

More about haemophilia

Blood and clotting

Why doesn't blood clot properly in people with haemophilia?

Haemophilia is a bleeding disorder whereby blood doesn't clot properly. It is caused by not having enough of one of the essential clotting ingredients (called factors) in the blood. The 'ingredients' that cause haemophilia are usually factor VIII (8) or IX (9). Roman numerals are used when referring to clotting factors.

Haemophilia A, or Classical Haemophilia, is the most common form and is due to the deficiency of factor VIII. Haemophilia B, or Christmas Disease, is due to factor IX deficiency.

Haemophilia A is five times more common than haemophilia B¹.

For blood to clot normally, a person needs to have at least thirty percent of the clotting factor.

Treatment involves injecting the factor required so blood can clot normally.

A person with haemophilia does not bleed any faster than a person without haemophilia, but the bleeding continues for longer if it is not treated. There is a myth that people with haemophilia bleed to death from a cut. This is NOT true.

Internal bleeding (often referred to as a 'bleed') is the biggest problem for people with haemophilia. Prompt treatment will, however, fix most problems. Chapter 3 discusses bleeds in more detail.

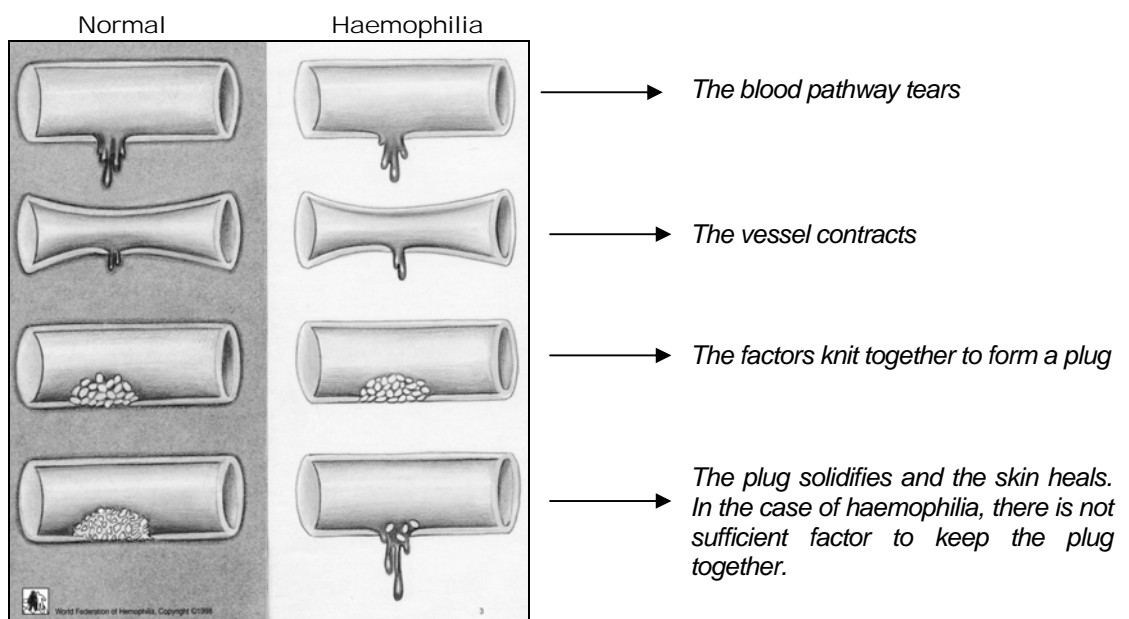
How blood clots

There are three stages involved in stopping bleeding:

- Blood vessels contract, directing the blood flow away from the injury.
- Platelets in the blood knit together to form a 'plug' that stops blood flow.
- A series of chemical reactions turn liquid blood into solid blood so that the skin has a chance to heal. Factor VIII and IX are essential elements to these chemical reactions.

A factor VIII or IX deficiency means it takes longer for the blood to solidify over the wound. It is like thickening gravy without enough flour to soak up the fluids...it's possible, it just takes longer.

The diagram below illustrates what happens within the body:



(Image Source: *Haemophilia in Pictures*, WFH 1998)

People with haemophilia may experience 'rebleeding' at the site of an injury. This is typical of haemophilic bleeding.

Inheritance

How did my child get haemophilia?

Haemophilia is the result of genetic mutation (change) on the factor VIII or IX gene. Mutation is a normal part of nature. There are many mutations that lead to haemophilia, though families tend to have the same mutations. Part of the factor VIII gene is prone to mutation and thus change at this particular site is common.

In families with a history of haemophilia, the mutation occurred at some point in previous generations. Examining the family tree will help establish where this change occurred.

In the case of children with no previous family history of the disorder, the mutation may have occurred in the child or, more commonly, in the mother.

How can a woman carry the haemophilia gene?

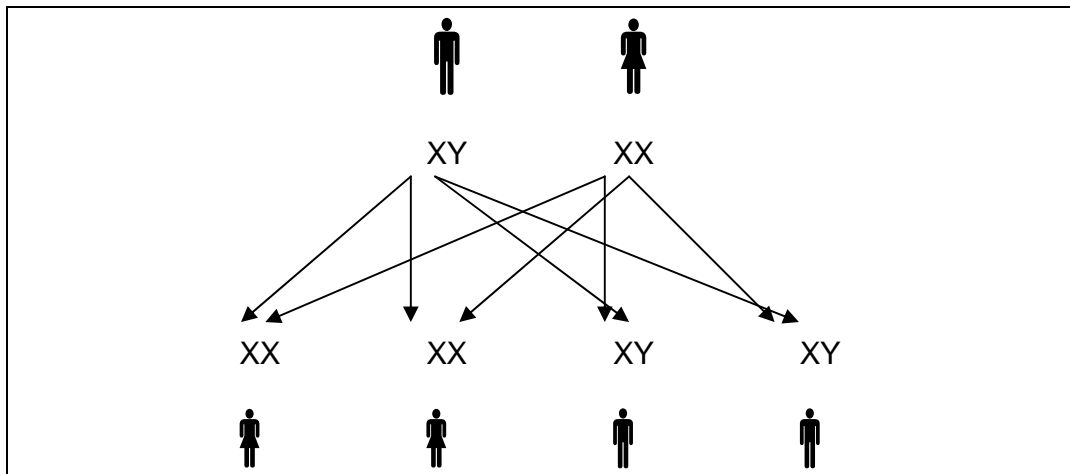
To understand this, the nature of chromosomes should first be considered. Everyone inherits two sex chromosomes, one from each parent. (Chromosomes are genetic blueprints.)

Together, these chromosome pairs determine gender. Females always have the combination XX. One X chromosome is inherited from each parent. Males have the combination XY. They inherit one of the mother's two X chromosomes plus his father's single Y chromosome.

Factor VIII and IX production is generated by instructions contained on the X chromosomes. An X chromosome with genetic instructions that lead to haemophilia can be passed from parent to child.

Although females may have some milder symptoms of haemophilia and can pass the gene on, they rarely have symptoms of severe haemophilia.

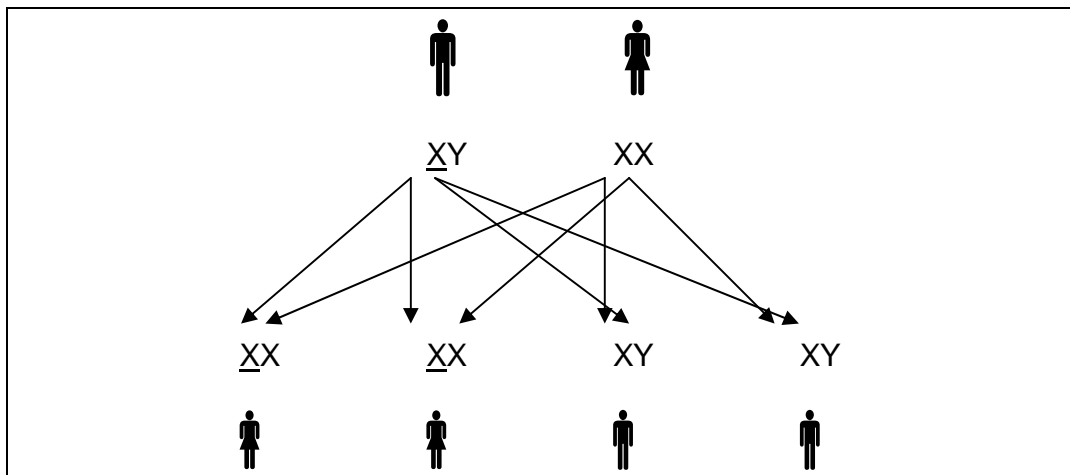
For every child any couple has, there are four possible combinations of chromosomes. These are shown overleaf.



Normal inheritance pattern for X and Y chromosomes

Father with haemophilia

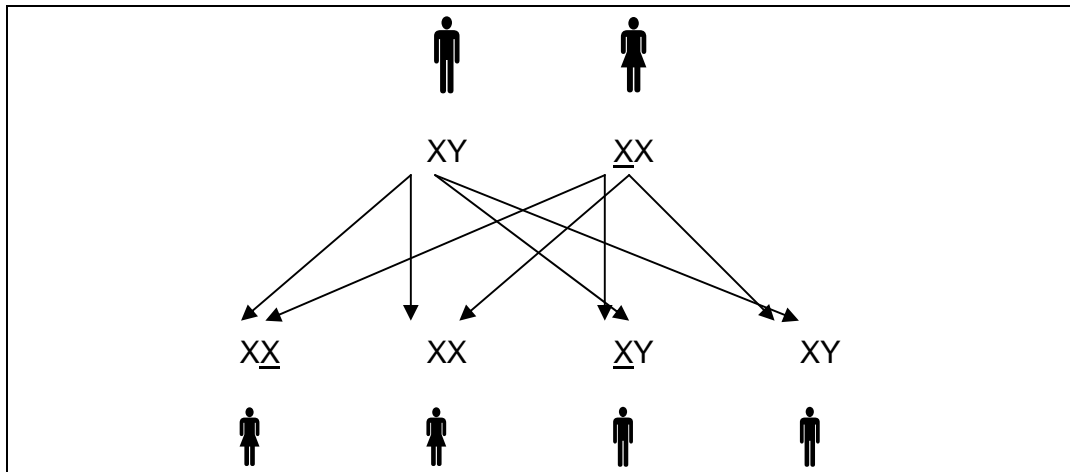
If the gene responsible for haemophilia is located on the father's X chromosome, his sons will not have haemophilia because they do not inherit their father's X chromosome. However all daughters will have the genetic coding that results in haemophilia on the X chromosome inherited from their father. All daughters of men with haemophilia will carry the gene responsible for haemophilia.



Father has haemophilia. The chromosome containing the gene responsible for haemophilia is underlined.

Mother with the gene responsible for haemophilia

If the gene responsible for haemophilia is located on one of the mother's X chromosomes, all her children have a fifty percent chance of inheriting this gene.



One of the mother's chromosomes includes genetic code that leads to haemophilia. This chromosome is indicated with an underline.

Therefore, each child born to a woman who carries the gene responsible for haemophilia has a twenty five percent chance of being a:

- female who does not carry the gene responsible for haemophilia,
- female who does carry the gene responsible for haemophilia,
- male who does not have haemophilia,
- male who has haemophilia.

In the illustration above, the daughter who inherited her mother's chromosome containing the gene responsible for haemophilia (i.e. X̄X) will have a fifty percent chance of passing that gene onto her own children.

The son who inherited his mother's chromosome containing the gene responsible for haemophilia (i.e. X̄Y) will have haemophilia, and will subsequently pass this gene onto all his daughters.

Will my child's children have haemophilia too?

If a male has haemophilia, his sons will not have haemophilia because the gene is carried on the X chromosome and his sons inherited the Y chromosome from their father. Haemophilia is not 'carried' on the Y chromosome.

All the male's daughters will 'carry' the gene responsible for haemophilia because they inherited his only X chromosome, which contains the affected genes.

Can girls have haemophilia?

Most women with one haemophilia chromosome do not have symptoms of haemophilia because they have a second X chromosome which functions sufficiently to generate enough clotting factor. Some females do, however, exhibit some symptoms such as heavy periods, easy bruising and bleeding following surgery or trauma. If you or your daughters experience these symptoms, mention it to your treating health care professional.

While most people with haemophilia are male, it is possible - but extremely rare - for females to have haemophilia. This occurs where the father has haemophilia and the mother carries the haemophilia gene, which is passed onto the daughter. There are also rare instances where a girl is born with haemophilia and neither parent has the haemophilia chromosome. This is due to a mutation (change) in the girl's own genes that affects both of her X chromosomes.²

You should discuss with your haematologist the advisability of having your daughter's blood tested.

Types of haemophilia

There are different types of haemophilia and they are determined by which factor is deficient. The most common types are:

Haemophilia A

Haemophilia A, or classical haemophilia, is the most common type. It is present in about seventy-five to eighty percent of the total population of people with haemophilia.

Someone with Haemophilia A is deficient in factor VIII (i.e. doesn't have enough factor VIII).

Haemophilia B

Haemophilia B, also known as Christmas Disease, is the second most common type of haemophilia. A person with haemophilia B has a deficiency in factor IX.

Other haemophilias

There are other bleeding disorders which are very rare, like factor VII (7) and XIII (13) deficiency and von Willebrand disorder.

Even though there isn't a specific explanation about other clotting factor deficiencies here, this book may still be very relevant and helpful. Parents who have children who suffer from these types of blood disorders experience many of the same feelings and have many things in common with parents of children with haemophilia. For further information about von Willebrand disorder and the rarer clotting deficiencies, contact Haemophilia Foundation Australia.

Mild, moderate & severe haemophilia

Your child's haemophilia may have been described as mild, moderate or severe.

Mild	6-24% of normal clotting factor activity levels
Moderate	1-5%
Severe	less than 1%

Each person is born with a pre-determined clotting factor activity level. This will not change throughout a person's life. For example, if a boy has mild haemophilia he will still have mild haemophilia as a man. He will not develop moderate or severe haemophilia. Likewise, a boy with severe haemophilia will have severe haemophilia all his life.

Families with a history of haemophilia tend to have similar clotting factor levels. A family with a history of mild haemophilia is extremely unlikely to have a child with severe haemophilia.

The average person has approximately 100% clotting factor activity, but levels vary greatly. People with haemophilia have significantly lower factor levels than normal.

By knowing the severity of your child's condition, you are in a position to help your child as much as possible by being prepared for what to expect.

However, the exact level of factor deficiency doesn't always correlate with the individual's actual bleeding tendency. In time, you will anticipate the types of bleeds your child may have.

What can I expect?

“The hardest thing is that I don’t know what to expect!”

Many parents worry about what to expect now that they know their child has haemophilia. There can also be several months between your child’s diagnosis and the first bleed. It is not uncommon to think ‘maybe they made a mistake with his diagnosis.’

“All the knowledge in the world can’t beat experience.”

There are physical effects that your child may experience, and their severity, occurrence and frequency are subject to whether he has mild, moderate or severe haemophilia. Effects also vary from person to person and can even vary between brothers with haemophilia of the same severity.

Mild

- 6-24% clotting factor activity
- Can bleed following severe injury or surgery
- May never have bleeding problems – joints are rarely affected
- May not be diagnosed until later in life

Moderate

- 1-5% clotting factor activity
- Can bleed with slight injury
- May bleed once a month/every few months - joints may be affected

Severe

- Less than 1% clotting factor activity
- Can bleed without injury
- May bleed 1-2 times a week – usually joints are affected

This is a guide only. Each person with haemophilia is different. As you become more familiar with your child's haemophilia, you will come to know his tendency to bleed.

With regular treatment, bleeding episodes can be kept to a minimum.

Over time, you will come to know what is likely to cause bleeds and how they will affect your child.

“Haemophilia has become just a part of our life. It's no stress. Xavier has his needle between shower and teeth. He usually argues more about the teeth cleaning than the needle.”