

Living with Kidney Failure

Contents: A structured discussion concerning the treatment of kidney failure and some of the related problems.

Time: 2 periods plus homework.

Intended use: GCSE Biology or Integrated Science. Links with work on the kidney and homeostasis.

Aims:

- To complement and revise prior work on the kidney
- To outline the nature of kidney failure and the methods for its treatment
- To develop awareness of, and sympathy for, some of the medical, economic and human problems associated with kidney failure
- To develop awareness of problems associated with the allocation of limited resources in the National Health Service
- To encourage readiness to enter into discussion.

Requirements: Students' worksheets No. 302:

For each member of the class:

1 copy of General Briefing (sheet GB)

1 copy of Test (sheet T)

For each group of four students:

1 copy of each of the Expert's Briefings (sheets EB1, EB2, EB3)

1 copy of the Chairperson's Briefing (sheet CB)

This unit is best used after a conventional lesson or lessons on the kidney. The information on the structure and working of the kidney in the General Briefing is highly simplified and makes no mention of the complex procedure of selective reabsorption.

Procedure

- 1 Give each student a copy of the General Briefing (sheet GB). Allow them time to read and study it — this is best done for homework preceding the lesson.
- 2 Get them to do the test. This should take no more than 10 minutes. Go through the answers.
- 3 Form the class into groups of four. Each group should have a Chairperson, chosen for his or her potential for leading a discussion. If the class does not divide neatly into groups of 4, have some groups of 5.
- 4 Give the Chairperson their Briefing (sheet CB). Give Expert's Briefings (sheets EB1, EB2, EB3) to the other three members of the group — a different sheet to each member. If any groups have 5 members, sheet EB1 could be given to two people. Allow them time to study the briefings.
- 5 Hand over the running of the group discussions to the Chairpersons. Avoid intervening if possible.

This structured approach to the discussion should help increase students' commitment to the work. However, if the teacher wished, the unit could be used more conventionally by giving students copies of all the sheets and getting them to read the briefings, then answer the questions in the Chairperson's Briefing.

Note that the costing of kidney treatment is difficult, and estimates of cost vary widely. The figures given in sheet EB3 are at 1984 prices.

No mention has been made in the students' materials of peritoneal dialysis. This method employs the peritoneum as a natural body membrane for dialysis, and is quite commonly used, though less so than kidney machines or transplants.

Other resources

The following organizations are sources of further information about kidney treatment:

British Kidney Patient Association, Bordon, Hampshire

European Dialysis and Transplant Association, St Thomas's Hospital, London SE7 7EH

Acknowledgements Figures 1 and 2 (General Briefing) are reproduced by permission from *Science* by Graham Hill and John Holman (Nelson); Figure 3 (General Briefing) supplied by the British Kidney Patient Association; Figure 2 (Expert's Briefing 1) is adapted from *Revised Nuffield Advanced Biology Study Guide 1* (Longman).

Living with Kidney failure

General Briefing

Kidneys and kidney failure

What do the kidneys do?

The job of the kidneys is to purify the blood. As it travels around the body, the blood collects waste products such as urea. It also collects excess water. The kidneys remove the waste and excess water so they can be passed out of the body as urine.

Figure 1 shows the human urinary system. You can see there are two kidneys, one on each side of the body, just above the waist.

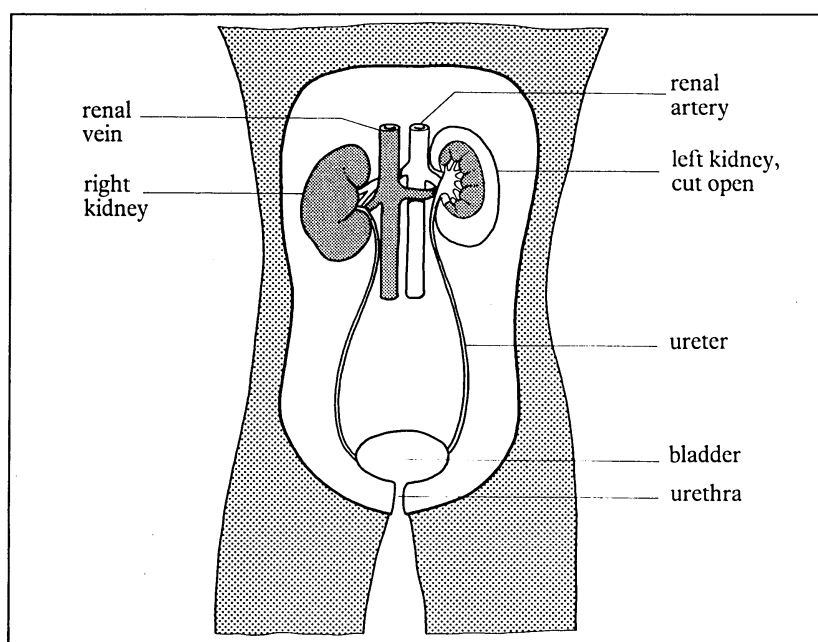


Figure 1 The human urinary system

Each kidney has a rich blood supply. About a litre of blood flows through the kidneys each minute (Figure 2).

In some ways the kidneys act like filters, filtering out harmful waste substances from the blood. However, the process is much more complicated than simple filtration. For one thing, the waste substances are soluble in water, so they cannot be filtered off in the usual way. For another thing, the kidneys have to remove excess water from the blood as well as waste.

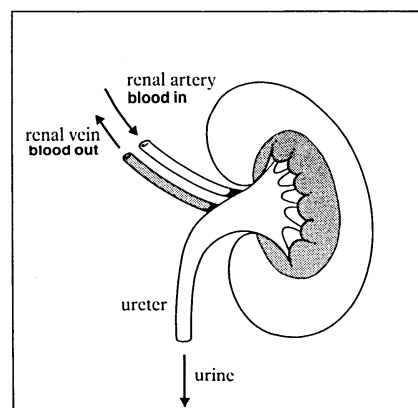


Figure 2 Detail of a kidney's blood supply

What can go wrong with the kidneys?

Sometimes stones form in the kidneys. They do not stop the kidneys working, but they can be painful and they may cause blockages.

Sometimes a kidney may stop working completely. This is called **kidney failure**. It may happen because the kidney has been damaged, or because of an infection. If only one of the kidneys fails, the other can manage on its own. But if both fail, the patient will be poisoned by his or her own waste products. If patients are not treated quickly they will die.

How can kidney failure be treated?

In Britain several thousand people have kidney failure each year. Until the 1960s it was not possible to treat them, and they usually died. But in recent years, doctors and scientists have developed two ways to deal with kidney failure:

- 1 **Kidney machines** — artificial kidneys which the patient must use two or three times a week (more details in Expert's Briefing 1)
- 2 **Kidney transplants** — a healthy kidney is transplanted into the patient's body (more details in Expert's Briefing 2)

Why do people still die from kidney failure?

Some people suffering from kidney failure are ill in other ways as well. They may have diabetes, or very high blood pressure. These complications may make it difficult to treat them on a kidney machine or to give them a transplant.

But over 1500 people who *could* be treated die from kidney failure in Britain each year. This is because the cost of giving transplants and running kidney machines is very high. There are not enough kidney machines to treat everyone. Expert's Briefing 3 gives more information about this problem.



Figure 3 A patient being treated on a kidney machine

Test on kidneys and kidney failure

- 1 What important job in the human body is done by the kidneys?
- 2 Why do the kidneys need to have a rich blood supply?
- 3 Kidneys produce urine. What does urine contain?
- 4 Give two causes of kidney failure.
- 5 Why will a person with kidney failure die unless he or she is treated?
- 6 What are the two major ways of treating kidney failure?

Living with Kidney Failure: Expert's Briefing 1

What are kidney machines?

You will shortly be taking part in a group discussion on kidney treatment. You are the only one in your group who has read this sheet, so you will be the expert on kidney machines. After you have read this, the Chairperson of your group will be asking the kind of questions a 'man or woman in the street' might ask. Try to answer them as simply as possible, in your own words.

Kidney machines work in a similar way to real kidneys. The patient's blood flows on one side of a very thin membrane. On the other side, a watery solution called a **dialysate** flows.

Impurities from the blood pass across the membrane into the dialysate. This is called **dialysis**. It is important to stop *useful* substances, like sugar and some salts, passing out of the blood along with the impurities. To stop this happening, the dialysate has sugar and salts dissolved in it. Their concentration is the same as the normal concentration of sugar and salts in the blood. In this way, these useful substances are prevented from leaving the blood. Figure 1 shows the basic idea.

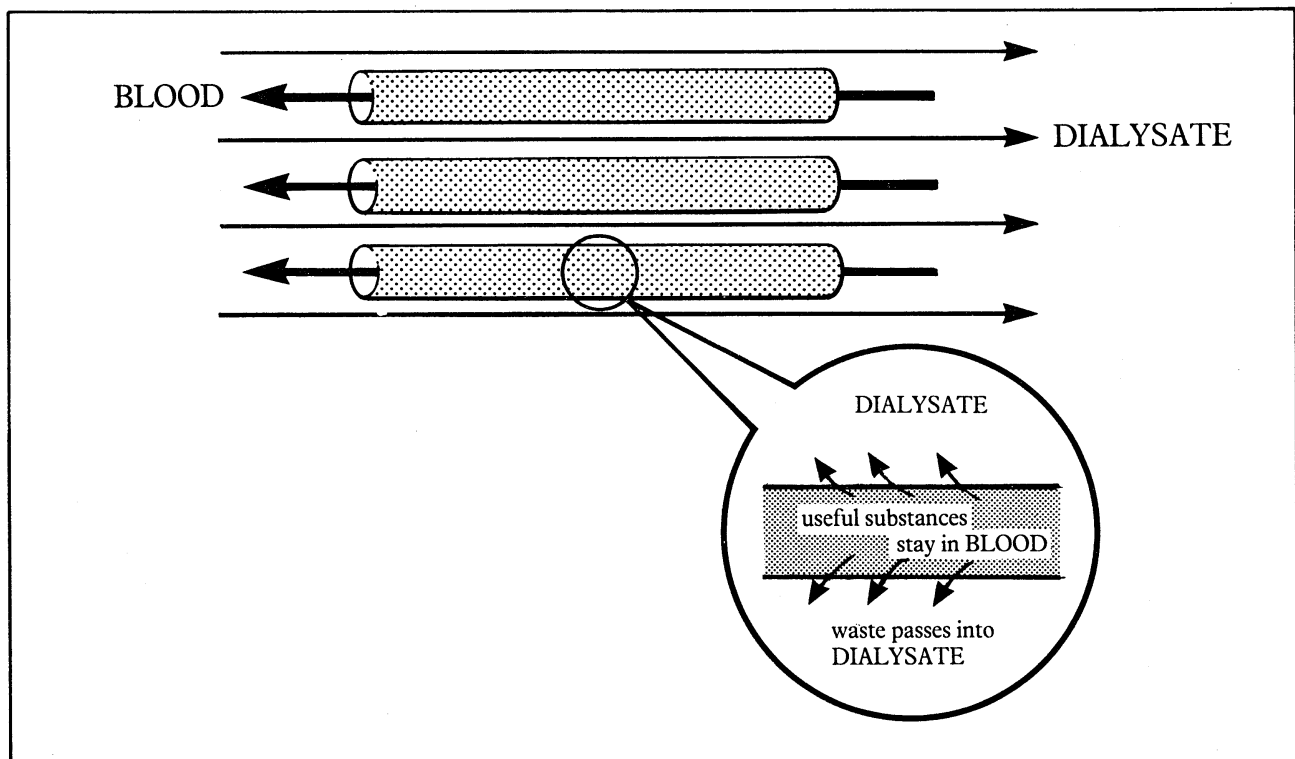


Figure 1 How dialysis works

The patient has to be connected to the machine for ten hours or so, two or three times a week. Blood from an artery, usually in the arm or leg, flows into the machine. After passing through the machine and getting cleaned, the blood flows back into a vein. The blood has to pass many times through the machine to get rid of all the waste. This is why the patient must stay connected to the machine for about ten hours. The patient's blood is collected through a hypodermic needle inserted into a vein in the arm. Blood is returned through another needle inserted in the same vein (Figure 2). The vein is a specially large capacity one, made surgically by connecting a normal vein to an artery.

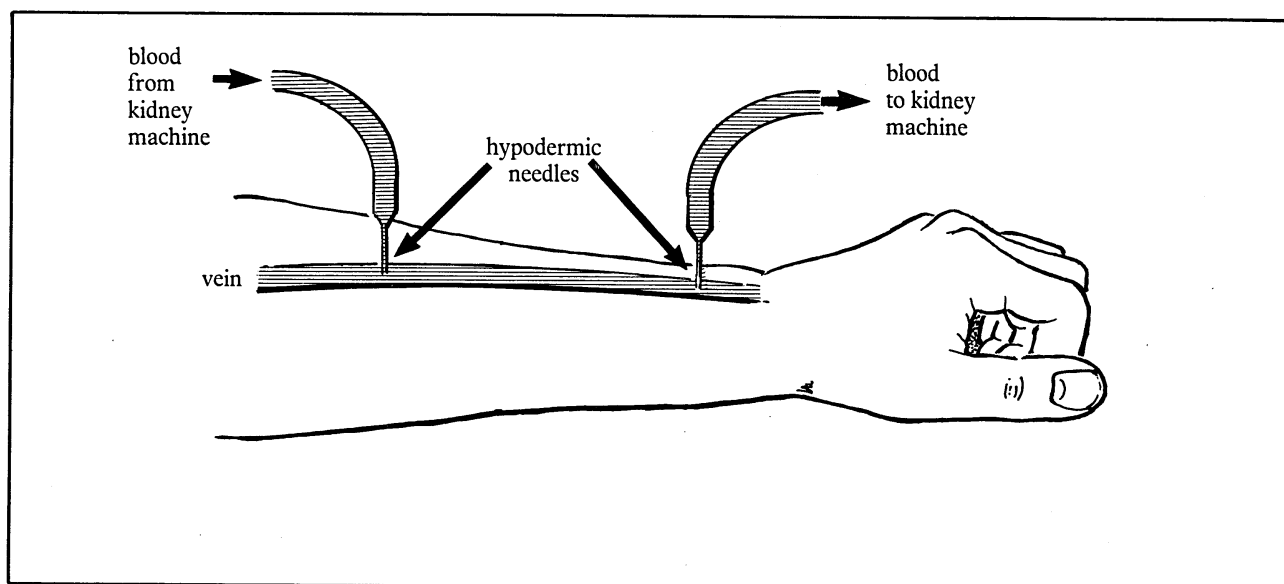


Figure 2 Connecting a patient to a kidney machine

Some kidney patients have their own kidney machine at home. Others go into a hospital or treatment centre each time they need dialysis.

Kidney machines save lives, but they can bring problems. Life can be difficult and restricted because dialysis takes up several hours a week, each week of the year. Patients sometime suffer medical problems such as anaemia and infections, bone disease and loss of sexual drive. They have to follow a careful diet. The diet cuts down particularly on foods which produce a lot of waste products like urea. The only time the patient can eat these 'forbidden foods' is when they are connected to the machine.

Living with Kidney Failure: Expert's Briefing 2

What are kidney transplants?

You will shortly be taking part in a group discussion on kidney treatment. You are the only one in your group who has read this sheet, so you will be the expert on kidney transplants. After you have read this, the Chairperson of your group will be asking the kind of questions a 'man or women in the street' might ask. Try to answer them as simply as possible, in your own words.

Sometimes, doctors can replace a failed kidney with a healthy one, taken from a human **donor**. This is a **kidney transplant**. The kidney may come from a live donor or from a person who has just died.

Live donors We have two kidneys, so one can be donated. This is most commonly done by relatives. The chances of a kidney being rejected by the patient's body are less if the kidney comes from a close relative. However, only about 12 per cent of transplant kidneys come from live donors.

People who have just died To be of any use, the kidneys need to be 'alive' when they are taken from the donor's body. They must be removed within an hour of death, and used within twelve hours.

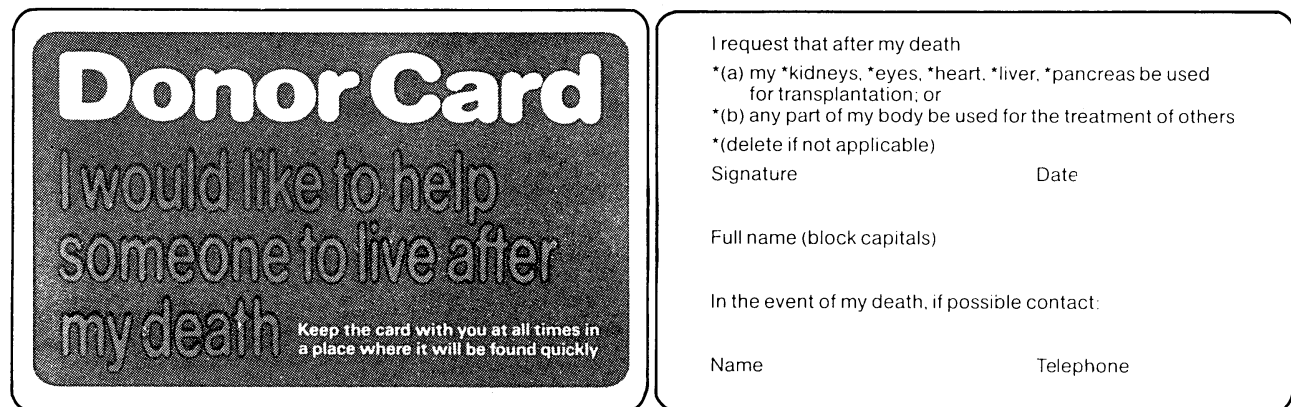


Figure 1 A Donor Card (front and back)

The best kidneys come from young, healthy donors. Often, these are people who have been killed in road accidents.

Kidneys cannot be taken from a person's body without permission from close relatives. However, some people carry a signed Donor Card (Figure 1). This gives permission for their kidneys and other organs to be used in transplants.

Problems with kidney transplants

Shortage of donors There are not enough donated kidneys available to allow every suitable patient to have a transplant. This is partly because there is a shortage of donors. Even where a donor is found, the kidneys can often not be removed quickly enough after the person has died.

Rejection Unless the new kidney comes from an identical twin, it will not match the patient's own body perfectly. Doctors try to match the new kidney as closely as possible, for example, by taking it from a close relative like a sister or brother. Even so, the body is bound to **reject** the kidney to some extent. Transplant patients are given medicines to control the rejection, but these medicines may have unpleasant side-effects.

If there is serious rejection of the kidney, the patient may have to have another transplant.

Living with Kidney Failure: Expert's Briefing 3

Statistics about kidney treatment

You will shortly be taking part in a group discussion on kidney treatment. You are the only one in your group who has read this sheet, so you will be the expert on statistics about kidney treatment. After you have read this, the Chairperson of your group will be asking the kind of questions a 'man or woman in the street' might ask. Try to answer them as simply as possible, in your own words. Your briefing is quite short but you have a calculation to do before the discussion starts.

Proportions of patients on different kinds of treatment

Between a quarter and a third of kidney failure patients are treated by transplants. The remaining patients, if they receive treatment, are treated by kidney machines. More than half of kidney machine patients have treatment at home.

Cost of treatment

Treatment for kidney failure is very expensive. The figures given here are approximate:

- 1 The cost of a *transplant* is around £6000 for the operation. Follow-up treatment costs around £1800 per year.
- 2 For kidney machine treatment in hospital, the cost is around £12 000 per patient per year.
- 3 For kidney machine treatment at home, the cost is around £7500 per patient per year.

Calculation

Work out the cost of keeping a kidney patient alive for three years by each of the treatment methods given above. You should assume the transplant works first time, though this is not always true.

For most patients these costs would have to be paid by the National Health Service.

Living with Kidney Failure: Chairperson's Briefing

You are the chairperson of a group of students. It is your job to ask questions and chair a discussion on kidneys and kidney failure. Much of the success of the session will depend on how well you do your job.

Everyone in your group will have read the General Briefing. Each member (except for you) will also have read an Expert's Briefing. The Expert's Briefings are:

- 1 What are kidney machines?
- 2 What are kidney transplants?
- 3 Statistics about kidney treatment.

You will begin by asking some specific questions about treatment of kidney failure. These questions will probably be answered by one of the Experts, though you should allow others to answer if they want. *Try to act as a 'man or woman in the street' who is trying to find out about kidney treatment.* Encourage the Experts to answer in their own words — don't let them read out from the Briefing sheets! Let the Experts draw diagrams, on an overhead projector, a blackboard or on paper, if they want.

After the specific questions, you will raise some general points for discussion. By this time, if the specific questions have worked properly, your group should have a reasonable idea of the facts behind kidney treatment. Try to encourage everyone to enter into the discussion.

Specific questions

(The number after each question refers to the Expert who is most likely to know the answer)

- 1 *How does a kidney machine work? (1)*
- 2 *What do patients have to do when they go for treatment on a kidney machine? (1)*
- 3 *What is a kidney transplant? (2)*
- 4 *Where do kidneys for transplant operations come from? (2)*
- 5 *Why do kidney transplant operations sometimes fail? (2)*
- 6 *Most kidney patients would prefer a transplant, if they could get one, to treatment on a machine. Why is this? (1,2 or all)*
- 7 *What proportion of kidney patients get transplants? (3)*
- 8 *Why can't everyone who wants a kidney transplant have one? (2)*
- 9 *What are the costs of different ways of treating kidney failure assuming the patient survives three years from the time treatment starts? (3)*
- 10 *What proportion of kidney machine patients are treated in their own homes? (3)*
- 11 *Why is home treatment preferable to going to a hospital kidney unit? (1,3 or all)*

General points for discussion

Encourage everyone to take part.

- How would your life be affected if you had kidney failure and had to go on a machine several times a week?
- At present, there are not enough kidney machines in Britain to treat everyone who is suffering from kidney failure. Why is this?
- To provide enough kidney machines would cost the National Health Service money. Where should this money come from? Possibilities are:
 - (a) By spending more money on kidney machines and less on other parts of the Health Service
 - (b) By spending a bigger *total* amount of money on the Health Service. This would mean increasing taxes, or cutting other services like education.
- If you think the best answer is to spend less on other parts of the National Health Service, which parts do you think should be cut?
- Doctors sometimes have to turn away people who need kidney treatment because there are not enough kidney machines. This may mean these people will die. How should a doctor decide who to treat and who to turn away? Factors which doctors have to consider include:
 - (a) Whether the patient is suitable for treatment
 - (b) Whether treatment will help the patient
 - (c) Whether the patient has dependents, such as a family
 - (d) The age of the patient.
- How can we overcome the problem of shortage of transplant kidneys?
- Which members of the discussion group would be prepared to carry a Donor Card?
- Which members of the group would be happy to leave parts of their body for medical experiments as well as transplants?
- At present the law says parts of people's bodies should not be used for transplants unless permission has already been given by the close relatives, or on a Donor Card. Should the law be changed so that *everyone's* kidneys were available, unless relatives or a Donor Card said no?