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ARTICLE

Analysis of ultrasound coronary parameters and blood red cell distribution width and N-terminal pro-brain natriuretic peptide concentrations following coronary lesions in children with Kawasaki disease

Wuying Gao[1]
Zhenjie Chen[2]
Yi Lu[3]
Xiaowei Bai[1]
Mushui Chen[4]
Ying Lu[5]

Author details can be found at the end of this article

Correspondence to:
Wuying Gao
(13567335933@163.com)

Abstract

Aims/Background Kawasaki disease is an acute inflammatory condition primarily affecting the young children. It can lead to coronary artery abnormalities, which can worsen the prognosis. Early diagnosis of coronary disease is crucial for the effective treatment and the prognosis evaluation. To explore the clinical significance of ultrasound examination characteristics, peripheral blood red cell distribution width, and changes in N-terminal pro-brain natriuretic peptide levels for the early detect coronary artery abnormality in children with Kawasaki disease.

Methods The case-control study was conducted. 85 Kawasaki disease patients diagnosed in our hospital from January 2020 to December 2023 were selected as the Kawasaki disease group. 100 healthy children who received physical examination in the Department of Child Healthcare during the same period were selected as control group. The cardiac ultrasound indicators, erythrocyte sedimentation rate, C-reactive protein, white blood cell, neutrophil percentage, platelet count, D-dimer, red cell distribution width, N-terminal pro-brain natriuretic peptide of two groups were compared. The Kawasaki disease group was further divided into the coronary artery lesion group and the non-coronary artery lesion group based on whether coronary artery lesions occurred in the Kawasaki disease patients. The differences of above indicators were compared.

Results The left main coronary artery, left anterior descending branch, and right coronary artery Z-scores of the Kawasaki disease group were all higher than those of the control group ($p < 0.05$). There was no significant difference in left ventricular ejection fraction between Kawasaki disease group and control group ($p > 0.05$). The erythrocyte sedimentation rate, C-reactive protein, neutrophil percentage, platelet count, D-dimer, red cell distribution width, and N-terminal pro-brain natriuretic peptide of Kawasaki disease group were all higher than those of control group ($p < 0.05$). The left main coronary artery, left anterior descending branch, and right coronary artery Z-scores of Kawasaki disease patients with coronary artery lesions were all higher than those of Kawasaki disease patients without coronary artery lesions ($p < 0.05$). The left ventricular ejection fraction of Kawasaki disease patients with coronary artery lesions was lower than that of Kawasaki disease patients without coronary artery lesions ($p < 0.05$). The erythrocyte sedimentation rate, C-reactive protein, white blood cell, neutrophil percentage, platelet count, D-dimer, red cell distribution width, and N-terminal pro-brain natriuretic peptide of Kawasaki disease patients with coronary artery lesions were all higher than those of Kawasaki disease patients without coronary artery lesions, and the differences were statistically significant ($p < 0.05$). After treatment, the left main coronary artery, left anterior descending branch, and right coronary artery *Z*-scores of Kawasaki disease patients with coronary artery lesions significantly decreased ($p < 0.05$), and the left ventricular ejection fraction significantly increased ($p < 0.05$). The erythrocyte sedimentation rate, C-reactive protein, white blood cell, neutrophil percentage, platelet count, D-dimer, red cell distribution width, and N-terminal pro-brain natriuretic peptide of Kawasaki disease patients with or without coronary artery lesions significantly decreased after treatment compared with before treatment in the same group ($p < 0.05$).

Conclusion Kawasaki disease patients with coronary artery lesions exhibit significantly increased coronary artery vessel diameter, as well as elevated red cell distribution width and N-terminal pro-brain natriuretic peptide concentration. The combined use of ultrasound combined with red cell distribution width and N-terminal pro-brain natriuretic

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peptide examination can assist in determining whether Kawasaki disease patients have coronary artery lesions and assessing the clinical treatment effect.

Key words: Coronary artery disease; Kawasaki disease; N-terminal brain natriuretic peptide precursor; Red blood cell distribution width; Ultrasound examination

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Introduction

Kawasaki disease (KD), also known as mucocutaneous lymph node syndrome, is an acute febrile rash disease affecting medium and small arteries throughout the body, mostly seen in infants and young children, especially boys. Indeed, the aetiology of KD is not fully understood, it is commonly believed to be related to multiple infections, but the specific correlation remains unconfirmed (Kuo, 2023). Kawasaki disease is characterised by manifestations affecting the mucous membranes of the eyes and mouth, high fever, hard oedema and desquamation of hands and feet and multiple rashes. Cardiac complications are particularly serious, especially the formation of coronary artery aneurysms, which may lead to risks such as myocardial infarction and shock. In addition, it may be accompanied by other systemic symptoms such as interstitial pneumonia and aseptic meningitis. Kawasaki disease is more common in Asian children, especially those under 5 years old, and can occur all year round (Mohankumar et al, 2023).

The presence of coronary artery lesions can worsen the prognosis KD. Early diagnosis of coronary lesions is crucial for the treatment of KD and the evaluation of prognosis (Sun et al, 2022). In order to make qualitative and quantitative evaluation of coronary artery lesions, some scholars proposed that the standardised Z value of ultrasound index can provide longitudinal assessment of coronary artery diameter and classify coronary abnormalities, reducing the deviation of conventional ultrasound index for evaluating the severity of coronary artery lesions (Hörl et al, 2021). Kawasaki disease complicated by coronary artery lesions is essentially an immune and metabolic disorder that disrupts the balance between pro-inflammatory and anti-inflammatory responses. This imbalance alters the metabolism microenvironment of coronary artery, causing acute or chronic damage to the coronary arteries (Jone et al, 2022; Dong et al, 2023). A study has also shown that (Pilania et al, 2020), dynamic changes of platelets reflect the coronary artery lesions in children with KD. In addition, some studies have found that (Guo et al, 2023; Hosseininasab et al, 2023), N-terminal pro-brain natriuretic peptide (NT-proBNP) and blood routine related indicators can be used to determine the degree of myocardial injury. In children with KD and coronary lesions, myocardial and cardiac functions also easily affected, suggesting that NT-proBNP can serve as a predictive factor for coronary lesions. Currently, few studies have evaluated the risk of coronary lesions in children with KD by combining hematological indicators with coronary artery inner diameter Z values. This study aims to explore their evaluation significance for coronary artery lesions and provide a basis for clinical practice by collecting clinical data, ultrasound results and hematological indicators from children with KD.

Methods

General information

This retrospective study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Haining People's Hospital (No.2024-067). The informed consent has been obtained from every participant. In this case-control study, 85 children diagnosed with KD confirmed between January 2020 and December 2023 were selected as KD group. Additionally, 100 healthy children examined in the child care department during the same period were selected as the control group. The inclusion and exclusion criteria for study subjects are as follows:

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Inclusion criteria: (1) Diagnostic criteria for children with KD selected in this study refer to the criteria in the Suggestions for Clinical Management of Coronary Arterions in KD (Cardiovascular Group, Pediatrics Branch of Chinese Medical Society and Immunology Group, Pediatrics Branch of Chinese Medical Association, 2012). The main manifestations were fever, conjunctival congestion, swelling of hands and feet, erythema, chapped lips, and strawberry tongue; (2) To determine whether the children with KD had coronary lesions, the diagnostic criteria were based on the diagnostic criteria established by Japanese Kawasaki Disease Research Group (Fukazawa et al, 2020). According to these criteria, coronary artery dilation is diagnosed if the internal coronary artery diameter exceeds 3 mm in the child aged <5 years, or 4 mm in the child aged ≥5 years; (3) Children admitted in the study are 6 months to 5 years; (4) Control group is the children who underwent physical examination in our hospital; (5) All patients in KD group were diagnosed for the first time; (6) The families of the children who are willing to participate in the study signed the informed consent form after thorough communication.

Exclusion criteria: (1) Children with arrhythmia; (2) Children with chromosome or birth defects; (3) Children with HIV infection; (4) Children with pericardial effusion, cardiac hypertrophy, heart disease or congenital heart disease; (5) Respiratory infections, typhoid fever and other types of fever.

Ultrasound examination

The examination was performed by colour Doppler diagnostic instrument (iE 33, Philips, Amsterdam, Netherlands) with S5-1 and S12-4 probes at frequencies from 5 to 10 MHz. The examination is conducted when patients were in a calm state. Scan the subxiphoid, apx, and the superior sternal fossa to record the left ventricular ejection fraction (LVEF). The left main coronary artery was displayed on the left ventricular long axis section, and the probe was slowly adjusted to scan the anterior left descending branch and the near left circumflex branch. Move the probe to visualise the right main coronary artery and proceed to measure its inner diameter. Measure the inner coronary diameter at the widest dilated lumen of each branch by determining the distance between the anterior intima to the posterior. Repeat this measurement three times and calculate the average. The Kobayashi formula is used to calculate the Z value: the formula of Z value is Z = (measured value–average)/standard error.

Analysis of laboratory indicators

Venous blood was collected before and after treatment for anticoagulation, and routine blood indexes such as red cell distribution width (RDW), neutrophil percentage (N), white blood cells (WBCs), and platelet count (PLT) were measured by automatic blood analyser X N-2800 (Sysmex, Kobe, Japan). Erythrocyte sedimentation rate (ESR) levels were measured by ROLLER-20 dynamic blood sedimentation analyser (Alifax Italy Co., Ltd., Milan, Italy).

Similarly, 2 mL of venous blood was collected before and after treatment, and the supernatant was retained after centrifugation. The serum concentration of C reaction protein (CRP) was measured by a domestic puumen PA-900 specific protein analyser (SYSMEX, Kobe, Japan). D-dimer (D-D) concentration were measured by an ACL-TOP-350 Automatic Hemagglutator (BECKMAN COULTER, Brea, CA, USA). N-terminal pro-brain natriuretic peptide concentration was by Beckman Access 2 fully automated Microparticle chemiluminescence immunoanalyzer (BECKMAN COULTER, Brea, CA, USA). All test kits were purchased from BECKMAN COULTER, Brea, CA, USA.

Treatment

This dose regimen consisted of three doses based on 100 mg/kg aspirin enteric-coated tablets (No. 20211019, Barer Healthcare Co., Ltd., Leverkusen, North Rhine Westphalia, Germany). Following normalisation of the patient's body temperature, the dosage was adjusted to 3 mg/kg once a day. Medicine was discontinued upon normalisation of the blood routine. Additionally, 2 g/kg of human C immunoglobulin (No. 20210809, Guangdong Shuanglin Biopharmaceutical Co., Ltd., Zhanjiang, Guangdong, China) was administrated on the 5th day of the disease course and infused over a period of 8-12 hours.

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Statistical methods

The data were analysed by statistical software SPSS 21.0. (IBM, Armonk, NY, USA) Measurement data collected in this study, such as CRP, WBC, N, PLT, D-D, RDW, NT-proBNP were described using mean ± standard deviation (SD). The comparison between the two groups was conducted using the *t*-test, while the comparison before and after treatment within the same group was performed using paired *t*-test. Gender was categorised as statistical data, and the adoption rate of score method (%) was compared using χ^2 test. A *p* value < 0.05 was considered statistically significant.

Results

Comparison of baseline characteristics between Kawasaki disease and control groups

The difference in baseline characteristics between the KD group and control group was not statistically significant ($p > 0.05$), as detailed in Table 1.

Comparison of cardiac ultrasound findings between Kawasaki disease and control groups

Z values of the left main coronary artery, left anterior descending artery and right coronary artery in the KD group were greater than those in the control group ($p < 0.05$), and LVEF of KD group was not significant ($p > 0.05$, Table 2).

Table 1. Comparison of baseline characteristics in the two groups

Group	n	Age (years old)	Height (cm)	Weight (kg)	Gender (%)	
					Male	Female
KD group	85	4.91 ± 1.33	115.6 ± 3.80	17.40 ± 2.43	49(57.65)	36(42.35)
Control group	100	5.14 ± 1.40	114.8 ± 3.45	17.18 ± 2.56	50(50.00)	50(50.00)
t/χ^2		–1.139	1.500	0.596	1.080	
p		0.256	0.135	0.552	0.299	

Note: KD, Kawasaki disease.

Table 2. Comparison of cardiac colour ultrasound findings between Kawasaki disease and control groups ($\bar{x} \pm s$)

Group	n	Left main coronary artery (Z value)	Left anterior descending branch (Z value)	Right coronary artery (Z value)	Left ventricular ejection fraction was (%)
KD group	85	4.88 ± 1.54	6.48 ± 1.89	5.89 ± 1.91	67.58 ± 4.20
Control group	100	3.20 ± 0.89	4.28 ± 1.14	4.75 ± 1.54	68.40 ± 4.75
t		9.245	9.743	4.493	–1.234
p		< 0.001	< 0.001	< 0.001	0.219

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Comparison of laboratory indicators between the Kawasaki disease group and control group

The ESR, CRP, WBC, N, PLT, D-D, RDW, and NT-proBNP of children in the KD group were greater than those in the control group, and differences were statistically significant ($p < 0.05$, Table 3).

Comparison of cardiac ultrasound results in Kawasaki disease children with and without coronary lesions

Z values of the left coronary artery trunk, left anterior descending artery, and right coronary artery were greater than children without coronary KD ($p < 0.05$), and the LVEF of KD children with coronary disease were lower than those with non-coronary disease ($p < 0.05$, Table 4).

Comparison of various laboratory indicators in Kawasaki disease children with and without coronary lesions

The ESR, CRP, N, PLT, D-D, RDW and NT-proBNP of KD children with coronary lesions were greater than those without coronary lesions, and the differences were statistically significant ($p < 0.05$, Table 5).

Comparison of cardiac colour ultrasound findings before and after treatment of children with Kawasaki disease

Z values of the left main coronary artery, left anterior descending artery and right coronary artery were significantly reduced ($p < 0.05$), and LVEF was significantly increased

Table 3. Comparison of various laboratory indicators between the Kawasaki disease and control groups ($\bar{x} \pm s$)

Group	n	ESR (mm/h)	CRP(mg/L)	WBC ($\times 10^9$/L)	N(%)	PLT ($\times 10^9$/L)	D-D(mg/L)	RDW(%)	NT-proBNP (pg/mL)
KD group	85	40.43 ± 7.48	65.29 ± 13.20	15.9 ± 2.7	61.12 ± 9.88	332.8 ± 43.1	2.20 ± 0.61	15.84 ± 2.90	223.1 ± 97.5
Control group	100	14.39 ± 2.88	4.10 ± 1.03	5.8 ± 1.2	48.02 ± 7.74	198.6 ± 23.1	0.39 ± 0.14	12.31 ± 1.56	38.6 ± 11.0
t		32.135	46.213	33.707	10.105	26.926	28.806	10.516	18.792
p		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Note: ESR, erythrocyte sedimentation rate; CRP, C reaction protein; WBC, white blood cell; N, neutrophil percentage; PLT, platelet count; D-D, D-dimer; RDW, red cell distribution width; NT-proBNP, N-terminal pro-brain natriuretic peptide.

Table 4. Comparison of cardiac ultrasound results in Kawasaki disease children with and without coronary lesions ($\bar{x} \pm s$)

Group	n	Left main coronary artery (Z value)	Left anterior descending branch (Z value)	Right coronary artery (Z value)	Left ventricular ejection fraction was (%)
Coronary lesion group	32	6.74 ± 1.46	9.14 ± 1.82	7.32 ± 1.85	66.26 ± 3.11
Non-coronary lesion group	53	3.76 ± 1.38	4.87 ± 1.56	5.00 ± 1.66	68.38 ± 4.14
t		9.438	11.477	5.971	–2.500
p		< 0.001	< 0.001	< 0.001	0.014

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($p < 0.05$). The left main coronary artery, left anterior descending artery and right coronary artery in children without KD were not statistically significant ($p > 0.05$, Table 6).

Comparison of laboratory indicators before and after treatment of children with Kawasaki disease

After treatment, the levels of ESR, CRP, WBC, N, PLT, D, D-D, RDW and NT-proBNP values of KD children with and without coronary artery disease significantly decreased compared with pre-treatment levels ($p < 0.05$, Table 7).

Discussion

The incidence of KD is steadily rising each year, and coronary disease stands as one of its severe complications, posing significant risks to children's health. Identifying sensitive factors that reflect the onsite of coronary lesions in children with KD is crucial for timely

Table 5. Comparison of various laboratory indicators in Kawasaki disease children with and without coronary lesions ($\bar{x} \pm s$)

Group	n	ESR (mm/h)	CRP (mg/L)	WBC (×10^9/L)	N(%)	PLT (×10^9/L)	D-D(mg/L)	RDW(%)	NT-proBNP (pg/mL)
Coronary lesion group	32	48.19 ± 7.22	79.24 ± 12.89	16.3 ± 2.5	73.05 ± 9.43	371.2 ± 41.4	2.54 ± 0.60	17.51 ± 2.74	481.5 ± 94.1
Non-coronary lesion group	53	35.74 ± 6.85	56.87 ± 11.46	15.7 ± 2.3	53.92 ± 8.75	309.7 ± 38.9	1.99 ± 0.56	14.83 ± 2.65	67.1 ± 17.9
t		7.955	8.317	1.128	9.484	6.893	4.271	4.460	31.253
p		< 0.001	< 0.001	0.263	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Table 6. Comparison of cardiac colour ultrasound findings before and after treatment of children with Kawasaki disease ($\bar{x} \pm s$)

Group	Time	Left main coronary artery (Z value)	Left anterior descending branch (Z value)	Right coronary artery (Z value)	Left ventricular ejection fraction was (%)
Coronary artery disease group (n=32)	Pretherapy	6.74 ± 1.46	9.14 ± 1.82	7.32 ± 1.85	66.26 ± 3.11
	Post-treatment	4.55 ± 1.20	6.47 ± 1.60	5.98 ± 1.46	68.10 ± 4.00
	t	6.555	6.233	3.216	–2.054
	p	<0.001	<0.001	0.002	0.044
Non-coronary lesion group (n=53)	Pretherapy	3.76 ± 1.38	4.87 ± 1.56	5.00 ± 1.66	68.38 ± 4.14
	Post-treatment	3.45 ± 1.14	4.46 ± 1.48	4.81 ± 1.50	68.81 ± 4.40
	t	1.261	1.388	0.618	–0.518
	p	0.210	0.168	0.538	0.605

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Table 7. Comparison of laboratory indicators before and after treatment of children with Kawasaki disease ($\bar{x} \pm s$)

Group	Time	Erythrocyte sedimentation rate (mm/h)	CRP (mg/L)	WBC (×10⁹/L)	N(%)	PLT (×10⁹/L)	D-D (mg/L)	RDW(%)	NT-proBNP (pg/mL)
Coronary artery disease group (n=32)	Pretherapy	48.19 ± 7.22	79.24 ± 12.89	16.3 ± 2.5	73.05 ± 9.43	371.2 ± 41.4	2.54 ± 0.60	17.51 ± 2.74	481.5 ± 94.1
	Post-treatment	26.10 ± 5.57	7.40 ± 3.30	5.9 ± 1.8	54.74 ± 8.80	241.8 ± 28.6	0.66 ± 0.16	15.60 ± 2.43	134.8 ± 36.8
	t	13.703	30.542	19.097	8.030	14.547	17.126	2.950	19.410
	p	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	< 0.001
Non-coronary lesion group (n=53)	Pretherapy	35.74 ± 6.85	56.87 ± 11.46	15.7 ± 2.3	53.92 ± 8.75	309.7 ± 38.9	1.99 ± 0.56	14.83 ± 2.65	67.1 ± 17.9
	Post-treatment	18.30 ± 4.31	4.31 ± 0.93	5.6 ± 1.2	48.54 ± 7.70	213.5 ± 28.4	0.40 ± 0.13	12.50 ± 1.89	43.0 ± 14.5
	t	15.688	33.280	28.343	3.360	14.541	20.135	5.211	7.616
	p	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001

and accurate assessment of condition. This knowledge enables healthcare professionals to implement treatment measures promptly, thereby enhancing the prognosis of children.

Standardisation of coronary diameter measurement to Z value can assess the location of coronary diameter and risk stratification. The results of this study showed that Z values of left main coronary artery, left anterior descending artery and right coronary artery in KD group were greater than those of control group, and there was no significant difference between LVEF of KD group and control group. Z values of the above artery in KD children with coronary artery disease were higher than those in KD children without coronary artery disease, and LVEF was lower than that in KD children without coronary artery disease. The findings mentioned above indicate that the identified indicators can serve as a foundation for evaluating the occurrence of coronary lesions in children with KD. A higher Z value suggests greater arterial inflammation and more profound coronary dilation. Left ventricular ejection fraction is commonly utilised as an indicator of cardiac function. Children with coronary lesions often exhibit impaired cardiac function, leading to abnormal levels of this index (Wang et al, 2021). This study revealed improvement in the aforementioned indicators following the treatment of children with KD, reinforcing their significance in assessing treatment effectiveness and disease prognosis.

The study findings revealed that levels of CRP, N, PLT, ESR, D-D, NT-proBNP, and RDW were elevated in the KD group compared to the control group. Additionally, the levels of these indicators were significantly higher in children with KD who had coronary lesions compared to those without coronary lesions. C-reactive protein and N levels are indicative of the inflammatory response, and their elevation can heighten the risk of cardiovascular disease in children with KD (Seki and Minami, 2022; Piccinelli et al, 2023). Platelets play a crucial role in systemic vascular inflammation in KD. As children with KD experience immune vascular damage, platelet aggregation and activation, they may produce substantial amounts of platelet growth factors (Martínez-Ramírez et al, 2023). Following platelets aggregation and immune complexes formation, body will release a significant amount of histamine, induce vascular inflammation, and then cause coronary endothelial damage. This process ultimately results in artery wall destruction and the development of coronary lesions. A study has indicated that (Branchford and Neeves, 2020) the occurrence of coronary artery lesions is closely linked to the hypercoagulable state of blood. The aggregation of inflammatory factors will aggravate the damage to coronary arteries and endothelial cells, affect the balance state of fibrinolytic system, and induce hypercoagulable state. Inflammatory

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response not only impairs fibrinolytic system but also leads to a hypercoagulation state. This hypercoagulation state, in turn, exacerbates the existing inflammatory response. All of these conditions can contribute to abnormal dilatation of coronary arteries and exacerbate the progression of the disease (Lu et al, 2022). Consequently, the KD group with coronary lesions exhibited higher levels of ESR, PLT, and D-D levels. The aggregation of numerous inflammatory mediators further promotes erythrocyte sedimentation. Therefore, coronary lesions in children with KD can be assessed by detecting the above-mentioned indicators.

When coronary lesions manifest in children with KD, cardiomyocytes may undergo ischaemic necrosis, in response to inflammatory cytokines stimulation, these cardiomyocytes may secrete NT-proBNP. Serum NT-proBNP also possesses the characteristics of a long half-life, excellent stability, and minimal individual variation. Therefore, detecting NT-proBNP level is important for diagnosing KD and determining whether it is complicated with coronary lesions. The study suggested (Bai and Zhang, 2022) a certain correlation between NT-proBNP levels and both the hypercoagulable state of blood and inflammatory response. To target KD children with elevated NT-proBNP expression, early intervention is crucial to prevent the development of coronary lesions. A higher RDW level indicates a greater disparity in volume between erythrocytes (Liu et al, 2022). The primary pathological changes in KD involve vasculitis reactions, where the excessive production of inflammatory factors hampers the maturation of red blood cells. Consequently, a substantial number of immature red blood cells are released into the bloodstream. Additionally, the significant release of inflammatory factors increases red blood cell volume heterogeneity and elevates RDW levels by inhibiting the bone marrow stimulation response to EPO. The detection of the RDW levels may offer valuable evidence for diagnosing children with KD.

This study suggested that after treatment, levels of ESR, CRP, WBC, N, PLT, D-D, RDW, and NT-proBNP values in KD children with and without coronary artery disease significantly decreased compared to their corresponding levels before treatment. Moreover, after treatment, the levels of these indicator in KD children without coronary lesions were lower compared to those in the KD children with coronary lesions after treatment. This suggests that the level of the aforementioned index can effectively evaluate the treatment effect and prognosis of patients. Studies have reported that elevated levels of CRP and N levels in children with KD are prone to coronary lesions, which aligns with the findings of this study (Clark et al, 2021).

This study innovatively combines ultrasound coronary artery examination with blood biochemical indicators such as RDW and NT proBNP to conduct a in-depth and systematic analysis of KD patients with coronary artery lesions. This approach significantly enhances diagnostic accuracy and sensitivity. By comprehensively analysing these indicators, we have more comprehensively elucidated the characteristics and progression of coronary artery disease in KD patients, providing a new perspective for clinical diagnosis and treatment. Furthermore, the study also investigated the close relationship between coronary artery disease in KD patients and levels of RDW and NT proBNP, providing important basis for developing targeted treatment plans. Additionally, this study focused on the changes in ultrasound parameters and biochemical indicators of KD patients after treatment, offering new reference indicators for evaluating treatment effectiveness.

Kawasaki disease induced cardiovascular damage through multiple factors and mechanisms. This study analysed inflammatory indicators and coronary artery Z value to establish a diagnostic basis for accessing the occurrence of coronary lesions in children with KD. However, the small sample size of this study may introduce bias into the results. Therefore, expanding the sample size and variables is necessary to further validate the findings of this study in the future.

Conclusion

In conclusion, KD children with coronary lesions exhibit a significantly increase in coronary vessels diameter, as well as elevated levels of RDW and NT-proBNP. The integration of ultrasound examination with RDW and NT-proBNP assessment can serve as a valuable

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tool to determine the presence of coronary lesions in children with KD and to evaluate the effectiveness of clinical treatment.

Key points

- Kawasaki disease is an acute inflammatory condition primarily affecting the young children.
- Kawasaki disease patients with coronary artery lesions exhibit significantly increased coronary artery vessel diameter.
- Elevated red cell distribution width and N-terminal pro-brain natriuretic peptide concentration.
- The combined use of ultrasound combined with red cell distribution width and N-terminal pro-brain natriuretic peptide examination can assist in determining whether Kawasaki disease patients have coronary artery lesions.

Author details

[1]Department of Pediatrics, Haining People's Hospital, Haining, Zhejiang, China

[2]Pediatric Intensive Care Unit, Children's Hospital, Zhejiang University School of Medicine, Hangzhou, Zhejiang, China

[3]Department of Ultrasound, Haining People's Hospital, Haining, Zhejiang, China

[4]Department of Quality Inspection, Haining People's Hospital, Haining, Zhejiang, China

[5]Department of Laboratory, Haining People's Hospital, Haining, Zhejiang, China

Availability of data and materials

All data and materials generated or analysed during this study are included in this published article.

Author contributions

Study concepts: WG; Study design: ZC, YingL; Definition of intellectual content: ZC, XB; Data analysis: YingL, XB, MC; Statistical analysis: YiL, MC; Manuscript drafting: YiL, MC and WG; Manuscript review and guarantor of the integrity of the entire study: WG. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Haining People's Hospital (No.2024-067). All participants signed an informed consent form.

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Conflict of interest

The authors declare no conflict of interest.

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