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REVIEW

Polycystic Ovary Syndrome and Pelvic Floor Dysfunction: A Narrative Review

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Abstract: Pelvic floor dysfunction is one of the most common disorders in women that is associated with social and economic consequences. In general, this disorder imposes direct and indirect costs on the economy of various societies. This review aimed to investigate pelvic floor dysfunction in women with polycystic ovary syndrome (PCOS). In this narrative review, the published articles on pelvic floor dysfunction were examined in PubMed, Scopus, Web of Sciences and Google Scholar. We searched for terms related to polycystic ovary syndrome and pelvic floor dysfunction. Inclusion criteria of this research were observational, experimental, and review studies. In this investigation, the complications associated with polycystic ovary syndrome were examined as risk factors for pelvic floor dysfunction. In this narrative review, we discuss about changes in hormone levels, obesity and overweight, hormonal medications and complications such as diabetes and metabolic disorders and obstetric complications of PCOS can be involved in the pathophysiology of pelvic floor dysfunctions, including stress urinary incontinence and pelvic organ prolapse in women with PCOS. This review highlights knowledge gaps about protective effect of hyperandrogenism on pelvic floor dysfunction as well as destructive effect of metabolic changes on pelvic floor dysfunction in women with PCOS. Further cohort and prospective studies are recommended in women with PCOS to investigate the concept of pelvic organ dysfunction in these women.

Keywords: pelvic floor, muscles, urinary stress incontinence, polycystic ovary syndrome

Introduction

Millions of women around the world suffer from symptoms of pelvic floor dysfunction.[1,2] Pelvic organ prolapse is a function of the weakness or injury of supporting tissues of pelvic floor, which is associated with the pressure of organs on different parts of the vagina (anterior, posterior, apex). The female pelvic floor provides support for the organs that lie on it and plays an important role in sexual function and parturition, as well as controlling the release of urine and feces.[3] The dysfunction of pelvic floor muscle affects contraction and fiber length of pelvic floor muscles.[4]

Several sexual, urinary and digestive symptoms are present in pelvic floor dysfunction and prolapse of pelvic organs.[5,6] A study on Korean women showed that the prolapse rate of pelvic organs in women over 50 years of age was 180 per 100,000.[7] Urinary incontinence is a complication of pelvic floor disorders with prevalence rates of 5–70% in different countries as well as 25–40% incidence in the majority of studies.[8] Pelvic floor disorders are frequently observed in women and can be influenced by factors such as age, type and number of childbirths, multiple birth, high BMI, and

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family history.[9,10] The pathophysiology of pelvic floor disorders involves factors such as genetics, hormonal imbalance, and neuromuscular damage.[11–14]

Prevailing scientific literature has indicated the presence of androgen receptors in the levator ani muscle and pelvic fascia.[15] The existence of androgen receptors in the vaginal wall can play an essential role in the development of pelvic floor disorders in women.[16] Thus, androgen-related disorders may interfere with the function of pelvic floor muscles. In this regard, polycystic ovary syndrome (PCOS) is one of the most heterogeneous disorders in women of reproductive age, which is associated with the increase in androgen levels.[17] The prevalence of PCOS has been reported at 3–10%, which is different across geographical locations as well as races and ethnicities.[18] The clinical characteristics of PCOS include oligomenorrhea, hirsutism, baldness and acne.[19] Based on the Rotterdam criteria, there are four phenotypes of PCOS as follows: (A) hyperandrogenism (HA), chronic anovulation (AO) and polycystic ovaries (PCOM); (B) (AO +PCOM); (C) (HA+AO); (D) (HA+PCOM).[20] The long-term complications of PCOS include impaired glucose tolerance and diabetes, cardiovascular disease and hypertension, dyslipidemia, endometrial cancer, ovarian cancer, and breast cancer.[21,22] The results of some studies on women with PCOS indicated a higher frequency of pelvic organ prolapse in them.[23] Another research showed that the strength of pelvic floor muscle of women with PCOS is similar to women without PCOS.[24] According to the evidence, women with polycystic ovaries may have abnormal electromyography activity the urethral sphincter.[25]

Disorders of pelvic floor muscles have negative effects on women's emotions and sentiments and are associated with psychological problems such as depression, anger, anxiety, sadness,[26] as well as social burdens at individual and community levels.[27] In general, pelvic floor dysfunctions inflict direct and indirect costs on the economy of societies.[28–31] Given the increasing frequency of PCOS and pelvic floor dysfunctions and the lack of a study investigating the relationship between pelvic floor dysfunction in women with PCOS, this review examines pelvic floor dysfunction in such women.

Method

This narrative review is based on SANRA (scale for the quality assessment of narrative review articles), which is a feasible and valid scale for assessment of narrative reviews to improve the standard of nonsystematic reviews.[32]

This study was approved by ethical committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran with ethic code number [IR.SBMU.RETECH.REC.1397.970].

In this study, a review of articles published on pelvic floor disorders in PubMed, Scopus, Web of Sciences and Google Scholar was performed and the following Medical Subject Headings [MeSH] terms were searched: stress incontinence, urinary incontinence, urine incontinence, pelvic organ prolapse, androgens, testosterone, hormones, POP, muscle, pelvic floor dysfunction, menstrual cycle, polycystic ovary syndrome, PCOS, obesity, overweight, metabolic syndrome, diabetes, body mass index, waist circumference, insulin resistance, hypertension. We combined search terms and fields using AND, OR. The search was performed by two researchers without time limitation until December 2019. The manual search of the reference lists of articles was carried out by researchers. The search strategy was developed with English language restriction.

Inclusion criteria of this study were observational, experimental, and review studies. After searching the mentioned databases, the titles and abstracts of the articles were studied and then the full text of related research was reviewed. In this research, the symptoms and complications associated with PCOS were investigated, which were risk factors for pelvic floor disorders, and played a role in its pathophysiology. Therefore, the findings were presented in the form of clinical and biochemical symptoms related with PCOS and pelvic floor dysfunction. The population in this research included women with PCOS or women without it and the indicator of this study was pelvic organ dysfunction. A total of 78 references were used in this narrative review.

Results and Discussion

Hormonal Changes

Hormonal imbalance has been claimed to be involved in the pathophysiology of pelvic floor dysfunction. Hormones play a crucial role in pelvic floor function and hormonal changes throughout the life of women and are implicated in several aspects of pelvic floor physiology.[33] Testosterone is a male hormone with an essential role in the function of pelvic floor muscles and lower urinary tract by increasing muscle mass and decreasing adipose tissue of skeletal structure, inducing protein synthesis and modulating the physiological function of lower urinary tract through nitric oxide.[34] There are high levels of testosterone in the third

decade of life in women, which are gradually reduced afterwards.[35]

The question is whether women with PCOS who have high levels of androgen show disrupted pelvic floor function? Evidence in this respect remains insufficient, although a number of studies have noted the positive effect of testosterone. A case–control study performed on 103 women with PCOS and 99 women as the control group used a pelvic floor distress questionnaire. The results showed that pelvic organ prolapse was higher in women with PCOS, especially in those with hyperandrogenic phenotype, menstrual cycle disorder, and polycystic ovary ultrasound and that there was a significant correlation between luteinizing hormone levels and pelvic organ prolapse symptoms in this study.[23] The result of the Douchi et al study showed that serum testosterone levels of PCOS women with a mean age of 28.8 years was related to the distribution of peripheral muscle mass.[36] Evidence has shown that testosterone may induce muscle hypertrophy.[37] The pelvic muscle strength plays an important role in effective function of this muscle.[4] Kogure et al reported that progressive resistance training three times per week for four months among 45 PCOS and 52 nonPCOS women leads to increased muscle strength in women with PCOS because of hyperandrogenism.[38] In a case–control study (PCOS=36 and control=43), Antônio et al reported that the pelvic floor muscle strength was not significantly different between PCOS and the control group and that the prevalence of urinary incontinence in the PCOS group was 0% and control group was 18%.[24]

Some studies have attempted to identify the androgens role in pelvic organ function. Kim et al conducted a study on 2321 women aged over 20 years to examine the relationship between testosterone levels and urinary incontinence. The findings of this study showed that the probability of stress unrinary incontinence (SUI) and mixed incontinence were increased by 1.45- and 1.68-fold among women with low testosterone levels, respectively, but there was no association between testosterone level with urgent incontinence.[35] Teleman et al examined 6917 Swedish women aged 50–59 years and found that high levels of estradiol (and not testosterone) were associated with female urinary incontinence.[39]

Medications used by women with PCOS may have a role in pelvic organ function because of the hormonal component of some of them. Oral contraceptives are a treatment option for women with PCOS.[40] Nurses' Health Study results in Boston on 21,864 premenopausal nurses indicated that women who used oral contraceptives were on average 27% more likely to develop urinary incontinence.[41] According to the results of a cohort study on Swiss women, those taking oral contraceptives had a reduced risk of developing symptoms related to stress, urgent, and mixed incontinence.[42] There is no evidence about the medical management of PCOS and risk of pelvic organ dysfunction.

Estrogen and progesterone may play a role in the function of the lower urinary tract via central mechanisms on neural receptors; estrogen can also alter the function of the bladder and urethra by changing cell cycle activity, blood flow, collagen synthesis and sensitivity of alpha-adrenergic receptors.[43,44] Women with PCOS may experience hyperestrogenism.[45,46] Micussi et al in their study of 30 women having menstrual cycles with ovulation showed that estradiol levels on the seventh day of the menstrual cycle as well as testosterone levels on twenty-firstday were associated with pelvic floor muscle tone.[47] However, the following question is raised: are women with PCOS who experience hormone imbalance at a higher risk of pelvic floor dysfunction? Although it has been suggested that high androgen levels in women with PCOS and the presence of androgen receptors in the urinary tract may have a protective role on pelvic floor muscle function, there is still insufficient evidence to support the protective role of PCOS in pelvic floor muscle dysfunction.[48] In a cross-sectional study of 42 PCOS patients and 13 premenopausal women, Micussi and colleagues reported that the serum levels of estradiol and testosterone correlated with pelvic floor muscle tone and that maximum voluntary contraction (MVC) and PCOS patients had higher electromyographic value; in other words, the hyperandrogenism in these patients had a protective effect on pelvic floor muscles.[49] Future studies are needed to investigate the potential effect of hormonal imbalance and pelvic organ function in women with PCOS.

Obesity

Obesity, being overweight and central obesity are common disorders of women with PCOS.[50,51] Obesity may is a risk factor for SUI and lower urinary tract symptoms (LUTS).[52] Evidence has shown that intra-abdominal pressure increases in obese women, leading to pelvic floor injury and increased likelihood of stress incontinence in addition to affecting the neuromuscular function of the urinary tract.[53] A meta-analysis showed that overweight and obese women were 1.36 and 1.47 times more likely to develop pelvic organ prolapse, respectively.[54] Every five-unit increase in BMI is associated with 20–70% increase

in the likelihood of stress incontinence in women.[55] Although weight loss is not usually associated with anatomical improvement, it reduces symptoms of pelvic organ prolapse.[56]

While the role of obesity in the development of pelvic organ prolapse symptoms is generally unknown, it has been suggested that weight loss in obese people plays an important role in reducing pelvic organ prolapse symptoms.[52] Montezuma et al who studied symptoms of urinary incontinence among women with PCOS examined four groups of women aged 18–40 years as follows: 18 women with PCOS having normal BMI, 32 patients with polycystic ovary syndrome with BMI>25 kg/m^2, 29 controls with normal BMI, and 34 controls with BMI <25 kg/m^2. Their findings indicated that the control group with BMI >25 kg/m^2 had a higher level of stress incontinence.[48] Furthermore, Taghavi et al, in a study on 103 PCOS women and 99 controls, found that the BMI had no significant affect on the pelvic organ prolapse distress.[23] Melo et al found that pelvic floor muscle thickness of PCOS patients was not different from the control group; however, the mean BMI of control group and PCOS was 22.5 kg/m^2 and 27.8 kg/m^2,[57] respectively. In Micussi et al, a study of 42 PCOS and 13 premenopausal women, there was no correlation between BMI and muscle tone and MVC.[49]

Given these statements, it is important to understand the effect of obesity and its neurophysiological mechanism on pelvic floor dysfunction of PCOS patients.

Metabolic Disorders

Available scientific evidence has shown the association between metabolic syndrome (MetS) and urological disorders. The outcomes of MetS (ie obesity, hypertension, diabetes) may lead to pelvic floor dysfunction such as urinary incontinence (UI).[58] MetS is a disorder to which women with polycystic ovary syndrome are exposed.[58] The results of a meta-analysis showed that women with PCOS are 3.35 times more likely to develop MetS.[59] The association between metabolic disorders as a complication of PCOS with pelvic floor dysfunction has been dealt with in a number of studies. Research on 100 Polish women showed that MetS and high triglyceride levels were correlated with the severity of organ prolapse.[60] Women with PCOS are at increased risk of hypertension.[61] Yoon et al, in a study of 5318 Korean women (19 years and older), reported that 9.18% of women had UI. They also revealed that UI had a significant relationship with insulin resistance in nondiabetic postmenopausal women.[62] Women with diabetes are exposed to a higher risk of UI,[63] while PCOS is a risk factor for diabetes.[64] A study on Italian women showed that those suffering from pelvic organ prolapse were more prone to develop metabolic disorders.[65] An investigation of 586 Turkish women indicated that from 186 patients with pelvic organ prolapse, coexistence of diabetes and hypertension increased the risk of pelvic organ prolapse by 1.9-fold.[66]

Therefore there are different types of PCOS. Hosseinpanah et al reported that there is no difference in metabolic features of different phenotypes of PCOS.[67] Ramezani Tehrani et al found that in 85 women with PCOS, the phenotype B of PCOS (oligo/anovulation + hyperandrogenism), MetS was more prevalent than other phenotypes, but phenotype A had a higher serum level of insulin, glucose, cholesterol, and triglycerides.[68] Evidence showed that insulin resistance may aggravate the electromyographic activity.[69] In a study on 5318 nondiabetic Korean women Yoon et al reported that insulin resistance was a risk factor for UI.[62] Sachdeva et al and Stopinska-Gluszak et al found that the phenotype A of PCOS was a high risk for adverse metabolic outcomes.[70,71] In line with this finding, Taghavi et al reported that PCOS patients with menstrual dysfunction (M), and hyperandrogenism (HA) phenotype experience POP symptoms more frequently than the other phenotypes.[23] As a result, it seems women with phenotype A may experience higher adverse metabolic outcomes and pelvic floor dysfunction, but much more research is needed to deeply understand the role of metabolic disorder in pelvic floor function in women with PCOS.

Obstetric Complications

The obstetric factor association with pelvic floor disorders is well documented.[72] The results of a meta-analysis showed that women with PCOS have increased risk of cesarean section, pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM).[73] Women with history of cesarean delivery have higher pelvic floor muscle (PFM) strengths than vaginal delivery group.[74] There is a multifactorial mechanism about the damage of pelvic floor during vaginal delivery.[72,75] However the cesarean section may reduce the risk of pelvic floor dysfunction but according to the above-mentioned evidence comorbidities such as hypertension and diabetes may increase the risk of pelvic floor dysfunction.

Conclusion

Overall, studies suggests that cardiovascular diseases, chronic obstructive pulmonary disease, MetS, constipation,

autoimmune and renal diseases and obstetric complications can all impair pelvic floor function.[72,76] Nonetheless, PCOS (endocrine-metabolic disorder) is associated with increasing risk of cardiovascular disease[77] and MetS.[78] Moreover, this review highlights knowledge gaps about protective effect of hyperandrogenism on pelvic floor dysfunction as well as destructive effect of metabolic changes on pelvic floor dysfunction in women with PCOS. Further cohort and prospective studies are recommended in women with PCOS. Since PCOS and the pelvic floor dysfunction, are both prevalent health problems, it seems that the diagnosis of women with PCOS who are at higher risks for development of pelvic floor dysfunction as well as adopting preventive strategies for them are cost effective in health problem management.

Abbreviations

PCOS, polycystic ovary syndrome; MVC, maximum voluntary contraction; MetS, metabolic syndrome; SANRA, scale for the quality assessment of narrative review articles; PIH, pregnancy-induced hypertension; GDM, gestational diabetes mellitus; pelvic floor muscle (PFM); stress urinary incontinence (SUI).

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Disclosure

The authors report no conflicts of interest in this study.

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