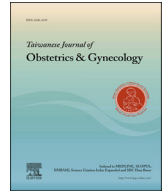




Contents lists available at ScienceDirect

Taiwanese Journal of Obstetrics & Gynecology

journal homepage: www.tjog-online.com

Review Article

Pelvic floor dysfunction, and effects of pregnancy and mode of delivery on pelvic floor

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ARTICLE INFO

Article history:
Accepted 25 August 2014Keywords:
anal incontinence
levator ani muscle injury
pelvic floor dysfunction
pelvic organ prolapse
urinary incontinence

ABSTRACT

Pelvic floor dysfunction (PFD), although seems to be simple, is a complex process that develops secondary to multifactorial factors. The incidence of PFD is increasing with increasing life expectancy. PFD is a term that refers to a broad range of clinical scenarios, including lower urinary tract excretory and defecation disorders, such as urinary and anal incontinence, overactive bladder, and pelvic organ prolapse, as well as sexual disorders. It is a financial burden on the health care system and disrupts women's quality of life. Strategies applied to decrease PFD are focused on the course of pregnancy, mode and management of delivery, and pelvic exercise methods. Many studies in the literature define traumatic birth, usage of forceps, length of the second stage of delivery, and sphincter damage as modifiable risk factors for PFD. Maternal age, fetal position, and fetal head circumference are nonmodifiable risk factors. Although numerous studies show that vaginal delivery affects pelvic floor structures and their functions in a negative way, there is not enough scientific evidence to recommend elective cesarean delivery in order to prevent development of PFD. PFD is a heterogeneous pathological condition, and the effects of pregnancy, vaginal delivery, cesarean delivery, and possible risk factors of PFD may be different from each other. Observational studies have identified certain obstetrical exposures as risk factors for pelvic floor disorders. These factors often coexist; therefore, the isolated effects of these variables on the pelvic floor are difficult to study. The routine use of episiotomy for many years in order to prevent PFD is not recommended anymore; episiotomy should be used in selected cases, and the mediolateral procedures should be used if needed.

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Epidemiology and risk factors

Pelvic floor dysfunction (PFD) occurring in women comprises a broad range of clinical scenarios such as lower urinary tract excretory and defecation disorders, including urinary and anal incontinence, overactive bladder (OAB), and pelvic organ prolapse (POP), as well as sexual disorders [1]. In developing countries, the prevalence of POP, urinary incontinence (UI), and fecal incontinence (FI) is 19.7%, 28.7%, and 6.9%, respectively. POP is a major health problem for both developing and developed countries [2]. In the Women's Health Initiative study, varying degrees of POP were observed in 41% of women in the age range of 50–79 years [3]. Despite there being a large number of cross-sectional studies,

unfortunately, the number of large-scale longitudinal and prospective studies on the true incidence of PFD is very limited. Nevertheless, there is a consensus that PFD is a major health issue for aging women. In the United States, about 400,000 surgeries are performed every year for UI only. DeLancey [1] stressed this as a hidden epidemic, and has drawn attention to the role of assisted vaginal delivery (VD) by means of episiotomy in the prevention of perineal disease and UI. Age, ethnicity, multiparity, mode of delivery, history of pelvic surgery, pregnancy, chronic cough, obesity, spinal cord disorders, family history, and genetics are among the most common identifiable risk factors for the development of PFD [4]. Reported pregnancy-related risk factors include pregestational body mass index (BMI), BMI at term, weight gain, smoking during pregnancy, duration of the first and second stages of labor, spontaneous or operative delivery, perineal lacerations, weight of the newborn, maneuvers and episiotomy, as well as epidural analgesia. The other risk factors that have been reported include past histories

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of previous lower abdominal surgeries such as laparoscopic and hysteroscopic procedures, uterine curettage, and UI surgeries [5].

Impact of levator ani injury, VD, and operative delivery on the pelvic floor

The prevalence of PFD increases significantly with age. Approximately 10% of women between the ages of 20 years and 39 years, compared with 50% of women aged ≥ 80 years, suffer from at least one PFD disorder [6]. The loss of strength of connective tissues may induce PFD formation as a result of hormonal changes, particularly estrogen deficiency related to advancing age and duration of postmenopausal state. However, in the same age group, the prevalence of PFD is more common in multiparous women than in nulliparous women, which again stresses the role of obstetric trauma.

Recently, a relatively large number of studies have been conducted to emphasize the role of levator ani muscle injury (LAMI) in the development of POP, such as uterine prolapse, cystocele, and enterocele, as well as vaginal vault prolapse after hysterectomy [7]. Avulsions occurring in levator muscle have been found to play a role especially in the formation of cystocele and uterine prolapse. Furthermore, a direct correlation between POP symptoms and the degree of defect was found. An increased risk of developing uterine prolapse was found in patients with bilateral avulsion compared to those with unilateral avulsion [8]. Despite these findings, not all women who have LAMI present with these compartment defects. Thus, it has been suggested that there may be different factors leading to the development of PFD. Levator avulsions are more common causes of the formation of central and anterior defects than of posterior defects [9]. It is still unclear whether there is an association between different types of LAM defects and specific compartment defects. In a study where 151 patients with POP were compared with a control group of 135, the odds ratio for LAM defects was found to be 7.3 [95% confidence interval (CI) 3.9–13.6]. This indicates that having LAMI increases one's risk of developing POP by 7.3 times. In the literature, there has been a consensus that PFD starts to develop earlier in life in patients with serious LAMI. Moreover, in those patients, despite promising postoperative short-term results, the risk of recurrent POP and cystocele is increased [7,10,11].

Many risk factors have been identified for LAMI; one such risk factor is forceps delivery, which was found to increase the risk of LAMI by 3.4–14.7-fold in different studies [1,12]. LAMI was seen in 35–64% of patients who had forceps-assisted delivery [13,14]. Although a relationship between LAMI and forceps delivery has been demonstrated, it is not clear whether it is solely related to the case itself or application of the device. It is also unclear whether the speed of the fetal head descent during the second stage of labor and/or use of different types of forceps is the cause of injury. Another risk factor for LAMI is the length of the second stage of labor. A study reported that in women who had LAMI confirmed by magnetic resonance imaging, the second stage of labor was 78 minutes longer [12]. In a study investigating the risk factors for LAMI, the use of forceps, anal sphincter rupture, and episiotomy were found to be the risk factors, but surprisingly, vacuum extraction was not. Gestational age, birth weight, and head circumference did not show a statistically significant difference in the development of LAMI. Another study reported that the second stage of labor longer than 110 minutes increased the risk of LAMI by 2.27-fold [15]. Moreover, this strong relationship between the duration of the second stage of labor and LAMI has been emphasized by other investigators [13,16]. Although it has not been defined as a risk factor in Kearney et al's study [12], fetal head circumference has been identified as an independent risk factor in

Valsky et al's study [15]. In this study, fetal head circumference in primiparous women was assessed by transperineal ultrasound. The risk of LAMI was increased by 3.34-fold when the fetal head circumference was > 35.5 cm and by 5.32-fold when the duration of the second stage of labor was also increased. The variations in results reported in the literature depend on patient selection bias, demographic and genetic characteristics, and variations in obstetric practice. Based on these findings, many researchers hypothesized that elective cesarean delivery (CD) may prevent LAMI. In a study investigating the effects of fetal head on the vaginal side walls during the second stage of labor, it was found that the maximum head pressure was 31.8 ± 11.0 kPa and 5.5 ± 3.7 kPa during and between uterine contractions, respectively. The average head pressure was 13.34 ± 4.8 kPa during uterine contractions. The pressure of the fetal head during birth was measured to be two-fold more than the amniotic pressure, and this pressure increases toward the end of the birth. Hence, it is stated that fetal head pressure is one of the most important factors for POP development in birth-related injuries [17]. Another study reported that occiput posterior presentation and macrosomia work synergistically, increasing the risk of perineal trauma [18]. Shek and Dietz [19] found that women with a lower BMI were at a higher risk of developing LAMI, but the clinical significance is questionable, because the upper limit was 30.01 kg/m^2 . Epidural analgesia has been shown to be protective against LAMI in some studies [13].

An association has been found between advanced maternal age at first delivery and LAMI by some studies [12,20], but not by the others [15,19]. Delayed childbearing has been identified as a risk factor for PFD in several studies. Kuh et al [21] found a strong association between the symptoms of stress UI and the maternal age of ≥ 30 years at the first VD among British women. Foldspang et al [22] found increased risks of UI with increasing age at the time of the last childbirth for women aged 30–44 years. The risk of requiring surgery for stress UI and POP also appears to increase with increasing age at the first childbirth, irrespective of the mode of delivery. For example, in one study, 14% of women aged ≥ 30 years at the first vaginal childbirth required surgery for POP compared with 6% of women younger than 30 years [23]. The trend toward delayed childbearing in developed countries may result in an increased prevalence of PFD in the next decades.

Effect of normal delivery and CD on PFD

One of the key factors causing PFD is the mode of delivery. It is thought that VD may be responsible for the development of PFD by damaging pelvic support tissues such as muscles and connective tissues as well as nervous structures, especially at the second stage of labor. It has been reported that partial denervation in the pelvic floor may occur especially in the first pregnancy, and the risk of PFD increases with the severity of the damage in most women with VD [18]. Damage to the nerves of the pelvic floor and affected pelvic floor muscles has been shown to be more prominent in nulliparous incontinent women compared to nulliparous continent women [24]. Despite all these studies, there are not enough evidence-based data confirming that VD is solely responsible for PFD. Besides, pregnancy itself may be one of the most important risk factors for the development of PFD. Hormonal changes during pregnancy and the mechanical effects that start to increase in the third trimester and reach the maximum level at term are the factors changing the structure of the pelvic floor. It has been suggested that increased intra-abdominal pressure due to growing uterus and the change in the axis of lumbar spine may also be predisposing factors for the development of PFD. It has also been reported in these studies that increased pressure on the bladder during pregnancy causes an increase in the urethrovesical angle, and a decrease in the support of

the bladder neck and urethra, which may be responsible for urethral hypermobility as well as UI [25,26]. The use of prostaglandins for induction of labor has been reported to cause incontinence by reducing urethral resistance [27]. A positive correlation has been shown between the increasing number of VD and urethral sphincter deficiency [26].

One of the important components of PFD is UI that severely disrupts patients' quality of life [15,29]. Dealing with this issue, in a retrospective Norway EPINCONT study, women aged ≤ 65 years were examined to investigate the effects of route of delivery, VD versus CD, on incontinence by looking at the medical birth records. Those who had a history of both modes of delivery were excluded from the study. The women who were nulliparous and delivered by CD only or by VD only were included in this study. The incidences of any type of UI in the nulliparous women, cesarean group, and vaginal group were found to be 10.1%, 15.9%, and 21%, respectively. The incidences of stress UI were 4.7%, 6.9%, and 12.2%, respectively; urge UI were 1.6%, 2.2%, and 1.8%, respectively; and mixed type were 3.1%, 5.3%, and 6.1%, respectively. Adjusted odds ratio for any type of incontinence was found to be 1.5 in the cesarean group compared with nulliparous women (95% CI 1.2–1.9). In case of VD, compared with CD, the odds ratio for any incontinence was found to be 1.7 (95% CI 1.3–2.1) and that for severe incontinence was found to be 2.2 (95% CI 1.7–3.2). In summary, the risk for stress UI increased by 2.5-fold in case of VD compared to CD; however, no difference was observed in the risk of UI. This study indicates that CD may not be protective against UI [28]. In another study, a strong relationship was found between VD, UI, and POP, but no relationship was observed between VD and urge incontinence [29].

Denervation, disruption, and damage to the pelvic floor support system, in particular in the levator complex, were found to be the most important risk factors for future development of POP. Disorders that occur during hemostasis depending on microdamage of connective tissue and extreme stress of the vaginal wall are the other factors that contribute to the development of POP [29]. Compared to nonpregnant women, the urethrovesical angle was found to be significantly increased in postpartum women [25]. It has been reported that VD also negatively affects urethral function by decreasing functional urethral length, maximum urethral pressure, and urethral closure pressure, whereas such changes have not been observed after CD [26]. As discussed earlier, the pregnancy state itself is a mechanical condition that negatively affects pelvic support and tensile strength of the fascia, which was found to be less in pregnant women than in nonpregnant women [30]. Even in the early stages of pregnancy, a downward displacement of the pelvic floor was demonstrated with perineal ultrasound. In addition, a significant decrease has been observed in the contraction of the pelvic floor muscles, as well as an increase in bladder and urethral mobility, which especially impairs late in pregnancy. An increased laxity of joints in pregnant women suggests that a generalized effect exists in the connective tissue during pregnancy, and this effect is caused by hormonal changes [31]. Based on these changes, it has been claimed that CD may not be protective against PFD [30]. MacLennan et al [32] reported the existence of a strong relationship between PFD and aging, parity, pregnancy, and operative VD. CD has not been found to reduce pelvic floor morbidity compared to VD at long term [32]. Another study, which was designed to investigate whether the pregnancy state itself or the type of delivery leads to POP, revealed that the pregnancy state itself was responsible for the development of POP [33]. When nulliparous pregnant women at 36 weeks of gestation and at the 6th week of postpartum period were evaluated, 46% were found to develop varying degrees of POP. There was no difference in the rate of development of POP between the VD and the CD group, and

hence pregnancy itself was seen as a key risk factor for the development of POP.

Compared to white counterparts, black women were found to be more prone to POP during pregnancy. In this study, CD was found to be only partially protective against POP, because 46% of 94 nulliparous women already had POP at the 36th week of gestation. At best, only 54% of POP can be prevented with routine practice of elective CD. A total of 83% were detected to have prolapse at 6 weeks postpartum. These differences have been noted to occur during the delivery. While the risk of developing new POP was 37% after VD and 35% after CD, the progression of already existing POP was 15% and 8% after VD and CD, respectively. By contrast, none of the patients who underwent cesarean section in the latent phase was found to be at risk of development of POP. When the women with a history of VD were compared with those with a history of CD, in terms of the development of new POPs and the degree of POP, statistically significant differences were not observed. Based on these findings, investigators concluded that CD does not have any protective effect in terms of pelvic support when it is performed in the active phase of labor. Accordingly, as opposed to the popular belief, it was found that the damage to the pelvic support tissue might occur not only in the second stage, but also in the first stage of labor [33]. In another study along the same lines, CD, which was performed after a pause in the second stage of labor in primiparous women, has no protective effect in terms of the PFD development [34]. Previous studies indicate that there is not sufficient evidence to recommend widespread use of elective CD for the prevention of PFD [35].

In a prospective study involving 200 nulliparous women, it has been shown that VD increases the mobility of pelvic organs significantly by affecting all the pelvic compartments (central, anterior, and posterior) that are responsible for POP. These VD-dependent changes in women's pelvic organs put them at a greater risk [36]. Increased mobility of the pelvic organs has mostly been associated with the use of forceps. Increased mobility is seen in decreasing frequency for vacuum-assisted VD, spontaneous VD, CD performed in the second stage of labor, and CD performed during the first stage of labor [36]. Although it has been stated that there is not enough evidence for elective cesarean by patient's preference to prevent PFD, 31% of female obstetricians desired elective CD to avoid any pelvic floor damage [37,38]. It was claimed that VD causes serious and irreversible changes in the pelvic structures. These changes may be summarized as follows. VD causes a significant amount of stretching in nervous, muscular, fascial, and ligament structures of the pelvic floor. Too much strain of these structures can lead to anatomical and functional changes, which may not be completely reversible. It is stated that these changes may cause POP and also stress UI, depending on urethrovesical hypermobility due to decreased bladder neck and urethral support. It is claimed that during VD, pudendal nerve branches are affected, leading to partial denervation of the pelvic floor. This causal relationship may get worse over time and with subsequent childbirths. This situation may be the first step toward the development of stress UI and POP, which may develop in the future [18]. Although these neural and structural changes have been found in women who had VD, their role and extent of impact remain elusive in the patient group. Pelvic floor muscle strength was found to decrease significantly after birth with VD, which was not seen after CD [39]. Lukacz et al [40] compared CD and VD in terms of PFD, and found that VD increases the risk of POP, UI, FI, and OAB development by 1.82-, 1.81-, 1.72-, and 1.53-fold, respectively. They defined VD as a risk factor independent of parity. In addition to this, CD was protective against PFD, similar to nulliparity. However, interestingly, seven patients needed to be offered the option of CD to prevent the occurrence of PFD.

Another study advocating the protection against pelvic floor damage via CD in the literature was performed by Uma et al [41]. They found that CD decreases the potential risk of having pelvic surgery compared to VD. In this study, unlike previous studies, delivery with forceps and macrosomia was not found to be a risk factor for PFD. Episiotomy and prolonged labor exceeding 12 hours showed borderline significance, and were associated with POP surgery. Retrospective nature of the study, absence of physical examination findings, and the small number of patients undergoing POP surgery in the CD group are the limitations of this study. In a study among Turkish women, 184 patients undergoing stress UI and POP surgery were compared with a control group of 290 in terms of the risk factors. In the surgery group, the history of giving birth to a larger fetus (3800 ± 416 g vs. 3373 ± 637 g, $p < 0.000$) and that of at least one operative VD, forceps or vacuum (17.9% vs. 7.6%, $p < 0.001$), were found to be statistically significant. In this study, a strong relationship was shown between the number of VDs and the history of pelvic floor surgery. The authors have found that having four or more births increase the risk of development of POP by 11.7 times [42]. The rates of development of new POP and progression of the existing one in nulliparous women with a history of forceps-assisted delivery were detected to be 73% and 18%, respectively. However, both rates were 29% in the vacuum-assisted delivery group [33]. This study showed a relationship between a difficult and mismanaged delivery and PFD.

In a review article, it was stated that, although operative VD is defined as an important risk factor for PFD, this is a multifactorial event and pregnancy itself was found to be the most important risk factor [29]. A study that showed protective effect of elective CD on stress UI only suggested that, when potential risks are considered, obstetricians should not recommend CD to prevent UI, FI, and POP in the absence of any other indications [43]. Eason et al [44] performed a prospective study involving 949 patients to investigate the effect of pregnancy and mode of delivery on UI. While the UI rate was 16.3% before pregnancy and 55.8% during pregnancy in primiparous women who had CD and VD, it was 16.3–58.9% before and during pregnancy in primiparous women. Hence, there was no significant difference between CD and VD. UI rates at 3 months postpartum were found to be significantly different between VD and CD, 33% and 12%, respectively. Using multivariate analysis, it was seen that CD significantly reduced the rate of incontinence in the immediate postpartum period. Within a 3-month period, a 50% decrease in the UI prevalence is remarkable. Long-term follow-up failed to show a significant difference between VD and CD groups [44]. The authors of this study found that one of every two pregnant women developed UI during pregnancy, and this UI increased approximately two-fold in the 3rd month of postpartum period, irrespective of VD or CD. In Brazil where almost half of deliveries are performed by cesarean section, this practice was not found to be protective against UI [45]. Consequently, they reported that pregnancy itself is a risk factor for UI rather than VD or CD.

Relationship between the mode of delivery and OAB

Compared with other PFDs, the association between the mode of delivery and OAB syndrome is not well established. For example, the likelihood of OAB syndrome does not differ significantly in women who underwent VD or CD 5–10 years ago [46]. In another study, it has been emphasized that pregnancy state itself is a risk factor for OAB, and not the mode of delivery. In this study, OAB symptoms were more likely to be seen among multiparous women compared to primiparous women, who were again more likely to have the symptoms compared to nulliparous ones. Although these symptoms are more frequently seen in the VD group than in the CD group, it did not reach statistical significance [47].

However, there are studies reporting that VD is associated with OAB syndrome [29]. Handa et al [48] showed that histories of vacuum- and forceps-assisted delivery increase the risk of OAB by 1.76-fold (0.68–4.57) and 2.92-fold (1.44–5.93), respectively. In this study, operative VDs, especially those with forceps application, were found to increase the risk of OAB development.

Effect of the mode of delivery on FI

Despite the high prevalence and distressing nature of FI, the mechanism by which childbirth influences this condition is not fully understood. Laceration of the external anal sphincter during VD is the main risk factor for incontinence of flatus or feces. The coexistence of an unrecognized injury to the internal anal sphincter may explain why up to one-half of parturients subsequently experience FI even after repair of a recognized sphincter laceration [49]. Vacuum extraction also increases the risk of FI. The association of VD with FI has been documented. Ryhammer et al [50] reported that the odds of flatus incontinence were 6.6-fold higher (95% CI 2.4–18.3) after the third VD, compared with the first or second VD. Pollack et al [51] prospectively followed 309 nulliparous women for 5 years after VD and found that, compared with the women who had only one VD, those who had >1 subsequent childbirths were at a significantly increased risk of anal incontinence (odds ratio 2.4; 95% CI 1.1–5.6). In this study, most of the subsequent childbirths (95%) were VDs. Several studies, including a recent review article, have examined outcomes that were associated with CD versus VD for the primary prevention of FI [52]. With the exception of a few studies, most do not provide evidence for CD as a preventive strategy. Moreover, the impact of delivery type on FI appears to decline with age. Thirty years after delivery, comparable prevalence rates of flatus incontinence and FI were found among women whose index delivery was complicated by anal sphincter disruption or those who had VD with episiotomy or CD [53]. Similarly, Bollard et al [54], in a study, did not find any significant difference in reported FI symptoms between women with a history of forceps-assisted delivery (14%), spontaneous VD (10%), or elective CD (0%) 34 years after delivery, but acknowledged the need for a larger sample size to detect a statistically significant difference. In a Cochrane review [55] including 21 studies published in 2010, only one study showed less incidence of anal incontinence in the CD group compared to the VD group. This study, which involved 6028 women who gave birth by cesarean section and 25,170 women who gave birth vaginally, is satisfactory in terms of study power, but having only one randomized study is the disadvantage of the study. In this study, as a result, it is not appropriate to suggest elective cesarean section due to the lack of demonstrable benefit of CD for anal incontinence. In addition, elective or emergent CD did not show any benefit in terms of prevention of AI [55].

Routine versus selective use of episiotomy for PFD

Episiotomy has been performed traditionally in order to avoid fetal trauma and prevent direct trauma on pelvic floor muscles during childbirth. While Memon and Handa [29] defined the history of perineal laceration as a risk factor for POP development, they have not found a similar relationship with episiotomy. However, research on the relative risks and benefits of routine episiotomy has led to conflicting results. Early advocates of routine episiotomy argued that it protects the mother's perineum, resulting in better postpartum pelvic organ support. However, high-quality evidence to support the practice of routine episiotomy is lacking. In a systemic review of 28 prospective studies looking into pelvic floor outcomes after episiotomy, no difference was found in symptoms of UI between spontaneous laceration and episiotomy

groups. In addition, episiotomy was not found to be protective against FI; prolapse decreased pelvic floor muscle strength [56]. Moreover, median episiotomy is known to increase the risk of anal sphincter damage. Episiotomy has been shown to reduce perineal muscle strength paradoxically compared to spontaneous perineal laceration, due to extensive tissue separation in the postpartum period. In addition, the optimal length of episiotomy, perineal in depth, and the optimum angle in mediolateral episiotomy are not known to prevent perineal damage.

The accepted consensus between episiotomy, postpartum pain, and dyspareunia is in favor of limited episiotomy in selected cases. When limited and routine episiotomies were compared in terms of UI prevalence, perineal pain, and dyspareunia at 4 years after the first birth, the difference was not found to be statistically significant between two groups. Higher psychological morbidity was identified in routine episiotomy application (assessed by the Edinburgh Postnatal Depression Scale). This prospective study argues against routine episiotomy. However, antenatal factors that may have significant effects on morbidity are highlighted. In addition, there is no evidence that it has protective effect on the fetus. Cochrane reviews indicated that limited episiotomy should replace routine episiotomy [57–59]. Mediolateral episiotomy has been argued to be a risk factor for PFD, as it causes FI by damaging the anal sphincter [46]. Despite that, mediolateral episiotomy has not been found to increase the incidence of prolapse, UI, and FI, compared with the first- and second-degree spontaneous perineal lacerations and intact perineum [60]. There is also evidence suggesting a protective role of mediolateral episiotomy against the development of central support defects of the anterior vaginal wall [61]. Hence, the role of episiotomy as a risk factor versus a protective factor for the development of PFD remains unknown, as concluded by a 2005 systematic review [56].

Relationship between PFD and sexual dysfunction

Another condition associated with PFD is sexual dysfunction. This situation, similar to UI, may be due to the factors associated with the development of PFD, or it may also be caused by surgical procedures performed to correct PFD. The incidence of sexual dysfunction in women with UI is reported to vary between 26% and 47% [62,63]. A total of 11–77% of women with UI experience urinary leakage during coitus [64,65]. Comparing women who have both POP and UI with those who have only UI, sexual dysfunction was found to be more common in the first group with both morbidity [66]. In the study performed by Sen et al [62], advanced age, POP, and mode of delivery were found to be risk factors for sexual dysfunction.

POP and UI surgeries have a big role in the reconstruction of local anatomy and in reducing or eliminating the symptoms. However, this situation may not provide optimal sexual function. The reason for sexual dysfunction following vaginal surgery may be classified as organic and/or psychosocial [67]. The prevalence of sexual dysfunction in women who gave birth has been increasing. The main question related to this issue is the following: Does cesarean operation prevent sexual dysfunction? Klein et al [68] examined the rate of dissatisfaction during sexual intercourse at 3 months postpartum in a prospective study involving 135 women who underwent CD and 864 women who had VD. Higher dissatisfaction rate was found in the VD group, showing statistical significance (70% vs. 54%, $p < 0.05$). However, dyspareunia rates were found to be identical in both groups (31% vs. 31%). By contrast, in another study, although sexual dysfunction is seen less in short-term follow in CD group, in the long term, it did not change perineal pain, sexual dysfunction, and sex dissatisfaction rates. It is concluded that CD does not prevent sexual dysfunction [69].

Do pelvic floor exercises conducted during and after pregnancy decrease PFD?

As with all diseases, strategies to prevent the formation of PFD have gained importance in recent years. Pelvic floor exercise program is one of these strategies, and it is extremely important that women participate actively in this process. These exercises should be recommended to all women in the 1st trimester [43]. In a prospective randomized study, when the UI of the patients was evaluated with International Consultation on Incontinence Questionnaire—Urinary Incontinence Short Form, to perform these exercises up to at least 22 weeks regardless of the previous status, reduces significantly by increasing the ability to contract in primiparous pregnant women [70]. A decrease in risk of FI as well as UI supports the importance of pelvic floor exercises during pregnancy to prevent PFD [71,72].

Lifestyle changes during pregnancy have been recommended to prevent constipation and obesity that may negatively affect PFD.

Conclusion

As demonstrated in this review, the literature on this subject contains many contrary studies. Although it is difficult to compare between CD and VD in terms of PFD, well-planned, prospective, double-blind, randomized, multicenter studies are needed and they should include patients with homogenized risk factors. When examined from the perspective of evidence-based medicine, results from the current literature may be summarized as follows: (1) A total of 65% of patients with incontinence remember that the first episode of incontinence happened during pregnancy or in the postpartum period; (2) having a history of the first VD in the advanced age may be one of the major risk factors for pelvic floor damage; (3) routine episiotomy should no longer be used in modern obstetric practice, as its cannot prevent direct trauma to the pelvic floor muscles; (4) pregnancy itself is the most important and independent risk factor for PFD. Pelvic floor muscle exercises performed during pregnancy and early postpartum period may be protective against UI during late trimesters of pregnancy and late postpartum period, as well as against anal incontinence; (4) elective CD (without trial of labor) seems to lower the risk of postpartum UI within a short period of time (3–6 months). However, CD does not prevent UI and FI in the long term; (5) CD does not prevent sexual dysfunction in the long term; and (6) enough scientific data are not available to recommend elective CD in order to prevent PFD. Further studies are needed to demonstrate the effect of mode of delivery on PFD in women at high risk, such as those with a previous history of PFD and those older than 40 years.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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