

124 cases of clinical analysis of children with viral myocarditis

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Abstract. – OBJECTIVE: A study on clinical characteristics, diagnostic methods of children's viral myocarditis (VMC) and analysis of the effect of VMC is carried out.

PATIENTS AND METHODS: A retrospective analysis of the clinical data of 124 cases of children with VMC from January 2008 to March 2011 in Xuzhou Children's Hospital is conducted.

RESULTS: The age of onset of 1 VMC is less than 1 year old with the majority, fever, precordial pain, and fatigue as the main manifestation, auxiliary examination of abnormal electrocardiogram (ECG) in 110 cases, accounting for 88.71%, the positive rate of dynamic ECG is 92.31%, and abnormal rate of myocardial enzyme examination is 96.77%. The effective rate of treatment is 94.35%, and the effective rate of treatment of creatine phosphate sodium is 100%.

CONCLUSIONS: For childhood, especially 1 year old children with viral infection in clinical, attention should be paid to the VMC performance, suspected children should be timely ECG, dynamic ECG and myocardial enzyme examined with diagnosis and early treatment. The myocardial protection of creatine phosphate sodium has definite therapeutic effect on VMC of children.

Key Words:

Children with viral myocarditis, Electrocardiogram, Myocardial enzyme, Creatine phosphate.

Introduction

Viral myocarditis, VMC, is a common disease of cardiovascular system in children, refers to the virus and toxin direct invasion of myocardial cells, leading to diffuse or focal myocardial interstitial occurring inflammatory exudation and myocardial fiber necrosis or degeneration, resulting in cardiac function disorder with disease systemic symptoms¹⁻³. In recent years, the incidence of VMC was in gradually increased trend⁴⁻⁶ because of its diverse clinical manifestations complex, illness development is rapid, and there are no specificity diagnosis methods and it is a serious threat to the life and health of children⁷. This study has a retrospective

analysis of the clinical data of 124 cases of children with VMC from January 2008 to March 2011 in our hospital. The report is as follows.

Patients and Methods

Patients

The study includes 124 patients, diagnosis conforms to diagnosis standard of VMC of the meeting in Kunming (1999)⁸⁻¹¹. The age ranged from 1 months to 9 years, average 2.4 years old, male 75 cases, accounting for 60.48%, female 49 cases, accounting for 39.52%, the age from 1 to 3 months in 42 cases, accounting for 33.87%, ~1 years in 38 cases, accounting for 30.65%, ~3 years in 29 cases, accounting for 23.39%, ~6 years in 9 cases, accounted for 7.26%, ~9 years in 6 cases, accounting for 4.84%.

Clinical Manifestations

Prodromal symptoms were fever, cough, sore throat, nasal obstruction, abdominal pain, diarrhea, etc. The main clinical manifestations were fatigue, pale, chest tightness, chest pain, precordial discomfort, palpitations, Dohan, long sigh, breath shortness of breath, abdominal discomfort and irritable crying, etc. By physical examination low heart sound blunt and all kinds of arrhythmia, including premature, heartbeat tachycardia, bradycardia, etc. can be found.

Laboratory and Equipment Inspection

One hundred and twenty-four cases took routine electrocardiogram (ECG) examination, there were 78 cases that took dynamic ECG (Holter) examination, myocardial enzymes, amino terminal pro brain natriuretic peptide (NT-proBNP) and virus assay, among which myocardial enzymes include creatine kinase isoenzyme (CK-MB), creatine kinase (CK), lactate dehydrogenase (LDH), hydroxybutyric acid, aspartate amino transferase. Compare the positive rate differences of these findings.

Table I. Laboratory and auxiliary examination results of children with viral myocarditis (cases)

Auxiliary examination	ECG		Myocardial enzyme				Virus detection		
	ECG	HOLTER	CK-MB	CK	LDH	AST	HBDH	NTP	
Positive	110	72	107	30	93	61	40	72	98
Proportion (%)	88.71	92.31	86.29	24.19	75	49.19	23.26	58.06	79.3

Note: $\chi^2 = 29.84, p < 0.05$.

Treatment

Children took bed rest and nutrition, 5% glucose 50-100 ml was added vitamin C 150-200 mg/kg intravenous drip, once a day, Leigh Bhave Lin from 10 to 15 mg/(kg * D) and fructose 100 mg/(kg * D), including 58 cases of children with creatine phosphate sodium intravenous drip (within 1 year old in 5% glucose 50 ml added creatine phosphate sodium 0.5 g, over 1-year-old children 5% in 50 ml glucose added creatine phosphate sodium 1 g), once a day, treatment for 10-14 d. For arrhythmia, corresponding anti arrhythmia medicine auxiliary treatment was given.

The Standard of Curative Effect Evaluation

Clinical therapeutic effect evaluation standard takes the reference of disease diagnosis-based cure improved standards¹²⁻¹⁵ for assessment, clinical cure: The clinical manifestations of children all disappear, ECG return to normal and last for 1- 2 weeks; Improved: clinical manifestation is reduced, ECG is shown that premature significantly reduces from frequently (>10 times/min reduced to < 5 times/min), or non-continuous display block, no frequent Beckoning tachycardia; Invalid: no change of the clinical manifestations, no change of ECG; Clinical cure and improvement are effective treatment.

Statistical Analysis

Use SPSS 13.0 software (SPSS Inc., Chicago, IL, USA) for statistical analysis, count data by χ^2 -test analysis, $p < 0.05$ means the difference has statistical significance.

Results

Age and Gender Differences

In VMC children's age distribution, children of less than the age of 1 are more common, accounting for 64.52%, and more common in men than in women, men account for 60.48%, women 39.52%.

Clinical Symptoms

In the study all VMC patients in fever in 117 cases, accounting for 92.13%, the whole body lack of power in 113 cases, accounting for 91.13%, heartbeat too fast or too slow in 77 cases, accounting for 62.01%, low and dull heart sound in 58 cases, accounting for 46.77%.

Laboratory Examination

VMC laboratory test results are shown in Table I.

The results of the multi sample rate by χ^2 -test show that there are statistically significant differences of the comparison between routine ECG examination, 24 h dynamic ECG, myocardial enzymes and the positive rate of various virus detection ($\chi^2 = 29.84, p < 0.05$), in which the highest detection rate is dynamic ECG, up to 92.31%, followed by ECG and CK-MB, respectively, 88.71% and 86.29%.

Therapeutic Outcome

In this study, the total effective rate of VMC treatment is 94.35%, there is no statistical significance of sex, age, and clinical symptoms differences comparing the routine treatment group

Table II. Results of treatment of 124 cases of children with VMC (cases)

Group	Cases	Cure	Improved	Ineffective
Routine treatment group	66	42	17	7
Creatine phosphate sodium group	58	52	6	0

Note: $\chi^2 = 4.68, p < 0.05$.

with adding sodium phosphocreatine group ($p > 0.05$). Compare therapy of routine treatment group with creatine phosphate sodium group, $\chi^2 = 4.68$, $p < 0.05$ and the difference was statistically significant, as shown in Table II.

Discussion

VMC easily involves children. At present, the incidence of children with VMC is not clear; in this study, mainly less than 1-year-old children, accounting for 64.52% of VMC due to viral infection in childhood, is a high incidence. In this study, there are 124 cases of VMC involving children with fever, precordial pain, and malaise. Thus, the children with fever, malaise, and other related clinical signs or symptoms of virus infection should be closely observed and monitored so that myocarditis may occur during the course of the disease. As and when needed, relevant specialized examinations should be done to these children to accomplish timely diagnosis and prevent the diseases¹⁶⁻²³. The results of this study show the highest detection rate for relevant laboratory and equipment inspection is ambulatory ECG, 92.31%, followed by ECG and CK-MB, 88.71% and 86.29%, respectively.

At the same time for the Holter and ECG examinations in children, there are 8 cases that ECG didn't detect but Holter detected abnormal²¹. The conventional ECG examination can only record the ECG data at a point of time when the subjects are static with recording heart rate, generally only dozens of times, with lack of data of long enough and dynamic changes, especially the load, transient myocardial ischemia, paroxysmal arrhythmias and positive rate of ST-T in intermittent change is relatively low. However, one Holter detection can obtain 100,000 to more than 140,000 heartbeat cycle information. Holter detection not only can detect the fixed and sustained arrhythmia, but also it can obtain a transient or intermittent arrhythmia, myocardial ischemia and complicated arrhythmia and other information. At the same time, Holter also can make qualitative and quantitative diagnostic accuracy of all kinds of arrhythmia, clarify the relationship between arrhythmia of patients and emotion, the general situation, activities of patients, evaluate arrhythmia severity, define prognosis, and formulate prevention plan²². So for VMC patients, Holter examination has more advantages than the conventional ECG. The abnormal rate of myo-

cardial enzyme examination was 96.77%, CK-MB abnormal increase was more common, followed by LDH anomaly. Therefore, ECG, dynamic ECG and myocardial enzyme examination should be routine examinations projects of children VMC. But VMC is still lacking of a specific diagnosis criteria; the direction of future research is still looking for sensitive and specific tests and examination index.

The pathogenesis of VMC has not been completely elucidated. Some studies²⁶⁻²⁸ suggest that it is related to the virus direct damage to infected myocardial, thereby, triggering the body's immune response. With the features of acute onset, rapid development and severe illness, treatment less often leads to severe heart failure, arrhythmia occurred in children with acute pulmonary edema, complications. According to some foreign research reports, current clinical treatment principles mainly protect myocardial cells, promote myocardial metabolism and nutrition, antiviral and symptomatic anti shock, correct heart failure and the comprehensive treatment²⁹. For VMC, the interferon therapy can be used, but the curative effect is not certain. The hospital symptomatic conventional treatment effective rate was 96.77%, of which 58 cases with creatine phosphate sodium, whose effective rate was 100%. Creatine has temporarily stored high-energy phosphate group, a kind of high efficient energy supply material that has a protective effect on ischemic myocardium, can maintain the ATP level of myocardial cells, promote the myocardial to restore, and to maintain the cell membrane stability with the resistance to reperfusion injury²⁴.

The myocardial protection effect is mainly through: (1) To maintain the integrity of cell membrane, reduce the membrane phospholipid degradation products; (2) Maintain high-energy phosphate levels of the myocardial cells; (3) Promote the recovery of myocardial contractile force; (4) Anti arrhythmia (by increasing the electric conduction of the ischemic region); (5) Antithrombotic function and improve the microcirculation in ischemic area; (6) Resistance to the reperfusion injury to complete. Our observations show that combination with sodium phosphocreatine can improve the curative effect of VMC patients.

Conclusions

Children with fever, precordial pain, malaise and other related clinical signs or symptoms of

virus infection, especially less than 1-year-old children, should be done the relevant ECG and myocardial enzymology check in time for the timely diagnosis. The detection positive rate of Dynamic ECG is higher and should be carried out regularly. Treatment of VMC plus sodium phosphocreatine can improve the treatment efficiency. Clinical sample source of the study is relatively small, and it needs further clinical studies.

Conflict of Interest

The Authors declare that they have no conflict of interests.

References

- 1) LINLIN L, LIANG F. Research advances in the pathogenesis of viral myocarditis of children. *J Inn Mong Med* 2010; 42: 194-198.
- 2) JUN L, YU L, BAORONG C. Clinical analysis of 70 cases of children with viral myocarditis. *Strait J Preven Med* 2009; 15: 86-87.
- 3) YUBO W, YINGFENG W, JINXIANG H. Children with viral myocarditis. *China Pract Med* 2010; 5: 67-68.
- 4) ZAIYING Z, YONGHONG Z, HUAHONG Q. Clinical analysis of 78 cases of children with viral myocarditis. *Acta Med Sin* 2009; 22: 474-475.
- 5) CARDIOVASCULAR SCIENCE GROUP OF THE SUBSPECIALTY SOCIETY OF CHINESE MEDICAL ASSOCIATION, Editorial Board of Chinese Journal of Pediatrics Viral myocarditis diagnosis standard (Revised Draft). *Chin J Ped* 2000; 38: 75.
- 6) CHUANXING S. Disease diagnosis based on cure improved standards. Beijing: People's Medical Publishing House, 2002; pp. 265.
- 7) TAKEDA N. Cardiomyopathy: molecular and immunological aspects (review). *Int J Mol Med* 2003; 11: 13-16.
- 8) NATHAN M, WALSH R, HARDIN JT, EINZIG S, CONNOR BO, BALAGURU D, VERMA R, STARR JP. Enteroviral sepsis and ischemic cardiomyopathy in a neonate: case report and review of literature. *ASAIO J* 2008; 54: 554-555.
- 9) FREUND MW, KLEINVELD G, KREDIET TG, VAN LOON AM, VERBOON-MACIOLEK MA. Prognosis for neonates with enterovirus myocarditis. *Arch Dis Child Fetal Neonatal Ed* 2010; 95: F206-F212
- 10) KAO KL, YEH SL, CHEN CC. Myopericarditis associated with varicella zoster virus infection. *Pediatr Cardiol* 2010; 31: 703-706.
- 11) QINGWEN S. Curative effect observation of creatine phosphate Injection treatment on unstable angina pectoris. *Chinese Community Physicians: medical specialty* 2010; 129: 50.
- 12) HERATH VC, GENTLES TL, SKINNER JR. Dilated cardiomyopathy in children: review of all presentations to a children's hospital over a 5-year period and the impact of family cardiac screening. *J Paediatr Child Health* 2015; 51: 595-599.
- 13) PETTIT MA, KOYFMAN A, FORAN M. Myocarditis. *Pediatr Emerg Care* 2014; 30: 832-835.
- 14) HICHIJO A, MORINE M. A case of fetal parvovirus b19 myocarditis that caused terminal heart failure. *Case Rep Obstet Gynecol* 2014; 2014: 463571.
- 15) LOBO ML, TAGUCHI Â, GASPAR HA, FERRANTI JF, DE CARVALHO WB, DELGADO AF. Fulminant myocarditis associated with the H1N1 influenza virus: case report and literature review. *Rev Bras Ter Intensiva* 2014; 26: 321-326.
- 16) DEN BOER SL, MEIJER RP, VAN IPEREN GG, TEN HARKEL AD, DU MARCHIE SARVAAS GJ, STRAVER B, RAMMELOO LA, TANKE RB, VAN KAMPEN JJ, DALINGHAUS M. Evaluation of the diagnostic work-up in children with myocarditis and idiopathic dilated cardiomyopathy. *Pediatr Cardiol* 2015; 36: 409-416.
- 17) CAUGHEY RW, HUMPHREY JM, THOMAS PE. High-degree atrioventricular block in a child with acute myocarditis. *Ochsner J* 2014; 14: 244-247.
- 18) ESPOSITO S, RAHAMAT-LANGENDOEN J, ASCOLESE B, SENATORE L, CASTELLAZZI L, NIESTERS HG. Pediatric parechovirus infections. *J Clin Virol* 2014; 60: 84-89.
- 19) AROLA A, OJALA T, LAUERMA K, KARIKOSKI R, RUUSKANEN O, HAPPONEN JM, JOKINEN E. Myocarditis in children--a diagnostic and therapeutic challenge. *Duodecim* 2014; 130: 317-325.
- 20) MARTINS AC, LINS JB, SANTOS LM, FERNANDES LN, MALAFRONTA RS, MAIA TC, RIBERA MC, RIBERA RB, DA SILVA-NUNES M. Vivax malaria in an Amazonian child with dilated cardiomyopathy. *Malaria J* 2014; 13: 61.
- 21) TOPRAK G, YÜKSEL H, DEMIRPENÇE Ö, ISLAMOĞLU Y, EVLIYAĞLU O, METE N. Fibrosis in heart failure subtypes. *Eur Rev Med Pharmacol Sci* 2013; 17: 2302-2309.
- 22) XIN H, CHEN ZY, LV XB, LIU S, LIAN ZX, CAI SL. Serum secretory phospholipase A2-IIa (sPLA2-IIA) levels in patients surviving acute myocardial infarction. *Eur Rev Med Pharmacol Sci* 2013; 17: 999-1004.
- 23) TREGLIA G, STEFANELLI A, BRUNO I, GIORDANO A. Clinical usefulness of myocardial innervation imaging using Iodine-123-meta-iodobenzylguanidine scintigraphy in evaluating the effectiveness of pharmacological treatments in patients with heart failure: an overview. *Eur Rev Med Pharmacol Sci* 2013; 17: 56-68.
- 24) DI MONACO A, SESTITO A. The patient with chronic ischemic heart disease. Role of ranolazine in the management of stable angina. *Eur Rev Med Pharmacol Sci* 2012; 16: 1611-1636.