ATHLETIC TRAUMA: ON THE FIELD EVALUATION

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INTRODUCTION

During the past twenty-five years America has witnessed a virtual explosion in sports participation. From the little league baseball player to the elderly jogger, sports have become an integral part of the lives of millions of Americans. A recent government survey estimated that more than one million injuries occurred in high school and college athletic programs last year.[3] This report revealed that football is by far the most hazardous major sport, with an injury rate four times greater than that of non-contact sports.

A major factor in the successful management of athletic injuries is early evaluation of the type and extent of the injury. Athletics are unique in this respect. In few situations other than athletics do we find physicians or paramedical personnel in attendance who actually anticipate an injury, witness it, and administer care within seconds.

An injury may be defined as a microscopic or macroscopic disruption of normal tissue continuity. This broad definition demonstrates the infinite gradations of injury which are possible. These gradations present clinically in varied degrees of immediate or delayed pain, degrees of swelling, degrees of response to local treatment, and degrees of healing per unit time.[1] Such a definition requires that the physician be familiar with the anatomy of the injured area and visualize the actual tissues involved, render an opinion on the functional significance of the injury, and extrapolate from these factors the course of treatment and prognosis.

Physicians have all been taught to treat the diagnosis and not the symptoms. This may be successful in the office, but it is not always realistic on the field. The field diagnosis of athletic injuries may be more accurately described as "symptoms associated with injuries and the management of those symptoms".[2]

As physicians on the sidelines of any game or contest, we basically must serve two functions: to care for and assist any athlete who may be injured during the course of the event, and to keep the coach informed as to the availability of these individuals. Fulfilling these duties requires a certain amount of discipline. We are all "fans" and tend to get carried away with the action on the field. It is very important to discipline oneself and not get involved with the emotions of the game so that one pays strict attention to the players and their activity. If a team returns a kickoff 98 yards for a touchdown, the first response may be to join the cheers and congratulations. Instead one should scan the entire length of the field to see if there is anyone that was left behind. Therefore as physicians, we must pay attention to the players and not the play.

The responsibility is to assure that any player that leaves the field does so under his own power, is alert, and does not cause further harm by premature ambulation. If a player seems to be hurt, the trainer or coach should be notified.

Physicians who work regularly with athletic teams cooperate closely with athletic trainers. Athletic trainers are paramedical personnel who's primary job is the prevention, treatment, and rehabilitation of athletic injuries. The athletic trainer has had extensive training in athletic trauma, therefore he is a vital tool in the team's ability to perform. The team physician and the trainer have the same goals. They are working together to help the athlete, should an injury occur. Each trainer-physician relationship is different and may hinge on various factors.

The trainer and the physician must be able to handle any situation that occurs in an athletic contest. All possible situations that could occur should be discussed and rehearsed so that when an injury occurs, everyone knows their responsibilities. While it is important for the physician to be thorough and correct in his decisions, one must be able to deal with a certain amount of questioning and criticism. Decisions made by the physician may not always be understood by the coach or athlete. When an athlete is injured he is first examined by the trainer and then by the physician. The trainer may then treat the patient with the consent of the physician. If the physician removes the player from competition, the physician and the trainer must see to it that the athlete is not inadvertently put back into the game. If the physician re-evaluates a player's status, he should advise the trainer of this so that both are working within the same guidelines. A physician should not cave into the pressure of an anxious coach, parent, or player if the athlete's condition has not improved. If the athlete thinks the "doc" is an easy

mark for coaches and parents, the athlete will try to go over the physician's head to manipulate the situation.

The team physician should be available to discuss problems and the rationale behind his recommended course of action. If he evaluates only the most obvious symptoms, exercises poor judgement, is conservative beyond the point required, and fails to tailor decisions to specific situations and individual athletes, then he can expect disagreement and friction from the trainer and the athletic staff. A physician who is aware of the changes in his profession and athletics, and who is willing to try new techniques, is likely to be successful in the treatment of athletic trauma.

The first rule of a sideline physician is to never walk onto the field unless called by the trainer or coach. In most instances the trainer will evaluate the situation first and, if needed, will signal for the physician. If the team does not have a trainer, the coach will evaluate the situation and then call for the physician. Remember, very few experienced trainers panic, therefore when they do, the injury is usually serious. In contrast, most coaches panic when a player goes down, therefore give the coach some time to control himself and to calm the player down when he walks out to the field. If the coach then looks up with a sense of panic, the physician should walk onto the field to evaluate the situation. Above all, in any circumstances, do not panic and do not overreact to any situation.

When approaching an injured athlete, observe what he is doing, i.e. is he quiet, active, holding onto an extremity, shouting, or rolled into a fetal position. These actions can give the physician clues in handling the situation (Fig. 1).

When evaluating the athlete, and if not familiar with his demeanor, talk with the coach and trainer about his pain threshold and his ability to cope with stress. Some athletes will overreact to almost any injury, while others are true stoics and won't complain about anything.

When one arrives on the scene of an injury, first determine if the athlete is conscious or unconscious. The easiest way is to just ask the athlete "what is the problem", and at the same time assess:

1) an open airway
2) presence of any obvious deformity
3) any bleeding or other discharge, particularly from the mouth, ears, and nose.
4) movement of the arms or legs.

If the athlete is unconscious and not responding, check his airway and breathing. If the athlete is unresponsive and not breathing, one must assume head and neck trauma. In this case an airway must be maintained, the patient placed on a back board, and CPR started immediately. If the player is unresponsive and breathing, wait for a period of 1-2 minutes before moving. Most athletes will regain consciousness on their own. If they still remain unconscious, again assume head and neck trauma, place them on a back board and transport them to the hospital.

If the player is semi-conscious or awake, you must still elicit a verbal response and look for obvious deformities. In many cases even if the athlete can not talk, they can still respond to directions. Again, it is very important to always rule out head, neck, and spinal injuries. It is not in the realm of this paper to discuss evaluation procedures for the differ-

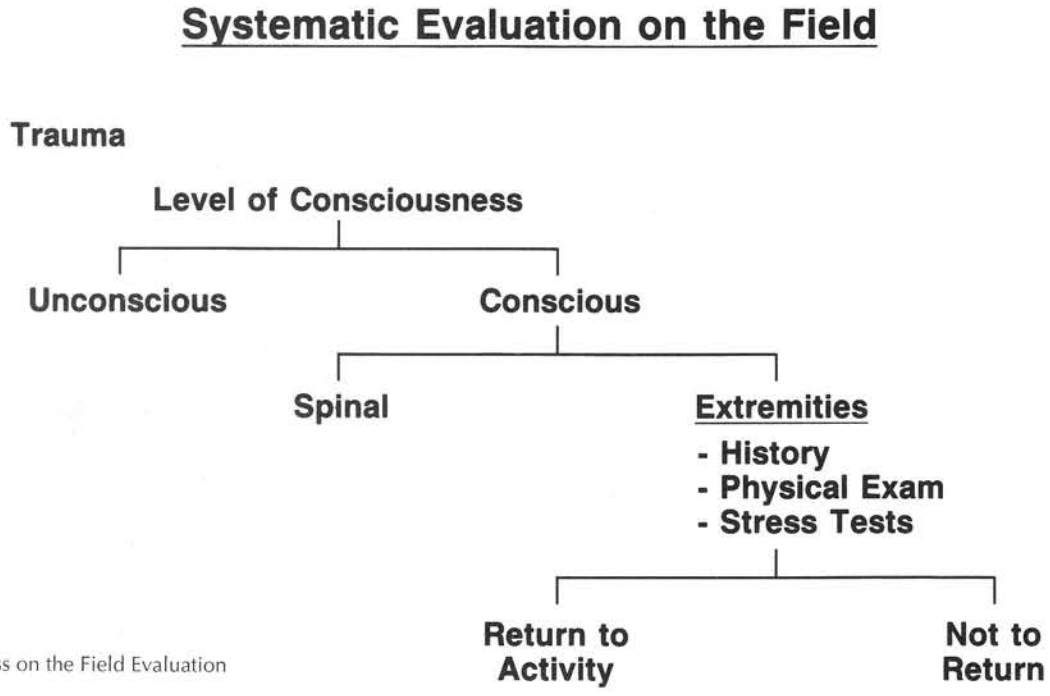

Fig. 1. Systematic Process on the Field Evaluation

ential diagnosis of head, neck, or back pain. However, direct pain over the spine, inability to move either the arms or legs, or sensory loss, indicates trauma to the axial skeleton, and transportation off the field on a stretcher/backboard is mandated. When transporting a semiconscious athlete off the field, it is very important for the athlete to be face up on the stretcher to maintain an open airway.

It is advisable to have at least five individuals to help an athlete off the field on a stretcher/backboard, with seven persons being more beneficial. The person at the head should be the physician, in charge at all times. In placing the athlete on the backboard, he should be positioned in one movement with the head and neck well immobilized and protected, maintaining the normal curvature of the cervical spine. When placed on the backboard the neck should be supported on either side with sandbags and the head strapped or tapped to the board.

If the player with suspected head trauma is awake and responsive, the physician must check his alertness and cerebral function. Ask the athlete where he is, the score, or the period. Check the size, symmetry, and reactivity of the pupils to a light stimulus. Check the function of cranial nerves 2-12. If any of these signs are suspicious, it would be wise to transport the athlete off the field on a stretcher and transport them to the hospital. If the athlete insists on walking off the field, (most do) take a firm grip of both arms and with assistance, help him off the field. When he sits on the bench, again assess the injury with a complete neurological evaluation, with the assumption of transport to the hospital. To be conservative in these instances is to be wise.

After the possibilities of head, neck, and back injuries have been eliminated, the extremities can be evaluated. According to Jackson and Furman,[3] trauma involving the extremities during a two year period contributed to nearly 65% of all injuries, with the lower extremity representing nearly 50% of those cases. The ankle and foot were involved 15% of the time. Knee problems contributed to nearly 25% of all injuries during this period. Sprains accounted for more than one half of both knee and ankle injuries.[3] The largest number of athletes with lower extremity trauma involved sports such as basketball, soccer, track, and wrestling in which twisting, acceleration and deceleration motions are prone to cause injuries to that area.

Most of all foot and ankle trauma involves the lateral ligaments of the ankle, particularly the anterior talofibular ligament. This is partly due to the fact that the fibula or lateral malleolus extends distally to the subtalar joint and forms an effective bulwark against eversion stress, while the medial malleolus is proximally situated and acts as a fulcrum for talar rotation. Therefore, the anatomy of the ankle and foot must be understood before evaluation can proceed.

To insure appropriate identification and diagnosis of lower extremity injuries, one must follow a precise pattern for examination, regardless of which extremity or joint is involved.

HISTORY

As in all medical problems, the history is very important. Many athletic injuries occur with no one witnessing them. Therefore, it is important to ask the athlete certain questions that help key in on the injury. The following questions should be asked while on the field before an examination is started.

1) When did the injury occur?
2) How did the injury occur?
3) Did the athlete hear any audible popping or snapping?
4) Has the athlete injured the limb before?
5) Where is the pain?
6) What elicits the pain?

The more information a physician can obtain from the history, the more accurately the specific problem can be identified.

OBSERVATION

Observation of the injured part is the next most important step in evaluation on the field. What signs or objective evidence of injury are apparent? Is there swelling, redness, ecchymosis, muscle spasm, or any other physical changes that may give a clue to the extent of the injury? Is there joint instability or a visible deformity?

Usually, severe injuries such as a major fracture or dislocation are quite easily identified, even by those with a limited background in the area of athletic injuries. One of the simplest tests is to compare the injured body part to the contralateral side. When examining the athlete on the field, it is not necessary to remove the shoe or sock. If there is a major fracture with a severe deformity, removing the shoe or sock can add to the injury. In this case, the safest form of treatment is to splint the part one joint above and below the affected area and apply ice over the shoe and sock. If a gross deformity is not identified, the physician can resume the examination.

PALPATION

Once the history has been taken and observations have been made the physician can palpate the injured body part with light pressure for the purpose of determining the physical signs and/or symptoms of the injury. When carrying out this procedure some of the signs to look for are swelling, joint

instability, point tenderness, abnormal muscle tightness or spasm, bony deformity, or crepitus of the fracture site. Joint instability may be caused by tearing of the ligamentous, muscular, or tendinous structures. Point tenderness is usually found at the injury site regardless of whether the injury is due to osseous or soft tissue damage.

Bony deformity may be the result of a dislocation or fracture with displacement. This may result in crepitus or a grating sound upon movement of the injured part. Again, the shoe and sock should be left intact and on the foot. Palpation of the bone should be performed quickly and systematically. Because most of the bones of the foot and ankle are subcutaneous, their prominence presents the most practical reference points. In most instances the physician can key-in on the primary area of pain and palpate peripherally from that point. One must remember in palpating the ankle that point tenderness of one area may be significant of a fracture pattern and injury to other structures. For example, pain along the distal third of the fibula, may indicate a supination-external rotation stage 2 fracture. Therefore, pain of the anterior tibiofibular ligament should elicit pain with palpation. In this instance, further evaluation should be limited to identification of any other fractures or dislocations. If none are found, the athlete is splinted, iced, and sent to the hospital without question.

However, if the athlete can not localize the pain, the following systematic approach is performed to palpate bony landmarks with the shoe and sock on the foot.

BONY PALPATION

Medial Aspect
1st Metatarsophalangeal Joint
First Metatarsocuneiform joint
Navicular Tubercle
Head of the Talus
Medial Malleolus
Sustentaculum Tali
Medial Tubercle of the Talus

Lateral Aspect
5th Metatarsophalangeal Joint
Entire shaft of 5th met
Styloid process of the 5th met
Calcaneus
Peroneal Tubercle
Lateral Malleolus

Sinus Tarsi Area
Dome of the Talus
Inferior Tibiofibular Joint

Area of Hindfoot
Dome of the Calcaneus
Medial Tubercle

Plantar Surface
Sesamoid Bones
Metatarsal Heads

Digits
Proximal Shafts of Tibia and Fibula

SOFT TISSUE PALPATION

Head of 1st Metatarsal

Navicular Tubercle and the Talar Head

Lisfranc Joint

Deltoid Ligament

Tarsal Tunnel

Dorsum of the Foot between the Malleoli

Lateral Malleolus
Anterior Talofibular Ligament
Calcaneofibular Ligament
Posterior Talofibular Ligament

Sinus Tarsi
Extensor Digitorum Brevis Muscle

Insertion of the Triceps Surae Muscle Group
Retrocalcaneal Bursa
Calcaneal Bursa

Plantar Surface of the Foot
Plantar Aponeurosis

STRESS TESTS

Manual Stress testing on the field is beneficial in the assessment of ligament integrity. However, the physician can be fooled very easily if not experienced in stress testing of the foot and ankle. Ligament injury is classified into three categories.

Grade I	Mild	Minimal hemorrhage, no functional loss Less than 10% of the fibers torn
Grade II	Moderate	Some functional loss, Moderate hemorrhage, 10-90% of the fibers torn
Grade III	Severe	Complete loss of function, Complete separation of the ligament

Fig. 2. Anterior Draw test performed to isolate the Anterior Talofibular ligament.

Fig. 3. Talar Tilt test performed to isolate the Calcaneal Fibular ligament.

Fig. 4A. Stressing the forefoot in abduction to stress the medial ligamentous structures of Lisfranc's joint.

Fig. 4B. Stressing the forefoot in adduction to stress the lateral ligamentous structures of Lisfranc's joint.

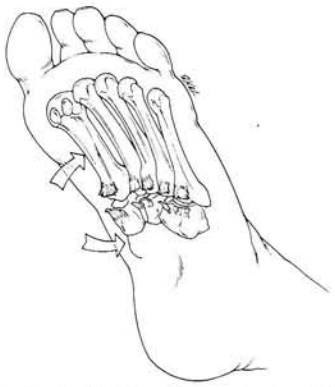

Fig. 4C. Stressing the forefoot in Dorsiflexion to stress the plantar ligamentous structures of Lisfranc's joint.

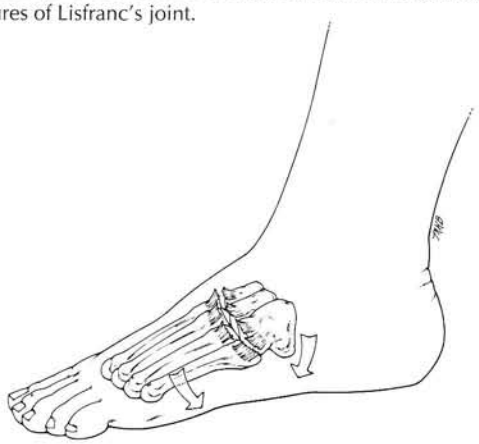

Fig. 4D. Stressing the forefoot in plantarflexion to stress the Dorsal ligamentous structures.

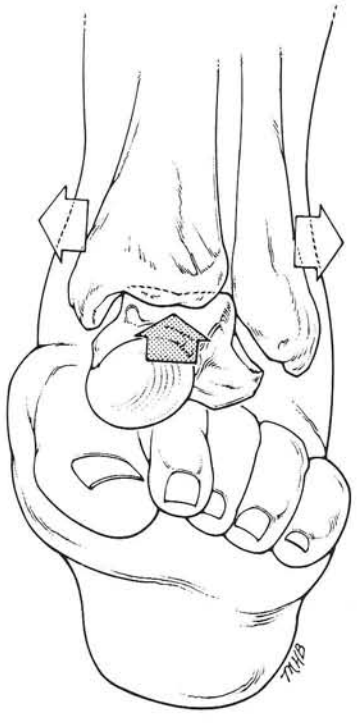

Fig. 5. Forced Dorsiflexion will separate the inferiorn Tibiofibular articulation which would stress the tibiofibular syndesmoses.

One must remember that a complete ligament tear may not be painful immediately after the injury. This is due to a complete rupture of the ligament with total disruption of joint proprioception. Therefore, the nerve endings supplying the joint are destroyed. Second, if the capsule of the joint is totally compromised, swelling will initially be minimal due to lack of hemorrhage accumulation. However, within 30 minutes severe edema will amass in the joint with subsequent severe pain. Therefore, a joint with severe laxity, yet without pain is an indication of total ligament disruption and should be splinted, iced, and elevated immediately. Remember to always compare the contralateral limb and perform the same test for ligament laxity.

Tests for ligamentous integrity:
Anterior Draw Test - Anterior Talofibular ligament (Fig. 2)
Talar Tilt Test - Calcaneal Fibular Ligament (Fig. 3)
Lisfranc Stress Test - Lisfranc Joint
Forefoot Abduction (Fig. 4A), Adduction (Fig. 4B), dorsiflexion (Fig. 4C), plantarflexion (Fig. 4D)
Forced Dorsiflexion-Inferior Tibiofibular syndesmoses (Fig. 5)

If any of the above tests are positive for substantial ligament damage, the joint should be splinted and the athlete taken off the field where further inspection can be performed. However, if the above testing is negative for pain or joint instability, place the foot and ankle through a passive range of motion which includes:

Ankle Motion
Dorsiflexion
Plantarflexion

Subtalar Motion
Inversion
Eversion

Midtarsal Motion
Forefoot adduction
Forefoot abduction

Toe Motion
Flexion
Extension

Knee
Flexion
Extension

The severity of the injury, and the presence of pain upon palpation, movement, and stress testing, will determine the method used to remove the athlete from the field. If the athlete has a severe fracture, a stretcher should be used and the extremity splinted. Two-man transport can be performed if the athlete can move, but cannot place any weight on the extremity. If the athlete can place weight on the extremity without any pain, then he can walk off the field without assistance. In any case, re-evaluation of the athlete must be performed on the bench.

Re-evaluation of the athlete on the side line should be done if they have not yet left the field for the hospital. At this time removal of the shoe and sock can be performed. A complete evaluation must include neurological, vascular, and muscle testing, repeat stress testing, and range of motion of the affected extremity with comparison to the contralateral side.

Treatment of the athlete on the sidelines is determined by the severity of the injury. In most cases ice application with compression, and elevation should be performed.

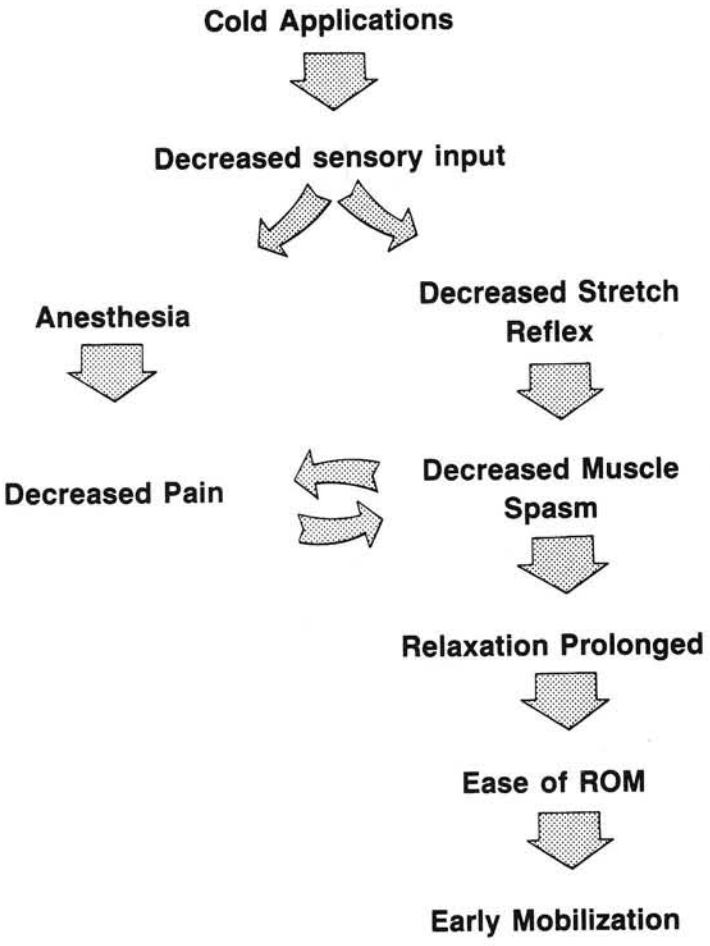

Fig. 6. Application of cold compresses: A chain affect leading to decreased pain with early mobilization

The physiological effect of ice can be summarized into five basic categories:

1) reduced pain
2) reduced muscle spasm
3) reduced metabolism
4) decrease circulation if applied for a short period of time (under 15 minutes)
5) increased circulation if applied for a long period of time (over 15 minutes)

Ice should be applied for 15 to 20 minutes, preferably as a crushed ice, every hour for 72 hours. The ice should not be placed directly on the skin, but over a compression ace wrap along with elevation. The most important factor for control of edema within the first 60 minutes post-injury is elevation.

As illustrated in Figure 6, local application of cold causes a decrease in sensory nerve input, resulting in a local anesthesia and in a decreased stretch reflex. The local anesthesia reduces pain and inhibits the stretch reflex, thereby minimizing muscle spasms. Reduced pain levels allow muscle spasms to decrease, thus the pain-spasm-pain cycle is broken. Once spasms are eliminated the muscle relaxes which allows easier range of motion, and thus earlier mobilization and use of the body part.

Edema can be controlled by increasing the tissue pressure outside the blood vessel and by decreasing the hydrostatic pressure within the blood vessel. This is accomplished by compression and elevation. An elastic wrap or elastic tape provides compression to the body part which in turn increases the outside pressure of the blood vessel. Elevation decreases the hydrostatic pressure inside the vessel. Both of these factors tend to reduce edema.

In addition to compression and elevation, the formation of additional tissue debris (resulting from controlling secondary hypoxic injury) is controlled. This minimizes tissue oncotic pressure which also helps to control edema. If the athlete is to be transported to the hospital, the limb should be immobilized and packed in ice. This will ensure minimal edema upon presentation at the hospital.

Return to play is perhaps the most difficult decision for a team physician. In the acute situation, only those with the mildest ankle and foot injuries should be allowed to return to competition and only after a complete evaluation has been performed. There must be an understanding that the ankle and or foot must be taped and then a mobility test performed by the athlete to stress the injured limb. This test is done on the sidelines with the physician present.

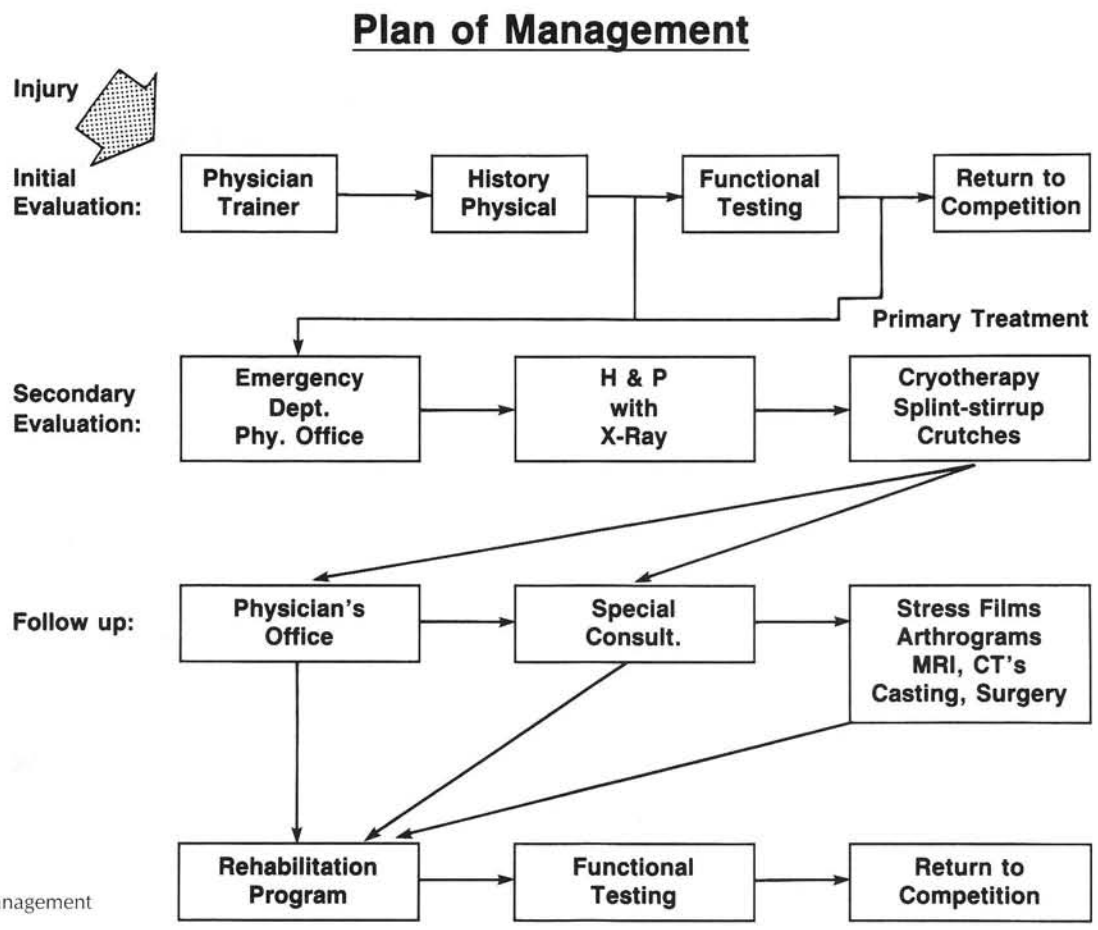

Fig. 7. Plan of Management

Muscle testing is performed of all such structures affecting the injured joint before taping is performed. The athlete then stands and hops on the affected limb without assistance from the opposite limb. He then runs straight for fifteen yards and then returns running backwards. The athlete then runs from side to side, not crossing his legs for fifteen yards and then returns in the opposite direction. Next, the athlete runs figure-eights, and then full speed, cutting to his right or left and pushing off of the affected limb. Only after these tests have been performed successfully, can the athlete return to activity with periodic icing during the contest. For more severe injuries, return to activity should not be allowed until further diagnostic tests can be performed in the hospital or office.

The use of tape either for selected injuries of the foot, ankle, or leg, or for prophylaxis of chronic injuries has been readily adopted by physicians, athletic trainers, and coaches. To justify the use of adhesive strapping, an accurate diagnosis and a thorough evaluation of the extent of tissue damage is required. Only then can taping practices be highly effective in supporting and protecting soft tissue structures that have been weakened as a result of injuries.

The most common joint to be protected by tape is the ankle. Mild ankle injuries that occur during competition may be benefitted by taping. Tape should be applied directly on the skin and then over the sock. This affords maximal assistance in supporting the joint for short period of time. It is not the purpose of this paper to describe taping techniques. Therefore, the physician should have a sound knowledge of many methods of taping multiple joints of the foot, ankle, and leg.

Most injuries that are seen by the physician can be diagnosed and treated on the sideline without further attention. The physician must have a solid understanding of anatomy, the mechanism of injury, and intervention modalities, so that most injuries which do require follow-up will not be complicated. However, it is that one severe injury that occurs every 4 to 5 games that challenges the physician's ability to handle athletic trauma without the comforts of the modern diagnostic equipment of the hospital or office. It is this challenge of on the field diagnosis that defines a true physician of sports medicine.

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