

## SPONTANEOUS FRACTURE OF CUFFED DUAL-LUMEN CENTRAL VENOUS CATHETERS IN HEMODIALYSIS PATIENTS

Chi-Wei Lin, Hsi-Hsien Chen, I-Chun Li, Yi-Lung Lin, Tzen-Wen Chen

*Cuffed dual-lumen central venous catheters (DLCVC) have been used increasingly in hemodialysis treatment. DLCVC-related complications such as infections and thrombosis were well discussed in the past. However, reports of spontaneous catheter fracture, one of the rare complications of DLCVC, have increased as a result of more frequent and longer use of DLCVC. Three of our hemodialysis patients were found to have spontaneous catheter fracture during the past two years. We analyzed the possible causes by reviewing the patients' age, sex, comorbid conditions, duration of catheter use, catheter infection, thrombosis, use of intracatheter thrombolytic agents, and the use of intracatheter antibiotic lock. The published studies about this complication were also reviewed. (Acta Nephrologica 2007; 21: 221-223)*

**Key words:** *cuffed dual-lumen central venous catheter (DLCVC), hemodialysis, spontaneous catheter fracture*

### INTRODUCTION

Cuffed dual-lumen, soft, silicon rubber central venous catheters (DLCVC) have been used increasingly as permanent vascular access of hemodialysis.<sup>1</sup> Several complications such as infections and thrombosis were well discussed in the past. Other rare but severe complications such as spontaneous fracture of catheter had been noted increasingly as a result of their broad use.<sup>2</sup>

Three of our patients receiving hemodialysis with DLCVC were found to have spontaneous catheter fracture in the past two years. We try to explore the possible risk factors so as to prevent this rare but life-threatening complication.

### MATERIALS AND METHODS

We reviewed the medical records of 17 patients who received cuffed, dual-lumen, soft, silicon rubber central venous catheters (PERM CATHETER, TYCO International Ltd, USA) as their permanent vascular access for hemodialysis between Sep. 1999 and Sep. 2001. The mean age of all patients was  $71 \pm 10$  years (range from 48-85 years), and the mean duration of catheter use was 16 months (range from 5-24 months). The patient popu-

lation consists of 8 male (47%) and 9 female (53%). Diabetes was noted in 13 patients (77%) and chronic glomerulonephritis was noted in 4 patients (23%). Our indications for DLCVC insertion include: (1) severe congestive heart failure (23.5%) and thus unsuitable for arteriovenous fistula creation, and to avoid arteriovenous fistula-induced high-output heart failure; (2) failure of arteriovenous fistula malfunction (64.7%); (3) patients' choice (11.8%) for fear of pain. Under anesthesia, DLCVC were inserted from the internal jugular vein. The catheter's tip position was checked using regular chest radiograph obtained shortly after completion of the surgical procedure. The settings of hemodialysis for patients with DLCVC as their vascular access are: blood flow: 200-220 ml/min, dialysate flow: 500 ml/min, dialysate with bicarbonate base, and 4-hour dialysis thrice weekly. Data Analysis and Statistics—Data are shown as mean  $\pm$  standard deviation. Statistical comparison was made using unpaired Student's *t* test.

### RESULTS

A total 17 patients were included between Sep. 1999 and Sep. 2001. Complications were recorded (Table 1): Infections were noted in nine patients (53%), one was

Department of Internal Medicine, Division of Nephrology, Taipei Medical University Hospital, Taipei, Taiwan

Received: February, 2007      Revised: March, 2007      Accepted: September, 2007

Correspondence author: Dr. Tzen-Wen Chen, Department of Internal Medicine, Division of Nephrology, Taipei Medical University Hospital, Taipei, Taiwan, No. 252, Wusing St., Taipei City 110, Taiwan (R.O.C.)

Tel: 886-2-27372181 ext. 3903

Fax: 886-2-87320395

Reprint requests: Chi-Wei Lin; No.252, Wusing St., Taipei City 110, Taiwan (R.O.C.)

E-mail: 022008@gmail.com



Table 1. Characteristics of patients who received DLCVC as their permanent vascular access for hemodialysis between Sep. 1999 and Sep. 2001.

	Age	Sex	DM	Duration	# Infection	Thrombosis	Antibiotic lock	Urokinase.
1*	80	F	+	11 M	B. subtilis	+	Gentamycin	+
2*	80	F	+	19 M	S. aureus	+	-	+
3*	75	M	+	19 M	S. aureus	-	-	-
4	81	F	+	11 M	-	-	-	-
5	85	F	+	24 M	S. aureus	+	-	+
6	67	M	+	12 M	S. aureus	-	-	-
7	68	F	+	9 M	-	+	-	+
8	48	M	-	8 M	-	-	-	-
9	78	F	-	7 M	-	+	-	+
10	80	M	+	7 M	S. aureus	-	-	-
11	70	M	+	18 M	-	-	-	-
12	84	F	-	24 M	-	-	-	-
13	61	M	+	16 M	-	+	-	+
14	56	F	+	13 M	-	+	-	+
15	61	F	+	5 M	S. aureus	-	-	-
16	64	M	+	24 M	S. aureus	+	-	+
17	81	F	-	16 M	S. aureus	-	-	-

\* : patients with catheter fracture

# B. subtilis: Bacillus subtilis; S. aureus: Staphylococcus aureus

Bacillus subtilis, and the others were Staphylococcus aureus. Intracatheter gentamycin lock was used in the patient who got Bacillus infection. Catheter thrombosis (> 1 week after catheter insertion) was noted in eight patients (47%), all with diluted urokinase (250,000 u in 250 ml of saline) drip into DLCVC. The mean duration of DLCVC use was  $14 \pm 6$  months, ranging from 5-24 months. The three patients with spontaneous catheter fracture were of older age and had diabetes mellitus as their underlying disease. Catheter infections developed in all three patients. Thrombosis was noted in two patients. The mean duration of catheter use in these patients was  $16 \pm 4$  months (Table 2).

## DISCUSSION

DLCVC has been increasingly used as permanent vascular access in hemodialysis, especially in the elderly and patients with diabetes because it involves simple, painless on/off dialysis procedure and can be used immediately post insertion, without the need to wait for the vascular access to mature. Among our cases, the episodes of catheter infection, DM and older age were factors

with the greatest correlation. However, prolonged use of DLCVC (repeated use of clamp) had been postulated to be the factor most correlated with catheter fracture in previous study. But no such correlation was found in our study. More evidences are needed to confirm our finding. Spontaneous catheter fracture had been noted, especially among oncology patients who need central venous catheters (CVC) for repeated chemotherapy, blood examination, and parenteral alimentation. Moshe et al. studied 295 patients with CVC use between 1990 and 1996, and 12 patients were found to have catheter leakage or fracture without obvious causes.<sup>2</sup> Mechanisms of spontaneous catheter fracture may be related to chronic mechanical friction as the catheter passes between the clavicle and the first rib (Pinch-off sign),<sup>3</sup> which had been decreased by intraoperative x-ray guide. Prolonged use of catheter had also been postulated to be the cause of catheter fracture due to natural wearing after prolonged use, repeated use of clamp, and repeated contact with disinfectants that makes the catheter brittle and break.<sup>4</sup> Catheter may also contain barium sulfate, either throughout the entire catheter or in a radiopaque strip. Too small or too many barium sulfate particles



Table 2. Statistical comparisons of characteristics of patients with and without spontaneous catheter fracture.

		fracture		not fracture		P value
		Mean	SD	Mean	SD	
Age	(y/o)	78.3	1.6	70.3	3.1	0.02
DM	(%)	100		71	13	0.02
Duration	(month)	16.3	2.7	14.6	2.0	0.31
Infection	(%)	100		43	14	<0.01
Thrombosis	(%)	37	33	43	14	0.28
Antibiotic lock	(%)	33	33	0		0.29
Urokinase	(%)	67	33	43	14	0.28

SD: standard deviation

led to high viscosity of the raw silicone before polymerization, causing improper mixing of barium sulfate particles in silicon matrix. This resulted in insufficient removal of admixed air bubbles and unequal dispersion of barium sulfate, with the potential for weak spots after extrusion of the silicone into its definite shape.<sup>5</sup> Gram-negative infection of catheter had also been postulated to be the cause of leakage of polyurethane catheter.<sup>6</sup> However, no relation with silicon catheter was reported. Intracatheter use of antibiotics or thrombolytic agents had been reported to be safe and have no adverse effect on catheters.<sup>7</sup>

## CONCLUSION

The episodes of catheter infection, DM and older age may predispose DLCVC to spontaneous fracture. Avoiding prolonged use of catheter, decreased infection episodes, and improved quality of catheter could decrease the incidence of spontaneous catheter fracture.

## REFERENCES

1. Twardowski ZJ: Intravenous catheters for hemodialysis: historical perspective. *J Artif Organs* 2000; 23: 73-6.
2. Moshe Koller, Moshe Z. Papa, Amikam Zweig, Gur Ben-Ari: Spontaneous leak and transection of permanent subclavian catheters. *J Surg Oncol* 1998; 68: 166-8.
3. Aitken DR, Minton JP: The "pinch-off" sign: A warning of impending problems with permanent subclavian catheters. *Am J Surg* 1984; 148: 633-6.
4. Golper TA, Carpenter J: Accidents with Tenckhoff catheters. *Ann Int Med* 1981; 95: 121-2.
5. Marcel C. Weijmer, Saskia M. Kars, Piet M. ter Wee: A scanning electron microscopy analysis of a spontaneous hemodialysis catheter fracture. *Am J Kidney Dis* 2001; 38: 858-61.
6. Riu S, Ruiz CG, Martinez-Vea A, Peralta C, Oliver JA: Spontaneous rupture of polyurethane peritoneal catheter. A possible deleterious effect of mupirocin ointment. *Nephrol Dial Transplant* 1998; 13: 1870-1.
7. Vercaigene LM, Sitar DS, Penner SB, Bernstein K, Wang GQ, Burczynski FJ: Antibiotic-heparin lock: in vitro antibiotics stability combined with heparin in a central venous catheter. *Pharmacotherapy* 2000; 20: 394-9.