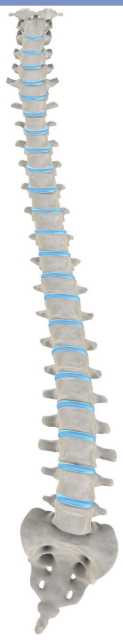
Adolescent Idiopathic Scoliosis



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The spine is made up of a series bones called "vertebrae". These vertebrae are connected to each other by discs and connective tissue. These vertebrae make up different sections of the spine from top to bottom. These sections include the cervical (vertebra in the neck), thoracic (vertebra in the chest), lumbar (vertebra of the low back) and sacral (located just above the tail bone). Each vertebra is numbered starting at the top in each section. Adolescent idiopathic scoliosis (AIS) can present as curvature of the thoracic and lumbar spine.

There are many causes of scoliosis, but AIS is the most common. It is a diagnosis of exclusion, meaning other diseases or causes have to be ruled out first. AIS is defined as a persistent lateral curvature of the spine of more than 10 degrees in the upright or standing position. Although the lateral curvature is the main component it can also be associated with rotation of the spine, and different plane curvatures. These additional curvatures and rotation make AIS a complex three-dimensional deformity.

What is Scoliosis?

Scoliosis is divided into three categories: congenital, idiopathic and neuromuscular. Congenital scoliosis indicates the patient was born with the curvature of the spine and is caused by a failure of the vertebrae to individually form or separate from each other. Neuromuscular scoliosis is caused by a wide variety of disorders which include cerebral palsy, Duchenne muscular dystrophy and myelomeningocele (also known as spina bifida). Each of these categories is very different and requires different treatment interventions than adolescent idiopathic scoliosis.

Idiopathic means the identifying cause of the disease/disorder is unknown. Research into the cause has targeted multiple areas and exemplifies the complex nature of this disorder. The current consensus is that it is a multifactorial process that includes altered melatonin production, connective tissue disorder, skeletal muscle abnormalities, contractile protein dysfunction or a nerve function problem.

Who Does it Affect?

Idiopathic scoliosis is divided into three age categories based upon the initial presentation of the curve. Infantile idiopathic scoliosis presents between the ages of birth and two years old, juvenile idiopathic scoliosis presents between the ages of three and 10 years old, and adolescent idiopathic scoliosis presents between the ages of 11 and 17 years of age. Another difference between the three types of scoliosis is that infantile and juvenile scoliosis have a higher association with other spinal abnormalities such as tumors, syringomyelia (a large tube or cyst in the spinal cord), and descending of the cerebellum into the spinal canal. These disorders require additional and different treatment from adolescent idiopathic scoliosis.

Three to five percent of people have curves greater than 10 degrees but only 0.2-0.3% require treatment. There is a difference between females and males with AIS. In curves between 11-20 degrees there are more females with AIS than males. As the curves get bigger (greater than 20 degrees) so do the numbers of females with AIS compared to males. Also female curves increase or progress more often than in males.

How Is AIS Diagnosed?

Adolescent idiopathic scoliosis is usually first identified by a family member, school screening or pediatric or family physician. Because AIS is usually painless, a fullness or prominence of the back is noted especially with bending forward. This prominence or rib hump can be measured using a scoliometer (a leveling device placed over the spine). The scoliometer measures the angle of trunk rotation at the apex or peak of the prominence. Once the patient is referred to a scoliosis specialist and after a thorough history and physical examination, radiographs or X-rays are taken. These X-rays are done while the patient is standing and include front, side and bending positions.

What Are the Signs and Symptoms?

The symptoms and signs of adolescent idiopathic scoliosis included shoulder asymmetry (one shoulder higher than the other) waist line asymmetry or tilt, trunk shift (comparing the chest or torso to the pelvis), and limb length inequality. AIS is a painless deformity and the patients have no weakness or movement problems.

Symptoms or signs that alert the physician that another diagnosis should be considered include: other structural abnormalities of the spine found on X-ray, excessive kyphosis (forward curvature of the spine), juvenile-onset scoliosis, infantile onset scoliosis, rapid curve progression, associated syndromes or lower extremity deformities, back pain and neurologic signs or symptoms.

How Are Curves Measured?

While the patient is standing, X-rays are taken with the patient standing in the anterior/posterior plane, the lateral plane, side bending, fulcrum bend and push prone. During the push prone X-ray, the patient is placed on the radiograph table in the prone (on their belly) position while manual pressure is applied to the apex of the thoracic curve at the same time the pelvis and shoulders are stabilized. The side bending X-rays help to determine the flexibility of the curves. A Cobb angle is used to measure the curve; the major curve is the curve with the largest Cobb angle.

Minor curves are treated differently depending on their flexibility. Patients can present with a variety of curve patterns depending on the location of the curve, the magnitude of the curve and curve flexibility. Follow-up X-rays monitor the curves and their angles, and will alert the physician to progression of the scoliosis.

How Is Progression Monitored?

Progression of scoliosis depends on the curve magnitude and the skeletal maturity of the patient at the time it is identified. The smaller the curve and the more fully grown the patient is, the less likely the scoliosis is to increase. The difficulty is trying to predict when a patient is going to go through a growth spurt. Your health care provider will consider a number of growth factors (ie, growth of the hip socket and iliac crest, when a girl has begun menstruation) to assign a Risser sign number. The smaller the Risser sign number (0-5), the more growth is remaining. The most accurate predictor of growth remaining is peak height velocity (PHV, the maximum height reached by age 7).

Generally, curves less than 30 degrees at skeletal maturity are not likely to progress, compared to curves greater than 50 degrees which will generally continue to progress at a rate of 1 degree a year.

What Treatments Are Available?

Treatment of adolescent idiopathic scoliosis depends on the size and location of the curve and the growth remaining of the patient. There are three types of treatment in AIS: observation, bracing and surgery. In general, patients are observed for progression with curves between 0-20 degrees. These patients are followed periodically with radiographs to note any curve progression. For patients with curves of 20-40 degrees a brace is used if progression is documented and the patient has substantial growth remaining. Bracing will not correct the curve but might prevent curve progression. Successful use of a brace is dependent on the amount of time the patient wears the brace. The brace is worn until growth is complete and is worn between 16 and 23 hours a day. Surgery is usually indicated for 50° curves, 40° curves in a skeletally immature patients, curves that progress despite bracing, and "unacceptable" (to the patient) deformity.

Curve in Degrees	Treatment
0-20	Observe for progression
20-25	Brace if progression documented, and substantial growth remaining
25-30	Brace if progressive and growth remains
30-40	Brace if growth remains
40-45	Brace if growth remains vs. surgery

What if Surgery Is Needed?

Depending on curve type, curve flexibility and location of cure, surgical correction of scoliosis can be approached in many ways.

Fusion surgery is the procedure of choice. *(See the NASS Patient Education Brochure on Fusion for more detailed information.)* The vertebra are fused together with bone either anteriorly (from the front of the spine), posteriorly (in the back of the spine) or a combination. Instrumentation is used to allow the fusion to heal and help hold the correction of the scoliosis. Instrumentation includes: screws, rods, hooks, and wires.

Long-term followup is difficult to assess because of the large variety of curves, flexibility of curves and progression of curves. The vast majority of patients who have scoliosis and are treated with observation, a brace or surgery lead productive lives and are not limited by their scoliosis or its treatment.

Notes

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