GUIDELINES BY AN *AD HOC* EUROPEAN COMMITTEE FOR ELECTIVE CHRONIC PERITONEAL DIALYSIS IN PEDIATRIC PATIENTS

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Chronic peritoneal dialysis (CPD) is the dialysis modality of choice in many European countries (1). It has enabled children of all ages, from neonates to young adults, to be successfully treated while awaiting the ultimate goal of renal transplantation. Since end-stage renal failure (ESRF) is comparatively rare in children, their care needs to be concentrated in designated tertiary-care centers. This is essential if children are to benefit from the support of an experienced multidisciplinary team.

The European Paediatric Peritoneal Dialysis Working Group was established in 1999 by pediatric nephrologists with a major interest in peritoneal dialysis (PD). Currently, the group has representatives from 12 European countries. One of the functions of the group is to establish expert guidance in important clinical areas associated with PD, in conjunction with other members of the multidisciplinary team. The relatively small number of pediatric patients has resulted in few controlled comparative studies in CPD, but there are increasing numbers of reports of clinical experience based on cooperative work via registries.

These guidelines were initiated and discussed at three meetings of the group and developed through eight drafts by email discussion with the principle authors, one of whom is a senior pediatric renal nurse (CG). They are opinion based, incorporating the cumulative clinical experience of the group members and relevant literature. These guidelines emphasize the importance of preparation of the child and family, the attention to detail to secure peritoneal access, and the importance of postinsertion catheter and exit-site care. Preparation for home PD should follow a proper training program, and the need for continuing support to the child and family at home is stressed.

WHEN TO INITIATE DIALYSIS

Indications for initiating ESRF treatment in children are based upon a combination of clinical, biochemical, and psychosocial assessments that are individualized for each patient. Since transplantation is the stated goal for all children with ESRF, an increasing number of units are offering pre-emptive transplantation for children in whom the

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progressive decline in renal function gives sufficient time to prepare them for the transplant list.

Dialysis should be initiated when the measured or calculated glomerular filtration rate is between 15 and 10 mL/minute/1.73 m^2, unless the child remains asymptomatic and growth is well maintained. Symptoms such as nausea, vomiting, and lethargy are combined with anthropometric data (particularly a fall in height velocity), fluid restriction (especially if compromising an adequate nutritional intake), hypertension, and biochemical values (residual renal function, hyperkalemia, hyperphosphatemia, acidosis) to make the evaluation. Diminished school performance and restricted daily activities are also important factors in children.

CHOICE OF THERAPY

1. The patient and family should have been actively involved in the choice of therapy. In pediatrics, this choice also has to take into account the difficulties of vascular access in small children, large distances from the tertiary-care center, comorbidity factors, and the psychosocial situation.
2. If CPD is chosen, automated peritoneal dialysis (APD) rather than continuous ambulatory peritoneal dialysis (CAPD) is generally advocated for children, as APD gives greater freedom during the day for school and social activities.

PREPARATION OF THE PATIENT AND FAMILY

1. It is essential that the child and family be prepared by a pediatric nurse experienced in CPD and with access to appropriate written information and other teaching aids, such as dolls or videos (2,3).
2. Play preparation by a play specialist is recommended, and if the child has phobias, to needles and tubes for example, then a child psychologist should be consulted (4).
3. Before commencing on PD, a home visit should be performed by the dialysis nurse. If possible, she/he should be accompanied by other members of the multidisciplinary team (*e.g.*, social worker) (5).
4. Liaison with the nursery/school/college is important and this should be done either with a direct school visit or at least by telephone contact (6).
5. The child and family may benefit from contact with a similar-aged child on home dialysis.
6. A nutritional assessment will be required for all dialysis patients. If nutritional support is required then the appropriate route for supplementation (oral, nasogastric, or gastrostomy) should be discussed with the pediatric renal dietitian and team members.
7. If it is appropriate to consider a gastrostomy then this can be placed at the same time as the PD catheter under the same anesthetic with minimal additional morbidity (7). Particular care should be taken if there is any evidence of systemic or skin infection, particularly with *Candida* species.

USE OF CATHETER AND SURGICAL PROCEDURE

1. The placement of a PD catheter requires an experienced surgeon and should be given appropriate priority. All catheters in children are placed under general anesthetic.
2. Double-cuffed curled catheters are preferred in most children (8–10) (pediatric size in patients 3 – 10 kg body weight, and adult catheter in patients > 10 kg). A single-cuffed catheter may be needed in infants less than 3 kg.

   There is no firm agreement on exact catheter configuration as there are no conclusive data on the impact on peritonitis rates. Aggregate data from the North American Pediatric Renal Transplant Cooperative Study (NAPRTCS) registry suggests that pediatric patients should be treated with PD catheters that have a swan-neck design, two cuffs, and downward pointing exit sites (9).
3. Prior to theater, the exit site for the catheter should be agreed upon with the child and marked on the abdomen by either the dialysis nurse or the surgeon. The exit site should avoid the belt line and be above the nappy or diaper line in infants. In all but the smallest infants, the exit site should be downward facing (11). The exit site should be located as far as possible from other exits (*i.e.*, gastrostomies, colostomies, urostomies) to prevent infections.
4. Laxatives should be given preoperatively to children who suffer from constipation.
5. Partial omentectomy may reduce postoperative obstruction, but there are no prospective pediatric series addressing this issue (12).
6. Consider elective herniotomy if there is any evidence of inguinal or other hernia prior to or during catheter placement (13).

7. Entry into the peritoneum should be lateral or paramedian, with the deep cuff outside the peritoneum. The peritoneum is closed tightly around the catheter, below the level of the deep cuff, using a purse-string suture.
8. A tunneling device with a sharp point is recommended for creating the catheter tunnel, and strict hemostasis is required. No incision should be made at the exit site.
9. The subcutaneous cuff should be at least 2 cm from the exit site.
10. A cephalosporin antibiotic should be given intravenously (IV) at the time of catheter implantation.
11. All catheter connections should be Luer lock. Disconnect “flush-before-fill” systems such as Y-sets should be routine for CAPD.

IN-THEATER PROCEDURE (10,14)

1. The catheter should be tested in-theater for patency and leaks, with a dialysis nurse or a nephrologist present.
2. No suture should be placed at the exit site, which should be downward facing with the possible exception of infants.
3. The catheter will be irrigated in-theater until the dialysate is clear, then capped off. The PD fluid should contain heparin 500 IU/L.
4. The catheter must be immobilized at all times and no keyhole dressing applied.
5. If the catheter has to be used for immediate dialysis, then use only low volumes (10 mL/kg/cycle). In this situation, keeping the patient supine for the first few days and adequate analgesia will also help to avoid high intraperitoneal pressure and possible leaks.
6. If possible, leave the catheter for 2 weeks until the patient returns for training. This will allow initial healing to take place.

CATHETER CARE (10,14)

1. Use gauze or a nonocclusive dressing that absorbs any moisture. Avoid using occlusive dressings without gauze.
2. Keep the catheter immobilized. Avoid excessive movement at the exit site.
3. The patient may be mobilized gently on the next day. The child should not return to school for at least 1 week.
4. It should be 6 weeks postimplantation before the child engages in heavy exercise.
5. Do not dress the catheter for 1 week unless a dressing change is necessary. Evaluate the exit site weekly throughout the 6-week healing period.
6. If there is any hematoma in the catheter tract, treat with 2 weeks’ oral antibiotics.
7. There is to be no showering or swimming during the initial 6-week period.

EXIT-SITE CARE (10,14)

1. Dressing changes at the exit site should be avoided in the first week. If required, a strict aseptic technique should be used.
2. After the first week, use a strict hand-washing regime, sterile solutions, sterile dressing, and restricted staff. Gloves or masks are not advocated.
3. The frequency of exit-site care has not been established but should be a minimum of twice weekly. Wet or dirty dressings require change; the frequency should be a minimum of daily during exit-site infections.
4. Sterile saline from single-use sachets or diluted cleansing agent is recommended. The cleansing agent may need to be individualized because of skin sensitivities.
5. Povidone iodine and hydrogen peroxide should be avoided: they are toxic to skin cells. Crusts or scabs should not be forcibly removed during cleansing.
6. Do not use tap water for exit-site cleansing. Due to danger of pseudomonas infection, there should be no prolonged immersion of the exit site in the bath, but showering before the exit-site change is suggested.
7. Swimming is not encouraged, especially in public pools, lakes or rivers, and whirlpools or hot tubs. It can take place with good supervision and with occlusive dressings covering the exit site and catheter after the 6-week healing period. An immediate dressing change should take place after swimming.
8. If trauma to the exit site occurs, contact the center. If any hematoma is present then prompt administration of an

antibiotic chosen on past history of skin colonization is recommended for 7 days.

9. There are no convincing data to suggest screening children or care givers for *Staphylococcus aureus* nasal carriage or on the use of mupirocin cream around the exit site on a regular basis. However, this is recommended for those requiring a second catheter due to *S. aureus* infection, when both child and family should be screened and treated.
10. Diagnosis and treatment of exit-site and tunnel infections will be included in guidelines for management of PD-associated infections in children.

TRAINING FOR HOME PD

1. Children's trained nurse(s) with appropriate experience/qualification should train the family and provide them with support (15).
2. Two family members (which can include the patient if capable) should be trained (16).
3. The nurse should already have carried out a home assessment with other members of the team (*e.g.*, social worker, technician) and made recommendations for home adaptations to ensure safe delivery of home dialysis (17).
4. Training information should include preparation materials (*e.g.*, dolls, videos, books, literature). A quiet private environment for learning should be available to the child and family (18).
5. The training program includes the following:

    - dialysis therapy (machine or manual exchanges);
    - exit-site/catheter care;
    - signs and treatment of peritonitis;
    - blood pressure recording and monitoring;
    - importance of fluid balance and use of different strengths of dialysis fluid;
    - recording and monitoring weight;
    - administration of medications;
    - dietary management;
    - management of dialysis at home;
    - arrangements at school re playing sports, hobbies, travel, and holidays;
    - documentation;
    - trouble-shooting problems;
    - contacting the hospital;
    - management of supplies;
    - support at home and patient organizations; and
    - benefits available.

6. Equipment meeting appropriate regional safety standards should be available for the child and family (19). They should be taught how to correctly use weighing scales, blood pressure devices, and dialysis equipment.
7. The dialysis technician should be informed of the discharge date and equipment required and provide technical support for the equipment at home. This support may also involve direct contact with the company supplying the equipment and includes prompt delivery of supplies.
8. The multidisciplinary team provides support for the child and family during training and should include a nephrologist, a renal nurse, a renal dietitian, and a renal social worker. Other staff that may be involved include play staff, schoolteachers, psychologist/psychiatrist, and youth worker (20).
9. The child and family are discharged home when they are competent and confident in providing dialysis therapy (21). It may be beneficial for the family to manage the dialysis entirely themselves in accommodation away from the ward before discharge home.
10. Alternatively, training may be undertaken or completed in the home environment.
11. Regular telephone contact and support for the family should be organized (22,23).
12. Knowledge, information, and skills of performing PD should be assessed at regular intervals, preferably at home. A formal home update program should be considered (24).
13. Families who have a child on home PD for a prolonged period require regular discussion of support in order to avoid exhaustion and burnout (25).

CONTAMINATION OF PD CATHETER

1. If there is contamination of the PD catheter without disconnection (*i.e.*, accidental touching of the catheter tip), then cefuroxime 125 mg/L should be added to the dialysis fluid for 48 hours. This may be done in-hospital or by the family at home following advice from the renal nurse.
2. If the line is accidentally disconnected at the connector, the renal nurse should advise the family to clamp the catheter and reconnect the line. The child will need to attend the unit for a line change after draining the peritoneal fluid from the abdomen. A specimen should be cultured. Cefuroxime 125 mg/L will be added to the dialysis fluid for 48 hours.
3. If there is a split in the dialysis catheter the family will be advised to clamp the line above the split, cover the split with sterile gauze, and attend the unit for a line change. Peritoneal dialysis fluid is drained and cultured and cefuroxime 125 mg/L added to the dialysis fluid for the next 48 hours.
4. In the posttransplant period, if the PD catheter has not been in use for some time it is unlikely that dialysis fluid can be drained from the abdomen. The catheter should not be flushed. In the event of disconnection or a split catheter, the child should be admitted, commenced on IV antibiotics, and the dialysis catheter removed as soon as possible.

DENTAL PROPHYLAXIS FOR CHILDREN ON PD

Children who have indwelling peritoneal catheters do not require antibiotic prophylaxis for dental treatment, provided there is no other indication for prophylaxis, such as cardiac problems (26).

REMOVAL OF THE PERITONEAL CATHETER POST RENAL TRANSPLANT

The optimal time for catheter removal posttransplant has not been settled (27). In children in whom the graft is placed extraperitoneally, the PD catheter is usually left in place in case dialysis or drainage of ascites is required postoperatively. If the catheter is not required then routine flushing of the catheter is not recommended.

Rejection episodes requiring return to dialysis are rare after the first month, but catheter-related infections increase at this time (28). Hence, removal of the PD catheter at 3 – 6 weeks following successful transplantation is recommended.

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