Disease and Condition: Iron Overload

What is special about golden blood type?

The golden (Rh null) blood is the rarest blood group, lacking Rh antigens in the red blood cells (RBCs). Learn more about the golden blood type, other rare blood types, and blood charts.

Proteins known as Rhesus (Rh) factors or antigens are completely absent in the red cells of people with the golden blood type or Rh null blood group. This is the rarest blood group in the world, with less than 50 individuals having this blood group. Golden blood type was first discovered in an Australian Aboriginal woman in 1961.

Our red blood cells have sugars and proteins called antigens on their surface membranes. Depending on the mix of antigens present, blood is categorized into different blood types, and we have A, B, O, or AB blood types. The ABO system has a further distinction as Rh-positive or Rh-negative depending on the presence or absence of the "Rh-D" factor in the cells.

A person with the golden blood type, or the Rh null blood type lacks all the Rh antigens whereas a person with the Rh-negative blood group lacks only Rh-D antigen.

The worry with the golden blood type is that donations of the Rh null blood type are incredibly scarce and difficult to obtain. An Rh null person has to rely on the cooperation of a small network of regular Rh null donors around the world if they need blood. Across the globe, there are only nine active donors for this blood group. This makes it the world's most precious blood type, hence the name "golden" blood.

Who has the golden blood type?

The golden blood type seems to be a result of a genetic mutation (spontaneous change in a gene). It is commonly seen with mutations in the RHAG gene, which codes the Rh-associated glycoprotein. This protein is required for directing the Rh antigens to the RBC membrane.

RHAG mutation is often associated with a disease called hereditary stomatocytosis. These individuals can have long-term, mild, hemolytic anemia and increased RBC breakdown. The Rh-null phenotype can also be seen in the case of certain anemias a person may be born with.

The following conditions may put you at a higher risk of the golden blood type:

- Consanguineous marriage (marriage between cousins, brother-sister, or anybody who is a near or distant relative)
- Autosomal genes (abnormal genes that have disease traits passed down through families)
- Changes or complete deletion of certain genes, which are RHD and RHCE or RHAG

Can golden blood be donated? Is golden blood type good?

Golden blood type can be donated. Because of the absence of antigens on RBCs, a person with Rh null blood is considered to be a universal donor, and this blood can be donated to anyone with rare blood types within the Rh systems.

This blood is excellent for transfusion because it lacks common antigens, and it can be accepted by anyone who needs a transfusion without the risk of a blood transfusion reaction. However, due to its rarity, it is extremely difficult to find this type.

Conversely, the golden blood type is usually not so good for the people who have it. If they ever require a blood transfusion, receiving blood that has the Rh antigens may inevitably cause a transfusion reaction.

Sickle cell disease is named after a farming tool.

See Answer

What are potential complications of the golden blood type?

People with Rh null or golden blood type may have:

- **Mild to moderate hemolytic anemia since birth:** This leads to premature destruction of RBCs, which may cause low hemoglobin levels and lead to paleness and weariness. This occurs due to structural defects in RBCs like:
  - Mouth-like or slit-like shape
  - Less elastic structure of red cells
  - Abnormal red cell membrane
  - Increased fragility due to the lack of Rh antigen
  - Altered blood cell volume
- **Blood transfusion challenges:** People with the golden blood type may face challenges during a blood transfusion. If the person's blood is exposed to Rh antigens (proteins on the surface of RBC) from the other person's blood, they readily form corresponding autoantibodies and there may be a severe transfusion reaction. Therefore, for these types of patients, hospitals need to have special protocols in place and quick response management.
- **Rh incompatibility during pregnancy:** If the mother is Rh null and the baby is Rh-positive, and if the mother's blood gets sensitized by the baby's positive blood, then the mother's blood may produce protective proteins called antibodies that could target future pregnancies or lead to abortion or miscarriage.

- **Hemolytic crisis:** Several studies have found that an infection or sepsis in such individuals may precipitate massive hemolysis, subsequent kidney failure, and other complications.

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How many blood types are there?

A, B, AB, and O are the four main blood groups. Each blood group can be RhD-positive or RhD-negative, resulting in a total of eight blood groups:

Table. Various blood types and their blood group antigen and Rh factor

Blood type	Blood group antigen	Rh factor
A+	A present, B absent	Present
A−	A present, B absent	Absent
B+	B present, A absent	Present
B−	B present, A absent	Absent
AB+	Both A and B antigens present	Present
AB−	Both A and B antigens present	Absent
O+	Both A and B antigens absent	Present

Blood type	Blood group antigen	Rh factor
O−	Both A and B antigens absent	Absent

Blood transfusion these days is only done after blood typing. Hence, people with certain blood groups can only donate to and receive from specific blood groups.

Table. Blood group transfusion

Blood group	Can donate blood to	Can receive blood from
A+	A+, AB+	A+, A−, O+, O−
A−	A+, A−, AB+, AB−	A-, O−
B+	B+, AB+	B+, B−, O+, O−
B−	B+, B−, AB+, AB−	B−, O−
AB+	AB+	All blood group types
AB−	AB+, AB−	AB-, O−, A−, B−
O+	O+, A+, B+, AB+	O+, O−
O−	All blood group types	O−

Blood groups are passed down from parents:

- The A and B genes are dominant, and group O is dependent on each parent inheriting an O gene.
- The *Rh D* gene is inherited from either or both parents, resulting in RhD-positive blood group "expression."
- The expression of the RhD-negative blood group is caused by the absence of the *RhD* gene.

What are the 3 rarest blood types?

The three rarest blood types include:

1. **Rh-null or golden blood type**
    - Golden blood type is the world's rarest blood type, with fewer than 50 known cases ever reported. When a person's blood lacks all 61 possible antigens, they are said to be Rh-null.
    - Because Rh-null lacks all possible antigens, it can be donated to people who have blood types that are very different from the main eight. However, Rh-null people can only accept blood from people with Rh-null blood type.
    - The scarcity of Rh-null blood, combined with its unique properties, makes it extremely valuable for scientific research, earning it the name "golden blood."
2. **AB−**
    - AB− is the rarest of the eight basic blood types, accounting for less than one percent of the world's population. Within the United States, the least common of the eight well-known blood types is AB−, with only 1 in every 167 people in the United States having it.
    - While AB− can receive blood from all other Rh-negative types, A, B, AB, and O, it can only donate blood to others who have AB blood, both Rh-negative and positive.
    - Because AB− has both A and B antigens on its red cells, it is compatible with all the other major Rh-negative blood types.
    - It is the universal plasma donor, and anyone from any blood group can receive plasma from AB blood.
3. **HH blood type, rare ABO group, or Bombay blood group**
    - This extremely rare phenotype blood group is found in approximately four per million of the world's population. One in every 10,000 people in Bombay may have it.
    - 179 people in India are believed to have the Bombay phenotype blood group.
    - Though the people with the Bombay blood group are also O−, the additional H antigen that functions as a component of the ABO blood group is missing here. The absence of the H antigen is referred to as the "Bombay phenotype."

- A person with the Bombay blood group can give blood to someone with the ABO blood group. They, however, can only take blood from their blood type, which is the HH blood type.

Is O negative the rarest blood type?

According to research, the distribution of O-negative (O−) blood type among the world's population is approximately 2.55%. According to the American Red Cross, about 38% of Americans have blood group O-positive and 7% (1 in every 15 individuals) have blood group type O-negative.

The prevalence of type O− varies with ethnicities:

- 8% among Caucasians
- 4% among African Americans
- 1% among Asians
- 4% among Latino-Americans

O− blood, also called "universal donor," is perhaps the most valuable blood in the world because it can be transfused to nearly any blood type (except when the person has some rare antigen outside of the main ones).

- When the recipient's blood type is unknown, such as during trauma or an emergency, O− blood is frequently used in transfusions.
- Unfortunately, O− blood is quite rare, and donors are in high demand all over the world due to the importance of this blood type.
- Because of its universality, O− blood is always the first to run out during a blood shortage according to the American Red Cross (can be given to people with type A, B, AB, or O)
- Unfortunately, people with O− blood can only receive O− blood, which is often in short supply.

Though only 2.55% of the world's population is O-negative, it is not the rarest blood type.

How may blood type affect COVID-19?

The global biomedical research community is working hard to identify coronavirus risk factors and potential therapeutic targets as the pandemic continues.

The potential role of blood type in predicting COVID-19 infection risk and complications has become a hot topic, and new studies add to the evidence that there may be a link between blood type and COVID-19 vulnerability.

According to recent research:

- People with blood type O may have the lowest infection risk.
- Individuals with A and AB may be at a higher risk of having serious clinical outcomes.
- Anti-A antibodies in people with blood groups O or B may block the virus's interaction with the cell receptor for angiotensin-converting enzyme 2 (ACE2), which is a mechanism for virus transmission.

Additional research is needed to better understand why this is happening and what it means for patients.

Clinicians should continue to follow current protocols in the care of COVID-19 patients until more data is collected and the public must remain vigilant in wearing masks, maintaining physical distance, and maintaining strict hand hygiene.

Frequently asked questions (FAQs) about golden blood type

What ethnicity has the golden blood type?

The first person found to have the golden blood type was an Australian Aboriginal woman. Since then, fewer than 50 individuals have been found to have Rh null blood type. These people are from all over the world from all ethnicities, from the Americas, Europe, Africa, Asia, and Australia. Ethnicity appears to have no bearing on the golden blood type. Instances of golden blood type have been reported relatively slightly higher in some regions in South America than in other parts of the world. Although rare, golden blood type has been reported from all corners of the world.

What are the odds of being Rh-null?

The odds of being Rh-null is just 1 in 6 million. Some factors may marginally increase the possibility of getting Rh-null blood type. These include marriages with close relatives (consanguineous marriage), hereditary factors, and mutations in the RHD, RHCE, and/or RHAG genes.

What is the difference between Rh-negative and Rh-null blood?

Rh factors are proteins (antigens) on the surface membrane of red cells. Currently, there are 49 identified Rh antigens. Rh D is one of the most significant among the Rh antigens. Rh-negative blood lacks the Rh D antigen, while Rh-null blood lacks all of the 49 Rh antigens.

Why is Rh null so valuable?

Rh null is valuable because it is such a rare blood group and so few donors are available in the world. It can be safely given to any person without the risk of transfusion reactions that can be deadly for vulnerable patients. However, it is not easily available, so it is uncommon to see it given to people with other blood groups. Rh null people cannot receive any other blood group, so it is extremely valuable for life-saving transfusions in this rare group of people.

Can blood type affect personality?

A theory on blood type personalities surfaced in the 1920s in Japan. It was claimed to be based on surveys, questionnaires, statistical analysis, and observation. There is no scientific evidence to support this theory, and studies have not found any correlation between blood type and personality. Some people believe in this theory, but science does not support it.

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