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Scoliosis

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Scoliosis is a lateral curvature of the spine. Although it can result from a variety of causes, more than 60% of all cases are considered idiopathic. Eighty percent of idiopathic scoliosis occurs in adolescents, while infantile scoliosis (ages 0 to 3 y) and juvenile scoliosis account for 1% and 12% to 21% of cases, respectively. Nonidiopathic scoliosis, about one third of all cases, is associated with underlying neurologic disorders (cerebral palsy, myelomeningocele, tethered cord syndrome, spinal muscular atrophy, syringomyelia, muscular dystrophy, Friedrich ataxia, Riley-Day syndrome), musculoskeletal disorders (leg length discrepancy, developmental dysplasia of the hip, osteogenesis imperfecta, Klippel-Feil syndrome), and connective tissue disorders (Marfan syndrome, Ehlers-Danlos syndrome, homocystinuria).

The primary tasks for the clinician when scoliosis is diagnosed are to: 1) determine whether the condition is idiopathic or if there is an underlying cause and 2) measure the curvature and ascertain whether it is likely to worsen. The major factors influencing the progression of the curve are sex, potential for future growth, and the magnitude of the curve at the time of diagnosis. Mild curvature of the spine (10 to 30 degrees) occurs equally in males and females, but 80% to 90% of patients who have curves greater than 30 degrees are females. The more potential for growth, the greater is the risk that the curvature will worsen. Growth potential can be determined by assessing Sexual Maturity Rating (SMR) on physical examination and Risser grading on radiography. Risser grading is a measurement of the ossification of the iliac apophysis: 0 is no ossification, grade 1 is up to 25% ossification, grade 2 is 26% to 50% ossification, grade 3 is 51% to 75% ossification, grade 4 is 76% to 99% ossification, and grade 5 is complete ossification. The lower the SMR stage and Risser grade, the greater is the risk that the scoliosis will progress. The magnitude of the curve is measured on radiograph by determining the Cobb angle: an angle derived from the positions of the most tilted vertebrae above and below the apex of the curve. The greater the Cobb angle, the higher is the risk of progression.

The adverse effects of progressive scoliosis include cosmetic deformity with its potential for social and psychological consequences both during childhood and adulthood; the financial costs of therapy; and although the association is controversial before adulthood, the development of chronic back pain. With extreme curvatures (possibly >50 degrees, certainly >75 degrees), scoliosis can lead to respiratory compromise as well. Because scoliosis often occurs without symptoms, the concept of universal screening during the adolescent years has been advocated, both through screening in school and by routine examination during health supervision visits. School-based screening was begun in 1984 and endorsed by the American Academy of Orthopaedic Surgeons (AAOS), with the underlying conviction that early detection of scoliosis when the deformity may have gone unnoticed can lead to nonoperative treatment that can have a positive impact on long-term outcome.

The primary screening test is the physical examination, which includes visual inspection of the back with the patient standing upright and the Adams forward bending test. With this test, the patient stands with feet together and knees straight and slowly bends forward from the waist, as if to touch the toes, allowing the arms to hang with palms touching. The examiner, with eyes level with the back, looks for asymmetry of one scapula or one side of the rib cage or the paraspinal muscles more prominent than the other. A scoliometer, which is a variation of a carpenter’s level, is useful for quantifying the degree of chest deformity, both in the initial evaluation and in following progression of the curve. The degree measurements noted on the scoliometer are not equivalent to the degrees of the Cobb angle. Many clinicians use a scoliometer measurement of 6 to 7 degrees or more as an indication for obtaining radiographs. If scoliosis is
suspected based on physical examination findings, a radiograph of the back should be considered to measure the degree of curvature (ie, the Cobb angle) and the Risser grade.

Screening is not without its difficulties. Almost one third of patients who are identified as having scoliosis by school screening programs are found on further investigation to have no abnormality. In 1996, the United States Preventive Services Task Force (USPSTF) concluded that evidence was insufficient to make a recommendation for or against screening. However, the USPSTF changed its position in 2004, recommending against routine screening of asymptomatic adolescents for idiopathic scoliosis because of the low predictive value, the relatively small percentage of children whose curves progress, and the possibility of screening leading to unnecessary treatment, including the use of braces. This change in position was influenced by a study in the Netherlands that showed no significant reduction in the need for scoliosis surgery attributable to screening. Patients detected by screening were significantly younger at diagnosis than patients who were detected otherwise. Further, patients detected by routine screening had additional years of concern about their scoliosis, and although they were more likely to be treated with bracing, they did not have better final outcomes.

The USPSTF urges that instead of routine screening, clinicians should evaluate scoliosis when it presents as a symptom or is found incidentally. If scoliosis screening is undertaken, the AAOS, Scoliosis Research Society, Pediatric Orthopaedic Society of North America, and the American Academy of Pediatrics (AAP) agree that girls should be screened twice, at ages 10 and 12 years, and boys once at 13 or 14 years. The AAP Bright Futures recommends examination of the back at adolescent health supervision visits, which can include the forward bend test.

Treatment of scoliosis begins with a focused history and physical examination, looking for an underlying cause of the curvature. In cases of idiopathic scoliosis, intervention is aimed at preventing, or at least minimizing, cosmetic deformity, respiratory compromise, and significant pain. Exercise therapy has been advocated, but there is no evidence that it reverses or even slows the progression of curvature. Bracing uses mechanical force to straighten the spine, but whether it can reliably prevent progression of the curve is less certain. One of the major issues with brace therapy is the difficulty that adolescents have in adhering to the regimen, with one study showing only 15% compliance and reporting that most patients wore their braces only 65% of the recommended time. In general, bracing can be considered for curves between 20 and 40 degrees in patients who still have significant growth potential. With skeletal maturation, as evidenced by a high Risser grading, such curves should not need intervention. For curves greater than 40 degrees, surgery using spinal fusion and any of a variety of instrumentation techniques is the generally recommended treatment.

Comment: Two controversial questions for the pediatrician surrounding scoliosis are whether to screen routinely, and in a child complaining of backache who has a curve, how likely is scoliosis an explanation for the pain. The problem with routine screening is that it is poorly predictive of patients who will ultimately benefit from intervention. Most children identified by routine screening in early adolescence either do not have scoliosis or have curves that require no treatment. These children will more than likely be irradiated at least once, if not serially, and will face anxiety over whether they will become “deformed” or need surgery. The argument for routine screening becomes more difficult in the absence of solid evidence that early bracing really retards curve progression. If it does not, curves destined to warrant surgery will progress despite early screening.

As for back pain and scoliosis, although long-term follow-up studies support the association of scoliosis and chronic back pain in adulthood, the evidence among pediatric patients is less clear. When a child or adolescent who has scoliosis complains of back pain, consideration should be given to the possibility of the scoliosis not being idiopathic, an underlying musculoskeletal or neurologic cause producing the pain, or the back pain being unrelated to the scoliosis. Who said practicing medicine is easy?

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Parent Resources from the AAP at HealthyChildren.org

The reader is likely to find material to share with parents that is relevant to this article by visiting this link: http://www.healthychildren.org/english/health-issues/conditions/orthopedic/pages/scoliosis.aspx.