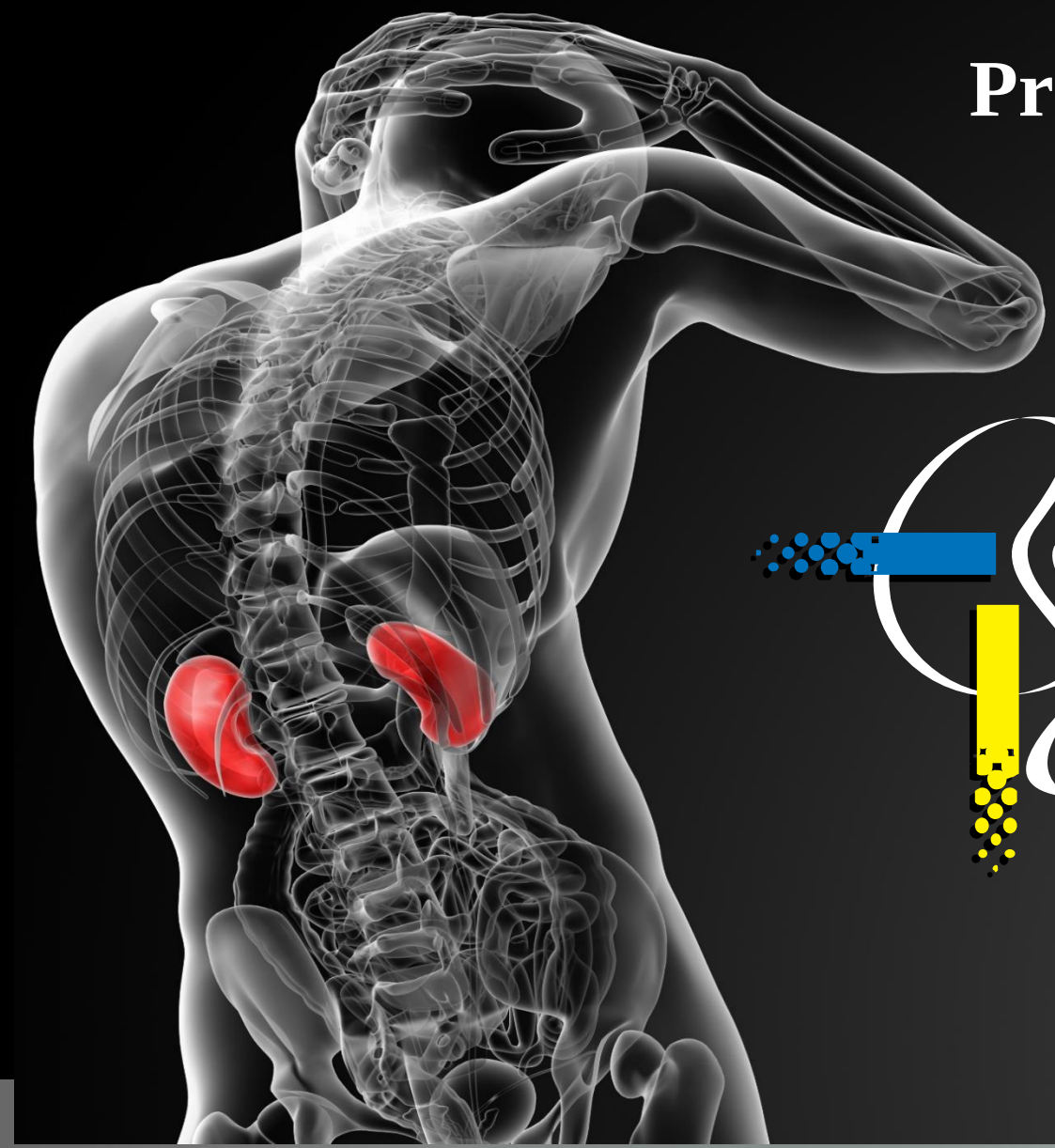
NRO



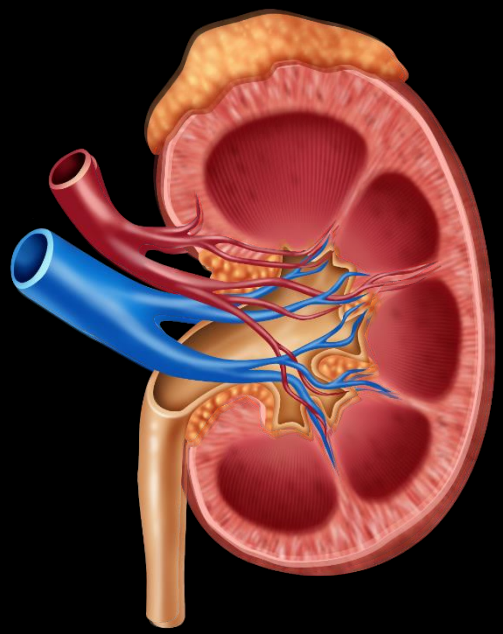
Prof. George Mellotte

HSE National Clinical Lead
Kidney Services
National Renal Office

World Kidney Day™

KIDNEYS

What are kidneys & what do they do?



Kidneys

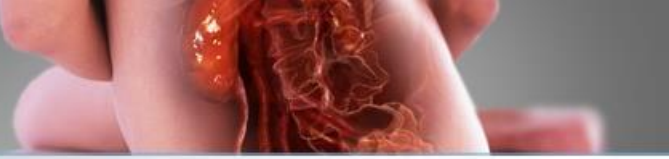
- Two bean-shaped organs,
- each the size of a fist. 11-12 CM

- Weigh 5-6 oz/ 150-170g
  0.5% of total body weight
  Kidneys get 20% of the hearts output!

Functional Unit of Kidney = Nephron

- Glomerulus – Filters the blood - GFR
- Tubule – Concentrates the filtrate into urine
- Interstitium – Makes Hormones

People typically have 1 million Nephrons!



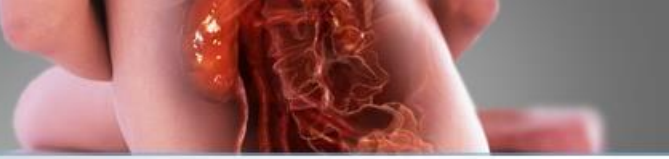
Function of the Kidney

Primary balancing organ of the body

- **Remove waste products Incl Drugs & Toxins**

Kidney controls your blood pressure

- **Remove excess fluid from your body**
  - **Linked with salt balance**
- **Balance the minerals and chemicals in your body**
  - **Acid/base balance**
  - **Sodium, Potassium, Calcium, Phosphate, Magnesium**
- **Produces RENIN to Control Blood pressure**
  - **Renin –Angiotensin system**



Function of the Kidney 2

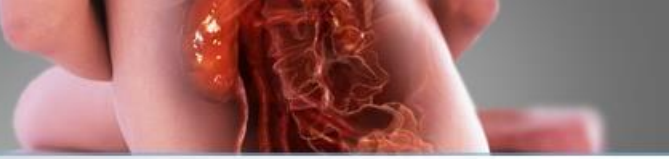
- **Kidneys produces a hormone called EPO – Erythropoietin**
  - **Tells the bone marrow to make red blood cells**

Kidney controls your blood pressure

- **Kidneys help maintain healthy bones**
  - Activates Vitamin D (Calcitriol)

KIDNEYS

When kidneys don’t work well



Warning Signs are Rare

- **Blood in the urine – is always ABNORMAL**
- **“Frothy Urine”**
- **Pain in Kidneys is rare!**
  - Pain passing urine is more likely related to bladder!
- **Difficulty in passing urine –**

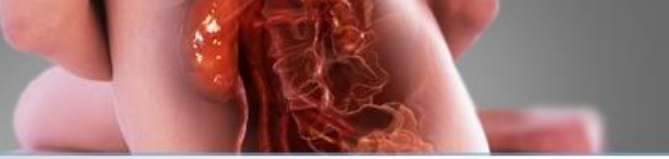
- **Hard to control blood pressure**
- **Fluid retention -**

Early kidney disease
has no signs or symptoms

Blood and urine tests
are the only way to
know

KIDNEYS

Kidney Tests



Common tests

- Blood Chemistry Tests
  - Renal profile, - To measure kidney function – Creatinine & GFR
  - Bone Profile – To check Calcium & Phosphate
  - Lipid (Cholesterol) – as Kidney disease causes High Cholesterol

- Urine Analysis Dipstick (confirm with laboratory based tests)
  - Protein or Albumin in urine
    - Ratio of urine protein/albumin to urinary creatinine
      - "corrects" for concentration effect
  - Blood cells in Urine

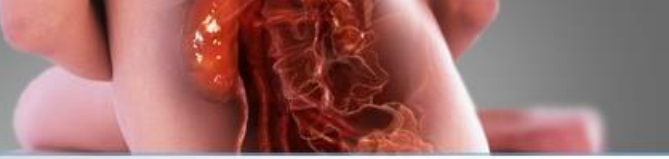
- Haematology
  - Blood Count – to check for Anaemia due to EPO lack

Serum Creatinine is not a good measure of kidney function

- Creatinine is a by-product of muscle break down
- Muscle mass is dependant on Body size & musculature
  - Age
  - Sex
  - Body Habitus

sCr	120 μmol/L	120 μmol/L
GFR	30 mL/min	130 mL/min

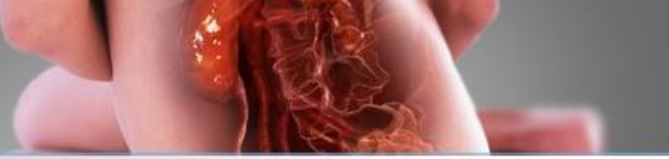
Reproduction courtesy of PE Stevens



What is GFR?

- Glomerular filtration rate = Measure of Kidney function
  - Easier to notice declining renal function
  - Level correlated with severity of complications
  - Level correlated with severity of kidney damage

- Average loss of kidney function is 0.5-1ml/year from the age of 30 in most patients
  - Progressive scarring of kidney units
  - Accelerated by
    - High Blood pressure
    - Protein in the urine
- Reduction in muscle mass in the elderly
  may mask deteriorating renal function



What is eGFR

eGFR is a method of calculating GFR based on Serum Creatinine

Multiple Formulas

Cockcroft & Gault Formula

$$eGFR = \frac{(140 - age) \times \text{Ideal Weight Kg}}{\text{serum Cr}} \times SF(1.2 \text{ males} / 1.05 \text{ females})$$

MDRD formula – CKD EPI

Expressed mls/min/per 1.73m^2.

- This is a “best fit” formula & assumes standard body size:

- underestimates kidney function in young healthy muscular/tall males
- over estimates kidney function in very underweight/small patients
- Cannot be used in Pregnancy/in people who have had amputations or muscle diseases

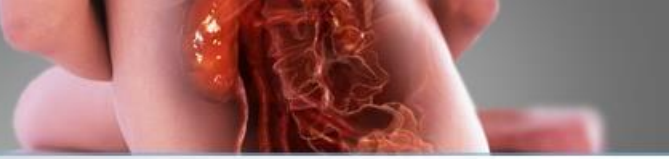
Classification of Chronic kidney disease (CKD)

Stage	Description	GFR (mL/min/1.73 m^2)
1	Kidney damage* with Normal GFR Only if other signs of kidney disease	> 90
2	Kidney damage – Mild Only if other signs of kidney disease	60–89
3a	Moderate Kidney Failure	45–59
3b	Moderate Kidney Failure	30–44
4	Severe Kidney Failure	15–29
5	End Stage Kidney failure	< 15 (or dialysis)

eGFR can be thought of as equivalent to % kidney Function

eGFR unreliable > 60

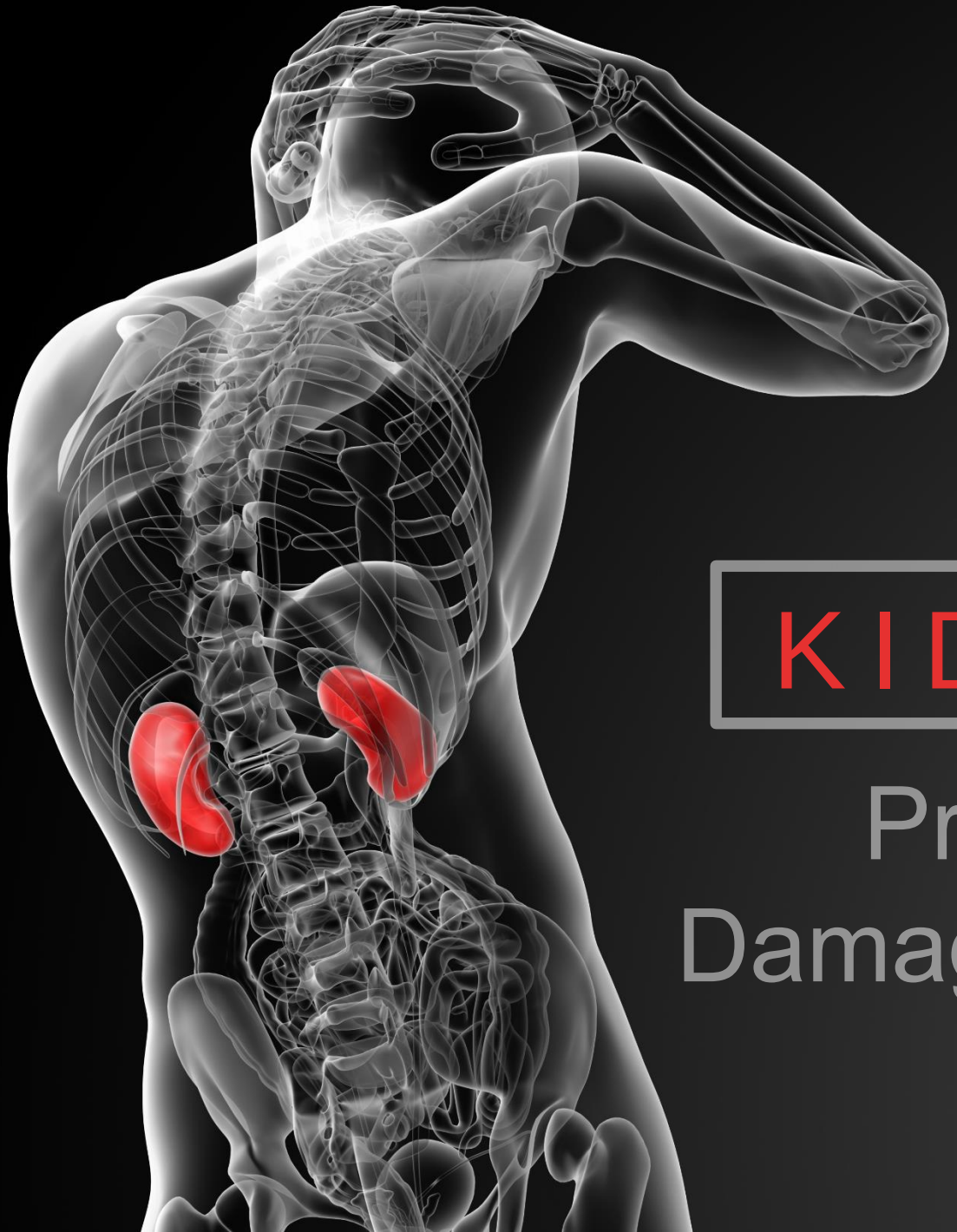
www.kidney.org/professionals/kdoqi



Symptoms of Severe Kidney Failure

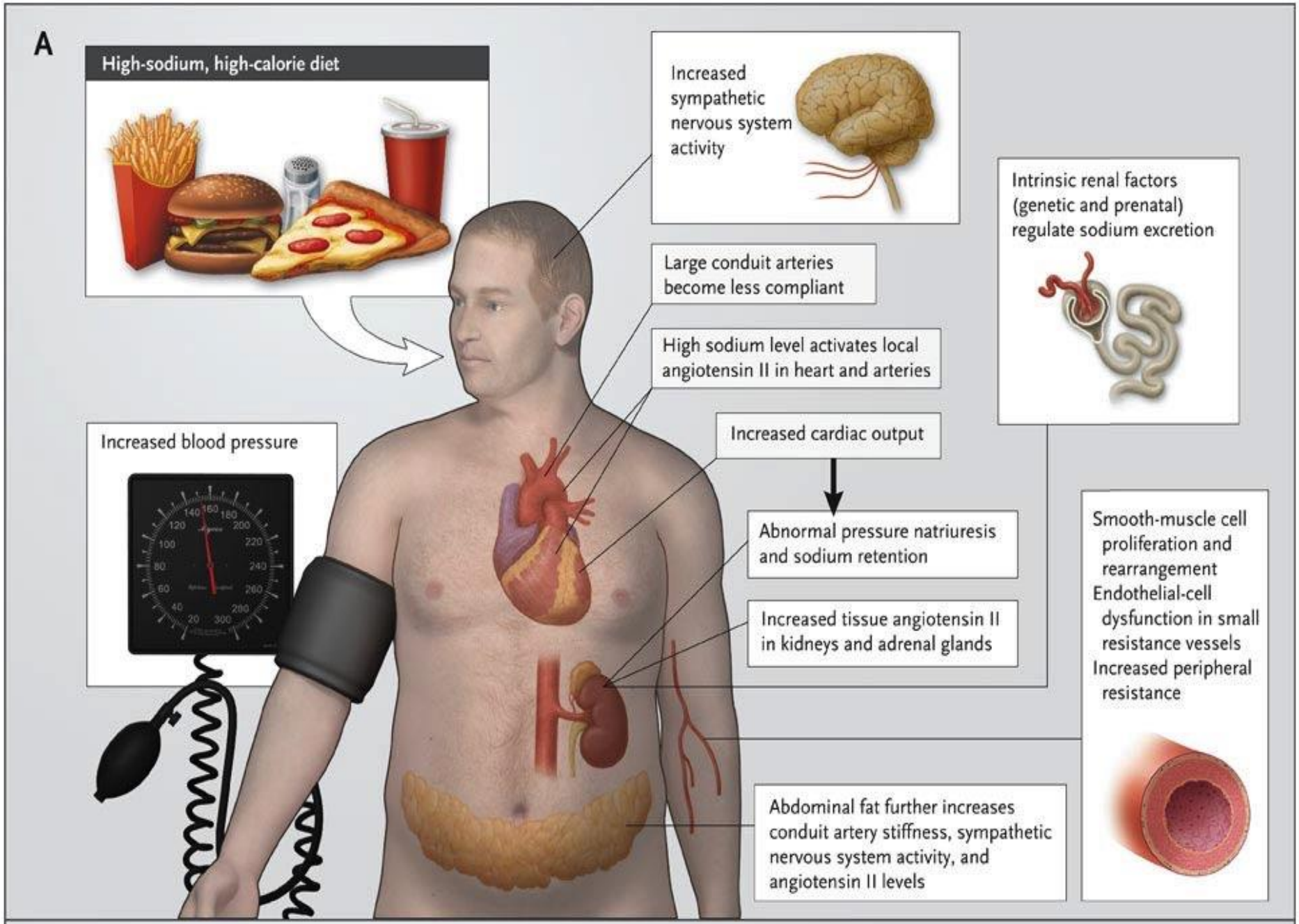
- Most are mild but increase in severity with CKD
  - ITCH
  - Tired - due to anaemia
  - Occasionally Nausea, poor appetite
  - Mental health issues (Apathy /Depression)

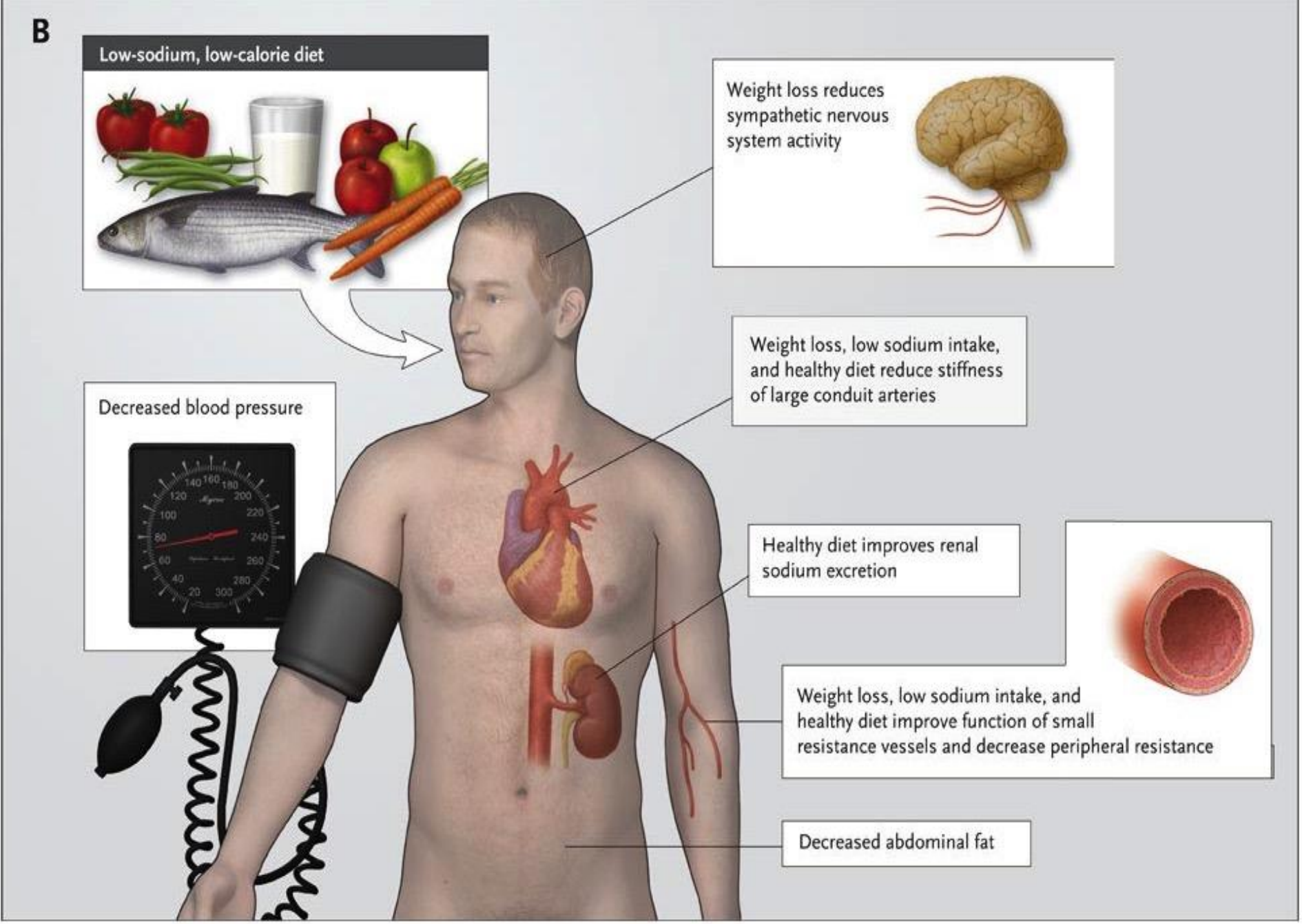
  - **Fluid Retention**
  - **For Diabetics – changing insulin requirements**



KIDNEYS

Protecting Damaged Kidneys



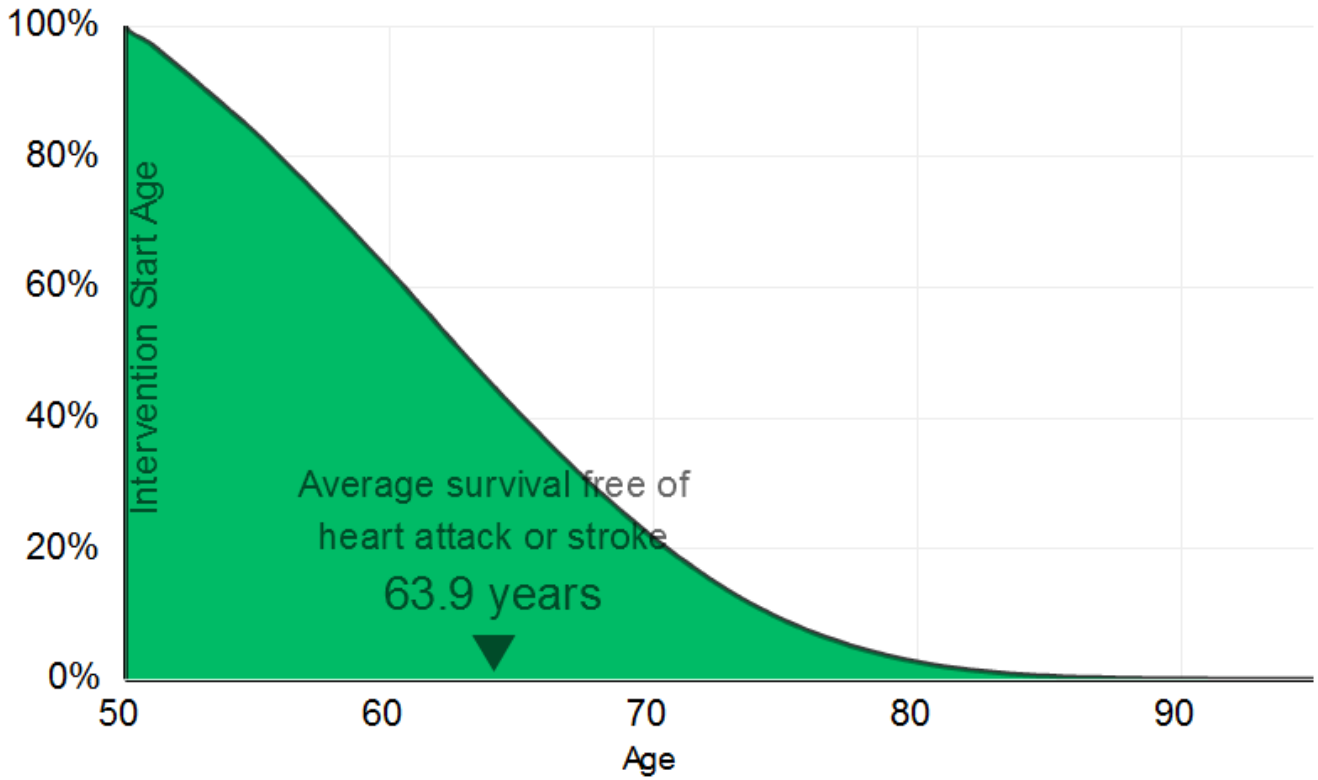

B
Low-sodium, low-calorie diet
Weight loss reduces sympathetic nervous system activity
Weight loss, low sodium intake, and healthy diet reduce stiffness of large conduit arteries
Decreased blood pressure
Healthy diet improves renal sodium excretion
Weight loss, low sodium intake, and healthy diet improve function of small resistance vessels and decrease peripheral resistance
Decreased abdominal fat

Your heart age is about

92

compared to a person of the same age, gender and ethnicity with optimal risk factors

% Chance of survival free of Heart Attack or Stroke



Intervention start age 50

Interventions

Future smoking category

20+/day

Systolic Blood Pressure

184 → 184

Total Cholesterol

7.0 → 7.0

HDL Cholesterol

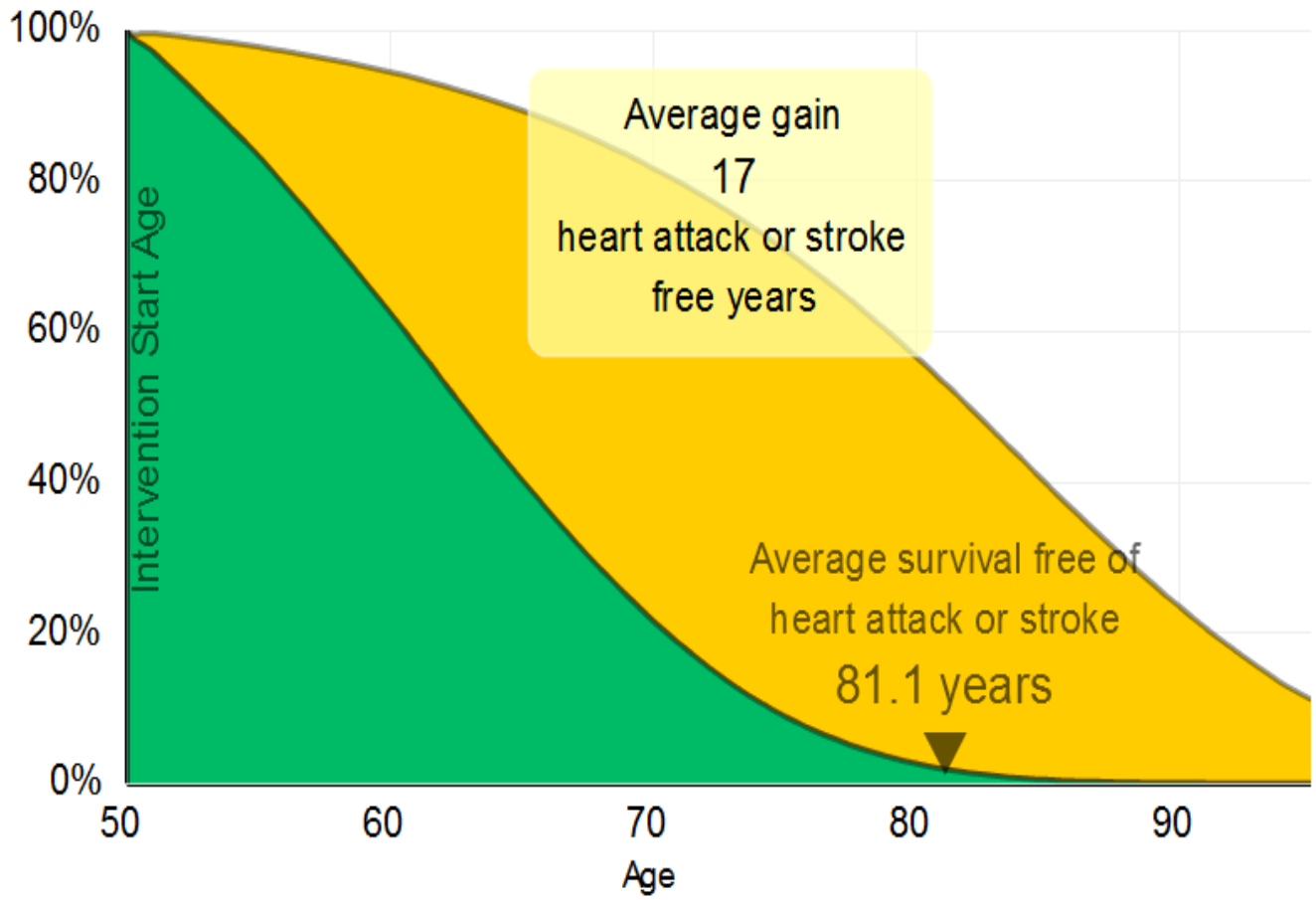
0.7 → 0.7

NonHDL Cholesterol: 6.3

BMI: 30.9

Reset

NRO



Intervention start age 50

Interventions

Future smoking category

I quit

Systolic Blood Pressure

184 → 132

Total Cholesterol

7.0 → 4.8

HDL Cholesterol

0.7 → 2.1

NonHDL Cholesterol: 2.7

BMI: 30.9

Reset

KIDNEYS

Ask your doctor to check your kidneys if ...

HSE NRO

You have diabetes

You have hypertension

You are overweight

One of your parents or other family members suffer from kidney disease

You come from an ethnic group with high risk

NRO

Strict Blood pressure

Control

Lose Weight

BMI <25

Exercise

Avoid Salt

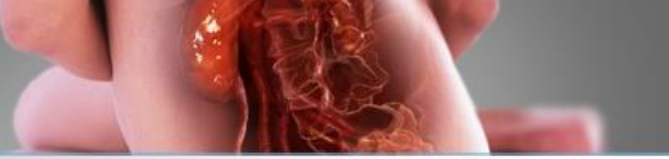
Stop smoking

Novel Treatments

Control Cholesterol

KIDNEYS

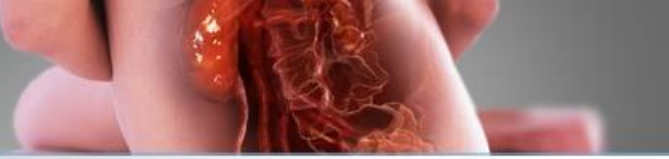
When Kidneys Fail



Dialysis removes

waste products and unwanted water

It does NOT replace the other functions of the kidney



How do kidneys fail?

Kidney failure is usually a very slow process
  – Months to years

- Kidney Failure is usually independent of the disease that caused the initial disease
  – A wearing out process

- Acute severe intercurrent illness can however precipitate a sudden collapse in kidney function
  – e.g. cardiac surgery or a severe pneumonia

When to start?

- Accepted reasons
  - Patient has unacceptable symptoms
  - Kidney Function <8-10% - eGFR <8-10mls (creatinine > 400-500umol/L)
  - Risk of Malnutrition/hyperkalaemia
- The timing to start Dialysis is influenced by quality of life issues

Treatment Choice

Haemodialysis

Intermittent

Complex

Hospital Based

Problems

Poorly tolerated in cardiac disease

Vascular access

Most suitable

Active patients

Patients with limited ability to self care

Nephrotic Syndrome

C.A.P.D. /A.P.D.

Simple

Independent

Patient dependent

Problems

Peritonitis risk

Catheter Malfunction

Protein losses

Most Suitable

Diabetics

Elderly

Patients living away from a HD unit

Transplantation

Desirable

Scarce resource

Not a cure

Problems

Graft Failure

Infection risk

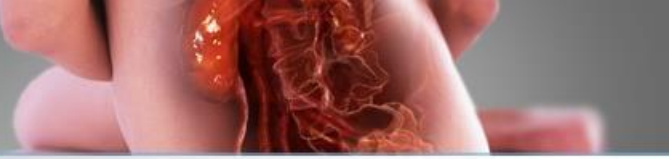
Cancer Risk

Only medically fit patients are Transplanted

NRO

Peritoneal dialysis

Trinity College Dublin
The University of Dublin



Peritoneal dialysis

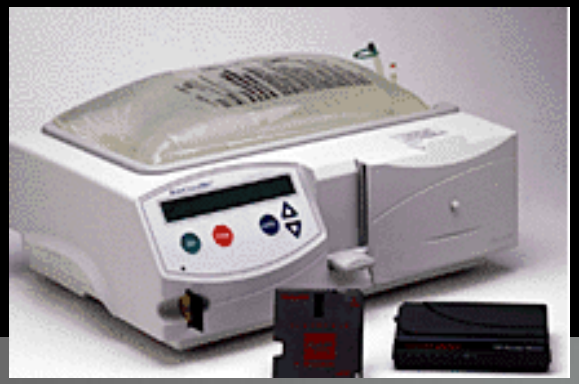
It is a home based system

- 4 components
  - A silastic catheter in the peritoneal cavity
  - Sterile dialysis fluid (supplied as 2 - 5L bags)
  - An area for exchange in the home
  - A pumping device (APD) or a Heating plate (CAPD)

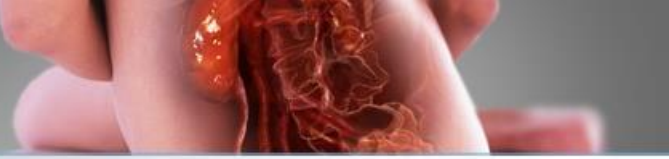
- For CAPD, done 4 times daily, 7 days a week
- For APD, machine done 4-6 times every night using a "**Home Choice**"

Automated Peritoneal Dialysis (APD)

- Automated Peritoneal Dialysis (APD) uses a machine to perform the fluid exchanges.
- Dialysis is done at home, at night while pts sleeps.
  - The APD machine controls the timing & frequency of exchanges
  - Patient connect their catheter to the APD machine's tubing going to bed & disconnects from the machine in the morning.
  - Not all patients can do APD



Haemodialysis



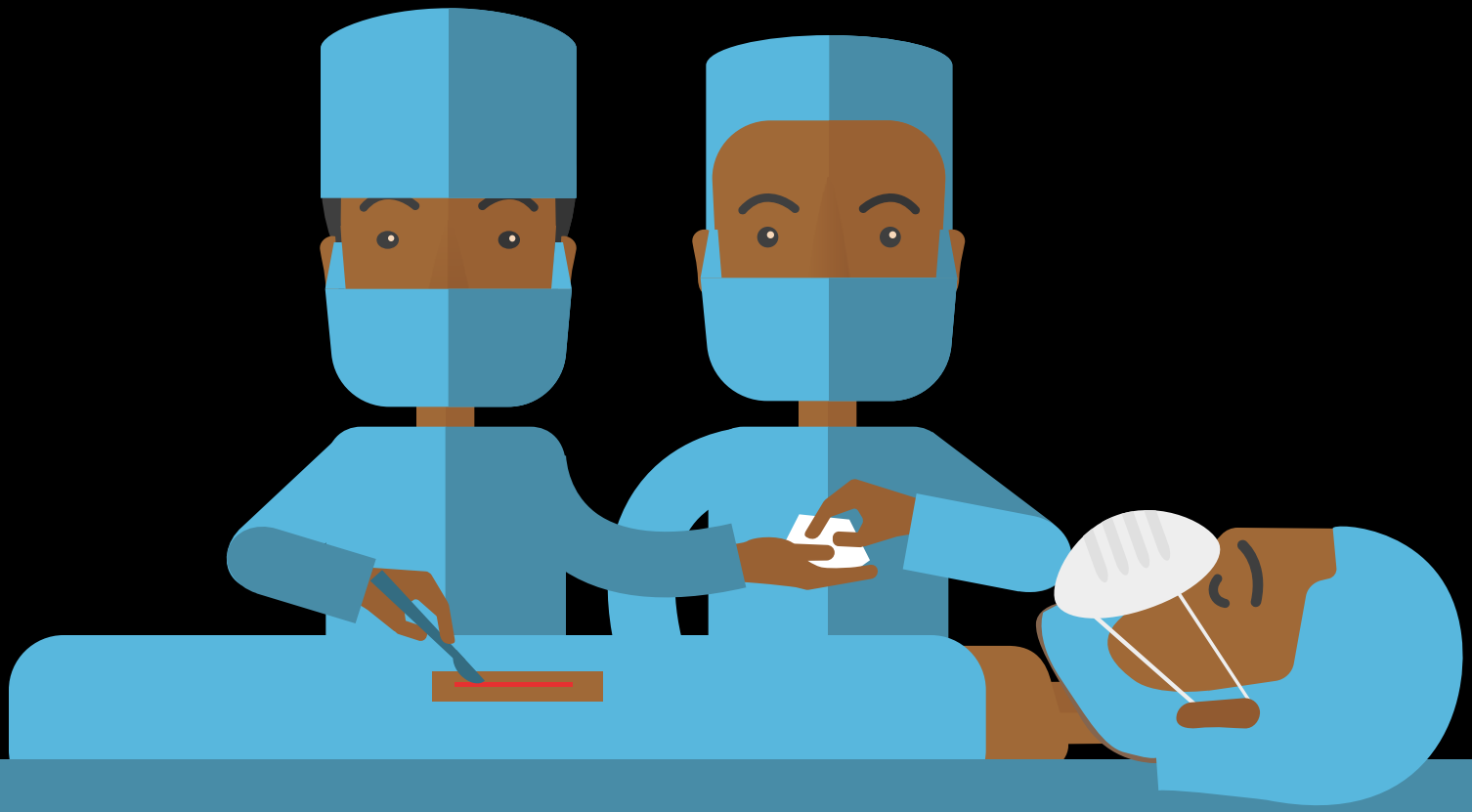
Haemodialysis

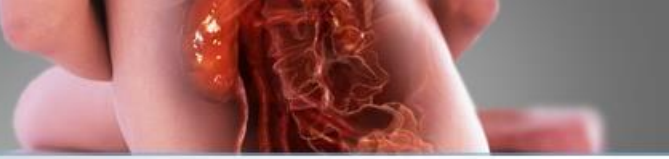
- **It is primarily a hospital based system – original type of dialysis**
- Vascular access – i.e. a way to get blood from a patient
    - "permcath" or an "AV fistula"
  - Machine to pump blood & dialysis fluid – HD machine
  - An Artificial Kidney
  - A Water treatment unit

- Each Treatment session lasts ~ 4 hours
  - this is independent of travelling time
  - Done on an alternate day basis – MWF or TTS – 3 times per week

NRO

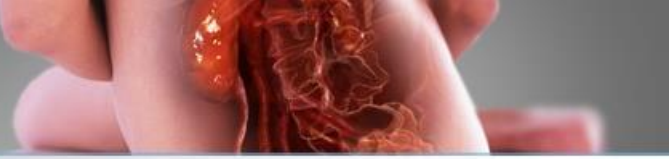
Kidney transplantation





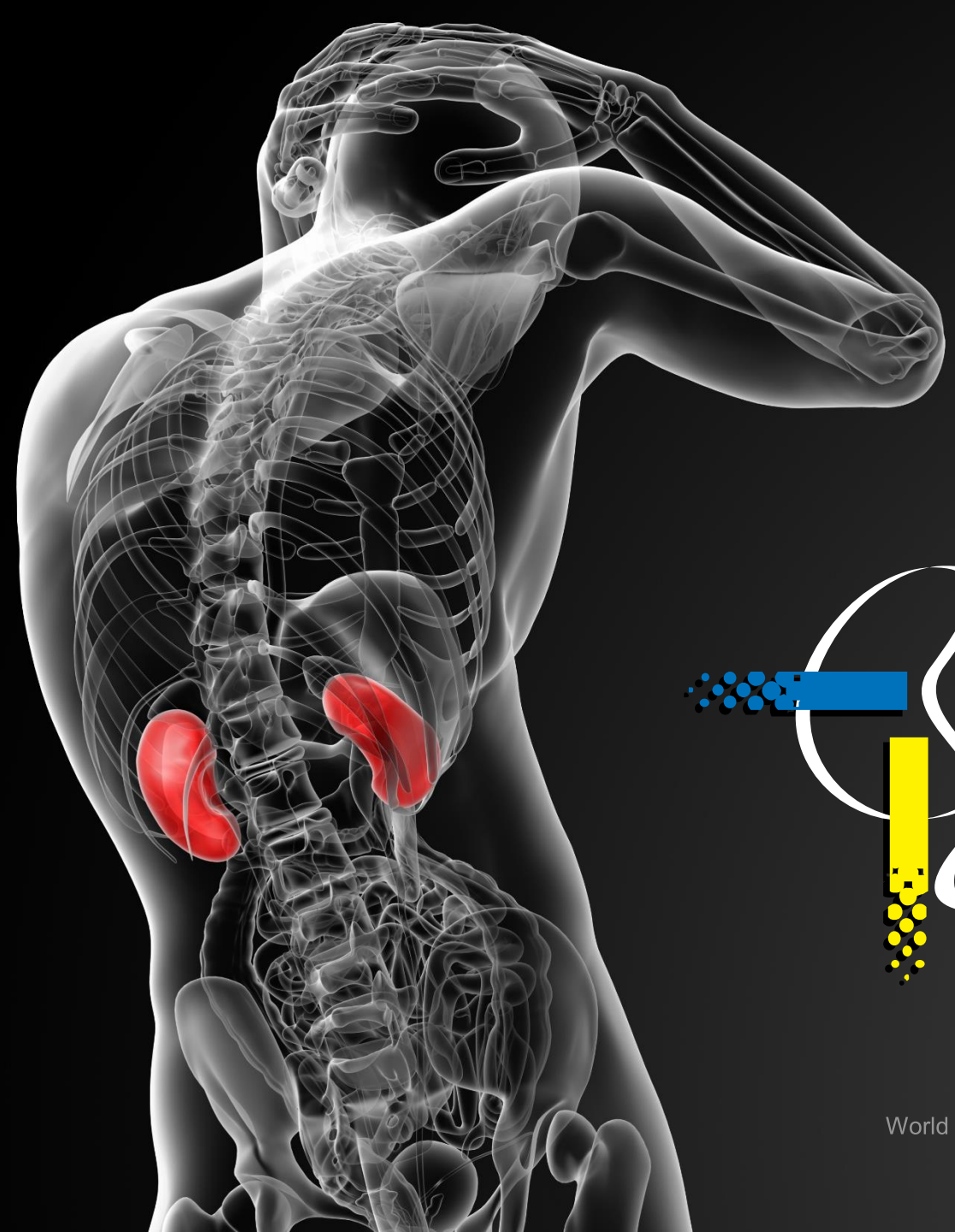
Candidates

- Recipient Evaluation
  - Only 30% patients on dialysis are fit for transplant list
  - Average waiting time is between 6 - 24 months
  - All transplants done in Beaumont
- Commence work up early
  - Pre-dialysis transplantation (refer when GFR < 12)
- Full assessment
  - Cardiac: ECG, ECHO, often a Coronary Angiogram
  - Routine CXR, abdominal US, dental review
  - MSU, Urological evaluation if appropriate
  - Cervical smear
  - Blood group cytotoxic anti-bodies, HLA typing,
  - Viral screen – HIV, Hepatitis, CMV, EBV



Key issues in Kidney Transplantation

- Organ Shortage – Long waiting time
- Acute Kidney rejection – NOW thankfully rare
- Long term complications
  - Increased risk of infections/Cancer
  - Cardiovascular risk
  - Transplant Kidney “wearing out
  - Chronic rejection
- Most transplants “FAIL” because the patient dies from another disease – especially old age!



World Kidney Day™

World Kidney Day is a joint initiative

ISN

IFKF International Federation of Kidney Foundations

Every 24 Hours…IN USA

- 5225 new cases of diabetes are diagnosed
- 180 non-traumatic lower limb amputations are performed
- 133 people begin treatment for end-stage renal disease
- **ONE NEW DIALYSIS UNIT!**
- 634 people die of diabetes or diabetes is a contributing cause of death

National Diabetes Fact Sheet, CDC, 2011.
http://www.cdc.gov/diabetes/pubs/factsheet11.htm