

ORIGINAL ARTICLE

Parental genetic knowledge and attitudes toward childhood genetic testing for inherited eye diseases

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Abstract

Background: This study aimed to explore the parental genetic knowledge and attitudes toward childhood genetic testing of the inherited eye diseases (IEDs) in China.

Methods: This is a cross-sectional survey. All parents were assessed via self-administered questionnaires. Data were collected through the Internet at the pediatric eye clinics in a tertiary referral eye hospital.

Results: In total, 359 parents were included into this survey. The proportion of correctly answered the factual genetic knowledge questionnaire ranged from 35.7% to 81.3%, which is positively correlated to the educational levels and household per capita income. The attitudes toward childhood IEDs genetic testing appeared to be consistent. More factual genetic knowledge was predictive for a favorable attitude toward genetic testing. Han Chinese might be slightly more likely to have a favorable attitude. Interestingly, the higher educational levels and lower monthly incomes were predictive factors for a reserved attitude toward genetic testing. The families without history of IEDs were more inclined to remain a reserved attitude than those with family history of IEDs.

Conclusion: This study illustrated that more factual genetic knowledge was considered as an indicator for the favorable attitudes. Therefore, the effective strategies should be taken to provide the correct knowledge of genetics and genetic testing to parents, especially those who need to make an informed decision thereon to undertake childhood genetic testing.

KEYWORDS

genetic testing, genetics, inherited eye disease, knowledge, parents, pediatrics

1 | INTRODUCTION

Clinically and genetically, inherited eye diseases (IEDs) are a heterogeneous group of disorders that are important causes of childhood visual impairment. Approximately 30%

of childhood blindness worldwide was attributable to hereditary causes, and the number was increasing (Gilbert & Foster, 2001). There is a clear association between IEDs, which include familial exudative vitreoretinopathy, retinitis pigmentosa, Stargardt disease, and Leber congenital amaurosis, and

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hereditary gene mutations (Zhang et al., 2019). Over the past 20 years, scientific understanding of the relationship between eye diseases and genetics has improved greatly (Ahram, Soubani, Abu Salem, Saker, & Ahmad, 2015).

Adequate knowledge regarding the genetic component of diseases as well as personal attitudes toward DNA-testing are major determinants of optimizing the use of genetic testing (Cappelli et al., 1999). Several population studies, including studies in the Finnish and Dutch populations, have generally shown a lack of understanding of genes and heredity (Henneman, Timmermans, & van der Wal, 2004; Jallinoja & Aro, 1999). Morren et al. examined perceived knowledge and attitudes toward DNA-testing because of the significance they have for chronically ill patients and their families and offspring (Morren, Rijken, Baanders, & Bensing, 2007). Their results showed low levels of perceived knowledge, especially in older and less educated patients with chronic diseases.

Identifying differences in viewpoints on genetic testing has grown in importance, and most studies have been carried out to assess the association between genetic knowledge and attitudes toward genetic testing among people in the United States or Europe countries (Calsbeek, Morren, Bensing, & Rijken, 2007; Haga et al., 2013; Hann et al., 2017; Henneman et al., 2004). Attitudes toward genetic testing were found to be generally favorable, especially in younger and more educated patients. Higher levels of perceived knowledge were associated with more favorable attitudes (Calsbeek et al., 2007; Haga et al., 2013). In addition, some studies showed that the participants still had recognized the potential benefits and limitations of genetic testing, although they lacked scientific genetic knowledge (Chen, Xu, Huang, & Dhar, 2013; Johnson, Gaitanis, & Morrow, 2011; Jordan & Tsai, 2010).

Because the onset of most IEDs is during childhood, loss of visual acuity usually begins in the first two decades of life. Parents play an important role in opting for genetic testing. To our knowledge, no existing research has exhaustively explored the attitudes of parents and the public in Western countries toward childhood genetic testing, and few studies have been conducted in Asia. Our previous study indicated that, qualitatively, parental insufficient genetic knowledge might affect their attitudes toward childhood genetic testing of inherited retinal diseases in China (Zhang et al., 2019). Thus, this study aimed to investigate parental current genetic knowledge and the relationship between parental genetic knowledge and attitudes toward childhood IEDs genetic testing quantitatively.

2 | MATERIALS AND METHODS

2.1 | Study population

Parents were recruited from the pediatric retina service of the Zhongshan Ophthalmic Center, Sun Yat-sen University from

September to November 2019. The parents of all potential patients were approached for participation at the registration desk as they checked in for their initial consultation.

2.2 | Design

The data were gathered using a cross-sectional questionnaire. The questionnaire was based on previous studies (Jallinoja & Aro, 1999; Morren et al., 2007; Zhang et al., 2019), but it was expanded upon for this study based on the literature and discussion among members of a multidisciplinary research team (X.D. and W.C.). Parents were invited to scan the two-dimensional barcode that was linked to the electronic questionnaire and participate anonymously. The study was approved by the Institutional Review Board of the Zhongshan Ophthalmic Center. All procedures were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Written informed consent was obtained from all parents.

2.3 | Measurement

2.3.1 | Demographic data

Parents were asked about their sex, age, ethnicity, education, marital status, income, and family history. Respondents were also asked whether they intended to reproduce or not.

2.3.2 | Factual genetic knowledge

A summary index, which was developed by Jallinoja and Aro, was employed and measured genetic knowledge by means of 16 structured items on genes and heredity in general (Jallinoja & Aro, 1999). For our study, this summary index was translated into Chinese and cross-culturally adapted. Ultimately, 12 items were used in our study population (Table 2). The items measured knowledge about the associations between genes, chromosomes, cells, and the body. A summary index of the correct answers was formed (score 1: correct, score 0: incorrect/do not know/missing data). The reliability of this summary index (Cronbach's alpha) was 0.861. Test-retest reliability, estimated by calculating the intra-class correlation coefficient, was .847.

2.3.3 | Attitudes

Attitudes toward genetic testing were examined using 12 statements (Table 4). These items were also adapted and modified

from the literature (Morren et al., 2007; Zhang et al., 2019). Items were scored based on a 5-point scale (1 = totally disagree; 2 = disagree; 3 = do not know; 4 = agree; 5 = totally agree). Two scales were then composed to measure a favorable attitude that included five statements on the pros of genetic testing (e.g., “I approve of using DNA-testing for early detection of diseases”) or a reserved attitude that included seven statements on the cons of genetic testing (e.g., “I worry about the consequences of genetic testing for being able to take out my children's insurance”). Total scores for each scale were calculated by adding up the item scores, with favorable attitudes ranging from 5 to 25 (Cronbach's alpha = 0.792) and reserved attitudes ranging from 7 to 35 (Cronbach's alpha = 0.793). Test–retest reliability (intra-class correlation coefficient) was 0.792 and 0.793, separately. As the scales measured two different concepts that were not well correlated ($r = -.16$), they were not added up to create one total genetic attitude scale. This phenomenon of creating two independent dimensions measuring a rather positive and a rather negative attitude is supported by former research (Calsbeek et al., 2007).

2.4 | Statistical analysis

Statistical analysis was performed using SPSS version 17.0 (SPSS, Chicago, IL, USA). Descriptive statistical analysis was calculated to estimate frequencies, means, and standard deviations of the study variables. The responses for the factual genetic knowledge questionnaire were compared to early reports (Calsbeek et al., 2007; Haga et al., 2013), using the chi-squared test, with a Bonferroni correction for the number of questions in the measure of knowledge. Multivariate linear regression models for factual genetic knowledge and two dimensions of attitudes were conducted separately and included all participant characteristics in an Enter manner with likelihood ratio tests. Two-sided p values are reported for all tests using a Type I error level of .05 to indicate statistical significance.

3 | RESULTS

3.1 | Sample characteristics

There were 380 participants invited to the online survey. Eleven refused to respond to the survey. About 369 parents were finally enrolled in this study, and the overall response rate was 97.1%. Among these eligible participants, 10 were children's siblings rather than parents. Thus, 359 parents were finally included in our study. Participant characteristics are reported in Table 1. Among the participants, 67.7% ($n = 243$) were mothers, and 32.3% ($n = 116$) were fathers. Age group included ≤ 20 years old ($n = 8$; 2.2%), 21 to 30

TABLE 1 Sociodemographic characteristics of parents ($n = 359$)

Items	<i>N</i>	%
Gender		
Male	116	32.3
Female	243	67.7
Age (years)		
≤ 20	8	2.2
21–30	138	38.4
31–40	192	53.5
≥ 41	21	5.8
Ethnicity		
Han	337	93.9
Other	22	6.1
Educational levels		
Medical school or less	70	19.5
High school diploma	83	23.1
College graduate	186	51.8
Master or higher	20	5.6
Marriage status		
Married	349	97.2
Unmarried	4	1.1
Divorce or separation	4	1.1
Widowed	2	0.6
Household per capita income (CNY)		
$\leq 5,000$	116	32.3
5,001–10,000	138	38.4
10,001–20,000	61	17.0
$> 20,000$	44	12.3
Family history of IEDs		
Yes	39	10.9
No	320	89.1
Whether you have IEDs		
Yes	11	3.1
No	289	80.5
Whether to reproduce or not		
Yes	71	19.8
No	207	57.7
Not sure	81	22.6

Abbreviation: IEDs, inherited eye diseases.

years old ($n = 138$; 38.4%), 31–40 years old ($n = 192$; 53.5%) and ≥ 41 years old ($n = 21$; 5.8%). About 93.9% ($n = 337$) were Han Chinese, and 6.1% ($n = 22$) were ethnic minorities. The proportion of participants with a college degree or higher was 57.4% ($n = 206$). As for family history, 10.9% ($n = 39$) indicated that they had a family history of IEDs. In terms of household per capita income, 32.3% ($n = 116$) reported that it was less than or equal to 60K CNY.

3.2 | Factual genetic knowledge

The cumulative proportion of respondents with correct answer from the factual genetic knowledge questionnaire is presented in Table 2. The proportion ranged from 35.7% (128/359) to 81.3% (292/359) (overall mean = 59.2%; median = 63.1%). The item known most often (“One can see a gene with the naked eye”) was correctly answered by 81.3% (292/359) of the parents. Eighty-percent (287/359) correctly answered true to item 3 (“A gene is a molecule that controls hereditary characteristics”), and 77.7% (279/359) correctly answered true to item 10 (“The onset of certain diseases is due to genes, environment, and lifestyle”). For item 4, 76.9% (276/359) correctly answered true (“Gene are inside cells”). Items (5), (7), (8), and (11) were often answered incorrectly and might identify areas to target for further education. The items known the least concerned statements about associations between genes, chromosomes, cells, and the body (“A gene is a cell”) and (“Genes are bigger than chromosomes”), which were both answered correctly by only 36.0% of parents. Only 39.3% of parents (141/359) correctly answered item 8

(“The genotype is not susceptible to human intervention”), and 41.5% (149/359) correctly answered true to item 11 (“The carrier of a disease gene may be completely healthy”). Participants had similar average subsection proportion for questions regarding genetic scientific facts (59.4%) and questions pertaining to the disease-related concepts (58.8%).

In comparison to previous studies, they had the same demographic characteristics, for example, age, gender. A significantly smaller proportion of our study population had correct responses on each item of the factual genetic knowledge questionnaire compared to a U.S. study (Haga et al., 2013), which explored the genetic knowledge in a community-based population for genomic risk of type 2 diabetes mellitus. In their study, 65.0% of participants had a college degree and 22.0% of them had an annual household income less than 20K dollars. In addition, 60.0% were White ethnicity, and 29.0% were Black or African-American. For the majority of items on the factual genetic knowledge questionnaire, participants in our study had significantly more genetic knowledge than a Netherlands population (Calsbeek et al., 2007), for which, patients were selected from the Panel

TABLE 2 Parents' factual genetic knowledge (n = 359)

	Current study population (n = 359)	Patient population		General population	
		Calsbeek et al. (2007) (n = 306) ^a	p	Haga et al. (2013) (n = 300) ^b	p
Genetic scientific facts					
1. One can see a gene with a naked eye.	292 (81.3)	230 (75.0)	.120	297 (99.0)	<.001
2. A gene is a disease.	221 (61.6)	217 (71.0)	.038	294 (98.0)	<.001
3. A gene is a molecule that controls hereditary characteristics.	287 (79.9)	159 (52.0)	<.001	252 (84.0)	.291
4. Genes are inside cells.	276 (76.9)	129 (42.0)	<.001	279 (93.0)	<.001
5. A gene is a cell.	130 (36.2)	89 (29.0)	.020	222 (74.0)	<.001
6. A gene is a part of a chromosome.	232 (64.6)	104 (34.0)	<.001	273 (91.0)	<.001
7. Genes are bigger than chromosomes.	128 (35.7)	64 (21.0)	<.001	249 (83.0)	<.001
8. The genotype is not susceptible to human intervention.	141 (39.3)	50 (16.0)	<.001	75 (25.0)	<.001
Average subsection proportion	59.4	42.5	—	80.9	—
Disease-related concepts					
9. Healthy parents can have a child with a hereditary disease.	237 (66.0)	225 (75.0)	.190	291 (97.0)	<.001
10. The onset of certain diseases is due to genes, environment, and lifestyle.	279 (77.7)	225 (75.0)	.051	294 (98.0)	<.001
11. The carrier of a disease gene may be completely healthy.	149 (41.5)	202 (66.0)	<.001	285 (95.0)	<.001
12. All serious diseases are hereditary.	179 (49.9)	181 (59.0)	.165	294 (98.0)	<.001
Average subsection proportion	58.8	68.8	—	97.0	—
Overall average proportion	59.2	51.3	—	86.3	—

^aStudy population for Calsbeek et al. (2007) were enrolled in the Panel of Patients with Chronic Diseases in the Netherlands and diagnosed with a chronic disease.

^bStudy population for Haga et al. (2013) were from general population, and selected from the Durham, NC through newspaper advertisements, flyers on the Duke University's campus and throughout the community, posters on public transit buses, and online advertisements in America.

TABLE 3 Regression analyses of factual genetic knowledge (n=359)

	Unstandardized B	Standardized coefficients beta	t	p
Gender	-0.498	-0.075	-1.561	.119
Age	-0.205	-0.041	-0.865	.388
Ethnicity	0.234	0.018	0.383	.702
Marriage	0.609	0.063	1.321	.187
Educational Level	1.603	0.447	8.911	<.001
Household per capita income	0.254	0.115	2.299	.022
Family history of IEDs	-0.382	-0.038	-0.819	.413
Whether to reproduce or not	-0.042	-0.009	-0.186	.853
F-value	14.175	—	—	<.001
R ² -Adjusted	.227	—	—	—

Abbreviation: IEDs, inherited eye diseases.

of Patients with Chronic Disease in a nationwide longitudinal study in the Netherlands since 1998. Also, 18.0% of the participants had high-level education. Multivariate linear analysis revealed higher education level and higher household per capita income, to be important predictive factors for superior factual genetic knowledge (Table 3).

3.3 | Attitudes toward genetic testing

When asked about their attitude toward childhood genetic testing, 41.2% of parents indicated that they were somewhat in favor of childhood genetic testing, and 26.5% reported that they were extremely supportive. Most parents expressed that they agreed or strongly agreed with positive attitudes toward childhood genetic testing (Table 4). For example, 69.9% ($n = 251$) of parents indicated that they agreed or strongly agreed that the results of genetic testing would help diagnose their child's diseases or improve treatments for their child's diseases ($n = 238$; 66.3%).

Attitudes were relatively consistent regarding the consequences of childhood genetic testing. Regarding their decision to have another child, 51.0% ($n = 183$) of parents thought the results would have an influence on their decision. More than 30.0% of parents agreed with the possibility that the result of a DNA-test would affect their child's physical and psychological status ($n = 116$; 32.3%) or affect their child's eligibility for health insurance coverage ($n = 124$; 34.5%). There were 93 (25.9%) parents who were worried about the consequences of testing on family relationships. Less than 25.0% of parents were worried about the likelihood of their child finding a job in the future. There were 72.4% ($n = 260$) of parents who would opt for the genetic test if it was free of charge. Only 20.0% thought that genetic testing would not be necessary because the disease was untreatable.

In the multivariate linear regression model (Table 5), Han Chinese parents ($p = .036$) and parents with superior genetic knowledge ($p < .001$) were more likely to have favorable attitudes toward childhood genetic testing. However, we did not observe any association between genetic knowledge and reserved attitudes. Interestingly, parents with a higher level of education ($p = .008$) and lower household per capita income ($p = .037$) were more likely to express reserved attitudes. In addition, parents without history of IEDs, were more likely to indicate reserved attitudes than those with family history of IEDs ($p = .048$).

4 | DISCUSSION

Advances in applying genetic testing to childhood eye diseases have enabled the identification of previously undiagnosed diseases, recognition of novel presentations of known diseases, and discovery of new syndromes (Domínguez-Carral et al., 2017). Greater scientific understanding of IED-related genetics and genetic testing might improve parents' current attitudes toward childhood genetic testing (Hann et al., 2017; Hashemi-Soteh et al., 2019; Zhang et al., 2019). The present study analyzed parental knowledge of genetics and attitudes toward childhood genetic testing in southern China and investigated how their knowledge of genetics impacted their attitudes toward genetic testing. In summary, parents demonstrated high genetic knowledge and positive attitudes toward genetic testing, although knowledge of potential consequences of genetic testing varied.

Overall, parents demonstrated similar knowledge of genetic scientific facts and disease-related concepts, with approximately three-fifths (59.4% and 58.8%, respectively) correctly judging the items. These results were inconsistent with published findings (Calsbeek et al., 2007; Haga

Items	Strongly agree/agree <i>n</i> (%)	Mean score ^a
Favorable attitudes		
1. I think the development of DNA research is hopeful for the treatment of diseases.	238 (66.3)	3.88 ± 0.90
2. I approve of using DNA-testing for early detection of diseases.	251 (69.9)	3.95 ± 0.86
3. I would inform my spouse about the results of a DNA-test for a specific disease.	317 (88.3)	4.21 ± 0.74
4. I want to know whether my children's disease is hereditary.	310 (86.4)	4.21 ± 0.77
5. I would inform my siblings about the results of a DNA-test for a specific disease.	133 (37.0)	3.03 ± 1.13
Reserved attitudes		
6. I worry about the consequences of genetic testing for being able to take out my children's insurance.	124 (34.5)	3.23 ± 0.95
7. As long as a disease cannot be treated, I do not want my children undertake genetic testing.	71 (20.0)	2.61 ± 1.10
8. I worry about the consequences of DNA-testing for the chances of finding a job.	86 (24.0)	2.94 ± 1.00
9. Telling my children the results of genetic testing will affect their physical and psychological health.	116 (32.3)	3.01 ± 1.04
10. The positive results of children's genetic testing will affect family relationship (e.g., Spousal relationship, mother-in-law, and daughter-in-law).	93 (25.9)	2.84 ± 1.05
11. The results of genetic testing would have an influence on my decision to have another child.	183 (51.0)	3.42 ± 1.08
12. If genetic testing is free of charge, my children will take the test.	260 (72.4)	4.00 ± 0.93

Abbreviation: IEDs, inherited eye diseases.

^aMean score (items were answered on a 5-point scale: 1 = totally disagree to 5 = totally agree).

TABLE 4 Parents' attitudes toward IEDs childhood genetic testing (n=359)

et al., 2013; Jallinoja & Aro, 1999). The proportions were far lower than those in a U.S. population-based study (80.9% and 97.0%, respectively) and slightly higher than the results of a European study (42.5% and 68.8%, respectively). Considering disparities in genetic knowledge level, this inconsistency might result from different proportion of high educational level and cultural differences of these study populations. Additionally, there could also be differences between the Chinese, American, and Dutch science education curricula and health systems (Haga et al., 2013).

We found a positive correlation between education and household per capita income with the level of genetic knowledge, which was in line with the study (Haga et al., 2013). There might be a lack of formal way of acquiring genetic counseling, or obtain insufficient information about eye-related gene and genetic testing from doctors for those parents.

Apart from assessing the level of genetic knowledge, we investigated whether it affected attitudes toward genetic testing. Several studies had investigated the potential benefits and limitations of genetic testing and found consistency in the

attitudes of parents toward genetic testing (Chen et al., 2013; Johnson et al., 2011; Jordan & Tsai, 2010). The majority appeared to be in favor of the medical possibilities of genetic testing in general. When it came to reserved attitudes, parents were mainly concerned about the charge of genetic testing, which we similarly found in our previous qualitative study (Zhang et al., 2019). This result indicated that if genetic testing was covered by medical insurance, parents would be more likely to accept it.

An interesting finding of our study was that a favorable attitude appeared to be partly determined by the level of factual genetic knowledge, while no relationship with having a reserved attitude was observed. These results were different from the results of previously published reports (Calsbeek et al., 2007; Haga et al., 2013; Jallinoja & Aro, 1999). It was possible that there was biased reporting in the media of the benefits of genetic research compared to its potential harms as a medical application. Some parents in our study might not be made informed decisions regarding clinical uses of genetic or genomic testing. Thus, efforts were needed to educate

TABLE 5 Regression analyses of favorable and reserved attitudes toward IEDs childhood genetic testing (n=359)

	Favorable attitude				Reserved attitude			
	Unstandardized B	Standardized Coefficients Beta	t	p	Unstandardized B	Standardized coefficients beta	t	p
Gender	0.542	0.077	1.497	.135	-0.075	-0.007	-0.135	.893
Age	-0.025	-0.005	-0.092	.927	-0.134	-0.018	-0.328	.743
Ethnicity	-1.449	-0.106	-2.102	.036	-0.382	-0.019	-0.363	.717
Marriage	-0.467	-0.046	-0.893	.372	0.436	0.029	0.545	.586
Educational Level	0.203	0.053	0.901	.368	0.914	0.166	2.654	.008
Household per capita income	0.027	0.012	0.215	.830	-0.404	-0.119	-2.098	.037
Family history of IEDs	-0.876	-0.083	-1.659	.098	-1.602	-0.105	-1.986	.048
Whether to reproduce or not	0.064	0.013	0.253	.800	-0.268	-0.037	-0.689	.492
Knowledge of gene and genetic testing	0.319	0.302	5.284	<.001	0.075	0.049	0.811	.418
F-value	6.401	—	—	<.001	1.968	—	—	.042
R ² -Adjusted	.120	—	—	—	0.024	—	—	—

Abbreviation: IEDs, inherited eye diseases.

clinicians about some of these issues so that they could appropriately inform parents about the risks and benefits of genetic testing.

Taking the sociodemographic composition into account, having a reserved attitude varied according to education, income level and family history, which is consistent with previous studies (Haga et al., 2013). Otherwise, comparing to ethnic minorities in China, Han Chinese might be slightly more likely to have a favorable attitude. Several previous studies also had suggested that people from ethnic minority groups might have greater concerns about genetic testing than the ethnic majority (Armstrong et al., 2012; Sussner, Thompson, Jandorf, et al., 2009; Sussner, Thompson, Valdimarsdottir, Redd, & Jandorf, 2009). However, only 6.1% of the respondents in our study were ethnic minorities, so the ethnic disproportion may have affected the results. Thus, further studies were needed to illustrate the effect of ethnic on the attitude toward genetic testing.

There are several limitations to this study. First, patients were recruited from a referral center for pediatric retinal diseases, so the selection bias was unavoidable. Second, although applying the web-based method allowed us to collect data from a large number of subjects in a short period of time, parents who were unable to complete the questionnaire were not included. Third, the recruited respondents were parents whose children not always had IEDs. Fourth, the survey was conducted in an urban area. Accordingly, the majority of parents might have already attained the relevant genetic knowledge and have also had a strong willingness to consult a physician. Taken together, these

factors might contribute to relatively high scores for genetic knowledge. Considering these limitations, the results of this study might be biased and could not be generalized throughout the country.

In conclusion, the majority of parents who participated in this study had a high level of genetic knowledge. As for attitudes toward childhood genetic testing, the parents had more positive attitudes toward genetics, which was based on their genetic knowledge. Sociodemographics, such as ethnicity, education level, income level, and family history should be taken into consideration because parental genetic knowledge and attitudes toward genetic testing varied according to different sociodemographic characteristics. Above all, we suggested providing accurate and complete information to parents whose children might be scheduled for genetic testing. Personalized education should be emphasized to clinicians or genetic consultants, which would help them assist parents in making informed decisions.

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CONFLICT OF INTEREST

The authors have no conflict interests to report.

AUTHORS' CONTRIBUTIONS

All authors were involved in revising the test critically for important intellectual content, and all authors approved the final version to be published. HMX and XYD are responsible for the study conception and design. YZ and SJH collected the samples and clinical parameters. YZ are responsible for the analysis and interpretation of data. YZ and SJH drafted the article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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