

# Seated-Baduanjin as an adjuvant rehabilitation treatment for dysfunctional ventilatory weaning response

## A case report

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### Abstract

**Rationale:** Seated-Baduanjin as adjuvant rehabilitation treatment in a patient with Dysfunctional ventilatory weaning response (DVWR) is extremely rare, and we report a case of a patient's rehabilitation exercise who suffered from DVWR.

**Patient concerns:** A 62-year-old patient was admitted for dyspnea for more than a month after surgery.

**Diagnoses:** On arrival, the patient was conscious but anxious, and he had difficulty breathing. When attempting to disconnect the ventilator, the patient's autonomous respiration > 25 times /min, and the heart rate > 120 times /min. He had to rely on the ventilator to survive. According to the characteristics of the patient, we considered the patient with DVWR.

**Interventions:** We provided the same essential treatment as the last hospital and performed the Seated-Baduanjin for the patient which was a new form of bed exercise, 2 times a day, 30 minutes each time.

**Outcomes:** The patient showed a gradual improvement in breathing and muscle strength.

**Lessons:** In this case report, the Seated-Baduanjin showed a remarkable therapeutic effect on a patient and might be an adjuvant treatment for DVWR.

**Abbreviations:** DVWR = dysfunctional ventilatory weaning response.

**Keywords:** dysfunctional ventilatory weaning response, rehabilitation exercise, respiratory failure with ventilation, seated-Baduanjin

## 1. Introduction

Interrupted and prolonged weaning characterizes dysfunctional ventilatory weaning response (DVWR).<sup>[1]</sup> With the constant progress of mechanical ventilation theory and technology, the application of mechanical ventilation in intensive care unit (ICU) is increasingly common; Ventilator has become a powerful tool for the treatment of various diseases, such as acute or chronic respiratory failure. Previous research has shown that 30% of mechanical ventilation patients in the clinic have difficulty in

ventilator withdrawal delay.<sup>[2]</sup> As well known, DVWR can increase the incidence of lung infection and mortality rate in patients.<sup>[3]</sup> Lengthy ventilation leads to extended stays in critical care and hospital and results in multiple physiological and psychological implications. With a rapid increase in the number of prolonged mechanical ventilation patients, the financial burden has also become a concern for the healthcare system. These expenses cause psychological, physical, social, and economic stresses in such patients as well as their caregivers.<sup>[4,5]</sup>

In recent years, previous studies have demonstrated that it is important to give early mobilization for patients with ventilators, to wean the ventilator as soon as possible.<sup>[6,7]</sup> As a kind of exercise, Baduanjin could improve the anxious and depressive for patients with coronary heart disease, and it also reduces angina frequency and angina duration.<sup>[8,9]</sup> In additional, Baduanjin could increase 6-minute walking test, decrease grading of heart function and BNP level for patients with heart failure.<sup>[10]</sup> In our department, we have introduced the Seated-Baduanjin into the rehabilitation training in patient after the myocardial infarction and achieved a better effect. Therefore, we tried to apply the Seated-Baduanjin (Fig. 1) to the critically ill patients such as DVWR patient, and produced the desired results, as described in detail below.

## 2. Case report

On August 26, 2016, a 62-year-old patient with aortic dissection (type I, DeBakey) underwent ascending aortic replacement + total arch replacement + stent trunk surgery + cabrol shunt + temporary pacemaker substitution on general anesthesia in the other hospital. After the operation, the patient maintained

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**Figure 1.** (A–I) The introduction of the Seated-Baduanjin. A: Prop up the sky with both hands to regulate the internal organs. B: Slap wrist and elbow by using another hand to relieve tension. C: Clasp hands and hit the chest area about per second a time. D: Sway head to expel sickness. E and F: Place hands on your head, then raise head and stretch your elbows. G: Rub the waist with the hands to strengthen the kidneys. H: Punch with clenched fists and make a circle left and right. I: Stretch arms back like an eagle to cure all diseases.

mechanical ventilation. Three days after the operation, the patient suffered from lower limb paraplegia, and we considered that it was due to secondary ischemic spinal cord injury caused by surgery. Ultrasound showed no deep vein thrombosis (DVT) in the lower extremities. The patient also suffered from pulmonary infection and sputum culture results for *Burkholderia* capacity, so the doctor gave the patient voriconazole for oral suspension and ceftazidime for injection anti-infection, tracheotomy to strengthen the airway care. After infection control, they used ceftazidime for injection. Paraplegia gave the monosialotetrahexosylganglioside sodium injection to nerve nutrition, enoxaparin anticoagulation with warfarin, but the lower extremities of the patient still could not move, the muscle strength is 0, with respiratory fatigue. So the patient sought medical advice from our hospital on October 9, 2016. On arriving, the patient was diagnosed with the pulmonary infection, respiratory failure, aortic dissection, paraplegia, deep vein thrombosis of the lower extremity. PE: HR: 110 bpm, R 28, T 37.8°C, WBC:  $9.55 \times 10^9/L$ , N: 87.7%, Hb 108 g/L, Na +132 mmol/L, Cl 95.1 mmol/L, pH 7.472, PaO<sub>2</sub> 104 mmHg, Pro-BNP 818.3 pg/mL, TNT 0.308 μg/L. He was conscious but anxious. When attempting to disconnect the ventilator, the patient's autonomous respiration >25 times/

min, and the heart rate >120 times/min. He had to rely on the ventilator to survive. Also, the patient was unable to cough, with thick and yellow sputum. The physical examination revealed that auscultation of lungs could hear moist rale. The strength of the upper extremity was normal, the lower extremity muscle was paralyzed, and the feeling was good, but muscle strength of grade was 0. Ultrasound results showed DVT of the lower extremity which it may be caused by paralysis of the lower limb for more than a month. We provided the same basic treatment as the last hospital. It included simple joint movements, such as clenching and stretching joint. With the approval from the Ethics Committee of our hospital, we performed the rehabilitation training for patients. The patient received the Baduanjin exercise in bed, which was another form of exercise—Seated-Baduanjin (Fig. 2), 2 times a day, 30 minutes each time.

After administration of the Seated-Baduanjin for 3 days, we found that the patient's dyspnea alleviated, his heart rate was 98 bpm, R 20 times/min, and body temperature was 36.8°C. He still needed the ventilator and could not cough. Auscultation of lungs could hear wet rales again. However, he could be separated from the ventilator to high flow oxygen for 2.5 hours for the first time. Six days later, he had a cough reflex but was weak, and the

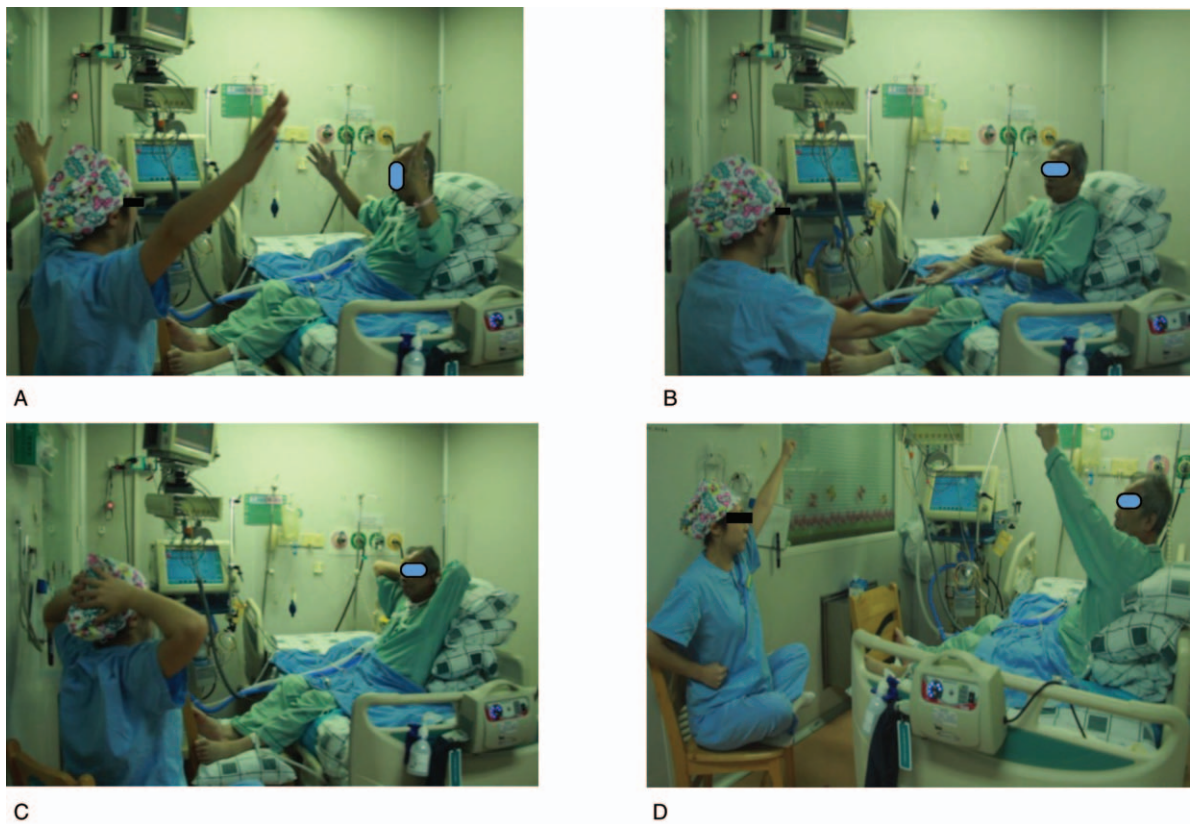


Figure 2. (A–D) The nurse instructs the patient to do the Seated-Baduanjin.

sputum was better than before, he could be separated from the ventilator to high flow oxygen for 5.5 hours. Also, we found the patient with lower limb muscles had contractile action. On October 21st, the patient was successfully removed from the ventilator. We still gave the patient a Seated-Baduanjin every day. Finally, the patient was successfully discharged on October 28th. As shown in Table 1, his lower extremity muscle strength increased to level 2 on the left and level 1 on the right according to the Lovett Grading Method in manual muscle testing (MMT).<sup>[11]</sup> Besides, the changes in various indicators during the patient’s hospitalization were also shown in Table 2.

### 3. Discussion

Compelling evidence indicates that Baduanjin is widely used for adjuvant rehabilitation treatment of numerous ailments and in the management of body functions, due to the active movements of the Baduanjin.<sup>[4,8–10,12]</sup> To the best of our knowledge, this is

the first case to report the significant rehabilitation effect with the use of Baduanjin on DVWR patients.

Interrupted and prolonged weaning characterizes DVWR.<sup>[1]</sup> Previous studies reported that ventilator dependence rate was 13% in the respiratory ICU, once the patient developed DVWR, it would suppress a cough and increase the lung infection rate. Besides, DVWR was associated with increased depression and mortality.<sup>[2,3]</sup> In recent years, more researchers realize that it is essential for patients with ventilators to give early mobilization patients with mechanical ventilation including bed movement, standing or even walking.<sup>[13]</sup> However, the Baduanjin exercise is not reported in DVWR patient.

As an essential component of traditional Chinese exercises, Baduanjin exercise has origins in the ancient martial arts that have been practiced for thousands of years.<sup>[4]</sup> Compared with Tai Chi, Baduanjin has only 8 postures. It is characterized by simple, slow, relaxing movements that can be quickly learned. Many previous studies have shown that Baduanjin can relieve depression, anxiety, improve heart failure, and enhance of cardiorespiratory endurance.<sup>[14–17]</sup> When practicing Baduanjin, the body maintains a steady gravity center. With the lumbar spine as the axis, the movement of the four limbs is driven. The muscle tension and relaxation are alternating at different parts of the body.<sup>[14]</sup> Patients who can do the Seated-Baduanjin should meet the following conditions:  $FiO_2 < 60\%$ ,  $PEEP \leq 10\text{cmH}_2\text{O}$ ,  $R < 35$  breaths per minute; the upper muscle strength level is higher than 3; no cardiogenic shock and severe heart failure (cardiac function IV); no malignant arrhythmia (ventricular fibrillation, ventricular tachycardia, frequent ventricular premature beats); no spine fractures, no dislocations, and structural integrity. In this case, the muscle strength of the patient’s upper limb was level 5,

**Table 1**  
Patient’s muscle strength changes.

The muscle strength	Dates					
	10.9	10.12	10.15	10.18	10.21	10.28
The left upper limb	5	5	5	5	5	5
The right upper limb	5	5	5	5	5	5
The left ankle	0	0	1	1	1	2
The right ankle	0	0	1	1	1	1
The left quadriceps muscle	0	0	1	1	1	2
The right quadriceps muscle	0	0	1	1	1	1

**Table 2**  
**Patient's hospitalization changes.**

Index	Dates					
	10.9	10.12	10.15	10.18	10.21	10.28
HR	110	98	90	85	75	70
RR	28	20	21	20	19	20
MAP	67	70	81	84	87	88
SPO <sub>2</sub>	98	99	100	100	100	100
Cough response	No	No	Weak	Better	Strong	Strong
Sputum	Yellow phlegm, large amount	Yellow phlegm, large amount	Yellow phlegm, medium amount	Yellow phlegm, medium amount	Yellow phlegm, small amount	Yellow dilute phlegm small amount
Oxygenation index, mmHg	171	200	250	330	379	400
PEEP	8	5	5	5		
Stop using the ventilator time, h	0	2.5	5.5	20	24	24

HR=Heart Rate, RR=Respiratory Rate, MAP=Mean Arterial Pressure, PEEP=Positive End-Expiratory Pressure.

and his cardiopulmonary function was relatively stable, which met the above conditions. Moreover, the patient was unable to perform out-of-bed activities (standing, or walking) because of paralyzed from the lower extremity. He could only perform a simple joint movement in bed. Our Seated-Baduanjin just suited the patient's current rehabilitation situation. Therefore, we tried to apply the Seated-Baduanjin to the patient in bed and achieved a better effect. The Seated-Baduanjin has been previously applied to the study of rehabilitation therapy after reperfusion in patients with acute myocardial infarction. The project has been received the foundation from the Department of Science and Technology of Guangdong Province (2014A020221092), and its safety and efficacy have been clinically affirmed. Through this action, the patient can exercise pulmonary chest function, and relieve breathing, strengthen the purpose of breathing muscles. Therefore, it is suitable for ICU patients.

In this case report, the Seated-Baduanjin showed a remarkable therapeutic effect on a patient with the DVWR. This beneficial effect of the DVWR may be ascribed to the practical actions of the Seated-Baduanjin. DVWR may be triggered by respiratory muscle disability, cardiac dysfunction, phrenic muscle weakness when the ventilator is out of use, and symptoms relieved by Seated-Baduanjin. As demonstrated above, Seated-Baduanjin can increase the patient's cardiopulmonary function, reduce anxiousness, and enhance self-confidence which was the compelling explanation for DVWR treated by rehabilitation exercise (Table 2). Hence, we speculate that Seated-Baduanjin exercise may be an adjuvant treatment for DVWR.

The present study has some limitations. First, this is a single sample report, and lack of enough evidence. Besides, the mechanism for the effects of Seated-Baduanjin in the patient with DVWR was unclear. In the further, additional more extensive studies are required to confirm our results.

In conclusion, present case report firstly shows that the Seated-Baduanjin is an adjuvant treatment for DVWR, evident from the remission of the patient's cardiopulmonary function and reduction of the anxiousness and the use of breathing machine time. This exercise may also contribute to increased muscle strength in patients with spinal cord injuries, which is conducive to neurologic rehabilitation. Therefore, the Seated-Baduanjin exercise therapy may be safe and effective for patients with DVWR.

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The patient was informed about and consented to, the publication of the case details.

## Author contributions

**Conceptualization:** Liheng Guo.

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