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Tai Chi Quan and Stroke Prevention and Rehabilitation

Review Article

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Abstract Stroke is a major cause of mortality and disability across the globe and remains the third leading cause of death in China, with the total stroke incidence increasing 6.7% annually from 1984 to 2004. The prevention of strokes is more important than their treatment. Tai Chi Quan is a slow and graceful Chinese exercise that includes a form of mindful meditation known for its health benefits. Many studies have shown that Tai Chi Quan not only improves gait, balance capacity and muscle strength in older adults, but also modifies blood pressure, cholesterol and glucose levels, suggesting its potential benefits for stroke prevention and rehabilitation. This article will summarize the effects of Tai Chi Quan on stroke prevention.

Keywords Tai Chi Quan, Stroke Prevention, Primary Prevention, Secondary Prevention, Rehabilitation

1. Introduction

Stroke is a major cause of mortality and disability worldwide [1]. According to reported global estimates, 15 million people have been a victim of stroke. Of these, five million died and another five million were left with permanent disability [2]. In the United States, approximately 759,000 people have a new or recurrent stroke each year. In China, stroke remains the third leading cause of death, with the total stroke incidence [3] increasing 6.7% annually from 1984 to 2004.

Stroke is a disease characterized by a high incidence and severe after-effects. Therefore, it is important to take efforts to prevent strokes rather than just treat strokes. The risk factors for stroke include old age, hypertension, a previous stroke or transient ischemic attack (TIA), high blood cholesterol, high blood pressure and smoking [4]. Primary prevention plays the most significant role in the reduction of the burden of stroke [5]. Secondary prevention addresses all the measures for avoiding recurrences following a first TIA or stroke, and recurrences are becoming more frequent in increasingly aging populations [6].

Tai Chi Quan is a form of traditional Chinese exercise that has been practiced in China for many hundreds of years and is now widely practiced throughout the world. Tai Chi Quan exercise emphasizes continuous slow (flowing) movements, with small-to-large expressions of motion, unilateral-to-bilateral shifts of body weight, and the rotation of the trunk, head and extremities, combined with deep diaphragmatic breathing and relaxation. It has been estimated that over 100 million people regularly practice Tai Chi Quan in China alone [7]. Over the

centuries, it has become far more focused on the homoeostasis of the body's internal environment. Therefore, Tai Chi Quan is recommended for elderly people [8].

Some review articles [9,10] have shown that Tai Chi Quan can help to improve blood pressure [11], blood glucose, and blood cholesterol levels, as well as improve balance and prevent falls in the elderly [12,13] by improving the condition of the musculoskeletal system [14,15]. This applies to both healthy people and patients with chronic cardiovascular diseases, rheumatoid arthritis and osteoarthritis. Tai Chi Quan may then be applied as physical and mental treatment for the rehabilitation of patients [16].

Together with economic advancements in society as a whole, people's living standards have improved and, with increases in the average lifespan of the population, the age of onset of strokes is also gradually increasing. Some risk factors for stroke, such as gender, age and ethnicity, cannot be controlled. However, measures can be undertaken to prevent the development of some risk factors. Tai Chi Quan is one such safe and effective preventive measure that is also suitable for elderly people. In the present paper, the potential application of Tai Chi Quan to stroke prevention is discussed.

2. Primary Prevention

2.1 Tai Chi Quan and high blood pressure

A total of 26 studies (11 in English, 15 in Chinese) have shown that Tai Chi Quan may have beneficial effects on blood pressure. These studies include nine RCTs, 13 NRSs, and four OBSs [17]. Each of the eight studies specifically designed to evaluate patients with hypertension reported improvements in blood pressure with Tai Chi Quan, although no difference when compared with conventional exercise was sometimes observed. The other 18 studies offer supportive evidence that Tai Chi Quan can reduce blood pressure and may play a role in primary prevention. More than one-half of the studies were published in Chinese and offer data that has historically been excluded from other reviews. One study entitled "The Effect of Tai Chi Exercise on Blood Pressure: A Systematic Review" states that the duration of Tai Chi Quan training for the studies ranged from 12 weeks to three years. The magnitude of the changes in systolic blood pressure and diastolic blood pressure in the Tai Chi Quan group ranged from -7 to -32 mmHg and -2.4 to -18 mmHg, respectively. High blood pressure is the most common primary office diagnosis in the United States, and it is the main reason for more than 35 million visits to physicians per year. Clinical trials have consistently shown that lowering blood pressure is accompanied by substantial reductions in stroke. While pharmacologic therapy is often emphasized, the critical importance of non-pharmacological approaches and lifestyle modifications, including increased physical activity and exercise, have continued to be recognized by the most recent report for both the primary and secondary prevention of high blood pressure [18]. Clinical trials have reported excellent compliance with Tai Chi Quan interventions and suggest that Tai Chi Quan may promote exercise self-efficacy, while several studies mention better adherence to Tai Chi Quan as compared with standard exercise [19,20].

2.2 Tai Chi Quan and high blood glucose

Weight reduction and exercise are recognized as treatment strategies to control blood glucose levels and reduce macrovascular risk factors, thereby preventing complications such as cardiovascular disease [21-24]. People with diabetes who exercise regularly have better glycaemia control [25-28] and cardiovascular outcomes than those who do not exercise [28-30]. Tai Chi Quan offers a number of advantages as a form of exercise and has been demonstrated to decrease blood glucose [31]. A previous study (Effect of 12-week Tai Chi Chuan Exercise on Peripheral Nerve Modulation in Patients with Type 2 Diabetes Mellitus) reported that patients with high blood glucose had a mean fasting blood sugar level of 160.6 (SD 53.8) mg/dL and a mean insulin resistance index of 8.2 (SD 7.9) before the exercise programme. After 12 weeks of Tai Chi Quan, these levels had decreased by 11% and 23% to 142.6 (SD 44.0) and 6.3 (SD 6.2), respectively. In contrast, the reduction in these levels in the control group was substantially less (–0.6% and 11% for the two outcome variables, respectively) [32]. These results indicated that a 12-week programme of Tai Chi Quan exercise may improve high blood glucose levels.

2.3 Tai Chi Quan and high blood cholesterol

Hypercholesterolemia is another risk factor for stroke. The majority of studies have shown no association between hypercholesterolemia and total stroke. A ten week Tai Chi programme was found to improve the blood pressure, lipid profile and SF-36 scores in Hong Kong Chinese women. The mean age of the 20 subjects was 40.8±5.9 years (median, 42.5 years, range, 30–50 years). After completing the ten week Tai Chi Quan exercise programme, their systolic blood pressure, total cholesterol and low-density lipoprotein cholesterol levels were significantly reduced [33]. Although studies show that Tai Chi Quan can improve high blood cholesterol, less work has been done on Tai Chi Quan and blood cholesterol. Therefore, further studies on the effects of Tai Chi Quan on blood cholesterol are needed.

3. Secondary prevention

3.1 Preventing the causes of stroke

The risk factors for intervention to prevent aetiology include primary prevention such as high blood pressure, high blood cholesterol and high blood glucose, etc.

3.2 Treatment of cognitive disorders after stroke

Stroke and cognitive disorders are closely correlated; strokes increase the incidence of cognitive disorders and dementia [34]. Strokes are also leading causes of lasting disability, the need for long-term care (LTC) and reliance upon nursing homes [35,36]. Tai Chi Quan is easy to implement in community settings and is very well suited for older adults who may have physical limitations [37]. A Chinese and American study found that patients who did Tai Chi Quan three times a week had significantly higher scores on an eight month memory test than subjects who did not engage in Tai Chi Quan. Tai Chi Quan not only has a beneficial effect on the physical body, but also on the spiritual aspects of the patient's well-being, delaying the onset of Alzheimer's disease [38]. Some studies have shown that Tai Chi Quan helps to improve brain function by regenerating nerves in the brain, which can prevent dementia from occurring. Tai Chi Quan is an aerobic exercise while at the same time promoting eye-hand and eye-foot coordination, as the eyes follow the hands and feet during the slow, smooth movements. This focused attention in turn promotes the unification of the mind and body, improves concentration and stimulates brain activity, which improves memory. Aerobic exercise continued for more than half a year has been found to improve the function of the frontal lobe of the brain [39].

3.3 The treatment of depression after a stroke

Depression or a negative mood are common feelings experienced by stroke survivors, further compounding recovery [40]. The mental concentration or mindfulness associated with Tai Chi Quan is thought to promote peacefulness and tranquillity, reduce stress and tension, and improve overall mood [41]. However, few studies have examined the effects of Tai Chi Quan on mood or depression [42]. Depression can also have a negative effect on sleep. Poor sleep quality constitutes one of the most common difficulties facing older adults, with 58% reporting sleeping difficulties at least a few nights per week. Interestingly, the benefits of Tai Chi Quan emerged after participants had learned the 20 separate movements of Tai Chi Quan and were then able to practice the full set for nine weeks. Together, these findings suggest a temporal progression of benefit in which Tai Chi Quan impacts arousal mechanisms, followed by improvements in sleep. In conclusion, Tai Chi Quan can be considered a useful non-pharmacological approach to improve sleep quality in older adults with moderate complaints, and thereby has the potential to ameliorate sleep complaints, possibly before syndromal insomnia develops.

4. Rehabilitation

The mind-body interaction is emphasized while performing Tai Chi Quan. Over the past decade, a number of studies examining the effects of Tai Chi Quan reported that it could improve balance capacity, the fear of falling, bone health and muscle strength in older adults. The ten classical movement types of Tai Chi Quan are extremely important for the rehabilitation of patients who have suffered a hemiplegic stroke. Many Tai Chi exercises involve the arm and calf muscles, which help strengthen the core of the body and the symmetrical distribution of the centre of gravity. This in turn promotes stability when walking, as well as reducing muscle atrophy and maintaining and strengthening muscles. Tai Chi exercises are very slow and smooth and, therefore, are suitable for patients who have suffered a stroke. Thus, Tai Chi is excellent for rehabilitating stroke patients, as it is effective at improving equilibrium and balance, preventing muscle atrophy and improving the difficulties associated with walking [43].

5. Summary

Stroke is a major cause of mortality and disability worldwide, and is preventable by controlling risk factors such as high blood pressure, high blood cholesterol, and high blood glucose. Tai Chi Quan is an exercise that improves posture and the maintenance of balance by shifting the body's centre of gravity to and from unilateral and bilateral positions at a smooth and slow movement speed, and is even recommended for older adults with chronic diseases. There are many reports indicating that Tai Chi Quan can control blood pressure, blood glucose and blood cholesterol levels, as well as improving gait, balance capacity, fear of falling and muscle strength, resulting in a better quality of life for elderly adults. Tai Chi Quan is also useful for the prevention of strokes.

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