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Introduction

Despite apparent cost benefits, improved quality-of-life indicators, and initiatives to increase selection of the modality, the utilization of peritoneal dialysis (PD) remains low in many industrialized countries. Although many nephrology groups strive to provide patients an equal opportunity to choose PD versus hemodialysis (HD), utilization of PD varies greatly from practice to practice. One reason is a lack of understanding of which patients are eligible for PD. In addition, there is a lack of understanding of the difference between contraindications to PD as opposed to barriers to choosing the modality. Contraindications to PD are those that cannot be overcome despite the physician and/or patient choice. There are clear surgical contraindications to PD such as active intra-abdominal infection, loss of domain/unreparable hernia and dense abdominal adhesions which are not amenable to laparoscopic lysis [1]. In addition, there are medical contraindications such as documented loss of peritoneal function/ultrafiltration failure of the peritoneal membrane, and severe protein malnutrition and or proteinuria >10 g/day [2, 3]. Much of the time, medical contraindications to PD are actually barriers that

could be overcome with careful effort and institution of proper support systems. This chapter will clarify all patients that should be considered eligible for PD. Also medical contraindications versus barriers to PD will be contrasted. Lastly, possible solutions to overcome these barriers will be discussed.

Surgical Contraindications to Peritoneal Dialysis

Decreased Capacity of Peritoneal Cavity

The peritoneal cavity must allow up to 2 liters of fluid to dwell at any time for peritoneal dialysis to be effective. In pediatric patients, an exchange volume of 1,000–1,100 mL/m² BSA is recommended, though in infants and toddlers less than 2 years of age, this may be decreased to 800 mL/m² BSA [3, 4]. Women starting third trimester of pregnancy or patients with extensive abdominal adhesions that are not amenable to surgical correction do not have appropriate capacity of the peritoneal cavity for dialysate [3]. However, it is difficult to predict the degree of adhesions preoperatively. After abdominal surgery adhesions between the omentum and abdominal wall occur in over 80% of patients and involve the small intestine up to 20% of the time [5]. In a sample of 436 patients who underwent PD catheter placement, Crabtree et al. reported the need for

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adhesiolysis in 32% of those who had prior abdominal surgery (58%), but only 3.3% in those without prior abdominal surgery. It is not surprising that they found adhesiolysis was needed more commonly based on the number of prior operations, ranging from 22.7% after one operation to 52% if the patient had a history of four or more operations [6]. However, the severity of adhesive disease may only be evident after attempted lysis of adhesions and catheter placement as shown in his study where the incidence of catheter failure from extensive adhesions was only 1.8%. In a similar study of 217 catheter insertions, Keshvari found a 42.8% incidence of previous abdominal surgery and 27% incidence of adhesions. Extensive laparoscopic adhesiolysis was required in only three patients. When comparing the patients who had adhesions and those without, he found no difference in the incidence of mechanical complications or need for revision [7]. Catheters have also been placed in a suprahepatic location in patients with a hostile pelvis precluding low placement of a catheter, and in infants undergoing open heart surgery with successful dialysis [8]. Therefore, history of prior abdominal surgery is not a contraindication to trying peritoneal dialysis if surgeons with experience in advanced laparoscopy can attempt lysis of adhesions and catheter placement in these patients.

Lack of Integrity of the Abdominal Wall

Uncorrected mechanical defects that prevent effective PD such as surgically irreparable hernia, omphalocele, gastroschisis, diaphragmatic hernia, pericardial window into the abdominal cavity, and bladder extrophy are also contraindications, although rare exceptions to this rule have been described [9]. The volume of dialysate must dwell in the abdomen where the peritoneum is well vascularized. Therefore these conditions prevent proper peritoneal dialysis and may lead to fluid leak into the pleural space or soft tissues. Because of the increased intraabdominal pressure with peritoneal dialysis, the incidence of abdominal wall hernia is almost 30% in adults and up to 40% in children [10, 11]. Literature regarding

giant abdominal wall hernia repair before or during peritoneal dialysis is lacking. However, ventral and inguinal hernia repair may be performed preoperatively or concomitantly with PD catheter insertion and may allow effective PD [12]. More details on hernia repair in PD patients are found in a subsequent chapter. If adequate hernia repair is not successful, there tends to be rapid enlargement and dialysate leak [13, 14], thus these patients may no longer be candidates for PD.

Eligible Patients for Peritoneal Dialysis

Most patients are medically eligible for PD. Peritoneal dialysis has few absolute medical contraindications. One large Dutch study demonstrated that only 17% of end-stage kidney disease (ESKD) patients had a medical contraindication to PD [15]. The most common was previous major abdominal surgery. Many patients in this study had a social contraindication to PD. That is, there was an inability to perform PD exchanges by themselves. In a US study, only 23% of eligible patients had a medical contraindication to PD, consistent with 17–21% seen in studies from other countries [16].

Thus, medical eligibility for PD must remain broad. Specifically, the scope of patients eligible for PD should not be limited to those who have progressive chronic kidney disease (CKD) who are followed in outpatient clinics for a period of time. Certainly, pre-ESKD care allows for modality education and optimal patient choice [17]. Patients who are urgent starts or require unplanned dialysis are often only considered for HD via a central venous catheter (CVC). Nephrologists often delay or even inadvertently deny modality education in such patients. This is more often the case if there is uncertainty of renal recovery. Urgent start with acute PD catheter placement has been shown to be safe and feasible. It may be associated with increased risk of mechanical complications but, unlike with HD via CVC catheter, is not associated with increased risk of infections complications [18]. Patients who require unplanned dialysis should be evaluated for barriers and contraindications to PD and

offered this modality if appropriate. Urgent start PD should be considered and a transitioning outpatient Nurse- assist PD program should be established until such patients can be educated to perform independent home care.

As mentioned, another at risk group, who is denied modality education, is patients who start dialysis for acute kidney injury. These patients are most often started on HD via a CVC catheter with the thought of imminent renal recovery. However, a number of these patients at 30–60 days show no signs of renal recovery. These patients for multiple reasons, including comorbid debilitating illnesses, forgotten modality education and/or a perception that the patient is “doing well on HD”, are never offered PD. They are often directly referred for arteriovenous access placement without consideration of PD eligibility.

Another unique opportunity to transition patients to PD is HD transfers from outside dialysis units that may be stable but who have not been offered modality education at previous centers. Lastly, patients who have failed multiple arteriovenous accesses for HD require reevaluation of PD eligibility and concerted efforts to overcome barriers to transitioning to PD must be made.

Beyond proper eligibility, there are true medical contraindications to PD. Psychiatric illness that prevents safe and hygienic self care is a clear contraindication. Additionally, patients who demonstrate a consistent lack of medical compliance and follow up are not able to be offered PD. Patients who have significant lung disease with poor lung compliance often cannot tolerate PD secondary to restriction of ventilation from dialysate fill volumes. Lastly, patients with severe neurologic disease, movement disorder, or severe arthritis preventing self care whom have no caregivers cannot perform PD.

Barriers to Peritoneal Dialysis

The Elderly

There are patient groups that nephrologists often overlook as appropriate for PD. Firstly, the geriatric population is a population of patients often

overlooked for PD. In 2004, a Dutch study showed that older age was associated with more contraindications to PD therapy and stronger likelihood to be directed to HD therapy [15]. This group of patients often has barriers to rather than contraindications to PD. In the elderly, the goal of care shifts more from quantity of life the quality of life. PD is well- suited for this goal of care. The modality avoids hospitalizations and complications of HD. Careful efforts to evaluate eligibility and overcome barriers are critical in this patient population [19].

They are several potential advantages of PD in the elderly. Most importantly is increased cardiovascular stability with PD. The potential for cardiovascular disease and related complications increases with age. Elderly can most benefit from the hemodynamic stabilities of PD. Additionally, vascular access surgeries are avoided with PD. Elderly often have poor target veins and require repeated vascular procedures. This modality also avoids chronic venous catheter when arteriovenous access cannot be created. Lastly, PD does not require anti-coagulation and lowering the risk of G.I. bleeding.

Conversely, there are potential problems in the elderly. There are an increased number of and complex co- morbidities in older patients that may prevent them from actually performing the dialysis exchanges. These include depression, dementia, impaired vision, decrease physical and mental abilities that impair self-performance of dialysis procedure. These limitations are real but can be overcome. Manual dexterity problems can be partly overcome with connection assistant devices and certainly use of the cyclor is important. There are other adaptive CAPD systems such as the rotary disc system. Home care assistance from family, friends, and home nurses allows more patients to receive PD at home. Some patients can start with assisted PD with a RN and then graduate to self-care. Family or friends can be trained as an assistant and models can be developed with two daily nursing visits. Employment and training of a dedicated care giver can be considered and finally more assisted living centers or skilled nurse facilities should be available to elderly patients to perform PD. Healthcare policies supporting assisted PD can

increase utilization and this has been shown in a number of countries, including Canada and France [20]. Assisted PD does not cost more than in-center HD even when the cost of home care provider is taken into account [21]. In conclusion PD is not contraindicated in the elderly and offers advantages over in-center HD. Homecare assistance can allow more elderly patients to receive PD. PD mortality is affected by the increased risk of co-morbidities at this age but not due to the modality per se.

Obesity

Obesity is often considered medical contraindications to PD. Obese patients with ESKD are less likely to initiate PD in the United States [22]. There are several reasons for this. Obese patients are often not offered PD as a modality. Clinicians are inexperienced and thus less comfortable with the management of PD in obese patients. Also, there are misconceptions about the outcomes of PD in obese patients. The relationship between body mass index (BMI) and mortality in dialysis patients is opposite of the relationship in the non-CKD population. A low BMI (<22) is associated with an increased risk of death, regardless of modality of dialysis. Obesity (BMI > 30) seems to confirm a survival advantage in patients with ESKD. This benefit seems to be more pronounced in HD as compared to PD. However, there is no clear evidence that the mortality significantly differs between obese patients on PD versus on HD [23–25].

There are mechanical and technical reasons obesity can pose problems in performing PD. These include higher risks of catheter leak, exit site infections and peritonitis. Also, there are concerns that patients with high BMI may have difficulty achieving solute clearance and adequate ultrafiltration. Early catheter placement and proper positioning of PD catheter by the surgeon using an upper abdominal or presternal exit site can help reduce catheter leaks, exit site

infections and peritonitis. Achieving adequate clearance in the obese patient can be achieved with larger dwell volumes and use of CCPD. Careful monitoring of residual kidney function is paramount in the obese patient as the loss of this function may require transition to HD. In conclusion, obesity is not an absolute contraindication to PD. Careful planning on catheter placement and diligence to achieve adequacy of dialysis can allow the obese patient to successfully undergo PD.

Polycystic Kidney Disease

Patients with polycystic kidney disease (PKD) are one last patient population group that is often not considered for PD. It is often felt that the risk of complications and technique failure due to the limited intraabdominal space is higher in patients with PKD. There are clear considerations that must be made as this patient population. There is a theoretical higher likelihood to develop hernia, cyst rupture and increased pain when adding PD fluid to an abdomen with enlarged kidneys. However, in a number of retrospective and observational studies the technical survival, quality of dialysis, duration in therapy and rates of complications in PD are comparable in patients with cystic or noncystic kidney disease. Therefore PKD should not be considered a medical contraindication to PD [26].

In conclusion, in industrialized countries PD is underutilized partly from poor assessment of eligibility and contraindications. There are very few medical contraindications to PD. There are several things that need to occur to promote increased utilization of this modality. Certainly efforts to promote pre-ESKD care are essential. In addition, patients that start dialysis without predialysis care should be considered eligible for PD. Efforts to overcome barriers to PD by offering support, such as assist devices and home care support, should be employed. Challenging patient populations, such as elderly and the obese, must not be excluded from PD.

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