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Effect of adenosine cyclophosphate combined with vitamin C on cellular immune function of children with viral myocarditis

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ABSTRACT

Objective: To investigate the curative effect of adenosine cyclophosphate combined with vitamin C on children with viral myocarditis andon cellular immune function. **Methods:** A total of 96 cases of children with viral myocarditis were randomly divided into control group and observation group, 48 cases in each. The control group received routine treatment for viral myocarditis. The observation group received routine treatment for viral myocarditis as well as vitamin C and adenosine cyclophosphate. **Results:** The total effective rate of observation group 89.59% was higher than that of control group 64.58%, and differences were statistical significant. The electrocardiogram total effective rate of observation group 91.67% was higher than that of control group 68.75%, and differences were statistical significant. After treatment, the level of $CD3^+$ (65.09±10.35)%, the level of $CD4^+$ (42.93±6.22)%, the level of $CD8^+$ (29.55±4.87)% and the level of NK (47.37±8.52)% of observation group were higher than the level of $CD3^+$ (51.85±9.33)%, the level of $CD4^+$ (35.18±5.73)%, the level of $CD8^+$ (24.46±4.03)% and the level of NK (35.64±7.72)% of control group, and differences were statistical significant. After treatment, myocardial enzyme indexes lactate dehydrogenase (329.65±19.76) U/L, creatine phosphate kinase (126.36±12.92) U/L, hydroxybutyrate dehydrogenase (271.68±14.73) U/L, glutamic oxaloacetic transaminase (31.22±3.76) U/L and creatine kinase (185.28±13.83) U/L of observation group were lower than lactate dehydrogenase (348.06±20.51) U/L, creatine phosphate kinase (163.19±13.15) U/L, hydroxybutyrate dehydrogenase (305.50±16.42) U/L, glutamic oxaloacetic transaminase (37.87±4.07) U/L and creatine kinase (202.79±15.47) U/L of control group, and differences were statistical significant. After treatment, heart function indexes CI, FS and EF levels of observation group were higher than those of control group, and differences were statistical significant. **Conclusions:** Adenosine cyclophosphate combined with vitamin C treatment of children with viral myocarditis has exact curative effect, and it can improve cardiac function of patients and improve immune function.

1. Introduction

Viral myocarditis in children is mainly caused by virus infection, among which enterovirus and adenovirus are the most common[1]. There are symptoms of upper respiratory tract infection, abdominal pain and temperature rise in children with viral myocarditis, and with the development of the disease, it may induce arrhythmia, heart failure, pulmonary edema and other serious complications[2]. In the research, adenosine cyclophosphate combined with vitamin C was used to treat children with viral myocarditis, hereby reported as follows.

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2. Materials and methods

2.1. General information

A total of 96 cases of children with viral myocarditis treated in our hospital from October 2013 to October 2015 were enrolled as research subjects, and they were 2-13 years old. Inclusion criteria: children were 2-15 years old and met the diagnostic criteria for viral myocarditis. Exclusion criteria: those with unclear diagnosis, those complicated with congenital heart disease, severe pulmonary infection, congenital immunodeficiency, severe hepatic and renal insufficiency and relevant history of drug allergy. They were randomly divided into observation group and control group according to random number table, 48 cases in each. Control group: 26 male cases and 22 female cases that were (7.2±2.3) years old; with history of respiratory tract infection 60.42% (29/48), with history of enteral infection 16.67% (8/48) and without history of specific infections 22.92% (11/48). Observation group: 27 male cases and 21 female cases that were (7.5±2.6) years old; with history of respiratory tract infection 62.50% (30/48), with history of enteral infection 18.75% (9/48) and without history of specific infections 18.75% (9/48).

2.2. Methods

Control group received routine treatment for viral myocarditis. The measures were as follows: they received ribavirin, vitamin C, energy mixture, coenzyme Q and vitamin E therapy, and received conventional therapy such as oxygen uptake, sedation and cardiac glycoside if necessary. Based on the treatment of control group, observation group received adenosine cyclophosphate (Hunan Zhongqi Pharmaceutical Co., Ltd., Approval No.: h20067434) therapy, intravenous drip of adenosine cyclophosphate 1 mg/kg, 1 time/d and 2 weeks as a course of treatment.

2.3. Observation indexes

(1) Immune function indexes[3]: Changes in levels of cellular immune function indexes $CD3^+$, $CD4^+$, $CD8^+$ and NK in children were observed before and after treatment, and flow cytometer was used for detection. (2) Myocardial enzyme indexes[4]: Changes in levels of myocardial enzyme indexes lactate dehydrogenase, creatine phosphate kinase, hydroxybutyrate dehydrogenase, glutamic oxaloacetic transaminase and creatine kinase in children were observed before and after treatment, and myocardial enzyme spectrum detector was used for detection. Reference indexes: lactate dehydrogenase LDH 100-240 IU/L, aspartate aminotransferase AST 0-40 IU/L, creatine kinase CK 24-194 IU/L, creatine kinase isoenzyme CK-MB 0-25 IU/L and alanine aminotransferase ALT 0-40 IU/L. (3) Heart function indexes[5]: Changes in levels of heart function indexes cardiac index (CI), fractional shortening (FS) and ER (ejection fraction) in children were observed before and after treatment, and ultrasonic cardiogram was used for detection.

2.4. Criteria for curative effect Literature[6] was referred to develop the criteria

Excellent: symptoms in children were significantly controlled within 1 week, myocardial enzymes and other related indexes were basically returned to normal, and electrocardiogram examination results were normal. Effective: symptoms in children were improved within 1 week, myocardial enzyme indexes were optimized to some extent, and electrocardiogram examination results were improved. Invalid: there was no improvement compared with before treatment.

2.5. Statistical analysis

SPSS 13.0 statistical software was used. Comparison between groups was by t or χ^2 test. $P<0.05$ indicated statistical significant differences.

3. Results

3.1. Curative effect

Control group included 16 excellent cases, 15 effective cases and 17 invalid cases, and the total effective rate was 64.58%; observation group included 29 excellent cases, 14 effective cases and 5 invalid cases, and the total effective rate was 89.59%. The total effective rate of observation group was higher than that of the control group, and differences were statistical significant ($\chi^2=8.491$, $P<0.01$).

3.2. Comparison of cellular immune function

After treatment, the improvement in the level of $CD3^+$ (65.09±10.35)%, the level of $CD4^+$ (42.93±6.22)%, the level of $CD8^+$ (29.55±4.87)% and the level of NK (47.37±8.52)% of observation group was better than that in the level of $CD3^+$ (51.85±9.33)%, the level of $CD4^+$ (35.18±5.73)%, the level of $CD8^+$ (24.46±4.03)% and the level of NK (35.64±7.72)% of control group, and differences were statistical significant ($P<0.01$), shown in Table 1.

3.3. Comparison of myocardial enzyme indexes

After treatment, myocardial enzyme indexes lactate dehydrogenase (329.65±19.76) U/L, creatine phosphate kinase (26.36±2.92) U/L, hydroxybutyrate dehydrogenase (271.68±14.73) U/L, glutamic oxaloacetic transaminase (31.22±3.76) U/L and creatine kinase (185.28±13.83) U/L of observation group were lower than lactate dehydrogenase (348.06±20.51) U/L, creatine phosphate kinase (33.19±3.15) U/L, hydroxybutyrate dehydrogenase (305.50±16.42) U/L, glutamic oxaloacetic transaminase (37.87±4.07) U/L and creatine kinase (202.79±15.47) U/L of control group, and differences were statistical significant ($P<0.01$) (Table 2).

3.4. Heart function indexes

After treatment, heart function indexes CI, FS and EF levels of observation group were higher than heart function indexes CI, FS and EF levels of control group, and differences were statistical significant ($P<0.01$), shown in Table 3.

Table 1

Comparison of levels of cellular immune function indexes between two groups (mean±SD, %).

Group	$CD3^+$		$CD4^+$		$CD8^+$		NK	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group (n=48)	45.87±7.12	51.85±9.33	32.89±5.57	35.18±5.73	22.65±3.81	24.46±4.03	25.98±6.26	35.64±7.72
Observation group(n=48)	46.26±7.31	65.09±10.35	32.78±5.93	42.93±6.22	22.52±3.68	29.55±4.87	25.78±6.01	47.37±8.52
t	0.265	6.583	0.094	6.349	0.170	5.579	0.160	7.068
P	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01

Table 2

Comparison of myocardial enzyme indexes between two groups (mean±SD, U/L).

Groups	Lactate dehydrogenase		Creatine phosphate kinase		Hydroxybutyrate dehydrogenase		Glutamic oxaloacetic transaminase		Creatine kinase	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group	356.23±23.67	348.06±20.51	35.42±3.97	33.19±3.15	313.32±17.98	305.50±16.42	39.78±5.24	37.87±4.07	210.76±16.79	202.79±15.47
Observation group	357.43±22.89	329.65±19.76	35.39±3.88	26.36±2.92	314.76±18.05	271.68±14.73	39.82±5.11	31.22±3.76	211.89±17.05	185.28±13.83
t	0.253	4.479	0.037	11.017	0.392	10.622	0.038	8.315	0.327	5.846
P	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01

Table 3

Comparison of heart function indexes between two groups (mean±SD).

Groups	CIfL/(min m2)]		FS (%)		EF (%)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Control group (n=48)	2.71±0.42	2.92±0.55	29.11±5.32	31.50±6.08	57.56±9.33	61.49±10.05
Observation group (n=48)	2.69±0.38	3.68±0.78	29.58±5.89	37.37±7.13	57.21±9.52	68.74±12.95
t	0.245	5.517	0.410	4.340	0.182	3.064
P	> 0.05	< 0.01	> 0.05	< 0.01	> 0.05	< 0.01

4. Discussion

That myocardial cells are infected with virus is the main reason inducing viral myocarditis[7], and large replication of viruses can cause great damage to myocardial cells, lead to myocardial cell lysis and necrosis, and seriously affect children's heart function. In recent years, incidence of viral myocarditis shows increasing trend. Zhang *et al*[8] analyze the epidemiology of coxsackie B group virus infection in children with viral myocarditis in Changchun area, and results show that coxsackie B group virus infection rate in children with suspected viral myocarditis is higher than that in adults, and each year, it is increasing. Early diagnosis and effective treatment is the key to dealing with children with viral myocarditis[9]. In the research, control group received conventional symptomatic treatment and observation group, based on treatment of control group, received adenosine cyclophosphate combined with vitamin C. Results showed that the total effective rate of observation group was 89.59% and higher than that of the control group 64.58%, and differences were significant. It indicated that the curative effect of adenosine cyclophosphate combined with vitamin C in treatment of children with viral myocarditis was significant.

Study[10] reports that virus infection can affect body's cellular immunity and humoral immunity and reduce body's immunomodulatory function, children's immune resistance seriously reduces and it is very bad for children's rehabilitation prognosis. Xu *et al*[11] analyze the clinical value of detection of cellular immune function of patients with viral myocarditis, and results show that there is cellular immune dysfunction in most patients with viral myocarditis, and clinicians should enhance the immune function of patients with viral myocarditis. Therefore promoting the recovery of myocardial function, improvement of cardiac function and improvement of immune resistance is the key to the treatment of children with viral myocarditis. Results of the research showed that after treatment, improvement in $CD3^+$, $CD4^+$, $CD8^+$ and NK levels of observation group was better than that in $CD3^+$, $CD4^+$, $CD8^+$ and NK levels of control group, and after treatment, levels of myocardial enzyme indexes lactate dehydrogenase, creatine phosphate kinase, hydroxybutyrate dehydrogenase, glutamic oxaloacetic transaminase and creatine kinase of observation group were lower than levels of myocardial enzyme indexes lactate dehydrogenase, creatine phosphate kinase, hydroxybutyrate dehydrogenase, glutamic oxaloacetic transaminase and creatine kinase of control group; heart function indexes CI, FS and EF levels of observation group were higher than heart function indexes CI, FS and EF levels of control group, and differences were statistically significant. It indicated that adenosine cyclophosphate combined with vitamin C could promote the recovery of children's myocardial function and improve their immune resistance. It was speculated that this might be because that adenosine cyclophosphate was one of the important

regulatory substances in human body. It can effectively antagonize catecholamine, promote metabolism of myocardial cells and reduce cardiac stress while relieve tachycardia, inhibit secretion of norepinephrine and improve cardiac function of children with viral myocarditis. Another study shows that adenosine cyclophosphate can increase myocardial contractility, decrease pulmonary vascular resistance and promote the recovery of myocardial function[12]. Vitamin C belongs to free radical scavenger, has the effect of reducing the damage of oxygen free radicals to unsaturated fatty acids, reduces body's inflammatory response[13] and reduces the extent of myocardial damage, and vitamin C can improve myocardial nutrition and metabolism and promote the improvement of body's immune resistance.

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