Case Report
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The First Korean Case Report of Anti-Gerbich

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In this study, we report the first Korean case of an anti-Gerbich (Ge) alloantibody to a high-incidence antigen that belongs to the Ge blood group system. The alloantibody was detected in a middle-aged Korean woman who did not have a history of transfusion. Her blood type was B+, and findings from the antibody screening test revealed 1+ reactivity in all panels except the autocontrol. The cross-matching test showed incompatible results with all 5 packed red blood cells. Additional blood type antigen and antibody tests confirmed the anti-Ge alloantibody. While rare, cases of hemolytic transfusion reaction or hemolytic disease in newborns due to anti-Ge have been recently reported in the literature. Therefore, additional further studies on alloantibodies to high-incidence antigens, including anti-Ge, are necessary in the future.

Key Words: Ge, Blood group antigens, Transfusion

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INTRODUCTION

The Gerbich (Ge) system consists of 3 highly prevalent antigens, Ge2, Ge3, and Ge4, and 5 rarer antigens [1]. These are located on the sialoglycoproteins glycophorin C (GPC), glycophorin D (GPD), or both [1].

Interestingly, >50% of the Melanesian population in Papua New Guinea is known to be Ge antigen negative whereas about 10% are reported to have natural anti-Ge [2]. Other than the Melanesians, however, cases of anti-Ge alloantibody are very rare for other ethnicities, and there has been no report of such a case in Koreans to date. Having detected such an anti-Ge alloantibody from a pretransfusion test in a middle-aged Korean woman with no transfusion history, we here report the case along with a short review of the literature.

CASE REPORTS

A 53-yr-old Korean woman was admitted to our hospital because of cervical pain with radiculopathy. After a magnetic resonance imaging (MRI) scan, surgery was planned. Complete blood count results were as follows: hemoglobin level, 11.6 g/dL; white blood cell count, 4.2×10^9/L; and platelet count, 142×10^9/L. ABO and RhD blood grouping results were group B and RhD positive. The patient had no transfusion history. However, we could not obtain detailed information on her pregnancy history. A preoperative antibody screening test using a LISS/Coombs card with 2 test reagents ID-Diacell I-II (DiaMed Ag; Cressier, Morat, Switzerland) showed 1+ reactivity in both cells. An antibody identification test using a LISS/Coombs card with an ID-DiaPanel test reagent (DiaMed Ag) showed 1+ reactivity with all 11 panel cells of the ID-Diapanel (Table 1). However, additional identification test results using both the NaCl/Enzyme card with the ID-DiaPanel P test reagent (DiaMed Ag) and a cold phase panel (treating 4°C) revealed no reaction. The results of the autocontrol and direct antiglobulin test (DAT) were negative. Repeated antibody screening and identification tests using a new sample from the patient showed the same results. Cross-match-

Table 1. Results of the unexpected antibody test

Rh-hr donor			Rh-hr						Kell				Duffy		Kidd		Lewis		P	MNS			Luth.		Xg		Result	
			D	C	E	c	e	C^w	K	k	Kp^a	Kp^b	Js^a	Js^b	Fy^a	Fy^b	Jk^a	Jk^b	Le^a	Le^b	P_1	M	N	S	s	Lu^a	Lu^b	Xg^a	♀+♂ LISS/ Coombs	Enzyme	4°C
1	$C^wCD.ee$	$R_1^wR_1$	119,300	+	+	0	+	+	0	+	0	+	nt	+	+	0	0	+	0	+	+	+	0	+	0	+	+	1+	–	–
2	CCD.ee	R_1R_1	828,964	+	+	0	+	0	+	+	0	+	nt	+	0	+	+	0	+	0	0	+	0	+	0	+	+	1+	–	–
3	ccD.EE	R_2R_2	115,152	+	0	+	0	0	0	+	0	+	nt	+	0	+	0	+	+	+	+	0	+	0	+	0	+	0	1+	–	–
4	Ccddee	r'r	921,494	0	+	0	+	0	0	+	0	+	nt	+	0	+	+	0	0	0	+	+	0	+	0	+	+	+	1+	–	–
5	ccddEe	r''r	447,034	0	0	+	+	0	0	+	0	+	nt	+	+	+	+	0	0	0	+	+	0	+	0	+	+	+	1+	–	–
6	ccddee	rr	237,533	0	0	0	+	0	0	+	0	+	nt	+	+	+	0	+	0	+	+	+	0	+	0	+	+	nt	1+	–	–
7	ccddee	rr	405,739	0	0	0	+	0	0	+	0	+	nt	+	0	+	+	0	0	+	+	+	0	+	0	+	+	+	1+	–	–
8	ccD.ee	R_0r	576,244	+	0	0	+	0	0	+	0	+	+	+	0	0	+	0	0	+	+	+	0	+	0	+	+	0	1+	–	–
9	ccddee	rr	112,486	0	0	0	+	0	0	+	0	+	nt	+	0	+	0	+	0	+	+	0	+	+	0	+	+	+	1+	–	–
10	ccddee	rr	056,515	0	0	0	+	0	0	+	+	+	nt	+	+	0	0	+	+	0	0	+	+	+	0	+	+	nt	1+	–	–
11	ccddee	rr	526,547	0	0	0	+	0	0	+	0	+	nt	+	+	0	+	0	0	+	+	+	0	+	+	+	+	nt	1+	–	–
																									Autocontrol			–	–	–

Abbreviation: nt, not tested.

ing between the patient's serum and the 5-unit B+ packed red blood cells (RBCs) yielded incompatible results.

Suspecting the existence of an antibody to a high-incidence antigen, further tests on RBC antigens and antibodies were requested from the reference laboratory (the central laboratory of the Swiss Red Cross in Bern, Switzerland) where the anti-Ge antibody was detected. Negative results for Ge antigens were also shown using sera including anti-Ge. Results from additional blood type antigen tests other than those for the Ge antigen were negative for K, Kp^a, Fy^a, and S, but positive for M, s, Lu^a, k, Kp^b, Le^a, Fy^b, Jk^a, and Jk^b. The patient was discharged after a successful operation without having a transfusion during her time in the hospital. However, she was lost to follow-up as she currently resides in the United States, limiting our ability to conduct additional tests on anti-Ge subtypes and to take a more accurate family history.

DISCUSSION

Ge blood group system antigens are expressed on the GPC and GPD proteins that are encoded by a single gene (*GYPC*) located at the long arm of chromosome 2, and inherited through autosomal dominant traits [3]. According to the composition of high-prevalence antigens such as Ge2, Ge3, and Ge4, representative Ge-negative phenotypes are categorized as the Yus type (Ge: -2, 3, 4), Ge type (Ge: -2, -3, 4), or Leach type (Ge: -2, -3, -4). Known antibodies for the Ge antigens are anti-Ge2, anti-Ge3, anti-Ge4, and other antibodies to low-prevalence Ge antigens.

Anti-Ge2 is a red cell antibody that can be detected from all of the Yus, Ge, and Leach types, and is more frequently discovered than anti-Ge3 [4]. Reactivity can be lost when papain-treated RBCs are reacted with a patient's serum that has anti-Ge2, and hemolytic transfusion reactions could occur when a person who has anti-Ge2 receives a RBC transfusion from an incompatible blood type, although this is controversial [3]. There have also been some reports of cases where a patient has shown tolerance after a transfusion [5-7]. Anti-Ge3 is detected from the Ge and Leach types but not the Yus type, and it is known to react with antigens from GPC and GPD and induce hemolysis [3]. The reactivity does not deteriorate even if papain-treated RBCs are reacted with the patient's serum, while hemolytic transfusion reactions by anti-Ge3 can occur [8]. A recent report noted a case where a Ge-negative patient with anti-Ge3 had a mild acute hemolytic transfusion reaction during multiple transfusions from Ge-positive blood in 2 hospitalizations [9]. Also, another report suggested that this antibody is related not

only to maternal anti-Ge3-mediated hemolysis but also to severe hemolytic disease of the newborn (HDN) due to the phagocytosis of Ge-positive erythroid progenitors by monocytes [10]. Anti-Ge4 is a very rare antibody to be detected from someone who is a Leach type. As such, there have not been any case reports of clinical significance related to hemolytic reactions to date.

In some literature on the Kell system antigen where the Ge system is not expressed in RBCs, the manifestation of the Kell system antigen, which is a high-incidence antigen, is also reported to be weak [6, 11]. This is most likely to occur in the Ge and Leach types [12]. While we could not show additional test results on the Ge blood group subtype, the fact that a complete negative conversion occurred when the serum of our patient was reacted with the papain-treated panel cells led us to consider anti-Ge2 rather than anti-Ge3. Also, the fact that the patient showed positive results for high-frequency or high-prevalence antigens such as k and Kp^b suggests that it may be a Yus phenotype. While she did not have a history of transfusion, the authors note that detailed information on her pregnancy history could not be acquired, which limits our ability to clearly identify whether the detected anti-Ge alloantibody was natural or acquired.

As mentioned in the Introduction, Ge-negative phenotypes occur very rarely in most of the population groups except for the Melanesian population. Likewise, Ge antigens are considered to be frequent in the Asian population, and therefore reports on anti-Ge alloantibody have been rare. In a study of 4,253 Thai individuals, only one did not show agglutination during anti-Ge serum tests including anti-Ge2 or anti-Ge3 [8]. In Japan, 2 cases in 1984 showed anti-Ge with Ge-negative phenotype [11]. One was a 17-yr-old female patient without pregnancy or transfusion histories, and the other was a 41-yr-old multipara without a transfusion history. In both cases, each of their family members went through a Ge blood group system test where the brother and the sister of the multipara turned out to be a Ge-negative phenotype, but anti-Ge was not detected in the sister. Using their serum, 22,000 Japanese were tested but none turned out to be Ge negative.

However , there has been very little research on Ge blood type antigen and antibody in the Korean population. Therefore, additional research in Korea is needed on rare blood group antibodies and high-incidence antigens, including Ge cases. Although it is rare, since a clinically significant alloantibody including anti-Ge was detected during an antibody identification test of a high-incidence antigen that reacts with all panel cells, it is necessary to conduct active serological and molecular genetic tests to determine the characteristics of this alloantibody. To our knowledge, this is the first Korean case report of anti-Ge alloantibody in the literature.

Authors' Disclosures of Potential Conflicts of Interest

No potential conflicts of interest relevant to this article were reported.

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