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ABSTRACT

The following case investigates insidious onset of shin pain in a Division I female cross-country runner. Though her initial evaluation revealed early onset medial tibial stress syndrome, the sequence of events that occurred immediately afterwards is what makes this case unique. As the student-athlete underwent lower extremity rehabilitation to increase her mileage, she reported that her pain had plateaued. The initial x-ray revealed a periosteal reaction of the posterior left tibia. After adhering to the treatment plan for four weeks, the student-athlete continued to report significant bouts of pain as demonstrated by the Visual Analog Scale. A follow-up x-ray revealed a transverse fracture through the proximal tibia. It was discovered through teammates that she was exercising at the university's recreation center for up to three extra hours per day, despite set limitations by the athletic trainers, team physician, and coaches. Her roommate also confided in the coaching staff that there were instances of the student-athlete deliberately skipping meals, and even conducted bouts of binging and purging. The student-athlete was immediately removed from team activities and referred to the team physician, who reviewed her case and relevant medical history. Further, she was referred to additional behavioral counseling for disordered eating, obsessive compulsive tendencies, and her idealization of weight and excessive exercise. Although true exercise addiction is rare, the comorbidity rate in patients with disordered eating is clinically relevant. The Exercise Addiction Inventory is a simple and reliable questionnaire for healthcare providers to utilize during pre-participation examinations as a way of identifying athletes who may have a related medical history, and greater risk of developing comorbidities.

Key Phrases
Emotional wellness and mental health, comorbidities, college and university patient population

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INTRODUCTION

A Division I female cross-country runner with a previous history of depression, anorexia, and bulimia nervosa presented with increasing left proximal shin pain at the beginning of winter training. Initial evaluation revealed early-onset medial tibial stress syndrome, which was treated conservatively for two weeks with instrument assisted soft tissue mobilization, as well as intrinsic foot, gluteus medius and calf strengthening. Despite defined parameters for cross-training, in addition to daily rehabilitation and treatment, her reporting of pain remained relatively high compared to her baseline levels at the onset of medical care. As cross-country is often defined as an aesthetic sport, this student-athlete experienced episodes of body dysmorphia, depression, disordered eating habits, and even unhealthy patterns of excessive exercise. At this time, the student-athlete was referred to our team physician, nutritionist, and behavioral psychology department for further evaluation.

Patient Information

Patient: The student-athlete is a female cross-country runner (age=20years; height: 1.91m; mass: 56.9kg). She had a previous history of bilateral tibial and metatarsal stress fractures that began as a freshman in high school and occurred intermittently until her senior year of college. She was consistently meeting with a psychiatrist through the institution for episodes of anorexia nervosa and bulimia, which initially began upon arrival to campus. The student-athlete's parents were well-known ultramarathoners – sometimes running up to 80-

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100 miles a weekend which may have added additional pressure for her success. In terms of family dynamic, she would often report a distanced relationship between herself and her father, and a heightened desire to please her parents. Although she has an extensive medical history specifically related to the female athlete triad, her parents would often minimize her injuries, such as blaming the reoccurrence of injuries on inconsistent wear of compression socks or inadequate turnover rate in her training shoes.

Differential Diagnosis and Evaluation

The student-athlete presented with left shin pain of insidious onset. She denied night pain, including difficulty falling or staying asleep, and denied antalgic gait pain during the first few steps after awakening. When asked to point where the pain resides, she was able to locate the muscle belly of the tibialis anterior. She reported that it did not replicate the same pain that she experienced previously during her numerous stress injuries. In general, she reported the most discomfort while ascending and descending staircases when her ankle was positioned in full plantarflexion. She reported no difficulty completing activities of daily living, but reported that she could only run one mile before the symptoms became bothersome. The differential diagnoses list included: chronic exertional compartment syndrome, tibialis anterior contusion, tibial stress reaction or fracture, fibular stress reaction or fracture, and medial tibial stress syndrome. With continuation of rehabilitation and controlled training parameters, her reporting of pain remained moderately high. After an additional two weeks of rehabilitation, initial x-rays confirmed a left proximal periosteal tibial stress reaction, and she was again limited in weight-bearing training. Approximately four weeks post-imaging, a follow-up x-ray revealed a complete transverse fracture through her left proximal tibia.

Body Structure and Function

Upon examination, she was tender to palpation along the muscle belly of the tibialis anterior and its insertion of the muscle onto the tibia, but did not present with edema surrounding the muscle belly, or effusion within the tibiofemoral joint. There were no other signs of trauma. A tuning fork was placed at her tibial tuberosity and along her distal tibial shaft to determine any areas of stress-related injury. She denied pain at all of the locations that the tuning fork was placed. The patient reported pain was a 4/10 measured with the Visual Analog Scale. When compared bilaterally, she demonstrated full active and passive ankle and knee ranges of motion and were all within normal limits. Manual muscle tests demonstrated weakness of the left tibialis anterior (4/5), gastrocnemius (4/5), medial hamstring (4/5) and gluteus medius (4/5). During functional testing, she was able to complete calf raises without discomfort, but noted localized pain with double leg hopping (forward/backward and side-side).

Activity and Participation

Due to her medical history, the mileage assigned for this specific student-athlete was scaled back to 30-35 miles/week, in comparison to the rest of the team, which typically completed around 60 miles. As a high school runner, she was very successful at regional and state track and field championships. When she initially arrived at the university, she presented with a significantly smaller frame than when she was first recruited, thus leading the coaching staff to believe she was suffering from some form of disordered eating or possible overtraining. She was referred to mental health counseling the following week and continued to work with counselors until her junior year of college.

Environmental and Personal Factors

She had a previous mental health history that included depression, anorexia nervosa, bulimia and most recently, suicidal ideation. The student-athlete's parents were well-known for competing

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in ultramarathons, and appeared unconcerned about the number of stress-related injuries that she had accumulated over time.

INTERVENTIONS

The physician and athletic trainers outlined a structured cross-training plan to maximally reduce the amount of force through her shins while maintaining her overall fitness. The student-athlete's adherence to the treatment plan was demonstrated by completing rehabilitation at least three times during the week. Despite consistent treatment sessions with the athletic trainers, her symptoms continued to worsen with specified training intervals. When the team physician asked her to clarify her symptom reporting, she reported lower pain thresholds compared to what she reported to her athletic trainers and coaching staff. She was to solely complete one workout per day for a maximum of 30 minutes on the bicycle, or 60 minutes in a pool setting. Her training progression would begin with aqua jogging or supervised bike workouts, and then eventually to elliptical and anti-gravity treadmill training until she became asymptomatic for at least eight weeks.

OUTCOMES

Body Structure and Function: Prior to her follow-up x-ray, she described having a "drop foot" sensation while walking to class. Subsequent evaluation demonstrated knee joint effusion and edema at the proximolateral tibia. A neurological screen of the lower quarter was completed and proved to be negative. Despite rehabilitation to strengthen her gastrocnemius and tibialis anterior, she still lacked full strength in comparison to the contralateral side (4/5 manual muscle testing).

Activity and Participation

Based on her numerous referrals, and previous physical and mental health history, the athlete ultimately decided that it was in her best interest to dismiss herself from all team activities. She was immediately removed from activity and referred to our team physician, who then referred her to mental health counseling and nutrition staff. In order to ensure that she had full potential to return to a healthy lifestyle, she had access to the same medical treatment that was available to her while actively participating on the team. Although she was no longer physically on the team, she remained active with the student-athlete community through an internship developed by the nutritional department. She volunteered her time by preparing post-practice meals, and setting up hydration stations throughout various facilities. She remained roommates with her previous teammates until her graduation the following spring.

Environmental and Personal Factors

Over the following weeks, the healthcare team was notified of the student-athlete completing numerous additional unsupervised cross-training sessions lasting between two to three hours at the university recreational center. Furthermore, the student-athlete's roommate confided in the coach that she observed her skipping multiple meals throughout the week, and was behaving similarly to previous episodes of binging and purging. Even though there were several interventions between the student-athlete, coaches, and medical staff about the importance of compliance to the physician's recommendations, she continued to complete additional workouts in secrecy.

DISCUSSION:

The literature reports an inconsistent prevalence of individuals suffering from exercise dependence (EXD), ranging from 0.3% to 77%, yet the co-occurrence rate with persons diagnosed with anorexia nervosa is three times higher than other diagnoses of disordered eating.[1-4] EXD is often described as a manifestation of uncontrollable exercise, increased tolerance, and associated anxiety/ depression with withdrawal of activity.[2-4] A

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component of EXD related to this patient specifically is continuance – the perpetuation of exercise despite comprehension of the potential to increase the physical deficits and interpersonal strains.[4] Populations commonly affected by EXD include young women, high-performance athletes, and high achievers with associated body dysmorphia.[4-6] Although this patient presented with several red flags in relation to the female athlete triad, the effects of a possible underlying diagnosis of EXD and additional bio-psychosocial disorders on her initial shin pain make this case unique.

A prominent strength in this case was the close-knit relationship between the athletic trainers, team physician, and coaching staff. By maintaining thorough communication, the entire staff was able to provide the student-athlete the help that she crucially needed. Another strength was the willingness of her teammates to discuss her irregular eating and exercise patterns with the staff. Since it was difficult to know when the patient was truthful in her responses, the advocacy of her teammates assisted in an efficient transition to referral. On the other hand, a significant limitation included minimal communication with the sports medicine staff and the mental health counseling center on campus. Since the center is located outside of the athletic department, it was difficult for the athletic trainers to communicate their concerns and any crucial updates directly to the counselors. Another limitation includes the inability to control the student-athlete's activity outside of the athletic training room and track facilities. Because she was able to walk, bike, and run anywhere on campus, she had greater capability to complete additional workouts, in contrast to someone who plays soccer or lacrosse and needs extensive equipment or teammates for activity. Lastly, there were no patient-reported outcomes tracked throughout this patient case beyond subjective pain. However, the background and psychosocial factors that influenced this case are still evident, and can help other athletic trainers understand how family and social factors influence difficult patient cases.

CLINICAL BOTTOM LINE:

Typical red flags in cases related to the female athlete triad include accelerated weight loss within a short period of time, dark and sunken orbitals, brittle nails, dissociation from team activities both on and off campus, and co-morbidities such as depression, anxiety, and obsessive-compulsive disorder. Although the diagnosis of EXD is rare, there are a number of screening tools available for clinicians to utilize for the referral process should concerning histories present themselves. The Exercise Addiction Inventory is a simple survey with significant reliability when paired with other disordered eating questionnaires.[7] Since the sports medicine staff did not utilize this scale with their current student-athletes, it is something to consider for future pre-participation screening, especially for student-athletes with relevant medical history. In general, athletic trainers should be well-educated about the long-term health risks of relative energy deficiency in sport, and employ supplemental resources when working with high-risk teams such as cross-country, volleyball, and be aware of the effects related to aesthetic sports such as gymnastics, cheerleading, and swimming on athletes' mental health and overall well-being.

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