Efficacy of standardized rehabilitation in the treatment of diastasis rectus abdominis in postpartum women in Eastern China

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Research Article

Keywords: Diastasis rectus abdominis, postpartum women, rehabilitation, Physical Functioning Scale
Abstract

Objectives: The aim of the study was to retrospectively summarize the experience and efficacy in the treatment of diastasis rectus abdominis (DRA) via standardized rehabilitation procedures in Eastern China.

Methods: This retrospective study included the parturients with DRA admitted to the Xishan People’s Hospital of Wuxi between January 2017 and May 2021. Patients were separated in standardized rehabilitation group (SR) and non-standardized rehabilitation group (non-SR). The outcomes were the change of rectus abdominis separation and Physical Functioning Scale (PFs). Measurement data were compared between the two groups using Student’s t-test or Fisher’s exact test. Multivariate linear regression was used to analyze the factors associated with standardized rehabilitation process. P value < 0.05 was considered statistically significant.

Results: A total of 294 patients with DRA were included in the study. Among the 294 patients, 171 patients were treated with SR (SR), and the other 123 patients were treated without SR process (non-SR). Compared with non-SR, the separation of the rectus abdominis was significantly reduced in SR after standardized rehabilitation treatment (p value<0.0001). The multiple linear regression model analysis results suggested that standardized rehabilitation was an independent factor influencing the prognosis of DRA in parturients (P<0.0001). In addition, the quality of life of the study group was significantly improved (p value<0.0001).

Conclusions: Standardized rehabilitation method has the high efficiency in the treatment of DRA in postpartum women, and can improve the quality of life of parturients.

Introduction

Diastasis rectus abdominis (DRA) is characterized by an increased distance between the rectus abdominis on both sides of the linea alba in pregnant women and postpartum women. The incidence of DRA, which is about 46.5–100% in the middle and late stages of pregnancy and approximately 30–70% after delivery, is continuously increasing in China. Parturients often have different degrees of DRA during the third trimester. If ineffectively treated or without treatment, they can end up with long-term severe DRA. However, when DRA is timely treated, the symptoms are immediately relieved, and the muscle elasticity increases. Therefore, effective treatment is very important to improve the separation of rectus abdominis after delivery.

Currently, there are many recommended methods for the treatment of patients with postpartum DRA, such as restraint band assistance, exercises for enhancing the pelvic floor muscles and/or abdominal binding, electrical stimulation therapy, acupuncture treatment in traditional Chinese medicine, and surgical treatment. Surgery is an effective method for treating DRA; however, it is not considered a good choice, which is a traumatic treatment method, it may cause complications such as postoperative scars (even if minimally invasive surgery is used), wound infection, patch rejection, postoperative adhesions, and other complications. Moreover, if postpartum women need another abdominal surgery in the long term, it will be affected by the abdominal surgical repair. Furthermore, effective methods for treatment of postpartum
DRA are still controversial, and there is a lack of effective standardized non-surgical treatment programs. Previous studies have reported that Chinese medicine—acupuncture can effectively ameliorate DRA. Nonetheless, this method is difficult to master, it requires a long learning cycle, and its promotion is very slow. Based on the traditional Chinese medicine massage technique, combined with the practical application of muscle and movement system, we have created a new systematic and standardized non-surgical method for the treatment of DRA, which is easier to learn and easy to use. It has been applied in clinical practice over the last five years, generating good effects and social benefits for postpartum women with DRA. Therefore, the formulation of standardized rehabilitation treatment methods can benefit patients and significantly improve the quality of life in these patients.

The purpose of this study was to retrospectively summarize the treatment experience and efficacy of DRA in postpartum women who received standardized rehabilitation treatment in a clinical hospital in Eastern China between January 2017 and May 2021.

**Materials And Methods**

**Study design and subjects**

This retrospective study included all the patients with diastasis rectus abdominis admitted at Xishan People's Hospital of Wuxi City between January 2017 and May 2021. This study was approved by the Ethics Committee of Xishan People's Hospital of Wuxi City. The requirement for informed consent was waived.

Inclusion criteria were: 1) 22–36 years; 2) body mass index (BMI) ≤ 29 kg/m²; 3) diagnosed with DRA between 3–6 months after delivery. Exclusion criteria were: 1) patients with incomplete data or missing follow-up data; 2) patients with any heart or respiratory disease, including excessive coughing and sneezing; 3) patients with any kind of pelvic or abdominal surgery, excluding caesarean section.

**Data collection**

The study group has completed the standardized rehabilitation treatment. Data collection and follow-up were carried out for both study and the control group during the same period. Collected data included age (year), weight (kg), numbers of pregnancies, BMI (kg/m²), natural delivery, cesarean section, diabetes, hypertension, chronic constipation, abdominal pain, pelvic pain, and low back pain, the inner edge of DRA and PFs from both groups. Both the study and the control groups were followed up for more than 3 months.

**Standardized Rehabilitation process**

Before this procedure, the patients were suggested to relax the whole body. The total length of the procedure took about 70 minutes, of which 40 minutes were for manual massage (Part 1) and 30 minutes for the treatment of electrophysiological equipment (Part 2) (Fig. 1). The standardized rehabilitation process was completed once every other day, and the entire standardized rehabilitation was performed 10 times before completion. More details are shown in the Supplementary material (Figure S1-19).
Outcome measures

Each value was measured and calculated by doctors and nurses in the same group. At the level of the umbilicus and 4.5cm above/below the umbilicus, the distance between the inner edges of the rectus abdominis was detected by using a B-ultrasound probe, which is very accurate. Each measurement points of postpartum women used soluble markers to ensure the standardization of repeated measurements.

Physical Functioning Scale (PFs-10)

The Physical Functioning Scale (PFs-10) is a self-reported health measurement tool developed in the United States using data from medical outcome research and applying it to patients with acute and chronic diseases \(^{16}\). PFs-10 includes 10 items and is used to assess the degree of health-related limitations in physical functions. These items are scored on a 3-point Likert scale (1 = very limited, 2 = slightly limited, 3 = not limited at all), which has been proven reliable and valid according to previous studies\(^{17,18}\). Based on this measurement, we compiled the data before and after the treatment of standardized rehabilitation for performing the statistical analysis.

Statistical analysis

The data were analyzed using SPSS 22.0 (IBM, Armonk, NY, USA). The continuous data were expressed as means ± standard deviations and analyzed using Student's t-test. Categorical data were presented as frequencies and scores and were analyzed using Fisher's exact test. Multivariate linear regression (enter method) was used to analyze the factors associated with the standardized rehabilitation process. P-value < 0.05 was considered statistically significant.

Results

Baseline characteristics

According to exclusion and inclusion criteria, among 453 parturients with DRA admitted at Xishan People's Hospital of Wuxi City between January 2017 and May 2021, a total of 294 patients were included in the study (Fig. 2). Among them, 171 patients were treated with standardized rehabilitation (SR), and the other 123 patients were treated without SR process (non-SR). There was no statistically significant difference in age, weight, and BMI between these two groups (P > 0.05, Table 1). There was also no statistically significant difference in natural delivery, cesarean section, diabetes, hypertension, chronic constipation, abdominal pain, pelvic pain as well as low back pain between these two groups (P > 0.05, Table 1).
Table 1
Characteristic and clinical features of patients

<table>
<thead>
<tr>
<th>Items</th>
<th>SR (n = 171)</th>
<th>non-SR (n = 123)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>28.00 ± 3.12</td>
<td>27.35 ± 3.33</td>
<td>0.076</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>60.05 ± 6.08</td>
<td>60.11 ± 6.26</td>
<td>0.936</td>
</tr>
<tr>
<td>Numbers of pregnancies</td>
<td>1.46 ± 0.55</td>
<td>1.44 ± 0.56</td>
<td>0.795</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.4 ± 2.52</td>
<td>23.47 ± 2.43</td>
<td>0.762</td>
</tr>
<tr>
<td>Natural delivery</td>
<td>112</td>
<td>97</td>
<td>0.308</td>
</tr>
<tr>
<td>Cesarean section</td>
<td>59</td>
<td>26</td>
<td>0.062</td>
</tr>
<tr>
<td>Diabetes</td>
<td>5</td>
<td>3</td>
<td>0.906</td>
</tr>
<tr>
<td>Hypertension</td>
<td>3</td>
<td>2</td>
<td>0.708</td>
</tr>
<tr>
<td>Chronic constipation</td>
<td>31</td>
<td>18</td>
<td>0.502</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>3</td>
<td>3</td>
<td>0.987</td>
</tr>
<tr>
<td>Pelvic pain</td>
<td>4</td>
<td>2</td>
<td>1.000</td>
</tr>
<tr>
<td>Low back pain</td>
<td>87</td>
<td>66</td>
<td>0.792</td>
</tr>
</tbody>
</table>

Before the treatment of standardized rehabilitation, there was no statistically significant difference between SR and non-SR in the measurement of the inner edges of the rectus abdominis, including the level of the center umbilicus and 4.5cm above/below the umbilicus (P > 0.05) (Table 2). However, compared with non-SR, the change in the inner edges of the rectus abdominis, including the level of the center umbilicus and 4.5cm above/below the umbilicus, were obviously improved after the treatment with standardized rehabilitation in SR; the observed difference was statistically significant (P < 0.0001) (Table 2, 3)

Table 2
The inner edges of the rectus abdominis before and after standardized rehabilitation

<table>
<thead>
<tr>
<th>Items</th>
<th>Above the umbilicus (4.5cm)</th>
<th>Center of umbilicus</th>
<th>Below the umbilicus (4.5cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before SR (cm)</td>
<td>After SR (cm)</td>
<td>Before SR (cm)</td>
</tr>
<tr>
<td>SR (n = 171)</td>
<td>4.58 ± 0.66</td>
<td>0.80 ± 0.28</td>
<td>4.62 ± 0.81</td>
</tr>
<tr>
<td>non-SR (n = 123)</td>
<td>4.48 ± 1.02</td>
<td>3.84 ± 0.92</td>
<td>4.68 ± 0.49</td>
</tr>
<tr>
<td>P value</td>
<td>0.309</td>
<td>&lt; 0.0001</td>
<td>0.466</td>
</tr>
</tbody>
</table>
### Table 3
Multiple linear regression model (before and after standardized rehabilitation)

<table>
<thead>
<tr>
<th>Items</th>
<th>Above the umbilicus (4.5cm)</th>
<th>Center of umbilicus</th>
<th>Below the umbilicus (4.5cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
<td>P value</td>
</tr>
<tr>
<td>(constant)</td>
<td>18.649</td>
<td>1.4</td>
<td>0.163</td>
</tr>
<tr>
<td>Age (year)</td>
<td>0.025</td>
<td>1.919</td>
<td>0.056</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>0.146</td>
<td>1.331</td>
<td>0.184</td>
</tr>
<tr>
<td>Height (m)</td>
<td>-11.482</td>
<td>-1.386</td>
<td>0.167</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>-0.389</td>
<td>-1.37</td>
<td>0.172</td>
</tr>
<tr>
<td>Numbers of pregnancies</td>
<td>0.029</td>
<td>0.415</td>
<td>0.678</td>
</tr>
<tr>
<td>Natural delivery vs Cesarean section</td>
<td>0.126</td>
<td>1.459</td>
<td>0.146</td>
</tr>
<tr>
<td>SR vs non-SR</td>
<td>2.493</td>
<td>32.55</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

### Health-related quality of life

The Physical Functioning Scale (PFs-10) was used to evaluate the degree of mean values of health-related quality of life in physical functions; the list includes 10 items as listed in the Table 4. There was no statistically significant difference in the mean values of health-related quality of life before SR treatment between these two groups (P > 0.05, Table 4).
Table 4
Mean values of health-related quality of life in both groups before standardized rehabilitation

<table>
<thead>
<tr>
<th>Items</th>
<th>SR (n = 171)</th>
<th>non-SR (n = 123)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Limited a lot (n)</td>
<td>Limited a little (n)</td>
</tr>
<tr>
<td>Vigorous activities</td>
<td>107</td>
<td>62</td>
</tr>
<tr>
<td>Walking 100m</td>
<td>13</td>
<td>56</td>
</tr>
<tr>
<td>Walking several 100m</td>
<td>55</td>
<td>99</td>
</tr>
<tr>
<td>Walking more than 1km</td>
<td>107</td>
<td>63</td>
</tr>
<tr>
<td>Bending/kneeling/stooping</td>
<td>91</td>
<td>80</td>
</tr>
<tr>
<td>Lifting/carrying groceries</td>
<td>95</td>
<td>76</td>
</tr>
<tr>
<td>Bathing/dressing</td>
<td>13</td>
<td>64</td>
</tr>
<tr>
<td>Moderate activities</td>
<td>75</td>
<td>96</td>
</tr>
<tr>
<td>Climbing 1 flight of stairs</td>
<td>17</td>
<td>76</td>
</tr>
<tr>
<td>Climbing several flights of stairs</td>
<td>94</td>
<td>76</td>
</tr>
</tbody>
</table>

Mean ± SD                     | 17.82 ± 4.94 | 17.80 ± 4.95    |

MD                            | 4.61         | 4.64            |

P value                       | 0.973        |

Mean ± SD, means ± standard deviations; MD, mean difference.

After the treatment of standardized rehabilitation, 20 days later, the Physical Functioning Scale (PFs-10) was also used to evaluate the degree of mean values of health-related quality of life in physical functions, which include 10 items as listed in Table 5. Compared with non-SR, mean values of health-related quality of life were obviously increased after the treatment of standardized rehabilitation in SR; there was no statistically significant difference (P < 0.0001, Table 5).
Table 5  
Mean values of health-related quality of life in both groups after standardized rehabilitation

<table>
<thead>
<tr>
<th>Items</th>
<th>SR (n = 171)</th>
<th>non-SR (n = 123)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Limited a lot (n)</td>
<td>Limited a little (n)</td>
</tr>
<tr>
<td>Vigorous activities</td>
<td>50</td>
<td>44</td>
</tr>
<tr>
<td>Walking 100m</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Walking several 100m</td>
<td>27</td>
<td>70</td>
</tr>
<tr>
<td>Walking more than 1km</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>Bending/kneeling/stooping</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Lifting/carrying groceries</td>
<td>36</td>
<td>51</td>
</tr>
<tr>
<td>Bathing/dressing</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Moderate activities</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>Climbing 1 flight of stairs</td>
<td>0</td>
<td>48</td>
</tr>
<tr>
<td>Climbing several flights of stairs</td>
<td>41</td>
<td>67</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>23.78 ± 6.25</td>
<td>18.28 ± 5.21</td>
</tr>
<tr>
<td>MD</td>
<td>5.35</td>
<td>4.86</td>
</tr>
<tr>
<td>P value</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
</tbody>
</table>

All 294 postpartum women included in this study were followed up for 3 months at our hospital. For the parturient in SR, the symptoms of DRA were not recurrent or worsen. There were very few patients in non-SR whose DRA improved, even though not completely.

**Discussion**

The treatment of diastasis rectus abdominis (DRA) can be complex. Medical clinical centers are often the first line for diagnosing and treating DRA in postpartum women in China. We designed standardized rehabilitation that can effectively alleviate the DRA of postpartum women (Table 2–5). Simultaneously, these results may also help medical staff and rehabilitation physiotherapists engaged in postpartum rehabilitation in other clinical hospitals alleviate DRA patients’ symptoms and improve the quality of life.

DRA is one of the common complications during pregnancy and postpartum. It can appear around 14 weeks of pregnancy and gradually worsens until delivery. In the past, little attention was paid to maternal postpartum DRA. However, with more and more researches and studies, a deeper understanding of DRA has been gained. Although the condition itself has become clearer, diagnosis and treatment of DRA are still
controversial \textsuperscript{7,20}. Nevertheless, it has been clearly reported that long-term postpartum DRA may lead to health complications, such as persistent low back pain, abdominal and pelvic pain, and similar. According to statistics, approximately 40\% of women report persistent lower back and pelvic pain in the first half-year after childbirth \textsuperscript{19,21}. DRA is not a health problem for many postpartum women that can be solved by itself and may even progress for many years \textsuperscript{22}. Therefore, whether to intervene or provide treatment is related to the symptoms of DRA and whether they can be directly or indirectly relieved. This is also essential for improving the quality of life of postpartum women.

Previously, surgery has been considered an effective treatment for DRA\textsuperscript{23}. While depending on the understanding of DRA, non-surgical treatment and/or early active intervention methods are another effective way to treat DRA\textsuperscript{7}. Simultaneously, parturients regular abdominal exercises and aerobic exports, pelvic floor muscle exercise, posture and back care, corsets, acupuncture treatment, and other methods have all been recommended as efficient non-surgical interventions for DRA treatment \textsuperscript{2,7,10}. The previous study has proven that abdominal muscle exercise is very effective in reducing DRA in the early postpartum period, which means exercise can significantly improve DRA symptoms and is an effective non-surgical solution \textsuperscript{2}. To date, there is little scientific knowledge about which non-surgical methods are recommended to treat DRA. Although there are many recommended non-surgical methods, there is also a lack of regulation and standardization \textsuperscript{24}. Herein, we set the standardized rehabilitation procedure (\textit{Figure S1-19}) and treated the patients since 2017, achieving effective results as presented above. All the parturients who received standardized rehabilitation treatment experienced significant improvement in their condition, and their quality of life was significantly improved.

In China, traditional acupuncture physiotherapy is efficient and has its own characteristics\textsuperscript{10}; however, it is very difficult to master. Using this method to treat DRA may also be time-consuming and laborious. Exercise pelvic floor muscles, rectus abdominis, and other exercise programs are mainly subjective recovery treatment methods, which require patients to fully complete exercise and perseverance \textsuperscript{8}. Other studies have reported that electrophysiological and magnetic therapy equipment can effectively relieve DRA in postpartum women \textsuperscript{12}. Based on the understanding of the previous research, combined with the characteristics of electrophysiological treatment, we have designed the current standardized rehabilitation treatment program for DRA, which has been promoted through clinical trials over recent years, with good effects. This suggested that standardized rehabilitation treatment is safe and efficient for parturients with DRA. The standardized rehabilitation treatment model we set mainly included the standardized operation of medical staff or rehabilitation physiotherapists and the proficient use of electrophysiological treatment equipment. The whole course of treatment had a short cycle (20 days) and remarkable curative effect while providing patients with a comfortable treatment environment. Compared with other non-surgical treatments for DRA, standardized rehabilitation treatment significantly improved the separation of the rectus abdominis above the umbilical cord, below the umbilical cord, and the central part of the umbilicus of the parturients’ DRA, evading partial recovery.

\textbf{Study limitation}
The non-surgical treatment used for DRA is somewhat different from the standardized rehabilitation treatment we designed. The current research plan adopts a combination of Chinese and Western medicine, which is more convenient to master, apply and promote. Our research provides a simple, and effective standardized method to effectively treat patients with DRA. We hope to promote this standardized rehabilitation treatment, as well as to obtain further improvements and enhancements.

**Conclusion**

This retrospective study revealed that the standardized rehabilitation treatment method we established had high efficiency and simplicity. This approach can improve the quality of life of parturients, thus should be further promoted and applied.

**Declarations**

**Acknowledgements**

None.

**Conflict of interest statement**

The authors declare no competing interests.

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**Authorship**

All authors have read and approved the final manuscript. The authors thank all the members of the Department of Postpartum Rehabilitation Center and Department of General Surgery, Wuxi Xishan People's Hospital, for their persevering work. CC and JH: designed the research and drafted the paper. JG and LY: performed research and reviewed this paper. JF and ZY: designed standardized rehabilitation. LYY, YY, and YZ: organized the cases. ZX, WB, QH, and XY: collected and analyzed the data. All authors read and approved the final manuscript.

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**Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Ethics approval and consent to participate**

The study was approved by the Ethics Committee of Wuxi Xishan People’s Hospital, No. xs2020ky013. The need for individual consent was waived by the committee.

**Consent for publication**

Not applicable.

**References**


**Figures**

**Figure 1**

Standardized rehabilitation for non-surgical treatment of DRA

- **Part 1 (40 min)**
  - Prone position, relax the whole body
  - Pushing Du Channel with finger
  - Push erector spinae with palm
  - Pushing the back Dai Mai acupuncture with finger
  - Warm rubbing of the Baihui acupuncture
  - Circular rubbing of abdomen
  - Pushing Renmai acupuncture with finger

- **Pushing Chengmai acupuncture with finger**
  - Pushing the abdominal wall artery with finger
  - Pushing the front Dai Mai acupuncture with finger
  - Bilateral combing and pulling
  - Inhale and exhale squeeze
  - Hip bridge training

- **Acupuncture relaxation**
  - Shake to loosen
  - Crossing and vertical push
  - Converge abdominal muscle
  - Patting and relaxation
  - Warm shenzhen Shenque acupuncture
  - Rest and adjustment

- **Part 2 (30 min)**

**Standardized Rehabilitation.** A representative process, which is promoted by a fixed step-by-step manual massage combined with the treatment of electrophysiological equipment.
Figure 2

Flow-chart of the standardized rehabilitation study. The participants included in this study were selected based on the inclusion and exclusion criteria.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Suppel.Ma.docx
- Supply.S119.pdf