.
   e. Prolonged exposure to cold causes the individual to become numb and drowsy, his eyesight fails and he becomes unconscious. Respiration may cease.

2. Treatment

a. If frost-bitten part is on face, ears or trunk, cover with the warm ungloved hand. If a hand is involved, insert it within the shirt, up against the body. If a foot is involved, remove the shoe and sock and place it within the shirt and against the body of another man.

b. Warmth greater than body temperature should never be applied.

c. Massage, if used, should be very gentle and no coarse material used. Rubbing with snow is harmful. Massage should not be directly over the frost-bitten area, but should be a stroking of the extremity toward the body. Paint the part with 1:5000 merthiolate or 1:1000 acriflavine, wrap in sterile dressings, cover warmly and put at complete rest.

d. Warm drinks, food and clothing. Artificial respiration. Stimulants and oxygen may be necessary in case of prolonged exposure to cold. In these cases also, rapid warming of the whole body should be avoided.

B. Immersion Foot -

This condition is seen in men afloat in life boats for long periods of time with their feet immersed in cold sea water. A similar condition known as "Trench foot" was seen in the last war.

1. Symptoms -

a. Feet are cold, waxy white and swollen, with cyanotic areas.

b. Feet are insensitive to touch or pain and feel woody.

c. Feet became red, swollen, painful, blistered or gangrenous if suddenly warmed.

2. Treatment -

a. Prophylactic - boots or constricting clothing should be removed. Oil or grease should be thickly applied. Don't allow the patient to walk. No massage.

b. Treatment of the case. Swab foot with alcohol, leave pledgets of alcohol between toes, apply ice bags. Elevate the feet on pillows about 8 - 12 inches. No massage. General supportive treatment.

c. A pressure bandage is sometimes used.

XIII. DOG BITE AND SNAKE BITE

A. Dog Bite -

Dog bite is dangerous chiefly because of the possibility of rabies or hydrophobia, a serious, fatal disease which is caused by a filterable virus. In any case of dog bite, the first thing to do is catch the dog, preferably alive. If the dog is killed, his head should be kept

for microscopic examination. If alive, the dog should be observed for 10 days, in which time he will develop symptoms if rabid. If the dog is found to be rabid, the patient must receive the Pasteur treatment, otherwise he will develop rabies in 20-60 days. The bite should be treated as follows:

1. Treatment -
   a. Wash the wound thoroughly with soap and water.
   b. Cauterize the wound either with fuming nitric acid followed by immediate application of baking soda, or carbolic acid, cleaned off immediately with 95% alcohol.
   c. Apply sulfanilamide powder and a sterile dressing.

B. Snake Bite -

The poisonous snakes of the United States are the coral snake and the pit vipers (including rattlesnakes, copper-heads and cotton-mouth moccasins). The coral snake is small and slender and has black and red bands divided by narrow yellow bands, encircling the body. The pit vipers have stout bodies, thin necks and flat triangular heads. There is a blind pit between the eye and nostril on each side of the head. The grooved or hollow fangs fold back against the roof of the mouth, and are elevated when the snake strikes.

Snake venom contains two types of toxin.

a. Neurotoxin - causes paralysis, shock, respiratory failure.
b. Hemolysin - breaks down red blood cells and injures blood vessel walls.

Some snakes have more of one type of venom than the other. For example, the coral snake venom is largely neurotoxic while rattle-snake venom is chiefly hemolysin.

1. Symptoms of poisonous snake bite.
   a. Pain is severe.
   b. Swelling.
   c. Shock and weakness.
   d. Paralysis and respiratory failure. Bloody urine (hemoglobin in urine).
   e. Death may occur during the first 24-36 hours.
   f. Tetanus may follow.
2. First Aid Treatment -
   a. Apply tourniquet above the site of the bite. It should be tight enough to obstruct veins and lymphatics but not the arteries. Release it for 5 or 10 seconds every 15 minutes.
   b. Have patient lie down.
   c. Sterilize knife or razor blade in a flame. Sterilize the skin with iodine and make cross incisions 1/2 x 1/2 inch or longer at each fang mark, through the skin and into subcutaneous tissues (1/8 x 1/4 inch deep.

b. Have patient lie down.
c. Sterilize knife or razor blade in a flame. Sterilize the skin with iodine and make cross incisions 1/2 x 1/2 inch or longer at each fang mark, through the skin and into subcutaneous tissues (1/8 x 1/4 inch deep.)
d. Apply suction over these wounds with suction cup, mouth, or bottle in which suction is obtained by burning a small piece of paper inside.
e. Give shock treatment - No alcohol.
f. No morphine - Barbiturates can be given.
g. Strychnine 1/10 grain is sometimes used for respiratory failure.
h. 5 % glucose or transfusions may be necessary.
i. Make additional cross-incisions and apply suction if swelling spreads.
j. When not applying suction over the wounds, potassium permanganate or epsom salts compresses should be applied.
k. Tetanus precautions - Antivenoms are available against certain types of snake.

C. Black Widow Spider Bite -
These are quite poisonous and can be recognized by the crimson hourglass marking on the under side of the abdomen. The bite causes severe pain and violent muscle cramps, especially of the abdomen, with fever and sweating.

1. Treatment -
a. Tourniquet and incision as for snake bite.
b. Keep patient quiet and warm. Hot baths.
c. Morphine gr. 1/4 to gr. 1/2.
d. Calcium gluconate intravenously. 10 cc of a 10% solution.

D. Tarantula Bite -
Not very poisonous but infection may occur in the bite.
Sulfanilamide powder may be of help. If infection occurs, hot compresses are used.

E. Tick Bite -
Ticks often are carriers of serious diseases and in removing ticks, it is important not to crush them or leave the head in the skin. Apply a few drops of chloroform or ether and gently withdraw it. A lighted cigarrette or hot pin held near the tick will often cause it to loosen its hold on the skin.

F. Bee, Wasp or Hornet Bites -
Press out the sting and apply a compress of dilute ammonia water or baking soda paste.

XIV. PLASMA

The use of plasma has revolutionized the treatment of shock, hemorrhage, and burns. The saving of life in this war through the use of plasma can hardly be estimated and its value is so great that the Army and Navy has accumulated large stores of this material. In simple terms, plasma is the liquid part of citrated blood from which the red blood cells have been removed. The blood is obtained from volunteer donors by the American Red Cross, the plasma separated, frozen and evaporated under partial vacuum, dried and packaged ready for use. Plasma is a straw colored fluid; when dried it is reduced to a straw-colored powder. In the latter form it will last indefinitely at ordinary temperatures and for that reason it is easily available at all times for first aid treatment of shock, hemorrhage and burns. The Standard Army and Navy package of dried plasma consists of two bottles, stoppered with vaccine type rubber stoppers and intravenous equipment in two sealed metal cans. The two metal cans are packaged in a tape sealed, water proofed fiber board box. One of the bottles contains the dried plasma sealed under 29 inches of vacuum - (in order to preserve this vacuum, the metal can in which it comes is also sealed under 25 inches of vacuum). The other bottle contains 300 cc. of sterile distilled water. The rubber tubing and needles are sterile and to prevent contamination of these needles, they are covered with glass caps. The plasma is made ready for use by opening the cans with the keys attached to the top of each. The double ended needle is inserted into the stopper of the bottle containing the distilled water. This bottle is then inverted and the other end of the needle is plunged into the stopper of the dried plasma bottle.

The vacuum in this bottle causes the water to flow in and the plasma goes into solution in about two minutes. When the water does not flow into the plasma bottle freely, the needle of the airway should be inserted into the stopper of the water bottle. This will allow displacement of the water with the air and thus speed up the flow.

The airway and intravenous set are then connected to the plasma bottle and the plasma is ready to administer after clearing all the air out of the tube. The intravenous tubing is fitted with a small gauze filter to strain out shreds of fibrin, while the airway is likewise fitted with a cotton filter to cleanse the air which is sucked into the bottle. It is not necessary to type plasma because it is pooled from at least twelve donors and therefore its agglutinins are diluted and neutralized. This results in a great saving of time when it is used in first aid work, and for patients who have lost a large volume of blood, plasma can be given immediately to

tide the patient over until a donor is typed and his blood cross matched for a blood transfusion. The length of time that these various agents will act in maintaining the circulating blood volume is as follows:

Whole blood - - - - - - - - - - - - Six to eight hours or more.
Plasma - - - - - - - - - - - - - - About three hours.
Saline or glucose - - - - - - - - Less than one hour.

XV. FRACTURES

A. Definition:

A fracture is a break in the continuity of a bone. It is not necessary that the fragments be separated. In many fractures the bone may only be "cracked".

B. General Classification:

1. Simple Fractures -
   In this type there is a break in the bone but no communication with the exterior surface of the skin.
2. Compound Fractures -
   In this type, there is direct communication of the fracture with the exterior surface of the skin. A bone fragment may protrude through the skin, or there may be a wound channel, such as produced by a bullet or shrapnel fragment, which extends from the surface of the skin down to the break in the bone. This latter type is the type most commonly seen in battle casualties. In the last war, more than 30% of all battle casualties resulting from gunshot wounds in the experience of the American Expeditionary Force were compound fractures. The mortality in this type of injury should be low if these men are given prompt first aid treatment and proper measures taken to prevent shock and infection. It is in this type of wound that debridement is so essential to prevent infection, and early evacuation of these patients is one of the chief aims of the first aid man. An iodine blister occuring on the skin over a simple fracture necessitates treatment of the injury as a compound fracture.

C. Classification of Fractures with Regard to Position, Number, and Shape of Bone Fragments.

1. Transverse -
   A break into two fragments which is usually in a straight line, more or less at right angles to the long axis of the bone.
2. Spiral -
   Two fragments, but the break line is in a spiral or S shape. These are produced by twisting injuries as seen among ski troops, or by torsion produced by muscular contraction.

3. Serrated -
Two fragments broken with a saw-tooth edge along the break line.
4. Comminuted -
Three or more fragments resulting from the break.
5. Impacted -
The broken ends are jammed together so that they more or less telescope each other.
6. Greenstick -
An incomplete break of the bone usually resulting in the convex surface breaking while the concave surface remains intact. This is seen more commonly in children in whom the bones are more elastic.
7. Depressed Fractures -
This type occurs in flat bones such as the skull. A fragment is driven below the normal surface of the bone.
8. Pathological -
These fractures are the result of a disease process within the bone causing a gradual weakening. Bone cyst or bone tumors can weaken a bone in this way and the stress required to fracture it may be slight, such as the simple act of turning over in bed and catching an arm or leg in the sheets.
9. Complicated -
Any of these above mentioned types plus injury to vital structures such as nerves and arteries.

D. Symptoms of Fracture -
1. The patient frequently feels or hears the bone snap.
2. Pain and tenderness at the point of the break.
3. Deformity in some cases.
4. Partial or complete loss of motion is often present in adjacent joints.
5. Swelling and discoloration.
6. Crepitus or grating may be felt (although attempts to obtain this sign should not be made).
7. Unevenness in the bone.
8. Shock.
9. In compound fracture a bone fragment may protrude through the skin, or there may be a wound channel extending down to the bone. The bone may not be visible at the base of the wound.
10. Symptoms in Special Types of Fracture.
a. Fracture of the Skull.
Unconsciousness, swelling or laceration of scalp, bleeding or leakage of spinal fluid from nose, mouth and ears, difference in size of pupils, blackening of tissues under the eyes, changes in pulse and respiration, paralysis or twitching of muscles.

b. Fracture of the Spine -
Pain or deformity at the site of fracture. If the spinal cord is injured there may be paralysis or loss of sensation below the site of the fracture. Loss of control of bladder and bowel.

c. Fracture of Lower Jaw -
Pain on movement of jaw, irregularity of teeth, inability to swallow or talk in some cases. Bleeding and drooling of saliva from the mouth. In cases of bilateral fracture, the soft tissues may drop back and strangle the patient and one of the most important things in treatment is to clear the upper air passages by airway or traction on the jaw.

d. Fracture of the Clavicle -
Injured shoulder is at lower level than uninjured. Patient unable to raise arm above shoulder and supports elbow with hand of sound limb. Fractured ends can usually be felt.

e. Fracture of Rib -
Pain especially on breathing or coughing. The broken rib is tender and hand pressure over the sternum produces pain at the site of the fracture. The break can be felt sometimes. The patient usually holds his hand tightly over the break. If the lung is punctured, coughing up of bright red, frothy blood may occur.

E. First Aid Treatment of Fractures -

1. General Procedures.

a. Splint all fractures where they lie.

b. Morphine 1/4 grain and shock treatment.

c. Always arrest hemorrhage and apply sulfanilamide powder and sterile dressings to the wound in case of compound fractures. If the bone protrudes from wound, apply sulfanilamide powder before applying traction and mark patient's record clearly so that the surgeon will know the fracture has been compounded. The measures described under wound treatment hold here.

d. In applying splints first apply sufficient traction to the extremity to restore proper alignment and be sure the splint extends beyond the joints above and below the fracture.

e. In applying splints, be sure bony prominences are well padded.

f. Place patient on litter and secure the injured part with sufficient support that no motion will be present while transporting the litter.

g. Dress the litter properly to conserve patients body heat.

h. Evacuate as soon as possible, particularly compound fractures which all require debridement. Tetanus toxoid and gas gangrene anti-serum will be given.

i. If possible, all compound fractures of long bones should have a traction - countertraction type of splint.

2. Recommended Splinting of Simple Fractures Prior to Transportation.

a. Clavicle -
Figure of eight bandage around shoulders, crossing over the spine and with a sling at the wrist. Stockinette is best for this purpose. When the patient is lying down, a pillow should be placed between the shoulder blades.

b. Fracture of Surgical Neck of Humerus -
Wrist sling. Keep patient in sitting position.

c. Fracture of Shaft of Humerus -
Chest pad between chest and humerus, with double sling or Velpeau type bandage. A well padded external splint helps immobilize. Murray-Jones splint no longer used because of pressure on axillary nerves. Traction is unnecessary.

d. Fracture of Elbow -
Ladder splint bent and fitted to posterior surface of humerus and ulnar surface of forearm. Cut out wire at point of elbow. A cardboard posterior right angle splint or molded plastic splint can be used. Support any of these splints with a wrist sling.

e. Fracture of Forearm, Ulna and Radius -
Anterior and posterior molded plaster splints, including the elbow, or anterior and posterior board splints, well padded, supported by a sling extending from elbow to tips of fingers.

f. Fracture of the Wrist -
Board splints or anterior and posterior molded plaster splints.

g. Carpus and Metacarpus -
Skin fitting unpadded molded plaster splints.

h. Phalanges -
Roller bandage fastened beneath fingers or molded plaster.

i. Fracture of Neck of Femur -
Army traction (Thomas) splint with leg internally rotated.

j. Fracture of Shaft of Femur -
Army traction splint.

k. Knee Joint -
Army traction splint with knee flexed 20 to 30 degrees and with long pad under flexor surface.

l. Tibia and Fibula -
Ladder splint extending to upper third of thigh, or plaster splint. Pad well under the knee and above the Os Calcis on each side of the tendo achilles.

m. Ankle -
Ladder or molded plaster splint from toes to above the knee.

n. Os Calcis -
Ladder or molded plaster splint from toes to the knee.

o. Metatarsus -
Molded plaster splints.

p. Spine -
Dorsal and Lumbar. Stretcher in hyperextension, not on a soft bed. A folded blanket placed beneath the kyphos will have a tendency to reduce the fracture and prevent cord injury. A plaster jacket in hyperextension is preferable when equipment is available. The simplest method of moving these patients short distances is face down on a blanket, carriers grasping the four corners of the blanket.
Cervical Spine - A voluminous cotton collar, small pillow or gauze roll tight around the neck, supporting the occiput and chin. Catheterize in case of paralysis.

q. Pelvis -
Bilateral plaster Spica -

The above mentioned splinting methods are not strictly first aid procedures. On the battlefield the medical corps man must rely on his ingenuity and improvise his own splints. However, a knowledge of the above procedures is valuable to the trained technician.

F. Healing of Bones -
If infection does not occur, most bones will show good healing in 4-6 weeks. At the time of fracture, bleeding occurs at the ends of the fragments. This blood forms a jelly like clot into which grow blood vessels and connective tissue cells, known as fibroblasts. This connective tissue forms a firm fibrous union between the bone ends and later calcium salts are deposited on this fibrous mesh work to form bony callus which adds rigidity to the union. At this time the bones again are strongly united and in time the excess calcium absorbs, the bone smooths off and the medullary canal reforms.

XVI. DISLOCATIONS

A. Definition -

When a bone gets out of place at a joint, and remains out of place, the injury produced is called a dislocation. The joints are enclosed in flexible sacs known as joint capsules and are reinforced by heavy bands of white connective tissue extending from one bone to another and known as ligaments. In every dislocation these structures are stretched or torn, and after the bones are put back in place, the joints should be supported and motion restricted for some time in order to give these structures a chance to heal. Injuries to ligaments are known as sprains.

B. Common Locations and Symptoms -

1. Shoulder squared off, arm held out to side, loss of carrying angle, axilla filled out.
2. Fingers -
   Phalanx is dislocated to dorsal surface of more proximal phalanx.
3. Elbow -
   Joint fixed in semi-flexed position and displaced bones project prominently behind.
4. Jaw -
   Mouth held wide open and cannot be closed.
5. Wrist, Hip, Knee and Ankle may also be dislocated.

C. Reduction of Dislocations -

It is always best for dislocations to be reduced by a medical officer since fractures and other damage are often produced by unskilled reduction. An anaesthetic such as sodium pentothal or nitrous oxide is often necessary for the relief of pain and muscle spasm. However under certain circumstances, the technician may have to reduce dislocations himself and this can be done in the simpler cases.

1. Shoulder -
   Take off one shoe and place your heel up near the patient's armpit with patient lying down. Then apply traction at an angle of 10-15 degrees abduction. After reduction, immobilize either with a Velpeau bondage or a double sling, that is, a triangular bandage around the neck supporting the forearm, another holding the humerus against the ribs. This method of reduction is not without considerable danger.
2. Lower Jaw -
   Patient in a chair, pad thumbs well and press down and back on molar teeth, lifting up on chin with fingers until mandible snaps back into place. Support jaw with 4 tailed or Barton bandage.

3. Elbow -
Place knee in bend of elbow, pull arm foreward against knee and slowly and forcibly bend forearm to right angle. Bandage in this position.

4. Fingers -
Reduce by steady traction in straight line with the finger. Do not attempt reduction of second joint of the thumb.

5. Knee -
Flex the thigh and apply traction.

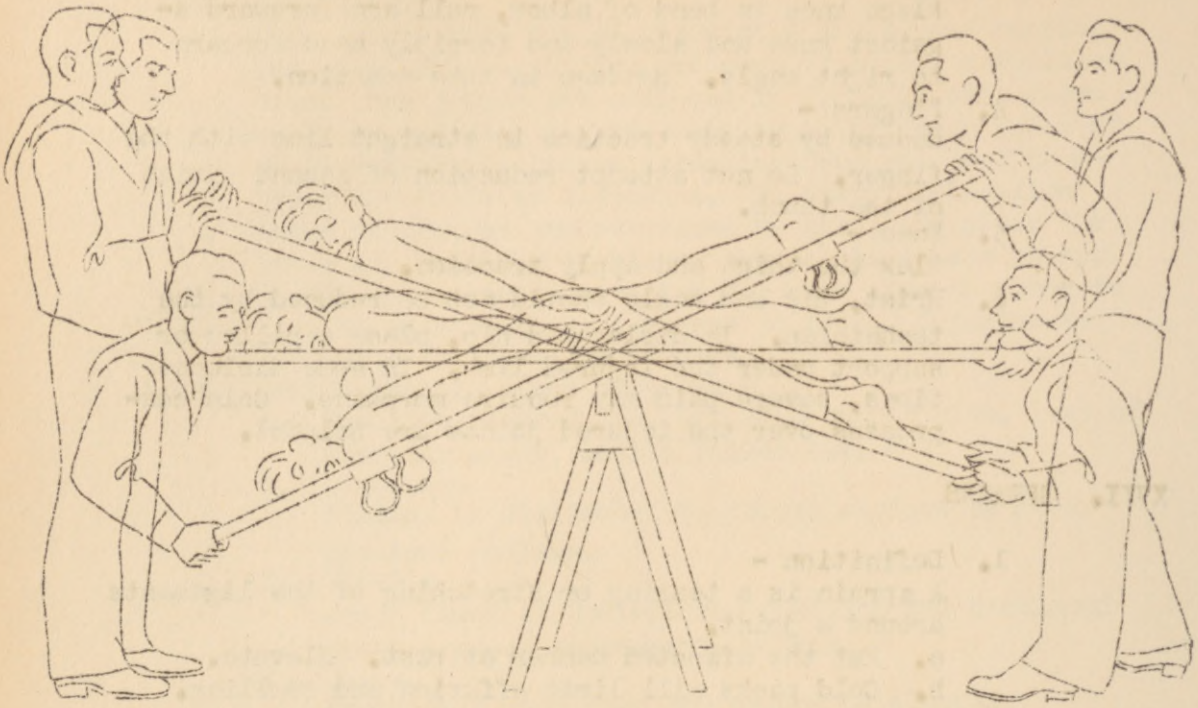
6. Wrist, hip and ankle should not be reduced by the technician. In dislocated hip, place a pillow or support under the injured limb. In some dislocations, severe pain may require morphine. Cold compresses over the injured joints are helpful.

XVII. SPRAINS

1. Definition -
A sprain is a tearing or stretching of the ligaments around a joint.
   a. Put the affected member at rest. Elevate.
   b. Cold packs will limit effusion and swelling.
   c. After twenty four hours, when swelling has subsided, hot compresses will increase the circulation and stimulate healing. The strength of the joint can then be increased by the use of proper adhesive plaster strapping. This will be demonstrated to you.

XVIII. STRAINS

1. Definition -
A strain is an injury to a muscle or tendon in which the fibers are stretched or torn. Pain, stiffness and pain on movement are the symptoms.
The treatment consists of:
   a. Heat.
   b. Put the injured muscle at rest. Adhesive strapping is useful.
   c. Gentle massage to aid the return flow of blood in the veins.
   d. Liniments may be of value.



XIX. ARTIFICIAL RESPIRATION

Certain accidents, the most frequent of which are drowning, electrical shock and gas poisoning, cause cessation of breathing. Other causes include drug poisoning (such as morphine or barbiturates) prolonged exposure to cold, blows on the head and neck, chest injuries and certain types of infection. In all cases, it is important to rule out an obstruction of the upper air passages, since in these cases artificial respiration is useless. The tongue should be pulled forward since this may fall back into the throat particularly if the patient is unconscious. If a foreign body is present in the pharynx, larynx or trachea, an attempt should be made to remove it. Try a sharp blow on the back with the body suspended head down, or wiping or suction if available. It may be necessary to establish an artificial airway with a rubber tube passed

behind the tongue to the larynx. Tracheotomy is a last resort, and can be performed with a pocket knife if necessary. There are two chief methods of applying artificial respiration:

A. The Prone-pressure or Schaefer Method.

1. Lay the patient face down, one arm extended directly overhead, the other bent at the elbow with the face turned to one side and resting on the hand or forearm, so that the nose and mouth are free for breathing.
2. Kneel, straddling the patient's hips, with the knees just below the patient's hip bones or the opening of the pants pockets. Place the palms of the hands on the small of the patient's back with the fingers over the patient's ribs, the little fingers just touching the lowest ribs, the thumbs along side the fingers and the tips of the fingers just out of sight.
3. While slowly counting "one", "two" and with the arms held straight, swing slowly foreward, so that the weight of the body is gradually, but not violently, brought to bear on the patient. (60 lbs. of pressure is usually sufficient). This should take 2 to 3 seconds.
4. While counting "three" swing back to remove the pressure.
5. While counting "four", "five", rest.
6. Repeat these operations, so that 12 to 15 complete cycles are made per minute. In other words the complete cycle of compression and release should take 4 to 5 seconds.
7. As soon as artificial respiration has been started, and while it is being continued, an assistant should loosen all tight clothing about the patient's neck, chest and waist and wrap the patient with a blanket.
8. Continue artificial respiration without interruption until natural breathing is restored or until rigor mortis has set in; do not stop merely because the patient appears to be dead. Some persons have been revived by artificial respiration after 20 to 30 minutes of submersion.
9. If natural breathing stops after being restored, use this method of resuscitation again.
10. Keep the patient lying down after breathing is restored. Stimulants such as aromatic spirits of ammonia, coffee or tea can be given after the patient regains consciousness.
11. In changing operators, the rhythm of respiration must not be broken.

B. Eve's Rocking Method -

This method works entirely by the force of gravity and had been adopted on British warships as the method of choice. It is claimed that in drowning the inspiratory recoil is lost, chiefly because of flaccidity of the diaphragm, and consequently Schaefer's method may not work.

Procedure:

1. Lay the victim face down on a stretcher and wrap well with blankets above and below.
2. Wrists and ankles are lashed to the handles.
3. Hoist the litter to a wooden saw horse or sling which acts as a pivot on which the litter can be tilted with either head or feet down.
4. The first tilt is head down and at an angle of 50° from the horizontal. The weight of the abdominal organs pressing on the diaphragm produces full expiration and also forces aortic blood through the coronary arteries, and empties the stomach and lungs of water.
5. Full inspiration is produced by tilting the footend down to 50°.
6. Further rocking is done a dozen times a minute through an angle of 45° each way.
7. The method is safe and can be done by anyone. During any delay in getting a litter, Schaefer's Method should be used until the rocking can be started.
8. This method would be valuable in cases complicated by rib fracture or chest injury where direct compression of the thorax is contra-indicated.

XX. UNCONSCIOUSNESS

A. Definition -

Unconsciousness may be due to many causes and it would be impossible to teach the technician how to recognize all these causes in the short time alloted to this course. What we will attempt to do, is teach you a general plan of procedure to follow in the handling of any unconscious patient. The first thing to do when an unconscious person is found is to rule out the following conditions since each requires a special treatment.

1. Stopping of breathing.
   Look for electrical contacts, escaping gas etc.
2. Hemorrhage.
3. Poisoning.
   Examine the surroundings for empty bottles etc.
   Examine the patient's mouth.

4. Sunstroke.
5. Head Injury.
   Look for evidence of a fall. Examine the scalp for cuts or bruises.

In some cases the cause of unconsciousness will be in doubt and these can be given satisfactory first aid treatment by roughly dividing them into the three following groups on the basis of easily determined symptoms.

1. Red Unconsciousness.
   Symptoms: Red or flushed face and a strong pulse.
   Treatment: Put in a lying position, head slightly raised and keep the patient quiet. Apply cold applications to the head. Loosen any tight clothing around the neck. Give no stimulants and apply just enough heat to keep the patient warm. Transport carefully in a lying position.
2. White Unconsciousness.
   Symptoms: Pale face a nd fast weak pulse. Other symptoms of shock.
   Treatment: Keep quiet in a lying position with the head level or low. Apply external heat. Use inhalation stimulants if there is no bleeding and no head injury. Transport very carefully in a lying position.
3. Blue Unconsciousness.
   This group includes the cases requiring artificial respiration and the treatment has already been discussed under artificial respiration.

Some of the common causes of unconsciousness are listed below.

1. Apoplexy or Stroke -
   This condition is due to the rupture of a diseased blood vessel in the brain. The pressure of the blood on the brain causes unconsciousness and in addition some of these symptoms:
   a. Face usually red, but may be ashen gray.
   b. Pulse strong and slow.
   c. Pupils may be unequal in size.
   d. One side of body may be limp. Mouth may be drawn to one side.
   e. Snoring respiration.

The treatment is as outlined under red unconsciousness.

2. Alcoholism -
It is possible for individuals to die following the drinking of large quantities of alcohol. These patients show slow noisy breathing, cyanosis, rapid feeble pulse, incontinence and sometimes convulsions.
Treatment:
   a. Insert a stomach tube and wash the stomach with warm water of 5% sodium bicarbonate solution.
   b. Keep the patient warm with blankets and hot water bottles.
   c. Inhalation of oxygen and carbon dioxide is helpful.
   d. Stimulants.
3. Skull fracture and Concussion.
Treat these patients as described under red unconsciousness. In cases due to bullet or shrapnel wound, compound fractures of the skull will be seen, and in some of these, brain tissue may actually bulge from the wound. These cases are not necessarily hopeless - some make complete recoveries, so the technician would do well to treat these cases promptly, applying sulfanilamide powder and a sterile dressing to the wound and transporting the patient to a hospital promptly.
4. Shock -
5. Hemorrhage -
6. Sunstroke -
7. Heat exhaustion -
8. Prolonged exposure to cold.
9. Poisonous drugs.
10. Fainting - This condition is due to a sudden failure of the blood supply to the brain. The patient should be placed in shock position, his clothing loosened and an ammonia inhalant used. Cold water sprinkled on the face is of help. A patient who begins to feel faint, should lie down or place his head between his knees.
11. Epileptic Convulsions -
These are severe convulsions during which the patient falls down, becomes rigid at first and then develops twitching and jerking of the limbs and face. There may be loss of bladder and bowel control during the attack. Following the attack, the patient usually passes into a deep sleep, or coma which may last several hours.
Treatment:
During the attack, prevent the patient from hurting himself and especially from biting his tongue. This is best done by placing a padded stick between his teeth. Do not try to restrain the patient. After the convulsion, allow the patient to sleep.
12. Diabetic coma.
13. Uremia.

XXI. POISONS

The principal point to be remembered in the treatment of poisoning is that poisons, when diluted, are not absorbed as rapidly as when they are in a concentrated form. In addition to diluting the poison it should be cleaned out of the stomach either by causing vomiting or by putting down a stomach tube and washing out the stomach. There are two types of poisons for which emetics or stomach tube are not used, and these are acid or alkali poisoning. In these two types of poisoning there is a danger of rupturing the esophagus.

The following emetics are useful in most types of poisoning.

A. Soap suds.
B. Salt water.
C. Soda water.
D. Lukewarm water.
E. Milk - especially for corrosive poisons.

Four to seven glassfuls should be given, preferably lukewarm. If vomiting does not occur, the back of the throat should be tickled. A teaspoonful of mustard powder in a glass of warm water can also be tried to induce vomiting. When the stomach has been well washed out, the antidote, if known can be given. A large dose of epsom salts can be safely given later to cleanse the poison from the gastro-intestinal tract. Following are some of the specific measures to employ in certain types of poisoning.

A. Acids -
   1. Neutralize with an alkali such as magnesia, chalk, white wall plaster, sodium bicarbonate or lime water.
   2. Give a demulcent such as milk, olive oil or egg white.
   3. Keep the patient warm. Morphine 1/4 grain for pain.
   4. No emetics or stomach tube.

B. Alkalies -
   1. Neutralize with a weak acid such as lemon juice or vinegar.
   2. Keep the patient warm.
   3. No stomach tube or emetic.
   4. Demulcent such as milk or egg white.

C. Barbiturates
   1. Pass a stomach tube and wash the stomach, or give an emetic.
   2. Give a large dose of epsom salts.
   3. Keep the patient warm.
   4. Stimulants and oxygen if available.

D. Cyanide.
1. Pass a stomach tube and wash out with 1.5% solution of hydrogen peroxide.
2. Apply artificial respiration if necessary.
3. Get medical assistance immediately. There are specific antidotes available which must be given intravenously. These are sodium nitrite and sodium thiosulfate.

E. Iodine.
1. Give a starchy preparation, such as a heaping tablespoonful of cornstarch or flour stirred into a pint of boiling water, the mixture being allowed to cool.
2. Wash stomach until the washings are no longer blue.
3. Morphine if necessary for pain.
4. Treat shock. Plasma and transfusions if necessary.

F. Morphine -
1. Wash the stomach with .05% potassium permanganate solution.
2. Inject intravenously 7 1/2 grains of caffeine sodio-benzoate.
3. Inhalations of 10% carbon dioxide and 90% oxygen.
4. Artificial respiration if necessary.
5. Epsom salts.
6. Treat shock.

G. Carbolic acid and Lysol.
1. Pass a stomach tube and wash out the stomach with olive oil or other edible oils. If no oil is available, use tap water or soap suds.
2. 5% glucose solution intravenously.
3. 10% carbon dioxide and 90% oxygen or artificial respiration, if necessary.
4. If there is a surface burn wash it off with 95% alcohol.

H. Phosphorus (in rat paste or matches).
1. Pass a stomach tube and wash out the stomach with 500 cc of 0.5% solution of copper sulfate.
2. Repeat at 15 minute intervals.
3. Give magnesium sulfate as a purge (1 ounce).
4. Morphine sulfate for pain.
5. Eventually give a demulcent such as starch, milk or eggs.

I. Silver Nitrate.
1. Wash out with salt solution.

J. Strychine.
1. Inject intravenously 7 1/2 grains of sodium amytal.
2. Pass a stomach tube and wash out the stomach with a 0.1% solution of potassium permanganate.

K. Mercury Bichloride.
1. Give large quantities of egg white mixed with milk or water.
2. Pass a stomach tube and wash thoroughly.

3. Saline solution intravenously.
4. Treat shock. Plasma and transfusions if necessary.

XXII. GAS GANGRENE AND SERUM PROPHYLAXIS

A. Gas gangrene is such an important problem in the treatment of war wounds that some mention should be made of this serious complication. The anaerobic bacteria causing this condition thrive in wet cultivated soil and wounds contaminated with this material are very apt to develop this type of infection, but any contaminated wound can become infected in this way.

Gas gangrene is somewhat more common in the lower extremity than the upper. It has a tendency to follow fascial planes and hence frequently involves a number of muscles of the same group. In advanced cases the limb is swollen and crepitant to the touch and the skin is moist and discolored, while a thin, foul smelling, bloody discharge with a musty or rotten egg odor exudes from the wound. The patient appears acutely ill with rapid, thready pulse and sunken cheeks, but mentally alert.

The involved muscles pass through various stages of dissolution signified by a gradual change in color from brick red through yellow to a greenish black. In earlier cases the symptoms are less evident and the patient may complain of increased pain in the wound but show only swelling of the limb with the over-lying skin tense and pale, or discolored. X-Ray examination often reveals gas bubbles under the skin.

As in any infection, preventive treatment is of more value than treatment after the infection has occurred. Prophylactic treatment in gas gangrene includes proper treatment of the wound, including debridement, local and oral use of one of the sulfa drugs, and the use of anti-gas gangrene serum. In treatment of an established case of gas gangrene the following measures have their place.

1. Excision of involved muscles, or adequate exposure of infected tissue.
2. X-Ray treatment.
3. Zinc peroxide or other oxidizing agents, such as hydrogen peroxide and potassium permanganate in the wound.
4. Sulfathiazole.
5. Gas gangrene antitoxin.
6. Amputation.

B. Serum Prophylaxis -
Gas gangrene antitoxin is prepared from the blood of horses which have been injected with the toxic products of these bacteria. The horses produce in their blood stream this protein substance, known as anti-toxin, which has the power of neutralizing the toxins of the bacteria. When a sufficient quantity has been formed, the horses are bled and the serum which contains the antitoxin, is separated from the horse blood. Gas gangrene antitoxin then, is horse serum. Since many people will have serious reactions, even death, when horse serum is injected under their skin, certain precautions are always taken before the injection is made.

1. Ask the patient if he is allergic, that is, if he has ever had hay fever, asthma, eczema, hives or similar conditions. Ask him particularly if he is allergic to horses, that is, if he sneezes or wheezes or breaks out in a rash when he is near a horse. These people are especially liable to have a fatal reaction from horse serum. People who have previously had horse serum may also react to a second dose.
2. In this test, horse serum is diluted one part in ten with normal saline solution. A drop is injected intra-cutaneously into the skin of the forearm. If, in 20 to 30 minutes, a pale irregular swelling surrounded by redness, appears, the patient is sensitive to horse serum.
3. Eye Test -
Take the same 1 to 10 dilution of horse serum and place one drop on the inner side of the lower lid. After 20 to 30 minutes compare with the opposite eye. If the eye is red, and there is swelling and watering, the patient is sensitive to horse serum.

If the patient is negative to the above tests, it is probably safe to administer the full dose of antitoxin, usually 10 to 15,000 units. If any of the tests are positive, the antitoxin must be administered by a medical officer, if he considers it essential, and usually in fractional doses. Whenever horse serum is administered to a patient, a syringe containing 1 cc of 1:1000 adrenalin should be at hand for use in case of serum reaction.

C. Tetanus -
Every soldier in the armed forces of the United States, now receives immunizing injections of tetanus toxoid. Toxoid is a substance prepared by chemically treating the poisonous toxin produced by tetanus bacteria in

such a way that its harmful properties are to a great extent lost. However, when it is injected into a human individual, it is still strong enough to cause that person to produce antitoxin. This is known as active immunity in contrast to passive immunity as used in prophylaxis against gas gangrene, where the antitoxin is "borrowed" from a horse.

In the last war toxoid was not as yet developed and as to protect the soldiers from "lock jaw" or tetanus, antitoxin was used, as it still is for gas gangrene.

In this war, every soldier will have a permanent immunity to tetanus before he goes into battle and at the time he is injured, he will receive an additional dose or "booster shot" of 1 cc of tetanus toxoid. Please note that tetanus toxoid is not prepared from horse serum and it is not necessary to test a patient before administering it.

Serum and toxoid prophylaxis are very useful but one must not depend on them entirely for protection against gas gangrene and tetanus. The proper care of the wound is still the most important factor in preventing these diseases and the technician has a great part in the application of proper first aid treatment and swift evacuation of the patient to a surgical station where treatment of the wound can be carried out.