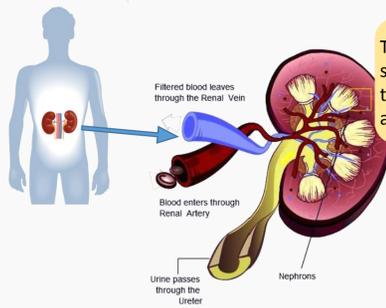


ReDVA Chronic Kidney Disease

The Kidneys
And the facilitation of the haemodialysis process
Failure
Treatment
Problems
Research
Maturation



The kidneys are bean shaped organs about the size of an adult fist and about 150g each

- The kidney functions are:**
- Filter waste from the blood
 - Control water content
 - Helps control blood pressure
 - Produces essential hormones
 - Regulates salts in the body

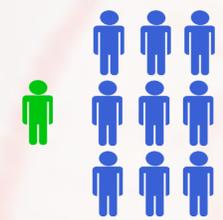
Inside the kidneys are "nephrons". These are tiny units where the filtering occurs.

The kidneys can filter about 200 litres of blood a day, almost a barrels worth, while removing 2 litres of waste



When kidneys fail to function

- Waste removal can be less than 20-10%
- The blood becomes toxic and can be terminal if left untreated



Kidney organ replacement is the ideal treatment, however:

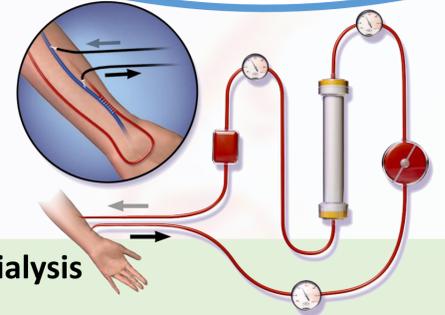
- Only 1 in 10 patients receive a kidney after 90 days
- Only 1/2 of patients ever receive a kidney

The number of Patients with Chronic Kidney Disease is increasing in the UK

- Approximately 10% of UK adults suffer from moderate to severe kidney disease
- Kidney disease occurs more frequently than diabetes and heart disease combined
- The rate of Kidney disease is increasing but the number of kidney donors and transplants is not matching the demand

Haemodialysis

- This is an artificial filtering of the patients blood by using a machine called a dialyzer.
- Blood is extracted from the body put through this machine where it is filtered and electrolyte balance controlled, then returned to the body.

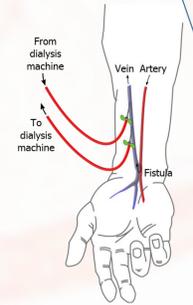


- The process extracts about 50ml of blood at any one time from the body
- In one session all the blood in the body passes through the machine 15 times
- This process happens 3 times a week with a total of **12 Hours a week**

Blood cannot be taken from an artery for this process as the vessels will collapse.

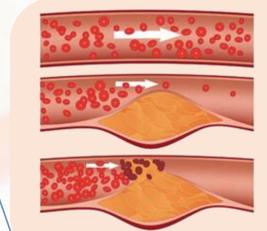
To cope with the stress of the dialysis process, a special connection must be created known as an **Arteriovenous Fistula**

This is a connection surgically performed that joins an artery to a vein, typically in the lower and upper arm
This bypasses the smaller vessels and increases flow



Cardiac Loading

- The heart can be stressed harder as the blood flow is now higher with the fistula in place.



Blockage

- The vein or artery can develop a narrowing of the vessel known as a "stenosis".
- This can constrict enough to reduce blood flow hindering the fistula function
- Another kind of blockage is when the blood clots in the fistula

Maturation is necessary for dialysis and can take several weeks. Despite these weeks, some fistulae do not mature



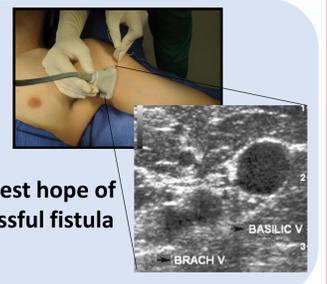
3 in 5 fistulae created will fail to mature and become functional

1 year ■■■■■ Of the fistulae that mature, 60% are still working at 1 year
3 years ■■■■■ and 40% at 3 years

For mature fistulae, over time it may fail or suffer other complications with repeated needle puncture, some issues are illustrated below.

Ultrasound

- By using ultrasound the vessels can be examined before surgery helping to pick the best vessels that may have the best hope of maturing and being a successful fistula

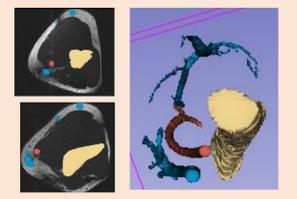


Balloons and stents



- In the event of blockages, a balloon may inflate at the site of narrowing, expanding the vessel and allowing blood to flow freely again.
- In other cases, to halt recoil of the vessel, a metal frame called a stent is inserted at the blockage point

MR Imaging



By using magnetic resonance imaging, greater clarity of the surrounding geometric features can be studied by 3D reconstruction.

Using this data, a virtual fistula can be studied using computer flow models, giving more information linking maturation and fistula failure to the forces in the fistula from flow

