Прилози, Одд. биол. мед. науки, МАНУ, XXIX, 2, с. 85–93 (2008)
Contributions, Sec. Biol. Med. Sci., MASA, XXIX, 1, p. 85–93 (2008)
ISSN 0351–3254
УДК: 616.61-008.64-78

PERITONEAL DIALYSIS AS A VALUABLE TOOL FOR BLOOD PURIFICATION

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A b s t r a c t: Peritoneal dialysis (PD) is used to a limited extent in most developed countries for haemodialysis (HD). However, the survival using PD does not differ from that using HD and may even to some extent favour the use of PD.

In patients who are expected to stay for many years in a chronic renal replacement therapy programme an important reason for starting with PD is to save the vascular access for later use. Other favourable issues are also discussed. This paper will also cover various aspects of how to reduce the risk of problems in a PD programme. In addition the concept of early start or acute start of peritoneal dialysis will be covered.

Key words: Peritoneal dialysis, technique, access, complications.

The use of PD as a treatment for chronic kidney failure in Sweden is approximately 20%. The extent of its use/prevalence has been stable over the previous 10 years although data indicate that the prognosis is at least as good using PD as for HD [1, 2] or may be even better in some areas [3].

According to Swedish guidelines [4], the use of PD is suggested as the first choice if the patient does not have contraindications (Table 1)

Besides preservation of vessels, a further reason is reluctance to establish an AV access that causes large recirculation of blood in a patient with a tendency to develop congestive heart failure [5].

Ethnic, economic and technical reasons exist in various countries and centres that may restrict a frequent use of PD. In addition, on the other hand, the absolute and relative contraindications for PD have to be considered.

Table 1 – Табела 1

Reasons for preferring PD as the first choice of dialysis mode
Причини за давање предност на ПД како прв избор на дијализен модалитет

- Vascular access preservation
- Cardiologic aspects incl. increased volume load for the heart by a large AV-fistula.
- Less risk of bleeding complications – no use of anticoagulation
- No risk of transmission of diseases through the device, e.g. viral hepatitis

Table 2 – Табела 2

Relative and absolute contrindications for PD [4]
Релативни и апсолутни контраиндикации за ПД

Absolute contraindications:

- Severe intra-abdominal adhesions
- Large diaphragmatic defects (i.e. secondary pleural effusion)
- Active diverticulitis or inflammatory bowel disease
- No compliance (failure even to be in an assistant PD-programme)

Relative contraindications:

- Large abdominal and especially inguinal hernia (rec. operation before PD-start)
- Use of a colostomy or PEG (percutaneous epigastrical gastrostomy)
- Recent abdominal surgery
- Severe adiposities
- Low memory capacity (if the patient performs PD him/herself)

Once it has been decided that PD should be used it also has to be considered how the facilities at the centre and the abilities of the patient allow the procedure. Thus, the operation conditions, numbers of trained and devoted physicians that insert the PD-catheter, post-operative care and training programmes are important to reduce the risk of access problems, subsequent infections and peritoneal membrane dysfunction or psychical failure.

The most frequently used PD catheter-insertion techniques request a break-in period of 2 weeks [6]. If the patient is in acute need of dialysis such a break-in period may be a reason for the physician to insert a central dialysis catheter and initiate HD. Since many patients are reluctant to change the mode of treatment once they have started dialysis, this will in up to 30 % of the patients be a reason to lose them from the PD programme [7]. One option using those techniques would be to start PD by having the patient in a supine position during the following period until the catheter is adequately healed and adhered to the tissue and the risk of leakage is strongly reduced. Another option would be to only use nightly PD exchanges with or without the use of an exchange device. The third option would be to use an insertion technique that enables immediate start of PD with a very low risk of early or late leakage [6, 8, 9]. Such surgical technique should also enable insertion under local anaesthesia, even in a partly sitting position in patients with congestive heart failure [10].

Thereby the catheter is inserted through the rectus muscle above the linea arcuata, with the inner cuff fixed between the peritoneal membrane and the inner rectus fascia, fixed in total by three purse string sutures that tighten the tissue at all levels. By using a bent stylet during the operation procedure [11] the location of the catheter into the lower abdominal region can be facilitated. Prophylaxis against post-operative infections is done by a single preoperative dose of 1.5 g cefuroxime and directly postoperatively, in the first PD-dialysis bag, instillation of cefuroxime 250 mg/L into the PD fluid. This action reduces the risk of postoperative infections significantly [12] as well as the risk of subsequent peritonitis and tunnel infections [13]. It also allows the immediate start of acute dialysis, for example in patients in the ICU [14, 15]. By using this insertion technique two different types of Tenckhoff catheters were tested. Thereby, a randomized study showed that a straight instead of a coiled catheter caused fewer postoperative drainage problems [16]. In patients who have problems in keeping the intraabdominal part of the catheter in the lower abdomen the use of a Di Paolo catheter may be considered [17]. Possibly the direct use of such catheter is also preferable, according to an Italian multi-centre study [17]. To reduce the tension in the operation wound and postoperative pain, the use of a surgical girdle may be favourable. It can be used when the patient is out of bed during the next 3–5 days [18, 19]. By measuring the drained volume in relation to time elapsed it can be decided if outflow problems are due to the position of the patient or, e.g., to outflow obstruction. If flow obstruction is present it might be due to location problems (Fig 1). The use of a bent stylet [11] or guide wire [20] may help to correct such dislocations so as to avoid a second operation. To avoid exit-site infection, early detection of any infection and early initiation of antibiotics may help to avoid the progress into a tunnel infection and subsequent peritonitis. Those infections in most cases need the removal of the catheter and the reinsertion of another one at another location using antibiotic prophylaxis during the procedure.

The glucose load caused by intra-abdominally inserted peritoneal dialysis fluids may partly be considered as a disadvantage if patients are obese. Thus the use of polymers of glucose (Icodextrin, Baxter) and amino acids are used additionally in some PD-programmes. Thereby the use of 2-3 bags with low glucose concentration are supplemented by one bag of glucose polymer (to induce ultrafiltration) that is used over a longer dwell and one bag with amino acids (Nutrineal, Baxter) as a supplement for dialysis. In contrast, in patients with malnutrition or poor appetite, the addition of the glucose-containing bags secures a caloric supplement without an additional load of water to the patients. This additional nutritional support may be essential in the early phase of acute kidney injury during the Intensive Care Unit period when parenteral alternatives may cause volume overload and congestive heart failure. A concentration of 2.2–3.5% glucose in the bags in these situations helps to withdraw excessive water over 24h in a slow manner, and in addition supplements the patient with up to 1000 calories using six 4 dwells/24 h (Table 3). In diabetic patients the presence of glucose in the PD-fluid may be one factor in reducing the risk of severe hypoglycaemic episodes induced by insulin treatment. During the period prior to the dialysis start, insulin resistance and lowered ability to experience hypoglycaemia frequently result in the fact that the patients want to "feel safe" by having a somewhat higher blood glucose and subsequent HbA1c. When starting them on PD a significant improvement of the HbA1c can be achieved, although that is again impaired when the patients change for a kidney transplant [21].

In the chronic haemodialysis programme it has been shown that an intensive need for ultrafiltration of approximately more than 3% of body weight in one session [22] or more than 10 ml/kg/h [23] increases the risk of death. Such an excessive ultrafiltration need will rarely be present in PD patients. In contrast, patients with congestive heart failure may improve their cardiac condition using peritoneal dialysis [10].

However, even patients on peritoneal dialysis may develop congestive heart failure (CHF). A reason for CHF is, besides progressive heart dysfunction in the course of an acute myocardial infarction or progressive valvular calcifycations, an underestimate of the fluid retention of the patient when residual renal function, and thereby urine output, drops. This, besides a catabolic state, with loss of fat and muscles, may cause a wrong "dry weight" to be set in the patient. In the PD programs the use of, e.g., x-ray to estimate heart and lung status in order to optimize dry weight is less frequently used. Possibly such measures should be included in the follow-up programme, similarly to the case of HD patients. The loss of ultra filtration capacity of the peritoneal membrane (less than 200ml fluid removed using a routine PET with 2.27% glucose or < 400 ml using 3.86% glucose for 4 hours) may also be a reason for a progressive fluid retention. Such loss may be due to recurrent episodes of peritonitis with intestinal adherences and in the course of sclerosing peritonitis [24]. A lack of function of the peritoneal membrane is also attributed to the long-term use of PD fluids that are contaminated with glucose degradation products or contaminants that derive from the processing during manufacturing of the fluids [25, 26]. Notable is the fact that biocompatible PD fluids may even improve residual renal function and urine output [27]. In patients who lack residual urine output such ultrafiltration dysfunction may be critical and urge a change from the PD to the HD programme. Attempts may be made by addition of diuretics to increase urine output, or another alternative is the use of glucose polymers (Icodextrin). In addition, data indicate that in some patients beta blockers may interfere negatively with the ultrafiltration function of the peritoneal membrane [28]. In such patients the withdrawal, or reduction of the dose of beta blocker used, may help to recover this dysfunction.

The self-experienced quality of life in a prospective 12 months trial showed no significant differences between those on PD versus those on HD, indicating that patients are prone to adapt to the treatment they have chosen (unpublished data from the study by Stegmayr *et al*.) [29].

In conclusion, data indicate that PD should be considered as a first choice option for a patient who is expected to have a long life expectancy in a chronic renal replacement therapy programme.

Options for reducing problems are suggested in Table 4. One of the insertion techniques using a straight Tenckhoff catheter is a surgical insertion through the rectus muscle, fixing the inner cuff between the peritoneal membrane and inner rectus fascia. Pre- and peri-operative cefuroxime prophylaxis is helpful. This technique does not need any break-in period and allows an immediate start of PD with few postoperative complications.

Table 3 – Табела 3

Approximate glucose absorption in calories/L PD fluid during a 1–4 hour dwell using various glucose concentrations

Приближна апсорпција на гликозата во килокалории на литар од ПД течност во текот на 1–4 часа при употреба на различни нивоа на гликоза

Dwell, hours	1.2% glucose	2.3% glucose	3.8% glucose	4.3% glucose
1	11	21	36	40
2	21	37	64	72
3	25	46	78	88
4	27	50	85	96

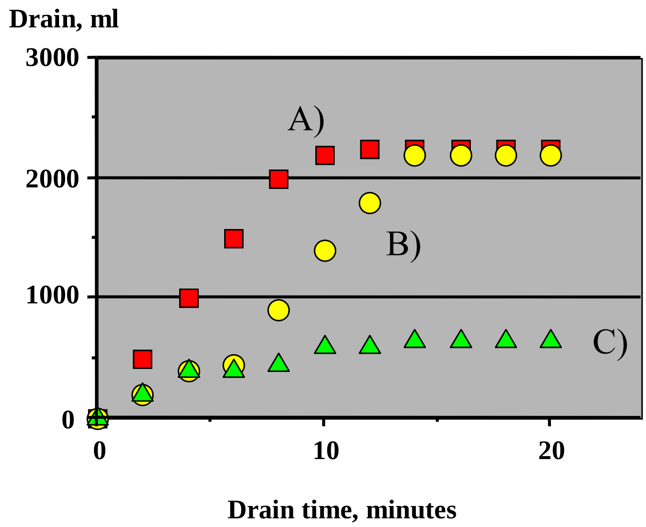

Figure 1 – Drainage protocol to evaluate if problem of drainage is due to obstruction or suboptimal position of the patient. A) normal drainage; B) temporary outflow reduction corrected when patient changed position; C) persistent outflow obstruction due to catheter dysfunction

Слика 1 – Протокол на дренажа е да се евалуира дали проблемот на дренажата е поради опструкцијата или субоптималната позиција на пациентот А) нормална дренажа, Б) привремена редукција на истекот коригирана кога пациентот ја променил позицијата Ц) постојана пречка во истекот причинета од дисфункција на катетер

Table 4 – Табела 4

Suggestions for approaches to reduce extent of problems
Предлози за пристапи кон намалување на опсегот на проблемите

- Break-in period 0 days – Use 3 purse-string suture technique
- Post-operative access problems – Use stylet for correction
- Post-operative leakage and late leakage – Use 3 purse-string sutures
- Post-operative drainage problems – Stylet to correct or change into Di-Paolo catheter
- Reduce risk of postoperative. infection – Cefuroxime iv. 1.5g and intra peritoneally. 250 mg/L first bag
- Reduce risk of exit site infection – Cefuroxime iv. 1.5g and i.p. 250 mg/L first bag
- Reduce risk of ultrafiltration failure – Avoid peritonitis and ß-blockers if possible, use biocompatible PD fluid

- Reduce risk for late peritonitis – Good training programme, avoid tunnel infections
- Reduce risk of congestive heart failure – adjust for loss of RRF, dry weight
- Maintain PD membrane function – avoid peritonitis, use biocompatible fluids
- Achieve compliance – motivate patient with trained staff, good follow-up programme and be ready to change to assisted PD/APD or change to HD

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Резиме

ПЕРИТОНЕАЛНАТА ДИЈАЛИЗА КАКО ДРАГОЦЕНО СРЕДСТВО ЗА ПРОЧИСТУВАЊЕ НА КРВТА

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Перитонеалната дијализа (ПД) се користи во ограничен стапен во повеќето развиени земји за хемодијализа (ХД). Сепак, преживувањето употребувајќи ПД не се разликува од тоа при употреба на ХД и во извесен степен може дури и да е од корист при користењето на ПД.

Кај пациентите кај кои се очекува долги години да останат на програмата на хронична ренална заместителна терапија, како важна причина да започнат со ПД е да го зачуваат васкуларниот пристап за подоцнежна употреба. Исто така изнесени се и други корисни теми за дискусија. Овој труд исто така ги опфаќа различните аспекти на тоа како да се намали ризикот за појава на проблеми во програмата на ПД. Покрај тоа ќе биде опфатен концептот за рано или акутно започнување со ПД.

Клучни зборови: перитонеална дијализа, техники, пристап, компликации.

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