Antibody Identification- Anti-D and Anti-C Case Study

A 72 year old Caucasian female is admitted with a hip fracture after falling. She has a history of Type 1 diabetes, hypertension and coronary artery disease (CAD); including coronary artery bypass graft (CABG).

<table>
<thead>
<tr>
<th>ABO/Rh</th>
<th>Anti-A</th>
<th>Anti-B</th>
<th>Anti-D</th>
<th>A1 cells</th>
<th>B cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>4+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4+</td>
<td></td>
</tr>
</tbody>
</table>

Direct Antiglobulin Test
Polyspecific AHG  0

Antibody Screen

| Cell | Rh | D | C | c | E | e | V | C⁺ | K | k | Kp | Js | Js | Fy⁺ | Fy⁻ | Jk⁺ | Jk⁻ | Le⁺ | Le⁻ | P₁ | M | N | S | s | Lu⁺ | Lu⁻ | I.S. | PEG | AHG |
|------|----|---|---|---|---|---|---|----|---|---|----|----|----|-----|-----|-----|-----|-----|----|----|----|----|-----|-----|-----|-----|----|
| I    | R,R₁ | + | + | 0 | 0 | + | 0 | + | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | 3+ |
| II   | R,R₂ | + | 0 | + | 0 | 0 | 0 | + | 0 | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | 2+ |
| III  | rr   | 0 | 0 | + | 0 | + | 0 | 0 | 0 | + | 0 | 0 | + | + | 0 | + | 0 | + | 0 | + | 0 | + | 0 | 0 | 0 |

Expected Results
The patient’s serum, Sample EDU-02, is group A with anti-D and anti-C.

Anti-D Discussion
After the ABO system, the Rh system is the most important blood group system in transfusion medicine with D being the most immunogenic Rh antigen.¹ The original 'Rh' antigen stimulated a transfusion reaction, which was investigated by Levine and Stetson in 1939. The reactions of this antibody paralleled those of the anti-'Rh' reported by Landsteiner and Wiener in 1940 but stimulated in animals. Years later, upon recognition that the human and the animal anti-'Rh' did not react with the same antigen, the antigen name switched to D and the system took the Rh name. Testing for the D antigen is included as part of routine donor and patient typing with “Rh positive” and “Rh negative” referring to the presence or absence of the D antigen on red blood cells. The D antigen is distinguished from other blood group antigens in that it is composed of at least 30 epitopes distributed along the extracellular portions of the RhD protein.² Most anti-D is IgG with some IgM and can cause a mild to severe, immediate/delayed transfusion reaction. Anti-D can also cause mild to severe hemolytic disease of the fetus and newborn (HDFN). The optimal technique for detection is the indirect antiglobulin test (IAT).³

Anti-C Discussion
The C antigen was recognized in 1941 and named “C” because it was the next available letter in the alphabet after A and B antigen nomenclature. The antibody is IgM and IgG and can cause a mild to severe, immediate/delayed transfusion reaction. Anti-C can also cause mild hemolytic disease of the fetus and newborn (HDFN). The optimal technique for detection is the indirect antiglobulin test (IAT).³
Antibody Identification- Anti-D and Anti-C Case Study (cont.)

Anti-D + Anti-C or Anti-G

The G antigen was first described in 1958 by Allen and Tippett as an antigen distinct from C and D.⁴ The initial investigation also showed that most serums containing “anti-CD” actually contained anti-G. Present on nearly all red cells that demonstrate either the D or C antigen; the G antigen is usually absent only when a person’s red cells lack both the D and C antigen. Although there have been rare reports of D positive, G negative individuals⁵,⁶; typically, the only phenotypes that would result in G negative red blood cells are rr (dce/dce), rr⁺ (dce/dcE), and r⁺r⁺ (dcE/dcE). As a result, most individuals are G positive. The rr phenotype is the most common and occurs in approximately 15% of the US population while rr⁺ and r⁺r⁺ occur in <1% combined.³ As a result, anti-G is almost always formed by D negative, G negative individuals with the rr phenotype. Anti-G can be stimulated by pregnancy or by transfusion with red cells demonstrating the r⁺ phenotype.

Since anti-G looks like a combination of anti-D and anti-C, it can be quite confusing when seen in an Rh negative patient who has no history of being exposed to D positive blood. For pretransfusion testing, as in the case presented here, it is not important to differentiate anti-G from anti-D plus anti-C. In either instance, the patient would be transfused with D negative blood, and since the vast majority of Rh negative blood has the rr phenotype, these units would most likely be G negative and crossmatch compatible.

It is important to differentiate between anti-D plus anti-C and anti-G in prenatal evaluations as anti-G has been associated with hemolytic disease of the fetus and newborn (HDFN). It is also very important to distinguish anti-D plus anti-C and anti-G in OB patients to determine if the patient should receive RhIg. If the antibody is anti-D, the patient does not require RhIg; if the antibody is anti-G, RhIg administration would be recommended to prevent the formation of anti-D.

References


This case study and antibody discussion was provided by Hemo bioscience (www.hemobioscience.com), the manufacturer of these Blood Bank proficiency samples.