Kidney Failure, Dialysis
and
Nocturnal Dialysis

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The vital organs

- The Brain - the “command centre”
- The Heart - the “pump”
- The Lungs - the “bellows”
- The Liver - the “manufacturing centre”

And …

The Kidneys - the “waste-disposal unit”
The kidneys are ‘vital’ to life

- The kidneys are essential to life
- Without them, we can’t survive
- But … there are some clever ways to replace the kidneys if they fail
The kidneys do lots of useful things

They remove wastes but do more, much more

They also …

- Control the blood pressure
- Remove excess fluids and salt
- Make EPO (a hormone which signals to the bone marrow to make red blood cells)
- Regulate calcium and vitamin D levels and thereby control the strength of bones
You can ‘predict’ the symptoms …

- Waste builds up: (Ugh) … toxins in the blood
- Poor BP control: High blood pressure
- Fluid retention: Swelling & breathlessness
- Anaemia: Tiredness & lack of ‘go’
- Low calcium: Weak and aching bones
- High Phosphate: Skin irritation and itch
- Other problems: Cramp, bowel disturbances

… and, if the kidneys completely fail, death occurs if no ‘replacement’ of their functions is possible
What causes kidneys to fail?

- **Nephritis** - kidney inflammation (30%)
- **Diabetes** - now the biggest cause (33%)
- **Atherosclerosis** - narrowed arteries (12%)
- **Reflux** - urinary tract malformed (10%)
- **Polycystic Kidneys** - inherited cysts (8%)
- **Analgesics** - excess painkiller use (< 5%)
Often, there is no warning

- Most kidney disease is painless
- Kidney failure comes on very slowly
  - As the body “adjusts” to feeling unwell, this slow change is not easy to recognise
- The major symptoms are …
  - tiredness, easy fatigue, sleepiness, loss of appetite, itch, night-time cramps
- Sadly, these are often ignored till it’s too late
The solutions include:

- Slowing down further kidney damage by ...
  - treating the underlying disease
  - controlling blood pressure, infection and cholesterol
  - using medications to slow the rate of loss of kidney function

- Making less waste
  - ? protein restricted diets to reduce the waste the body makes

- Replacing the kidneys
  - Artificial kidney treatment
  - Transplantation
Replacement options

**Dialysis** - the medical term used for artificial kidney treatment

**Transplantation** - the receiving of the gift of another person’s kidney

For another time
Dialysis ... firstly, what is it?
The artificial kidney

- An artificial kidney is simply a smart filter
- It filters the blood just like a real kidney
- Blood, high in waste, is brought to the filter
- The wastes diffuse out of the blood into a special cleansing fluid
- This fluid is constantly replaced and cycled past the blood, ‘washing’ the wastes away
The problem ... waste and fluid

Patients with kidney failure:

- Can’t remove wastes but also can’t remove fluid
- Usually don’t pass urine!

So ...

Patients with kidney failure:

- Are either being poisoned by their own waste
  or ...
  - Being drown in their own fluids

Potassium & fluid restriction is crucial & draconian

... but I will come back to this
The ‘options’ in dialysis

**Haemodialysis**
- In-centre haemodialysis
- Limited care (or satellite) haemodialysis
- Home haemodialysis (daytime or nocturnal)

**Peritoneal dialysis**
- Continuous Ambulatory Peritoneal Dialysis (CAPD)
- Automated Peritoneal Dialysis (APD) - using a fluid cycler machine through the night
Please Note

Today’s talk is only about haemodialysis

This does not mean peritoneal dialysis is a lesser option ... it is just a different one

Both are good, effective therapies

Both should be discussed with every patient approaching dialysis

At the end, it is usually a matter of choice
The march of technology

From this to this
A bit of history

Though earlier efforts are well known, ‘modern’ dialysis began in earnest in the 1960’s.

Much of the early running was in Seattle:

- Overnight, 8-10hr, 3 nights/wk in hospital but …
- Expensive & difficult to offer to large numbers
- So … efforts began to shorten time and to make dialysis possible at home

But, though very successful … this dual ‘push’ had a very sad and unanticipated result.
The origins of 4 x 3

In 1972, US Congress decided (in its ‘wisdom’) that 4hrs, 3/wk was *enough to sustain life* and thus decided 4x3 was all it would pay for …

Did you ever wonder why “4 hrs, 3 times/wk”?  
Now you know …
- It was not a medical decision
- It was not that 4x3 was ideal therapy
- No …
- It was a financial decision of the US senate
Ever since …

- Dialysis has been ~4 hrs x 3 times/wk
- But … hey … that’s only 12 hrs/wk
- 2 normal kidneys work 168 hrs/wk
- So, is dialysis really more efficient than normal kidneys?

The answer is an absolute .. NO!

So, what are the implications of this …
The ‘weight’ of fluid

1. Most people with kidney failure don’t make urine!

2. Any fluid taken stays ‘inside’ till the next dialysis
   - the blood volume and the blood pressure rises
   - the heart swells up and begins to labor
   - the lungs get wet
   - the patient literally begins to ‘self-drown’

3. 1 litre of water weighs 1 kilogram

4. Any ‘weight gained’, one dialysis to the next, is fluid gain … not body weight gain … and **MUST** be removed during dialysis to regain ‘dry weight’
To minimize this effect, Draconian fluid restrictions are needed. 750 ml/day max! … lettuce & watermelon are ‘fluids’! … It’s cruel!
Dietary restrictions are also severe. It’s ... no salt, no potassium, no phosphate ... no citrus, no bananas, no fluids ... nothing that’s ‘nice’
And ‘4 hrs on a machine’ ... and the rest

Drive in ... 20 min
Wait your turn to go on ... 30 min
Dialysis 4 hrs
Coming off/cleaning up 30 min
Drive home 20 min

= 6 hr plus

And ...

The brutality of removing all retained waste/fluids from 2-3 days in just 4 hrs ... it’s exhausting
After dialysis, it’s …

Head home

feeling like a has flattened you

… and ‘write off’ the rest of the day
A talk to a lay audience can be ‘misinterpreted’

Please, do not get me wrong ...

4 x 3 works

... it has ... for decades

Simply

there is a better way

for those who can manage it

... and not all can or will
A current dialysis patient’s lifestyle …

Is NOT conducive to:

- Restoring quality of life
- Allowing full employment
- Enhancing family life
- Returning good health and vitality

For many, it’s a …

‘live to dialyse, not dialyse to live’ existence
Nocturnal home haemodialysis

NHHD
Nocturnal home dialysis (NHHD) ...

Began in Toronto 1993 ... Uldall and Pierratos

They realised that with better and more reliable equipment, dialysis could be safely done overnight and at home

How could we have been so blind ...?

- Overnight = longer treatments
- Home = no nurses wages
- Overnight = treatment every night
- Home = no ‘dialysis centres’
Suddenly …

- Dialysis was possible, not for 4hrs, 3/wk but for 8-10hrs, 6-7/wk … yet leaving daytime uninterrupted.
- This increased effective dialysis time from 12 hr/wk to ~ 50-60hrs/wk and …

  The longer the treatment, the more gentle.

- As dialysis was possible every night, fluid and food restrictions were no longer needed.
- Overnight dialysis restores daytime activity.
- This, in turn, restores work and family activities.
Suddenly …

- Dialysis was patient friendly
- Fluid and waste removal was gentle
- Patients reported …
  - Feeling better
  - Sleeping better
  - All dialysis symptoms disappeared

… and costs came down … … enormously!
Nocturnal dialysis in Australia ...

- In 1997, I heard of the Canadian ‘experiment’
- It just made sense ...
- I went (1999), saw and was conquered
- 2 years later, DHS(V) finally supported a trial in Geelong
- We began in 2000 – the 1\textsuperscript{st} NHHD program outside N\textsuperscript{th} America
- Geelong has led the introduction of NHHD into Australia
- Multiple programs in all states now model ours
- NHHD is now accepted nationally/internationally as the optimum dialysis modality
Who is suitable for NHHD?
What’s the percentage?

If you can drive a car, you can drive a dialysis machine

And a dialysis machine is far, far safer
NHHD is …
Clinically superior and financially astute

- Clinical benefits are huge and well-accepted

But …

- The cost-savings are even more impressive
  - Conventional dialysis cost = $48,200/pt/yr
  - Nocturnal dialysis (6x) = $32,400/pt/yr
  - Nocturnal dialysis (3.5x) = $24,600/pt/yr
The biochemistry of time and frequency
NHHD vs Conventional - Creatinine

Creatinine pre & post dialysis
NHHD vs Conventional - Phosphate

NB. Nocturnal data is with PO$_4^-$ added to the dialysate
NHHD vs Conventional - Calcium

Corrected Calcium pre & post dialysis
And ... to keep our patients safe?
Safety Measures

Whilst-asleep dialysis safety is assured by:

- An under-machine ‘mouse’ to detect dialysate leaks
- Electrode tape around access to detect blood leaks
- Connector ‘boxes’ over luer-locks to stop disconnection … we haven’t used these
- Light-weight ‘back-slabs’ to stabilize/protect AVF needles/insertion sites … we haven’t used these
- Modem/internet technology to feed real-time machine data to centralized monitoring console (if desired)
Limitations ...

Clearly ...

Nocturnal dialysis is not for all ...

Patients have to be able to manage dialysis at home ... probably 30-40% of all HD patients.

It needs ...

A degree of dexterity

A capacity to ‘conceptualize’ the machine

The confidence to dialyse away from staff

The ability to self-needle
Conclusion

Nocturnal Haemodialysis:

- Is viable, safe, well accepted and effective
- Is suitable for both partnered & single patients
- It offers significant improvement in:
  - Life-style, rehabilitation and work capacity
  - Biochemical stability and normality
  - Dietary and fluid freedom
  - Subjective sleep and restorative rest
- Offers a new dialysis choice and enhances self-determination
Furthermore ...

- Longer, slower, gentler, more frequent and **more user-friendly** home-based dialysis is now a reality.
- **Flexibility of choice** should and **must** replace the institutionalized one-size-fits-all approach of the past.
- **Time and frequency** should be the prime dictators of adequacy.
- **New technologies** that will help attain these goals must be embraced.
Thank you for listening

and

for your education

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www.nocturnaldialysis.org