Ultrasound Assessment of Abdominal Muscle Thickness in Women With and Without Low Back Pain During Pregnancy

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Abstract

Objective: The aim of this preliminary study was to determine the differences in abdominal musculature thickness, within 1 month of delivery, in women who experienced back pain during pregnancy compared with those who did not.
Methods: B-mode ultrasound imaging was used to measure abdominal muscle thickness on 76 postpartum participants who participated in a larger study; 47 women experienced back pain during pregnancy, and 29 did not. Participant data were stratified by group, and primary comparisons were based on these grouping across the abdominal muscles, including rectus abdominis (upper and lower fibers), external oblique, internal oblique, and transversus abdominis. Means and standard deviations were also used to set parameters for future studies.
Results: In the present study, there was no difference in any abdominal muscle thickness between groups. Women with low back pain were significantly shorter (165.19 ± 6.64 cm) than women who did not have from back pain during pregnancy (169.38 ± 7.58 cm). All other demographics, such as age, weight, and date tested postpartum, were not significantly different between groups.
Conclusion: The results of this study showed no variation in abdominal muscle thickness in women who had back pain during pregnancy and those who did not. (J Manipulative Physiol Ther 2017;xx:0-6)
Key Indexing Terms: *Spine; Back Pain; Pelvic Pain; Postpartum*

Introduction

Pregnancy-associated musculoskeletal complaints are common, with 25% to 90% of women reporting low back and/or pelvic pain related to pregnancy.[1-8] Pregnancy-related back pain can be troublesome for an expectant mother in terms of intensity and resulting disability.[6,7] The presence of back pain during pregnancy has been correlated with sleep disturbances, use of pain medication, and disturbances to activities of daily living, such as standing for 30 minutes.[1,4,7] Although the etiology of pregnancy-related back pain is not clear, several factors have been implicated, including altered posture, hormonal changes, muscle fatigue, and muscle imbalance.[8-11]

Although little research has been done relating core muscular insufficiency, imbalance, or weakness to back pain during pregnancy, this topic has generated much attention in the nonpregnant population.[12-16] The abdominal musculature, including the transversus abdominis (TrA) and oblique muscles, form a "brace" around the abdomen, which can assist with spinal stability.[12] In the nonpregnant population, recruitment of the core stabilizing muscles, including the TrA, appears to be altered in those with low back pain.[13-15] Previous studies during or immediately after pregnancy have reported changes in gross morphology of the abdominal musculature, including thickness,[17,18] length,[19] and separation width and angles of insertion of the rectus abdominis (RA),[20] as well as the ability of these muscles to stabilize the pelvis both during and after pregnancy. Therefore, it is conceivable that the postural and biomechanical changes that occur during pregnancy[11,21] as a result of the growing fetus may contribute to alterations of the abdominal musculature, thus causing back pain at this time.

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Little quantitative data exist regarding the patterns of muscular adaptation in pregnant women who have back pain during pregnancy and those who do not. Several methods of assessing muscle have been used to contrast those who are asymptomatic and those with back pain, including relative strength, endurance, and recruitment timing with varied results. More recently, ultrasound imaging of muscles[14,22] has been promising in defining morphologic differences between asymptomatic and low back participants. Moreover, we have used this technology in our lab to determine the difference in abdominal thickness in nulliparous women and those within 1 month of giving birth.[18] Using a subset of data from a larger study, the purpose of this study is to determine differences in abdominal thickness (external oblique [EO], internal oblique [IO], TrA, upper rectus abdominis [URA], and lower rectus abdominis [LRA]), immediately after pregnancy, in women who experienced back pain during pregnancy compared with those who did not. We hypothesized that those women who had back pain during their pregnancy would have thinner abdominal muscles than those who did not. Therefore, the aim of this preliminary study was to determine the differences in abdominal musculature thickness, within 1 month of delivery, in women who experienced back pain during pregnancy compared with those who did not.

Methods

Participants

Participants for the present study were a subset of individuals from a previous study.[18] Briefly, participants were recruited through word of mouth and posters placed within the academic institution, in local obstetrician and gynecology offices, and in local business organizations. Postpartum women between the ages of 20 and 40 were eligible for participation. Postpartum women within 1 month of a normal vaginal delivery and asymptomatic nulliparous controls were included. The decision to evaluate women within 1 month after delivery came from the work of Coldron et al.[17] Exclusion criteria included a history of abdominal surgery, with the exception of childhood appendectomy or herniorrhaphy, and those with significant trunk deformity such as scoliosis identifiable on inspection. The Research Ethics Boards of the Canadian Memorial Chiropractic College (Approval Number 092012) and Sunnybrook Health Sciences Centre (Project Identification Number 193-2009) approved the present study.

Ultrasound Procedure and Data Collection

On induction into the study, participants were scheduled for a single assessment, which lasted up to 30 minutes. A brief history and measure of height, weight, age, date of parturition, and presence or absence of low back pain were collected. With each assessment, participants were given an information sheet regarding the research project and information on ultrasound imaging. At this time, each participant was given the opportunity to ask questions and signed the informed consent document. All participants provided consent and all information was kept confidential.

Ultrasound methodology has been reported elsewhere.[18] Participants were positioned in a supine recumbent position and the abdomen was draped to expose from below the xiphoid process to above the suprapubic bone. Palpation of the soft tissues about the suprapubic, xiphoid, and anterior superior iliac spine, along with visualization of the umbilicus, was used to define the neighborhoods and orientation for imaging transducer placement. Each target muscle within the image was confirmed by use of standard movements consistent with daily activities that are known to preferentially activate them.[23,24]

Images from the right side of the abdomen were obtained based on the assumption of symmetry and the work of Rankin et al.[22] A total of 5 measures were taken (1 for each muscle) per participant. Before obtaining the images, the ultrasound was used to scan the muscle to ensure uniformity and identify landmarks.[25] Three regions were explored and imaged for the measurement of muscle depth (transverse diameter):

1 Anterolateral abdominal—a point slightly medial (approximately 1 finger breadth) and superior (approximately 1 finger breadth) to the anterior superior iliac spine.[25-27] This region captured the EO, IO, and TrA. Once the ultrasound was placed in the appropriate region, TrA was identified by asking the patient to perform a slow Kegel exercise; mentally visualizing an effort to draw the vaginal tissues into the body, resulting in a sequential activation of the TRA followed by the oblique muscles. Once the TrA was identified, the fascial planes and fiber orientations for the EO and IO were clearly evident, making them easily distinguishable on the screen.[24] The image was frozen at the end of the exhalation, and the participant resumed a relaxed supine posture. Starting with EO, then IO, and finally TrA, digital measures of muscle thickness were obtained by taking a vertical measure from the inside edge of each superior fascial border to the inside edge of the corresponding inferior fascial border, at approximately midpoint of the muscle belly (Fig 1).
2 Mid-upper abdominal parasagittal—a point approximately midway between the umbilicus and the lower ribs lying along the midclavicular line.[25-27] This region captured the URA and the linea alba. Once the ultrasound probe was placed in the appropriate region, the patient was asked to lift her head from the examination table to identify the URA. The patient returned her head to the table, the image was frozen at the end of the next exhalation, and the