Effectiveness of *Radix astragali* and *Salvia miltiorrhiza* injection in treatment of skeletal muscle injury of aerobics athletes

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Abstract: This paper aims to observe and analyze the effects of *Radix astragali* and *Salvia miltiorrhiza* on skeletal muscle injury of aerobics athletes. In this study, 600 cases of aerobics athletes with skeletal muscle injury were randomly divided into experimental group and control group according to different treatment regimens, and the number of cases was the same, each with 300 cases. The control group was given local massage and rehabilitation training. On the basis of the above, *Radix astragali* and *Salvia miltiorrhiza* injection was given to the experimental group. The indicators of overall treatment efficiency, improvement of serum SOD level, improvement of serum MDA content, comparison of plasma creatine kinase (CK) and myoglobin (Mb) were observed and compared between the two groups. After implementation of different treatment programs, in comparison of overall treatment efficiency, the experimental group is significantly superior to the control group ($P < 0.05$); in comparison of improvement of serum SOD level, improvement of serum MDA content, the experimental group is superior to the control group($P < 0.05$). In addition, in comparison of plasma creatine kinase (CK) and myoglobin (Mb) level, the experimental group is significantly superior to the control group($P < 0.05$). It is very important for aerobics athletes with skeletal muscle injury to take active and effective therapy to recover as soon as possible. The program of *Radix astragali* and *Salvia miltiorrhiza* injection has obvious effect, which can promote athletes' skeletal muscle injury repair and improve the overall treatment efficiency, which is worth popularizing in practice.

Keywords: *Radix astragali*, *Salvia miltiorrhiza*, athlete, skeletal muscle injury, therapeutic effectiveness.

INTRODUCTION

Skeletal muscle injury is common in orthopedic diseases. The data show that skeletal muscle injury accounts for 10% to 50% in orthopedics (Attari *et al.,* 2016). The main characteristic of skeletal muscle injury is soft tissue injury. After the skeletal muscle is injured, it will cause strong pain. At the same time, as skeletal muscle is a kind of permanent cell with weak regenerative function, the healing time is long (Chen *et al.,* 2008; Balmadrid *et al.,* 2015). In addition, skeletal muscle injury will also easily lead to muscle atrophy, muscle stiffness and muscle scars and other complications, which significantly affects patients' normal life and work (Wu, 2014; Tang *et al.,* 2014). Aerobics athletes, due to strong specialty and peculiarity of their profession, are more prone to skeletal muscle injury.

There are many arguments about mechanism of skeletal muscle injury, the most common of which is that mechanical injury is an important cause of skeletal muscle injury (Chen *et al.,* 2009; Dai *et al.,* 2010). At the same time, some experts proposed by research that, muscle cell membrane damage leads to increased cell membrane permeability, thus issuing original intracellular enzymes such as creatine kinase, lactate dehydrogenase which enter the blood and result in increased activity and thus cause the injury (Dindo *et al.,* 2004; Inzucchi *et al.,* 2015). In addition, some scholars believe that centrifugal contraction is an important factor leading to muscle damage (Yoshio *et al.,* 2013), because during the centrifugal contraction, stress on muscle fiber is far beyond stress under concentric contraction, and eccentric contraction muscle is prone to delayed muscle soreness and injury (Gunaldi *et al.,* 2015). And moreover, less muscle fibers are involved in centrifugal movement, so single muscle fibers withstand greater force, which easily leads to injury (Hou *et al.,* 2015).

For aerobics athletes with skeletal muscle injury, it is essential to take timely and effective treatment to prevent inflammatory factors from phagocytosis of damaged and necrotic cell debris and prohibit activation of muscle satellite cells which hinders muscle regeneration. Based on this, this study analyzes effect of *Radix astragali (Astragalus membranaceus)*, *Salvia miltiorrhiza* injection in treatment of aerobics athletes' skeletal muscle injury.

MATERIALS AND METHODS

In this study, 600 cases of aerobics athletes with skeletal muscle injury who were treated in our hospital from June 2013 to August 2016 were study objects. All patients were approved by ethics committee of Chifeng University, ethical approval number as 2016HUCP2 and all patients signed on the informed consent. The patients were diagnosed after clinically relevant checks, and had symptoms such as varying degrees of pain in injured

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muscles, congestion, swelling or tenderness, limited joint mobility. The locations of the injury were: Quadriceps femoris, sacrospinalis, hamstring, tibialis anterior, musculus biceps brachii, brachioradialis, latissimus dorsi, abdominal and lumbar muscles, trapezius and deltoid. All patients in this study were given the right to know about the treatment, and informed consent was signed. Patients were randomly divided into experimental group, control group, each with 300 cases. In the experimental group, the patients were aged 20 to 32 years (28.6±3.4 years), with duration of 1-3 days (1.5±0.3 days), including 156 males and 144 females; in the reference group, the patients were aged 22 years to 33 years (26.9±3.8 years), with duration of 1-3 days (1.7±0.5 days), including 132 males and 168 females. After comparing relevant information of the two groups, the results are comparable, (P>0.05).

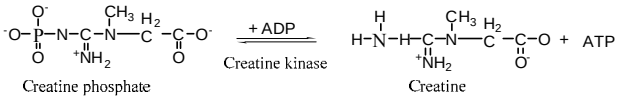

Fig. 1: Chemical schematic diagram of creatine kinase

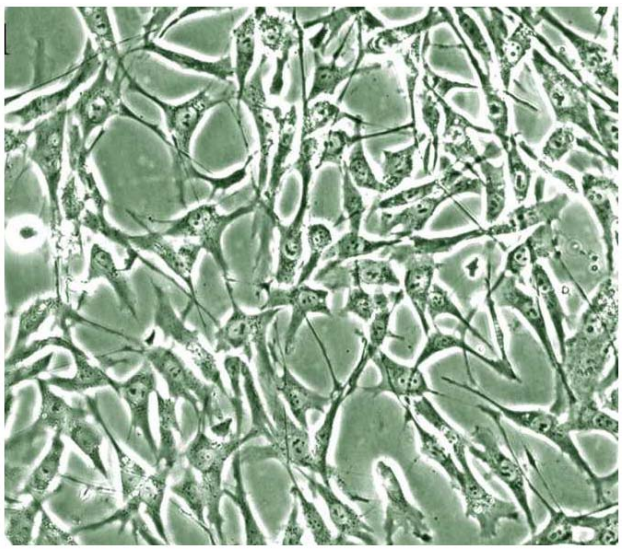

Fig. 2: Satellite cells of human skeletal muscle

The control group was treated with local massage and rehabilitation training. First, local massage was performed. For the injured area and nearby tender point, gentle massage was carried out. If there were muscle cord, nodule, etc., plucking and pushing, tendon-regulation therapy was performed, each time 0.5h and twice a day; secondly, starts rehabilitation training. In the 2 to 3 days after injury, progressive static training was carried out, which then turned to dynamic training, and transited from strength exercise to speed exercises. Pain must be avoided during the training and strenuous exercise is not allowed (Zhang *et al.,* 2013).

The experimental group was treated with *Radix astragali* and *Salvia miltiorrhiza* injection on the basis of treatment for the control group. 3ml *Radix astragali* Injection (produced by Chengdu Diao Jiuhong Pharmaceutical Factory, national medicine permission number: Z51021776) and 3ml *Salvia miltiorrhiza* Injection (produced by JiuZhiTang Co., Ltd. national medicine permission number: Z43020931) were mixed with 2ml lidocaine. On the first day of the first visit, on the 7th and 14th day of subsequent treatment, injection in local injured part was performed. During treatment, patient should avoid vigorous exercise, and is allowed to restore sport after local tenderness disappears. The course of treatment was two weeks for the two groups.

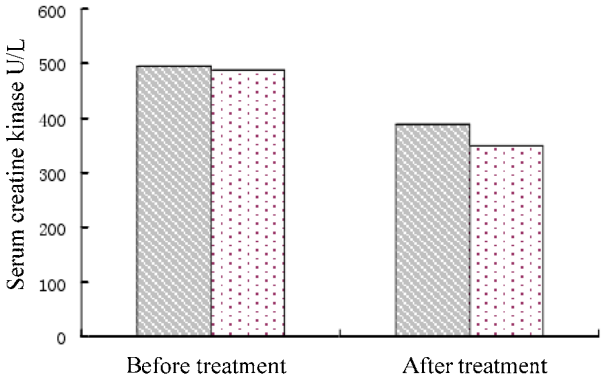

Fig. 3: Comparison of CK levels in the two groups (Note: the blue shadow represents the experimental group, while the white shadow represents the control group).

Observation indicators

Serum superoxide dismutase (SOD) activity (using xanthine oxidase method) and serum malondialdehyde (MDA) content (using thiobarbituric acid method) of the two groups were measured; plasma superoxide dismutase (CK) (using enzyme kinetic method) and myoglobin (Mb) (using enzyme-linked immunosorbent assay) of the two groups were measured; overall treatment efficiency was compared: markedly, that is, there was no local tenderness, no muscular nodular scar, no pain after strenuous exercise and no recurrence after 8 weeks of follow-up visits. Effective, that is, there was no local tenderness, no local pain after a lot of movement, but there was a muscle nodule. Invalid, that is, there was local tenderness, muscle nodules and pain after exercise (Zhu *et al.,* 2015).

STATISTICAL ANALYSIS

SPSS 21.0 statistical software was used to process the data involved in this study. Measurement data were expressed as x± s, comparison between groups applied t test, count data were expressed as [n (%)] and tested by chi-square. When P<0.05, the difference was statistically significant.

Table 1: Comparison of overall treatment efficiency between the two groups [n (%)]

Group	Markedly	Effective	Invalid	Overall treatment efficiency
Experimental group (n=300)	215(71.67)	75(25.00)	10(3.33)	290(96.67)
Control group (n=300)	108(36.00)	150(50.00)	42(14.00)	258(86.00)
X2				10.29
P				<0.05

Table 2: Comparison of serum SOD levels in two groups (x± s)

Group	Before treatment	1 week after treatment	2 weeks after treatment
Experimental group (n=300)	179.95±24.23	195.38±22.86	218.33±27.26
Control group (n=300)	180.36±25.37	184.35±19.24	190.35±23.76
t	0.34	6.79	8.36
P	>0.05	<0.05	<0.05

Table 3: Comparison of serum MDA content between the two groups (x ±s)

Group	Before treatment	1 week after treatment	2 weeks after treatment
Experimental group (n=300)	10.37±1.42	9.28±1.02	7.34±0.94
Control group (n=300)	10.86±1.65	10.23±1.35	9.26±0.87
t	0.25	7.63	9.08
P	>0.05	<0.05	<0.05

Table 4: Comparison of CK levels, Mb levels between the two groups (x± s)

Group	CK level		Mb level	
	Before treatment	After treatment	Before treatment	After treatment
Experimental group (n=300)	495.63±142.36	350.21±80.56	195.72±132.70	38.65±15.74
Control group (n=300)	492.33±138.69	390.26±100.37	189.63±144.28	58.62±25.46
t	0.31	8.25	0.45	5.49
P	>0.05	<0.05	>0.05	<0.05

RESULTS

Comparison of overall treatment efficiency

As shown in table 1, the overall treatment efficiency of the experimental group is significantly higher than that of the control group (P<0.05).

Comparison of serum SOD

As shown in table 2, there was no significant difference in serum SOD between the two groups before treatment (P> 0.05). After treatment, the improvement of serum SOD in the experimental group was significantly better than that in the control group (P <0.05).

Comparison of serum MDA content between the two groups

As shown in table 3 below, after treatment, compared with the control group, the experimental group shows a more significant trend in decrease of serum MDA content, P <0.05.

Comparison of CK levels, Mb levels between the two groups

As shown in table 4 below, after treatment, decrease in CK and Mb levels of experimental group is significantly more obvious than that of control group, as detailed in table 4, figs. 3 and 4.

DISCUSSION

Skeletal muscle injury will mainly relate to the two main processes of muscle fiber regeneration, scar tissue formation (Katarzyna *et al.,* 2015, Jean *et al.,* 2017). Because the two are competing with each other, so inappropriate treatment will not only extend the healing time, but also reduce healing quality and lead to repeated injury, forming muscle scars or myositis ossificans, thereby affecting normal movement of aerobics athletes (Liu *et al.,* 2013, Moumita *et al.,* 2015).

From the perspective of TCM, skeletal muscle injury falls into the scope of injury of tendons (Okuyama *et al.,* 2015). The main pathogenesis is that tendon twist and tendon damage, plus blocked meridian lead to gas stagnation and blood stasis (Rosenthal *et al.,* 2015; Samia *et al.,* 2016). The treatment should give priority to promoting blood circulation to remove blood stasis and promoting tissue regeneration (Kwabena *et al.,* 2016). *Radix astragali*

injection is refined by extracting active ingredients from *Radix astragali*. *Radix astragali* contains major components such as Astrageloside, trace elements and isoflavones, which can inhibit lipid per oxidation, enhance the body's antioxidant function, while significantly enhancing physiological metabolism of cells, thus giving full play to the role in promoting wound healing (Larsen *et al.,* 2013). The main effect of *Salvia miltiorrhiza* is to effectively improve local microcirculation and weaken micro vascular permeability, tissue edema degree (Luo *et al.,* 2014, Kargulewicz *et al.,* 2016). At the same time, it can also alleviate inflammation, degeneration and necrosis and thus effectively reduce mitochondrial damage, accelerate removal of lesions and promote tissue repair (Souich *et al.,* 2013, Szewczyk *et al.,* 2015).

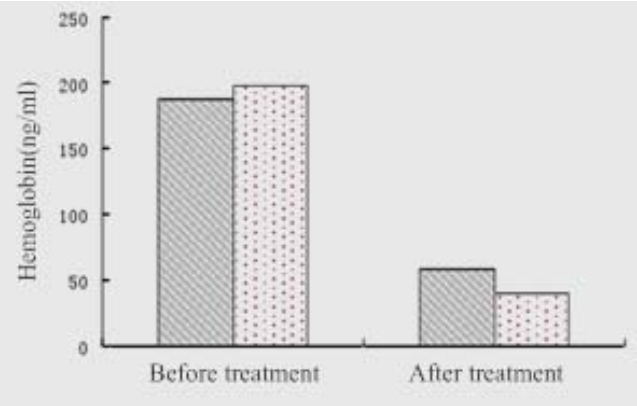

Fig. 4: Comparison of CK levels in the two groups (Note: the blue shadow represents the experimental group, while the white shadow represents the control group).

In this study, the results show that traditional Chinese medicine *Radix astragali*, *Salvia miltiorrhiza* injection is significantly effective in treatment of aerobics athletes with skeletal muscle injury, which can not only significantly improve serum SOD, MDA levels and CK, Mb levels in a short time and can effectively improve the overall treatment efficiency, with accurate, safe and reliable efficacy (Shim *et al.,* 2010, Schneider *et al.,* 2011).

CONCLUSION

In summary, implementation of traditional Chinese medicine *Radix astragali*, *Salvia miltiorrhiza* injection can achieve a good therapeutic effect in treatment of aerobics athletes with skeletal muscle injury, which can achieve a higher overall treatment efficiency, enhance the body's antioxidant capacity and promote bone healing.

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