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# I. OVERVIEW OF FIRST AID TREATMENT

## 1. Why is first aid treatment necessary?

Among the sick and wounded involved in accidents, or suffering from sudden illnesses, there are some patients who are in critical condition due to symptoms such as consciousness disorders, difficulty in breathing, circulation disorders, and bleeding. During these times, their lives are in constant danger so they must be immediately brought to a suitable medical facility to receive the correct treatment.

Prompt transportation and treatment by ambulance paramedics is essential to increase the chances of saving the patient's life during such times. If necessary, the general public should perform proper first aid treatment as well, which may help to save the patient's life and alleviate any after-effects.

Even if a patient is not in critical condition, first aid treatment relieves their anxiety or pain after an injury, burn, or poisoning; or relieves the symptoms of any endogenous or exogenous disease. Therefore, ambulance paramedics must choose the correct first aid procedure to treat various injuries or diseases, and must be skillful enough to perform each first aid procedure correctly

## 2. Chain of Survival

The concept of "chain of survival" (Fig. 3-2-18) was advocated because it is important for bystanders (ordinary citizens who are beside the patient), ambulance paramedics, and medical facilities to cooperate closely with each other to save the life of a sudden cardiac-arrest victim.

To achieve success in life support, it is necessary to link the "four chains"; namely, "early access" (early ambulance call), "early CPR" (early basic life support by cardiopulmonary resuscitation), "early defibrillation", and "early ALS" (early advanced life support). First aid treatment performed by ambulance paramedics is, therefore, important in saving human life and alleviating any after-effects. It also establishes an important link between first aid treatment by ordinary citizens and the life support treatment by medical facilities.

## 3. Life support and first aid treatments by ordinary citizens

There are many first aid procedures that ordinary citizens can perform, such as treating wounds or burns, immobilizing a limb with a splint, removing foreign objects, warming, and body position control. Among such treatments, "life support treatment" for resuscitation of the heart includes: opening an airway, artificial respiration, chest massage, and treatment to stop bleeding.

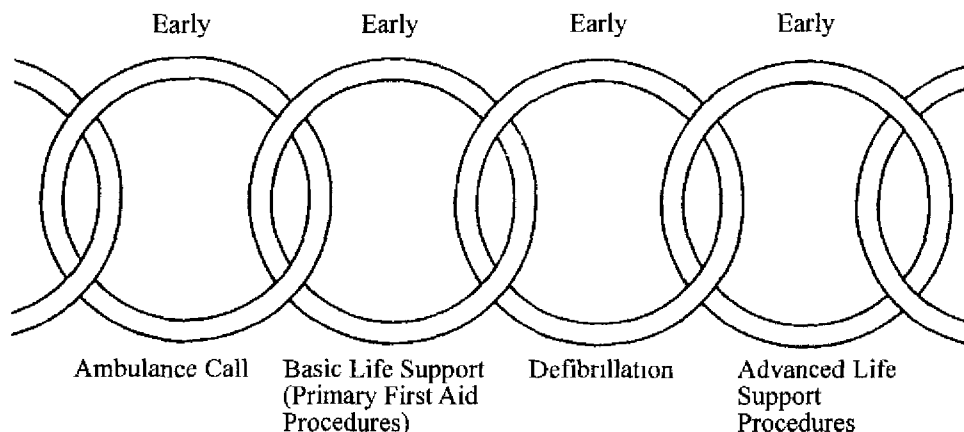


Fig. 3-2-18 Chain of Survival

#### **4. Emergency procedures by ambulance paramedics who have completed "Course I"**

Emergency procedures, which can be performed by ambulance paramedics who have completed Course I, include: securing an airway using hands or another oral airway, artificial respiration by aspiration of the oral contents, blowing air into the victim's mouth, using a mask bag or a manual trigger respirator, removing foreign objects from an airway using the Heimlich maneuver or hitting the back of the victim; feeding oxygen via a oxygen inhalator, chest massage, stopping bleeding, using dressings and bandages, splinting, warming, and body position control.

#### **5. First aid procedures by ambulance paramedics who have completed "Course II"**

In addition to the first aid procedures, emergency procedures that can be performed by ambulance paramedics who have completed Course II, include: auscultation (of the heart and respiratory sounds) using a stethoscope; measurement of blood pressure using a sphygmomanometer; observation of heartbeat and transmission of electrocardiograms using an electrocardiograph, observation of SpO<sub>2</sub> using a pulse oximeter, securing of an airway using the oral airway, removal of foreign objects in the trachea using a laryngoscope and McGill clamp, chest massage using an automatic chest massager, preservation of the blood pressure and immobilization of the legs using shock pants (MAST), and medical care for patients receiving medical treatment at home

#### **6. Ambulance life-support procedures by the ambulance paramedics**

In addition to first aid procedures, life-support procedures that can be performed by ambulance paramedics include: securing an airway by using medical instruments designated by the Minister of Health, Labor and Welfare (laryngeal mask, EOA, EGTA, WB tube, two-way tube), infusion to secure the venous path, and defibrillation using automatic external defibrillation equipment.

When performing securing an airway by using medical instruments and infusion to secure the venous path, it is mandatory to receive specific instructions from a physician.

When an ambulance paramedic performs ambulance life-support procedures, including the aforementioned procedures, it is essential for other ambulance paramedics, rescuers, or firemen to assist the paramedic so that they can perform procedures effectively.

#### **7. First aid procedures in a doctor's car or a doctor's helicopter**

Previously, some medical facilities and fire departments have been using a doctor's car and have yielded positive results. In addition, recently the Ministry of Health, Welfare and Labor have decided to introduce doctors' helicopters nationwide from 2001 fiscal year based on successful local results. Since first aid procedures are mainly performed by a doctor in the doctor's car or the doctor's helicopter, these procedures are considered basically the same as those done in an emergency room of a medical facility.

#### **8. First aid procedures by bystanders**

Recent attention has been given to the importance of training bystanders to provide proper pre-hospital care for victims of heart attack or cerebral stroke. This subject is covered as one of the major issues in the "Guidelines 2000 for Cardiopulmonary Resuscitation" of the American Heart Association (AHA). In particular, training is given to those people who have a high chance of encountering a victim or a patient in serious condition; in particular, police officers, fire fighters, aircraft crew, and staff of theaters, sports facilities, and health facilities in large-scale buildings. Training for these people is no different to those receiving general cardiopulmonary resuscitation training, however upgrading of supporting infrastructure is recommended, including training in the use of the automatic external defibrillator (AED), and the introduction of the AED to these facilities.

## **9. "Load and go", "Stay and stabilize"**

Ambulance paramedics must judge (at each emergency site) what kind of procedure they should use (and how long they should perform it) depending on various factors such as the condition of the victim, the skill level of the ambulance paramedics, the distance from the emergency site to a suitable medical facility, the state of emergency medical treatment to be performed at the medical facility, and the environment of the emergency site. Primarily, they must select a procedure that allows the victim to recover from their serious condition most effectively.

Generally, in serious injuries or sudden surgical diseases, sufficient treatment cannot be provided at the emergency site, so it is necessary to perform an emergency operation for the victim in a medical facility, such as an emergency life-support center. Therefore, it is desirable to transport the victim according to the "load and go" procedure (fixing the victim's cervical spine or spinal cord as necessary and immediately transporting them to a medical facility).

On the other hand, for cardiac-stoppage or respiratory-tract-blockage victims, it is most important to restore their heartbeat as soon as possible, or to immediately remove a foreign object from their respiratory tract. Such first aid procedures are the most important in view of the vital prognosis. Therefore, it is desirable to follow the "stay and stabilize" procedure (staying with the victim, and performing the procedure at the emergency site that best improves the victim's condition).

## **10. Precautions in performing first aid procedures**

### **1) Prevention of Secondary Disaster**

In disasters such as traffic accidents, fires, explosions, earthquakes and gas poisoning, it is important not only to rescue victims and perform first aid procedures for them, but it is also essential to prevent any secondary disaster from affecting the rescue team or bystanders. In particular, it is essential to wear protective equipment when entering a dangerous area where any explosion, electric shock or gas poisoning may occur and, at an accident site where the

traffic is heavy, the victim must be shifted to a safe place as soon as possible. It is also necessary to keep in close contact with the police, the rescue team, and the fire department on a day-to-day basis.

### **2) Measures against infection**

In cases such as traffic accidents or on-the-job accidents, many victims bleed, thus first-aiders are in danger of being exposed to infectious diseases via blood or body fluids. Moreover, when caring for a victim who has difficulty in breathing, and is vomiting blood or expectorating a lot of sputum, first-aiders must assume that the victim may be suffering from active tuberculosis.

Moreover, victims complaining of diarrhea, fever, or general malaise, (including those who have returned from overseas) may have a known or unknown infectious disease. Therefore, all ambulance paramedics must correctly recognize the danger of infectious diseases and take appropriate precautions against being infected during their work by wearing protection such as a mask, gown, and gloves.

### **3) The advantages (and disadvantages) of first aid procedures**

Ambulance paramedics perform first aid procedures to improve and stabilize the condition of a patient. However, you must be aware that, depending on the situation and treatment method, there is a danger of worsening the condition of the victim. For example, cooling a victim's burn with running water is only safe if applied to a relatively small area of their body. For a more extensive burn, however, you must be careful, because excessive cooling may lower their body temperature and cause them to suffer from a consciousness disorder, irregular pulse, hypotension, etc.

When a victim has a chest injury, complains of difficulty in breathing, and has a lowered SpO<sub>2</sub> value, it is necessary to perform oxygen inhalation. And if their SpO<sub>2</sub> value remains low, even after oxygen inhalation, then you must then perform artificial respiration using high-concentration oxygen.

However, if the victim is suffering from a pneumothorax due to lung damage, then performing artificial positive-pressure respiration

will worsen their condition and may even cause the victim to die due to a tension pneumothorax. In other words, a first aid procedure performed to try to improve the condition of a victim may, in fact, worsen their prognosis. Therefore, it is essential for first-aiders to realize that all first aid procedures performed at emergency sites are "double-edged swords".

#### **4) Explanation to victims**

As a matter of course, the first-aiders must ask the victim (if they are conscious), or a person or a family member accompanying the victim (if the victim is unconscious or is an infant), to outline their symptoms including the circumstances that to their present condition. In addition, the first-aiders must ask whether the victim has another disease or condition.

Furthermore, it is essential (if possible) to obtain prior consent from the victim (or their representative) by explaining (clearly and respectfully) about the need for (and effect of) the intended first aid procedure. Indeed, you must always remember that performing a first aid procedure without sufficient explanation may break (rather than develop) mutual trust.

## **II. EMERGENCY TEXT**

### **1. Securing an airway**

#### **1) Conditions where securing an airway is necessary**

The term "airway" refers to the path by which inhaled air passes into the lungs. The airway includes the nose, mouth, pharynx, larynx, vocal cords, glottis, trachea, bronchial tubes, and bronchioles. If, for some reason, a patient's airway becomes constricted or blocked, and the patient complains it is difficult to breathe, then it is necessary to perform a procedure to secure their airway. If this is not done, then the patient may die.

There are many possible causes of blockage in the airway, including depression of the tongue in consciousness-impaired patients, laryngeal edema due to inhalation burns or inflammation, a foreign object in the trachea, and swelling.

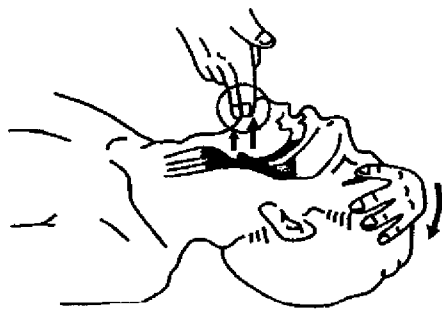
#### **2) Diagnosing constriction or blockage of an airway**

Judge the extent of constriction or blockage to the airway by assessing the victim for signs such as wheezing, hypophonia, forced respiration, cyanosis, whistling rale, attenuation of breathing sounds, retractions of the supraclavicular fossa and intercostal space, shock, or consciousness disorders. If the airway is only partially blocked, a variety of noises can be heard as the patient breathes. However, if the airway is totally blocked, the victim struggles to breathe or speak while holding their throat.

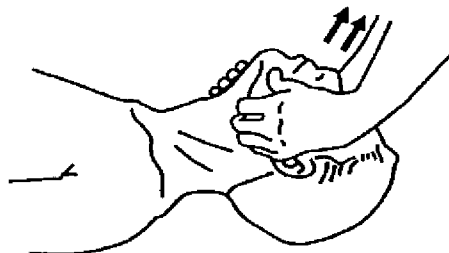
#### **3) Using the hands to secure an airway (Fig. 3-2-19)**

##### **(1) The head-tilt and chin-lift method (chin-lift method)**

First place the palm of one hand on the forehead of the patient then lift their chin with the index and middle fingers of the other hand while softly tilting their head back with the other hand. However, if there is any possibility that the patient's cervical vertebrae or cervical spinal cord is damaged, then instead try to secure an airway using the jaw-lift method described below, otherwise you may cause additional damage such as paralysis.



Head-tilt and chin-lift method



Jaw-lift method

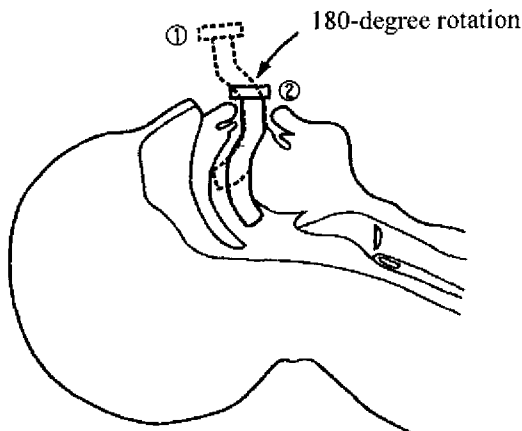
**Fig. 3-2-19 Techniques for using the hands to secure an airway**

#### (2) The jaw-lift method

Position yourself at the top (or side) of the patient's head, and grasp the ascending branch of the lower jaw with all of your fingers (excluding the thumbs). Place both thumbs on the lower jaw slightly below the corners of the mouth. Then, while tilting back their head with your forearms, use your fingers (excluding the thumbs) to lift the lower jaw so that their lower-teeth stick out more than the upper teeth. At the same time, use your thumbs to push down the lower lip so that the patient's mouth is open slightly. To summarize, the jaw-lift method requires three techniques to be performed simultaneously:

- ① Tilt head to the rear
- ② Lift the lower jaw
- ③ Open the mouth

Due to these three techniques, the other name for this method is "triple airway maneuver". However, if there is any possibility that the patient's cervical spinal cord is damaged, then one should try to secure an airway only by lifting the jaw and opening the mouth



Insert the airway into the mouth of the victim. When the end of airway reaches deep into the hypopharynx, rotate the airway 180 degrees.

**Fig. 3-2-20 Method to insert the airway from the mouth (oropharyngeal airway)**

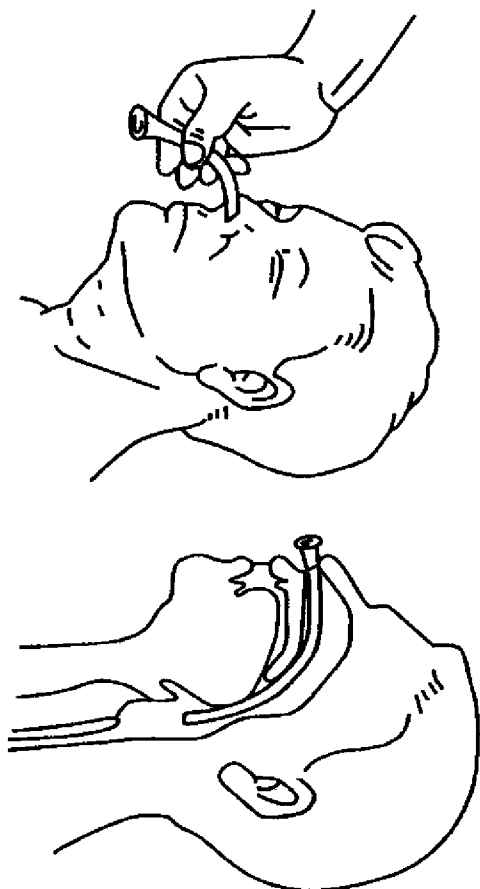
#### 4) Securing an airway by using devices

##### (1) Securing an airway by using an oropharyngeal airway (Fig. 3-2-20)

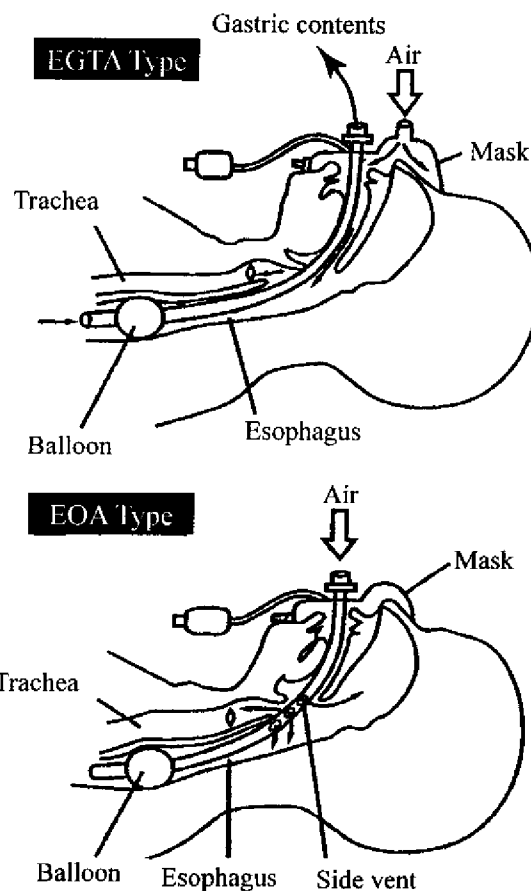
This device (oropharyngeal airway or oral airway) is used to prevent the base of tongue from depressing and to secure an airway from the mouth. To insert the device into the mouth, place the outer part of the bend toward the jaw and push the device into the mouth while putting it on the palate, and then rotate it a half-turn inside the mouth. Be careful not to force it into the mouth as it may further depress the base of tongue. After the device is set in its proper position, confirm that an airway is secured, and then be sure to secure the airway device with an adhesive plaster or similar.

##### (2) Securing an airway by using a nasopharyngeal airway (Fig. 3-2-21)

This device (nasopharyngeal airway or nasal airway) is a tube, which is to be inserted from the nose into the posterior part of the pharynx to secure an airway. The end of the nasopharyngeal airway is usually inserted deeper than the depressed base of tongue, thus it is the most effective method to secure an airway. However, for a patient suffering from deviation of the nasal septum (or similar), be careful as it may be difficult to insert, or it may cause nasal bleeding.



**Fig. 3-2-21 Method to insert the airway from the nose (nasopharyngeal airway)**



**Fig. 3-2-22 Securing an airway using the esophageal obturator airway**

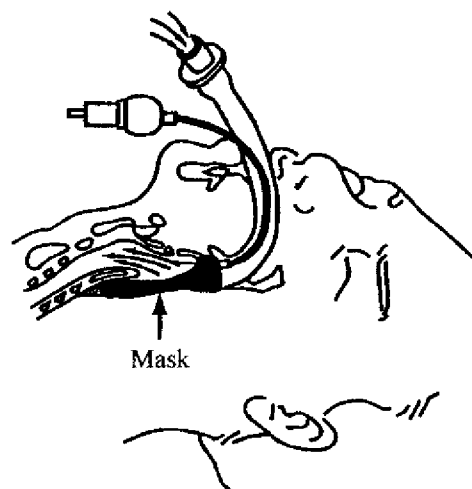
### **(3) Securing an airway by using special devices**

① Securing an airway using the esophageal obturator airway (Fig. 3-2-22)

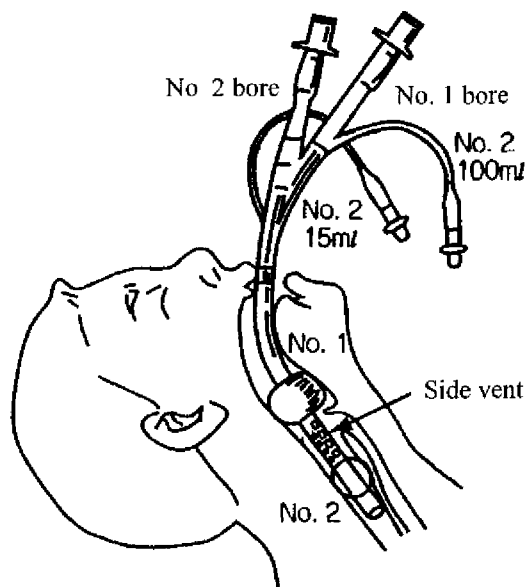
This device is used by ambulance paramedics to secure an airway. This airway consists of a facemask and a cuffed tracheal tube. The esophageal obturator airway has three variations; specifically, the tube either has a blind end (EOA type), an open end (EGTA type), or is the WB type. In all variations, the tube can be inserted into the esophagus and the balloon inflated to prevent air from entering into the esophagus, thus this device is used during ventilation

② Securing an airway using the laryngeal mask (Fig. 3-2-23)

This device is used by ambulance paramedics to secure an airway. A dish-shaped or soft oval



**Fig. 3-2-23 Securing an airway using the laryngeal mask**



**Fig. 3-2-24 Securing an airway using the combitube**

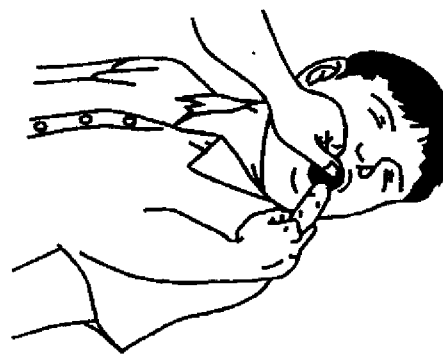
cuff is mounted at the end of the tube. This cuff can be inserted into the larynx and inflated so that it closes the inlet of the esophagus and secures an airway by expanding around the larynx. This device masks around the larynx, thus it is called the laryngeal mask.

③ Securing an airway using the combitube (two-way tube) (Fig 3-2-24)

This device is used by ambulance paramedics to secure an airway. There are two bores in the tube: one bore leads to the side vent, and the other bore leads to the end of the tube. One large balloon and one small balloon are mounted inside the tube. You can “blindly” insert this tube via the mouth of the patient, because if the tube goes into the esophagus, ventilation can then occur through the vent bore. Alternatively, if the tube goes into the trachea, ventilation can occur through the end of the tube.

④ Securing an airway by inserting a tube through the trachea

Many ambulance paramedics in foreign countries perform this method as a normal and reliable means of securing an airway, but in Japan it is not permitted, except by physicians (On/after 1st July, 2004, ambulance paramedics are allowed to perform this method according to specific instructions from a physician, if they are admitted that they have had a sufficient training.). There are two variations in inserting the tube through the trachea: insertion via the mouth or insertion via the nose. There are also two types of tubes



**Fig. 3-2-25 Cleaning the oral cavity**

(large or small) so that they can be used on anyone, including babies and the elderly. The small one (without the cuff) is used for babies and infants. The large one (with a cuff) is used in children and adults. The key point in inserting the tube is to use a laryngoscope to fully widen the larynx around the inlet of the trachea.

**4) Cleaning and suction inside the oral cavity (Fig. 3-2-25)**

If any foreign objects or regurgitated objects remain inside the oral cavity or around the larynx, open the mouth of the patient using the finger-cross method and remove the objects with your fingers (using a piece of gauze) or take them out with forceps or a similar instrument. Alternatively, remove them with a suction device. When doing so, it is most effective to use a laryngoscope

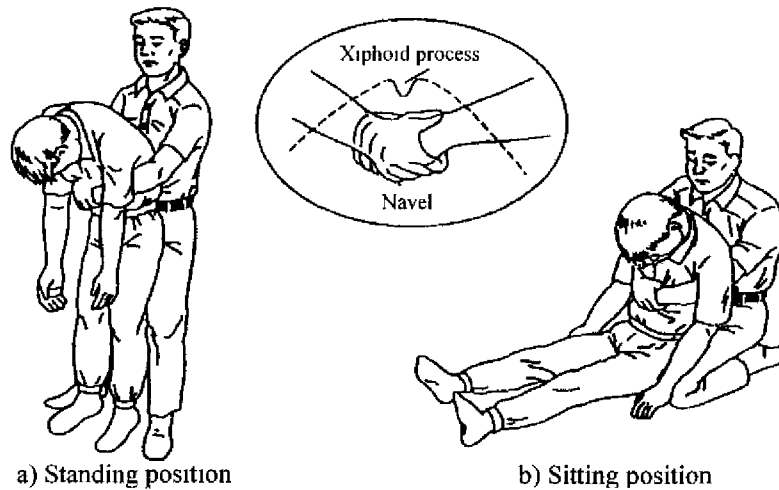
**5) Precautions of securing an airway**

When securing an airway, the most suitable method should be selected according to the condition of the victim and the skill of the ambulance paramedic in charge. If the victim's airway is not considered not secure enough (after observing their breathing with a device such as a pulse oximeter) you must perform an alternative procedure without hesitation.

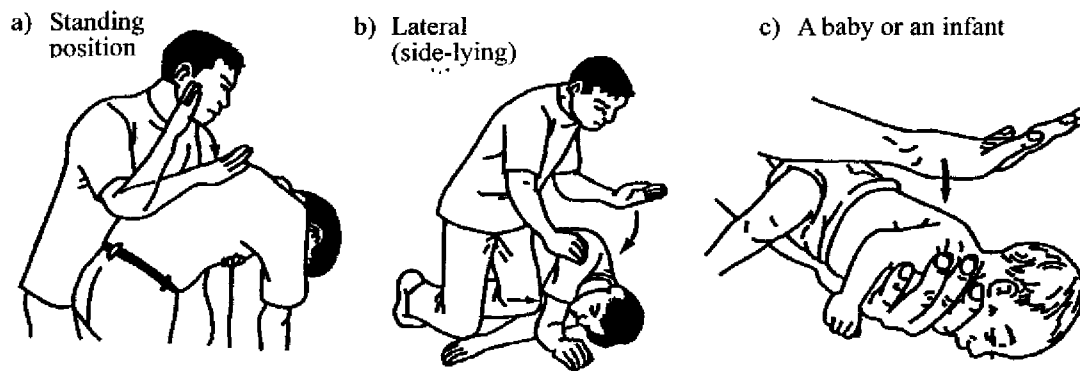
**2. Removing foreign objects from the respiratory tract**

Even if a victim has difficulty in breathing (due to a foreign object in their respiratory tract) you must first encourage the victim to try to expel the foreign object by coughing. If coughing is





**Fig. 3-2-26 Removing foreign objects from the respiratory tract using the Heimlich maneuver**



**Fig. 3-2-27 Back-hitting method maneuver**

ineffective, and the victim's breathing worsens, they show signs of cyanosis (blueness), or their level of consciousness falls, then you must immediately try to remove the foreign object from their respiratory tract using the following manual skills.

### 1) Heimlich maneuver (Fig. 3-2-26)

The Heimlich maneuver is also called "Infradiaphragmatic abdominal pressing" or "Upper abdominal pressing". In this method, the first-aider tries to discharge the foreign object by increasing the pressure inside the thoracic cavity by pressing the upper abdomen to push up the diaphragm. It is possible to perform this method by standing, sitting, or lying laterally. The key point is that you should apply sufficient force to quickly push up the diaphragm. It may be necessary to repeat this method 5 to 10 times, as

it is seldom possible to remove the foreign object the first time.

The Heimlich maneuver must not be performed on a pregnant woman. In addition, it may cause liver damage or stomach rupture. Therefore, in Japan, a variation to the Heimlich maneuver is recommended, tries to discharge the foreign object by increasing the pressure inside the thoracic cavity by applying force to the lower chest. As these methods may damage internal organs, you must not practice them on a healthy person.

### 2) Back-hitting method (Fig. 3-2-27)

In the back-hitting method, the first-aider hits the middle of the victim's back to dislodge the foreign object from their trachea. If the victim is sitting or standing, place one of your hands on the middle of victim's chest (at the middle of the sternum), keep the victim's head down, then

strongly hit the middle of each of the victim's shoulder blades 4 to 5 times in succession using the base of the palm of your other hand. If the victim is unconscious, kneel down next the patient and position them in the side-lying lateral position, then hit the back of the victim in the same way as mentioned above.

If the foreign object is stuck in the trachea of a baby, hold the baby upside down and hit the baby's back to discharge the foreign object. Another method is to hold the baby's jaw with the left hand, lay the baby down on the left forearm, and then use the right hand to forcefully hit each of the baby's shoulder blades.

### 3) Removing foreign objects by using a laryngoscope and a McGill clamp

If the foreign object is lodged around the larynx, a laryngoscope and a McGill clamp facilitates its removal. (See Page 212) However, you must be careful when using a laryngoscope for a conscious patient because the patient will feel nauseous or will vomit when the blade of laryngoscope presses on their tongue.

## 3. Oxygen inhalation

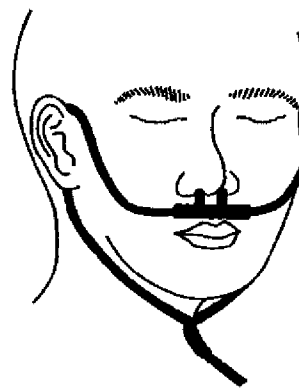
21% of air consists of oxygen, but higher-concentration oxygen is necessary for a patient in cardiac arrest, shock, or respiration failure. Therefore, when the patient is breathing spontaneously, administer oxygen via a device such as a nasal cannula, face mask, face mask with a reservoir, or a Venturi mask.

### 1) Conditions where oxygen inhalation is required

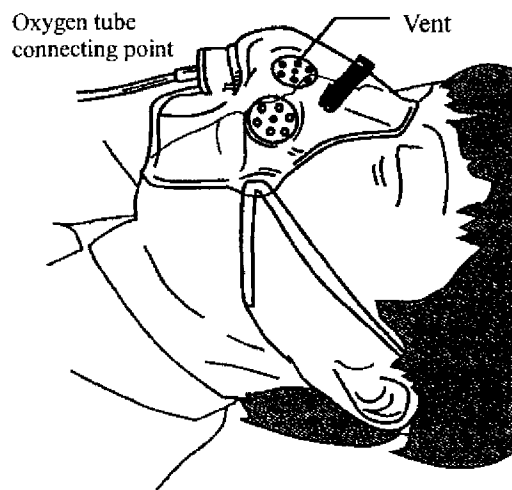
Oxygen is necessary to maintain life. It bonds to hemoglobin in red blood cells and is carried throughout the body. Humans require more oxygen than normal during the following four conditions:

- ① Increased oxygen demand
- ② Lung failure
- ③ Insufficient hemoglobin
- ④ Circulation failure

In patients who require oxygen inhalation, various abnormalities are observed, such as an abnormal breathing rate (over 30 or below 10 breaths per minute) or breathing pattern such as panting, apnea, dyspnea, paradoxical respiration, Cheyne-Stokes respiration, Biot's respiration, decrease in SpO<sub>2</sub> rate (below 95%), cyanosis, and consciousness disorders.



**Fig. 3-2-28 Oxygen inhalation using a nasal cannula**



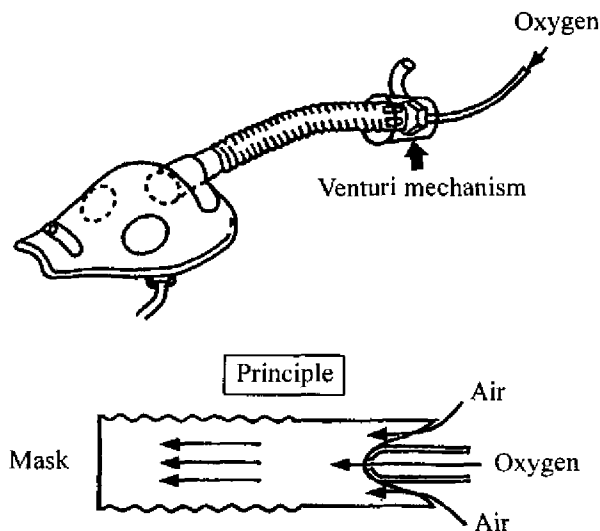
**Fig. 3-2-29 Oxygen inhalation by a face mask**

### 2) Oxygen inhalation by a nasal cannula (Fig. 3-2-28)

It is known that the oxygen concentration in lungs rises by 4% (each time) oxygen is inhaled at the flow rate of 1 liter per minute. Usually oxygen is supplied within the range of 1 liter to 6 liters per minute (at an oxygen concentration of 25 - 45%). However, administering oxygen at excessive concentrations will cause drying in the nasal cavity.

### 3) Oxygen inhalation using a face mask (Fig. 3-2-29)

In this method, the nose and mouth of the patient is covered by a face mask, and oxygen is supplied at the flow rate of 5-10 liters per minute to attain a concentration of 40-60%. If an oxygen reservoir bag is attached below the mask before starting oxygen inhalation, then higher concentrated oxygen can be administered to the patient. When the reservoir is added, you can



**Fig. 3-2-30 Venturi mask and its mechanism**

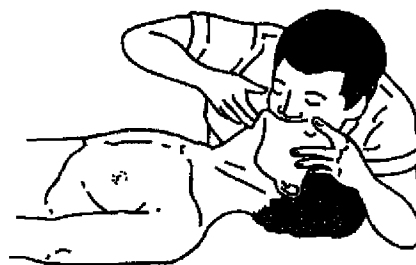
usually attain an oxygen concentration that is about 10 times higher than the oxygen flow rate. Thus it is possible to attain 60% by inhaling oxygen at 6 liters per minute, and 100% at 10 liters per minute.

#### **4) Oxygen inhalation using the Venturi mask (Fig. 3-2-20)**

This method is useful when you need to administer a constant density of oxygen to a patient. Constant density can be set by selecting the blue adapter for the lowest level (4 liters per minute for 24% oxygen concentration), the orange adapter for the highest level (12 liters per minute for 50% oxygen concentration), and other adapters for moderate levels.

#### **5) Precautions of oxygen inhalation**

Patients with COPD (chronic obstructive pulmonary disease, such as chronic bronchitis, bronchial asthma, or lung swelling) are normally in carbonemia, and their phrenic (breathing) nerve is stimulated when the oxygen concentration in their blood drops. This is different from normal people whose phrenic nerve is stimulated when the carbonic acid concentration in their blood drops. Thus if high-concentration oxygen is administered to a COPD patient, their phrenic nerve is suppressed, resulting in a consciousness disorder and an elevated carbonic acid concentration in their blood. This condition is called CO<sub>2</sub> narcosis, and it is one of the precautions in administering oxygen to COPD patients.



Head-tilt and chin-lift method. Open the patient's mouth widely and administer mouth-to-mouth artificial resuscitation while watching the patient's upper abdomen rise and fall.

**Fig. 3-2-31 Mouth-to-mouth artificial respiration**

#### **4. Artificial respiration**

##### **1) Conditions where artificial respiration is required**

Artificial respiration is required when the patient has ceased breathing, or: is struggling to breathe, breathing via their lower-jaw, paradoxical breathing, in severe dyspnea, suffering cyanosis, breathing less than 6 times per minute or over 30 times or per minute, when their SpO<sub>2</sub> value has dropped below 90% during inhalation of high-density oxygen. During assisted respiration, you must be careful not to interfere with the patient's spontaneous breathing.

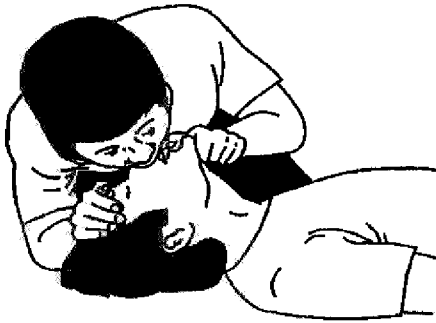
##### **2) Blowing air into the victim's mouth**

###### **(1) Mouth-to-mouth method (Fig. 3-2-31)**

Now you are placing one hand under the victim's neck and the other on the victim's forehead to secure the open airway by tilting his or her head. Do not move the hand under the victim's neck but move the other hand from the forehead to pinch the victim's nostrils shut with the thumb and index finger. Open your mouth wide, seal your mouth tightly around the victim's mouth and blow into his mouth. Blow about 10 ml/kg of breath in 2 seconds. If the victim is a child (1 – 7 years old), give breath of such amount that the victim's chest slightly rises with no stomach rise in 1 to 1.5 seconds. After blowing your breath into victim's mouth, move your mouth away from the victim and allow air escape from the victim's mouth. At this time, it is desirable to release the victim's nostrils. However, releasing the nostrils is not always necessary because it increases the procedures and many victims have nostril obstructed. Give breaths to a child once every 3 seconds, whereas give breaths to an adult once every 5 seconds.

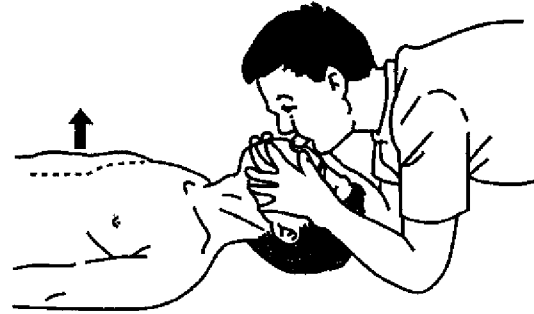
###### **(2) Mouth-to-nose method (Fig. 3-2-32)**

Maintain the backward head-tilt position with the hand on the victim's forehead.



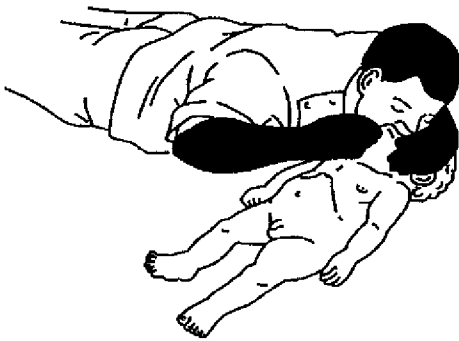
Secure an airway by using the head-tilt method and the chin-lift method. Close the victim's mouth with the thumb of your hand, which is lifting the jaw of the victim, and then breathe forcefully into the victim's nostrils.

**Fig. 3-2-32 Mouth-to-nose method**



Secure open airway by chin-lift and put the mask over the victim's face with the thumbs and index fingers of your both hands. Blow your breaths through the air inlet while observing the rise of the victim's chest.

**Fig. 3-2-34 Pocket mask**



When the victim is an infant (younger than 1 year), do not perform the backward head-tilt method but instead push the lower jaw forward and perform the mouth-to-mouth/nostrils method.

**Fig. 3-2-33 Mouth-to-mouth/nostrils**

with the hand on the victim's forehead. Use your the other hand to close the victim's mouth and seal your mouth around the victim's nose. Give breaths to the victim in the same manner as that for mouth-to-mouth method. After blowing breath into victim's nostrils, secure the open airway at the head-tilt position.

### **(3) Mouth-to-mouth/nostrils (Fig. 3-2-33)**

When the victim is an infant (younger than 1 year) or a newborn baby (less than 28 days after birth), seal your mouth around the mouth and nose of the victim and give a breath in 1 to 1.5 seconds for an infant or in 1 second for a newborn baby. Since the air amount to be blown into a victim significantly differs according to each individual infants, proper amount must be confirmed by observing the rise of the victim's chest. If a victim

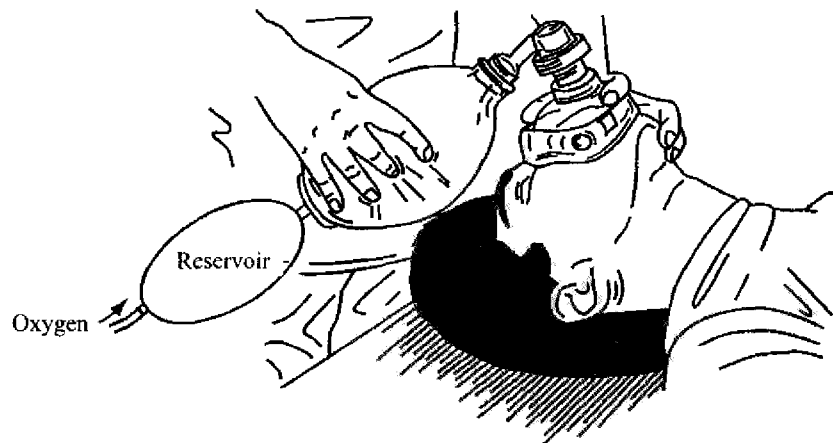
is treated by tracheotomy or endotracheal intubation, you can blow your breaths through the tube. Presence of air leak from the victim's mouth indicates the leak of cuff.

### **(4) Pocket mask (Fig. 3-2-34)**

If there is blood around or inside the mouth of the victim, sealing your mouth directly around the victim's mouth will bring the risk of infection. For such a victim, a pocket mask is a useful tool to safely and effectively perform mouth-to-mouth resuscitation. To use a pocket mask, secure an open airway by using the chin-lift method, then put the mask over the victim's mouth with your thumbs and forefingers and seal the mask to your lips while raising the chin of the victim with the other three fingers of each hand. Perform artificial respiration by breathing through the air inlet.

### **3) Back-valve mask artificial respiration (Fig. 3-2-35)**

The back-valve mask is a cheap, portable and very effective artificial respiration device; however one disadvantage is that you cannot attain sufficient ventilation when the airway is not secured properly. In addition, the bag mask cannot administer high-concentration oxygen. Thus when 600 ml of oxygen is administered 12 times per minute, the oxygen flow rate is only 15 liters per minute, which means the inhalation oxygen concentration is less than 60%. By putting a reservoir on the bag mask, however, the oxygen concentration rises to 100%. Therefore, a reservoir must be attached when ventilating.



**Fig. 3-2-35 Artificial respiration using the bag mask**

#### **4) Resuscitator**

Since artificial respiration of a cardiopulmonary-arrest victim requires a large amount of oxygen, using a resuscitator is desirable. To use a resuscitator, it is essential to secure the victim's open airway by lifting their chin, then sealing the mask tightly on their face. Maintain the chin lift position and press the valve lever steadily while observing the victim's chest rise. If the victim is breathing spontaneously, then only moderately assist their breathing using the resuscitator not as strongly as in artificial respiration. When spontaneous-breathing is restored, make the victim inhale oxygen.

#### **5) Precautions for artificial respiration**

When performing artificial respiration, it is essential to carefully observe the rise of victim's chest, because if their airway is insufficiently secured, then their abdomen expands instead of their chest. Moreover, if positive pressure is applied to a victim with a pneumothorax, then tension pneumothorax may develop and cause the victim to rapidly deteriorate and die. Therefore, in artificial respiration, do not force more than 10 ml/kg of air into the victim's chest at once – you must avoid forcibly blowing a large amount of air into the victim.

### **5. Chest massage (Cardio-Pulmonary Resuscitation - CPR)**

#### **1) Conditions where chest massage is necessary**

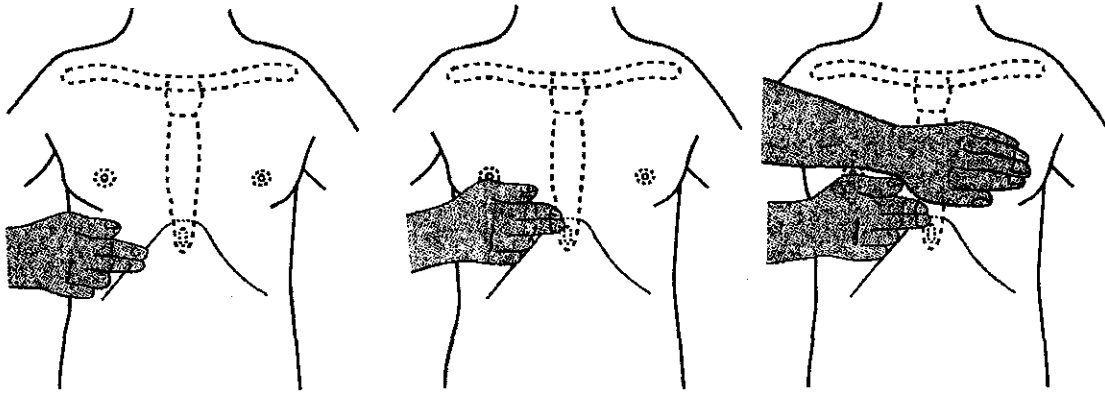
Chest massage is necessary for a victim with cardiac arrest, including ventricular fibrillation or electro-mechanical dissociation. It is difficult to identify the type of cardiac arrest without an electrocardiogram (ECG), so CPR must be applied to a victim immediately after confirmed that the victim has lost an arterial pulse. When a patient's heart stops, they show symptoms such as:

- (1) Unconsciousness
- (2) Apnea (absence of breathing)
- (3) Pale or bluish complexion
- (4) Absence of an arterial pulse

In particular, the absence of an arterial pulse is the most definite sign for you to start CPR. Check for a pulse in the carotid artery of adults and in the brachial artery of infants. In addition, the femoral artery is suitable for checking the pulse in all victims. Keep pressing these arteries for 5 seconds when checking for a pulse.

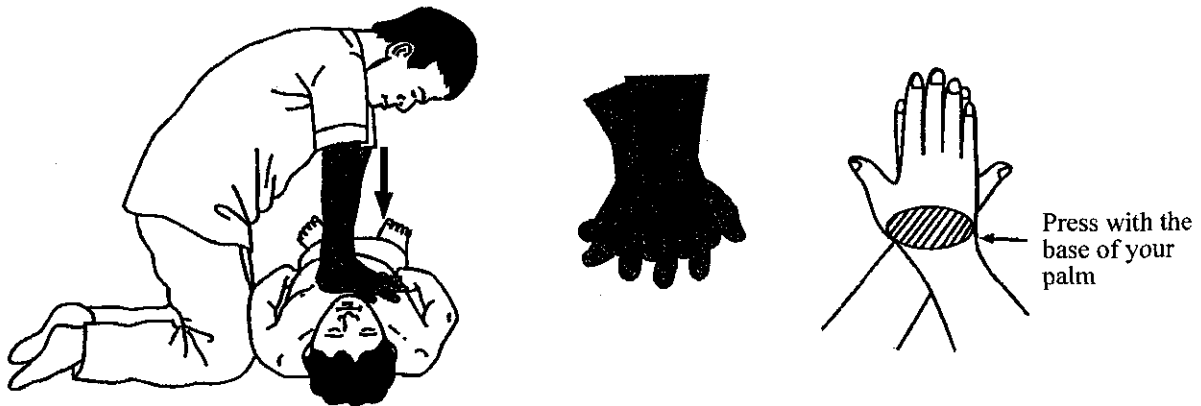
#### **2) Method of chest massage**

Lay the victim on their back. You should then take your position beside the left or right side of the patient's chest. Find the correct chest position to apply CPR according to the procedures shown in Fig. 3-2-36. Firstly, put the base of your palm just above the lower tip of the victim's breast bone and place your other hand over the first hand. (Fig. 3-2-36) Do not apply



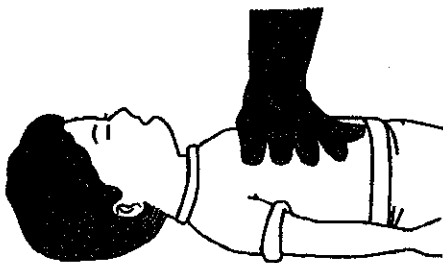
Facing the chest of a victim lying on their back, place your index and middle fingers across the victim's central abdomen then move them up until you feel the lower tip of the breastbone and then continue moving your fingers up until your middle finger comes to the second notch (incisura). Where your index finger is positioned is the correct part to apply massage, which is slightly above the costal margin.

**Fig. 3-2-36 Method to find the correct chest position to apply CPR**



**Fig 3-2-37 Correctly positioning hands for CPR**

a) Applying CPR to a small child



b) Applying CPR to a baby or infant



For a baby or infant, the correct breast bone position for CPR is one finger-width below an imaginary line connecting both nipples

**Fig. 3-2-38 Chest massage for a small child or a baby/infant**

CPR to the lower tip (xiphoid process) of the breastbone as this is above the abdomen, and pressing here may result in liver damage. In addition, since poking the chest wall with fingers

may fracture a rib, curl up the fingers of both hands so that they do not point into (and fracture) ribs.