

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

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## Research Article

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# Abstract

## Background

The aim of the study is to retrospective 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 from January 2017 to May 2021 at the Xishan People's Hospital of Wuxi. Patients were separated 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). Data of measurement 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 were 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). Comparing with non-SR, the separation of the rectus abdominis was statistically significantly reduced in SR after standardized rehabilitation treatment (p value<0.0001). The results of multiple linear regression model analysis suggested that standardized rehabilitation is an independent factor influencing the prognosis of DRA in Parturients (P<0.0001). The quality of life of the study group was statistically significantly improved (p value<0.0001).

## Conclusions

Standardized rehabilitation method has the advantages of 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 [1, 2]. The incidence of DRA is about 46.5% to 100% in the middle and late stages of pregnancy and approximately 30–70% after delivery [3–5], and the incidence is increasing year by year in China [6]. Parturients often have different degrees of DRA during the third trimester [6]. If treated ineffectively or without treatment, it will lead to long-term severe DRA. However, when DRA treated in time, the symptoms will be relieved immediately, the muscle elasticity will be increased as well [7]. 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[3], exercises to enhance the pelvic floor muscles[7] and/or abdominal binding[8], electrical stimulation therapy[9], acupuncture treatment in traditional Chinese medicine[10], and surgical treatment[11]. Surgery is an effective method for the treatment of DRA, but it's not a good choice. 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[10], but this method is difficult to master which needs 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. Through clinical practice and application in last five years, good effects and social benefits have been obtained for postpartum women with DRA[6, 12]. Therefore, the formulation of standardized rehabilitation treatment methods can benefit patients and significantly improve the quality of life of these patients.

The purpose of this study is retrospective to summarize the treatment experience and efficacy of DRA patients in postpartum women who received standardized rehabilitation treatment in a clinical hospital from January 2017 to May 2021 in Eastern China, for the promotion and application.

## Materials And Methods

### Study design and subjects

This retrospective study included all the patients with diastasis rectus abdominis admitted between January 2017 to May 2021 at Xishan People's Hospital of Wuxi City. 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:** 1) 22-36 years; 2) Body mass index (BMI) is less than or equal to  $29\text{kg/m}^2$ ; 3) diagnosed with DRA between 3-6 months after delivery[2, 13].

**Exclusion criteria:** Patients with incomplete data or missing follow-up data were excluded during this retrospective study. People with any heart or respiratory disease, including excessive coughing and sneezing, were excluded as well as any pelvic or abdominal surgery patients but not caesarean section.

### Data collection

The study group has completed the standardized rehabilitation treatment. Data collection and follow-up were carried out as well in the control group during the same period, including Age (year), Weight (kg), Numbers of pregnancies, BMI ( $\text{kg/m}^2$ ), 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, relax the whole body. Total time is about 70 minutes, of which, 40 minutes for manual massage (**Part 1**), and 30 minutes for the treatment of electrophysiological equipment (**Part 2**) (Figure 1). The

standardized rehabilitation process is completed once every other day, and the entire standardized rehabilitation needs ten times to be completed. More details are elaborated in the supplement material (**Suppl. Fig. 1-19**).

## 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 accurate to millimeters. Each measurement point of postpartum women was 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, which was developed in the United States using data from medical outcome research and makes it applicable to patients with acute and chronic diseases[14]. 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=a little limited, 3=no limit at all), which has been proved reliable and valid according to previous studies[15, 16]. Based on this measurement, we do comply with the data before and after the treatment of standardized rehabilitation so that 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  $\pm$  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 standardized rehabilitation process. P value < 0.05 were considered statistically significant.

## Results

### Baseline characteristics

According to Exclusion and Inclusion criteria, a total of 294 patients were included in the study among 453 parturients with DRA at Xishan People's Hospital of Wuxi City from January 2017 to May 2021 (**Figure 2**). Among the 294 patients, 171 patients were treated with standardized rehabilitation (SR), and the other 123 patients were treated without SR process (non-SR). There's no statistically significant difference in age, weight, and BMI ( $P>0.05$ , Table 1). Compared these two groups, there's no statistically significant difference in Natural delivery, Cesarean section, Diabetes, Hypertension, Chronic constipation, Abdominal pain, Pelvic pain as well as Low back pain. ( $P>0.05$ , Table 1)

Table 1  
Characteristic and clinical features of patients

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

Before the treatment of standardized rehabilitation, there's 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 of 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 of standardized rehabilitation in SR, the difference was statistically significant ( $P<0.0001$ ) (Table 2, 3)

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

Items	Above the umbilicus (4.5cm)		Center of umbilicus		Below the umbilicus (4.5cm)	
	Before SR (cm)	After SR (cm)	Before SR (cm)	After SR (cm)	Before SR (cm)	After SR (cm)
SR (n=171)	4.58±0.66	0.80±0.28	4.62±0.81	1.07±0.54	4.41±0.70	0.96±0.37
non-SR (n=123)	4.48±1.02	3.84±0.92	4.68±0.49	3.94±0.96	4.36±0.92	3.59±0.90
P value	0.309	< 0.0001	0.466	< 0.0001	0.597	< 0.0001

Table 3  
Multiple linear regression model(before and after standardized rehabilitation)

Items	Above the umbilicus (4.5cm)			Center of umbilicus			Below the umbilicus (4.5cm)		
	$\beta$	t	P value	$\beta$	t	P value	$\beta$	t	P value
(constant)	18.649	1.4	0.163	1.874	0.12	0.904	9.955	0.68	0.497
Age (year)	0.025	1.919	0.056	0.03	2.026	0.044	0.02	1.419	0.157
Weight (Kg)	0.146	1.331	0.184	0.02	0.155	0.877	0.081	0.67	0.503
Height (m)	-11.482	-1.386	0.167	-1.329	-0.137	0.891	-6	-0.659	0.51
BMI (kg/m <sup>2</sup> )	-0.389	-1.37	0.172	-0.044	-0.133	0.894	-0.216	-0.69	0.491
Numbers of pregnancies	0.029	0.415	0.678	-0.004	-0.055	0.956	0.052	0.691	0.49
Natural delivery vs Cesarean section	0.126	1.459	0.146	0.082	0.812	0.417	0.105	1.108	0.269
SR vs non-SR	2.493	32.55	<0.0001	2.678	29.917	<0.0001	1.934	22.978	<0.0001

## 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, which include 10 items as listed in the Table 4. Compared these two groups, there's no statistically significant difference in the mean values of health-related quality of life before the treatment of SR. (P>0.05, Table 4)

Table 4  
Mean values of health-related quality of life in both groups before standardized rehabilitation

Items	SR (n=171)			non-SR (n=123)		
	Limited a lot (n)	Limited a little (n)	Not limited at all (n)	Limited a lot (n)	Limited a little (n)	Not limited at all (n)
Vigorous activities	107	62	2	78	44	1
Walking 100m	13	56	102	10	41	72
Walking several 100m	55	99	17	40	71	12
Walking more than 1km	107	63	1	77	46	0
Bending/kneeling/stooping	91	80	0	66	57	0
Lifting/carrying groceries	95	76	0	67	56	0
Bathing/dressing	13	64	94	10	46	67
Moderate activities	75	96	0	53	70	0
Climbing 1 flight of stairs	17	76	78	12	55	56
Climbing several flights of stairs	94	76	1	66	56	1
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 the 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's statistically significant difference. (P<0.0001, Table 5)

**Table 5. Mean values of health-related quality of life in both groups after standardized rehabilitation**

Items	SR (n=171)			non-SR (n=123)		
	Limited a lot (n)	Limited a little (n)	Not limited at all (n)	Limited a lot (n)	Limited a little (n)	Not limited at all (n)
<b>Vigorous activities</b>	50	44	77	73	48	2
<b>Walking 100m</b>	0	30	141	9	40	74
<b>Walking several 100m</b>	27	70	74	37	65	21
<b>Walking more than 1km</b>	55	53	63	71	46	6
<b>Bending/kneeling/stooping</b>	56	40	75	64	53	6
<b>Lifting/carrying groceries</b>	36	51	84	72	51	0
<b>Bathing/dressing</b>	0	23	148	10	45	68
<b>Moderate activities</b>	33	42	96	55	68	0
<b>Climbing 1 flight of stairs</b>	0	48	123	11	53	59
<b>Climbing several flights of stairs</b>	41	67	63	63	59	1
<b>Mean ± SD</b>	23.78±6.25			18.28±5.21		
<b>MD</b>	5.35			4.86		
<b>P value</b>	< 0.0001					

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

Among 294 postpartum women in this study, regardless of whether standardized rehabilitation treatment was performed and perfected, all of them were followed up for 3 months via coming to our hospital. For the parturient in SR, the symptoms of DRA did not recurrent or worsen. Very few individual patients in non-SR whose DRA had been improved even though not completely.

## Discussion

The treatment of diastasis rectus abdominis (DRA) can be complex. Medical clinical centers are often the first line hospitals for the diagnosis and treatment of DRA in postpartum women in China. The standardized rehabilitation designed by us can effectively alleviate DRA of the postpartum women (Table 2,3,4,5). Simultaneously, the results may also help medical staff and rehabilitation physiotherapists who are engaged in postpartum rehabilitation in other clinical hospitals, assist in alleviating the symptoms of DRA patients, and improving 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[17]. In the past, little attention was paid to maternal postpartum DRA. However, with more and more research and studies, people have a deeper understanding of DRA, which has become clearer, although diagnosis and treatment of DRA are still controversial[7, 18]. However, it has been clearly reported that long-term postpartum DRA will lead to health complications, such as persistent low back pain, abdominal and pelvic pain, and so on. According to statistics, approximately 40% of women report persistent lower back and pelvic pain in the first half-year after childbirth[17, 19]. For many postpartum women, DRA is not a health problem that can be solved by itself, and may even progress for many years[20]. Therefore, whether to intervene or treat is the key related to whether the symptoms of DRA can be relieved directly or indirectly, and this is essential for improving the quality of life of postpartum women.

Previously, surgery is an effective treatment for DRA[21]. While depending on the understanding of DRA, non-surgical treatment and/or early active intervention methods are another effective way to treat DRA[7]. Simultaneously, parturients regular abdominal exercises and aerobic exports, pelvic floor muscle exercise, posture and back care, corsets, acupuncture treatment and other methods are all recommended as efficient non-surgical interventions for the treatment of DRA[2, 7, 10]. Previous study have proven that abdominal muscle exercise has been proven to be very effective in reducing DRA in the early postpartum period, which means exercise can significantly improve the symptoms of DRA and is an effective non-surgical solution[2]. To date, there is little scientific knowledge about which non-surgical methods are recommended to treat DRA, and there is a lack of regulation and standardization as well, although there are many recommended non-surgical methods[22]. Here, we have set this standardized rehabilitation procedure (**Suppl. Figure 1-19**) and treated the patients since 2017 obtained effective results as presented above. All the parturients who received standardized rehabilitation treatment have been significantly improved, and the quality of life has been significantly improved.

In China, Chinese traditional acupuncture physiotherapy is efficient and has its own characteristics[10], but it is very difficult to master. Using this method to treat DRA patients is 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[8]. Other studies have reported that electrophysiological and magnetic therapy equipment can effectively relieve DRA in postpartum women[23]. 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. Through clinical trials and promotion in recent years, good effects have been achieved, which suggested that standardized rehabilitation treatment is safe and efficacy to parturients with DRA. The standardized rehabilitation treatment model we set is mainly the standardized operation of medical staff or rehabilitation physiotherapists and the proficient use of electrophysiological treatment equipment. The whole course of treatment has a short cycle (20 days) and remarkable curative effect while giving patients a comfortable treatment environment. Compared with other non-surgical treatments for DRA, we found after standardized rehabilitation treatment that 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 were significantly improved, not partial recovery.

## Limitation

As what we know, 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, but not complicated, which is more convenient to master, apply and promote. The significance of our research is to treat patients with DRA through a reasonable, simple, and effective standardized method, so that patients can benefit. At the same time, this technology can also be shared with other medical staff or rehabilitation physiotherapists to help more patients. Indeed, we hope to promote this standardized rehabilitation treatment and obtain further improvements and enhancements as well.

## **Conclusion**

This retrospective study suggests that the standardized rehabilitation treatment method we have established has the advantages of high efficiency and simplicity, can improve the quality of life of parturients, and has the value of promotion and application.

## **Abbreviations**

DRA  
Diastasis Rectus Abdominis  
PFs  
Physical Functioning Scale  
BMI  
Body mass index.

## **Declarations**

### **Acknowledgements**

None.

### **Authors' contributions**

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### **Availability of data and materials**

The datasets used and/or analyzed during the current study 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.

### **Competing interests**

The authors declare no competing interests.

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## Figures

Standardized rehabilitation for non-surgical treatment of DRA

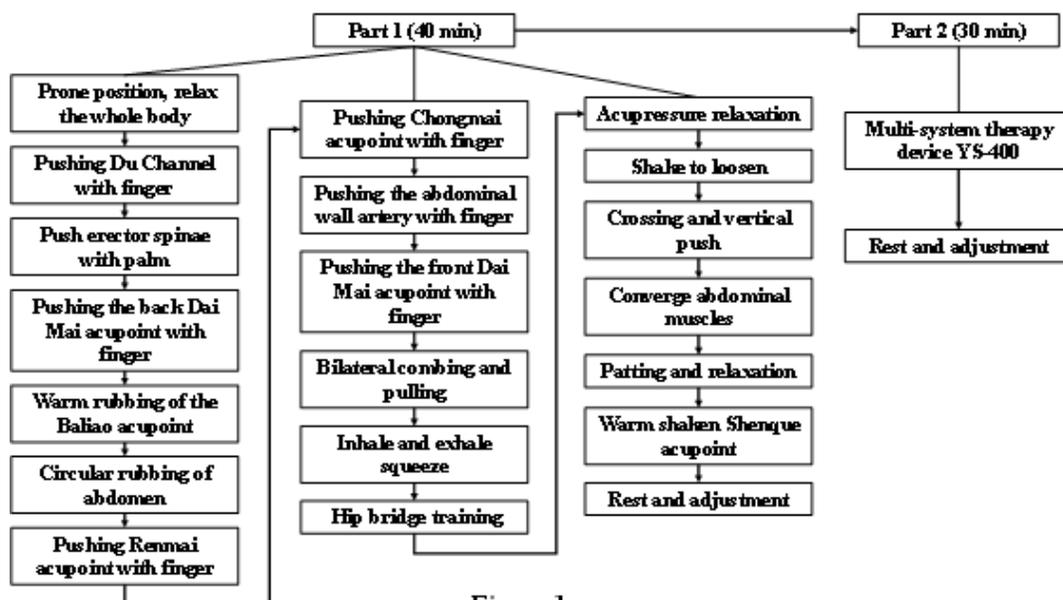


Figure 1

Figure 1

Standardized Rehabilitation. A process is representative presented which is promoted by a fixed step by step manual massage combined with the treatment of electrophysiological equipment.

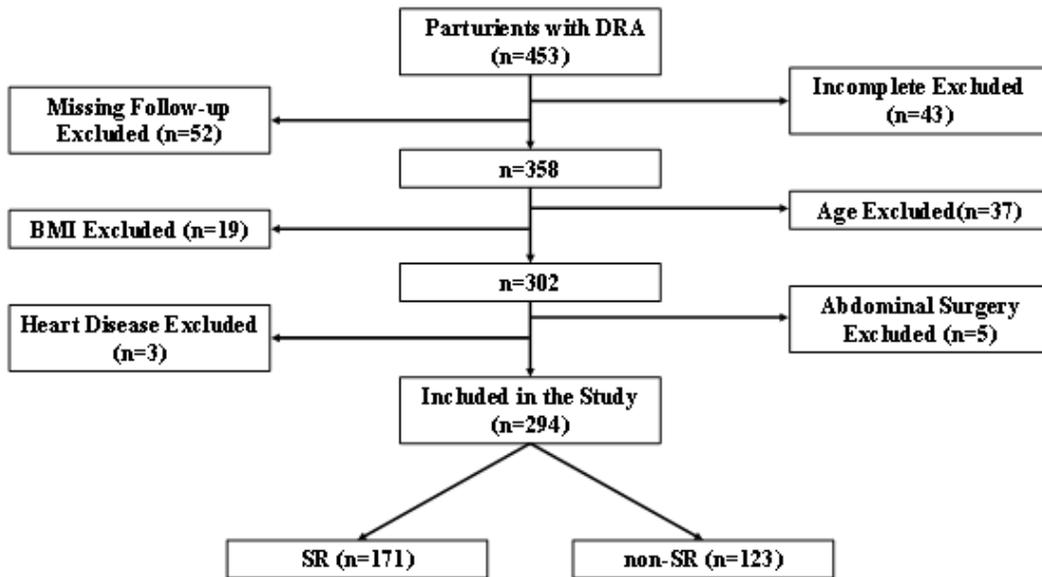


Figure 2

## Figure 2

Flow-chart of the standardized rehabilitation study. The participants analyzed for this study were depended on the inclusion and exclusion criteria.

## Supplementary Files

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