Back Pain in Young Athletes

Significant Differences From Adults in Causes and Patterns

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**Objectives:** To determine whether there are significant differences in the causes of back pain in young athletes compared with the general adult population and to review the diagnosis and assessment of young athletic adolescent patients who present with this complaint.

**Design:** Retrospective randomized case comparison study with two cohorts segregated by age and type of activity.

**Setting:** The adolescent sports medicine clinic of a children's hospital compared with the acute low back pain clinic of an orthopedic hospital.

**Patients:** One hundred adolescent athletes (aged 12 to 18 years; mean age, 15.8 years) with a chief complaint of low back pain were compared with 100 adults (aged 21 to 77 years; mean age, 31.9 years) with acute low back pain.

**Interventions:** None.

**Main Outcome Measures/Results:** Sixty-two percent of the adolescents had derangements of their posterior elements associated with the onset of back pain. Forty-seven percent of the 100 adolescents were ultimately shown to have a spondylolysis stress fracture of the pars interarticularis. By contrast, 5% of adult subjects were found to have spondylolysis associated with low back pain. Similarly, discogenic back pain was the final diagnosis in 48 of the 100 subjects in the adult group, while 11 of the 100 in the adolescent group had back pain attributable to disc abnormalities. Muscle-tendon strain accounted for back pain in 27% of the adults, while only 6% of the adolescents were diagnosed as having muscle-tendon strain. These differences were significant. Spinal stenosis and osteoarthritis as causes of back pain were encountered in 10% of the adults, while these conditions were not encountered in the children.

**Conclusions:** There is a significant difference in the major causes of low back pain in young athletes compared with causes of low back pain in the general adult population. Physicians diagnosing back pain in young athletes must have a specific understanding of these differences to avoid incorrect diagnosis and harmful delays in proper treatment.

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**Editor's Note:** This simple, descriptive study provides information on the differential diagnosis, evaluation, and treatment of back pain in adolescents and the differences between adolescents and adults with this problem. Adolescents are clearly different from adults, not only behaviorally (at least usually) but also medically.

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The participation of children and adolescents in organized competitive sports is growing in North America. Beginning with Little League baseball after World War II, these competitive sports now include soccer, football, swimming, hockey, figure skating, and gymnastics, and the list is growing. It is estimated that 30 million children now participate in organized sports in the United States.

Associated with this increased participation in sports by this age group have been increased numbers of injuries. Sports injuries can be classified into two major types: acute traumatic injuries, which result from a single blow or twist with resultant fractures, strains, or sprains, and overuse injuries, which result from repetitive training and microtrauma. Children's overuse injuries were rarely encountered before the advent of organized sports training. They are now a major concern.
source of morbidity in children and adolescents. Pipe reported that epidemiologic data now show that sports injuries exceed infectious diseases as a cause of children's morbidity in Canada.

High incidences of low back pain have also been reported in these young athletes, particularly those participating in sports such as gymnastics, figure skating, and dance. Certainly, however, low back pain is encountered in children participating in almost any sport requiring repetitive flexion, extension, or rotation of the spine as part of training. Three recent studies in both North America and Europe have reported an incidence of spinal derangement of up to 75% in young gymnasts. With early accurate diagnosis, many of these injuries can heal with restoration of painless function and a presumed improved natural history of back function.

Unfortunately, many of these low back injuries in young athletes are subject to incorrect or delayed diagnosis, with potential persistent derangement resulting. The reason for this appears to be twofold. Historic reports of studies of children and adolescents have suggested a low incidence of back pain in this age group in general and that the majority are subject to "nonspecific" lumbar pain that will resolve without specific treatment.

The second contributor to this sanguine approach to low back pain in young athletes is related to current approaches to back pain in the adult population. Epidemiologic studies have noted the high incidence (>80%) of severe low back pain in the North American adult population. Studies of the pathogenesis of adult back pain suggest an inevitable process of deterioration of the spinal elements, beginning with disk degeneration anteriorly, secondary alteration of the facet and neuroforaminal anatomy and biomechanics posteriorly, with subsequent pain syndromes related to the disk deterioration itself or pathologic deterioration of the facet joints and their contiguous neural elements.

Based on these observations that adult back pain results from an inevitable degenerative sequence with varied symptomatic presentations, there is presently a strong trend in the treatment of adult low back pain to minimize diagnostic interventions, including imaging techniques and neuromuscular diagnostics, and to focus on pain management and functional restoration of motion and strength.

The young athlete with low back pain is often seen initially by a pediatrician or primary care physician and believed to have nonspecific low back pain or, incorrectly, a "back strain." When this pain persists, the next consultant is usually a rheumatologist or orthopedist who most frequently deals with adult low back pain. A nonspecific functional approach is often advised.

The purpose of the present study was to compare

SUBJECTS AND METHODS

We reviewed the files of the Back Clinic of the New England Baptist Hospital, Boston, Mass, and the Division of Sports Medicine of the Boston Children's Hospital for the years 1989 to 1992. One hundred files of patients whose presenting complaint was low back pain were randomly selected from computer generated records of clinic visits, and the final diagnosis for each case was recorded. The Children's Hospital group was restricted to those aged 18 years and younger. These subjects' ages ranged from 12 to 18 years, with a mean age of 15.8 years. The New England Baptist Hospital group was restricted to those aged 21 years and older. These subjects' ages ranged from 21 to 77 years, with a mean age of 31.9 years. In both groups, all patients selected presented with a new complaint of low back pain that was not attributable to an acute injury, such as that from a motor-vehicle accident. The final diagnoses were based on history, examination, and findings of imaging techniques, including plain roentgenography, computed tomography, magnetic resonance imaging, bone scanning, single-photon emission computed tomography, and myelography.

The diagnostic characteristics of the subgroups of patients in this study were as follows: (1) Spondylolysis or spondylolisthesis was diagnosed for low back pain associated with a documented lesion of the pars interarticularis of the lumbar spine. This diagnosis was made with plain roentgenography, bone scanning, magnetic resonance imaging, or single-photon emission computed tomography with a specific lesion in the spine corresponding to the pattern of pain symptoms. All patients had pain on provocative hyperextension testing. (2) Lordotic mechanical back pain was diagnosed in the adolescents who demonstrated pain in the lumbar area of the back only, with variable pain with provocative hyperextension or hyperflexion testing but with a characteristic extension contracture of the lumbar spine resulting in inability to fully forward flex the lumbar spine. These patients inevitably demonstrated a dramatic inability to touch their toes. They often had associated hyperflexion deformities, or kyphosis, of the thoracic spine as apparent compensation for the decreased forward mobility of the lumbar spine. It has been hypothesized that this characteristic postural deformity and associated pain syndrome is related to the final stages of adolescent growth and maturation. Some observers have suggested contractures at the facet joint as the site of pain. (3) Disk degeneration was diagnosed in patients, adult or adolescent, who demonstrated low back pain, with pain referral patterns into the buttocks or upper legs, who were found to have degenerations of a disk(s) of the lower lumbar spine by roentgenographic or magnetic resonance imaging criteria. (4) Disk herniation was diagnosed when there was lower lumbar pain with associated sciatica distal to the knee. All patients demonstrated pain with the straight leg raising test and Laségue's test, and disk herniation at a level consistent with their pattern of neurologic deficit was documented on plain roentgenograms or magnetic resonance imaging scans. (5) Low back strain was diagnosed when there was tenderness in a specific portion of the muscles of the lumbar spine, pain on provocative stretching of that muscle-tendon unit toward the opposite extremity, and response to treatment in a pattern characteristic of any muscle-tendon strain anywhere in the body, ie, progressive resolution of symptoms in response to heat and muscle relaxants during a period of 3 to 4 weeks. A strain is an acute injury to a muscle-tendon unit, usually occurring at the muscle-tendon junction, due to overstretching of the muscle-tendon unit, overcontraction of the muscle-tendon unit in response to an externally applied load, or a combination of these two mechanisms. 

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the pathogenesis of low back pain in a group of young athletes with that in adult patients encountered in a general back pain clinic to test our clinical impressions that the causes, pathogenesis, and treatment are significantly different for these two population groups.

**RESULTS**

A comparison of the relative frequencies of the different diagnoses in the two age groups revealed several interesting patterns (Table).

Spondylolysis was by far the most common cause of low back pain in the Children's Hospital group, with 47 of the 100 cases having a diagnosis of spondylolysis confirmed with imaging techniques. In contrast, only five of 100 adult subjects were found to have spondylolysis associated with their low back pain. The difference was significant at P<.05.

The most common diagnosis in the adult group was discogenic back pain. The term discogenic back pain includes herniated lumbar disc, degenerated lumbar disk, or both. The Table shows that 48 of the 100 subjects in the adult group had discogenic back pain. In contrast, only 11 of the 100 subjects in the Children's Hospital group had back pain attributable to disk abnormalities. A further analysis of discogenic back pain in these two groups showed that degenerative changes in the disk were very uncommon in the Children's Hospital group, whereas degenerative changes in the adult group were almost as common as herniation of the lumbar disk (22 of 48 subjects compared with 24 of 48 subjects). As with spondylolysis, a statistically significant difference in the frequencies of discogenic back pain was noted in the two groups (P<.05).

The results also show a discrepancy between the two groups in their relative frequencies of lumbosacral strain. Lumbosacral strain is an acute injury of the muscle-tendon units of the extensor muscles of the spine, characterized by immediate onset after a provocative maneuver or activity, muscle tenderness, decreased motion away from the injured muscle group, and lack of neurologic signs. It is relatively frequently encountered in adults, particularly in physically active adults, while unusual in athletically active youngsters. Twenty-seven of 100 subjects in the adult group had lumbosacral strain compared with six of 100 subjects in the Children's Hospital group. Once again, this difference was significant.

In addition, review of these data demonstrated diagnoses that were specific to one group but not to the other. The Table shows that 10 of the 100 subjects in the adult group were diagnosed as having either osteoarthrosis or spinal stenosis, two conditions generally believed to be degenerative. The Children's Hospital group showed no evidence of either of these conditions. Likewise, the Table shows that 26 of the 100 Children's Hospital subjects had hyperlordotic or mechanical back pain, a diagnosis that was not encountered in the adult group.

As previously noted, the primary care physician must be aware of the diagnostic possibilities as well as the diagnostic probabilities when a patient of any age presents with a complaint of low back pain.14,26,32

Injuries to the posterior elements of the spine accounted for 73 of the 100 cases of low back pain in the adolescent group, indicating that this is the major site of pathology in athletically active adolescents with back pain. Of these posterior element injuries, spondylolysis stress fracture is potentially the most severe. The early diagnosis of spondylolysis stress fracture is now possible by careful history, physical examination, and diagnostic imaging, including plain roentgenography of the lumbar spine or radionuclide imaging.6,10,14,33-36

Every child presenting with low back pain of recent onset associated with a history of repetitive hyperextension training, such as gymnastics, and a physical examination demonstrating pain on provocative hyperextension testing should be sent for anteroposterior, lateral, and oblique roentgenograms of the lumbar spine.33,37 Although oblique roentgenograms may not necessarily be needed to visualize a pars interarticularis defect, this view may demonstrate fractures that are not yet evident on the lateral view. In children who have not yet progressed to a complete fracture through the site of stress fracture, radionuclide bone scanning and, in particular, computerized scanning techniques (single-photon emission computed tomography) may demonstrate a stress fracture at the pars interarticularis before it is evident on plain roentgenograms or even computed tomographic scans.34,35

The second reason it is essential to make an early diagnosis of spondylolysis before frank fracture of the pars interarticularis is evident on plain roentgenograms is that early intervention and treatment with bracing and/or activity modification can result in complete healing of the pars interarticularis defect, while delayed onset of treatment may result in nonunion with persistence of pain and disability.10,11,19,38 The longer a pars interarticularis fracture remains unstable, the less likely it is to respond to conservative or nonsurgical treatment.14,33,38,39 Surgical intervention may be needed to correct a long-standing symptomatic nonunion of a pars interarticularis fracture.10,12 The conservative measures are obviously preferred because of the risks of surgical complications, loss of lumbar motion, and trans-
fer of added stress to the remaining lumbar elements associated with fusion spinal surgery.40

It is equally important to emphasize the relative infrequency of discogenic back pain, lumbosacral strain, and degenerative conditions, such as osteoarthritis and spinal stenosis, in this young age group. Discogenic back pain was the final diagnosis in only 11 of the 100 subjects with low back pain in the adolescent group compared with the 38 cases of discogenic back pain in the adult group. While the occurrence of disk disease is significantly less prevalent than in the adult population, accurate diagnosis is important. Most adolescent disks will heal with controlled rest and rehabilitation.10,15,16,18

The low incidence of lumbosacral strain in the Children’s Hospital group is important for two reasons. Too often, the diagnosis of back strain is used as a “wastebasket” diagnosis, thus delaying specific diagnosis of the underlying pathology and appropriate treatment. Lumbosacral strain does exist in this population, but its low incidence suggests that the muscle-tendon structures are more resilient than in the adult when exposed to intrinsic or extrinsic stress. It must be emphasized that the group from the Children’s Hospital Division of Sports Medicine were athletically active adolescents and are not representative of the overall adolescent population. One could argue, however, that as more children and adolescents participate in organized sports, patterns of back pain in the general adolescent population may approach the patterns seen in this study.

Finally, it is important to emphasize that certain uncommon entities must always be considered in the differential diagnosis of low back pain in the child or adolescent. Although not encountered in this study, entities such as diskitis, osteoid osteoma, aneurysmal bone cyst, and chondroblastoma must be considered and ruled out in any adolescent with low back pain of undetermined origin.

CONCLUSION

Low back pain, regardless of the age of the patient, can be a diagnostic challenge for the treating physician. This study demonstrates significant differences in patterns of causes of low back pain between adolescent athletes and the general adult population. While adults are more apt to have disk abnormalities, muscular strain, and degenerative changes associated with their low back pain, athletically active adolescents are much more likely to have posterior element derangements, including spondylosis, as their underlying diagnosis.

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REFERENCES