

Original Article

# Comparison of Rehabilitation Exercise Protocol and Swiss Ball Training for Postpartum Pelvic Floor Dysfunction

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## ARTICLE INFORMATION

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## ABSTRACT

**Background:** Postpartum pelvic floor muscle dysfunction can impair muscle strength, urinary continence, pelvic floor function, and quality of life. Evidence directly comparing structured 5R rehabilitation with Swiss Ball training remains limited. **Objective:** To compare the short-term effects of 5R rehabilitation exercise and Swiss Ball training on pelvic floor muscle strength, urinary incontinence severity, pelvic floor distress, and health-related quality of life in postpartum women. **Methods:** This assessor-blinded, parallel-group randomized controlled trial was conducted at Shadman Medical Complex. Fifty-six postpartum women were allocated to 5R rehabilitation exercise or Swiss Ball training groups (n = 28 each). Participants completed supervised 45-minute sessions four days weekly for four weeks. Outcomes were assessed using the Modified Oxford Scale (MOS), ICIQ-UI SF, PFDI-20, and SF-12. Within-group changes were examined using Wilcoxon signed-rank tests, and post-intervention distributions were compared using Mann-Whitney U tests. **Results:** Both groups demonstrated changes in all outcomes (all within-group  $p < 0.001$ ). Post-intervention scores favored 5R for MOS ( $4.25 \pm 0.80$  versus  $3.50 \pm 0.88$ ;  $p = 0.003$ ), ICIQ-UI SF ( $5.93 \pm 3.61$  versus  $8.86 \pm 2.85$ ;  $p = 0.003$ ), and SF-12 ( $55.54 \pm 7.85$  versus  $49.39 \pm 6.49$ ;  $p = 0.006$ ). PFDI-20 did not differ statistically between groups ( $p = 0.210$ ). **Conclusion:** Both protocols were associated with favorable short-term changes, while post-intervention pelvic floor strength, urinary incontinence severity, and quality-of-life scores favored 5R rehabilitation. **Keywords:** Exercise Therapy; Pelvic Floor Disorders; Postpartum Period; Quality of Life; Rehabilitation; Swiss Ball; Urinary Incontinence.

## INTRODUCTION

Postpartum pelvic floor muscle dysfunction (PFMD) is an important maternal health problem that may manifest pelvic floor muscle weakness, urinary incontinence, pelvic organ prolapse symptoms, pelvic discomfort, and impaired physical and psychosocial functioning. Pregnancy and childbirth expose the pelvic floor and surrounding lumbopelvic structures to substantial mechanical and neuromuscular demands, and symptoms may persist beyond the early postpartum period. Persistent PFMD can interfere with physical activity, social participation, emotional well-being, and health-related quality of life, highlighting the need for accessible and effective conservative rehabilitation strategies (1,2).

Exercise-based rehabilitation is widely recommended as a conservative approach to postpartum pelvic floor symptoms. Pelvic floor muscle training aims to improve the strength, endurance, and coordinated activation of the pelvic floor musculature. Systematic-review evidence suggests that postpartum exercise, particularly targeted pelvic floor muscle training, can reduce the severity or likelihood of urinary incontinence and other pelvic floor symptoms (1,3,4). A randomized trial has also demonstrated that structured pelvic floor muscle training supported by regular reminders can improve postpartum urinary outcomes, emphasizing the potential importance of supervised practice, adherence, and progressive training (5). Nevertheless, pelvic floor dysfunction is multidimensional, and symptom improvement may require rehabilitation that addresses not only isolated pelvic floor contraction but also breathing, trunk control, posture, and functional movement.

The rehabilitation exercise 5R system represents a structured postpartum approach intended to promote progressive recovery through coordinated muscle activation, postural control, functional movement, and conditioning. Previous research comparing the 5R system with aerobic exercise and routine activity reported improvements in several measures of postpartum muscle function and physical recovery, although the intervention structure, treatment duration, and measured outcomes differed from those used in the present study (6). Therefore, evidence from that investigation cannot establish the comparative effect of the four-week 5R-based protocol used in women specifically diagnosed with postpartum PFMD.

Swiss Ball training provides another exercise-based approach to lumbopelvic rehabilitation. Its unstable support surface requires continuous postural adjustment and may facilitate coordinated activation of the abdominal, spinal, hip, and pelvic-region musculature. A randomized trial in women with postpartum low back pain compared Swiss Ball training with static exercise for the lower back and pelvic region, suggesting that this approach may have value in postpartum rehabilitation (7). Exercise incorporating a gym ball has also been investigated alongside traditional pelvic floor exercises in women with pelvic floor symptoms; however, evidence from postmenopausal populations cannot be directly generalized to postpartum women (8). Consequently, uncertainty remains regarding whether Swiss Ball training provides outcomes comparable or superior to a structured 5R-based rehabilitation protocol in postpartum PFMD.

Existing studies have generally evaluated pelvic floor muscle training, integrated postpartum rehabilitation, or ball-based exercise against usual care, aerobic exercise, static exercise, or other comparators. Direct comparative evidence regarding a 5R-based rehabilitation exercise protocol and Swiss Ball training for postpartum PFMD remains limited. In particular, their comparative effects on pelvic floor muscle strength, urinary incontinence severity, pelvic floor distress, and health-related quality of life have not been adequately established. A direct comparison could help clinicians select an exercise approach according to the principal symptoms and rehabilitation needs of postpartum women.

Therefore, this assessor-blinded, parallel-group randomized controlled trial aimed to compare the effects of a four-week 5R rehabilitation exercise protocol and Swiss Ball training on pelvic floor muscle strength measured using the Modified Oxford Scale, urinary incontinence severity measured using the International Consultation on Incontinence Questionnaire–Urinary Incontinence Short Form, pelvic floor distress measured using the Pelvic Floor Distress Inventory-20, and health-related quality of life measured using the 12-item Short Form Health Survey among postpartum women with PFMD. It was hypothesized that the changes in these outcomes would differ between the two intervention groups.

## MATERIALS AND METHODS

This assessor-blinded, parallel-group randomized controlled trial was conducted at Shadman Medical Complex over a period of nine months to compare a 5R rehabilitation exercise protocol with Swiss Ball training in postpartum women with pelvic floor muscle dysfunction. Eligible participants were women aged 20–40 years who were within six months after either vaginal or caesarean delivery, were primiparous or multiparous, had confirmed pelvic floor dysfunction accompanied by urinary incontinence occurring at least once per week, and were willing to participate. Women were excluded if they had experienced a high-risk pregnancy or postpartum complications, had a musculoskeletal or neurological disorder affecting movement or exercise participation, had undergone pelvic surgery, had a severe musculoskeletal condition, or had clinically significant diastasis recti. Participants were recruited using convenience sampling and then allocated in a 1:1 ratio to the 5R rehabilitation exercise group or Swiss Ball training group.

The required sample size was calculated using G\*Power version 3.1.9.4 with an assumed effect size of 0.68, a two-sided significance level of 0.05, and 80% statistical power. The calculation indicated a required sample of 70 participants, corresponding to 35 participants per group. Nevertheless, the study included 56 participants, with 28 allocated to the 5R rehabilitation exercise group and 28 allocated to the Swiss Ball training group. A computer-generated random-allocation sequence was used. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes that were opened after formal enrolment.

Blinding of participants and treating physiotherapists was not feasible because of the nature of the exercise interventions. Outcome assessments were performed by a physiotherapist who remained unaware of group allocation. Group identities were coded before statistical analysis so that the analyst could evaluate the outcomes without access to the intervention labels. Baseline information included age and body mass index, while the clinical outcomes were measured immediately before the intervention and after completion of the four-week treatment period.

Participants allocated to the 5R group received a structured rehabilitation exercise protocol comprising diaphragmatic breathing, pelvic floor muscle training, core strengthening, and progressive functional exercises. The exercises included bridging, wall squats, bird-dog exercises, and heel slides. Each supervised session lasted approximately 45 minutes and was delivered four days per week for four consecutive weeks. Exercise difficulty was progressed by modifying body position and increasing the duration of the contraction or breathing task according to the intervention protocol.

Participants allocated to the Swiss Ball group received exercises intended to improve core stability, proprioceptive control, postural control, and pelvic-floor support. The program included Swiss Ball wall squats, bridges, hamstring curls, planks, and seated balance exercises. Sessions were supervised and delivered for 45 minutes per session, four days per week for four weeks, ensuring that the intervention duration and therapist contact were comparable between groups. Progression involved increasing the number of repetitions, reducing the base of support, and incorporating upper-limb movements while participants maintained balance on the unstable surface.

Pelvic floor muscle strength was assessed using the Modified Oxford Scale. Urinary incontinence severity was evaluated using the International Consultation on Incontinence Questionnaire–Urinary Incontinence Short Form. Pelvic floor symptom-related distress was assessed using the Pelvic Floor Distress Inventory-20, and health-related quality of life was evaluated using the 12-item Short Form Health Survey. All four outcomes were recorded at baseline and immediately following the four-week intervention. The same blinded outcome assessor performed the assessments to reduce inter-assessor variability.

The distribution of each continuous or ordinal outcome was examined before inferential analysis, and most outcome variables were found to deviate from a normal distribution. Within-group changes from baseline to four weeks were therefore assessed separately for each intervention group using the Wilcoxon signed-rank test. Post-intervention scores were compared between the two groups using the Mann–Whitney U test. Test statistics were reported as Z values for within-group comparisons and as Mann–Whitney U and Z values for between-group comparisons. All statistical tests were two-sided, and a p-value of less than 0.05 was considered statistically significant. The analysis included the 56 participants reported as completing the study.

The trial was undertaken following institutional ethical approval and was reported in accordance with the CONSORT 2010 framework. Confidential group coding was maintained during statistical analysis, and participant information was used only for the purposes of the study.

## RESULTS

A total of 56 postpartum women completed the study, with 28 participants in each intervention group. The mean age was  $29.93 \pm 5.90$  years in the 5R group and  $29.75 \pm 6.87$  years in the Swiss Ball group. The corresponding mean BMI values were  $28.21 \pm 3.86$  and  $27.66 \pm 4.21$  kg/m<sup>2</sup>. No statistically significant baseline differences were identified for age, MOS, ICIQ–UI SF, PFDI–20, or SF–12 scores (all  $p > 0.05$ ); a baseline between-group test for BMI was not reported (Table 1).

Within-group analyses demonstrated changes in all four outcomes following the four-week interventions (Table 2). MOS scores increased from  $2.11 \pm 0.79$  to  $4.25 \pm 0.80$  in the 5R group and from  $1.82 \pm 0.77$  to  $3.50 \pm 0.88$  in the Swiss

Ball group (both  $p < 0.001$ ). ICIQ-UI SF scores decreased from  $13.36 \pm 2.82$  to  $5.93 \pm 3.61$  in the 5R group and from  $14.36 \pm 2.36$  to  $8.86 \pm 2.85$  in the Swiss Ball group (both  $p < 0.001$ ). PFDI-20 scores decreased by 62.82 points in the 5R group and 42.08 points in the Swiss Ball group, while SF-12 scores increased by 18.79 and 13.57 points, respectively; all within-group tests yielded  $p < 0.001$ .

**Table 1. Baseline Characteristics and Outcome Scores by Treatment Group**

| Variable               | 5R group (n = 28), mean $\pm$ SD | Swiss Ball group (n = 28), mean $\pm$ SD | Mann-Whitney U | Z      | p-value |
|------------------------|----------------------------------|------------------------------------------|----------------|--------|---------|
| Age, years             | 29.93 $\pm$ 5.90                 | 29.75 $\pm$ 6.87                         | 388.0          | -0.066 | 0.948   |
| BMI, kg/m <sup>2</sup> | 28.21 $\pm$ 3.86                 | 27.66 $\pm$ 4.21                         | NR             | NR     | NR      |
| MOS                    | 2.11 $\pm$ 0.79                  | 1.82 $\pm$ 0.77                          | 314.0          | -1.360 | 0.174   |
| ICIQ-UI SF             | 13.36 $\pm$ 2.82                 | 14.36 $\pm$ 2.36                         | 320.0          | -1.191 | 0.234   |
| PFDI-20                | 138.71 $\pm$ 21.51               | 127.79 $\pm$ 24.10                       | 283.0          | -1.787 | 0.074   |
| SF-12                  | 36.75 $\pm$ 6.05                 | 35.82 $\pm$ 5.48                         | 352.5          | -0.649 | 0.517   |

BMI, body mass index; ICIQ-UI SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form; MOS, Modified Oxford Scale; NR, not reported; PFDI-20, Pelvic Floor Distress Inventory-20; SD, standard deviation; SF-12, 12-item Short Form Health Survey.

**Table 2. Within-Group Changes in Clinical Outcomes After Four Weeks**

| Outcome    | Group      | Baseline, mean $\pm$ SD | Week 4, mean $\pm$ SD | Mean change (week 4 – baseline) | Wilcoxon Z | p-value |
|------------|------------|-------------------------|-----------------------|---------------------------------|------------|---------|
| MOS        | 5R         | 2.11 $\pm$ 0.79         | 4.25 $\pm$ 0.80       | 2.14                            | -5.013     | <0.001  |
|            | Swiss Ball | 1.82 $\pm$ 0.77         | 3.50 $\pm$ 0.88       | 1.68                            | -4.824     | <0.001  |
| ICIQ-UI SF | 5R         | 13.36 $\pm$ 2.82        | 5.93 $\pm$ 3.61       | -7.43                           | -4.646     | <0.001  |
|            | Swiss Ball | 14.36 $\pm$ 2.36        | 8.86 $\pm$ 2.85       | -5.50                           | -4.645     | <0.001  |
| PFDI-20    | 5R         | 138.71 $\pm$ 21.51      | 75.89 $\pm$ 24.62     | -62.82                          | -4.623     | <0.001  |
|            | Swiss Ball | 127.79 $\pm$ 24.10      | 85.71 $\pm$ 28.12     | -42.08                          | -4.624     | <0.001  |
| SF-12      | 5R         | 36.75 $\pm$ 6.05        | 55.54 $\pm$ 7.85      | 18.79                           | -4.631     | <0.001  |
|            | Swiss Ball | 35.82 $\pm$ 5.48        | 49.39 $\pm$ 6.49      | 13.57                           | -4.627     | <0.001  |

ICIQ-UI SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form; MOS, Modified Oxford Scale; PFDI-20, Pelvic Floor Distress Inventory-20; SD, standard deviation; SF-12, 12-item Short Form Health Survey. Negative changes in ICIQ-UI SF and PFDI-20 represent lower symptom scores.

**Table 3. Between-Group Comparisons of Post-Intervention Outcomes**

| Outcome    | 5R week 4, mean $\pm$ SD | Swiss Ball week 4, mean $\pm$ SD | Post-treatment mean difference | Between-group difference in mean change | 5R mean rank | Swiss Ball mean rank | Mann-Whitney U | Z      | p-value | r     |
|------------|--------------------------|----------------------------------|--------------------------------|-----------------------------------------|--------------|----------------------|----------------|--------|---------|-------|
| MOS        | 4.25 $\pm$ 0.80          | 3.50 $\pm$ 0.88                  | 0.75                           | 0.46                                    | 34.77        | 22.23                | 216.5          | -3.022 | 0.003   | 0.404 |
| ICIQ-UI SF | 5.93 $\pm$ 3.61          | 8.86 $\pm$ 2.85                  | -2.93                          | -1.93                                   | 22.09        | 34.91                | 212.5          | -2.957 | 0.003   | 0.395 |
| PFDI-20    | 75.89 $\pm$ 24.62        | 85.71 $\pm$ 28.12                | -9.82                          | -20.74                                  | 25.77        | 31.23                | 315.5          | -1.254 | 0.210   | 0.168 |
| SF-12      | 55.54 $\pm$ 7.85         | 49.39 $\pm$ 6.49                 | 6.15                           | 5.22                                    | 34.50        | 22.50                | 224.0          | -2.757 | 0.006   | 0.368 |

ICIQ-UI SF, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form; MOS, Modified Oxford Scale; PFDI-20, Pelvic Floor Distress Inventory-20; SD, standard deviation; SF-12, 12-item Short Form Health Survey. Mean differences were calculated as 5R minus Swiss Ball. Effect-size magnitude was calculated as  $|r| = |Z|/\sqrt{56}$ . Mann-Whitney U tests compare post-intervention score distributions. Statistical significance was set at  $p < 0.05$ .

Post-intervention distributions differed between the groups for MOS, ICIQ-UI SF, and SF-12 (Table 3). The 5R group had a higher MOS score than the Swiss Ball group ( $4.25 \pm 0.80$  versus  $3.50 \pm 0.88$ ;  $U = 216.5$ ,  $p = 0.003$ ,  $|r| = 0.404$ ) and a higher SF-12 score ( $55.54 \pm 7.85$  versus  $49.39 \pm 6.49$ ;  $U = 224.0$ ,  $p = 0.006$ ,  $|r| = 0.368$ ). The 5R group also had a lower ICIQ-UI SF score and mean rank than the Swiss Ball group ( $5.93 \pm 3.61$  versus  $8.86 \pm 2.85$ ;  $U = 212.5$ ,  $p = 0.003$ ,  $|r| = 0.395$ ), indicating lower post-intervention urinary-incontinence severity in the 5R group. The post-intervention PFDI-20 distributions did not differ statistically between groups ( $U = 315.5$ ,  $p = 0.210$ ,  $|r| = 0.168$ ).

Patient-level data or paired-change standard deviations remain necessary to calculate valid 95% confidence intervals for changes and to perform a baseline-adjusted treatment-effect analysis.

## DISCUSSION

This randomized controlled trial compared a four-week 5R rehabilitation exercise protocol with Swiss Ball training in postpartum women with pelvic floor muscle dysfunction. Both groups demonstrated favorable within-group changes in pelvic floor muscle strength, urinary incontinence severity, pelvic floor distress, and health-related quality of life. Post-intervention comparisons favored the 5R group for Modified Oxford Scale, ICIQ-UI SF, and SF-12 scores, whereas not statistically significant between-group difference was detected for PFDI-20. These findings suggest that the structured 5R protocol may provide greater short-term benefits for pelvic floor muscle strength, urinary symptoms, and health-related quality of life than the Swiss Ball protocol evaluated in this study. However, these findings should be interpreted in relation to the post-intervention comparison used rather than as definitive evidence of greater change over time.

The favorable changes observed in both groups are consistent with evidence supporting exercise-based rehabilitation for postpartum pelvic floor symptoms. Systematic-review evidence indicates that postpartum exercise, particularly programs incorporating pelvic floor muscle training, can improve pelvic floor outcomes and reduce urinary incontinence symptoms (1,3,4). The improvements observed in the present study may therefore reflect the shared exercise components of the two protocols, including supervised practice, repeated muscle activation, progressive loading, and engagement of the lumbopelvic musculature. Nevertheless, the magnitude and durability of these changes cannot be directly compared with previous reviews because the present intervention lasted only four weeks and did not include longer-term follow-up.

The higher post-intervention pelvic floor muscle strength in the 5R group may be related to its inclusion of direct pelvic floor contractions alongside diaphragmatic breathing, core strengthening, postural control, and functional exercise. Coordinating these components could plausibly facilitate motor control and integration of the pelvic floor with the abdominal and lumbopelvic musculature. Previous research on the 5R system also reported favorable changes in postpartum muscle function following a progressive rehabilitation program (6). However, that study used a 12-week intervention, incorporated rehabilitative ultrasound imaging, evaluated different outcomes, and compared the 5R system with aerobic exercise and routine activity. It therefore supports the general rationale for structured postpartum rehabilitation but does not provide direct confirmation of the effects of the shorter, adapted protocol evaluated in the present trial.

The Swiss Ball group also demonstrated increased pelvic floor muscle strength and favorable changes in the other measured outcomes. Swiss Ball exercise creates an unstable support surface that requires continuous postural adjustment and recruitment of the trunk and pelvic-region musculature. A previous randomized trial found that both static core exercise and Swiss Ball training were associated with favorable outcomes in women with postpartum low back pain, although that study did not specifically evaluate postpartum pelvic floor dysfunction (7). Gym Ball-assisted pelvic floor exercise has also been associated with greater pelvic floor muscle strength than traditional exercise in postmenopausal women (8). Differences in age, reproductive status, intervention content, treatment duration, and clinical condition limit direct comparison with the present postpartum sample.

The lower post-intervention ICIQ-UI SF score in the 5R group indicates less severe urinary incontinence than in the Swiss Ball group. This finding is clinically plausible because the 5R protocol included direct pelvic floor muscle training, whereas the Swiss Ball intervention focused principally on core stability, proprioception, and postural control. Direct and repeated pelvic floor contractions may improve voluntary recruitment and support around the urethra during activities that increase intra-abdominal pressure. Previous evidence supports pelvic floor muscle training as an important conservative intervention for postpartum urinary incontinence (3,4). A trial of smartphone-supported pelvic floor muscle training reported better adherence and selected measures of pelvic floor muscle function, although it did not identify a between-group improvement in urinary incontinence symptoms, demonstrating that improved participation or muscle function does not necessarily produce superior symptom outcomes over a short period (5).

Both groups also demonstrated lower pelvic floor distress scores, but the post-intervention PFDI-20 distributions did not differ statistically. This finding should not be interpreted as proof that the interventions were equivalent. Pelvic floor distress is a multidimensional construct that may reflect urinary, colorectal, and prolapse-related symptoms, some of which may be less responsive to a short exercise intervention. The absence of a detected difference may also reflect limited statistical power, variation in baseline symptom severity, or the use of an analysis

that did not adjust the post-intervention comparison for baseline scores. Longer treatment and follow-up periods may be required to determine whether either protocol provides greater improvement across the different domains of pelvic floor distress.

The higher post-intervention SF-12 score in the 5R group may reflect the combined influence of improved pelvic floor muscle function, reduced urinary symptoms, and greater confidence in physical activity. Pelvic floor dysfunction can adversely affect physical functioning, participation, and quality of life, supporting the inclusion of patient-reported health status alongside symptom-specific outcomes (2). However, the present study did not examine the mechanisms connecting physical improvement with quality of life, and the SF-12 scoring approach was not sufficiently described. This finding should therefore be regarded as a short-term patient-reported outcome rather than evidence of broader or sustained health improvement.

From a clinical perspective, the findings support the feasibility of using supervised, structured exercise approaches for postpartum pelvic floor rehabilitation. The 5R protocol may be particularly relevant when pelvic floor weakness and urinary incontinence are prominent concerns, whereas Swiss Ball exercises may offer an alternative means of engaging the wider lumbopelvic system. The results do not establish either intervention as a universal first-line or preferred treatment because both groups received active treatment, no usual-care control group was included, and outcomes were assessed immediately after a relatively short intervention.

The study has several strengths, including randomized group allocation, assessor blinding, comparable intervention duration and therapist contact, and assessment of muscle strength, urinary symptoms, pelvic floor distress, and health-related quality of life. However, important limitations affect interpretation. The achieved sample of 56 participants was lower than the calculated requirement of 70, potentially reducing statistical power. Convenience recruitment from a single center limits representativeness, while variation in parity, delivery mode, and postpartum duration may have influenced recovery. The four-week intervention and immediate post-treatment assessment do not establish the persistence of the findings. The Modified Oxford Scale is an ordinal examiner-rated measure, and the remaining outcomes were self-reported. Adherence, treatment fidelity, co-interventions, protocol deviations, adverse events, and loss to follow-up were not fully reported. Moreover, no primary outcome was identified, several outcomes were tested without adjustment for multiplicity, and the principal between-group analyses compared post-intervention distributions without baseline adjustment. A baseline-adjusted analysis or group-by-time model would provide a more direct estimate of the comparative treatment effect. Accordingly, the findings should be interpreted as preliminary short-term evidence requiring confirmation in adequately powered trials with reproducible intervention protocols and longer follow-up.

## CONCLUSION

Both the 5R rehabilitation exercise protocol and Swiss Ball training were associated with favorable four-week changes in pelvic floor muscle strength, urinary incontinence severity, pelvic floor distress, and health-related quality of life among postpartum women with pelvic floor dysfunction. Post-intervention scores favored the 5R group for pelvic floor muscle strength, urinary incontinence severity, and health-related quality of life, while no statistically significant between-group difference was detected for pelvic floor distress. These findings suggest a potential short-term advantage of the 5R protocol for selected outcomes, although confirmation using an adequately powered baseline-adjusted analysis and longer follow-up is required.

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