

Drager/SMBE Award

The annual Drager/SMBE encouragement award this year has been awarded to Michelle Catlin from Biomedical Engineering at Flinders Medical Centre. The Council congratulates Michelle on receiving this award and hope she finds the NSW Biomedical Technician's Conference enjoyable and rewarding.

Michelle's paper titled "Haemodialysis vs. Peritoneal Dialysis" is printed below.

Haemodialysis vs. Peritoneal Dialysis

Michelle Catlin

The most common method of treating end stage renal failure is Haemodialysis [1]. Since its introduction in the 1960's the composition of the dialyser and dialysate has improved but the main design has changed little. But even with improved methods and equipment haemodialysis remains a complicated and expensive method of treatment. In 1975 continuous ambulatory peritoneal dialysis (CAPD) was introduced [3] as both an alternative to haemodialysis as well as a method to be used in conjunction with haemodialysis. Since then the percentage of people using CAPD has increased at a steady rate. Both methods of dialysis have their attributes as well as disadvantages and will be examined in the following article. On the surface peritoneal dialysis appears to be a cheaper, easier and less demanding therapy than haemodialysis but there a number of factors to consider.

Haemodialysis

Blood is removed from the body at a steady rate into the haemodialysis machine where it is filtered, waste is removed as well as fluid. The blood is then returned to the body. The temperature of the blood is monitored and regulated before it is returned to the body as well as the control of blood pressure.

Haemodialysis has a rigid schedule with approximately 3 sessions per week with sessions lasting 4-5 hours (depending on the needs of the patient.) It is possible for a patient to be dialysed at home but treatment usually occurs in a hospital or satellite patient care centre [2]. Heparin is used during treatment to reduce the amount of blood clotting that occurs. Haemodialysis relies on the principle of osmosis and uses a large surface area to transfer waste products and fluid as fast as possible. Between dialysis the patients must adhere to a strict diet with a reduced fluid intake. Haemodialysis requires access to the vascular system and thus there is a risk of infection. The access point must be periodically changed.

Peritoneal Dialysis

A tube-like catheter is inserted to fill the abdomen with dialysis solution. The peritoneum is used to transport waste and fluid. The draining and filling process usually takes 30-40 minutes [2]. The dwell time (time when the fluid is in the abdominal cavity) usually takes 4-6 hours with 4 exchanges per day (depending on the patient.) Continuous ambulatory peritoneal dialysis is the most common form and does not require the assistance of a machine. Assisted peritoneal dialysis as the name suggests requires the patient to use a machine (cycler) to fill and drain the abdominal cavity (usually while sleeping.) A patient may use a combination of the two methods depending on their need and

mobility. The dwell time of the patient is dependant on the patient's ability to transport fluids and waste over time. Some patients may only require a short dwell time due to a fast transfer rate of waste material.

Peritoneal dialysis is generally regulated by the patient enabling a freer lifestyle than haemodialysis but at the same time this can be problematic if the patient skips treatments. The dialysate can be changed by the patient almost anywhere but preferably in well lit, clean areas so peritoneal dialysis is preferred by patients that wish to retain an active lifestyle. Infection is the biggest problem due to bacteria which can cause peritonitis. In a basic setup the main equipment is the transfer set and the dialysate. Dialysate bags are usually heated to body temperature before being used with most cyclers having a built in heating unit [3].

Cost

To determine the cost of both treatments the cost of hospital stays as well as the cost of hospital resources must be taken into consideration. In terms of the actual treatment the cost to the patient is very similar. The cost of the consumables is heavily dependant on their availability but overall has been found to be similar for both types of treatment [1]. The cost of the equipment however can be vastly different as haemodialysis requires the use of a haemodialysis unit. But as mentioned before patients on peritoneal dialysis treatment generally have more frequent and longer stays in hospital and so this increases the cost of the treatment. Overall the cost of both treatments is considered to be equal from the patients point of view, with haemodialysis being slightly more expensive if the cost of the haemodialysis unit is taken into consideration.

In Australia

In Australia 21% of dialysis patients are using CAPD, 6% are using APD with the remainder of the patients using haemodialysis either in hospitals, satellite patient care areas or at home [1]. The mortality rates for the two methods are so close as to not be significant and the quality of life for patients to be very similar (Peritoneal dialysis patients are considered to be more mobile but also more prone to infection.) In Australia renal transplant patients have a better initial success rate if they were using peritoneal dialysis compared to haemodialysis [1]. There is a reduced rejection rate and independence from dialysis treatment is achieved in less time. It must be noted that in other countries the reverse is true[3].

15% of world's dialysed patients are on some form of peritoneal dialysis (PD.)

United States has 13% on PD [3]

United Kingdom has 42% on PD [3]

Mexico has 81% on PD [3]

Japan has 6% on PD [3]

Australia has 21% on CAPD and 6% in assisted peritoneal dialysis (APD.) [1]

Summary:

Haemodialysis and peritoneal dialysis are generally seen as two different ways of reaching the same outcome. Haemodialysis has a high clearance rate over a short period of time whereas peritoneal dialysis has a low clearance but is continuous. The removal of urea occurs more effectively with peritoneal dialysis

as well as other small solutes and is said to retain residual renal function for a longer period of time. Peritoneal dialysis is generally chosen by younger patients that wish to continue a more active lifestyle compared to haemodialysis patients.

Patients using peritoneal dialysis require more hospital visits than haemodialysis patients which has been attributed to infections and peritonitis. It has been found that more patients change from peritoneal dialysis to haemodialysis than the other way, this has been found to be due to the fact that once a patient has peritonitis it is quite difficult to continue peritoneal dialysis. Although the outcomes for peritoneal dialysis appear to be better in terms of waste removal and retention of residual renal function peritoneal dialysis has been found to be less successful as a long-term treatment.

Both methods of dialysis have similar problems in terms of the patients overall health. Patients can suffer from anaemia due to the lack of red blood cells. Renal osteodystrophy affects 90% of dialysis patients and causes a patient's bones to become brittle and malformed. Sleep disorders as well as deposits of proteins on joints and tendons causing pain are also problems associated with both forms of dialysis.

References

- 1.) Collins, J. and Kerr, P. *ANZDATA Registry 2001 Report*, Chapters 4, 5 and 6 published 2002
- 2.) National Institute of Diabetes & Digestive & Kidney Diseases website
www.niddk.nih.gov accessed 25/10/02
- 3.) Thordis, E. Oreopoulos, D.G 2001. *Is Peritoneal Dialysis better than Haemodialysis? Data worth Knowing before Choosing a Treatment.*