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Clinical Study

# Spinal osteotomy in ankylosing spondylitis: radiological, clinical, and psychological results

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**Abstract**

**BACKGROUND CONTEXT:** Little is known about the psychological status in patients with ankylosing spondylitis (AS) before and after correction of fixed sagittal imbalance.

**PURPOSE:** The aim of this study was to evaluate the changes in patients' psychological status after surgical correction and the existence of a correlation between psychological state and the angle of correction.

**STUDY DESIGN:** A retrospective study was performed to assess radiological and clinical results, and psychological status in patients with AS with fixed kyphotic deformity.

**PATIENT SAMPLE:** The sample comprises 24 patients with AS with fixed sagittal imbalance who underwent one-stage corrective osteotomies at our hospital between March 2006 and May 2010. All of the patients included in this study demonstrated an inability to look straight forward because of severe kyphotic deformities.

**OUTCOME MEASURE:** The radiologic analysis included evaluation of thoracic kyphosis, lumbar lordosis, and the sagittal vertical axis (SVA) of the spine. Clinical assessments were performed with Short Form 36 (SF-36), the Bath Ankylosing Spondylitis Function Index (BASFI), and the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI). Patient psychological status was assessed using the Hospital Anxiety and Depression Questionnaire (HADS) and the Health Locus of Control-Form C Questionnaire (HLC-C).

**METHODS:** Each of the above measurements was recorded before and 1 year after the surgery. The changes derived from each measurement before and after the surgery were evaluated. We also analyze the correlations among the radiological, clinical, psychological, and mental evaluations.

**RESULTS:** Mean thoracic kyphosis changed from 38.5° to 33.3°. Mean lumbar lordosis was corrected from 13.8° to 26.1°, and the SVA was improved from 110.8 mm to 49.7 mm. There was significant improvement in the SF-36, BASDAI, BASFI, HADS, and HLC-C scores. The SVA changes were closely linked to BASFI and psychological status, especially anxiety and depression.

**CONCLUSIONS:** The scores of disease status, general health, and psychological status were improved significantly after correction of kyphotic deformity. And the correction of sagittal imbalance was correlated significantly with anxiety and depression. 

*Keywords:* Ankylosing spondylitis; Kyphotic deformity; Corrective osteotomy; Smith-Petersen osteotomy; Pedicle subtraction osteotomy; Psychological status

## Introduction

Ankylosing spondylitis (AS) involves ankylosis of the sacroiliac joint as well as gradual ossification of the ligament and joint capsule around the vertebral body. It causes ankylosis in the scope of spinal movement and, in many cases, it causes spinal deformity that includes many cervical, thoracic, and lumbar segments and accompanying pain [1]. Most cases result in kyphotic deformity, and if this deformity worsens, symptoms such as gait disturbance, difficulty in looking in the forward direction, and deterioration in digestive function because of compression of abdominal organs can appear [2]. As a consequence, AS with kyphotic deformity results in not only great physical disability, but also psychological changes in the patient's life secondary to social limitations [3].

FDA device/drug status: Not applicable.

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EVIDENCE & METHODS

**Context**
There is a paucity of literature regarding outcomes regarding treatment for deformity in the setting of ankylosing spondylitis (AS). This investigation sought to define alteration in psychological status following surgical correction of deformity and correlate the magnitude of correction with the extent of psychological improvement.

**Contribution**
In this small series of 24 patients surgically treated for AS associated deformity, significant improvement from baseline psychological function was noted postoperatively. Changes in the sagittal vertical axis and correction of lumbar lordosis were significantly correlated with improvements in psychological function.

**Implications**
The results of this study relate the impact of surgical correction on psychological function in patients with AS associated deformity. While the data may have been prospectively collected, this is essentially a retrospective case series and thus provides only Level IV evidence. The authors correctly recognize that their study design combined with limited follow-up (approximating one year) create the potential for selection as well as information bias. This, along with the specificity of the population under investigation, impair the generalizability of the study's findings, except perhaps to other patients with spinal deformity in the setting of AS. While the sample size is small, it should be appreciated that given the rarity of this condition it would be exceedingly difficult to collect a large number of cases of such patients except in a multi-center study.

*—The Editors*

Although there has been a recent increased interest in the treatment of AS, there are few studies on the psychological state among such patients. Therefore, this study analyzed changes in patients' psychological status after surgical correction. The existence of a correlation between psychological state and the angle of correction was also evaluated. We hypothesized that the surgical correction of AS could improve patients' psychological status.

## Methods

In this retrospective study, we reviewed the records of 24 patients with AS (20 males and 4 females) with severe kyphotic deformities who underwent one-stage corrective osteotomy at our hospital between March 2006 and May 2010. Radiological and clinical results and psychological status were evaluated for these patients at 1 year after surgery.

All patients demonstrated an inability to look straight forward and see the horizon. They were also unable to lie down flat in bed with their heads touching the pillow because of the gradually progressing, extreme kyphotic deformities. These patients also reported limitations in their day-to-day activities because of abdominal viscera compression and subsequent indigestion. Cases of severe limitations in walking, driving, maintaining personal relationships, and activities of daily living caused by the impairment in looking forward and kyphotic deformity were considered indications for surgical intervention.

The diagnosis was confirmed based on the Modified New York Criteria for AS [4]. Radiological assessment revealed ossification of the spinal and interspinous ligaments, as well as sclerosis of the sacroiliac joint and the capsule at the facet joint. There was also loss of lumbar lordosis, and the characteristic bamboo spine was also apparent. Each patient was positive for HLA B27.

Various spinal intervals were examined in the radiological evaluation using long-cassette standing posteroanterior and lateral spinal radiographs. It was taken while the patients stood in a foot template to ensure a standardized support base with hip and knee extension and shoulder flexion to 45° using positioning poles. The T1–T12 area, used to evaluate thoracic kyphosis, was measured from the upper endplate of T1 to the lower endplate of T12. The L1–L5 area, used to evaluate lumbar lordosis, was measured from the upper endplate of L1 to the lower endplate of L5. The sagittal vertical axis (SVA) of the spine, defined as the shortest horizontal distance between the posterior-superior edge of the sacral endplate and the plumb line from C7, was also measured. Each of the above measurements was recorded before and 1 year after the surgery.

For the clinical evaluation, the Bath Ankylosing Spondylitis Function Index (BASFI) [5], which is composed of 10 items, was completed before and 1 year after the surgery to assess physical function and the degree of limitation in the patients' daily lives. The Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [6], composed of six items related to major symptoms, was used to evaluate the state of the disease. Additionally, generic health status was measured using the Short Form (SF)-36 questionnaire [7], which measures eight multi-item dimensions: physical functioning (10 items), role limitations due to physical problems (4 items), role limitations due to emotional problems (3 items), social functioning (2 items), mental health (5 items), energy/vitality (4 items), pain (2 items), and general health perception (5 items). For each dimension, item scores are coded, summed, and transformed on a scale from 0 (worst possible health state measured by the questionnaire) to 100 (best possible health state).

Psychological and mental status were measured using two questionnaires before and 1 year after surgery. The Hospital Anxiety and Depression Questionnaire (HADS) [8] is a 14-item self-report measure of anxiety and depression. Seven questions assess anxiety and seven questions assess depression. All items are scored on a four-point scale from