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Is Breast Asymmetry Present in Girls with Adolescent Idiopathic Scoliosis?

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Abstract

Study Design: Cross-sectional descriptive study.
Objectives: To characterize breast asymmetry (BA), as defined by breast volume difference, in girls with significant adolescent idiopathic scoliosis (AIS), using magnetic resonance imaging (MRI).
Summary and Background: BA is a frequent concern among girls with AIS. It is commonly believed that this results from chest wall deformity. Although many women exhibit physiological BA, the prevalence is not known in adolescents and it remains unclear if it is more frequent in AIS. Breasts vary in shape and size and many ways of measuring them have been explored. MRI shows the highest precision at defining breast tissue.
Methods: Thirty patients were enrolled on the basis of their thoracic curvature, skeletal and breast maturity, without regard to their perception on their BA. MRI acquisitions were performed in prone with a 1.5-Tesla system using a 16-channel breast coil. Segmentation was achieved using the ITK-SNAP 2.4.0 software and subsequently manually refined.
Results: The mean left breast volume (528.32 ± 205.96 cc) was greater compared with the mean right breast volume (495.18 ± 170.16 cc) with a significant difference between them. The mean BA was found to be 8.32% ± 6.43% ($p < .0001$). A weak positive correlation was observed between BA and thoracic Cobb angle (0.177, $p = .349$) as well as thoracic gibbosity angle (0.289, $p = .122$). The left breast was consistently larger in 65.5% of the patients. Twenty patients (66.7%) displayed BA ⩾5%.
Conclusions: We have described BA in patients with significant AIS using MRI. This method is feasible, objective, and very precise. The majority of patients had a larger left breast, which could compound the apparent BA secondary to trunk rotation. In many cases, BA is present independently of thoracic deformity. This knowledge will assist in counseling AIS patients in regards to their concerns with BA.

Keywords: Adolescent idiopathic scoliosis; Breast asymmetry; Magnetic resonance imaging; Breast volume

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Introduction

Breast asymmetry is a common complaint among girls with adolescent idiopathic scoliosis (AIS). AIS is a complex tridimensional deformity of the spine that arises in 1% to 3% of otherwise healthy children between 10 years of age and skeletal maturity [1]. Patients with scoliosis are generally screened, evaluated, and if necessary, surgically corrected using a posterior approach. However, it is the anterior aspect of the deformity that often concerns girls with AIS, in particular, the asymmetry of their breasts. It is commonly believed that breast asymmetry is secondary to the chest wall deformity (eg, left breast larger in a right thoracic scoliosis) [2]. Breast asymmetry is defined as a difference in shape, position, and/or volume of the breast or the nipple-areola complex, and may be primary or secondary to a thoracic deformity. Some patients with scoliosis experience breast asymmetry, but its relationship with the thoracic deformity remains unknown [3,4]. Most women have some degree of minor physiological asymmetry (as high as 88% in some studies) [5,6], but this has not been previously described in the adolescent population.

Multiple methods for measuring the breast have been attempted, but none yields consistent results. The breast is an organ of varied size, shape, contour, width, height, projection, composition, volume, nipple level, and position on the chest wall. When performing aesthetic or reconstructive breast surgery, the plastic surgeon relies mostly on his/her aesthetic opinions and artistic skills as well as his/her experience [7]. Various methods to measure breast volume have been reported: Archimedean methods based on the water displacement principle [8-10], 3-dimensional (3D) thermoplastic casting [11-13], direct (from body surface) [14-18] or indirect (from 2D imaging such as photographs, mammograms, or ultrasonographies) [19-21] anthropometric measures, modern imaging procedures (computed tomography [CT] and magnetic resonance imaging [MRI]), and 3D body surface reconstruction obtained from biplanar images such as stereo photography, laser, or phase-shifted interferometry 3D surface scanning [22-41]. To date, MRI measurements show the highest level of precision and are considered the criterion standard for breast volume measurement [32,42-44].

It is unclear if breast asymmetry is more frequent in patients with AIS. Very few studies have evaluated the relationship between scoliosis and breast asymmetry [3,45]. The goal of this study is to describe breast asymmetry, as defined by breast volume difference, using MRI in a series of patients with significant AIS.

Materials and Methods

From July 2012 to January 2013, 30 consecutive female patients with AIS were recruited from the scoliosis outpatient clinic at Sainte-Justine's University Hospital in Montreal, Canada. These patients were enrolled on the basis of their skeletal (Risser 4–5, more than 1 year post menarche) and breast maturity, and their thoracic curvature, without regard to their subjective opinion on their breast asymmetry. Tanner breast stage was assessed by observation [46]. We included patients with significant thoracic curvatures (Cobb angle 30° or greater). Patients with congenital, juvenile idiopathic or neurologic scoliosis were excluded. All patients and parents of minors agreed to participate and gave informed consent. The study was approved by the ethics committees of both Sainte-Justine's University Hospital and the University of Montreal Hospital Center.

All MRI acquisitions were performed at one of our university institutions with a 1.5-T system (Achieva XR, Philips Healthcare, Best, the Netherlands) using a dedicated 16-channel breast coil. The patient was positioned prone with the arms resting overhead and the breast hanging freely in the breast coil to optimize its natural contour (Fig. 1). No intravascular contrast agent was used. A 3D gradient-echo sequence without fat suppression was used with the following parameters: repetition time = 7.6 ms; echo time = 4.6 ms; flip angle = 12°; field of view = 340 mm×340 mm×220 mm (adjusted on a subject-by-subject basis to cover the complete torso at the breast level); acquisition resolution = 1 mm×1 mm×2 mm; and reconstruction resolution = 1 mm×1 mm×1 mm. Images were exported from the scanner using the DICOM format and converted to the Analyze format using dcm2niigui software (MRIcron, McAusland Center for Brain Imaging, University of South Carolina, http://www.mccauslandcenter.sc.edu/mricro/mricron/index.html). The images were automatically reformatted to a resolution of 1 mm×1 mm×3 mm before segmentation to reduce the amount of data to process. Segmentation was performed using the software ITK-SNAP 2.4.0 (Penn Image Computing and Science Laboratory, Philadelphia, PA, www.itksnap.org) [47]. A preliminary segmentation of each breast was performed using a semiautomatic 3D

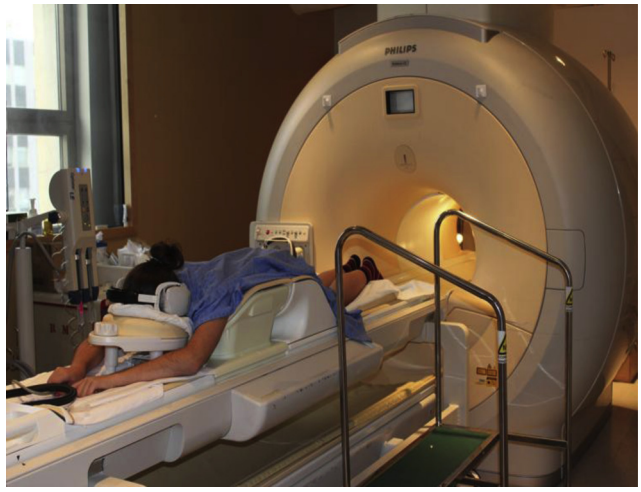

Fig. 1. Illustration of the positioning of a subject in the breast coil prior to insertion in the magnetic resonance imaging (MRI) magnet.