6
Peritoneal dialysis access in children
M. L. BRANDT and E. D. BREWER

1. INTRODUCTION

The history of peritoneal dialysis began in 1922 with Putnam’s publication of his work demonstrating that the peritoneum could be used as a dialysing membrane1. The first description of insertion of a chronic indwelling catheter for peritoneal dialysis was in 1968 by Tenckhoff2. Since that time, the surgical techniques used to place peritoneal dialysis catheters have undergone significant evolution3. Despite this evolution, placing and maintaining catheters for peritoneal dialysis remains a significant challenge, particularly in children. The challenge of pediatric peritoneal dialysis access is fitting a limited number of sizes of peritoneal dialysis catheters to children who come in a vast array of sizes. In addition, children have different abdominal proportions, less abdominal wall musculature and less subcutaneous fat than adults, factors which also make the procedure more complex. This surgical challenge is reflected in the high overall complication rates for children, which approaches 70% in some series4. Successful peritoneal dialysis access in children requires an understanding of these complications, which is the first step in improving outcomes.

2. COMPLICATIONS OF PERITONEAL DIALYSIS CATHETERS

Other than peritonitis, which usually occurs as a result of a break in exit site or dialysis technique, many complications associated with peritoneal dialysis catheters can be avoided by careful attention to surgical technique. The risk of peritonitis may be decreased by an initial, aseptic flush performed in the operating room and subsequent fastidious exit site care. Removal of the catheter may
be necessary if the peritonitis causes significant systemic symptoms or if the organism cannot be cleared with antibiotics. The catheter should be removed and as long a delay as possible allowed before placing a new catheter.

Leakage of dialysate is uncommon and usually occurs in the immediate postoperative period as the result of an inadequate closure of the layers of the abdominal wall or an inappropriately large subcutaneous tunnel. Leaks may also be caused by creation of a perpendicular tunnel, rather than an oblique tunnel, through the abdominal wall. Because early high-volume dialysis is associated with an increased risk of leak, dialysis should be delayed as long as possible after catheter placement. If this complication occurs, dialysis should be suspended for as long as possible in order to allow the site to heal. The catheter exit site should be cleaned and the catheter should be fixed securely to the abdominal wall with tape or other fixation device and dressed with an occlusive dressing until dialysis is resumed. When dialysis is initiated, lower pressure is preferable by using low fill volumes. If the leak persists after reinitiating dialysis, the catheter should be removed and positioned in a new location.

Catheter migration in the peritoneal cavity, which occurs in approximately 5–10% of catheters, usually occurs as a result of too much torque placed on the catheter at the time of surgical placement. The synthetic materials used to manufacture these catheters have “memory”. Because of this catheter memory, a catheter that is bent during placement will eventually try to assume its manufactured curvature. If the angle between the peritoneal portion and portion of the catheter in the abdominal wall is made too acute, the peritoneal portion will become displaced in the abdomen as the catheter seeks to return to a straight position. In infants, who have a very shallow pelvis and a proportionally short abdomen, catheter displacement is even more common. Occasionally, catheter migration may be due to constipation or excessive bladder distention. In these rare cases the catheter may return to its normal position with enemas or bladder drainage. If these maneuvers are unsuccessful, the intraperitoneal portion of the catheter can be repositioned using a laparoscopic technique. If a small (3 mm) camera and grasper are used, dialysis can be resumed within a day or two of laparoscopy. If there does not appear to be a significant amount of torque, a suture can be placed laparoscopically to hold the catheter to the peritoneum in the desired position. However, in most cases of catheter displacement, the degree of torque is too great to overcome and replacement of the catheter is indicated.

Cuff extrusion, like catheter migration, is usually caused by excess torque on the catheter at the time of placement. In this setting, it is the acute angle between the exit site and the portion of the catheter in the abdominal wall that is responsible. Cuff extrusion is more likely to occur if the cuff is placed too close to the exit site or if an exit site or tunnel infection occurs. If the catheter has two cuffs and no evidence of dialysate leak or peritonitis, it may be possible to shave the extruded cuff from the catheter and continue using the same catheter. In most cases, partial extrusion results in irritation and infection at the exit site, and catheter removal and replacement is indicated.

Acute exit site and tunnel infections may result from early catheter movement after surgery. Careful attention to catheter fixation, while avoiding sutures at the exit site, may decrease the risk of this complication. Both acute and chronic exit site/tunnel infections may respond to appropriate antibiotics and careful exit