Original Research

To screen or not to screen for adolescent idiopathic scoliosis? A review of the literature

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ABSTRACT

Objectives: Over the years, there has been much debate about the desirability and efficacy of screening for adolescent idiopathic scoliosis. To analyse the current evidence from a public health point of view a renewed evaluation of the literature was performed.
Study design: Literature review.
Methods: We performed two literature searches: from January 2000 to April 2015 for systematic reviews or guidelines on screening for adolescent idiopathic scoliosis and from January 2009 to April 2015 for all studies on adolescent idiopathic scoliosis and screening methods. We evaluated if screening for adolescent idiopathic scoliosis fulfils the criteria of the UK National Screenings Committee for appraising a screening programme.
Results: Adolescent idiopathic scoliosis is a condition with an unpredictable natural history. The optimal age and frequency of screening are unknown; it is not possible to predict which patients will need (conservative or surgical) treatment. The Forward Bending Test has a positive predictive value of 2.6% and a sensitivity of 56% (95% CI 23–88%) for (conservative or surgical) treatment, and is therefore not valid enough for use in a screening programme. There seems to be sufficient evidence that brace treatment is effective for preventing progression of adolescent idiopathic scoliosis. It is not clear if screening is cost effective.
Conclusions: Despite evidence that brace treatment is effective for preventing progression of adolescent idiopathic scoliosis, the benefits from the screening programme do not outweigh the harms. From a Public Health point of view, there is not enough evidence to support a screening programme for adolescent idiopathic scoliosis.
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Introduction

Adolescent Idiopathic Scoliosis (AIS) is a deformity characterised by a three-dimensional curvature of the spine; if all small curvatures are included it affects 2–3% of adolescents.[1] The curvature is determined by measuring the Cobb angle on an X-ray of the spine. Internationally, a scoliosis is diagnosed if the Cobb angle is ≥10°.[1]

Over the years, there has been much debate about the necessity and efficacy of screening adolescents for AIS.[2–6] The most important points of criticism were the accuracy of the screening test, the unpredictable natural history and insufficient evidence for brace treatment. One of the most recent

reviews presented statements and recommendations based on a combination of a literature review (search period until 2010) and expert opinion.[7]

Recently, the results of a randomized controlled trial (RCT) were published, with new evidence for the effectiveness of brace treatment for AIS.[8] To analyse the current evidence from a public health point of view, we considered a new evaluation of the literature to be desirable.

The UK National Screening Committee (UKNSC) has formulated criteria for appraising the viability, effectiveness and appropriateness of a screening programme.[9] Ideally, all of these criteria should be met before screening for a condition is initiated. These criteria are based on Wilson and Jungner's classic criteria to guide the selection of conditions that would be suitable for screening.

In this article, we will evaluate if AIS fulfils the criteria of the UKNSC.

Methods

The following databases were searched from January 2000 until April 2015 for systematic reviews or guidelines on screening for AIS: Guidelines International Network, National Institute for Health and Care Excellence, Cochrane Reviews, United States Preventive Services Taskforce.

We also performed a search in PubMed from January 2009 until April 2015. The following search terms were used: adolescent AND scoliosis AND idiopathic, combined with (using 'AND' and 'OR') 'predictive value of tests', 'mass screening', 'scoliosis/diagnosis', 'screening', 'screening tests', 'early diagnosis', 'Adam's forward bending test', 'forward bending test'. A total of 427 articles were found, of which 23 were relevant to the current review. Using the 'snowball method', we used the reference list of articles to search for other relevant articles.

We selected articles about screening methods that are suitable for use in public health settings, i.e. methods that are non-invasive, require little time or special equipment. The consensus statement of Labelle et al. concluded that the scoliometer used on a Forward Bending Test (FBT) is currently the best available technique for scoliosis screening.[7] Moiré topography is another available screening technique, but requires special equipment, interpreting the results can be challenging and it takes more time. Therefore, we narrowed our search to literature on the FBT and scoliometer.

The criteria formulated by the UKNSC are divided into four categories: the condition, the test, the treatment, and the screening programme. The literature found was used to determine if the criteria of the UKNSC are met. Criteria regarding genetic screening are not discussed in this article because they are not relevant to the subject.

Results

The condition

1. The condition should be an important health problem.

In the general population, the prevalence of scoliosis with a Cobb angle ≥10° is approximately 2−3%.[1] However, the reported incidence of severe curves (Cobb angle ≥30°) varies from 0.01 to 0.3%.[10−13] If a curve shows progression and the Cobb angle is between 25° and 45° (with skeletal immaturity), brace treatment is indicated. If further progression occurs despite brace treatment and if the Cobb angle is ≥45°−50° (with skeletal immaturity), surgical treatment is indicated.[8,14] If, after complete skeletal maturation, the Cobb angle is ≥30°, there is some increased risk for problems in adult life, such as reduced quality of life, pain, functional impairments and sometimes pulmonary problems.[15,16] Depending on the inclusion criteria used, approximately 10% of patients require brace treatment and approximately 0.1−0.3% require surgical treatment.[1]

2. The epidemiology and natural history of the condition, including development from latent to declared disease, should be adequately understood and there should be a detectable risk factor, disease marker, latent period or early symptomatic stage.

Five percent of the patients with a Cobb angle of >10° shows progression to >30°.[17,18] In earlier studies the possibility of improvement of the curve has been described.[19,20] This has not been found in the more recent literature.[1]

The cause of AIS is unknown; it probably has a multifactorial aetiology. It is not possible to make a reliable prediction as to which curves will show progression.

3. All the cost-effective primary prevention interventions should have been implemented as far as practicable.

Currently, there are no evidence-based primary prevention programmes.

The test

4. There should be a simple, safe, precise and validated screening test.

There are several tests that can be used for screening for AIS. The Adam's forward bending test (FBT) and scoliometer are suitable for screening purposes, because of the relatively little time and equipment that is needed. These tests are not diagnostic, X-rays are necessary to diagnose (the severity of) scoliosis. Currently, the scoliometer is the best tool available for scoliosis screening.[7]

In a meta-analysis of 36 studies investigating the clinical effectiveness of screening for AIS positive predictive values (PPV) of 28%, 5.6% and 2.6% were found for curves of >10°, >20° and (brace or surgical) treatment, respectively.[21] None of the studies reported the specificity of screening for AIS. Only one study reported the sensitivity of the screening programme: Yawn et al. investigated the effectiveness of screening for AIS in grade 5−9 by means of the FBT combined with the scoliometer.[22] They found a sensitivity of 64% (95% CI 45%−83%) for curves ≥20° and 56% (95% CI 23%−88%) for treatment.[22] The PPV of 2.6% for treatment means that, of 1000 adolescent referred for suspected scoliosis, 26 will be treated with