Is There Need of an Extension Channel/ New Double-Cuffed Channel in Surgical Management for Channel Perforation and Aneurysm of Tenckhoff Catheter?: Modified Partial Replantation

Peritoneal Dialysis (PD) was introduced by Popovich *et al.* in 1976 (1). There has been a dramatic rise in continuous ambulatory PD (CAPD) over the last 2 decades. Whereas there has been an increase in PD prevalence, the proportion of all dialysis patients using PD has declined. This modality of dialysis has been one of the most important therapeutic methods for patients with end-stage renal disease (ESRD).

Tenckhoff catheter placement is well established to facilitate PD in the treatment of ESRD. Complications with these catheters, while *in situ*, are well documented (2). The removal and replacement of Tenckhoff catheters in response to these complications adds morbidity in an already immunocompromised ESRD patient. The most common cause of catheter loss has been reported to be catheter-related infection (3). A salvage technique, 'partial replantation of Tenckhoff catheters', is well established as a means of rescuing the still-functioning conduit with refractory exit-site or tunnel infection, which requires the placement of a new double-cuffed catheter/extension channel in view of the infective nature of the damaged catheter (4).

Ironically, very little is known about the incidence, etiology, presentation, and surgical management of Tenckhoff catheter damage due to a crack/leak resulting from mechanical trauma. We hereby present our single-center experience of the causative factor, mode of presentation and modification of partial replantation as a salvage procedure for catheter damage due to physical/chemical insult in 14 patients over 17 years.

MATERIALS AND METHODS

PATIENTS

A retrospective review was performed on 14 patients with Tenckhoff catheter damage due to a crack/leak

resulting from mechanical trauma who underwent modified partial replantation from January 1997 to May 2013. All patients were on CAPD for 12 to 110 months with no mechanical or infective complication at least for the last 2 years (Table 1). Renal failure was due to hypertension ($n = 5$), diabetes mellitus ($n = 4$), glomerulonephritis ($n = 2$), obstructive nephropathy ($n = 1$), and unknown causes ($n = 2$).

PREREQUISITE FOR MODIFIED PARTIAL REPLANTATION

- 1) Written informed consent
- 2) No mechanical or infective complication at least for the last 2 years
- 3) No pericatheter leakage, edema, or induration at the exit site.
- 4) Leukocyte count of catheter fluid was within normal limits and culture was sterile.
- 5) No sign of infection over the internal cuff area.

MODIFIED PARTIAL REPLANTATION

Based on the clinical diagnosis of Tenckhoff catheter's crack and aneurysm, we planned for partial replantation in a modified method. One gram of vancomycin was administered intravenously 1 hour before the placement of the catheter as surgical prophylaxis. The surgical procedure was performed under local anesthetic 1% lignocaine in supine position. We placed the skin incision around 4–5 cm over the previous scar of catheter insertion. Dissection was carried out along the proximal normal portion of the catheter so as to gain adequate length from the looped internal part, which was then exteriorized along with the outer Teflon cuff superior to the incision line. This partial replantation was accomplished by excision of catheter proximal to the crack site and fitting the tungsten adapter at the cut end (Figure 1). The catheter replantation wound was closed in layers. There was no need to connect to a new double cuffed catheter or any segment of siliconized tube. In 1 case of channel aneurysm, due to the very short length of the normal proximal part of the catheter, attachment of the extension channel to the catheter *in situ* was required in addition to partial replantation.

RESULTS

No antibiotic was administered postoperatively. There was no wound- or tunnel-related complication in any case. The wound healed in 5 to 7 days under proper exit-site care. All of the patients resumed CAPD immediately after partial catheter replantation and were discharged 2 to 4 days thereafter. Suture removal was done from 7

TABLE 1
Patient Characteristics

Number of cases	Age & sex	Duration b/w catheter insertion & damage	Cause of catheter damage	Condition	Size of perforation/aneurysm	Distance from skin exit site	Management	Follow-up
1	60 F	84 months	Stenosis	Perforation	2 mm	2 cm	Modified partial replantation	24 months
2	41 M	33 months	Stenosis	Perforation	3 mm	4 cm	Modified partial replantation	60 months
3	58 M	48 months	Stenosis	Perforation	2 mm	3 cm	Modified partial replantation	48 months
4	45 F	24 months	Stenosis	Aneurysm dilatation	1 cm	2 cm	Modified partial replantation	48 months
5	64 M	110 months	Inadvertent stretching	Perforation	4 mm	3 cm	Modified partial replantation	9 months
6	46 M	12 months	Inadvertent stretching	Perforation	2 mm	6 cm	Modified partial replantation	34 months
7 (Fig. 1)	63 M	60 months	Inadvertent stretching	Perforation	2 mm	2 cm	Modified partial replantation	24 months
8	50 F	25 months	Inadvertent stretching	Aneurysm dilatation	2 cm	4 cm	Modified partial replantation	62 months
9	41 M	24 months	Surgical blade	Perforation	6 mm	5 cm	Modified partial replantation	38 months
10	35 F	13 months	Surgical blade	Perforation	5 mm	3 cm	Modified partial replantation	48 months
11	45 M	15 months	Catheter care by spirit	Perforation	2 mm	2 cm	Modified partial replantation	46 months
12	40 M	36 months	Not known	Perforation	3 mm	5 cm	Modified partial replantation	35 months
13	50 M	72 months	Not known	Perforation	2 mm	3 cm	Modified partial replantation	62 months
14 (Fig. 2)	50 F	35 months	Not known	Aneurysm dilatation	2.5 cm	1 cm	Partial replantation & extension channel attachment	6 months

to 10 days post-operatively. Thirteen patients continued PD without any catheter-related complication on follow-up varying from 6 to 62 months. However one patient developed exit-site/tunnel infection 3 years post-modified partial replantation procedure.

DISCUSSION

Tenckhoff catheter insertion for PD is a procedure associated with potentially significant surgical morbidity.

It is associated with early and late, infectious and non-infectious complications. Where there is a great burden of infectious complications like wound infection, post-insertion peritonitis, exit-site/tunnel infection (ESTI), and tuberculous peritonitis, the non-infectious complications like catheter migration, catheter obstruction, malposition, kinking, entrapment of the catheter leak from the main incision, and hemoperitoneum are also potentially significant (2,5). Tenckhoff catheter perforation as crack/leak and its channel aneurysm formation

Figure 1 — Tenckhoff catheter's crack with leak (arrow) (A), dissection of distal cuff (B), progression of the dissection proximal to distal cuff (C), excising exteriorized catheter proximal to crack (D), adequate length of catheter post excision (E), 10 days post-procedure of case 7.

Figure 2 — Aneurysmal dilatation and distal narrowing of Tenckhoff catheter of case 14.

are also among non-infectious complications, which are very poorly reported but deserve full mention of their presentation and management.

Removing a catheter because of intractable ESTI seems to be justified by the fact that the presence of foreign bodies, such as the catheter, usually makes complete eradication of infective pathogens difficult. The cuff and the catheter, once invaded by infective pathogens, are apt to provide a milieu of persistent colonization. In such situations, removal of the whole catheter may be mandatory if the tunnel infection has extended to

the inner cuff area (usually diagnosed by the presence of tender swelling in the proximal tunnel region or by a sonographic finding of fluid accumulation in that region); otherwise, removal of a part of the catheter is sufficient to treat ESTI. Total replantation and even partial replantation have been the established treatment modalities for ESTI (4,6).

However, partial replantation of Tenckhoff catheters is indicated for patients who meet the criteria like positive culture of exit-site discharge with negative culture of ascites, erythema, or tenderness localized over the exit site or the distal part of the tunnel, relapse or no response after antibiotic therapy for 3 weeks, and no sign of infection over the internal cuff area but near-cuff perforation of the catheter, which is a troublesome problem. High risk of ascending infection, irritation of exit site, and painful sensation are noted after repairing the perforation with glue (4). Wu *et al.* performed partial replantation in 26 cases out of which 24 cases had ESTI and 2 cases were due to channel perforation, as a modification of the previous procedure by Chao and Tsai (6). They used in all cases the extension channel as a new double-cuffed catheter connected to the native one by a segment of siliconized tube and always removed the native cuffed channel (4). On the other hand, in our series of 14 cases, the reason for intervention was perforation and channel aneurysm instead of ESTI. We preserved the proximal normal portion of the catheter,

exteriorizing it with the outer cuff, and there was no need of an extension channel except for 1 case where there was an inadequate length of proximal normal catheter. Hence, the added economic burden of using an extension channel for every replantation is unwarranted. In our study, there is quite a low rate of mechanical or infective complication like peritonitis in the follow-up that was probably due to extra care of the exit site and catheter by patients post-modified partial replantation, as they had experience of the consequences of carelessness.

By repositioning the catheter, we avoided not only the complications of catheter removal like wound hematoma and abscess, but also the need of a break-in period hemodialysis and its complications (7,8). Also the possibility of early or late dialysate leakage is ruled out as there is no disturbance to the proximal healthy portion of the catheter (9). Besides the psychological benefits of our modified partial replantation technique due to not adding a new double cuffed channel/siliconized tube to the native catheter *in situ*, the economic burden of reinsertion was also reduced without compromising the outcome, as depicted similarly in our previous study (10).

In conclusion, the proposed modified technique of partial replantation of a Tenckhoff catheter for channel perforation and aneurysm is a simple and effective procedure with minimal morbidity for an already compromised ESRD patient.

DISCLOSURES

The authors have no financial conflicts of interest to declare.

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