HOW I DO PERITONEAL DIALYSIS.

Dr Adam Mugford BVetMed MVetMed DACVECC MRCVS
CVS Referrals – Lumby Park Veterinary Specialists
Emergency and Critical Care
Selbourne Road, Alton, Hampshire GU34 3HL
United Kingdom

Peritoneal Dialysis (PD)

PD has the same principals as HD i.e The removal of solutes by diffusion however in PD the semipermeable membrane is the peritoneum rather than an artificial membrane, The dialysate is instilled into the abdominal cavity and after equilibration, is then removed again. It reduces uraemic substances in the blood stream and could be offered when IHD/CRRT not available. However like HD full physiological function not replaced. It removes metabolites and water via the administration and subsequent removal of dialysis solution into the peritoneal cavity. The exchange of solutes and fluid happens between blood and the dialysis solution across the peritoneal membrane. The osmotic gradient is created by the presence of osmotic agents (ie, dextrose) in the dialysate that draws fluid across the peritoneum to form the “ultrafiltrate”. The rate of diffusion depends on the size and the charge of the particles and concentration gradient. Urea (molecular weight 60 Daltons) is small and diffuses rapidly clearance of low molecular weight solutes is slower with PD than with hemodialysis.

Convection

PD is a form of convection i.e movement of solute across a membrane because it is trapped in the flow of fluid “solvent drag” is in quantities similar to the solutes plasma concentration. Convection allows for additional solute to be transferred beyond that achieved by diffusion alone. CRRT is clearly better but some relative advantages include the technical simplicity (absence of an extracorporeal circuit), excellent cardiovascular tolerance and decreased risk of bleeding (compared to heparin). Low efficiency can be an advantage the more gradual decline in uremic toxins means that patients are less likely to develop dialysis disequilibrium syndrome when compared to intermittent hemodialysis. Limitation include severe coagulopathy Contraindicated in peritonitis, vascular leak states (SIRS), severe hypoalbuminemia. Relative contraindications include, Recent surgery and Hernias (diaphragmatic, inguinal, or abdominal).

How long can it be done for?

An anephric dog was supported for 54d as outpatient in 1984 (AJVR)

The Dialysate

It is Commercially available (Dianeal, Gambrosol, Stay-Safe, Extraneal, etc.), but can hard to obtain in some parts of EU. Mix your own (strict aseptic technique): Don't use acetate containing fluids (Plasmalyte, Normosol), Dextrose should be added to these solutions to make approximate 1.5%, 2.5%, or 4.25% solutions. To make a 1.5% solution add 30 mL 50% dextrose to 1L and for 2.5% solution – add 50 mL 50% dextrose to 1 liter.

Why would we use different glucose percentages?

- 4.25% solution will achieve higher ultrafiltration rates and water removal.
- 1.5% normally used in normovolaemic patients.
- Lactated ringers is OK
- If normal saline is used, add sodium bicarbonate (30-45mmol/l)
- Previously, heparin was recommended to be added to prevent clot formation and improve
dialysate outflow, but most commercial dialysates do not contain it anymore.

- 500 IU/liter

**Catheters**

A wide selection is available, there is no consensus even in human medicine yet regarding optimal catheter and catheter placement technique. Jackson Pratt often available, technically not a PD catheter, but works well (with omentectomy) but need to form a semi-closed system. With the Jackson-Pratt less occlusion than noted by other multipurpose straight tube catheters. Requires a mini surgical approach, several days of successful PD have been achieved although no dacron cuffs so leaks can be severe.

**Catheter placement**

Mini-surgical approach possible, Omental entrapment/blockage of catheter is a common problem. Omentectomy can limit occlusion, but a more profound surgical procedure if PD is anticipated >3days, consider or if patient has a laparotomy anyway (e.g. uroabdomen). Mind the bladder when inserting catheter percutaneously (trocar or modified Seldinger) Sedation with IV opioids/benzodiazepines and local anaesthetic Sterility! Antibiotic cover recommended in human medicine and Use “tunnel-technique”. An alternative Percutaneous (blind) technique requires small skin incision (linea alba, paramedian) some prefilled abdomen with saline, pressure is applied but guard trocar to allow 1-2 cm into abdominal cavity, Then advance catheter off stylet, caudally and apply purse-string suture to secure.

**CHECKS**

Before you close, check catheter patency, 2-5mls of dialysate infused, then retrieved sterile dressing, including several layers of sterile gauze is applied and dressing should ideally not be changed for several days unless there is obvious bleeding or evidence of infection.

**Complications with insertion include:** Haemorrhage, Intestinal perforation, Kinking of the catheter with drainage problems, Catheter misplacement (within fascial planes), Leakage of dialysate, Septic peritonitis and wound infection.

**Dialysate exchanges:** Commercial “Y-sets” are available. Three-way stopcock system works with “flush before fill”, New dialysate bag is attached a portion of the dialysate is first flushed into the collection system to flush out any bacterial contaminants.

**Exchanges:** for each warm dialysate instilled and removed after certain “dwell time”. Each cycle containing instillation, dwell time and removal of dialysate is an “exchange”. Usually, 1-2 weeks of catheter placement before use minimises leakage of dialysate and this can become Impractical. Leakage can be minimized by Snug catheter placement, good abdominal closure, three purse-string suture technique, Catheter placement using a subcutaneous tunnel, Use of Dacron cuff(s), Smaller initial infusion volumes and patient positioning.

**Volumes**

Infuse dialysate over 10-15 minutes, Start with small volumes, approx. 10-20 mls/kg, Initial dwell time around 30-40 minutes, drain as much fluid as possible, Exchanges are hourly initially, after 24hrs, volume could be increased to 30-40mls/kg, but often becomes uncomfortable.

**Efficiency of the procedure?**

Can be increased by Increasing osmolality of the dialysate, Increase frequency of exchanges, More exchanges in the early stages of dialysate instillation, equilibrates with time, Increase dialysate volume with patient improvement, frequency can be lowered to q4-6 hrs. Good record keeping to track fluid ins-and-outs!

**On-going care**
• Includes Analgesia (opioids), Ketamine (renally excreted, consider prolonged action), Anti-emetics, nutrition, nursing care! body weight checks, continuous ECG, blood pressure, CVP?
• Regular blood work PCV/TS, blood glucose, blood gases, electrolytes, haematology, creatinine and check retrieved dialysate!

Further diagnostics

Renal biopsy may be needed to obtain an accurate histologic diagnosis. Contraindications include coagulopathy, severe anaemia, hydronephrosis, uncontrolled hypertension, renal cysts/abscess, pyelonephritis, and end-stage renal disease. Haemorrhage has been reported post renal biopsy in 9.9% dogs and 16.9% of cats and is reported to be more likely in dogs weighing less than 5 kg, and in patients with severe azotemia or hypertension.

Other issues

Hypoalbuminaemia so ensure an adequate feeding plan but not via gastrotomy or j-tube consider parenteral nutrition although remember hyperglycaemia might influence ultrafiltration; fluid status, etc. and reduce efficiency of PD.
Technical complications include; Blocked catheter, Inflow-or outflow obstruction, kinking/positional, fibrin clot (heparin 5000 IU into catheter for 2-4hrs may help).

Peritonitis May be revealed by presence of cloudy dialysate or any other suspicion, Cytology, gram stain, culture most often Staphylococcus most likely although gram negative possible (E.coli, Klebsiella, Acinetobacter, Proteus, Pseudomonas)

PD is discontinued when a clinical improvement i.e. urine output is noted

Summary

Commitment, cost, and prognosis, PD does not require complex equipment, Can achieve effective control of uraemia and electrolyte disturbances in select cases, need to continue until sufficient return of renal function is achieved!

Any further questions Stand 124 at the conference!

REFERENCES
