EVALUATION OF THE REPLACEABLE PERITONEAL CATHETER "REPL-A-CATH": A PROSPECTIVE STUDY

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ABSTRACT
The authors evaluated Repl-A-Cath—a replaceable peritoneal catheter, over a three-year period. This device consists of a silicone "percutaneous tunnel", through which a catheter is inserted into the peritoneal cavity. The catheter, which is hermetically sealed to the silastic tunnel, can be removed and replaced nonsurgically if necessary. Because of its system of hermetical sealing, it has the same degree of bacteriological safety as other models in use. Among 31 ReplA-Cath's implanted in 27 patients (21 on CAPD, six on IPD), the incidence of complications was very low. The greatest advantage of this catheter is that it can be replaced in case of obstruction and poor dialysate drainage can be corrected without trauma.

The conclusion reached after the University of Louisville's multicenter study on the risks and the hazards related to the devices associated with peritoneal dialysis (2), namely that "obstruction is the major problem encountered with all catheter designs" (3) is confirmed by the the literature which describes experience with the Tenckhoff catheter. Oreopoulos et al (4) and Valk et at (5) found an insufficient flow of dialysate in 14% of all catheter and Rubin et at (6) in 20%. Furthermore Devine et at (7) found that 21% of catheters had permanent obstruction, while Kablitz et at (8) reported 18%, and Vidt 13% (9).

One-way obstruction can be relieved by various manoeuvres such as flushing the catheter with heparin, or fibrinolytic solution or removing the clot with the Fogarty catheter or with Giovannetti et at "Italian cork screw" (10). Such methods often are unsuccessful and may produce additional complications such as: catheter damage, breaking off part of the instrument inside the catheter, bleeding, infection, etc. When one cannot relieve the obstruction, it becomes necessary to remove and replace the catheter. Generally to avoid leakage peritoneal dialysis must be interrupted and the patient undergoes additional trauma. These complications can be avoided with the "percutaneous tunnel" device, "Repl-A-Cath"*, which permits non traumatic removal and replacement of the catheter (Fig. 1). In this device, a subcutaneous silicone cannula (170 mm long and 5 mm diameter) serves as a tunnel through which the peritoneal catheter is intro

Figure 1: The "Repl-A-Cath" peritoneal device.

Figure 2: The components of "Repl-A-Cath": the silicone cannula serves as a "percutaneous tunnel" through which the peritoneal catheter is introduced into the abdominal cavity.

*Repl-A-Cath is manufactured by Miramed S.P.A., 41037 Mirandola, Italy.
nula’s threaded adapter, and prevents movement between catheter and cannula (Fig. 3). A ring nut is put on the catheter and tightened to the screw adapter (Fig. 4, 5). In this manner the flange is compressed inside the groove of the adapter and thus the connection between cannula and catheter is sealed.

This arrangement permits catheter removal and replacement without trauma in a few minutes. The catheter is removed under aseptic conditions by unscrewing the ring nut and pulling it out. A new catheter is introduced into the peritoneal cavity via the cannula (Fig. 6). This manoeuvre is facilitated by lubricating the cannula with sterile vaseline oil and stiffening the catheter with a semi rigid (nylon) guide. After replacement, the ring nut is screwed tightly onto the adapter and the hermetic seal is re-established. The study described in this paper was done to evaluate this new catheter design after three years of experience.

### METHODS

At the Dialysis Center of the City Hospital of Belluno (Italy) during the period Sept 1980 to Sept 1983, 31 Repl-A-Cath devices were implanted in 27 unselected chronic uremic patients (17 males, 10 females; mean age 54.11 ± 17.53 years). Of these, 21 were treated with CAPD and six with IPD. The overall evaluation period 470 patient months, corresponded to an average of 17.11 ± 11.12 catheter months per patient. The underlying renal diseases were: Chronic glomerulonephritis (nine patients), chronic pyelonephritis (nine), nephrosclerosis (four), polycystic kidney disease (four) and renal tuberculosis (one).

After local anesthesia, the cannula was implanted through a smalllaparotomy in the midline below the umbilicus and through a rectilinear percutaneous tunnel. The peritoneum was closed around the cannula by a “tobacco bag” with a 00 silk suture in contact with the proximal dacron cuff. The catheter was directed through the cannula towards the pouch of Douglas with the help of a clamp or a semirigid guide. On the average peritoneal dialysis was started four days after implantation.

### RESULTS

Of the 27 patients in this study three died (one with fungal peritonitis, and two of cardiovascular causes), nine were switched to hemodialysis, and 15 continue on peritoneal dialysis. The cannula was removed on 12 occasions: because of dacron cuff extrusion in three, recurring postoperative hernia in one, and modification of the dialysis program following serious and recurring peritonitis in eight. The average rate of removal was one every 39 catheter-months (Table I).

Two patients developed a postoperative hernia: in one, peritoneal dialysis was resumed after surgical repair; the other was transferred to hemodialysis because of recurring surgical complications. There were no episodes of leakage or bleeding. Skin exit-site infection developed in seven patients (22.58%), while infection of the subcutaneous tunnel developed in three (9.68%). In these cases, the cannula was replaced surgically.

In over 470 catheter-months, we verified 33 episodes of peritonitis in 16 patients (59.26%) - an incidence of one episode every 14.24 patient-months. In 16 episodes the peritonitis was caused by a gram-positive organism (Staph aurous 11, Staph albus one, Staph epidermidis four), in 11 by a gramnegative organism (E coli six, Pseudomonas aeruginosa four, C lastridium cloacae one), in three by fungi (Candida Albicans) and in three the culture was negative.

The dialysate flow through the catheter was interrupted 32 times in 12 patients (44.4%): In 16, because of one-way obstruction; in 10 because of permanent obstruction by fibrin clots; in five, because of extrapelvic migration of the catheter, and in one, because...
In all cases of insufficient dialysate flow, the catheter was easily removed and replaced (Table II). This manoeuvre never caused any serious complication, such as bleeding or visceral perforation or peritonitis within 48 hours. A few patients complained of slight abdominal pain at the point of catheter insertion.

In the presence of persistent peritonitis, we introduced a new catheter without the use of the semirigid guide, to avoid bowel perforation. Peters et al (13) found a variety of organisms coagulase-negative Staphylococci, Staphylococcus aureus, Pseudomonas aeruginosa and Acinetobacter calcoaceticus adhering and growing on the catheter surface. In addition these organisms produce large volumes of slime-like material, which may impair the host's defenses and inhibit the action of antibiotics. Thus an infected catheter may represent a focus of infection and therefore its replacement may shorten the duration of the peritonitis. We tested this hypothesis by removing and replacing the catheter in 10 episodes of peritonitis. Even though our preliminary results look promising a larger series of cases is needed before we can draw any definite conclusions (Fig. 7).

DISCUSSION

The idea of using a percutaneous tunnel to obtain longterm access to the peritoneal cavity was suggested first by McNeil (14) and later by Merrill (15) and Boen et al (16), however, it was soon abandoned because of the difficulties encountered, particularly the formation of visceral adhesions with subsequent risk of bowel perforation at catheter introduction, and the high incidence of peritonitis. During our three years experience with the Repl-A-Cath device, which also is based on the principle of the "percutaneous tunnel", we rarely encountered such problems. In fact we observed no visceral adhesions or obstruction of the end of the intra-abdominal catheter by omentum flaps. The incidence of intraluminal obstruction was very low - one episode every 18.07 dialysis-months. The hermetic seal between cannula and catheter completely insulates the dialytic compartment. The incidence of peritonitis with Repl-A-Cath is comparable to that we observed in patients dialysed with the Tenckhoff catheter (17) and is similar to that reported by most workers with other types of catheters (18).

In the absence of peritonitis, repeated cultures taken from the internal surface of the cannula and from the intraperitoneal catheter portion were negative. This suggests that the episodes of peritonitis were not related to Repl-A-Cath and therefore this device can be considered as safe bacteriologically as other peritoneal catheters currently in use.

Cuff extrusion was rare and generally was due to its placement at an incorrect distance from the skin exit-site. This complication can be avoided by placing the Dacron cuff at least 2 cm below the skin exit-site. Cuff extrusion, though not frequent in our series (1/78 catheter-months), is a serious complication which generally produces infection of the subcutaneous tunnel and predisposes to peritonitis. In our experience, cuff extrusion followed by tunnel infection always requires surgical replacement of the cannula to terminate recurring episodes of peritonitis, which are caused by the same organism found at the infected exit-site. Most of the Repl-A-Cath removals (66.6%) were due to transfer of the patient to hemodialysis because of modifications of the dialysis program.

The advantages of the Repl-A-Cath device are particularly evident in impaired dialysis flow due to obstruction, migration or catheter kinking. In such

![catheter survival](http://www.peritoneal-dialysis.com/)

Figure 7: Catheter survival and causes of catheter failure in our three years' experience.
cases, the catheter was removed easily and replaced immediately without trauma and without interruption of the dialysis. This was particularly useful in cases of fungal peritonitis because *Candida albicans* adheres to the silastic surface (19). In these cases the cannula can be closed temporarily and after complete healing has taken place, a new catheter is inserted to resume peritoneal dialysis.

Despite its advantages, our catheter is not "the answer" for all problems of the access to the peritoneum. It appears that the ideal catheter remains to be developed and that, as Oreopoulos says (20), we need further studies regarding its design, the role of the subcutaneous cuff and its correct distance from the skin exit-site, and regarding better materials. While it is as safe as other catheters, Repl-A-Cath seems to have solved without trauma some of the problems related to permanent peritoneal catheters such as obstruction, migration and kinking and the necessity of temporary removal.

REFERENCES