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Suggested Applications of Musculoskeletal Ultrasound to Identify the Etiologies of Low Back Pain

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1. Background

Low back pain (LBP) is the most common debilitating musculoskeletal disorder that influences approximately 80% of people one way or another in their lifetime (1, 2) and is also among the most common causes of absence from work (3, 4).

In recent years, there has been a worldwide increase in LBP incidence among various groups of the population (5-9). Therefore, a method is needed that can quickly and accurately determine the cause of this disorder. Plain radiographic X-ray, computerized tomography (CT), and magnetic resonance imaging (MRI) are widely used to unravel the cause of LBP (10, 11); however, despite their many advantages, each modality has some limitations (12-14).

On the other hand, ultrasonography (US), as an inexpensive and safe method, has shown to be relatively effective in the diagnosis of musculoskeletal disorders (15, 16). Previously, we discussed the role of US in the diagnosis of various etiologies of LBP (17). Here we intend to briefly reintroduce the application of US as a diagnostic technique in various LBP etiologies and propound some novel suggestions for further studies.

2. Previously Mentioned Application of Ultrasonography

2.1. Spinal Canal Diameter

Based on the debates in the literature, we discussed that US could mainly measure spinal canal diameter with the oblique midsagittal (18) or transabdominal (19) techniques. Although the diameter of the spinal canal might be a predicting factor for suffering from LBP, due to operator-dependent factors, US measurement could not gain enough attention (20). However, we believe that more focused studies and appropriate techniques can be developed to solve its limitations.

2.2. Paraspinal Muscles

It was discussed that using rehabilitative US imaging in assessing paraspinal musculature by measuring their thickness, size (21), and echogenicity (22) has been shown to be acceptable for clinical practice (22). Given the profound role of paraspinal muscles in the development and prognosis of LBP and the availability of US in follow-ups after specialized training, we recommend a vaster acquisition of US in this field.

2.3. Sacroiliac Joint Dysfunction

Doppler imaging of vibrations is a diagnostic method that could be reliable and accurate in measuring the laxity of the sacroiliac joint (23, 24). We believe that more standard studies need to be done to thoroughly explore the benefits of using US in sacroiliac joint pathologies.

2.4. Sacroiliac Joint Inflammation

Despite the limitations, using color Doppler ultrasonography was revealed to be effective in the diagnosis and prognosis of sacroiliitis by visualizing the blood flow to the region (25, 26); whereas sacroiliac joint effusion could be detected using high-resolution US (27). Therefore, different modalities of US seem to be an effective alternative to other more expensive diagnostic techniques.

2.5. Spondylolisthesis

It was shown that the measurement of vertebral dislocation using US should be sufficient for both diagnosis and follow-up of the patients with spondylolisthesis (28). Nevertheless, a lack of sufficient evidence at the moment limits the application of US in the complete management of spondylolisthesis.

2.6. Transabdominal Muscles

It appears that the transabdominal muscle dysfunction plays a profound part in the development and severity of LBP, and US proved to be a reliable modality to measure the transabdominal muscles thickness (29-31) especially in athletes (32). Also, it is easily available for the follow-ups after the training interventions; hence, we believe it might be the most effective modality in LBP rehabilitation via abdominal muscles training.

3. New suggestions for the Application of Ultrasonography

3.1. Spondylolysis Diagnosis

Pars interarticularis injury is one the most common etiologies of LBP, especially in young athletes. These lesions could be asymptomatic and later in adulthood become chronic and symptomatic (33). Spondylolysis is a nondisplaced fracture in pars interarticularis, which is caused by repeated stress to bones (34). Sport-related movements such as twisting, rotation, and extension augment the load on the spine and may lead to stress fractures (35). Studies showed that the majority of spondylolysis lesions could be found in asymptomatic patients; however, the most common complaint is either localized or diffused LBP (36).

There are various imaging modalities that may help clinicians in identifying the pars fracture lesions. Upon suspicion of an acute injury, it is recommended to perform an X-ray as the first diagnostic study. Then perform a scintigraphy or single-photon emission computed tomography (SPECT) is performed. In case of a positive SPECT, a computed tomography scan (CT) scan should be run to confirm the diagnosis in case of a positive SPECT. If SPECT comes negative, pars interarticularis injury has almost certainly been ruled out, and MRI could be used to discover other possible differential diagnoses (36). To our knowledge, there has been no report of using US in cases of spondylolysis. Considering that we could assess the continuity of the bone cortex, we suggest further standard studies in this field to investigate its feasibility and precision in this common condition.

3.2. Disc Height Measurement

Disc degeneration is believed to be one of the main etiologies behind discogenic chronic LBP, and with the increasing population age, this condition is becoming more prevalent (37, 38). Although imaging modalities such as MRI and CT scan are widely used to diagnose disc pathologies, they all have some considerable drawbacks, such as high cost. Therefore, with an increase in demand, a noninvasive, less expensive, and simple screening diagnostic method seems to be necessary. Many studies have shown that reduced disc height is associated with disc degeneration in the lumbar spine (39, 40); thus, we suggest US as an accessible alternative for disc height evaluation, especially when a discogenic condition is suspected.

3.3. Facet Joint Inflammation Detection

The degeneration of lumbar spine facet joints is one of the common conditions causing LBP (41-43). Current imaging modalities to diagnose facet joint lesions are X-ray, computed tomography (CT), and magnetic resonance imaging (MRI). However, Shi et al. (44) studied the feasibility of using US in the diagnosis of lumbar facet joint degeneration and concluded that US could precisely show the facet joint structures; therefore, it is beneficial to diagnose the degeneration of facet joints of the lumbar spine by ultrasound. Furthermore, we presume that color Doppler technology can also be beneficial, especially in the early stages of the condition, as it has been proven that color doppler is a proper diagnostic tool in many inflammatory presentations.

4. Conclusions

To sum up, although there is a continuous improvement in the imaging technologies, US as an accessible, easy to use, and financially more reasonable modality has more potential in the diagnosis of different etiologies of LBP, especially in athletes; therefore, further investigations are needed to shed more light on the matter.

Footnotes

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