Gastrointestinal system malformations in children are associated with congenital heart defects

Gastrointestinal sistem malformasyonları çocuklarda doğumsal kalp defektleri ile ilişkilidir

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ABSTRACT

Objective: To determine the frequency of congenital heart defects (CHD) in children with gastrointestinal malformations (GISM) and mortality rates in patients with GISM.
Methods: Two hundred and forty two consecutive children patients with GISM followed up in Pediatric Surgery Clinics of our hospital were examined for cardiovascular anomaly by the Department of Pediatric Cardiology, and the CHD incidence was investigated by examining the records of the patients retrospectively. Chi-square test was used for the statistical analysis of data.
Results: Two hundred and forty two patients with gastrointestinal system malformations were included in the study. Of 242 patients, 135 (55.8%) were male and 107 (44.2%) were female, and their age range was 0-15 years. The most frequent GISM were anorectal malformations (43.2%), atresia involving stomach, ileum or colon (21%) and esophageal atresia/tracheoesophageal fistula (18.3%). Congenital heart defects were observed in 28.5% of the participants. The most frequent defects were as follows; atrial septal defect (31 patients, 44.9%) a, ventricular septal defect (17 patients, 24.6%) and patent ductus arteriosus (5 patients, 7.2%). There was no significant difference ($p>0.05$) in mortality rate in patients with CHD (16.7%) and without CHD (13.3%) undergoing operations for GISM.
Conclusion: We would like to emphasize the importance of the earliest possible cardiological evaluation of all patients with gastrointestinal system malformations. *(Anadolu Kardiyol Derg 2011; 2: 146-9)*
Key words: Gastrointestinal system malformation, congenital heart defect, echocardiography, children, disease incidence

ÖZET

Amaç: Gastrointestinal sistem malformasyonlu (GİSM) çocuklarda doğumsal kalp hastalıklarının sıklığını ve mortalite ile ilişkisini saptamak.
Yöntemler: Hastanemizin, Çocuk Cerrahisi Kliniğinde GİSM nedeniyle izlenen ve kardiyolojik inceleme yapılan ardışık 242 çocuk hastanın kayıtları retrospektif olarak incelenerek, GİSM olan çocuk hastalarda doğumsal kalp defektlerinin (DKH) insidansı araştırılmıştır. Verilerin istatistiksel değerlendirmesinde Ki-kare testi kullanılmıştır.
Bulgular: GİSM saptanan, yaşları 0 gün ile 15 yıl arasında değişen 242 hasta değerlendirildi. Hastaların 135'i (%55.8) erkek, 107'si kız (%44.2) idi. En sık görülen gastrointestinal malformasyonları anorektal malformasyon (%43.2), mide, ileum veya kolon atrezisi (%21) ve özofajiyal atrezi/ trakeoözofajiyal fistül (%18.3) idi. Hastaların %28.5'inde doğumsal kalp hastalığı saptanmış olup, en sık gözlenen anomaliler; olguların 31'inde (%44.9) atriyal septal defekt, 17'sinde (%24.6) ventriküler septal defekt, 5'inde (%7.2) patent duktus arteriyozus idi. GİSM nedeni ile ameliyat edilen doğumsal kalp hastalığı olan (%16.7) ve olmayan (%13.3) hastalar arasında mortalite açısından anlamlı fark saptanmadı ($p>0.05$).
Sonuç: Gastrointestinal sistem malformasyonu saptanan hastaların erken dönemde kardiyolojik açıdan değerlendirilmesi gerektiği vurgulanmak istenmiştir. *(Anadolu Kardiyol Derg 2011; 2: 146-9)*
Anahtar kelimeler: Gastrointestinal sistem malformasyonu, doğumsal kalp defekti, ekokardiyografi, çocuk, hastalık insidansı

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The study results were partly presented at the 8th Congress of Pediatric Cardiology and Cardiovascular Surgery, 6-9 May, 2009, Bursa, Turkey

Accepted Date/Kabul Tarihi: 12.07.2010 **Available Online Date/Çevrimiçi Yayın Tarihi:** 23.02.2011

doi:10.5152/akd.2011.034

Introduction

Prevalence of gastrointestinal system malformations (GISM) are 1.3 per 1000 live births (1). Frequency of congenital heart disease (CHD) was higher in the group with GISM compared to normal population (1-4). Detailed investigation of the children with GISM for other system malformations is essential for the treatment of patients with GISM is difficult in the presence of coexisting anomaly (5). Association between ventricular septal defect (VSD), patent ductus arteriosus (PDA) and atrial septal defect (ASD) and esophageal atresia/ tracheoesophageal fistula (EA/TEF) and between VSD, ASD and pulmonary stenosis (PS) and anorectal malformation (ARM) have been presented previously (6, 7), however the relation between incidence of CHD and mortality is not well established.

This study aims to investigate the relation between CHD incidence and mortality in the children patients with GISM.

Methods

Consecutive 242 pediatric patients with GISM followed up at Pediatric Surgery Clinics of Dr. Sami Ulus Children Hospital's were examined for cardiovascular anomaly by the Department of Pediatric Cardiology and the CHD incidence was investigated by examining the records of the patients retrospectively.

Gastrointestinal system anomalies were grouped as EA/TEF, ARM, atresias involving stomach, ileum or colon, diaphragmatic hernia, abdominal wall defects, rotation defects, and annular pancreas. Physical examination of all patients was obtained. In all cases with GISM detailed cardiovascular examination including telecardiography, electrocardiography and echocardiography was performed. Hemodynamically insignificant patent ductus arteriosus and patent foramen ovale with no shunt were not considered as congenital heart diseases. Echocardiographic examination was performed using Hewlett Packard Sonos 1000-A (Andover, Massachusetts, USA) 3.5 MHz and 5.5 MHz transducers and since 2005 Vivid 7 pro (General Electric, USA) 3.0 MHz and 7.0 MHz transducers.

Statistical analysis

Data were analyzed using SPSS version 10.0 (Chicago, Illinois, USA) for Windows software. Comparisons were carried out using frequency blocks, descriptive statistics, and Chi-square analyses. Any p value less than 0.05 was considered as statistically significant.

Results

Of 242 patients included in the study, 135 (55.8%) were male and 107 (44.2%) were female, and their age range was 0-15 years. Concerning the patients who were diagnosed during the neonatal period, gestation age was 37.2±2.6 weeks, weight at birth was 2756±612 g, and the mean maternal age was 25.8±5.6 years. Detailed CHD distribution of the patients is presented in Table 1.

Congenital heart defects were observed in 69 patients (28.5%), of which 37 (53.6%) were male and 32 were female (46.4%). There was no statistically significant difference between genders ($p>0.05$). Of 227 patients with a single GISM, 61(26.8%) cases had CHD; and, of 15 patients with more than one GISM, 8 (53.3%) had CHD ($p<0.05$). Congenital heart defect was observed in 28.5% of the participants, namely (by the order of

Table 1. Distribution of CHD in GISM patients

Type of GISM	CHD, n	Frequency of CHD, %	ASD, n	VSD, n	PDA, n	PS, n	Dextrocardia, n	TOF, n	TGA, n	TA, n	AVSD, n	CoA, n	Other, n
ARM	30	27	15	8	2	1		1		1			1 AS, 1 ASD+VSD+PS
EA/TEF	16	34	6	2	2		1		1				2 ASD+VSD+PDA, 1 ASD+VSD, 1 PDA+PS
Atresia involving stomach, ileum or colon	14	25.9	8	4							1		1 ASD+VSD+PDA
Congenital diaphragmatic hernia	4	22.2	2				1					1	
Abdominal wall defect	2	14.3		2									
Rotation anomaly	2	22.2		1									AS
Annular pancreas	1	25			1								
TOTAL	69/242	28.5	31	17	5	1	2	1	1	1	1	1	8

ARM - anorectal malformations, AS - aortic stenosis, ASD - atrial septal defect, AVSD - atrioventricular septal defect, CoA - coarctation of the aorta, CHD - congenital heart disease, EA/TEF - esophageal atresia/tracheoesophageal fistula, GISM - gastrointestinal system malformations, PDA - patent ductus arteriosus, PS - pulmonary stenosis, TGA - transposition of great arteries, TOF - tetralogy of Fallot, TA - tricuspid atresia, VSD - ventricular septal defect

frequency): 31 (44.9%) with ASD, 17 (24.6%) with VSD, 5 (7.2%) with PDA, and 3 with ASD+VSD+PDA, 2 with isolated dextrocardia, and 2 with aortic stenosis (AS). Also ASD+VSD, ASD+VSD + PS, PDA+PS, tricuspid atresia (TA), PS, atrioventricular septal defect (AVSD), coarctation of the aorta (CoA), tetralogy of Fallot (TOF), and transposition of the great arteries (TGA) were observed each in one patient.

Anorectal malformations were observed in 111 (43.2%) children; atresia involving stomach, ileum, or colon in 54 (21%) patients; EA/TEF in 47 (18.3%) cases; congenital diaphragmatic hernia in 18 (7%) patients; abdominal wall defect in 14 children (5.4%); rotation anomaly in 9 (3.5%) cases; and, annular pancreas in 4 (1.6%) patients (Fig. 1).

In this study, eighty nine (36.7%) patients with GISM had one or more than one additional systemic anomalies. Most frequently affected systems were cardiovascular system (28.5%), urinary system (14.4), musculoskeletal system (7.8%), head and face (4.5%), and central nervous system (2.5%). Five patients had Down syndrome and one patient had VATER (vertebral defects, anal atresia, tracheoesophageal fistula and radial-renal dysplasia) association, while four children were described as babies with undefined syndromes. Of the five cases with Down syndrome, four were diagnosed with CHD. Of these four CHD patients with Down syndrome, one had AVSD, one had ASD, and two had VSD.

Upon physical examination of the 69 cases with CHD, three patients were cyanotic, and 28 had different murmurs. In 41 children with CHD, no murmurs were detected. Cardiomegaly was detected by chest X-ray in 13 patients. In 10 cases with a suspicion of chromosomal anomaly, chromosomal analyses were performed and Down syndrome was detected in five children.

Nine of the patients were referred to cardiovascular surgery departments of different centers because of their serious CHD. Among them, 2 patients with CHD died while waiting for surgery; one patient's parents did not approve operation and 2 cases were introduced to anal dilatation program.

Two hundred and twenty five children were operated by pediatric surgeons. Thirty-two (14.2%) of them died. There was no statistical significant difference in mortality between the patients with and without CHD (Table 2).

Discussion

The study has established the high frequency of CHD in children with GISM. The incidence of GISM's in the normal population is approximately 1.3 per 1000 live births (1). Although CHD frequency in the general population is less than 1%, it is as much as 16.5%-28.5% in patients with GISM (1, 2, 6, 7), and it reaches to 65% in GISM cases accompanied by syndromes (3). We have found the incidence of CHD 28.5% in patients with GİSM in this study.

The early failure of midline mesodermal embryogenesis is the most popular theory for the association of GISM with CHD (1). GISM's in neonatal babies are frequently accompanied by other congenital anomalies and they usually require surgical interventions and intensive care (1, 8). Therefore, they must be examined for additional anomalies at early periods. Routine physical examination, telecardiography, and electrocardiography were reported to be insufficient in discovering CHD's during the neonatal period (3, 9). Our study revealed that physical examination, telecardiography and electrocardiographic examination are insufficient in diagnosis of CHD. Therefore, all patients

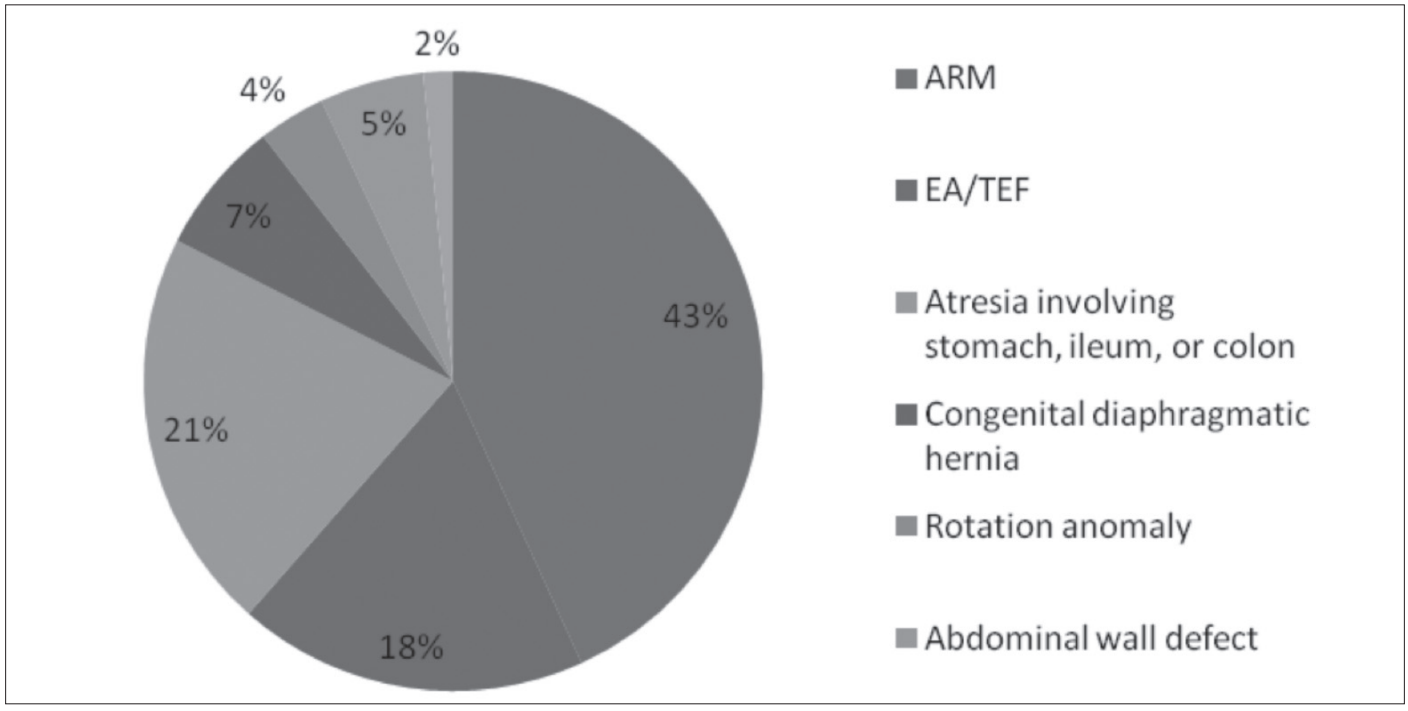

Figure 1. Distribution of GISM patients by diagnosis groups
ARM - anorectal malformation, GISM - gastrointestinal malformations, EA/TEF - esophageal atresia/tracheoesophageal fistula

Table 2. Mortality ratios of the GISM patients who underwent surgery

	Death	Recovery	p
CHD (+) Group (n=60)	10 (16.7%)	50 (83.3%)	>0.05*
CHD (-) Group (n=165)	22 (13.3%)	143 (86.7%)	
Total (n=225)	32 (14.2%)	193 (85.8%)	

Data are presented as number/percentage
*Chi-square test
CHD - congenital heart disease, GISM - gastrointestinal malformations

with GISM, especially in cases where gastrointestinal findings are part of a syndrome, are to be examined echocardiographically (3, 9). It is crucial for the surgery team to be aware of the presence of CHD in children with GISM and if necessary, provide infective endocarditis prophylaxis.

In the present study, CHD rate in GISM patients was found 28.5% and it was 40% in patients with GISM accompanied by syndromes, and the rate was found as 80% in patients with Down syndrome. Ventricular septal defect, ASD, PDA, AVSD, TOF, and PS were reported to be the most common conditions observed in cases with GISM (3, 4, 9). In the present study, ASD, VSD, PDA, and ASD+VSD+PDA were the most frequent ones.

Chittmittrapap et al. (10) defined various syndromes (VATER association, CHARGE association, Potter syndrome, SCHISIS syndrome, trisomy 18) in 14.2 % of patients with EA/TEF. In our study; we found syndromes in three patients (6.3 %) with EA/TEF. These were patients with VATER association, Down syndrome and undefined syndromes.

Olgun et al. (1) reported the rate of CHD incidence in diaphragmatic hernia, imperforate anus, omphalocele and EA/TEF as 8%, 15.9%, 28.6%, and 23.7%, respectively. Thompson et al. (3) reported the same risks as 17%, 23%, 19% and 12%, respectively. In the present study, CHD rates in cases with these anomalies were found as 22.2%, 27.7%, 20%, and 34%, respectively. Association of CHD may increase the mortality. Particularly, in various reports deaths were considered to be directly related to the heart lesion of infants with imperforate anus, omphalocele and EA with CHD and the reported death rates were 72.7%, 20%, 10% respectively (1). The risk of CHD is high among EA/TEF patient groups. Although all CHD's may occur in EA/TEF patients, VSD, PDA, and ASD are the most frequent ones (5, 11, 12). In the present study, ASD, VSD, and PDA were the most frequent anomalies in the EA/TEF patients. Mortality rates of GISM cases particularly suffering from cardiac malformations have decreased significantly with early diagnosis and treatment when compared with initially reported results (13).

In a study where CHD rate in ARM patients was 22%, VSD was found to be the most frequent CHD (14). In another study involving 103 patients, CHD rate was 27% and VSD, ASD, PS, and TOF were the most frequent conditions (15). In the present study, CHD rate in ARM patients was found as 27%, and ASD, VSD, PS, and TOF were the most common ones.

The difference in mortality rates between our patients who undergo surgery with and without CHD was not statistically significant. This may be related to the referral of patients who had serious CHD.

Study limitations

The most important limitation of this study is that we conducted the study retrospectively and we have no data about long-term outcomes of referred patients.

Conclusion

In the present study, it was found that the frequency of CHD in GISM patients is very high. All patients with GISM should be examined echocardiographically. We would like to emphasize that it is a valuable diagnostic method, especially in CHD diagnosis in babies with GISM who will undergo surgical therapy.

Conflict of interest: None declared.

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