CHAPTER 20

EMERGENCY RESCUE: SUPPLIES, EQUIPMENT & PROCEDURES

INTRODUCTION

This chapter outlines first aid equipment/supplies and the rescue/transportation of the injured patient. A Hospital Corpsman (HM) will be expected to recognize the uses and application procedures for many dressings and bandages, be able to identify the protective equipment needed in specific emergencies, and where and when to use them.

This will familiarize HMs with the phases of a rescue operation; stages of extrication; the precautionary steps to be taken in special rescue situations; recognizing the different patient-moving devices and lifting techniques; various forms of emergency transportation; how to identify essential basic life support supplies used in operational and non-operational rescue efforts; and provide the preparatory, en route, and procedures for patients being transported to medical treatment facilities.

EQUIPMENT AND SUPPLIES

LEARNING OBJECTIVE:

Identify initial equipment and supply needs.

In a first aid situation, the HM must always be ready to improvise. In many field emergency situations, standard medical equipment and supplies may not be immediately available, or the supplies are exhausted.

When assigned to Marine Corps units, HMs carry a medical equipment and supplies in a special bag. It is referred to as a “Unit One Bag” which is currently being replaced by the Modular Lightweight Load Carrying Equipment (MOLLE) bag or a “Stamp” bag.

Unique operational requirements or command decisions may modify the contents of these bags. As a HM, it is important to be familiar with the emergency medical equipment at the command, since a call may come at a moment’s notice and requiring use of these items to help save or sustain a life.

DRESSINGS AND BANDAGES

There are many different types of dressing bandages. HMs should be familiar with the various standard dressings and bandages, the respective functions, and proper application in first aid and emergency situations.

DEFINITION OF A DRESSING

A dressing is a sterile pad or compress (usually made of gauze or cotton wrapped in gauze) used to cover wounds to control bleeding and prevent further contamination. Dressings should be large enough to cover the entire area of the wound and extend at least 1" in every direction beyond the wound edges. If the dressing is not large enough, the edges of the wound are almost certain to become contaminated.

Battle Dressing

A battle dressing is a combination compress and bandage in which a sterile gauze pad is fastened to a gauze, muslin, or adhesive bandage. Most of the Navy first aid kits contain both large and small battle dressings of this kind. Most prepackaged battle dressings are 4 tailed bandages for use in bandaging extremity, abdominal, and head wounds (Fig. 20-1).
Any part of a dressing that comes in direct contact with a wound should be sterile (free from microorganisms). The dressings that HMs find in first aid kits have been sterilized. However, once they come in contact with fingers, clothing, or any other unsterile object, they are no longer sterile. If the HM drags a dressing across the casualty’s skin or allows it to slip after it is in place, the dressing is no longer sterile.

Should an emergency arise when a sterile dressing is not available, the cleanest cloth at hand may be used such as a freshly laundered handkerchief, towel, or shirt. Unfold these materials carefully so that the part that goes next to the skin is not touched. Always be ready to improvise when necessary, but never put materials directly in contact with wounds if those materials are likely to stick to the wound, leave lint, or be difficult to remove.

DEFINITION OF A BANDAGE

Standard bandages are made of gauze or muslin and are used over a sterile dressing to secure the dressing in place, to close off its edge from dirt and germs, and to create pressure on the wound and control bleeding. A bandage can also support an injured part or secure a splint. The most common types of bandages are the roller and triangular bandages.
Roller Bandage (Fig. 20-2) consists of a long strip of material (usually gauze, muslin, or elastic) wound into a cylindrical shape. Roller bandages come in various widths and lengths. Most of the roller bandages in first aid kits have been sterilized, so pieces may be cut off and used as compresses in direct contact with wounds.

Figure 20-2.—Roller Bandage

Image provided by: Department of the Army. (2009). Soldier’s handbook and training guide for MOS 68W STP 8-68W13-SM-TG.

General Application

Applying a roller bandage:

1. Hold the roll in the right hand so that the loose end is on the bottom
2. The outside surface of the loose or initial end is next applied to and held on the body part by the left hand.
3. The roll is then passed around the body part by the right hand, which controls the tension and application of the bandage. Two or three of the initial turns of a roller bandage should overlie each other to properly secure the bandage.
4. Perform pulse check of the extremity upon completion of applying roller bandage.

NOTE:

In applying the turns of the bandage, it is often necessary to transfer the roll from one hand to the other.

Bandages should be applied evenly, firmly, but not too tightly.

Excessive pressure may cause interference with the circulation and lead to disastrous consequences.

In bandaging an extremity, it is advisable to leave the fingers or toes exposed so the circulation of these parts may be readily observed.

It is likewise safer to apply a large number of turns of a bandage, rather than to depend upon a few turns applied too firmly to secure a compress.

Wet Bandage Application

Applying a wet bandage (or one that may become wet, HMs must allow for shrinkage. The turns of a bandage should completely cover the skin to prevent the possibility of pinching and discomfort as any uncovered areas of skin may become pinched between the turns, with resulting discomfort. In bandaging any extremity, it is advisable to include the whole extremity except the finger and toes so that uniform pressure may be maintained throughout. It is also desirable when bandaging a limb that the limb is placed in the position it will occupy when the dressing is finally completed, as variations in the flexion and extension of the limb will cause changes in the pressure of certain parts of the bandage.
Starting and Finishing the Roller bandage

1. The initial turns of a bandage on an extremity (including spica bandages of the hip and shoulder) should be applied securely, and, when possible, around the part of the limb that has the smallest circumference.

2. In bandaging the arm or hand, the initial turns are usually applied around the wrist, and in bandaging the leg or foot, the initial turns are applied immediately above the ankle.

3. The final turns of a completed bandage are usually secured in the same manner as the initial turns, by employing two or more overlying circular turns.

4. As both edges of the final circular turns are exposed, they should be folded under to present a neat, cuff-like appearance.

5. The terminal end of the completed bandage is turned under and secured to the final turns by either a safety pin or adhesive tape. When these are not available, the end of the bandage may be split lengthwise for several inches, and the two resulting tails may be secured around the part by tying.

Roller Bandage for Elbow

A spica or figure-eight type of bandage is used around the elbow joint to retain a compress in the elbow region and to allow a certain amount of movement.

1. Flex the elbow slightly (if it can be done without causing further pain or injury), or anchor a 2 or 3 inch bandage above the elbow and encircle the forearm below the elbow with a circular turn.

2. Continue the bandage upward across the hollow of the elbow to the starting point.

3. Make another circular turn around the upper arm, carry it downward, repeating the figure-eight procedure, and gradually ascend the arm.

4. Overlap each previous turn about two-thirds of the width of the bandage.

5. Secure the bandage with two circular turns above the elbow; and tie. To secure a dressing on the tip of the elbow, reverse the procedure and cross the bandage in the back (Fig. 20-3).

Figure 20-3.—Roller Bandage for Elbow

6. Perform pulse check of the extremity upon completion of applying roller bandage.
Roller Bandage for Hand and Wrist

For the hand and wrist a figure-eight bandage is ideal.

1. Anchor the dressing at the wrist, whether the wound is on the hand or wrist, with several turns of a 2 or 3 inch bandage. If on the hand, anchor the dressing with several turns and continue the bandage diagonally upward and around the wrist and back over the palm.

2. Make as many turns as necessary to secure the compress properly (Fig. 20-4).

Roller Bandage for Ankle and Foot

The figure-eight bandage is also used for dressings of the ankle, such as for supporting a sprain.

3. Continue the figure-eight turns overlapping one-third to one-half the width of the bandage and with an occasional turn around the ankle, until the compress is secured or until adequate support is obtained (Fig. 20-5).

Figure 20-4.—Roller Bandage for Hand and Heel

1. While keeping the foot at a right angle, start a 3-inch bandage around the instep for several turns to anchor it.

2. Carry the bandage upward over the instep and around behind the ankle, forward, and again across the instep and down under the arch, thus completing one figure-eight.

4. Perform pulse check of the extremity upon completion of applying roller bandage.

Roller Bandage for Heel

Due to the shape of the heel, it is one of the most difficult parts of the body to bandage.

1. Place the free end of the bandage on the outer part of the ankle and bring the bandage under the foot and up.

2. Carry the bandage over the instep, around the heel, and back over the instep to the starting point. Overlap the lower border of the first loop around the heel and repeat the turn, overlapping the upper border of the loop around the heel. Continue this procedure until the desired number of turns is obtained, and secure with several turns around the lower leg.
Roller Bandage for Arm and Leg

The spiral reverse bandage must be used to cover wounds of the forearm and lower extremities; only such bandages can keep the dressing flat and even. A spiral reverse bandage is a bandage that is turned and folded back on itself as necessary to make it fit the contour of the body more securely.

1. Make two or three circular turns around the lower and smaller part of the limb to anchor the bandage and start upward.
2. Make reverse laps on each turn, overlapping about one-third to one-half the width of the previous turn.
3. Continue as long as each turn lies flat.
4. Continue the spiral and secure the end when completed.
5. Perform pulse check of the extremity upon completion of applying roller bandage.

Four-Tailed Bandage

A piece of roller bandage may be used to make a four-tailed bandage. The four-tailed bandage is good for bandaging any protruding part of the body because the center portion of the bandage forms a smoothly fitting pocket when the tails are crossed over. This type of bandage is created by splitting the cloth from each end, leaving as large a center area as necessary. The four-tailed bandage is often used to hold a compress on the chin, or on the nose (Fig. 20-6).

Barton Bandage

The Barton bandage is frequently used for fractures of the lower jaw and to retain compresses to the chin.

1. As in the progressive steps illustrated below (Fig. 20-7), the initial end of the roller bandage is applied to the head, just behind the right mastoid process.

![Figure 20-7.—Using a Barton Bandage](image)

2. The bandage is then carried under the bony prominence at the back of the head, upward and behind the left ear, obliquely across the top of the head.
3. Bring the bandage downward in front of the right ear.
4. Pass the bandage obliquely across the top of the head, crossing the first turn in the midline of the head, and then backward and downward to the point of origin behind the right mastoid.

Figure 20-6.—Wrapping a Four-Tailed Bandage
5. Carry the bandage around the head under the left ear, around the front of the chin, and under the right ear to the point of origin.

6. This procedure is repeated several times, each turn exactly overlaying the preceding turn.

7. Secure the bandage with a pin or strip of adhesive tape at the crossing on top of the head.

**TRIANGULAR BANDAGE**

Triangular bandages are usually made of muslin. They are made by cutting a 36 to 40 inch square of a piece of cloth and then cutting the square diagonally, thus making two triangular bandages (in sterile packs on the Navy's medical stock list). A smaller bandage may be made by folding a large handkerchief diagonally. The longest side of the triangular bandage is called the base; the corner directly opposite the middle of the base is called the point; and the other two corners are called ends (Fig. 20-8).

![Figure 20-8.—Triangular Bandage](image)

The triangular bandage is useful as it can be folded in a variety of ways to fit almost any part of the body. Padding can be added to areas that may become uncomfortable.

**Triangular Bandage for Head**

This bandage is used to retain compresses on the forehead or scalp.

1. Fold back the base about 2 inches to make a hem.

2. Place the middle of the base on the forehead, just above the eyebrows, with the hem on the outside.

3. Let the point fall down over the back of the head.

4. Bring the ends of the triangle around the back of the head above the ears, cross them over the point, carry them around the forehead, and tie in a **SQUARE KNOT** (Fig. 20-9).

![Figure 20-9.—Triangular Bandage for the Head](image)

5. Hold the compress firmly with one hand and, with the other, gently pull down the point until the compress is snug.

6. Bring the point up and tuck it over and in the bandage where it crosses the back part of the head.
Triangular Bandage for Shoulder

1. Cut or tear the point, perpendicular to the base, about 10 inches.
2. Tie the two points loosely around the patient’s neck, allowing the base to drape down over the compress on the injured side (Fig. 20-10).
3. Fold the base to the desired width, grasp the end, and fold or roll the sides toward the shoulder to store the excess bandage.
4. Wrap the ends snugly around the upper arm, and tie on the outside surface of the arm.

Figure 20-10.—Triangular Bandage for Shoulder

Triangular Bandage for Chest

1. Cut or tear the point, perpendicular to the base, about 10 inches.
2. Tie the two points loosely around the patient’s neck, allowing the bandage to drape down over the chest.
3. Fold the bandage to the desired width, carry the ends around to the back, and secure by tying.

Triangular Bandage for Hip or Buttock

1. Cut or tear the point, perpendicular to the base, about 10 inches.
2. Tie the two points around the thigh on the injured side.
3. Lift the base up to the waistline, fold to the desired width, grasp the ends, fold or roll the sides to store the excess bandage, carry the ends around the waist, and tie on the opposite side of the body.

Triangular Bandage for Side of Chest

1. Cut or tear the point, perpendicular to the base, about 10 inches.
2. Place the bandage, points up, under the arm on the injured side.
3. Tie the two points on top of the shoulder.
4. Fold the base to the desired width, carry the ends around the chest, and tie on the opposite side.
Triangular Bandage for Foot or Hand

This bandage is used to retain large compresses and dressings on the foot or the hand.

For the foot:
1. After the compresses are applied, place the foot in the center of a triangular bandage and carry the point over the ends of the toes and over the upper side of the foot to the ankle.
2. Fold the excess bandage at the side of the foot, cross the ends, and tie in a square knot in front.

For the hand:
1. After the dressings are applied, place the base of the triangle well up in the palmar surface of the wrist.
2. Carry the point over the ends of the fingers and back of the hand well up on the wrist.
3. Fold the excess bandage at the side of the hand, cross the ends around the wrist, and tie a square knot in front.

Cravat Bandage

A triangular bandage can be folded into a strip for easy application during an emergency. When folded as shown in Figure 20-11, the bandage is called a cravat. When necessary, a cravat can be improvised from common items such as T-shirts, bed linens, trouser legs, scarves, or any other item of pliable and durable material that can be folded, torn, or cut to the desired size.

1. Bring the point of the triangular bandage to the middle of the base and continue to fold until a 2 inch width is obtained.
2. The cravat may be tied, or it may be secured with safety pins (if the pins are available).

Cravat Bandage for Head

This bandage is useful to control bleeding from wounds of the scalp or forehead.
1. After placing a compress over the wound, place the center of the cravat over the compress.
2. Carry the ends around to the opposite side.
3. Cross them and continue to carry them around to the starting point
4. Tie in a square knot.

Cravat Bandage for Eye

1. After applying a compress to the affected eye, place the center of the cravat over the compress on a slant so that the lower end is pointed downward.
2. Bring the lower end around under the ear on the opposite side.
3. Cross the ends in back of the head, bring them forward, and tie them over the compress.
4. Figure 20-12 shows the proper application of a cravat bandage for the eye.

![Figure 20-11.—Cravat Bandage](image)

![Figure 20-12.—Cravat Bandage for the Eye](image)
Cravat Bandage for Temple, Cheek, or Ear (also called a Modified Barton)

1. After a compress is applied to the wound, place the center of the cravat over it and hold one end over the top of the head.
2. Carry the other end under the jaw and up the opposite side, over the top of the head.
3. Cross the two ends at right angles over the temple on the injured side.
4. Continue one end around over the forehead and the other around the back of the head to meet over the temple on the uninjured side.
5. Tie the ends in a square knot.

Cravat Bandage for Elbow or Knee

1. After applying the compress (Fig. 20-13), and if the injury or pain is not too severe, bend the elbow or knee to a right-angle position before applying the bandage.

![Figure 20-13.—Cravat Bandage for the Elbow](image)

2. Place the middle of a wide cravat over the point of the elbow or knee.
3. Carry the upper end around the upper part of the elbow or knee, bringing it back to the hollow (antecubital or popliteal space).
4. Carry the lower end entirely around the lower part, bringing it back to the hollow.
5. Ensure that the bandage is smooth and fits snugly; tie in a square knot outside of the hollow.

Cravat Bandage for Arm or Leg

The width of the cravat used will depend upon the extent and area of the injury.

**For a small area:**

1. Place a compress over the wound and center the cravat bandage over the compress.
2. Bring the ends around in back, cross them, and tie over the compress.

**For a small extremity:**

1. It may be necessary to make several turns around to use the entire bandage for tying.
2. If the wound covers a larger area, hold one end of the bandage above the compress.
3. Wind the other end spirally downward across the compress until it is secure, then upward and around again.
4. Tie a knot where both ends meet (Fig. 20-14).

![Figure 20-14.—Cravat Bandage for the Arm](image)
Cravat Bandage for Axilla (Armpit)

This cravat is used to hold a compress in the axilla. It is similar to the bandage used to control bleeding from the axilla.

1. Place the center of the bandage in the axilla over the compress.
2. Carry the ends over the top of the shoulder and cross them.
3. Continue across the back and chest to the opposite axilla, and tie them.
4. Do not tie too tightly or the axillary artery will be compressed, adversely affecting the circulation of the arm (Fig. 20-15).

![Figure 20-15.—Cravat Bandage for Axilla](image)

5. Perform pulse check of the extremity upon completion of applying roller bandage.

BATTLE DRESSING

A battle dressing is a combination compress and bandage in which a sterile gauze pad is fastened to a gauze, muslin, or adhesive bandage. Most Navy first aid kits contain both large and small battle dressings of this kind. Most pre-packaged battle dressings are 4 tailed bandages for use in bandaging extremity, abdominal and head wounds (see Fig. 20-1).

COMBAT APPLICATION Tourniquet® (C-A-T®)

The Combat Application Tourniquet® (C-A-T®, Fig. 20-16) is a small and lightweight one-handed tourniquet that completely occludes arterial blood flow in an extremity. The C-A-T® uses a Self-Adhering Band and a Friction Adaptor Buckle to fit a wide range of extremities combined with a one-handed windlass system. The windlass uses a free moving internal band to provide true circumferential pressure to an extremity. The windlass is then locked in place; this requires only one hand, with the Windlass Clip™. The C-A-T® also has a Hook-and-Loop Windlass Strap™ for further securing of the windlass during patient transport.

![Figure 20-16.—C-A-T® Tourniquet.](image)

*Image provided by: Department of the Army. (2009). Soldier’s handbook and training guide for MOS 68W STP 8-68W13-SM-TG.*

Asherman Chest Seal

Utilized as standard rapid management in emergency situations, the Asherman Chest Seal (ACS™) is a sterile occlusive dressing for treating an open pneumothorax and preventing a tension pneumothorax in chest injuries from gunshot, stab wounds, or other penetrating chest trauma. The unique one-way valve is designed to let air and blood escape while preventing re-entry of either. It has been proven to be more effective treatment than standard petroleum gauze. The ACS™ is 5.5" in diameter, includes a gauze pad (4" x 4") to clean and dry the wound, and is clear so the wound can be observed.
MONITORING DEVICES

Automated External Defibrillator (AED) is a portable electronic device capable of analyzing cardiac rhythms and selecting the appropriate strength of defibrillation (the application of electrical therapy which stops the arrhythmia, allowing the heart to reestablish an organized electrical message to the heart tissue). The user simply places two self-adhesive pads on the torso of a cardiac arrest casualty and presses a button on the AED. The AED analyzes the rhythm and recommends the appropriate treatment. Some systems will go into an automatic analysis of the heart rhythm without pushing a button. Initially reserved for use by trained medical responders such as firefighters and EMTs, the devices are being used with great success in various public settings such as in airports and training environments.

CAUTION:
Not all AED’s are approved for use in operational platforms.

Pulse Oximeter is a medical device that measures the oxygen saturation of a patient’s blood and changes in blood volume in the skin, producing a photoplethysmograph (measured changes in light absorption). It is often attached to a medical monitor allowing staff to monitor a patient’s oxygenation. Some monitors also display the heart rate. Portable, battery-operated pulse oximeters are available for home blood-oxygen monitoring. A blood-oxygen monitor displays the percentage of arterial hemoglobin in the oxyhemoglobin configuration. Acceptable normal ranges are 95 to 100 percent, although values down to 90 percent are common. The pulse oximeter should be used in conjunction with other findings from the physical examination to monitor patient airway, breathing, and shock.

INTRAVENOUS FLUIDS AND DELIVERY DEVICES

LEARNING OBJECTIVE:
Describe the appropriate intravenous fluids based upon their uses.

There are two types of fluids used for intravenous drips; crystalloids and colloids. Crystalloids are aqueous solutions of mineral salts or other water-soluble molecules. Colloids contain larger insoluble molecules, such as gelatin; blood itself is a colloid. The most commonly used crystalloid fluid is normal saline, a solution of sodium chloride at 0.9% concentration, which is close to the concentration in the blood (isotonic). Ringer’s lactate or Ringer’s acetate is another isotonic solution often used for large-volume fluid replacement.

Normal Saline (NS) is the commonly-used term for a solution of 0.91% w/v (percent weight by volume) of Sodium Chloride NaCl. Less commonly, this solution is referred to as physiological saline or isotonic saline, neither of which is technically accurate. NS is used frequently in intravenous drips (IVs) for patients who cannot take fluids orally and have developed or are in danger of developing dehydration or hypovolemia. NS is typically the first fluid used when hypovolemia is severe enough to threaten the adequacy of blood circulation and has long been believed to be the safest fluid to give quickly in large volumes. However, it is now known that rapid infusion of NS can cause metabolic acidosis. The amount of normal saline infused depends on the needs of the patient (e.g. ongoing diarrhea or heart failure) but is typically between 1.5 and 3 liters a day for an adult.

Lactated Ringers Solution (LR) is often used for fluid resuscitation after a blood loss due to trauma, surgery, or a burn injury. Overall, it is used to increase body fluid and buffer acidosis. Previously, it was used to induce urine output in patients with renal failure.
The intravenous dose of LR solution is usually calculated by estimated fluid loss and presumed fluid deficit. For fluid resuscitation the usual rate of administration is 20 to 30 mL/kg body weight/hour. LR solution is not suitable for maintenance therapy because the sodium content is considered too high for adults, in view of electrolyte daily requirement.

**Hestastarch** is a synthetic plasma expander that works by producing expansion of plasma blood volume. It is used to prevent shock following severe blood loss caused by trauma, surgery, or some other problem. It increases the blood volume, allowing red blood cells to continue to deliver oxygen to the body. It is not a substitute for blood or plasma. It does not have oxygen-carrying capacity. Dosage for plasma volume expansion: Adult: 500-1000 mL (up to 1500 mL/day) or 20 mL/kg/day (up to 1500 mL/day).

**INFUSION EQUIPMENT**

**Intravenous Infusion Set**

A standard IV infusion set consists of a pre-filled, sterile container (glass bottle, plastic bottle or plastic bag) of fluids with an attached drip chamber which allows the fluid to flow one drop at a time, making it easy to see the flow rate (and also reducing air bubbles); a long sterile tube with a clamp to regulate or stop the flow; a connector to attach to the access device; and connectors to allow "piggybacking" of another infusion set onto the same line, e.g. adding a dose of antibiotics to a continuous fluid drip.

**Intraosseous Device**

When it is difficult to establish IV access in casualties in shock, an intraosseous (IO) device offers an alternative route for administering fluids and medications. This allows the medical provider to avoid more difficult and invasive techniques like central venous cannulation or saphenous cut down. An intraosseous device, such as the Pyng FAST-1™, delivers fluid through the bone marrow of the sternal manubrium.

The technique of using this device is readily applicable in low light conditions or when there is an absence of the tibia (common spot for some IO devices) such as trauma from land mines or improvised explosive device (IED).

**Infusion Pump**

An infusion pump allows precise control over the flow rate and total amount delivered. Infusion pumps can administer fluids in ways that would be impractically expensive or unreliable if performed manually by nursing staff. These pumps can administer as little as 0.1 mL per hour injections (too small for a drip), injections every minute, injections with repeated boluses requested by the patient, up to maximum number per hour (e.g. patient-controlled analgesia), or fluids whose volumes vary by the time of day.

**BREATHING AIDS**

**LEARNING OBJECTIVE:**

Describe breathing aids and their uses.

As a HM, it is imperative to become familiar with the breathing aids that may be available to help maintain an open airway and to restore breathing in emergency situations. Breathing aids include oxygen, artificial airways, bag-valve mask ventilator, pocket face mask, and suction devices.

**USE OF OXYGEN (O2)**

In an emergency situation, HMs will have a size D or E cylinder of oxygen available.
SETTING UP A D-SIZED OXYGEN TANK

Condition

The HM needs to set up a D-sized oxygen tank. The HM has already performed a patient care hand-wash. The HM will need a full oxygen cylinder with a regulator/flowmeter, non-sparking cylinder wrench, oxygen regulator/flowmeter for D cylinders, yoke attachment, humidifier, sterile water, oxygen cylinder transport carrier and/or stand oxygen, oxygen administration device, and warning signs. The HM is not in a CBRNE environment.

Standards: Set up the oxygen tank without violating safety precautions or endangering patients or yourself.

Performance Steps

Take body substance isolation (BSI) precautions.

Obtain the necessary equipment.

Oxygen cylinder (Fig. 20-17).

NOTE:
Check the oxygen cylinder tag to determine whether the tank is "FULL", "IN USE" (partially full), or "EMPTY" (Fig. 20-18).

CAUTION:
Always ensure that the cylinder selected contains oxygen and not some other compressed gas. United States oxygen cylinders are color coded green, silver or chrome with a green area around the valve stem on top. The international color code is white.
Performance Steps

1. Cylinder with regulator/flowmeter. (Fig. 20-19).

![Cylinder Regulator](image)

**Figure 20-19 — Cylinder Regulator**

**NOTE:**
When the cylinder regulator pressure gauge reads 200 psi or lower, the oxygen tank is considered empty.

The pressure-compensated flowmeter is affected by gravity and must be maintained in an upright position.

2. Humidifier.

3. Sterile water.


5. Oxygen cylinder transport carrier and/or stand.

6. Oxygen administration device appropriate for the patient as ordered by the medical officer (nasal cannula, non-rebreather mask, or bag-valve mask device with reservoir).

7. Warning signs.
   a. "NO SMOKING".
   b. "OXYGEN IN USE".

**CAUTION:**
Because of the extreme pressure in oxygen tanks, they should be handled with great care.
Do not allow tanks to be banged together, dropped, or knocked over.

8. Secure the oxygen cylinder.
   a. Upright position or as directed in local standard operating procedures.
   b. Secured with straps or in a stand.
   c. Away from doors and areas of high traffic.

9. Remove the cylinder valve cap.

**NOTE:**
The cylinder valve cap may be noisy or difficult to remove; however, the threads of the cylinder cap should never be oiled.

10. Use either the hand wheel or a non-sparking wrench to "crack" (slowly open and quickly close) the cylinder to flush out any debris.

11. Attach the regulator/flowmeter to the cylinder.
   a. Locate the three holes on the oxygen cylinder stem and ensure that an "O" ring is present (Fig. 20-20).

![Attach Yoke Regulator](image)

**Figure 20-20.—Three holes on the oxygen cylinder stem**

**NOTE:**
If the "O" ring is not present, an oxygen leak will occur.
b. Examine the yoke attachment and locate the three corresponding pins on the yoke attachment (Fig. 20-21).

![Yoke regulator attachment](image)

Figure 20-21.—Yoke regulator attachment. Notice Three corresponding pins

NOTE: The compressed gas industry uses a "pin-indexing system" for portable gas cylinders. The locations of the pins on the yoke match only the regulator/flowmeter for an oxygen cylinder.

c. Slide the yoke attachment over the cylinder stem, ensuring that the pins are seated in the proper holes.

d. Turn the vise-like screw on the side of the yoke attachment to secure it.

e. Open the valve to test for leaks, and then close it.

   i. If you hear a leak, check the regulator connection and obtain a new Regulator/flowmeter and/or cylinder, if necessary.

   ii. When in-wall oxygen is available, the flowmeter will be attached to the oxygen outlet as follows:

      1. Turn the flow adjusting valve of the flowmeter to the OFF position.

      2. Insert the flowmeter adapter into the opening outlet and press until a firm connection is made.

f. Fill the humidifier bottle to the level indicated (about two-thirds full) with sterile water.

g. Attach the humidifier to the flowmeter.

NOTE: If an oxygen tube connector adapter is present, remove it from the flowmeter by turning the wing nut.

i. Attach the humidifier to the flowmeter with the nut on the humidifier.

   ii. Secure the nut by hand-tightening it.

NOTE: Humidifiers and tubing should be changed IAW local policy or when obviously contaminated.

12. Post warning signs.

CAUTION: "OXYGEN" and "NO SMOKING" signs should be posted in the areas where oxygen is in use or stored.
Bag-Valve Mask (BVM) Ventilator

The BVM ventilator is designed to help ventilate an unconscious casualty for long periods while delivering high concentrations of oxygen. When using external cardiac compressions, the cardiac output is cut to 25 to 30 percent of the normal capacity, and artificial ventilation does not supply enough oxygen through the circulatory system to maintain life for a long period. For this reason, this system can be useful in extended CPR attempts.

Various types of BVM systems come in adult and pediatric sizes and are in use in the Navy. Essentially, they consist of a self-filling ventilation bag, an oxygen reservoir, plastic face masks of various sizes, and tubing for connecting to an oxygen supply.

Oxygen can be added by hooking the BVM up to an oxygen supply. The rescuer's breath dilutes the oxygen flow in artificial ventilation, requiring adjustment to the flow rate to increase the oxygen concentration. At 5 liters per minute, the oxygen concentration will be approximately 50 percent. At 15 liters per minute, this concentration will increase to 90 percent.

Limitations of the Bag-Valve Mask (BVM) Ventilator

The bag-valve mask ventilator is difficult to use unless the user has had sufficient practice with it. The system can be hard to clean and reassemble properly; the bagging hand can tire easily; and an airtight seal at the face is hard to maintain, especially if a single rescuer must also keep the airway open. In addition, the amount of air delivered to the casualty is limited to the volume that the hand can displace from the bag (approximately 1 liter per compression).

Procedures for Operating the Bag-Valve Mask Ventilator

To use the BVM ventilator:

1. Connect the bag up to an oxygen supply and adjust the flow in the range of 10 to 15 liters per minute, depending on the desired concentration (15 liters per minute will deliver an oxygen concentration of 90 percent).

2. After opening the airway or inserting an oropharyngeal airway, place the mask over the face and hold it firmly in position with the index finger and thumb, while keeping the jaw tilted upward with the remaining fingers (Fig. 20-22).

3. Use the other hand to compress the bag once every 5 seconds.

4. Observe the chest for expansion. If none is observed, the face mask seal may not be airtight, the airway may be blocked, or some component of the BVM ventilator may be malfunctioning.

Figure 20-22.—Bag Valve Mask

Image provided by Sean Brennan of the Biomedical Photography Department of Navy Medicine Support Command, Bethesda, MD.
**Pocket Face Mask**

A face mask designed with an oxygen-inlet flow valve for mouth-to-mask ventilation can be used to give oxygen-enriched artificial ventilation. The pocket face mask system cannot achieve oxygen concentrations as high as the BVM system. It has the advantage of providing greater air volume (up to 4 liters per breath) and being much easier to use (both hands are free to maintain the airway and keeping the mask firmly in place). The pocket face mask acts as a barrier device preventing the rescuer from coming in contact with the patient’s body fluids and breath, which are possible sources of infection.

To use the pocket face mask:

1. Stand behind the head of the casualty
2. Open the airway by tilting the head backward.
3. Place the mask over the casualty’s face (for adults, the apex goes over the bridge of the nose; for infants, the apex fits over the chin, with the base resting on the bridge of the nose).
4. Form an airtight seal between the mask and the face, and keep the airway open by pressing down on the mask with both thumbs while using the other fingers to lift the jaw up and back.
5. Ventilate into the open chimney of the mask.

The oxygen cylinder is usually fitted with a yoke-style pressure-reducing regulator, with gauges to show tank pressure and flow rate (adjustable from 0 to 15 liters per minute). A humidifier can be attached to the flow meter nipple to help prevent tissue drying caused by the water-vapor-free oxygen. An oxygen line can be connected from the flow meter nipple or humidifier to a number of oxygen delivery devices that will be discussed later.

When available, oxygen should be administered, as described below, to cardiac arrest patients and to self-ventilating patients who are unable to inhale enough oxygen to prevent hypoxia (oxygen deficiency). Hypoxia is characterized by tachycardia, nervousness, irritability, and finally cyanosis.

Oxygen must never be used near open flames since it supports burning. Oxygen cylinders must be handled carefully since they are potentially lethal missiles if punctured or broken.

**ARTIFICIAL AIRWAYS**

The oropharyngeal and nasopharyngeal airways are primarily used to keep the tongue from occluding (closing) the airway.

**Oropharyngeal Airway**

The oropharyngeal airway (Fig. 20-23) can be used only on unconscious casualties because a conscious person will gag on it. This airway comes in various sizes for different age groups and is shaped to rest on the contour of the tongue and extend from the lips to the pharynx. Selecting the correct size oropharyngeal airway is very important to its effectiveness. An airway of proper size will extend from the corner of the patient’s mouth to the tip of the earlobe on the same side of the patient’s face.

![Figure 20-23 - Oropharyngeal Airways](image)

A method of insertion is to depress the tongue with a tongue blade and slide the airway in. Another method is to insert the airway upside down into the casualty’s mouth; then rotate it 180° as it slides into the pharynx; this technique is for adults only (Fig. 20-24). For full step by step directions for application of the oropharyngeal airway refer to Chapter 21.

Figure 20-24 Oropharyngeal insertion


Nasopharyngeal Airway

The nasopharyngeal airway may be used on conscious casualties as it is better tolerated because it generally does not stimulate the gag reflex. Selecting the correct size nasopharyngeal airway is very important to its effectiveness. An airway of proper size will extend from the patient’s nasal opening to the tip of the earlobe on the same side of the patient’s face. It is made of flexible material designed to be lubricated and then gently passed up the nostril and down into the pharynx. If the airway meets an obstruction in one nostril, withdraw it and try to pass it up the other nostril. See Figure 20-25 for proper insertion of the nasopharyngeal airway. For full step by step directions for the nasopharyngeal airway refer to Chapter 21.

Figure 20-25 A: Select the correct size; B: Lubricate the tip and insert along the curve of the nostril; and C: Nasopharyngeal airway inserted

Suction Devices

The patient’s airway must be kept clear of foreign materials, blood, vomitus, and other secretions. Materials that remain in the airway may be forced into the trachea and eventually into the lungs. This causes complications ranging from severe pneumonia to a complete airway obstruction. Use suction to remove such materials.

In the field, a HM may have access to a fixed (installed) suction unit or a portable suction device. Both types of suction devices are equipped with flexible tubing, suction tips and catheters, and a non-breakable collection container.

Maintenance of suction devices consists of testing the suction pressure regularly and cleaning the device after each use.

Before using a suction device, always test the apparatus. Once the suction pressure has been tested, attach a suction catheter or tip. Position the patient on their side and open the patient’s mouth. This position permits secretions to flow from the patient’s mouth while suction is being delivered. Use caution in patients with suspected neck or spinal injuries. If the patient is fully and securely immobilized on a backboard, the backboard may be tilted to place the patient on the side. If the HM suspects such injuries but the patient is not immobilized, suction as best as possible without turning the patient. Carefully insert the suction tip or catheter at the top of the throat. DO NOT push the tip down into the throat or into the larynx. Apply suction no more than a few seconds at a time, since supplemental oxygen or ventilations cease while suctioning which will keep oxygen from the patient. Suction may be repeated after a few breaths.

RESCUE AND TRANSPORTATION

LEARNING OBJECTIVES:

Identify protective equipment items that are used during patient rescues.

Explain how and when each protective equipment item should be used.

It is a basic principle of first aid that an injured person must be given essential treatment before being moved. However, it is impossible to treat an injured person who is in a position of immediate danger. If the casualty is drowning, or if the life is endangered by fire, steam, electricity, poisonous or explosive gases, or other hazards, rescue must take place before first aid treatment can be given.

The life of an injured person may well depend upon the manner in which rescue and transportation to a medical treatment facility are accomplished. Rescue operations must be accomplished quickly. After rescue and essential first aid treatment have been given, further transportation must be accomplished in a manner that will not aggravate the injuries. In these operations, a HM may be responsible to direct others as well as acting as the primary rescuer.

This section will cover the use of common types of protective equipment; rescue procedures; special rescue situations; ways of moving the patient to safety; and procedures for transporting the injured after first aid has been given.

PROTECTIVE EQUIPMENT

The use of appropriate items of protective equipment will increase the HM’s ability to affect rescue from life-threatening situations. Protective equipment that is generally available on naval vessels and some shore activities include the oxygen breathing apparatus (OBA); hose (air line) masks; protective (gas) masks; steel-wire lifelines; and devices for detecting oxygen insufficiency, explosive vapors, and some poisonous gases.
Oxygen Breathing Apparatus

An oxygen breathing apparatus (OBA) is provided for emergency use in compartments containing insufficient oxygen. The apparatus is used for rescue purposes as it is a self-contained unit. The wearer is not dependent upon outside air or any type of air line within the effective life of the canister. Independence of the outside atmosphere is achieved by having air within the apparatus circulated through a canister. Never allow oil or grease to come in contact with any part of an OBA as the oxygen can become violently explosive in its presence. If any part of the apparatus becomes contaminated with oil or grease smudges, clean it before it is stowed.

Another device used is a Self Contained Breathing Apparatus (SCBA). The source of oxygen comes from a bottle that is usually strapped to the back. The effective life of the canister (as used in the OBA) or bottle varies from 20 to 45 minutes, depending on the particular apparatus and the type of work being done. One of the newer types of OBA is designed so that personnel can change canisters without leaving the toxic atmosphere.

If a HM requires entering an extremely hazardous area, a lifeline must be worn. The lifeline should be tended by two persons, one of whom is also wearing a breathing apparatus.

Hose (Air Line) Masks

Hose masks are part of the allowance of all ships having repair party lockers. They are smaller than the oxygen breathing ensembles and used by individuals entering voids or other spaces that have very small access hatches. The hose or air line mask consists of a gas mask face piece with an adjustable head harness and a length of air hose. Note that the air line mask uses air rather than pure oxygen. It must NEVER be connected to an oxygen bottle, oxygen cylinder, or other source of oxygen. Even a small amount of oil or grease in the air line could combine rapidly with the oxygen and cause an explosion.

Safety belts are furnished with each air line mask and MUST BE WORN. A lifeline must be fastened to the safety belt; and the lifeline should be loosely lashed to the air hose to reduce the possibility of fouling. The air hose and lifeline must be carefully tended so that they do not become fouled or cut. The person wearing the air line mask and the person tending the lines should maintain communication by means of standard divers' line-pull signals.

Protective (Gas) Masks

Protective masks provide respiratory protection against chemical, biological, and radiological warfare agents. They do not provide protection from the effects of carbon monoxide, carbon dioxide, and a number of industrial gases. Protection from these gases is discussed in the section, "Rescue from Unventilated Compartments."

In emergencies, protective masks may be used for passage through a smoke-filled compartment or for entry into such a compartment to perform a job that can be done quickly (such as to close a valve, secure a fan, or de-energize a circuit). However, they provide only limited protection against smoke. The length of time personnel can remain in a smoke-filled compartment depends on the type of smoke and its concentration. Protective masks are only designed to filter air that passes through the canister.

Lifelines

The standard Navy lifeline is a steel-wire cable, 50 feet long. Each end is equipped with a strong hook that closes with a snap catch. The line is very pliable and will slide freely around obstructions.
Lifelines are used as a precautionary measure to aid in the rescue of persons. Rescue, if necessary, should be accomplished by having another person equipped with a breathing apparatus follow the lifeline to the person being rescued, rather than by attempting to drag the person out. Attempts to drag a person from a space may result in fouling the lifeline on an obstruction.

An important point to remember is that a stricken person must never be hauled by a lifeline attached to the waist. The casualty may be dragged along the deck a short distance, but the weight must never be suspended on a line attached to the waist. If not wearing a harness of some kind, pass the line around the chest under the armpits and fasten it in front or in back.

When tending a lifeline, rescue personnel must wear gloves to be able to handle the line properly. Pay out the line carefully to keep it from fouling. Try to keep the lifeline in contact with grounded metal; do not allow it to come in contact with any energized electrical equipment.

Detection Devices

The detection devices used to test the atmosphere in closed or poorly ventilated spaces include the oxygen indicator, for detecting oxygen deficiency; combustible-gas indicators, for determining the concentration of explosive vapors; and toxic-gas indicators, such as the carbon monoxide indicator, for finding the concentration of certain poisonous gases. The devices are extremely valuable and used whenever necessary. However, they MUST BE USED ONLY AS DIRECTED. Improper operation of these devices may lead to false assurances of safety or, worse, to an increase in the actual danger of the situation. For example, the use of a explosion proof safety lamp in a compartment filled with acetylene or hydrogen could cause a violent explosion.

**RESCUE PROCEDURES**

If a HM is faced with rescuing a person threatened by fire, explosive or poisonous gases, or some other emergency, the scene survey must be completed to determine the extent of the danger and ability to cope with it. In a large number of accidents, the rescuer rushes in and becomes the second casualty. Do not take unnecessary chances!

**Phases of Rescue Operations**

In disasters where there are multiple patients (as in explosions or ship collisions), rescue operations should be performed in phases. These rescue phases apply only to extrication operations.

- The first phase is to remove lightly pinned casualties, such as those who can be freed by lifting boxes or removing a small amount of debris.
- The second phase removes those casualties who are trapped in more difficult circumstances but who can be rescued by use of the equipment at hand and in a minimum amount of time.
- The third phase removes casualties where extrication is extremely difficult and time consuming.
  - This type of rescue may involve cutting through decks, breaching bulkheads, removing large amounts of debris, or cutting through an expanse of metal.
  - An example would be rescuing a worker from beneath a large, heavy piece of machinery.
- The fourth phase is the removal of dead bodies.
Stages of Extrication

As part of the four rescue phases outlined above, the extrication process takes place in stages.

- The first stage is gaining access to the casualty(s). Much will depend on the location of the accident, damage within the accident site, and the position of the casualty(s). The means of gaining access must take into account the possibility of causing further injury to the casualty.

- The second stage involves giving lifesaving emergency care. If necessary, establish and maintain an open airway, start artificial respiration, and control hemorrhage.

- The third stage is disentanglement. The careful removal of debris and other impediments from the casualty(s) will prevent further injury to both the casualty(s) and the rescuer.

- The fourth stage is preparing the casualty(s) for removal, with special emphasis on the protection of possible fractures.

- The fifth stage is removing the casualty(s) from the trapped area and transporting to an ambulance or sickbay. This may be as simple as helping the casualty(s) walk out of the area or as difficult as carrying the casualty(s) out of a burning space.

The risk of injury to other personnel and additional injury to the previously wounded soldiers/sailors will be reduced if immediate attention is directed to the suppression of hostile fire. The medical personnel may therefore initially need to assist in returning fire instead of stopping to care for the casualty. The best medicine on any battlefield is fire superiority. As soon as the medic is directed, or is able to, keeping the casualty from sustaining additional injuries is the first major objective. Wounded soldiers/sailors who are unable to participate further in the engagement should lay flat and still if no ground cover is available, or move as quickly as possible if nearby cover is available. If there is no cover and the casualty is unable to move himself to find cover, he should remain motionless on the ground so as not to draw additional fire. There are typically limited medical personnel available. If they sustain injuries, no other medical personnel may be available until the time of evacuation in the CASEVAC phase.

Combat is a frightening experience, and being wounded, especially seriously, can generate tremendous anxiety and fear. Engaging a casualty with reassurance is therapeutically beneficial, and communication is just as important in patient care on the battlefield as it is in the MTF.

Key Points

1. Return fire as directed or required.
2. The casualty(s) should also continue to return fire if able.
3. Try to keep from getting shot.
4. Try to keep the casualty from sustaining any additional wounds.
5. Airway management is generally best deferred until the Tactical Field Care phase.
6. Stop any life-threatening hemorrhage with a tourniquet.
7. Reassure the casualty.
Rescue from Fire

If a HM must go to the aid of a person whose clothing is on fire, smother the flames by wrapping the casualty in a coat, blanket, or rug. Leave the head UNCOVERED. If there is no material to smother the fire, roll the casualty over SLOWLY and put out the flames with hands beginning around the head and shoulders, and then work downward toward the feet. If the casualty tries to run, force them to the ground. The casualty MUST lie down while trying to extinguish the fire. Running will cause the clothing to burn rapidly. Sitting or standing may cause the casualty to be killed instantly by inhaling flames or hot air.

**CAUTION:**

Inhaling flames or hot air can kill.
Do not put the face directly over the flames.
Turn face away from the flame when inhaling.

If a rescuer’s clothing catches fire, roll up in a blanket, coat, or rug. **KEEP HEAD UNCOVERED.** If material to smother the fire is not available, lie down, roll over slowly, and pat at the flames with hands.

If trying to escape from an upper floor of a burning building, be cautious opening doors into hallways or stairways. Always feel a door before opening. If the door feels hot, do not open it if there is any other possible way out. Opening doors or windows will create a draft making the fire worse. Do not open any door or window until actually ready to get out.

If the HM is removing an injured person from an upper story of a burning building, it may be accomplished by improvising a lifeline by tying sheets, blankets, curtains, or other materials together. Use square knots to connect the materials to each other. Secure one end of the line around some heavy object inside the building, and fasten the other end around the casualty under the arms. First, lower the casualty to safety and then follow down the lifeline. Do not jump from an upper floor of a burning building except as a last resort.

It is often said that the "best" air in a burning room or compartment is near the floor, but this is true only to a limited extent. There is less smoke and flame down low, near the floor, and the air may be cooler. But it is also true that carbon monoxide and other deadly gases are just as likely to be present near the floor as near the ceiling. If possible, use an oxygen breathing apparatus or other protective breathing equipment when inside a burning compartment. If protective equipment is not available, cover mouth and nose with a wet cloth to reduce the danger of inhaling smoke, flame, or hot air.

**CAUTION:**

A wet cloth gives no protection against poisonous gas or lack of oxygen.

**RESCUE FROM STEAM-FILLED SPACES**

It is sometimes required to rescue a person from a space in that has a steam leak. Since steam rises, escape upward may not be possible. If the normal exit is blocked by escaping steam, move the casualty to the escape trunk or, if there is none, move to the lowest level in the compartment.
RESCUE FROM ELECTRICAL CONTACT

Rescuing a person who has received an electrical shock can be difficult and dangerous. Extreme caution must be used to avoid electrocution of the rescuer (Fig. 20-26).

Figure 20-26.—Moving an Electrical Shock Victim Away from the Electrical Source

CAUTION:
Do not touch the casualty's body with the wire or any other object that may be conducting electricity.

The first step is to look for the power switch. If found, turn the power off immediately. Do not waste time hunting for the switch as every second is important.

If the switch cannot be found, try to remove the wire from the casualty with a DRY broom handle, branch, pole, oar, or similar NON-CONDUCTING object. It may be possible to use a DRY rope or DRY clothing to pull the wire away from the casualty. The contact can be broken by cutting the wire with a WOODEN-HANDLED axe. This is extremely dangerous as the cut ends of the wire are likely to curl and lash back at the person's hands before having time to get out of the way. When trying to break an electrical contact, always stand on some non-conducting material such as a DRY board, DRY newspapers, or DRY clothing.

Rescue from Unventilated Compartments

Rescuing a person from a void, gasoline or oil tank, or any closed compartment or unventilated space can be a hazardous operation. Aboard naval vessels and at naval shore stations, no person is permitted to enter any such space or compartment until a gas free engineer in concurrence with a damage control officer (DCO), or some person designated by the DCO, has indicated that the likelihood of suffocation, poisoning, and fire or explosion has been eliminated as far as possible. The rescue of a person from any closed space should be performed under the supervision of the DCO or in accordance with the DCO's instructions. In general, observe the following precautions when attempting to rescue a person from any closed or poorly ventilated space:

- If possible, test the air for oxygen deficiency, poisonous gases, and explosive vapors
- Wear a hose (air line) mask or oxygen breathing apparatus.
  - The air line mask is preferred for use in spaces that may contain high concentrations of oil or gasoline vapors
  - Do not depend on a protective mask or a wet cloth held over the face to protect from oxygen deficiency or poisonous gases
  - Before going into a compartment that may contain explosive vapors, be sure that people are stationed nearby with fire-extinguishing equipment
- When going into any space that may be deficient in oxygen or contain poisonous or explosive vapors, be sure to maintain communication with someone outside
  - Wear a lifeline and be sure that it is tended by a competent person

20-25
- Do not use, wear, or carry any object or material that might cause a spark
  - Matches, cigarette lighters, flashlights, candles or other open flames, and ordinary electrical lights must NEVER be taken into a compartment that may contain explosive vapors
  - The types of portable lights used by cleaning parties in boilers, fuel tanks, and similar places may be taken into a suspect compartment
  - This is a steam-tight, glove-type light whose exposed metal parts are either made of non-sparking alloy or protected in some way so they will not strike a spark.

If it is necessary to go into a space that may contain explosive vapors, do not wear clothing that has any exposed spark-producing metal. For example, do not wear boots or shoes that have exposed nail heads or rivets, and do not wear coveralls or other garments that might scrape against metal and cause a spark.

Particular caution must be made concerning the use of the steel-wire lifeline in compartments that may contain explosive vapors. If the steel-wire line is used, ensure it is carefully tended and grounded at all times. When other considerations permit, use a natural fiber rope line instead of the steel-wire lifeline when entering these compartments.

Rescue from the Water

Never attempt to swim to the rescue of a drowning casualty unless properly trained in lifesaving methods and then only if there is no better way of reaching the casualty. A drowning casualty may panic and fight against the rescuer in a violent manner making rescue difficult. The rescuer must avoid injury to themselves or the casualty. A non-trained rescuer can help a drowning casualty by holding out a pole, oar, or stick for the casualty to grasp; or by throwing a lifeline or some buoyant object that will support the casualty in the water.

Various methods are used aboard ship to pick up survivors from the water. The methods used in any particular instance will depend upon weather conditions, the type of equipment available aboard the rescue vessel, the number of people available for rescue operations, the physical condition of the people requiring rescue, and other factors.

It is frequently difficult to get survivors up to the deck of the rescuing vessel, even after they have been brought alongside the vessel. Cargo nets are often used, but many survivors are unable to climb them without assistance. Persons equipped with lifelines (and, if necessary, dressed in anti-exposure suits) can be sent over the side to help survivors up the nets.

A seriously injured person should never, except in an extreme emergency, be hauled out of the water by means of a rope or lifeline. Special methods must be devised to provide proper support, both to keep the casualty in a horizontal position and to provide protection from any kind of jerking, bending, or twisting motion. The Stokes stretcher (Fig.3-25) can often be used to rescue an injured survivor. People on the deck of the ship can then bring the stretcher up by means of hand-lines. Life preservers, balsa wood, unicellular material, or other flotation gear can be used, if necessary, to keep the stretcher afloat.

Treatment of Radioactive Contaminated Personnel

Treatment of life-threatening injuries, e.g., severe trauma, shock, hemorrhage, and respiratory distress, always takes precedence over decontamination procedures. This includes treatment of possible symptoms from irradiation and dose estimation procedures. Medical emergency response personnel teams must not be impeded when proceeding to render emergent care for reasons such as issuing dosimeters or controlling access to restricted areas. To stop emergency response personnel in such situations clearly displays a lack of understanding and good judgment.
It is instructive to note no health care worker in the United States has ever suffered radiation injury secondary to rendering emergency care to a contaminated patient. These points must be stressed because of a number of events that have occurred.

Under no circumstances will any individual be denied access to necessary treatment or treatment facilities because of radioactive contamination. Medical treatment of emergency medical conditions (conditions which can become medically critical or life threatening) and medical conditions with the risk of morbidity (conditions which will result in permanent injury or deficits) must always take precedence over decontamination or containment procedures. Concerns about the spread of radioactivity, i.e., radioactive contamination, or the possible contamination of medical personnel are nonetheless appropriate and should be attended to after the patient has been stabilized.

MOVING THE CASUALTY TO SAFETY

In an emergency, there are many ways to move a casualty to safety. Ranging from one-person carries to stretchers and spine boards. The casualty’s condition and the level of danger will dictate the appropriate method. Give all necessary first aid BEFORE moving the casualty.

Stretcher

The military uses a number of standard stretchers. When using a stretcher, the HM should consider a few general rules:

- Use standard stretchers when available and be ready to improvise safe alternatives
- When possible, bring the stretcher to the casualty
- Always fasten the casualty securely to the stretcher
- Always move the casualty FEET FIRST so the rear stretcher bearer can watch for signs of breathing difficulty

Stokes Stretcher

The Navy service litter most commonly used for transporting sick or injured persons is the Stokes stretcher (Fig. 20-27). It is a wire basket supported by iron rods. Even if the stretcher is tipped or turned, the casualty can be held securely in place, making the Stokes adaptable to a variety of uses. This stretcher is particularly valuable for transferring injured persons to and from boats. As mentioned before, it can also be used with flotation devices to rescue injured survivors from the water. Additionally, it can be used for direct ship-to-ship transfer of injured persons. Fifteen-foot tending lines are attached to each end for shipboard use in moving the casualty. It is limited to one casualty or 400 lbs.

![Figure 20-27.—Stokes Stretcher](image-url)
The Stokes stretcher should be padded with three blankets: two of them should be placed lengthwise so that one will be under each of the casualty’s legs, and the third should be folded in half and placed in the upper part of the stretcher to protect the head and shoulders. The casualty should be lowered gently into the stretcher and made as comfortable as possible. The feet must be fastened to the end of the stretcher so that the casualty will not slide down. Another blanket (or more, if necessary) should be used to cover the casualty. The casualty must be fastened to the stretcher by means of straps that go over the chest, hips, and just above the knees. Note that the straps go OVER the blanket or other covering, thus holding it in place.

Kendrick Extrication Device (KED)\textsuperscript{25}

Semi-rigid support used to immobilize casualties with minor neck and back injuries. It has the same limitations as the Stokes Litter (Fig. 20-28).

Miller (Full Body) Board

The Miller Board (Fig. 20-29) is constructed of an outer plastic shell with an injected foam core of polyurethane foam. It is impervious to chemicals and elements. It can be used in virtually every confined-space rescue and vertical extrication. It provides for full body immobilization through a harness system, including a hood and two-point contact for the head (forehead and chin) to stabilize the head and cervical spine. The narrow design allows passage through hatches and crowded passageways. It fits within a Stokes (basket) stretcher and will float a 250-pound person.

Figure 20-28 — Kendrick Extrication Device

Figure 20-29.—Miller (Full-Body) Board
Improvised Stretchers

Standard stretchers should be used whenever possible to transport a seriously injured person. If none are available, it may be necessary to improvise. Shutters, doors, boards, and even ladders may be used as stretchers. All stretchers of this kind must be very well padded (to reduce pressure points) and care must be taken to see that the casualty is fastened securely in place.

At times, a blanket may be used as a stretcher. The casualty is placed in the middle of the blanket in the supine position. Three or four people kneel on each side and roll the edges of the blanket toward the casualty. When the rolled edges are tight and large enough to grasp securely, the casualty should be lifted and carried.

Stretchers may be improvised by using two long poles (about 7 feet long) and strong cloth (such as a rug, a blanket, a sheet, a mattress cover, two or three gunny sacks, or two coats).

**CAUTION:**

Many improvised stretchers do not give sufficient support in cases where there are fractures or extensive wounds of the body.

They should be used only when the casualty is able to stand some sagging, bending, or twisting without serious consequences.

An example of this type of improvised stretcher would be one made of 40 to 50 feet of rope or 1-1/2-inch fire hose loosely weaved between two long poles.

Reeves Sleeve

Reeves Sleeve is designed for rapid immobilization of spinal and neck injuries in tight places. It is constructed of lightweight vinyl-coated polyester that is easily washed with soap and water.

It has one vertical lift point and four horizontal lift points for helicopter hoist capability allowing the sleeve to hoist patients from any angle. For head and cervical support, it includes removable Velcro head-securing blocks, adjustable head- and chin-securing straps, a chest- and arm-securing flap with Velcro, a leg-securing flap with Velcro and a spine board compartment for added strength and rigidity. Six chest and six leg straps with buckles and a yellow "fail-safe" strap are used for security. This stretcher has a load capacity of over 1,000 lbs.

Spineboards

Spineboards are equipment used in the immobilization of suspected or real fractures of the spinal column. They are made of fiberglass or exterior grade plywood, come in two sizes, short (18" × 32") and long (18" × 72"), and are provided with handholds and straps. Spineboards have a runner on the bottom to allow clearance to lift (Fig. 20-30).

![Figure 20-30.—Spineboard](image)

A short spineboard is primarily used in extrication of a sitting casualty, especially in automobile wrecks (where it would be difficult to maneuver the casualty out of position without doing additional damage to the spine). The long board makes a firm litter, protecting the back and neck, and providing a good surface for CPR and a good sliding surface for difficult extractions.
The short and long boards are often used together. For example, at an automobile accident site, the HM’s first task is to assess the whole situation and to plan the rescue. If bystanders must be used, it is essential that they be briefed in thorough detail on what the HM wants them to do.

Securing the casualty to the spineboard:
1. After all accessible bleeding has been controlled and the fractures splinted, the short spineboard should be moved into position behind the casualty.
2. A neck collar should be applied in all cases and will aid in the immobilization of the head and neck.
3. The head should then be secured to the board with a headband or a 6-inch self-adhering roller bandage.
4. The casualty’s body should then be secured to the board by use of the supplied straps around the chest and thighs.
5. The casualty may then be lifted out.
6. If the casualty is too large, or further immobilization of the lower extremities is necessary, the long spineboard may be slid at a right angle behind the short spineboard, and the casualty maneuvered onto the side and secured to the longboard.

Emergency Rescue Lines

The steel-wire line can be used to haul a person to safety. An emergency rescue line can be made from any strong fiber line. Both should be used only in extreme emergencies, when an injured person must be moved and no other means is available.

Figure 20-31 shows an emergency rescue line used to hoist a person from a void or small compartment. The running bowline is passed around the body, just below the hips, and a half hitch is placed just under the arms. The guideline is tied loosely to the casualty’s ankles to prevent banging against bulkheads and hatchways.

Rescue Drag and Carry Techniques

The HM may be required to evacuate a sick or injured casualty from an emergency scene to a location of safety. A casualty carried by manual means must be properly handled; otherwise the injuries may become more serious or possibly fatal. Situation permitting, evacuation or transport of a casualty should be organized and unhurried.

Manual carries can be tiring for the bearer(s) and involve the risk of increasing the severity of the casualty’s injury. In some instances, however, they are essential to save life and limb.
Manual carries should be accomplished by one or two stretcher bearers, if possible. They provide more comfort to the casualty, are less likely to aggravate injuries, and are also less tiring for the stretcher bearers. The distance a casualty can be carried depends on many factors:

- Strength and endurance of the stretcher bearer(s)
- Weight of the casualty
- Nature of the casualty’s injury
- Obstacles encountered during transport

The HM should choose the most effective evacuation technique (one or two rescuer) that will be the least harmful to both the rescuer and the casualty.

**ONE-RESCUER TECHNIQUES**

If a casualty can stand or walk, assist them to a safe place.

If there are no indications of injury to the spine or an extremity but the casualty is not ambulatory, they can be carried by means of any of the following:

- **Fireman’s Carry**: One of the easiest ways to carry a casualty (unconscious or unable to walk (Fig. 20-32).

![Figure 20-32.—Fireman’s Carry](image1)

- **Pack-strap Carry**: With the pack-strap carry, shown in Figure 20-33, it is possible to carry a heavy casualty for a considerable distance. Use the following procedure:

![Figure 20-33.—Pack-Strap Carry](image2)

1. Place the casualty in a supine position.
2. Lie down sideways along the casualty’s uninjured or less injured side. The HM’s shoulder should be next to the casualty’s armpit.
3. Pull the casualty’s far leg over the HM’s leg, holding it there if necessary.
4. Grasp the casualty’s far arm at the wrist and bring it over the HM’s upper shoulder as the HM rolls and pulls the casualty onto the back.
5. Raise up the HM’s knees, holding the free arm for balance and support. Hold both the casualty’s wrists close against the HM’s chest with the other hand.
6. Lean forward as the HM rises to his/her feet, and keep both of his/her shoulders under the casualty’s armpits. Do not attempt to carry a seriously injured person by means of the pack-strap carry, especially if the arms, spine, neck, or ribs are fractured.
- **Arm Carry**: The technique for a one-person arm carry is shown in Figure 20-34. Never try to carry a person who is seriously injured with this method. Unless that casualty is smaller than the rescuer, the HM will not be able to carry the casualty very far using this technique.

![Figure 20-34.—Arm Carry](image)

- **Blanket Drag**: A variant of the blanket drag is the *clothes drag*, where the rescuer drags the casualty by the clothing on the casualty's upper body (Fig. 20-35).

![Figure 20-35.—Blanket Drag](image)

- **Tied-hands Crawl**: The tied-hands crawl, shown in Figure 20-36, may be used to drag an unconscious casualty for a short distance. It is useful when required to crawl underneath a low structure. It is the least desirable method as the casualty's head is not supported.

1. Place the casualty in the supine position.
2. Cross the wrists and tie them together.
3. Kneel astride the casualty and lift the arms over the HM's head so that the wrists are at the back of the neck.
4. When crawling forward, raise shoulders high enough so that the casualty's head will not bump against the deck.

![Figure 20-36.—Tied-Hands Crawl](image)
TWO-RESCUER TECHNIQUES

If the casualty is ambulatory, the HM and assistant should assist the casualty to safety. If the casualty has either a spinal injury or a fractured extremity, there are a number of two-rescuer techniques that can be used to move the casualty to safety.

- **Chair Carry:** The chair carry can often be used to move a sick or injured person away from a position of danger. The casualty is seated on a chair and the chair is carried by two rescuers. This is a particularly good method to use when the HM must carry a person up or down stairs or through narrow, winding passageways. This carry **must NEVER be used to move a person who has an injured neck, back, or pelvis.**

- **Arm Carry:** The two-person arm carry, shown in Figures 20-37 and 20-38, can be used in some instance to move an injured person. However, this carry should not be used to carry a person who has serious wounds or broken bones. This carry must not be used to move seriously injured persons.

![Figure 20-37.—Chair Carry](image-url)