RESEARCH PAPER

Maternal and Obstetric Risk Factors Associated with Postpartum Pelvic Floor Dysfunction: Identifying Opportunities for Prevention

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ABSTRACT

Introduction: Postpartum pelvic floor dysfunction is a prevalent maternal health issue that encompasses urinary incontinence, anal incontinence, prolapse symptoms, and sexual dysfunction. Despite the fact that there is some form of inherent recovery after childbirth, the large percentage of women still exhibit their persistent symptoms even after the initial postpartum.

Aim: This paper was interested in defining the risk factors related to postpartum pelvic floor malfunction and assess the efficacy of guided pelvic floor muscle training to lighten the symptoms at 6 months postpartum.

Methodology: The study was a prospective cohort study among 240 women recruited within 48 hours of birth at one of the tertiary care centers. The participants were stratified based on mode of delivery and divided into normal care and systemized pelvic floor muscle training. Pelvic floor symptoms were measured and muscle strength was measured at six weeks and six months after delivery. Multivariate logistic regression was conducted in order to obtain the independent predictors of dysfunction.

Findings: Six months after delivery, 28.8% of the women had at least one pelvic floor symptom. Significant predictors were operative vaginal delivery, 2-stage labor, birthweight over 3.8 kg, body mass index (BPMI) over 30kg/ m and severe tear of the perineum. When the pelvic floor muscle training was structured, it would much better the muscle strength and decrease the urinary incontinence relative to usual care. The greater adherence to training, the greater the symptom resolution was.

Conclusion Postpartum pelvic floor dysfunction at six months is common, especially among high-risk women. Early diagnosis and systematic pelvic floor rehabilitation of the patient have a great impact and need to be part of the regular postpartum care.

Keywords: *postpartum, pelvic floor dysfunction, urinary incontinence, pelvic floor muscle training, obstetric risk factors*

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1. INTRODUCTION

Postpartum pelvic floor dysfunction (PPFD) is a continuum of symptoms and clinical issues that occur following pregnancy and childbirth and are indicative of the lack of support or changes in the functionality of the pelvic floor muscles, connective tissues and nerves. The standardized terminology frameworks highlight that pelvic floor dysfunction is associated with lower urinary tract symptoms (particularly urinary incontinence), anorectal symptoms (such as anal incontinence), pelvic organ prolapse (POP), and sexual dysfunction that usually coexist in overlapping patterns, instead of as individual issues (1,2). The postpartum period is also clinically significant as it is a period of active tissue repair and neuromuscular adjustment, but the period of time when symptoms can first manifest, or when they continue later than anticipated in the early phases of healing (2).

The prevalence of PPF is low and depends on the definition of outcome and the period of follow-up and the nature of the population. One of the most common indicators of postpartum pelvic floor symptoms which has been frequently reported is urinary incontinence. An article that presents a systematic review of urinary incontinence in the first postpartum year disclosed massive prevalence rates which might accumulate or transform over the postpartum periods, thus pointing to the idea that most women do leak far beyond the initial weeks of childbirth (3). Sexual dysfunction is also a major contributor of post partum

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morbidity. The meta-analytic data suggest that dyspareunia continues to be a significant issue that affects a significant number of women after childbirth, although prevalence tends to decrease with the time, but is still clinically significant up to 12 months following childbirth (4). The extended postpartum health syntheses also demonstrate that the sexual symptoms like dyspareunia, lubrication problems, and low sexual interests can persist even at one-year postpartum, and it confirms that postpartum related symptoms of the pelvic floor do not disappear automatically in many women (14).

Although the latter are less frequently mentioned, anal incontinence and defecatory dysfunction are highly influential and significantly associated with obstetric anal sphincter injury (OASIS). It has been well established by obstetric literature that OASIS is a primary cause of subsequent anorectal morbidity, and risk is determined by circumstances of delivery and detection (6). Modern evidence still confirms that the rate of postpartum anal incontinence is dependent on the extent of sphincter trauma and on the means by which symptoms are determined, so that systematic examination and follow-up should be encouraged, instead of depending on the spontaneous reporting (5). Since anorectal symptoms can have a delayed course or remain moderate throughout the time, postpartum window is also a critical time of identifying anorectal disease early and providing preventive advice (5,6).

Considering the mechanistic viewpoint, PPFD is representative of pregnancy-related pathways as well as birth-related pathways. Pregnancy in itself is a risk factor on the load to pelvic support structures, collagen and connective tissue hormonal effects, and abdominal and pelvic biomechanics (2). Birth may directly contribute to muscle/fascia and nerve PTSD, perineal injury. It has been shown by imaging and clinical research that postpartum levator ani muscle injury is the cause of pelvic floor symptoms and anatomical alterations implicated in POP and incontinence (10). Syntheses of obstetric levator ani trauma show that transvaginal birth and especially operative vaginal birth is a determinant factor in levator trauma, and that this may have long-term health consequences in the pelvic floor (9). In other meta-analytic evidence, it is seen that the forceps delivery is also linked with significantly increased odds of levator rupture than non-instrumental vaginal delivery, which increases the biologic plausibility of delivery mode as a viable risk factor pathway as an antecedent to subsequent dysfunction (8).

These postpartum symptoms have greater importance than just the complaints of the pelvis on a long-term basis. The profile of risks in POP is multifactorial and systematic reviews found vaginal birth, parity, birthweight, age, increased body mass index and levator deficiencies of vagina to be one of the risk factors verified or proven (7). Although the patient does not show immediate serious symptoms, the dysfunction of the pelvic floor may affect physical activity, sleep, social engagement, intimacy and health service utilization. Also increasing indications suggest that postpartum mental health may overlap with pelvic floor symptoms. To exemplify, the evidence of systematic reviews indicates that urinary incontinence can be linked with high risk of developing post-partum depressive symptoms as an example of how PPFD can be positioned at the center of post-partum wellbeing instead of focusing on urogenital outcomes only (15).

Considering that it is widespread and may persist, PPFD is becoming more and more a circumventable and manageable postpartum health condition, not an unavoidable medical outcome of childbirth. There are preventive strategies on the perinatal continuum. PFMT has been extensively suggested and good evidence has been attested in favor of PFMT as the means of preventing and treating urinary incontinence in expectant and after delivery women with programs planned and executed in the right way (11). Preventive interventions on reducing perineal trauma, such as restrictive episiotomy policies and use of perineal protection methods such as warm compresses or perineal massage during the second stage, are supported in international guidance frameworks (12). Also, there is now evidence-based clinical practice of OASIS that focuses on proper diagnosis, repair and planned postpartum follow-up that represents a prevention paradigm encompassing the primary prevention of injury, as well as the secondary prevention of long-term malfunction of post-injury dysfunction (13).

Methodology

Study Design and Setting

This research was developed as a prospective observational cohort study carried out at a tertiary care teaching hospital with an annual volume of delivery of over 4,000 births. The aim was to determine the risk-related factors related to postpartum dysfunction of the pelvic floor and provide assessment of the efficacy of the organized prevention measures in six months postpartum. The ethical approval of the institutional review board was sought before the data collection. The informed consent was obtained through written consent of all the participants.

Participants and Sampling

Patients were eligible to participate in the study and were aged 18 to 40 years of age with the birth of singleton pregnancies at the study center. The exclusion criteria were diagnosed pelvic floor disorders and already had a pelvic reconstructive surgery, known neurological disease, and multiple gestations. Selection bias was reduced by using consecutive sampling. The subjects were recruited within the 48 hours after childbirth and stratified on the basis of the mode of delivery; spontaneous vaginal delivery, operative vaginal delivery and cesarean section. A power analysis was further computed on a total population of 240 women to detect moderate effect with 80 percent power and 5 percent significance.

Data Collection Procedures

Medical records and structured interviews were compiled as the baseline demographic and obstetric variables. Variables were maternal age, body mass index, parity, gestational age, birthweight, duration of second stage of labor, episiotomy and perineal tear grade. Validated self-

administered questionnaires of urinary symptoms, bowel symptoms, pelvic organ prolapse symptoms, and sexual functioning were used to evaluate the participants who had surgery at 6 weeks and 6 months postpartum. Trained physiotherapists who did not know the information about the delivery tested clinical strength of the pelvic floor muscles with the help of the Modified Oxford Scale.

Data Collection Procedures

Before discharge, all subjects were provided with standard organization of postpartum education regarding the health of the pelvic floor. All women were then randomly combined into two subgroups under each mode of delivery, i.e. normal care and structured pelvic floor muscle training (PFMT). PFMT group members were allocated supervised group sessions one time a week in a six-week period with a personalised home exercise regimen. Follow up telephone reminders and exercise diaries were used to monitor compliance.

Outcome Measures

The main outcome was the occurrence of pelvic floor dysfunction in six months after childbirth, which is characterized by symptomatic cultural urinary deficits, anal deficits, prolapse signs, or dyspareunia. The secondary outcomes were muscle strength of the pelvic floor and symptom severity scores.

Statistical Analysis

A statistical program was used to analyze data. Characteristics at baseline were summarized as descriptive statistics. The chi-square tests and independent t-tests were used to compare categorical and continuous variables respectively. Risk factors of pelvic floor dysfunction were identified using the multivariate logistic regression. The statistical significance was defined as $p < 0.05$.

Results

Participant Characteristics and Study Flow

Two hundred sixty-eight women were eligible screened with 240 meeting the inclusion criteria and being enrolled in the study. Figure 1 shows the flow of the participant where it is evident that there is recruitment, exclusion, allocation, follow-up, and final analysis. At the 6-week follow-up, 12 participants were lost to follow-up and at 6 months, another nine, including the final analysis sample of 219 women. That the follow-up area was 91% six months later enhances the trustworthiness of longitudinal results and minimizes the chances of attrition effects.

Table 1. Baseline Demographic and Obstetric Characteristics by Mode of Delivery

Variable	Spontaneous Vaginal (n=139)	Operative Vaginal (n=41)	Cesarean Section (n=60)	p-value
Mean Age (years)	28.5 ± 4.4	29.1 ± 4.8	28.9 ± 4.7	0.63
BMI (kg/m²)	25.8 ± 3.6	26.9 ± 3.9	26.4 ± 4.1	0.21
Primiparous (%)	72 (51.8%)	26 (63.4%)	31 (51.7%)	0.34
Mean Birthweight (kg)	3.34 ± 0.41	3.71 ± 0.48	3.28 ± 0.39	<0.001
Second Stage >90 min (%)	29 (20.8%)	18 (43.9%)	—	<0.001
Episiotomy (%)	48 (34.5%)	29 (70.7%)	—	<0.001
3rd/4th Degree Tear (%)	6 (4.3%)	9 (22.0%)	—	<0.001
Gestational Age (weeks)	38.6 ± 1.2	38.9 ± 1.1	38.4 ± 1.3	0.18

Figure 1: Participant Flow Diagram

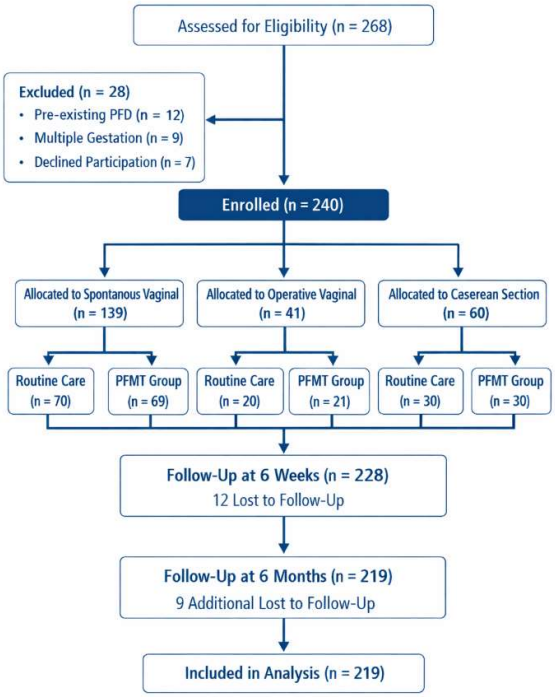


Table 1 displays the baseline demographic and obstetric data. The maternal age of the mean across groups were similar and the body mass index did not significantly differ between modes of deliveries. Operative vaginal birth was however related with much higher birthweight and extended second stage of labour. Episiotomy and severe cases of perineal tears were significantly higher in the group that went through operative vaginal delivery than in the spontaneous vaginal birth. These differences of baseline give a context to interpolate the subsequent pelvic floor outcomes and indicate that mechanical stress in delivery might play a significant role in postpartum dysfunction.

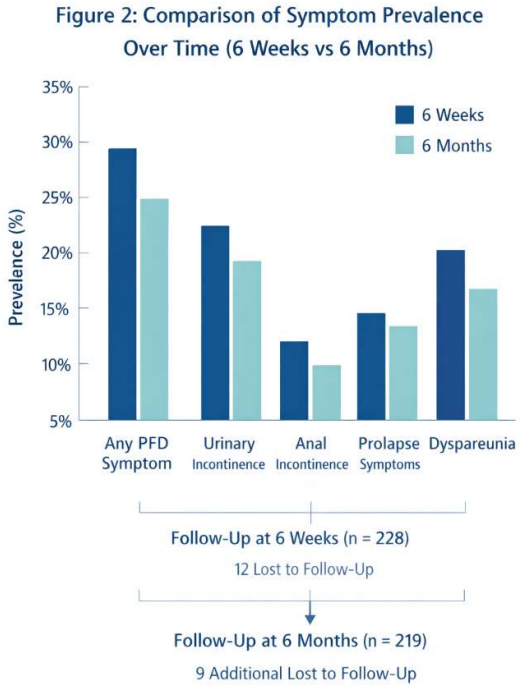
Prevalence and Evolution of Pelvic Floor Dysfunction

Table 2 provides the prevalence of symptoms of pelvic floor dysfunction at the times 6 weeks and 6 months postpartum and Figure 2 illustrates temporal comparisons. Sixty-eight percent (38.2) of women at six weeks postpartum complained of at least one symptom of pelvic floor dysfunction. At 6 months, this prevalence dropped by half to 28.8% where recovery was partial over time. At both time points, the most frequent complaint was urinary incontinence, 28.5 6 weeks and 21.5 6 months. Dyspareunia expressively also showed a significant decrease, and dropped to 15.5.

Table 2. Prevalence of Pelvic Floor Dysfunction Symptoms

Symptom	6 Weeks (n=228*)	6 Months (n=219*)
Any PFD Symptom	87 (38.2%)	63 (28.8%)
Urinary Incontinence	65 (28.5%)	47 (21.5%)
Anal Incontinence	19 (8.3%)	15 (6.8%)
Prolapse Symptoms	24 (10.5%)	19 (8.7%)
Dyspareunia	52 (22.8%)	34 (15.5%)

*Loss to follow-up: 12 at 6 weeks; additional 9 by 6 months.



Even though the symptom prevalence declined as time progressed, almost one-third of the participants still experienced dysfunction at six months. Such a persistence highlights the fact that spontaneous recovery is not complete to a significant percentage of women. A progressive reduction in Figure 2 reflects healing and adaptation in the body in regard to physiological conditions, but the prolonged load at six months suggests active preventive and rehabilitative measures should be taken.

Table 3 displays independent predictors of pelvic floor dysfunction six months postpartum and draws a forest plot of this variable in Figure 3. Surgical delivery in the vagina was also linked to almost three times high chances of dysfunction. Birthweight above three point eight kilograms, as well as, long second dosage of labor, were also major risk factors. Third or fourth degree of perineal tears showed the greatest adjusted odds ratio of women highlighting the effects of severe perineal trauma.

Risk Factor Analysis

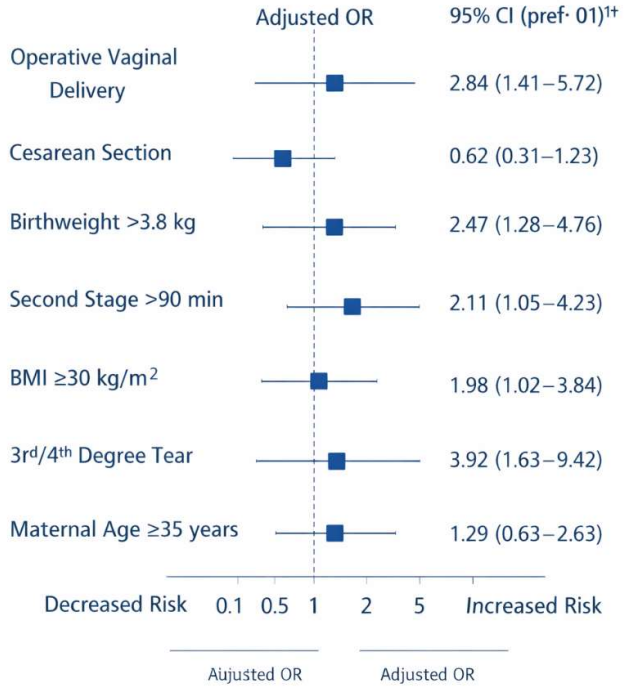
Table 3. Multivariate Logistic Regression: Predictors of PFD at 6 Months

Variable	Adjusted OR	95% CI	p-value
Operative Vaginal Delivery	2.84	1.41–5.72	0.003
Cesarean Section	0.62	0.31–1.23	0.17
Birthweight >3.8 kg	2.47	1.28–4.76	0.007
Second Stage >90 min	2.11	1.05–4.23	0.036

BMI ≥30 kg/m²	1.98	1.02–3.84	0.044
3rd/4th Degree Tear	3.92	1.63–9.42	0.002
Maternal Age ≥35 years	1.29	0.63–2.63	0.48

Model $\chi^2 = 34.6$, $p < 0.001$
Nagelkerke $R^2 = 0.29$

Figure 3: Forest Plot Demonstrating Adjusted Odds Ratios for Significant Predictors



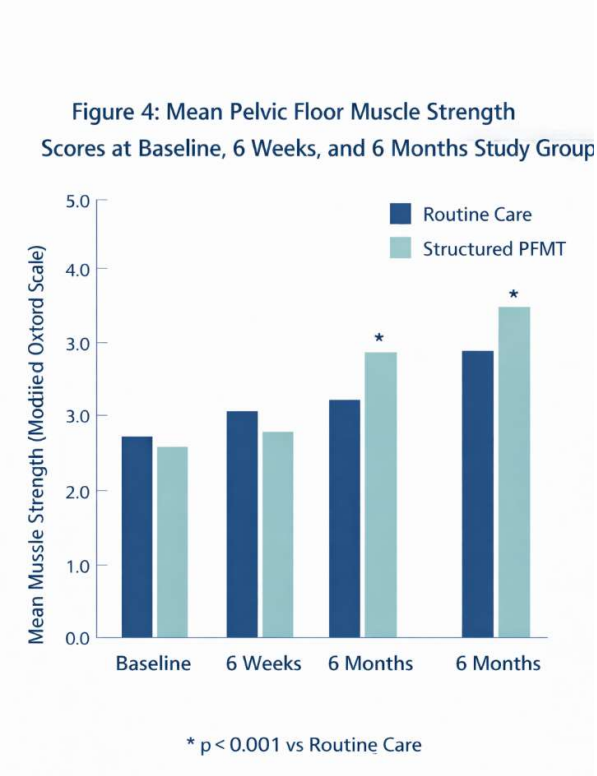
The reverse has been observed in cesarean section which had a non-relevant protective trend. High body mass index was significantly linked to dysfunction, which implied that the metabolic and mechanical aspects of the mother could be used to determine recovery. In this cohort, maternal age that was more than 35 years was not statistically significant. The visual representation of the forest plot showed the scale and accuracy of the given associations, where the confidence intervals were distinctly isolated and discontinuous with unity in meaningful predictors. Taken together such findings reveal that mechanical loading during childbirth especially when combined with instrumental help or severe perineal trauma is some of the major players in postpartum morbidity of the pelvic floor.

Effectiveness of Structured Pelvic Floor Muscle Training

Table 4 and Figure 4 provide the details of the effect of structured pelvic floor muscle training. The muscle strength scores were equal at the baseline, both in the routine care and progressive PFMT groups. At six months, the PFMT group showed a greater improvement in the scores of the Modified Oxford Scale than in routine care. The average gain of strength was nearly twice in the intervention.

Table 4. Comparison of PFMT vs Routine Care

Outcome	Routine Care (n=120)	Structured PFMT (n=120)	p-value
Baseline Muscle Strength (Oxford Scale)	2.4 ± 0.8	2.5 ± 0.7	0.52
6-Month Muscle Strength	3.1 ± 0.9	3.9 ± 0.8	<0.001
Improvement (Mean Change)	+0.7 ± 0.6	+1.4 ± 0.7	<0.001
Urinary Incontinence at 6 Months	32 (26.7%)	15 (12.5%)	0.006
Dyspareunia at 6 Months	21 (17.5%)	13 (10.8%)	0.14
Any PFD Symptom at 6 Months	41 (34.2%)	22 (18.3%)	0.004



The outcome of the symptoms was exactly the same as the strength outcomes. At six months, urinary incontinence was much reduced in women who had structured PFMT. Though the reduction of dyspareunia has not become statistically significant, there was a positive tendency. These findings show that pelvic floor rehabilitation with supervision improves neuromuscular recovery and symptom persistence. This trend in an overview of the creating separation in student groups across time, as shown by the graphical representation in Figure 4 which supports the cumulative advantage of structured training.

Influence of Adherence on Symptom Resolution

By compliance with PFMT, identification of clinical outcomes was a critical factor. Subgroup analysis on levels of adherence is also shown in Table 5, and Figure 5 shows the results of the resolution of symptoms visually. Females who attained at least 80% adherence showed and had considerably reduced persistent symptom rates at six months compared to less adherent females. The scores of

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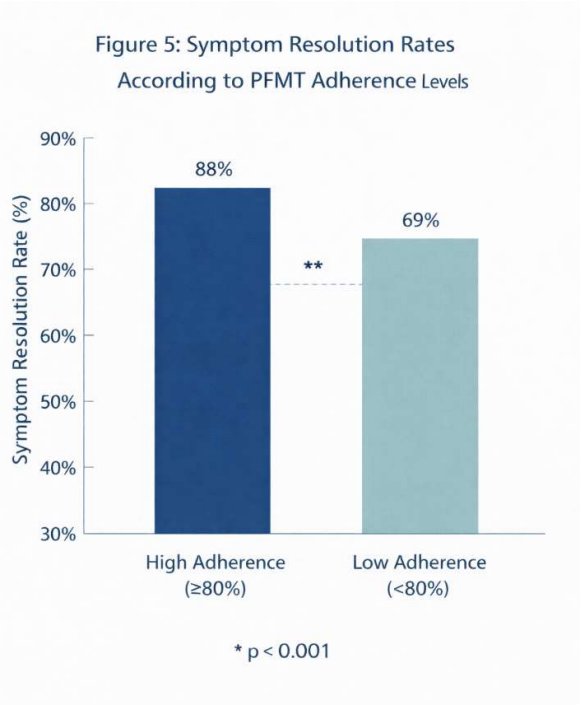
muscle strength were also significantly greater in the high-adherence subgroup.

Table 5. Subgroup Analysis: PFMT Adherence and Symptom Persistence

Adherence Level	Participants (n=120)	Persistent Symptoms at 6 Months	p-value
≥80% Adherence (n=78)	78	9 (11.5%)	<0.001
<80% Adherence (n=42)	42	13 (31.0%)	—

Mean Muscle Strength at 6 Months:
- High Adherence: 4.1 ± 0.7
- Low Adherence: 3.2 ± 0.8

$p < 0.001$



These results demonstrate that compliance is a close associative factor with intervention efficacy. The significant difference in the resolution of symptoms in Figure 5 favors the idea that the pelvic floor rehabilitation is dose-dependent. Formal follow-up and patient follow-up interventions can thus be a necessity of any effective prevention intervention.

The findings indicate that dysfunction of the postpartum pelvic floor is prevalent six months later, especially among women who experienced operative vaginal birth, prolonged labor, increased birthweight, high body mass index, and severe perineal trauma. Though natural recovery comes with time, structured pelvic floor muscle training plays an important role in functional restoration and minimizes the level of intractable symptoms. The complex of statistical data in Tables 1-5 and visual confirmation in Figures 1-5 support with the assistance of the risk identification and the supervised rehabilitation as the components of the target prevention strategy. All these results imply that the postpartum pelvic floor dysfunction is not an imminent result of giving birth, it is a condition alterable with timely structured intervention.

Discussion

The study examined prevalence, determinants and preventive effect of structured pelvic floor muscle training on postpartum pelvic floor dysfunctions. Females still had pelvic floor symptoms in almost a third at six months later after giving birth, and this was partially reversing with time. The most frequent symptom was always urinary incontinence, then dyspareunia, and complaints of the prolapse. These data are in line with the prospective cohort evidence that demonstrates that pelvic floor morbidity is often carried over the short term postpartum and can be

experienced in later reproductive years (16). The longitudinal study has also found that childbirth-related trauma is one of the contributing factors of the long-term pelvic floor impairment that lasts after vaginal delivery (17).

Operative vaginal birth became an important predictor of postpartum dysfunction among our cohort. Imaging and epidemiology studies have demonstrated a high risk of levator ani muscle trauma and connective tissue rupture, highly linked with subsequent disorders of the pelvic floor, with instrumental delivery (18). The results of the study also demonstrated that long second phases of labor and increased birthweight were independent predictors. These findings are similar to observational studies that investigated that greater fetal weight and longer labor duration are associated with the ability to fit mechanical loads on pelvic support structures, and there is thus an increased likelihood of developing postpartum incontinence and prolapse symptoms (19).

Cesarean birth showed non-significant trend of protective effect but past long-term population studies have reported inconsistent findings concerning protective effect of cesarean birth. Certain registry studies propose the decreased short-term symptoms of the pelvic floor in the aftermath of the cesarean operation, whereas the advantages in the long term are unclear (20). Our study found high body mass index to be specifically related to ongoing dysfunction, a finding that is corroborated by another epidemiological research that reported a correlation between obesity and intra-abdominal pressure as well as chronic strain of the pelvic floor (21). The maternal age exceeding 35 years and above could not attain statistical significance in our analysis but this does not relate to some of the large-scale population cases that reported age-related connective tissue vulnerability; this might be because the participants were relatively younger (22).

One of the value additions of this research is that structured pelvic floor muscle training is effective. The results favored improved muscle strength and lower incidences of urinary incontinence in six months among participants that were supervised and trained as opposed to routine care. What is more, randomized trials have also indicated that postpartum pelvic floor rehabilitation is effective in improving neuromuscular recovery and lowering the severity of the symptoms (23). Notably, our subgroup review showed that conformity to recommended exercises greatly determined the results. Past research studies within behavioral interventions have highlighted that adherence is a key variable to assess the success of therapy in the process of rehabilitating the pelvic floor (24).

Clinical Implications

The results demonstrate the necessity to implement risk stratification in the early perinatal stage. Females who have received operative vaginal birth, long labor, had children with big birth weight or those who come with high body mass index are high-risk factors in persistent pelvic floor dysfunction. The incorporation of structured muscle training of the pelvis floor into the standard care provision in the after child delivery stage can significantly lower morbidity in the long-term. Moreover, a detailed follow up system that promotes compliance may also increase the performance of interventions. Increased knowledge of the health of the pelvic floor prior to discharge by educated pre-hospital might also achieve awareness and preventive involvement.

Limitations

There are a number of limitations that need to be recognized. It was carried out in one tertiary center, which may not be applicable to other health care environments. The rates of follow-ups were high but there was also a possibility of attrition that created low-level bias. The evaluation of the symptoms depended partially on self-reported assessment that is susceptible to recall bias and reporting dissimilarity. In addition, no long-term results (more than six months) were considered, which limited the conclusion to persistent or late-onset pelvic floor disorders.

Conclusion

Postpartum dysfunction of the pelvic floor is most common at six months of the childbirth, especially in women who have been exposed to operative vaginal births, long second parts of labor, increased birthweight, and increased body mass index. Structured training of the pelvic floor muscles is an effective way of enhancing muscle strength and decreasing the persistence of symptoms, and compliance is the influencing factor in clinical practice. These results highlight the role of incorporating early screening and progressive rehabilitation into the postpartum care streams in order to reduce long-term morbidity of the pelvic floor.

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