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Developing Female Gymnast: Athlete at Risk

Gymnastics has a long and storied history, having first been described, by the Egyptians, nearly 4,000 years ago. But only in the past 30 years have female gymnasts come to prominence, developing strength, flexibility, focus and self-confidence along the way.

Young females have vaulted to the forefront of gymnastics. Their smaller frames allow them to perform difficult maneuvers with greater ease than their older and larger counterparts. This, combined with drive and intense training, allows these younger athletes to compete and excel at international levels.

However, there is a downside in the form of injury risks. Who can forget the image of American Kerri Strug, hobbled by an ankle injury, valiantly landing a vault and clinching an overall gold medal for the 1996 Olympic team?

Young athletes place high loads on their developing musculoskeletal systems. Many routines include high-impact landings that gymnasts must "stick" by hyper-extending their knees and spine. This maneuver minimizes the body movements that normally help to attenuate forces. Consequently, abnormally high loads are transferred to joints of the lower extremity and the spine, placing these athletes at increased risk for injury. In fact, the lower extremity is the most common site for injuries in females. They are twice as likely as males to injure their spines.

Dizzying moves make gymnasts prone to falls, which can result in acute fractures.

THE LOWER EXTREMITY IS THE MOST COMMON SITE FOR INJURIES IN FEMALES. THEY ARE TWICE AS LIKELY AS MALES TO INJURE THEIR SPINES

OTHER COMMON INJURIES

Stress fractures: Female gymnasts spend considerable time weight-bearing through the upper extremities: more than twice their body weight while performing back hand springs. This can result in wrist stress fractures; those affecting the growth plate are of particular concern as they may result in stunted growth of the involved extremity and chronic pain.

Falls: A dizzying array of moves, performed at rapid speeds and various heights, makes gymnasts prone to falling. This may cause acute fractures of the extremities, which are of special significance if they involve the growth plate.

Cartilage damage: The repetitive loading associated with gymnastics increases the risk of injuring joint cartilage. These injuries often result from excessive compression of the joint surfaces. Excessive elbow joint loading can lead to oseochondritis dissecans of the radial head or capitellum, an injury of the elbow joint cartilage.

Knee cartilage also is vulnerable. The high eccentric loads experienced during landings can result in cartilage damage of the patellofemoral joint. Repetitive compression and loading of the cartilage can result in cartilage deformation. If left untreated, these injuries may cause premature degeneration of the joints and eventually osteoarthritis.

Improper training volume: When not practicing their routines, these young athletes spend considerable time improving their strength. A well-designed strength program has many benefits, such as improved bone mineral density, cardiovascular function and self-confidence, and better body composition. However, improper training volume may result in musculoskeletal injuries such as tendonitis, stress fractures and growth plate fractures.

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'FEMALE ATHLETE TRIAD'

Female gymnastics is athletic but also artistic. As with other artistic sports such as dance and figure skating, the drive to remain thin is strong, placing these young females at risk for eating disorders. Unhealthy eating habits, coupled with high-intensity training, leads many girls to suffer from the "female athlete triad" – or the interrelationship among unhealthy eating, osteoporosis and altered menstrual cycles.

The resulting decreased bone density may help explain why females are at a greater risk of developing stress fractures as compared with males. Eating disorders can range from occasional severe calorie restriction to more significant problems such as anorexia nervosa or bulimia nervosa. Up to 74 percent of young female gymnasts reportedly have eating disorders.

It is critically important for coaches and parents alike to be aware of these athletes' body images. Their eating habits should be monitored closely for signs of disorders; the appearance of any signs of the triad should be examined for the other signs. These gymnasts should have access to a dietician and a counselor to help them through any challenges they experience with body image or eating disorders.

Coaches are important role models and should de-emphasize gymnasts' weight and focus on effort and work habits while in the gym. Coaches should instill healthy eating and exercise habits early on and vigilantly reinforce them as these athletes develop.

Gymnastics often calls to mind images of stern international judges determining the outcomes of competitions, often by fractions of points. But besides competition, gymnastics provides young athletes with an opportunity to develop coordination, confidence and strength, and, most important, to have fun.

REDUCING INJURY RISKS

Steps can be taken to reduce the injury risks faced by young female gymnasts:

- In terms of musculoskeletal injuries, gradually increase the loads they are subjected to. Before attempting more difficult moves, they should first master the components that make up those moves.
- Encourage them to report any pain or problems and seek medical attention if necessary. While undergoing treatment, they should modify their gym routines so as not to place any additional stress on injured tissue.
- Relative to acute injuries such as fractures, properly maintain equipment, close-spot them on more-difficult moves, and use safety equipment such as mats. Simple steps such as using the appropriate amount of chalk on equipment can give gymnasts a better grip and reduce their risks of falling.
- Properly design exercise programs to increase flexibility and strength.

REFERENCE:

Zetaruk, M. "The young gymnast," Clinics in Sports Medicine, 2000:19:757-781.

– Article by Brian Noehren

Q&A

Spondylolysis

WHAT IS SPONDYLOLYSIS?

Spondylolysis is a bony defect in the connection between vertebrae in the spinal column (known as the pars interarticularis) in the lower lumbar region. This defect can lead to stress fractures, compromising the stability of the spinal column.

WHAT IS THE PREVALENCE OF THIS CONDITION?

Spondylolysis affects 3 to 8 percent of the population. It is more common in children and adolescents who participate in sports that place a lot of stress on the lower lumbar spine, such as gymnastics, weightlifting and football. Generally, it is seen more often in males than in females. However, female gymnasts sustain these injuries at a comparable rate to males.

WHAT ARE THE SYMPTOMS?

Stress fractures generate the pain associated with this condition. The pain usually spreads across the lower back and sacral regions. The pain generally is worse with vigorous exercise or activity and improves with rest. Pain with hyperextension is common; that is, forward bending is OK but backward bending is painful.

CAN SPONDYLOLYSIS BE CONFUSED WITH ANOTHER CONDITION?

Arthritis and congenital malformations of the spinal column should be considered during differential diagnosis.

WHAT CAUSES SPONDYLOLYSIS?

Although it can be hereditary, spondylolysis usually is caused by activities that apply large forces through an extended lumbar spine. An extended spine is susceptible because sudden force application can compress the vertebrae and cause a fracture.

HOW IS SPONDYLOLYSIS DIAGNOSED?

Spondylolysis is diagnosed with X-rays of the lumbar region. Side-view X-rays best detect this abnormality. A computed tomography (CT) or magnetic resonance imaging (MRI) scan might be needed to detect small fractures.

HOW IS SPONDYLOLYSIS TREATED?

Conservative treatment is the first step. This typically involves pain-reducing and anti-inflammatory medications. Epidural injections have been used. A physical therapist or certified athletic trainer also may teach appropriate strengthening and stretching exercises. The primary goal is to allow the fracture to heal safely on its own. A back brace sometimes is prescribed if there is concern about the stability of the defect.

CAN THIS DEFECT WORSEN?

Excessive slippage can press on nerves in the low back. When one of the involved lumbar vertebrae shifts forward (usually at the L4 and/or L5 level), it is referred to as spondylolisthesis. This condition is more serious than spondylolysis alone.

WHAT ABOUT SURGERY?

If conservative treatments do not work, surgery may be required. This typically involves a spinal fusion. Internal screws and rods may be used to hold the vertebrae together.

– Article by Joaquin Barrios

CASE STUDY

Successful Physical Therapy Treatment of Spondylolysis in a Female Gymnast

PATIENT HISTORY

A 14-year-old female Level 9 competitive gymnast presented with a gradual onset of low back pain. She reported intermittent symptoms over the past year that resolved with rest. However, in the past two weeks the pain became constant and correlated with an increase in intensity in her training. She was anxious and concerned because her state-qualifying competition was only one month away and training was becoming difficult and more painful.

She described her pain as dull and achy at rest, increasing to sharp pain with changes in posture. Pain was worse with standing and walking, and especially with gymnastics activities that required lumbar extension. The pain was localized to the central and right low back. Spring testing over the L5 vertebra was positive for pain and there was palpable guarding. She was referred to a physician to rule out lumbar pathology.

X-rays were positive for spondylolysis of the L5 vertebra. She was referred to outpatient physical therapy and instructed to avoid hyperextension activity for four weeks. Her goal was to compete in a regional competition.

ASSESSMENT

Upon formal physical therapy evaluation (see Tables 1-2), the patient reported her pain level at 3/10 and at worst 8/10. She had an increased lumbar lordosis and anterior pelvic tilt.

Gymnasts are at a particularly high risk for overuse injuries to the lumbar spine.

The right posterior superior iliac spine and iliac crest were elevated and the anterior superior iliac spine depressed in all positions. She demonstrated a fair transverse abdominal contraction and decreased strength in her right gluteal musculature.

TREATMENT

Manual treatment involved soft tissue release of these structures along with manual stretching. Strengthening targeted the gluteal and core musculature. Transverse abdominal stabilization exercises were performed with the use of a blood pressure cuff for biofeedback. The patient was instructed in self-myofasical release of the hip flexor musculature using a foam roller, and in self-stretching of her leg splits using square hips and proper posture.

She progressed well without aggravation of symptoms. Repeat diagnostics demonstrated healing of the L5 vertebra. She was instructed by her physician to return to gymnastics gradually. Her return to sport was monitored closely by the physical therapist. As strength, flexibility and symptoms allowed, she progressed from lower-impact activities such as beam, bars and dance to tumbling and vaulting.

After 22 visits, she reported 2/10 pain that was experienced only with gymnastics. She was able to contain her pain level with continued core stability exercises and stretching. She then was discharged from formal physical therapy. After discharge, she petitioned into regional competition and subsequently qualified for national competition for the first time, experiencing minimal, intermittent symptoms.

SUMMARY

Spondylolysis of the lumbar spine is a common overuse injury in adolescent athletes. Because of the repetitive lumbar extension required to perform most gymnastics skills, gymnasts are at a particularly high risk for overuse injuries to the lumbar spine. Physical therapy and preventive maintenance involving gymnastics-specific flexibility and strengthening can limit the amount of training missed and ultimately lead to successful participation in gymnastics.

– Article by Talia Trapuzanno

PHYSICAL THERAPY AND PREVENTIVE MAINTENANCE CAN LIMIT THE AMOUNT OF TRAINING MISSED.

Table 1.

RANGE OF MOTION AND FLEXIBILITY	
Lumbar Flexion	90° with pain upon return
Lumbar Extension	20° with LBP
Lumbar Right Side Bending	20° with LBP
Lumbar Left Side Bending	30°
Hip Extension	5° with LBP

FLEXIBILITY	RIGHT	LEFT
Thomas Test	(+) For iliopsoas, RF, ITB contracture	(-)
Ober Test	(+) For TFL contracture	(-)
Ely's Test	(+) For RF contracture	(-)

Table 2.

STRENGTH	RIGHT	LEFT
Abdominals	2/5 Sahrmann Grading Method	
Gluteus Medius	4/5 pain, compensation	5/5
Gluteus Maximus	4/5 pain, compensation	4+/5
Hamstrings	4/5 pain	5/5
Hip Flexors	4/5 pain, compensation	4+/5

RESEARCH ABSTRACT

Injury Incidence in Gymnastics

Dixon M., Fricker P. "Injuries to elite gymnasts over 10 years," Medicine and Science in Sports and Exercise, 1993:25;115-119.

INTRODUCTION

The purpose of this article was to summarize the incidence and distribution of injuries among elite male and female gymnasts in a 10-year period.

METHODS

This was a retrospective study examining 42 males (ages 12 to 22) and 74 females (ages 9 to 19) enrolled in the elite gymnastics program at the Australian Institute of Sport. All athletes trained at the same facility and received medical care through the on-site AIS sports medicine department. All injuries sustained at AIS were referred to medical practitioners. Medical records were the data source for this study over a 10-year period. Injuries were classified by body part and tallied separately for males and females.

RESULTS

No life-threatening injuries were sustained during the course of this study. Elite gymnasts, regardless of gender, sustained an average of two injuries per year. Acute injuries accounted for 1.2 injuries per gymnast and chronic injuries accounted for 0.8 injuries per gymnast.

Male gymnasts were nearly twice (1.8 times) as likely to sustain an upper body injury as female gymnasts. In contrast, females were nearly twice as likely (1.7 times) as males to suffer a lower body injury. The most commonly injured body part among males was the shoulder, representing 19 percent of their injuries; for women, it was the ankle (16 percent).

Females were twice as likely to sustain a chronic injury to the spine. Acute injuries to the spine were equal between genders. No acute spine fractures were noted; acute injuries to the spine were mainly soft-tissue or ligamentous in nature. Stress fractures and spondylolysis to the lumbosacral spine were the only bony spine injuries.

Spondylolysis is a type of stress fracture injury typically involving the fifth lumbar vertebra. This injury often is associated with forceful extension of the loaded spine. Both male (7.1 percent) and female (9.5 percent) gymnasts sustained a spondylolysis injury at a higher rate than the general population (3 to 6 percent).

INJURIES	MALES (%)	FEMALES (%)
Upper Extremity		
Shoulder	19	1
Elbow	11	8
Forearm	1	1
Wrist	14	6
Hand/Thumb	7	5
Total	**52**	**21**
Lower Extremity		
Hip/Pelvis	2	5
Thigh	2	3
Knee	8	11
Lower Leg	1	2
Ankle	10	16
Heel	4	7
Foot	6	11
Total	**33**	**55**
Axial Skeleton/Trunk		
Head	1	2
Cervical	2	4
Thoracic	2	2
Lumbosacral	9	13
Chest/Abdomen	1	3
Total	**15**	**24**

DISCUSSION

Previous studies have found low injury rates among non-competitive gymnasts. In addition, injury rates have been correlated with level of competition. It is reasonable to postulate that as training time and requisite level of skill increase, injury rates also will increase. The elite gymnasts examined in this study should represent the highest injury rate among gymnasts of all abilities.

Based upon the results of this study, it is reasonable to conclude that the prevalence of serious injury is low in elite gymnastics. The gymnasts in this study typically sustained mild to moderate injuries while training. However, because of the high impacts of landing, it is possible for these athletes to sustain serious injuries. The importance of appropriate medical treatment should be emphasized in dealing with all gymnastics injuries.

– Article by Rich Willy