CHAPTER ONE:
INTRODUCTION
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Stress fractures are common overuse injuries that have plagued the athletic population for many years. College athletics today are twice as competitive as they were just a few years ago and as a result, the physical demands on college athletes have also increased tremendously. As a result, athletes are training harder and practicing much longer. All of which may increase the risk for developing stress fractures. In fact, recent reports have shown that stress fractures may comprise as much as 15.6% of all sports’ injuries (Bennell & Brukner, 1997).

Stress fractures are partial or complete fractures of bones as a result of accelerated bone remodeling in response to habitual, nonviolent, repetitive stress (Hough & Ray, 1994). The formation of stress fractures is a continuous process that takes place over time as opposed to a single isolated event. They can occur in all age groups and are not limited to a person’s physical condition, gender, or particular sport in which they participate.

They are most common in the weight-bearing bones of the legs and feet but can occur in the arms, hands and vertebrae as well. Among athletes, stress fractures will vary in location depending upon the sport or activity. Common anatomical sites cited throughout the literature are the tibia, metatarsals, and fibula followed by the navicular and femur. The most common site consistently mentioned is the tibia (Bennell et al., 1997).

There are a number of different theories as to the exact mechanism of injury behind stress fractures. The theory that seems to be most accepted and persistent throughout the literature involves muscle fatigue. Essentially, when the muscle systems become fatigued they are unable to continue to absorb the shock placed on the body.
during repetitive activity such as running. As a result, the overload of stress is eventually transferred directly to the bone resulting in microfractures that prompt the body’s natural process of bone remodeling. As the athlete continues to practice and compete, the rebuilding of new bone lags behind the breakdown, resulting in a weakened area of bone that is susceptible to fracture (Taunton, Clemmer & Webber, 1981).

The diagnosis of stress fractures is dependent upon accurate clinical assessment of signs and symptoms and correct interpretation of radiographic and bone scan results. The diagnosis can often be delayed for as long as 38 months after the onset of symptoms (Khan et al., 1993; Torg et al., 1982). One reason for such delays in treatment is that the athlete will often try to play through the pain of the injury in order to avoid having to sit out of practice and competition. The athlete will often continue playing with the discomfort until a point is reached where they can tolerate the pain no longer and are forced to seek medical attention. By this point it is often too late to prevent stress fracture formation. Once diagnosed either by positive radiograph or bone scan, it takes an average of 3-8 weeks of relative rest and non-weight-bearing activity before the stress fracture is healed.

One of the hazards involved with diagnosing stress fractures is that some soft tissue injuries, such as medial tibial stress syndrome (MTSS), can mimic stress fracture pain making diagnosis difficult (Hough et al., 1994). One important way to determine soft tissue injury from that of bone injury is to attempt to stretch the overlying muscles and tendons. If pain is elicited during the stretch, the injury is most likely to the soft tissue rather than to the bone (Jackson, 1991). Fortunately, since MTSS usually precedes
the formation of stress fractures, if the injury is caught early enough in this stage, often times a stress fracture can be avoided.

There are certain factors that can increase an athlete’s risk of suffering a stress fracture. Among these is the level of fitness of the athlete. According to Gaedner and colleagues (1988), the incidence of stress fractures is more common in the least fit and less common in those who are most fit. This is most important in the athletic population, particularly in freshmen collegiate athletes who are new to the athletic program.

Goldberg et al (1994) reported that of those athletes sustaining stress fractures, 67% were freshmen. One of the explanations for this was that freshmen, unaware of the increased physical demands of college athletics, appeared to be least compliant with summer and off-season training programs. This in turn resulted in an overall lower level of fitness and increased risk for developing stress fractures.

Another major factor that increases the risk for stress fracture formation is dramatic changes in training routine. Numerous studies have reported that abrupt changes in training routine, like those following an off-season or summer break, precede the majority of stress fracture injuries. In the same study, Goldberg and colleagues (1994) reported that 69% of the stress fracture cases followed a major increase in activity compared with the 3 months prior to injury. This increase in activity is consistent with what typically happens during pre-season training. Thus, it is believed that a gradual increase in training over time in order to increase fitness may help minimize the occurrence of stress fractures (Hough & Ray, 1994).
JUSTIFICATION FOR RESEARCH

The increased incidence of stress fractures in female collegiate athletes competing today has resulted in a vast amount of clinical research. Primarily the literature has focused on the underlying causes of stress fractures, as well as, the specific anatomical sites at which stress fractures occur.

Numerous studies have reported that one of the major contributing factors behind the development of stress fractures is a sudden increase or dramatic change in training routines (Goldberg & Pecora, 1994; Taunton et al., 1981; James et al., 1978). Although this is known, each year collegiate athletes are subjected to these same types of training mistakes. This is especially important for freshmen athletes who are not accustomed to the extreme physical demands of collegiate athletics and encounter this sudden dramatic change in workout intensity when they begin preseason workouts (Goldberg et al., 1994), thus, tremendously increasing their risk for developing stress fractures. In light of this, further research in this area concerning factors such as, when in an athlete’s season these injuries are occurring and in which specific groups. This would provide vital information to coaches and athletic staff on how to prevent stress fractures in their athletes. Therefore, the purpose of this investigation was to determine the incidence, frequency, and patterns of stress fractures for the last four years (1994-1998) among all female Division I athletes at Virginia Polytechnic Institute and State University.
RESEARCH HYPOTHESES

H₀₁ There will be no relationship between the incidence of stress fractures in athletes and academic class.

H₀₂ There will be no relationship between the incidence of stress fractures in athletes and anatomical site.

H₀₃ There will be no relationship between the incidence of stress fractures in athletes and season of injury.

DELIMITATIONS

The following are known delimitations to this study:

1. All Division I female athletes at Virginia Polytechnic Institute and State University from 1994-1998.

2. Stress fractures will be diagnosed by a positive technetium 99m bone scan or x-ray.

LIMITATIONS

1. Retrieval of injury data that was recorded and stored on a computer database in the athletic department.

2. Accessibility to athletes medical records.

3. Quality of information recorded in the medical records.
SUMMARY

Stress fractures in collegiate athletes are overuse injuries that develop over time and are preventable in nature. Freshmen athletes have been found to make up a large percentage of the athletes that suffer from stress fractures. Unfortunately, there has been very little research conducted on stress fractures that specifically examines the risks to these athletes. The findings from this study help clarify the connection between freshmen athletes and the increased incidence of stress fractures, in addition to providing further insight on approaches to treatment and prevention of these injuries.