

CHAPTER 2
INJURY PREVENTION AND TREATMENT
REVISED JANUARY 2019
TABLE OF CONTENTS

<u>INJURY PREVENTION</u>	2-3
<u>INITIAL INJURY TREATMENT</u>	2-4
<u>COMMON INJURIES AND PROBLEMS</u>	2-5
Muscle Cramps	2-5
Muscle Soreness.....	2-6
Muscle Pulls or Strains	2-7
The Foot	2-7
Ankle Sprain	2-8
The Lower Leg	2-8
The Knee.....	2-9
Shoulders	2-10
Low Back Pain.....	2-10
Environmental Problems	2-11

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 2

INJURY PREVENTION AND TREATMENT

1. INJURY PREVENTION.

a. No one likes to be injured, yet a surprising number of people simply ignore ways to prevent injuries. Most can be avoided completely, or at least controlled, by following certain basic principles and using a sensible approach to training.

b. The following are some common practices that often lead to injuries:

(1) Inadequate Conditioning and Training Habits.

(a) Sudden changes in intensity, duration, or frequency of exercise sessions often result in injuries. Therefore, the body should never be pushed beyond its capacity during a training program.

(b) A good guideline for a safe and systematic increase in training is not more than 10 percent per week.

(2) Overtraining.

(a) Training too hard or too frequently can increase susceptibility to injuries or illness, and result in an overall decrease in performance. This is especially true for weight training. After a training session, there must be an adequate rest period to allow the body to recover, adapt, and become stronger. Novice exercisers often experience overtraining by doing too much too soon. This results in slow gains in performance, discouragement, and eventual cessation of the exercise program.

(b) Signs and symptoms of overtraining are fatigue, frequent colds, insomnia, lethargy, elevated resting heart rate, and decreases in strength and endurance performance. Recognizing any of these signs or symptoms may indicate overtraining. A decrease in the volume of training is recommended. This can be accomplished by increasing the rest days between exercise or decreasing the number of sets performed with each muscle group for weight lifters, and decreasing the distance and/or intensity for endurance exercisers.

(3) Insufficient Warm-Up and Cool-Down.

(a) A proper warm-up and cool-down before and after exercise are the best ways to avoid injuries. The primary purpose of a warm-up is to allow the body time to acclimate to the activity before rigorous training begins. Jumping right into training without a warm-up can be compared to starting a car in freezing weather and driving the first mile at 60 miles per hour. If there is a weakness in the system, it will break down under these conditions.

(b) Refer to Chapter 3, Warm-Up, Stretching, and Flexibility, of this manual for more information on proper ways to warm-up and cool-down.

(4) Equipment in Poor Condition.

(a) Adequate equipment is essential for prevention of injuries in all activities. Always check equipment periodically to ensure it is in good working condition.

(b) Refer to instructions on proper equipment selection and maintenance under the appropriate exercise activities in Chapter 4, Cardiovascular Endurance, and Chapter 5, Muscular Strength and Endurance, of this manual.

(5) Inadequate Rest and Recovery Time.

(a) Allow an injury to fully heal before resuming a training schedule. Many serious injuries result from ignoring a minor injury. In addition, compensating for an injury while continuing training can cause a second injury to a different part of the body.

(b) Training should also be reduced after an illness. Relapses are common if sufficient time is not allowed for full recovery.

2. INITIAL INJURY TREATMENT.

a. One of the most important measures an individual can take to prevent a disability is to minimize the degree of damage that occurs immediately following an injury. When injuries occur, small blood vessels rupture and bleed into the surrounding tissues causing inflammation and swelling. This swelling puts pressure on the surrounding structures, resulting in pain and limitation of motion. Sometimes the damage that results from swelling can be worse than the initial injury. As most swelling occurs in the first hour after the injury, it is very important that the injury be treated immediately.

b. The initial treatment for just about any injury can be expressed in the acronym:

R—rest
I—ice
C—compression
E—elevation

(1) Rest. Stop exercising. Never attempt to “work off” an injury. Even if an injury seems relatively mild, assume the worst and stop exercising in order to minimize the degree of damage.

(2) Ice. Ice in a cold pack or a plastic bag minimizes the degree of swelling surrounding an injury. It eases pain by slowing down nerve conduction, helps prevent muscle spasm, and reduces the bleeding that causes swelling. Apply ice for 20 minutes at a time, approximately 4 times a day, for the first 48 to 72 hours following an injury. Ice should be applied to the injured area as soon as possible after the onset of pain. The sooner ice is applied, the greater the chance of minimizing impairment. Never apply heat to a new injury, as heat will increase swelling and may actually be harmful. If heat is applied within the first 24 to 72 hours, it may actually prolong the recovery period.

(3) Compression. Compression mechanically restricts the swelling. Compression can be applied by wrapping the injured part with an elastic wrap or bandage. When applying an elastic bandage, roll rather than stretch the bandage. Rolling allows the bandage to expand without becoming too tight if more swelling occurs. If it is too tight it may increase pain or cause numbness and restrict circulation.

(4) Elevation. Keep the injured part above the level of the heart. This helps drain blood and tissue fluid from the extremity, thereby minimizing swelling.

c. If pain and swelling persist, consult a physician. These symptoms may indicate that the injury is more serious than it first appeared. Remember, no matter how serious the injury is, initially treating with RICE therapy will do no harm and may be of great benefit.

3. COMMON INJURIES AND PROBLEMS.

a. Muscle Cramps.

(1) Cramps are powerful involuntary muscle contractions. Ordinary muscle cramps may result from a variety of things such as mineral depletion from excessive sweating or exercising in high heat and humidity. Other causes

include overfatigue, tight clothing or tape, sudden changes in body temperature (chilling or sudden overheating), and failure to warm up properly.

(2) If a muscle cramp develops, immediately stop exercising before the muscle becomes even tighter. It is imperative that the muscle is stretched immediately and the spasm relieved. For example, a cramp of the calf muscle is treated by straightening the knee and bending the foot upward. After stretching, gently massage the involved area to relax the muscle and reduce pain. Deep, vigorous massage is not recommended.

(3) A common muscle cramp that occurs during running is known as the “side stitch.” The side stitch is believed to be a spasm of the diaphragm muscle, which is the muscle separating the lung and abdominal cavities. The exact cause of a side stitch is unknown. Exercising on a full stomach increases susceptibility to side stitches, especially after having had milk or grain products. Other causes include improper warm-up or breathing. Exercising too intensely may also contribute to the development of a side stitch as it is believed to be related to oxygen debt. Generally, untrained individuals are more prone to side stitches.

(4) To avoid a side stitch, carefully stretch all muscles during the warm-up and perform a variety of abdominal exercises. If a side stitch develops during a workout, try to slow down or rest until the pain disappears. Walking, deep breathing, and abdominal stretching exercises have been known to help. Bending forward at the waist can also be tried.

b. Muscle Soreness.

(1) When beginning an exercise program or increasing the intensity of a program, particularly weight training programs, delayed muscle soreness will be experienced. This muscle soreness usually occurs 24 to 48 hours after exercise has stopped. The exact cause (or causes) of muscle soreness are unknown. Microscopic tears in the connective tissue of the muscle and tendons cause a release of certain substances that cause irritation to the muscle cells.

(2) The following are a few suggestions to help prevent muscle soreness:

(a) Stretching helps prevent muscle soreness and provides relief when soreness is present.

(b) A gradual progression in the intensity of exercise helps minimize the severity of the muscle soreness.

(c) Some experts have proposed that ingestion of 100 milligrams of vitamin C per day may prevent muscle soreness.

c. Muscle Pulls or Strains.

(1) A muscle pull or strain represents a partial tear of a muscle and is usually caused by overuse or excessive stress. Common sites of muscle strain during exercise are in the groin, quadriceps, and hamstring muscle groups. Muscle strains are much more common among those who do not perform proper warm-up and stretching exercises. This muscle injury is often associated with local blood vessel damage resulting in leakage of fluid and blood into the surrounding muscle, causing tissue swelling.

(2) The best treatment is RICE therapy, applied quickly. Most muscle strains will heal in approximately 2 weeks, but training activities should resume gradually as small tears can turn into more serious problems.

d. The Foot.

(1) Black Toenails.

(a) A black toenail is an accumulation of blood under the toenail and is a common complaint of runners and cross-country skiers. It occurs when toes jam against a shoe that is too tight.

(b) The toenail will usually fall off after several weeks. The exposed nail bed will be very sensitive and should be protected until the nail has grown back.

(c) To correct or avoid this condition, make sure shoes have ample room in the toe box and wear comfortable socks to cushion the toes.

(2) Blisters.

(a) Blisters are heat injuries to the skin produced by friction. There are a variety of causes, including shoes that are too tight or loose, dirty socks, rough spots in the threading of shoes, or holes in socks. The best way to prevent blisters is to prevent the friction that causes them.

(b) Blisters should not be punctured, as they may reabsorb into the skin. Cover the area with moleskin or a large bandage. If the blister does happen to break open, the area should be cleaned with an antiseptic. Gently squeeze out the remaining fluid with sterile gauze. Do not peel off the cap of the blister. Cover the area with a sterile gauze pad or bandage

that will let air in around the blister. If redness and pain occur, an infection may exist and should be examined by a physician immediately.

(3) Heel and Arch Problems.

(a) The arch of the foot is maintained by a tough, fibrous band called the plantar fascia which runs from the ball of the foot to the heel. When running, the arch spreads a bit under pressure every time a step is taken and landed. The more pressure, the more spread is needed to absorb it. This spreading stretches the plantar fascia. If wearing a shoe that does not give enough support and cushioning, or often running on a hard, unbending surface, this ligament can be strained, resulting in Plantar Fasciitis. Pain and tenderness usually develop on the sole near the heel, although it may occur anywhere from the heel to the ball of the foot. Workouts should be limited to soft surfaces and an ice pack applied to the tender area after exercise. Stretching and increasing the flexibility in the calf muscle will also help.

(b) Another kind of heel pain common among runners, joggers, and hikers is the bone bruise, often caused by wearing shoes with inadequate cushioning. Such bruises can be avoided by careful foot placement and by buying quality foot gear. While the bruise is healing, use ice to relieve the pain. Padding or a plastic heel cup may allow exercise in spite of the bruise.

e. Ankle Sprain.

(1) An injury that stretches or tears the ligaments surrounding the ankle is called a sprain. Most ankle sprains occur on the outside of the foot, although they can also occur on the inner side. Runners and joggers often develop this injury from stepping in a hole or on an object. Ankle sprains can be classified as mild, moderate, or severe. A mild sprain is one which stretches the ligaments. A moderate one may result in a partial tear of the ligaments. A severe sprain means one or more of the 3 ligaments in the ankle have torn, which requires immobilization with a cast.

(2) Immediately stop exercising when an ankle is injured, as a mild to moderate sprain can often be self-treated. Use RICE therapy as soon as possible. Treatment of moderate sprains may be required for 2 to 3 weeks before activity is resumed. If pain and swelling persist, consult a physician.

f. The Lower Leg.

(1) Shin Splints.

(a) The term “shin splints” is used to describe painful swelling of damaged muscles and tendons along the front or inner part of the leg between the knee and the ankle. The pain can be along the crest of the shinbone or on the inner lower leg. Shin splints are frequently caused by overuse and often occur in runners and cross-country skiers. Shoes with thin, inadequate cushioning or those in which the cushioning has been excessively worn down also cause shin splints.

(b) If shin splints occur, rest for a few days when the symptoms first appear. Running or exercising with severe shin splints may lead to stress fractures, which are tiny fractures in the bony substance of the tibia or fibula. The recommended treatment is RICE therapy. If the pain is not too severe, exercise may be continued but an ice massage should be applied to the area before and after each workout. Run slowly on soft, flat terrain within the limits of pain tolerance, then gradually return to normal training.

(2) Achilles Tendonitis.

(a) The Achilles tendon connects the powerful calf muscles to the heel. The most common cause of Achilles tendonitis is overuse of these tendons by too much running or jumping, especially on hard surfaces. Another cause is a sudden unexpected stretching of the tendon. The result is pain and inflammation from microscopic tears in the tendon. Careful warm-up and stretching before and after exercise and good quality footwear will help protect this vulnerable tendon.

(b) If Achilles tendonitis develops, RICE therapy should be initiated. Mild cases may disappear if exercise is reduced; however, it may be several weeks before full activity can be resumed. To avoid the development of a chronic case, do not rush the recuperative time as there should be no pain before regular activity is resumed.

g. The Knee.

(1) The knee is the most complex and vulnerable joint in the body. It is hinged and joins the thigh and shin bones of the leg. The kneecap normally rides smoothly in a groove. It is attached to the large quadriceps muscle of the thigh, which is strong enough to pull the kneecap sideways if the angle of pull is twisted. Muscular imbalance is often the cause of knee pain. Short, tight calf and hamstring muscles, combined with weak quadriceps muscles, can cause an imbalance which affects the pull on the kneecap. Other causes might be uneven shoe wear or an uneven or banked running surface.

(2) Knee pain can be treated with RICE therapy, but any knee that remains painful or swollen after an injury should be checked by either an orthopedic physician or podiatrist who is skilled in sports medicine.

(3) Chondromalacia.

(a) Chondromalacia is a disintegration of the kneecap and thigh bone cartilage surfaces, resulting in a rough, uneven gliding motion between these structures. This is often known as “runner’s knee.” Chondromalacia can occur when the kneecap moves out of its groove, causing the cartilage surface to become rough and irregular. Symptoms usually start as vague deep knee pains with a grating or crunching sensation felt over the kneecap when it is bent. Discomfort usually increases during activities such as kneeling, walking down stairs or running down hills. Chondromalacia is difficult to treat; be aware of early signs in order to prevent progression to a more chronic condition.

(b) The following steps can be taken to help prevent the development of chondromalacia.

1 Strengthen the quadriceps muscles and increase flexibility in the hamstrings.

2 Take a look at running style and shoes.

3 Use the RICE therapy. If there is a tendency towards chondromalacia, use ice on the knee before and after a workout.

h. Shoulders.

(1) In normal day-to-day activities, our arms hang at our sides or are raised no higher than the shoulders. Any activity that repeatedly requires the shoulders to be stretched without proper warm-up and strengthening may result in tendonitis. This is also known as “swimmer’s shoulder.” Some swimmers develop a painful shoulder by only breathing on one side while doing the crawl stroke. Try switching the breathing pattern to the other side for at least part of the workout.

(2) To relieve minor pain, RICE therapy can be used. More severe pain should be treated by a physician.

i. Low Back Pain.

(1) Back pain is the most common cause of disability and employee absence in the United States. Lack of physical activity, poor posture while standing or sitting, inadequate flexibility, and weak abdominal or back muscles can all cause low back pain.

(2) Low back pain can be treated in a number of ways if it is caused by weak abdominal and lower back muscles. Bent knee sit-ups, the pelvic tilt, and single knee raises are excellent strengthening exercises and are discussed in Chapter 5 of this manual. However, prevention is the best cure for low back pain. Learn how to properly lift heavy objects. Never lift with the back. Instead, bend at the knees and allow the legs to do the work. Sleeping on the stomach may cause a swayback condition and strain the back. Sleeping on the back may also cause problems unless a pillow is placed under the knees to allow the lower back to flatten. The preferred position is on the side with knees flexed (the fetal position). If numbness, tingling, or weakness of the back or leg muscles occur, immediately seek the advice of a physician.

j. Environmental Problems.

(1) Air Pollution.

(a) Try to avoid exercises in a heavily polluted atmosphere, as carbon monoxide takes the place of oxygen in the red blood cells and reduces aerobic capacity. Experts believe that over time, air pollution can irritate the airways (bronchitis), breakdown air sacs in the lungs (emphysema), reduce oxygen transport, and cause cancer.

(b) Aerobic exercises which can be done indoors may be considered if living in a heavily polluted area. Another option is exercising during the hours of lowest pollution, usually in the early morning.

(2) Heat.

(a) At moderate temperatures the body heat generated by exercise is easily dissipated. As temperatures rise (generally above 85 degrees Fahrenheit), the body must work much harder to cool itself and perspiration greatly increases. Perspiration helps cool the body by evaporating into the air. If humidity is also high, there are more water molecules in the air and perspiration will not evaporate as readily, even when sweating less. As a result, the internal temperature may rise to a dangerous level.

(b) It is common to lose more than a quart of sweat an hour when working in the heat. During vigorous exercise in a hot, humid

environment, sweat rates can approach 3 quarts an hour for short periods. A good estimate of fluid loss is to measure the body weight loss after work in the heat. Adequate replacement of water is vital to maintain exercise or work capacity and to avoid heat cramps, heat exhaustion, or heat stroke.

1 Heat cramps are characterized by involuntary cramping and spasm in muscle groups used during exercise. They result from dehydration and salt depletion. The sufficient way to treat and prevent heat cramps is to take in large amounts of fluids after exercise and adequate amounts of fluids during exercise. For further treatment of muscle cramps, refer to paragraph 3.

2 Heat exhaustion results from rapid volume loss in the blood from dehydration (result of profuse sweating) and other circulation disturbances. It is characterized by rapid, weak pulse, low blood pressure, feeling of faintness, profuse sweating, and disorientation. Treatment for heat exhaustion includes ceasing activity, lying in a cool area, and drinking fluids.

3 Heat stroke occurs when the heat regulatory system suppresses sweating. Heat stroke is an extreme emergency and can be fatal. Warning signs include:

- a Lack of sweating.
- b Flushed red skin.
- c Difficulty breathing.
- d Headaches.
- e Feeling dizzy and delirious.
- f Inability to think straight or walk a straight line.
- g A chilling sensation.

4 The major causes of heat stroke are:

- a Training intensely in high heat and humidity without allowing the body time to acclimate to the conditions.
- b Poor physical condition.

c Obesity.

d Drugs such as tranquilizers, blood pressure medicines, and diuretics.

e Plastic sweat suits. The suit makes it impossible for the skin to perform its normal cooling function. Water, not fat, is lost by sweating.

5 Treatment for heat stroke is to cool off immediately. Hose down with water or anything available, get out of the sun, and drink plenty of liquids. If headache, dizziness, or confusion persists, and the body temperature is above 101 degrees Fahrenheit, promptly seek hospital treatment.

(c) Always drink plenty of fluids before, during, and after exercising in the heat.

(3) Cold Weather.

(a) Exercising in the cold is usually of no concern due to the increased heat of working muscles and the extra clothing worn. However, exposed flesh is susceptible to frostbite if conditions are extremely cold; and if too much clothing is worn, there is risk of becoming overheated. There have been instances of heat stroke in over-clothed persons exercising in extremely cold conditions. The best clothing for exercise in the cold allows for evaporation of sweat while providing protection from the cold and wind. Clothing should be worn in layers to allow shedding as body temperature rises.

(b) Frostbite is damage to the skin resulting from exposure to extreme cold or wind-chill. Frostbite first appears as a patch of pale or white skin. With mild frostbite the skin appears red and swollen, while the skin may appear purple or black in severe frostbite cases. The first step in treatment is to warm the affected area with warm (not hot) water. Do not massage. Seek medical aid immediately.

(c) Hypothermia is a condition which occurs when the body is losing more heat than it can produce. As exposure to extreme cold continues and additional body heat is lost, the brain becomes affected. This is an extremely dangerous condition as the body's core temperature is dropping; and without treatment, the victim will lose consciousness and die. The warning signs of hypothermia are:

- 1 Loss of judgment and the ability to reason.
 - a Slow and slurred speech.
 - b A clumsy and staggered walk.
 - c Loss of control of the hands.
 - d An intense desire to lie down and sleep.

- 2 To treat hypothermia, these steps should be followed:
 - a Get the victim out of the wind and rain.
 - b Remove all wet clothing.
 - c Provide drinks, dry clothing, and a warm, dry blanket or sleeping bag for a mildly impaired victim.
 - d If the victim is only semiconscious, try to keep them awake.
 - e Seek medical aid immediately.