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Serological prevalence of human parvovirus B19 in diseases or disorders related to different human body systems

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Background/aim: Human parvovirus B19 is a pathogen that affects different parts of the body. We planned this study because of the lack of data on B19 seroprevalence based on different body-system diseases.

Materials and methods: The prevalence of parvovirus B19 antibodies was investigated retrospectively in 1239 patients by review of medical records from 2009–2012, according to their diseases classified under general titles in compliance with the International Classification of Diseases (ICD-10). Parvovirus B19-specific antibodies were detected by quantitative enzyme immunoassays.

Results: The positivity rate was 27.8% for only IgG, 8.5% for only IgM, and 2.6% for both IgG and IgM. The highest positivity for IgG alone was found in musculoskeletal system and connective tissue diseases (55.9%), while the highest positivity for IgM was found in neoplasms (16.4%). The highest positivity for IgG was seen in rheumatoid arthritis (72.2%) and pregnancy (52.6%), and the highest positivity for total IgM was found in upper respiratory tract disease (21.0%) and hepatic failure (17.1%).

Conclusions: Parvovirus B19 seroprevalence was relatively low in northeastern Anatolia compared to most serological studies conducted in other regions. We think that this study has provided the first wide-ranging information on the seroprevalence of B19 in diseases and disorders of the major human body systems.

Key words: Human parvovirus B19, seroprevalence, quantitative enzyme immunoassays, human body system diseases, ICD-10

1. Introduction

Human parvovirus B19 (B19), frequently seen all over the world, is a pathogenic agent associated with various diseases and disorders that affect different body systems. Erythema infectiosum, chronic arthritis, spontaneous abortion, hematological disorders, myocarditis, and glomerulonephritis are only some of these (1–3). B19 is spread from person to person by infected respiratory secretions, by infected blood and blood-product transfusions, and by vertical transmission from mother to fetus (4,5).

B19-specific IgM antibodies appear 10–12 days after exposure to the virus and may be detected in serum for 3–6 months. IgG antibodies appear after approximately 2 weeks and persist for life (6). The prevalence of antibodies to B19 has been reported at higher rates in studies carried out in different geographic regions. Approximately 15% of preschool children, 50% of adults, and 85% of the elderly are seropositive (7). B19-specific IgG antibody prevalence varies worldwide, ranging from 2% to 15% in children aged 1–5 years and from 30% to 60% in adults (8).

From the discovery of B19 until the present day, large numbers of studies have been done to clarify its relationship with various diseases. In Turkey the number of studies on the seroprevalence of B19 is very low and most of the publications are case reports. Also, although B19 is recognized as a pathogen associated with many diseases and disorders of various tissues and organs, there is no comprehensive report on its seroprevalence in human body systems in Turkey and around the world. To address this deficiency and provide input to the literature, we systematically evaluated the seroprevalence of B19 antibodies in major disease groups classified by the International Classification of Diseases (ICD-10), as well as several specific diseases and symptoms of patients admitted to our hospital.

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2. Materials and methods

2.1. Study populations

In this study, 1239 serum samples belonging to different patients (658 men and 581 women) with various diseases were evaluated retrospectively for B19 IgG and IgM antibodies. The study was performed on serum samples sent to our laboratory from various clinics at Atatürk University Research Hospital in Erzurum, Turkey, in 2009–2012. The clinical data for the diagnosis of diseases were obtained from medical records. The defined diseases were collected by us under general headings in accordance with the categories of the ICD-10 (9).

2.2. Detection of antibodies to parvovirus B19

PVB19-specific IgG and IgM antibodies were detected with quantitative enzyme immunoassays (NovaLisa Parvovirus B19 IgG/IgM-ELISA; Dietzenbach, Germany). In calculating the antibody prevalence, samples with a cut-off value of 10 NovaTec units or above were considered.

2.3. Statistical analysis

Statistical analysis was done using the Pearson chi-square test in 2 × 2 tables. When the P-value was less than 0.05, the differences between the variables were considered to be statistically significant. All statistical analysis was performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. B19 serology according to patient characteristics

The results of B19 serology in 1239 patients according to sex and age groups are summarized in Table 1. B19 antibodies were detected in 38.9% of the patients. Three hundred and forty-four patients (27.8%) had only IgG antibodies, 106 (8.5%) had only IgM antibodies, and 32 (2.6%) had both types of antibodies. When patients positive for both IgG and IgM antibodies were included, the seropositivity rate increased to 30.3% for IgG and to 11.1% for IgM. IgG and/or IgM antibodies were positive in 244 of 581 women (42.0%) and in 238 of 658 men (36.2%). The seroprevalence among females was significantly higher than in males (P = 0.036). The total IgM positivity showed no significant difference between males (72/658) and females (66/581) (P = 0.816). The seropositivity of IgG antibodies was significantly higher for 1-year-old children (38/161) compared to 2-year-olds (25/167) (P = 0.047). The prevalence of IgG antibodies showed a tendency to increase after the age of 6 years. When the positivity of this antibody in adults aged 18 and over (64/124) was compared with the positivity in children aged 17 and younger (312/1115), the results were extremely statistically significant (P < 0.000).

3.2. B19 serology in disease groups by ICD-10

According to the results obtained from the medical records, 820 of 1239 patients (no diagnosis was noted in the remaining 419 cases) were collected under 13 main disease headings of the ICD-10, as shown in Table 2. The highest positivity for B19 IgG antibody alone was detected in diseases of the musculoskeletal system and connective tissues and during pregnancy, childbirth, and puerperium (PCP). When B19 IgG and IgM antibodies were positive together in the same patient, the highest positivity for B19 IgM antibodies was detected in neoplasms. Total positivity of IgG plus IgM antibodies was calculated to be highest

Table 1. Results of B19 serology in 1239 patients according to sex and age.

Variables	n	IgG (+)	IgM (+)	IgG (+) IgM (+)	Total
Sex					
Female	581	178 (30.6)	46 (7.9)	20 (3.5)	244 (42.0)
Male	658	166 (25.3)	60 (9.1)	12 (1.8)	238 (36.2)
Age group					
1 year	161	37 (23.0)	14 (8.7)	1 (0.6)	52 (32.3)
2 years	167	23 (13.8)	13 (7.8)	2 (1.2)	38 (22.8)
3 years	75	9 (12.0)	11 (14.7)	2 (2.6)	22 (29.3)
4 years	69	13 (18.8)	8 (11.6)	1 (1.5)	22 (31.9)
5 years	66	14 (21.2)	7 (10.6)	1 (1.5)	22 (33.3)
6 years	61	15 (24.6)	5 (8.2)	1 (1.6)	21 (34.4)
7–11 years	289	88 (30.4)	26 (9.0)	12 (4.2)	126 (43.6)
12–17 years	227	87 (38.3)	21 (9.3)	6 (2.6)	114 (50.2)
≥18 years	124	58 (46.8)	1 (0.8)	6 (4.8)	65 (52.4)
Total	1239	344 (27.8)	106 (8.5)	32 (2.6)	482 (38.9)

Data presented as n (%) of patients.

Table 2. Results of B19 serology in disease groups by ICD-10.

Disease category by ICD	n	IgG (+)	IgM only/or together with IgG (+)	Total
Diseases of musculoskeletal and connective tissues	59	33 (55.9)	6 (10.2)	39 (66.1)
Diseases of the digestive system	54	22 (40.7)	8 (14.8)	30 (55.5)
Diseases of the skin and subcutaneous tissue	31	13 (41.9)	4 (12.9)	17 (54.8)
Pregnancy, childbirth, and puerperium	19	10 (52.6)	-	10 (52.6)
Neoplasms	67	22 (32.8)	11 (16.4)	33 (49.2)
Diseases of the blood and blood-forming organs	104	35 (33.7)	14 (13.5)	49 (47.1)
Endocrine, nutritional, and metabolic diseases	62	21 (33.9)	8 (12.9)	29 (46.8)
Diseases of the nervous system	46	18 (39.1)	3 (6.5)	21 (45.6)
Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	196	43 (21.9)	29(14.8)	72 (36.7)
Diseases of the genitourinary system	63	19 (30.1)	3 (4.8)	22 (34.9)
Diseases of the respiratory system	75	14 (18.7)	11 (14.7)	25 (34.9)
Certain infectious and parasitic diseases	24	5 (20.8)	3 (12.5)	8 (33.3)
Diseases of the circulatory system	20	4 (20.0)	2 (10.0)	6 (30.0)
Unspecified patients	419	85 (20.3)	36 (8.6)	121 (28.9)

Data presented as n (%) of patients.

in diseases of the musculoskeletal system and connective tissues, diseases of the digestive system, diseases of the skin and subcutaneous tissues, and during PCP.

3.3. B19 serology in specific diseases

Results of B19 serology in specific diseases or disorders that involve 15 or more patients are given in Table 3. The highest total seropositivity was detected in rheumatoid arthritis and hepatic failure. These were followed by acute lymphadenitis, juvenile arthritis, malnutrition, epilepsy, leukemia, malignant neoplasms, and other diseases. The highest positivity was detected in rheumatoid arthritis for IgG and in upper respiratory infections for IgM.

4. Discussion

Detection of B19 IgG and IgM antibodies in a serum sample is generally sufficient in order to understand the course of parvoviral diseases. A positive IgM result in the presence or absence of IgG antibodies reflects an acute infection, and a positive IgG result in the absence of IgM antibodies is indicative of past B19 infection (10).

The prevalence of these antibodies varies from region to region. In Turkey, the prevalence of the B19 IgG antibody has been reported in 38.6% of randomly selected children aged 4–6 years in Antalya (11), in 26.9% of children under the age of 15 and 54.5% of adults over the age of 20 with a presumptive diagnosis of B19 infection in İstanbul (12), and in 20.7% of children admitted to hospital aged 0–17 years and 36.0% of healthy adults in the Central Anatolia region (13). In our study representing the Northeast Anatolia region, overall seropositivity of B19 IgG antibodies was 33.7% in children aged 0–17 years and 51.6% in adults. According to the results, the prevalence of B19 IgG in Turkey ranges from approximately 21% to 39% in children younger than 18 years and approximately 36% to 55% in adults. This wide variation could be due to differences in the numbers, health status, sex, and age of patients, and to the possible differences in susceptibility of used tests and differences in the years of studies. B19 prevalence rates reported in studies conducted in other countries also differ from each other. Röhrer et al. (14), in a study in Germany, found a seroprevalence of IgG in adults aged 18 and up of 72.1%, and of 47.6% at 2–18 years. In this study, positivity of IgG antibodies in women was slightly significantly higher than in men (73.4% vs. 70.8%, respectively). In a study conducted in India, Kishore et al. (15) reported that seroprevalence of B19 in adult blood donors increased with age and the overall seroprevalence

Table 3. B19 serology in specific diseases or disorders.

Disease	n	IgG (+)	IgM only/or together with IgG (+)	Total
Rheumatoid arthritis	18	13 (72.2)	-	13 (72.2)
Hepatic failure (acute/chronic)	41	19 (46.3)	7 (17.1)	26 (63.4)
Acute lymphadenitis	23	10 (43.5)	3 (13.0)	13 (56.5)
Juvenile rheumatoid arthritis	16	7 (43.8)	2 (12.5)	9 (56.3)
Malnutrition	28	13 (46.4)	2 (7.1)	15 (53.6)
Epilepsy	22	10 (45.5)	1 (4.5)	11 (50.0)
Leukemia and malignant neoplasms	55	19 (34.5)	8 (14.5)	27 (49.0)
Anemia	37	13 (35.1)	3 (8.1)	16 (43.2)
Fever of unknown origin	64	16 (25.0)	10 (15.6)	26 (40.6)
Acute tonsillitis	24	5 (20.8)	4 (16.7)	9 (37.5)
Acute upper respiratory infections	19	3 (15.8)	4 (21.0)	7 (36.8)
Abdominal and pelvic pain	132	27 (20.4)	19 (14.4)	46 (34.8)
Urinary tract disorders	44	12 (27.3)	3 (6.8)	15 (34.1)

of the antibody was 39.9%, higher in males than in females (44% vs. 27%, respectively). Su et al. (16), in Taiwan, reported that overall seroprevalence of B19 IgG in healthy volunteers was 23.1%, that the positive rate of the antibody increased slightly with age, and that the antibody rate was slightly higher in men than in women (27.8% vs. 18.8%, respectively). The antibody positivity detected in our study was lower than in all of the other studies (excluding the Taiwan study).

It has been shown that the B19 IgG antibody seropositive rate varies depending on age, location, season, sex, and time of the last B19 epidemic (8,17). To reach a more satisfying conclusion, comparisons of epidemiological studies conducted in different locations should be made, taking into account all of these factors. Unfortunately, that is not always possible for several reasons, such as a limited number of studies on the subject, an insufficient number of cases, and the absence or lack of similar cases.

In our study, the highest positivity for B19 antibodies was found in diseases of the musculoskeletal and connective tissues, diseases of the digestive system, diseases of the skin and subcutaneous tissues, and during PCP, followed by the other diseases. The antibody positivity in unspecified cases was found to be lower than in all of the specified diseases. However, seropositivity of parvoviral antibodies is considerably varied in the same or different human body-system diseases. This situation has been observed in other studies. For example, for diseases of the musculoskeletal and connective tissues, a German study by Weissbrich et al. (18) showed that seroprevalence of B19 IgG in children affected by juvenile idiopathic arthritis was 31.3% in early-onset pauciarticular arthritis, 39.5% in reactive arthritis, 57.1% in unclassified arthritis, and 62.4% in arthralgia. In a study conducted in the Central Anatolia region in Turkey by Us et al. (19), IgG and IgM positivity were reported to be 52.9% and 1.1% in rheumatoid arthritis and 64.0% and 2.0% in systemic lupus erythematosus, respectively. Türk Dağı et al. (20) detected B19 IgG in 85 of 114 patients with rheumatoid arthritis and 29 of 46 healthy persons, and they reported that the difference of B19 IgG frequencies in these groups was not statistically significant. In our study, the antibody prevalence was found to be 72.2% in adults with rheumatoid arthritis and 43.8% in children with juvenile rheumatoid arthritis. Likewise, in association with diseases of the blood and blood-forming organs, and in disorders involving the immune mechanism, a study conducted in Tunisia by Regaya et al. (21) showed that B19 IgG antibody positivity was 56.5% in patients with sickle cell anemia and 39.1% in patients with beta thalassemia. In Nigeria, IgG and IgM antibody positivity was 61.6% and 17.8%, respectively, in sickle cell anemia. Iwalokun et al. (22) detected B19 IgM and IgG antibodies in 17.8% and 61.6%, respectively, of sickle cell anemia patients. B19 IgG and IgM antibody positivity in Kenyan children with severe anemia was found by Wildig et al. (23) to be 14.8% and 3.7%, respectively. The prevalence rates of

IgG in pregnancy among studies conducted in different countries vary widely. In studies of pregnant women, Ghazi (24) reported B19 IgG seroprevalence at 46.6% in Saudi Arabia, and Jensen et al. (25) reported it at 66% in Denmark. We found a 52.6% prevalence of B19 IgG seropositivity among pregnant women. In India, Kishore et al. (26) found that the B19 IgG antibody prevalence was 34.3% in children with hematologic malignancies such as leukemia and lymphoma, which are contained in the neoplasm group. This rate is very close to the value obtained for leukemia and malignant neoplasms in our study. There are limited studies on the seroepidemiology of B19 in the literature related to other body systems and tissues, and most of these are case reports and molecular studies.

Therefore, we think that the current study contributes to the literature related to the seroprevalence of B19 in diseases or disorders of the major human body systems.

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