Frequency of Puncture Holes in Peritoneal Dialysis Catheters Related to the Beta Cap Adapter

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Between November 2009 and September 2011, 12 patients (6 women, 6 men) undergoing continuous peritoneal dialysis (PD) or automated PD developed puncture-like holes in the PD catheter near the interface of the adapter with the superior aspect of the Silastic PD catheter. The adapter is used to connect the PD catheter to the PD transfer set.

Over the course of 23 months, the 12 patients presented to the PD unit with 19 separate instances of catheter holes, for an event rate of 0.23 holes per patient–year. Data including socio-demographic information, PD modality, need for antibiotic treatment, event recurrence, infectious complications, and time from catheter placement were collected from patients whose catheters did and did not develop holes. We observed no differences between patients whose catheters developed holes and those whose catheters did not. The location of the individual holes suggested a relationship between the adapter and the catheter holes. The holes, which led to increased patient morbidity and costs, may be related to structural changes made in 2006 to the adapter.

Key words
Peritoneal dialysis catheter, peritoneal dialysis catheter complications, peritoneal dialysis adapter

Introduction

For patients on peritoneal dialysis (PD), a functional and dependable catheter is integral to successful dialysis. Through the years, advancements in connectology have helped make catheters easier to use and have lowered complication rates. The adapter system, which connects the catheter to the transfer set, has been part of the evolution of connectology. In 1982, the beta cap technique was reported as a successful alternative to the standard closed system used at the time (1). Subsequently, in 1985, a locknut device was developed to help counteract the slack that tended to develop at the catheter–titanium junction after prolonged use of the PD catheter (2). More recently, the Argyle Beta-Cap Adaptor (Covidien, Mansfield, MA, U.S.A.) was developed as an alternative to titanium adapters to help lower costs while maintaining durability.

Here, we report our experience with a unique complication of puncture holes in PD catheters that may be related to design changes in the Argyle Beta-Cap Adaptor.

Case report

Between November 2009 and November 2011, our group cared for 66 PD patients. Among those 66 patients, 12 experienced a total of 19 holes in their PD catheter at the catheter–adapter interface (Figure 1). Standard protocol for such an event involved

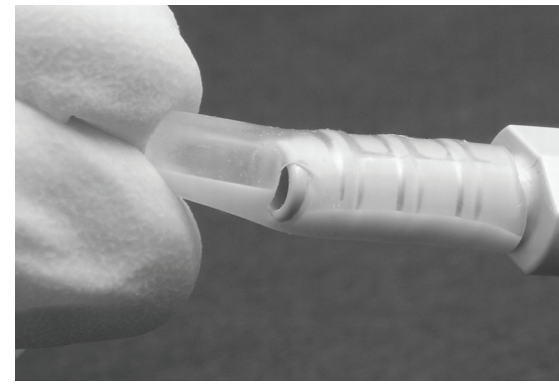

FIGURE 1 Catheter puncture hole.

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trans-section of the catheter proximal to the hole, at which point a new adapter and transfer set were attached. Most patients underwent fluid analysis to rule out peritonitis, and all received prophylactic antibiotics. Unfortunately, 1 patient experienced an episode of peritonitis after development of one of these holes (Table I).

The overall event rate was 0.23 events per patient–year, and the time from catheter placement to hole development was 781.8 ± 490.5 days. Three patients experienced multiple holes, and the time to hole development was generally shorter for subsequent holes than for the initial hole (Table I). We analyzed the demographic and clinical characteristics of patients who did and did not experience catheter holes (Table II), and we observed no significant differences between the groups.

In October 2011, we stopped using the Argyle Beta-Cap Adaptor on all new catheters, substituting the Medionics International (Markham, ON, Canada) titanium adapter. Also, on all existing catheters that now experience puncture holes, we are replacing the Argyle Beta-Cap Adaptor with the Medionics titanium adapter. We have not experienced any puncture holes associated with the titanium adapter, including in catheters that earlier developed puncture holes.

TABLE II The comparison between patients with puncture holes and ones without puncture holes.

Variable	*Punctured catheter* *Yes*	*No*	p *Value*
Patients [*n* (%)]	12 (18.2)	54 (81.8)	
Age (years)	51.0±16.3	54.6±14.7	0.45
Sex (% women)	60.0	41.7	0.26
Race (% African American)	40.0	41.7	0.92
Exit site (%)			
Right	83.3	80.0	0.84
Lower	66.7	42.2	0.19
Body mass index (kg/m^2)	25.2±3.1	27.8±5.9	0.18
Catheter duration (days)	758.0±504.2	563.1±532.3	0.09

TABLE I Patients with puncture holes and duration time from catheter placement

Pt ID	*Age*	*Sex*	*Peritoneal dialysis modality*	*Catheter placement* *Date*	*Duration (days)*	*Peritonitis*
1	67	Female	CCPD	Sep 5, 2008	441	Yes
2	30	Male	CCPD	Mar 14, 2008	637	No
3	44	Male	CCPD	May 9, 2008	585	No
				Dec 15, 2009	208	No
4	55	Male	CCPD	Feb 8, 2008	697	No
				Jan 5, 2010	143	No
				May 28, 2010	70	No
				Aug 6, 2010	44	No
5	38	Female	CAPD	May 16, 2008	731	No
6	63	Female	CAPD	Jun 5, 2009	416	No
				Jul 26, 2010	250	No
				Apr 2, 2011	100	No
				Jul 11, 2011	176	No
7	33	Female	CCPD	Feb 6, 2009	537	No
8	27	Male	CCPD	Jun 18, 2008	773	No
9	65	Female	CAPD	Dec 4, 2004	2294	No
10	77	Male	CCPD	Apr 10, 2009	844	No
11	54	Female	CCPD	Apr 3, 2009	831	No
12	59	Male	CCPD	Mar 5, 2010	614	No

Pt = patent; CCPD = continuous cycling peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis.

Discussion

The Argyle Beta-Cap Adaptor, made of Ultem Resin (Sabic Innovative Plastics, Pittsfield, MA, U.S.A.), was designed to maximize durability and lower costs. In 2006, it was redesigned at the proximal male end, with the rounded edge being straightened (Figure 2). Because all holes developing at the catheter–adapter interface occurred after the design change, we hypothesize that the straighter edge might be predisposing catheters to develop puncture holes. Indeed, kinking at the interface in the setting of the straighter adapter edge may have led to the puncture holes. This hypothesis may also explain why the time to subsequent holes was shorter in patients developing multiple holes in the catheter, because the catheters are shortened by trans-section, thereby predisposing them to kinking. The reason that patient 9 developed a puncture hole is unclear, because her initial catheter placement pre-dated the structural change made in 2006 to the Argyle Beta-Cap Adaptor. She may have required a new adapter at some point after the design change, but that possibility could not be confirmed.

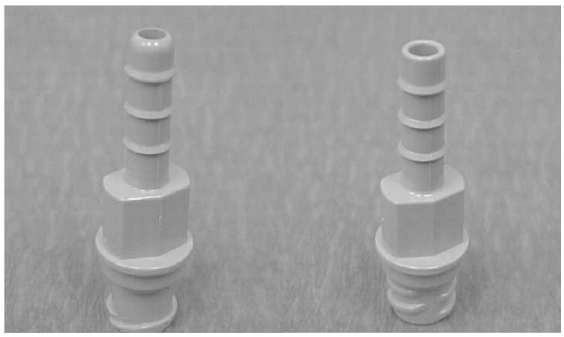

FIGURE 2 Change in the design of the Argyle Beta-Cap Adaptor (Covidien, Mansfield, MA, U.S.A.), 2006 (left) and 2009 (right). In 2006, the distal male edge was less straight. In 2009, the threading at the edge proximal to the patient was changed.

Conclusions

We suspect that modifications to the design of the Argyle Beta-Cap Adaptor may be associated with an increased risk of PD catheter puncture holes. The puncture hole frequency was felt to be greater than chance, and the catheter holes led to increased costs and morbidity in PD patients.

Disclosures

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

References

1 Mavichak V, Moriarty MV, Cameron EC, *et al.* Three and a half years experience with CAPD using the Beta Cap technique. Trans Am Soc Artif Intern Organs 1982;28:253–8.

2 Hudson S, Mackie R, Stewart WK. Lock-ring for Tenckhoff catheter/titanium adaptor junction. Uremia Invest 1985–1986;9:69–71.

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