Pelvic Organ Prolapse

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Pelvic organ prolapse is a chronic disease resulting from a weakening of the musculoskeletal apparatus of the pelvic organs.

pelvic organ prolapse | dynamic magnetic resonance imaging | diagnostic characteristics

1. Introduction

Pelvic organ prolapse and prolapse are a group of multifactorial diseases manifested by peripheral displacement of the uterus and/or vaginal walls in combination with adjacent pelvic organs (bladder, rectum, and bowel loops) beyond the vulvar ring as a result of functional failure of the ligamentous apparatus of the internal genitalia and pelvic floor muscles [1][2][3].

The prevalence of genital prolapse varies greatly according to various studies and ranges from 3 to 50% [2][4]. This variability is due to differences in the designs of the studies conducted, as well as the use of different approaches to the diagnosis of the conditions under study. In studies based on objective gynecological examination without taking into account subjective symptoms in the examined patients, the prevalence of pelvic organ prolapse (POP) reaches 50% [5].

Pelvic floor dysfunction occurs in 25% of non-pregnant women over 20 years of age in the population of economically developed countries, with 17% having moderate to severe urinary incontinence [6][7]. With increasing life expectancy, this pathology is expected to become particularly important in the near future. According to estimates by Wu et al. (2020), the proportion of women with symptomatic UTIs in the United States will increase to 46% by 2050 [6].

POP is divided into anterior compartment prolapse, which is represented by urethrocele, cystocele, and cystourethrocele; middle compartment prolapse, which includes uterine prolapse and vaginal vault prolapse; and posterior pelvic floor prolapse, which is represented by both rectocele and enterocele, depending on the impaired support of a particular component of the pelvic floor [8]. Anterior compartment prolapse is the most common among the above three types and is reported to be twice as common as posterior compartment prolapse and three times as common as apical prolapse [9].

Pelvic floor muscle incompetence with prolapse of the anterior vaginal wall manifests as symptoms such as urinary dysfunction, urinary incontinence, pelvic organ prolapse, dyspareunia, and pelvic pain, significantly impairing a woman's quality of life.

dMRIs serve as valuable tools in the diagnosis of pelvic prolapse in complex cases involving multiple compartments and multiple organs of the pelvis. This method allows for a more accurate assessment of pelvic prolapse, as a higher resolution provides better anatomical detail compared to translabial ultrasound. To diagnose this pathology, it is not sufficient to perform only a clinical examination. An effective diagnostic tool is dynamic magnetic resonance imaging (dMRI) of the pelvic floor, which allows a comprehensive assessment of the anatomical and functional characteristics of the pelvic walls and pelvic organs [10][11][12][13][14].

Until recently, the standard approach in the examination of patients with POP was the assessment of the anterior pelvic floor based on the clinical examination, as well as using ultrasound examination (US) and urodynamic tests. However, in recent years, the dMRI method has been increasingly used due to the high quality of the image obtained, good reproducibility, and maximum ability to display pelvic floor characteristics [12][15][16]. Yet, despite its significant advantages, the literature continues to discuss the diagnostic accuracy of the method, searching for correlations between the data obtained with its help and the results of the clinical examination of the patient.

The results of pelvic dMRI are particularly important when the results of physical examination and combined urodynamic examination do not coincide. The data obtained can provide useful information during the pre- and postoperative examination of patients with POP undergoing surgical treatment, especially for multicompartmental abnormalities. dMRI makes it possible to conduct more effective preoperative planning in complex cases and select a more optimal method of surgical correction [17][18].

2. Etiology and Pathogenesis of the Pathology of Pelvic Organ Support Structures

The etiological factors of pelvic floor dysfunction development include combinations of genetic, anatomical, physiological factors, high parity, and lifestyle factors that interact with each other in different periods of a woman's life and lead to the occurrence of this pathology [19][20][21].

Neshatian L et al. conducted a retrospective study of patients over 18 years of age with genital prolapse at the Stanford Pelvic Health Center, the results of which indicate a correlation between the severity of pelvic organ prolapse and an increase in the proportion of fat in the lumbar muscles. Magnetic resonance defecography findings of pelvic floor weakness, pelvic organ prolapse, and rectal prolapse were characterized by standard MRD measurements and compared with the psoas (L4 level) and puborectalis muscle index, as well as relative fat fraction quantified using the 2-Dixon scoring method [12].

A study by DeLancey J.O. (2016) showed that under physiological conditions, pelvic support is provided by the interaction between the group of muscles that lift the anus and the ligaments that stabilize the vagina at different

levels [22]. Any weakness or rupture of the connective tissue leads to pelvic floor defects. Three levels of connective tissue support of the vagina have been described [23]; with the cardinal and sacro-uterine ligaments providing the strongest support at the apical level [24][25]. However, changes in the structure of the extracellular matrix lead to pathological changes in the connective tissue, which eventually manifests as disorders of the function and integrity of the pelvic floor tissues and causes the development of prolapse [26].

3. Clinical Manifestations and Diagnosis of POP

Pathological changes in the anterior pelvic compartment affect the bladder, urethra and associated pelvic structures. Risk factors for this pathology include older age, a history of multiple pregnancies, a family history of pelvic floor disease, pelvic surgery and trauma, chronic increased abdominal pressure caused in particular by chronic constipation or chronic obstructive pulmonary disease, obesity, damage to nerves innervating the corresponding pelvic structures, connective tissue diseases such as Ehlers-Danlos syndrome.

Many women have symptomatic prolapse, which can affect their daily activities, sexual function, physical activity, and other aspects of quality of life. It is estimated that about 50% of women in labor have at least a mild degree of POP; the lifetime risk of undergoing pelvic reconstructive interventions in women is estimated at about 11%. Thus, this diagnosis is one of the most frequent indications for surgical treatment in women [27]. The most characteristic symptom is the sensation of a foreign body in the vagina extending beyond it. Patients with complete uterine prolapse may have puru-lent discharge from the vagina associated with the accession of secondary infection to the decubital ulcer. According to Lawrence J.M. et al. (2008), POP is often associated with the following diseases: 40% of patients suffer from urinary incontinence when straining, 37% suffer from overactive bladder and 50% suffer from fecal incontinence [28].

The combination of clinical manifestations resulting from pelvic floor disorders can cause psychological stress, which leads to decreased quality of life [29].

Urodynamic tests, pessary stress tests can help to diagnose the above-mentioned disorders in POP, but none of these tests can guarantee the accuracy of the diagnosis due to their very low sensitivity with regard to the prognosis of urinary incontinence (17–39%). On the other hand, although ultrasound has a high sensitivity in the diagnosis of stress urinary incontinence, this method does not have sufficient sensitivity for the diagnosis of prolapse [30].

dMRI of the pelvis allows a comprehensive assessment of the anatomical and functional features of the pelvis, excluding the exposure of the body to ionizing radiation [31]. The method is characterized by good visualization with high resolution and excellent soft tissue contrast. The method enables to assess the state of evacuatory function of visualized structures in dynamics [32].

Simultaneous visualization of all three regions of the pelvic floor using dMRI makes the assessment of multicompartmental abnormalities possible, allowing surgical treatment to be corrected in about 67% of cases [33]

[34].

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