BOMBAY BLOOD GROUP: SCIENCE & TECHNOLOGY

NEWS: *Round peg in a square hole: How doctors pulled off cross-blood transplant in patient with rare Bombay blood group*

WHAT'S IN THE NEWS?

Doctors at **MIOT International, Chennai**, successfully performed a **cross-blood kidney transplant** for a patient with the rare **Bombay blood group**, overcoming severe clinical challenges using advanced **plasmapheresis and immunosuppressive therapy**. This is the **first known instance** of such a transplant, expanding possibilities for rare blood group patients worldwide.

Background of the Case

- **Patient**: A **30-year-old male** with **Bombay blood group** required a kidney transplant.
- **Donor**: His **mother**, who had an **incompatible blood group**.
- **Challenge**: Traditional transplants require **blood group compatibility** to prevent **organ rejection**.
- **Medical Breakthrough**: Doctors used an advanced **plasmapheresis technique** to enable the cross-blood transplant.

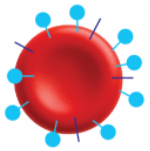
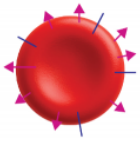
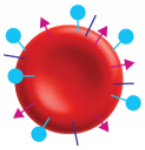
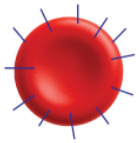
Understanding the Bombay Blood Group

What is the Bombay Blood Group?

- Discovered in **1952** by **Dr. Y.M. Bhende** in **Mumbai**.
- It is an **extremely rare** blood type caused by the **absence of the H antigen**.
- The **H antigen** is the **precursor for A, B, and O blood groups**.
- Since **A, B, and O blood groups** require the **H antigen**, individuals with the **Bombay blood group lack all of them**.

Compatibility Issues with Other Blood Groups

- **Cannot receive blood from ABO blood groups**, including **O type blood**.
- **Only compatible with another Bombay blood group donor**.
- **Rare Prevalence**:
    - **Worldwide**: 1 in 4 million.
    - **Mumbai (India)**: 1 in 10,000.
    - **Europe**: 1 in 1 million.

BLOOD GROUPS					
	Type A	**Type B**	**Type AB**	**Type O**	**Type Bombay O**
Antigen (on RBC)	Antigen A 	Antigen B 	Antigen A + B 	Antigen H 	No Antigen 
Antibody (in plasma)	Anti-B Antibody 	Anti-A Antibody 	Neither Antibody	Anti-A & Anti-B 	Anti-A, Anti-B and Anti-H 
Cannot donate	O, B, Bombay O	O, A, Bombay O	O, A, B, Bombay O	Bombay O	
Can donate	A, AB	B, AB	AB	O, A, B, AB	O, A, B, AB Bombay O
Can receive	A, O	B, O	AB, A, B, O	O	Bombay O

Challenges in Cross-Blood Kidney Transplantation

Why is Blood Group Compatibility Important in Organ Transplants?

- Organ transplants require the **recipient's immune system** to **accept the donor organ**.
- Mismatched blood groups **trigger an immune response**, leading to **graft rejection**.
- Normally, only **compatible blood groups** can donate organs to avoid this.

How Did Doctors Overcome Blood Incompatibility?

- **Solution – Double Filtration Plasmapheresis (DFPP):**
  - A **Japanese technique** that removes **antibodies** from the patient's blood.
  - Used to **reduce blood incompatibility** in ABO transplants.
  - Key to preventing **hyperacute rejection** of the transplanted organ.

Medical Steps in the Cross-Blood Transplant

1. **Measurement of Anti-H Antibodies**: Since the **Bombay blood group** has **unique antibodies**, their levels were assessed.
2. **Plasmapheresis**:
   - Used to **remove incompatible antibodies** from the patient's blood.
   - Helped lower the **risk of rejection**.
3. **Monoclonal Antibody Injections**:
   - Given to **deplete B cells**, reducing the immune system's ability to attack the new kidney.
4. **Intravenous Immunoglobulin (IVIG) Therapy**:
   - Further suppressed the immune response to prevent **graft rejection**.
5. **Kidney Transplant Surgery Performed**:
   - Conducted only after **antibody levels** were reduced to a **safe threshold**.

Outcome

- The transplant was **successful**, with **no complications**.
- The patient showed **stable kidney function** post-surgery.
- **Significance**:
  - A **historic achievement** in Indian medical science.
  - **Potentially life-saving** for others with rare blood types.

Significance of the Breakthrough

Why is This Transplant Important?

- **Expands the Donor Pool**:
  - Patients with rare blood types **struggle to find compatible donors**.
  - Cross-blood transplants **increase donor availability**.
- **Reduces Waiting Time for Transplants**:
  - **Shorter waiting times** mean **higher survival rates**.
- **Paves the Way for Future Cases**:
  - Sets a **global precedent** for cross-blood transplants.

Blood Group Systems – A Quick Overview

ABO Blood Group System

Blood Type	Antigen on RBCs	Antibodies in Plasma	Compatibility
A	A antigen	Anti-B antibodies	Can receive A, O
B	B antigen	Anti-A antibodies	Can receive B, O
AB	A & B antigens	No antibodies	**Universal Recipient**
O	No antigens	Anti-A & Anti-B antibodies	**Universal Donor**

Rh Blood Group System

Rh Type	D Antigen on RBCs	Compatibility
Rh Positive (Rh^+)	Present	Can receive **Rh+ and Rh-**
Rh Negative (Rh^-)	Absent	Can only receive **Rh-**

- The **Rh factor** was named after the **Rhesus monkey**.
- Plays a key role in **blood transfusions** and **pregnancy-related complications**.
- Important in **hemolytic disease of the newborn (HDN)**.

Conclusion

The **cross-blood kidney transplant for a Bombay blood group patient** marks a **historic advancement in transplant medicine**. It demonstrates the **success of advanced immunosuppressive techniques** and sets a **new precedent for rare blood type transplants worldwide**. This medical breakthrough could significantly **reduce waiting times for organ transplants** and **save lives** of patients with **rare blood groups** in the future.

Source: https://www.thehindu.com/sci-tech/health/miot-chennai-cross-blood-kidney-transplant-patient-bombay-blood-group/article69195971.ece