Sports Injuries

Prevention & Treatment

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DEFINITION & SIGNIFICANCE OF SPORTS INJURIES

Sports injury: any physical condition that is the result of sports activity or exercise, which requires an athlete to reduce training or activity, visit a medical professional, or take medication. It is usually associated with pain and/or impaired function.

Significance: delays progress in specific training and activities, decreases performance, wastes time (i.e., not being able to do the activity that you enjoy doing); in many cases causes loss of income or career.

CAUSES & PREVENTION OF SPORTS INJURIES

Mechanism of Injury

1. **Overuse:** chronic musculoskeletal stress injuries from repetitive light trauma to tissues by frictional, tractional, or compressive forces; may cause secondary inflammation, resulting in pain and disability; e.g., tendinitis, bursitis, stress fractures.
2. **Direct contact:** tissue damage from a sudden externally applied trauma; e.g., sprains, muscle contusions, fractures.
3. **Soft tissue failure:** injured muscle or tendon from a single violent muscular contraction or effort, without contact; e.g., strains, ruptured tendons.

Common Injury Groups

1. **Tendinitis:** (inflammation of tendon: achilles tendinitis; iliotibial band syndrome; patellar tendinitis; lateral humeral epicondylitis, (tennis elbow).
2. **Strains:** (stretch or tear of muscle-tendon = "pulled muscle"): shoulder girdle muscles; quadriceps; hamstrings.
3. **Sprains:** (stretch or tear of ligament): knees; fingers; ankles; plantar fascia.
4. **Bursitis:** (inflammation of bursa = lubricant bag about the joint): elbow; shoulder; hip; knee.
5. **Stress Fractures:** (cracked bone from overuse): foot.

Causes of Muscle Pulls (Strains)

1. Insufficient warm-up.
2. Poor flexibility: Tight and cold (or previously injured) muscles are more easily injured than more flexible and warmed-up muscles.
3. Overtraining, poor training methods, and poor endurance: You should gradually increase (less than 10% per week) exercise dosage = duration (workload, # repetitions), intensity (speed, resistance), and frequency (# workouts per week). A stronger muscle is better able to absorb energy, and therefore a fatigues muscle is more often injured.
4. Muscle imbalance: Compared with paired muscle of opposite limb, or antagonist (opposing) muscle of same limb.
5. Nutritional deficiency: Especially ow electrolytes and minerals, which may predispose to muscle injury.
6. Structural abnormality: e.g., flat feet, leg length discrepancy, scoliosis or increased lordosis (arched back).

7. Trauma.

10 Commandments for Prevention of Athletic Injuries

1. Pre-participation history and physical exam.
2. Conditioning (including heat acclimatization).
3. Equitable competition (comparable size and age of athletes).
4. Proper rules and regulations, properly adhered to.
5. Good coaching techniques.
6. Protective equipment & proper playing environment.
7. Good nutrition.
8. Prompt, proper evaluation and treatment of injury or illness; record keeping.
9. Rehabilitation following injury.
10. Re-evaluation of athlete after he/she is able to return to competition.

(Explanation of 10 Commandments for Prevention of Athletic Injuries)

1. **Pre-participation history and physical exam**
   Main goals are: disease screening, prevention of injuries and other complications (including death), and improvement of athletic performance. Exam particularly important in interscholastic athletes, those with previous injuries, and those over 45 years old or with cardiac risk factors (see " ... Stress Tests", below).

2. **Conditioning (including heat acclimatization)**
   Conditioning = physical preparation for your sport. As part of their pre-participation evaluation, athletes should be tested for cardio-respiratory fitness, flexibility, and muscle strength. Those who have particular injury potential due to weakness or tightness should be put on an individualized exercise program. This should include the principles of overload, pregression, and specificity of training.

3. **Equitable competition (comparable size and age of athletes)**
   Mainly important with contact sports.

4. **Proper rules and regulations, properly adhered to**
   Many rules are made with safety in mind and often with the purpose of preventing specific injuries and therefore should be enforced.

5. **Good coaching techniques**
   Technical instructions leading to skillful performance can decrease the incidence and severity of injuries.

6. **Protective equipment and proper playing environment**
   Protective equipment should fit well and be in good condition. Playing fields and surfaces should be examined regularly for obstacles and conditions that might

cause injury. Proper precautions and preparations should be made in hot, humid weather and in very cold weather.

7. **Good nutrition**
   Sensible eating and fluid intake can have a strong influence on the athlete's performance and health, and should replace the many fads and misconceptions concerning sports nutrition.

8. **Prompt. proper evaluation and treatment of injury or illness; record keeping**
   An "on the field diagnosis" or working assessment must be made until a more specific diagnosis can be determined. Initial management might include: basic first aid measures and simple treatment, stabilization of the more seriously injured patient, rapid transportation to an emergency facility for definitive care, or referral to a physician for further evaluation. Record keeping is important to observe for trends in certain types of injuries (i.e., to help determine incidence and causes of injuries), to document days lost from practice and response to treatment, and to try to decrease the incidence and severity of future injuries.

9. **Rehabilitation following injury**
   A proper athletic rehabilitation program speeds recovery and helps prevent reinjury or occurrence of other injuries.

10. **Re-evaluation of the athlete after he/she is able to return to competition**
    (See below - "Evaluation for Return to Participation")

Exercise-Related Cardiovascular Complications

When discussing the incidence of exercise-related cardiovascular complications in asymptomatic persons, the error lies in the assumption that these are previously "healthy" individuals. Cardiac events during physical exertion may actually represent manifestations of latent coronary artery disease, or other cardiovascular abnormalities, including ruptured aorta, anomalous anatomy of coronary arteries, hypertrophic and/or right ventricular cardiomyopathy, mitral valve prolapse, and irregularities of the conduction system. Thus, the combination of exercise and a diseased or susceptible heart, rather than exercise itself, seems to be the major acute cardiovascular risk of physical activity.

According to the American Heart Association's Committee on Exercise, "The risk of strenuous exercise in the sedentary population may be minimized or perhaps even eliminated through proper preliminary testing and the individualized prescribing of exercise programs".

The American College of Sports Medicine recommends maximal exercise stress tests (= exercise tolerance test, treadmill test, etc.) for the following individuals starting an exercise program:

1. All apparently healthy individuals at or above age 45.
2. All individuals at or above age 35 with at least one of the following coronary risk

factors: history of high blood pressure (above 145/95); elevated total cholesterol/high density lipoprotein cholesterol ratio (above 5); cigarette smoking; abnormal resting electrocardiogram; family history of coronary or other atherosclerotic disease prior to age 50; and diabetes mellitus.

3. Individuals at any age with known cardiovascular, pulmonary, or metabolic disease.

TREATMENT AND REHABILITATION OF SPORTS INJURIES

A. The **goal of rehabilitation** is to restore to a normal or optimal state of health and function. Therefore, rehabilitation of an athletic injury is the process of returning the athlete to that high level of conditioning and performance. Functional restoration must take into account the type, age (e.g. pediatric, adult, or senior athletes), and level of performance of the injured athlete (e.g., recreational [occasional or competitive], institutional, professional or Olympic athletes), the structure injured, and the athlete's level of conditioning prior to the injury.

B. The **team approach to sports medicine** improves care. Careful communication between the sports medicine physician and the trainer and/or physical therapist will ensure a good outcome. Also, problems that obviously require surgical management should be referred immediately to the surgeon on the sports medicine team.

C. **Guidelines for When You Should See A Doctor**

1. **Pain**, especially if: a) pain is severe; b) pain intensifies when you use the injured body part; c) pain is continuous and unchanged for 3 or more days; d) pain suddenly increases the morning after injury; and/or, e) pain in a joint or bone for more than 2 weeks.

2. **All joint injuries:** if not treated quickly, joint injuries may become chronic.

3. **Loss of function:** e.g., if you can't move a limb, joint, or finger.

4. Any **injury that doesn't heal** in 3 weeks.

5. **Any infection** in or under the skin associated with pus, red streaks, swollen lymph glands, or fever

D. **Timing of Rehabilitation**
The rehabilitation process begins immediately after injury and ends only when the injured athlete can successfully return to his or her previous level of competition or activity.

E. Phases of the Rehabilitation Process

1. Basic athletic first aid - control of the inflammatory process and pain.

2. Restoration of range of motion and flexibility.

3. Improved muscular strength.

4. Improved muscular endurance.

5. Retraining of coordination, agility, and sports-specific skills.

6. Improved general cardiorespiratory endurance.

(Explanation of Phases of the Rehabilitation Process)

1. **Basic athletic first aid - control of the inflammatory process and pain:**
   Early athletic first aid helps minimize pain and swelling (i.e., inflammation), protects the athlete from further injury, and facilitates an early start with the rehabilitation activities. Sprains, strains, and contusions are the most common types of athletic trauma. Steps in basic athletic first aid: P.R.I.G.E.S.:
   a) **Protection:** Protect the injured area from further injury, with crutches (use if walking causes any pain, swelling, limping, or buckling of the extremity); an arm sling; a cervical collar; and taping, padding, or bracing.
   b) **Rest:** If you can be sure that an injury is not serious, then "relative rest" of the injured extremity may be employed. This means providing enough protection to keep the athlete asymptomatic, and often substituting different activities and exercises that cause less stress to the injured area.
   c) **Ice:** Used acutely, ice decreases pain, swelling, tissue damage, bleeding, and muscle spasm.
   d) **Compression:** An elastic bandage is used in conjunction with ice to prevent and decrease edema/swelling.
   e) **Elevation:** Elevate the injured part higher than the heart; combined with ice and compression for edema control.
   f) **Support:** a more functional type of protection for minor injuries with minimal symptoms, especially when the athlete is going to return to pay right away; e.g., ankle and wrist taping for a minor sprain.

Exercise-induced heat illnesses are acute conditions due to dehydration, electrolyte losses, and failure of the body's heat dissipating mechanisms, which also need basic first aid.

a) Heat cramps: Usually lower leg muscles are affected, but abdominal and intercostal muscles can also be involved.
   Treatment: rest, oral fluids, cooling down, stretching, ice massage, and muscle massage.
b) Heat exhaustion: dehydration as a result of excessive fluid loss. Rectal temperature *100-105°.* Symptoms: fatigue or dizziness, nausea, headaches, and muscle weakness. Sweating should be evident.
   Treatment: For mild cases, treat the same as for heat cramps. For serious

cases, including those with hypotension, persistent headache and vomiting, or altered mental states, initiate IV fluid resuscitation, cool vigorously (e.g., with ice-water bath), and consider transport to an emergency facility.

c) Heatstroke:Often characterized by motor disturbances (such as ataxia) and severe nervous system disturbances (such as confusion, delirium, or come). Circulatory collapse and hypotension are possible. Rectal temperature usually exceeds *105°.* The skin is usually warm but the person may not sweat (although sweating usually occurs in the initial stages).
Treatment: Cool the athlete immediately with fanning and an ice-water bath, raise his legs, place him in the shade, and begin IV fluids. Transport immediately to a medical facility.

2. **Restoration of range of motion and flexibility**
Limited range of motion may result from muscular spasm, soft tissue contracture, intraarticular blockage, and pain. Before starting a strengthening program, the joint range of motion and soft tissue flexibility must be improved. Flexibility can be improved through therapeutic exercise, application of heat and/or cold, while decreasing pain with TENS, local anesthetic infiltration, electrical stimulation, and acupuncture. Maintaining flexibility allows more efficient muscle action at extremes, decreases joint compression forces, and decreases musculotendinous overstress. Inflexibility increases the force against which antagonistic muscles must contract, thus increasing fatigue and decreasing efficiency of these muscles.
3. **Improved muscular strength**
In most cases the patient/athlete should gain at least 75% of normal range of motion before beginning strengthening programs. Then isometric exercises are begun first, then manual resistance exercises begin once the joint can be moved while maintaining resistance. This progresses to isotonic or isokinetic exercises. Isokinetic exercises are preferable during this phase because of the ability to control speed while maintaining force (the resistance accommodates to the amount of force exerted throughout the range of motion).
4. **Improved muscular endurance**
Both sides of the body should be worked independently. Once strength in the injured side is 90-95% of the uninjured side, the emphasis is Changed to development of muscular endurance (i.e., a high-repetition, low-weight program); but some studies have suggested that the muscular endurance program be done before the strength program. Strength can usually be maintained with one or two workouts at near maximal resistance per week. Maintenance of muscle endurance can be a significant factor in the prevention of injury (fatigued muscles are less able to protect the joint and also get strained more easily).

6) **Retraining of coordination, agility, and sports-specific skills**
Coordination and agility training is necessary for the athlete to transform the strength, flexibility and endurance gained into full- speed performance skills. Complex tasks should be practiced in parts rather than as a whole. There should be a gradual progression through increasingly more complex functional activities, starting slowly and

with low force. As the movement is accomplished with greater degrees of precision, the speed and force can be increased. Balance, proprioception (= position sense), and agility activities should be emphasized. For lower extremity injuries this might consist of bicycling, weight shifting, single-let standing, rolling slant board, and mini-trampoline drills. Also, a progression of walking and running lazy S's, figure 8's, and zig-zag cutting should be done, as well as various jumping drills (e.g., plyometrics), after the patient/athlete can run at 75% of maximum speed without pain or recurrent swelling. For upper extremity injuries, weight-bearing through the arms in various positions (sitting push-ups, wall push-ups) and weighted-ball or weighted-implement activities are used. Don't forget the thorough warm-up and cool-down programs.

7) **Improved general cardiorespiratory endurance**
The cardiorespiratory endurance (aerobic fitness) of the athlete should not be allowed to decrease during the early phases of the program. Training can be done with a stationary (or regular) bicycle, swimming, running in a swimming pool with a floatation vest, rowing machines, stair-steppers, and cross-country ski machines. These low-impact conditioning exercises are especially useful if the healing phase is delayed for more than a few weeks (e.g., after fractures or surgery).

F. **Evaluation for Return to Participation**
Full rehabilitation is the main criterion. Strength is documented through manual or isokinetic muscle testing. Flexibility testing and goniometry show recovery of mobility. Return of endurance, coordination, and agility is documented by comparing functional and agility tests to pre-injury levels. The athlete must then demonstrate full-speed performance of his specific sports skills to the team physician, athletic trainer, coach, or a combination of these three.

The following guidelines are broad and general and may not precisely fit every clinical circumstance (i.e., there are many exceptions). But, in general, the athlete can usually return to participation when he/she has:

1) full range of motion

2) normal strength

3) normal neurological examination

4) no persistent swelling

5) no unchecked joint instability

6) ability to run (or perform his/her sport) without pain

7) been instructed in proper warm-up, flexibility, and strength program

8) been instructed in proper use of ice and heat

9) been instructed regarding proper taping and bracing to protect the injured area
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10) been instructed to report increases in pain and post-exercise sweiling to

the physician and/or trainer and coach
11) not taking corticosteroid or analgesic medications
12) been informed regarding the risks of future injury and disability as it relates to the injury and the chosen sport

After completion of all these phases of athletic rehabilitation, maintenance training programs for flexibility, strength, and cardiorespiratory endurance are designed.

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When is it OK to exercise with pain?

1. When cause/diagnosis of pain is known;
2. When pain decreases with exercise and day-by-day;
3. When minimal/no signs of inflammation (Le. problem is chronic, not acute);
4. When non-involved body parts are exercised ("relative rest");
5. When pain doesn't alter body mechanics (e.g. causing limping or poor throwing technique).

Dr. Roget's Rules for the Aging Athlete:

("athlete" defined as anyone participating, in fairly regular physical activity, and wanting to continue or increase activity)

1. Techniques of "pain free progression of exercise" (especially after an injury): success at one level of exercise before increasing; maintain intensity below pain production; better to increase by minutes with aerobic exercise; don't increase both intensity and duration at same time.
2. Frequent low-intensity exercise is better than infrequent high-intensity "weekend warrior" type exercise. Strength is usually maintained longer than flexibility and tissue recovery ability, therefore "we're strong enough to hurt ourselves". Aging connective tissue needs gradual repetitive stress to adapt.
3. Cross-training is very important. Work on balance, agility, and some high-impact activities also.
4. Maintain flexibility; stretch after warming-up, and stretch muscles and tendons, not ligaments.
5. Alternate days of high-impact and low-impact exercise, especially if exercise is frequently intense.
6. Allow for adequate rest and recovery. When in doubt (about an injury developing or worsening), rest or do an extra low-impact workout day.
7. Nutritional supplements (to assist with tissue recovery): vitamins & minerals, extra protein (approx. 1 gm per lb. of body wt.), calcium, water.

PLAN FOR SUCCESSFULLY COMPLETING A MARATHON

BY VANCE ROGET, M.D.

1. **PREVENT INJURIES:**
   EQUIPMENT: shoes & socks you're used to; double-tie shoes; gloves if cold; hat/visor; sunglasses & sunscreen.
   HEAT ILLNESSIDEHYDRATION (*see below for symptoms): drink before thirsty (including day before race); water and sports drink (GU20) -- need fluids, calories, and electrolytes.
2. **FINISH:**
   PACE YOURSELF: even effort & time/mile; aim for "negative splits" (i.e. 2nd half faster than 1 st);
   STRETCH & WALK AS NEEDED: tightness & fatigue precede cramps; don't stop too long '"- better to walk through aid stations and keep moving while eating! drinking;
   FOOD (carbo-gels, etc.) and **FLUIDS** to keep energy up.
3. **HAVE FUN:**
   KEEP RELENTLESSLY POSITIVE ATTITUDE: e.g. focus on your ability to run, your feeling of fitness, and how your hard work is paying off in health and many other ways;
   ENVISION THE FINISH: with associated overwhelming pride of accomplishment, the food, massage, family & friends, etc.;
   RUN WITH A FRIEND, MUSIC, FOCUS ON FUN ENVIRONMENT;
   RELAX & move efficiently. My mantra: think "strong, light, & relaxed".

*HYPERTHERMIA/HEAT EXHAUSTION/HEAT STROKE:

These conditions can cause death, kidney failure and brain damage. Symptoms of impending heat injury include: nausea, vomiting, headache, dizziness, faintness, irritability, extreme fatigue, confusion, weakness, and rapid heart rate. Impending heat stroke may be preceded by a decrease in sweating and goose bumps on the skin, especially chest. Heat stroke may progress from minimal symptoms to complete collapse in a very short period of time. The faster the pace, the more heat is produced (so slow down if feeling hot, and other symptoms).

If signs of heat exhaustion occur: get in shade; drink more cold fluids (if alert & swallowing OK), apply ice or wet towel to body (face/head, neck, armpits, groin); elevate legs if feeling dizzy or lightheaded. CALL FOR HELP.

RISKS ASSOCIATED WITH LOW SODIUM:

Low sodium levels (hyponatremia) in marathon & ultramarathon runners have been associated with severe illness requiring hospitalization. It is important for long-distance athletes to use fluids containing electrolytes to replace the water and salts lost during exercise - WATER ALONE IS NOT SUFFICIENT, as water intoxication and possibly death may result. This problem may actually worsen after the race, as the low-electrolyte-containing fluid which has been

accumulating in the stomach is absorbed. Potassium and calcium replacement may also be important, although these levels change less with fluid loss and replenishment.

IF WEATHER WILL BE HOT:

Before event, drink 2-3 large glasses of fluid up to 2 hrs. before start; then 5-10 min. before, another 1-2 cups of water or sports drink.

During hard exercise. or hot weather, drink 3-4 cups (1 full cup is 8 oz.) per hour, OJ every 5-6 miles if you run a 12 or 10 min./mile pace, or at least 1 cup every 2 miles.

Sports injuries are injuries that occur during sport, athletic activities, or exercising. In the United States, there are approximately 30 million teenagers and children combined who participate in some form of organized sport. Of those, about three million athletes age 14 years and under experience a sports injury annually. According to a study performed at Stanford University, 21 percent of the injuries observed in elite college athletes caused the athlete to miss at least one day of sport, and