7.1 The problem of blood loss

Learning outcomes
By the end of this topic you should be able to:

- understand the problems of blood loss and ‘shock’
- identify the problems with nineteenth century blood transfusion attempts
- explain the importance of Landsteiner’s work in establishing blood types

Blood loss has always been a major problem in surgery. Bleeding makes it difficult for the surgeon to see what he is doing, but there is also the problem of ‘shock’: if a patient loses too much blood, their body cannot function and they will die.

Medical descriptions of shock were not made until the eighteenth century, which is surprising considering the amount of blood lost in human history! This was probably in part because of the deeply-held medical belief that bleeding people was an effective treatment for many kinds of disorders – including the symptoms of shock, which were confusion, rapid breathing and a fast pulse.

During the 17th century, there were experiments with blood transfusions using blood from animals (usually sheep) as well as from humans. Although patients occasionally survived, in most cases they died and the procedure was banned.

Once anaesthetics and antiseptics made it possible to perform complex operations, there was a renewed drive to find a way of dealing with the two problems of blood loss: controlling and replacing it.

Controlling blood loss
The usual way to deal with wounds or amputations was to seal the blood vessels by placing a hot iron onto the wound or pouring hot oil over it. This process was called cautery and was extremely painful.

In the 16th century a French surgeon, Ambroise Paré, developed metal clips to place on arteries during an operation. He also tried using silk thread to tie the blood vessels after an amputation instead of using heat to seal them. This was far less painful, but the ligatures did not always stop the bleeding if they were not tied properly.

Cautery: The use of heat to seal blood vessels and stop bleeding
Ligature: A thread tied around a blood vessel to stop bleeding
Shock: When there isn’t enough blood in the circulatory system to keep the body working properly
Transfusion: The process of giving blood from a donor to the patient

Furthermore, this was before Pasteur developed the germ theory and therefore there was no understanding of the way that a surgeon’s dirty hands inside a wound increased the chances of infection and led to a higher death rate. For these reasons, cautery continued to be the main way of dealing with bleeding until Paré’s idea of silk ligatures was further developed by Joseph Lister in the late 19th century (see page 119).

Source A: A description of surgery in the 1840s by Dr Abbot. This describes an operation in the US but the same procedure would have taken place in Britain.

I remember an operation upon a young man for the removal of a large cancerous growth on the end of his tongue. The operation was done by a short, quick stroke of a knife which removed the outer half of the tongue. Of course, the bleeding was quite free. Dr Warren stepped back to the furnace where the hot iron was. At a look from Dr Warren the assistant quickly slipped both of his hands over the patient’s eyes and the hot iron was instantly applied to the whole bleeding surface of the tongue. The patient jerked suddenly backwards. Driven almost insane by the pain and the sizzle of his searing flesh, the patient broke free from his restraint, and a bloody struggle ensued with the attendants who attempted to hold him down.
The problems with transfusion

The doctor who brought blood transfusions back into medical practice in Britain was called James Blundell. His speciality was the care of women during pregnancy and birth. The most common cause of death during childbirth was a massive amount of blood loss right after the baby was born. Blundell found that a transfusion of human blood could sometimes stop the mother from dying.

Spurred on by this, Blundell and his followers developed different kinds of syringes, pumps and tubes to help make their transfusions. But there were three main problems:

- Clotting – just as a scab forms over a wound, blood starts to clot as soon as it leaves the body. Blood clots in the transfusion tubes would block them up so the transfusion couldn’t continue.
- Availability – clotting also meant that blood couldn’t be stored. Transfusions could only be done with the donor (the person giving the blood) attached to the recipient (the person getting the blood), as shown in Source B.
- Immune response – experience had shown that transfusing blood from an animal into a human seemed to destroy human blood cells, often leading to death. A similar reaction seemed to happen with some human blood: the donor blood would cause the recipient’s red blood cells to clump together. We now know that this happens because of an immune system response: antibodies don’t recognise the donor blood and attack it.

Source B: A drawing of a 19th-century blood transfusion.

Blood types

The problem of the immune response was solved in 1901 when Karl Landsteiner suggested that there were different blood types – A, B and O. A fourth group, AB, was added in 1902 by two other scientists.

Landsteiner’s findings showed that some of the blood types were incompatible – they could not be mixed without potentially fatal consequences. But transfusions between people of the same blood type were safe.

However, even with this breakthrough, the number of transfusions didn’t increase very much. There was still the problem that a donor needed to be present to provide the blood whenever it was needed. This was not very practical and therefore Landsteiner’s work did not have a big immediate effect on surgery.

Activities

1 Use details from Source B to describe the way in which transfusions were carried out in the nineteenth century.
2 Explain why nineteenth century surgeons had success with some transfusions but continued to experience major problems with others.
3 Landsteiner’s work solved a major problem of blood transfusion. Why do you think it did not immediately make much impact on the number of transfusions carried out?

Summary

By the nineteenth century, methods to control blood loss had become very sophisticated. Although the nineteenth century saw blood transfusion reintroduced into medicine, there were too many problems with it for it to become widespread practice.