An update on the Augustine blood group system

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This update of the Augustine (AUG) blood group system (Daniels G. The Augustine blood group system, 48 years in the making. Immunohematology 2016;32:100–3) describes two antigens that have been added to the Augustine system (International Society of Blood Transfusion system 36), bringing the number of antigens in the system to four. Further information on the clinical significance of Augustine system antibodies and the function of the Augustine glycoprotein, equilibrative nucleoside transporter 1, is presented. Immunohematology 2019;35:1–2.

Key Words: Augustine, SLC29A1, adenosine transport, erythropoiesis, ENT1

New Augustine Antigens

Since the publication of the original review,1 two new antigens have been added to the Augustine (AUG) blood group system: AUG3 and AUG4 (Table 1).

An antibody to a low-prevalence antigen (AUG3) caused severe hemolytic disease of the fetus and newborn (HDFN) requiring two exchange and four top-up transfusions. Targeted exome sequencing for blood group genes revealed that the baby was heterozygous for a novel variant in the Augustine gene, SLC29A1, encoding p.Thr387Pro in the fifth extracellular loop of equilibrative nucleoside transporter 1 (ENT1). The baby’s brother, father, two paternal aunts, and grandmother were all heterozygous for the variant allele, and their red blood cells (RBCs) were all AUG:3.2

An antibody to a high-prevalence antigen (AUG4) in a white woman, who had been pregnant and transfused, was first found in 1995. Recent whole exome sequencing revealed homozygosity for a missense mutation in SLC29A1 encoding p.Asn81Ser. The variant was present in 0.1 percent of individuals in the Exome Aggregation Consortium but was never found in a homozygous state. The AUG:–4 RBCs of the propositus were AUG:1,2, confirming that ENT1 is present, but flow cytometric analysis revealed an approximately 30 percent reduction in surface ENT1 relative to that on AUG:1,2,4 (common phenotype) RBCs. The antibody of the propositus reacted with AUG:1,2 and AUG:1,–2 RBCs, but not with AUG:–1,–2 (null phenotype) RBCs.3

Clinical Significance of Augustine System Antibodies

An acute hemolytic transfusion reaction caused by anti-AUG2 (anti-Ata)4 and severe HDFN caused by anti-AUG32 confirm previous reports that Augustine system antibodies have the potential to be dangerously hemolytic.

Functional Aspects of the Augustine Glycoprotein

Analysis of mature RBCs and developing erythroid cells from the three previously reported AUG:–1,–2 (null phenotype) siblings revealed macrocytosis and abnormal morphologies together with a decreased level of proliferation during erythropoiesis and delayed erythroblast maturation. This finding suggests a role of ENT1-mediated adenosine transport in erythroid differentiation.5

Table 1. Antigens of the Augustine system

<table>
<thead>
<tr>
<th>Number</th>
<th>Antigen</th>
<th>Prevalence</th>
<th>Nucleotides</th>
<th>Exon</th>
<th>Amino acids</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUG1</td>
<td>High</td>
<td>c.589+1G&gt;C</td>
<td>6</td>
<td>Slice site</td>
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<tr>
<td>AUG2</td>
<td>Ata</td>
<td>High</td>
<td>c.1171G&gt;A</td>
<td>12</td>
<td>Glu391Lys</td>
<td>1</td>
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<tr>
<td>AUG3</td>
<td>ATML</td>
<td>Low</td>
<td>c.1159A&gt;C</td>
<td>12</td>
<td>p.Thr387Pro</td>
<td>2</td>
</tr>
<tr>
<td>AUG4</td>
<td>ATAM</td>
<td>High</td>
<td>c.242A&gt;G</td>
<td>3</td>
<td>p.Asn81Ser</td>
<td>3</td>
</tr>
</tbody>
</table>

1. Daniels G. The Augustine blood group system, 48 years in the making. Immunohematology 2016;32:100–3
2. Daniels G. The Augustine blood group system: AUG1, AUG2, AUG3. Immunohematology 2016;32:100–3
5. Daniels G. The Augustine blood group system: AUG1, AUG2, AUG3. Immunohematology 2016;32:100–3
References


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Manuscripts

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