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Original Research

Comparison of the Thickness of Lateral Abdominal Muscles Between Pregnant Women With and Without Low Back Pain

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Abstract

Objectives: To compare the thickness of the external oblique, internal oblique, and transversus abdominis muscles in pregnant subjects with and without low back pain (LBP) by the use of ultrasound to measure thickness.
Design: A case-control study.
Setting: An academic and tertiary care referral spine and sports medicine center.
Participants: Fifty pregnant women with LBP during pregnancy and 54 pregnant control subjects.
Methods: Case and control subjects were matched for body mass index, gestational age, and number of previous pregnancies. A multiple linear regression model with adjustment for the gestational age of the subjects, as the potential confounder of the primary outcomes, was used to evaluate the association between LBP appearance and abdominal muscles thickness of the subjects.
Main Outcome Measures: The thickness of lateral abdominal muscles was measured by ultrasound with the subject in a hook-lying position on the examination table.
Results: We found that there was no significant difference between pregnant subjects with and without LBP in terms of the thickness of external oblique, internal oblique, and transversus abdominis muscles.
Conclusion: These findings suggest that other factors rather than the thickness of core stabilizing muscles are influential in the etiology of LBP during pregnancy. We hypothesize that enlargement of uterus during pregnancy might influence the thickness of the lateral abdominal muscles.

Introduction

Low back pain during pregnancy (LBPP) is a common condition, with the prevalence of 20%-90% in different studies [1-3]. LBPP influences the ability to sit, walk, and stand, leading to the inability of pregnant women to perform their daily activities [3,4]. Although most symptoms in pregnant women experiencing LBPP resolve postpartum [5,6], it was shown previously that the intensity of pain in one-third of women with LBPP is severe. Importantly, this group of patients is at greater risk of developing a new episode of low back pain (LBP) during next pregnancies and even later in their lives [3,4,7].

Because of the importance of LBPP, many researchers have already tried to find the etiology of this condition [1]. In light of these efforts, an extensive list of theories that can explain some aspects of LBPP are suggested. For example, it has been suggested that carrying a child can change woman's spinal biomechanics and, consequently, as the result of the expansion of uterus, abdominal muscles stretch [8]. Stretching of the abdominal muscles in turn alters the muscles' ability to maintain spinal stability and leads to LBPP [9,10].

The role of lateral abdominal muscles, including transversus abdominis (TrA), internal oblique (IO), and external oblique (EO) muscles, in stabilizing the lumbar spine has been highlighted during the past decade [11,12]. On the basis of reports indicating the activation of deep trunk muscles, particularly TrA, independent of the direction of spine postural perturbations [13], some studies on isolated TrA activation and its contribution in

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lumbar stability were performed [14]. These findings were further supported by studies in which investigators showed the impairment in contraction of TrA among patients with LBP compared with healthy subjects [11]. Ultrasound (US) imaging studies demonstrated a linear relation between the functional activity and the size of deep trunk muscles across a span of activation range [15]. Furthermore, the acceptable reliability of US as a noninvasive, cheap, and easy-to-use technique for measuring the thickness of deep trunk muscles has been reported in different studies [16]. Therefore, the clinicians were encouraged to use thickness measurements via US of deep trunk muscles as an indicator of muscle function and thereby lumbar stability.

Although the association between the thickness of deep trunk muscles and LBP in general population has been well studied, it is not still clearly defined how the abdominal muscles adapt to the biomechanical changes as the result of carrying a child during pregnancy. We hypothesized that biomechanical changes during pregnancy could influence the thickness of lateral abdominal muscles. Considering the possible role of these muscles in LBP, we compared the thickness of the EO, IO, and TrA muscles between pregnant subjects with and without LBPP by using US imaging techniques.

Methods

Participants

We performed a case-control study at an academic and tertiary care referral spine and sports medicine center. In this study, 50 pregnant women with a gestational age of 12-39 weeks who were experiencing LBPP were referred to our center. As control subjects, 54 healthy pregnant women who met the inclusion criteria of the study were relatively matched for body mass index (BMI), gestational age, and number of previous pregnancies. The criteria to select subjects were as follows: 1) pregnant women with pain between the inferior gluteal fold and inferior border of twelfth rib (on the basis of pain drawing test); 2) gestational age of 12-39 weeks; 3) age younger than 45 years; and 4) no history of LBP before the current pregnancy. Those who used any medicine or product containing corticosteroid in the past 30 days and current use of analgesic medications other than acetaminophen (especially nonsteroidal anti-inflammatory drugs) were excluded from the study. All subjects received written and oral information about the study procedures before participation. All procedures and study protocols were approved by the Ethical Committee of our university.

Measurements

All recruited subjects of the study were invited to our center to undergo US measurements. First, general information of the subjects, such as age, number of previous pregnancies, and LBP during previous pregnancies was collected. Pain intensity also was recorded by the use of a visual analog scale, with scores ranging from 0 to 100. Next, body weight and height of the subjects were measured according to the standard protocols [17]. Finally, the thickness measurements via US of the EO, IO, and TrA muscles were performed at rest and during an abdominal drawing-in maneuver (ADiM).

US Thickness Measurements

We used a protocol described by Mannion et al. [18] to measure the diameters of lateral abdominal muscles (TrA, IO, and EO). The diameters were measured on both sides of the subjects at rest and during ADiM while the patients were in a hook-lying position. In this position, subjects laid on the bed while they were supine and their hips flexed to almost 30°. To measure the abdominal muscles thickness, a point 25 mm anteromedial to the midpoint between the inferior rib and the iliac crest on the mid-axillary line was set for the linear transducer position [19]. A Sonosite Micromaxx (Sonosite Inc., Bothell, WA) US machine with a linear transducer (6-13 MHz) that was transversely positioned at the mentioned anatomical point was used to record the thickness of abdominal muscles in B-mode format.

Before we measured the muscles diameters, the subjects were trained to perform the ADiM by repeating it 5 times while their maneuvers were monitored with the US biofeedback effect [20]. The US assessor measured the thickness of the lateral abdominal muscles considering the following instructions: 1) to prevent biofeedback effects, the scanner screen was tilted in a way that subjects could not see the monitor; 2) an adequate amount of US gel was used on the subjects' skin to reduce the need for excess inward pressure and to increase the area of contact [17,18]; 3) the assessor had to freeze the image for the measurements at the end of normal expiration [21]; 4) the US assessor was not aware of allocation of the subjects into the LBPP or control groups; and 5) considering the effect of food consumption on lateral abdominal muscles thickness, all of the US measurements were performed 4 hours after the last meal of the subjects [17].

Statistical Methods

Data analysis was performed using SPSS 16 (SPSS Inc, Chicago, IL). Data normality was assessed using 1-sample Kolmogorov—Smirnov test. To evaluate the association between LBP presence (whether they suffered from LBPP) and abdominal muscles thickness, we used a multiple linear regression model with adjustment for the gestational age of the subjects as the potential confounder of the primary outcomes. Data are