Interventional Cardiology

Transcatheter Retrieval of Dislodged Port-A Catheter Fragments: Experience with 47 Cases

Tsung-Neng Tsai, Chih-L Han, Wei-Shiang Lin, Shih-Ping Yang, Tien-Pieng Tsao, Kai-Min Chu, Bieng-Hsian Tzeng and Shu-Meng Cheng

Objective: The purpose of the present study was to investigate the incidence and location of dislodged Port-A catheter fragments and the efficacy and safety of transcatheter retrieval of dislodged Port-A catheter in our hospital.

Materials and Methods: Forty-seven cancer patients, mean age 56 years old with 53.2% male, were referred to our catheterization laboratory for retrieval of fractured Port-A catheter, were enrolled from January 2005 to March 2006. The procedures were performed under hospital guidelines and the patients followed in the outpatient department for at least 1 month after procedures. The characteristics of all fractured Port-A catheters were recorded. The procedure-related clinical status was evaluated.

Results: The most common location of fractured catheter tip was found between the right atrium and inferior vena cava (11/47). Forty-six of the forty-seven (97.8%) dislodged catheters were successfully retrieved by the transcatheter method. Only one patient received surgical intervention because of failure to retrieve a dislodged catheter. Most of the procedures were performed with standard vascular tools (loop snares and pigtail catheters). In our experience, more sophisticated devices such as grasping forceps, baskets, or flexible triple grasping forceps have the drawback of limited valve compared to loop snare and even carry considerable risk of perforation. The complication rate of this procedure was fairly low (2/47, 4.3%), only one patient develop hematoma at right groin due to concomitant thrombocytopenia, and the other had flail of tricuspid valve damaged by a fragment passing though the valve.

Conclusion: The most frequent location of dislodged Port-A catheter was found to situate between the right atria and inferior vena cava, where it was technically easier to be removed by the endovascular approach, with few complications reported. Therefore retrieval of dislodged Port-A catheters by endovascular approach might be the first choice of treatment because it is both safe and effective.

Key Words: Transcatheter retrieval • Dislodged Port-A catheter

INTRODUCTION

The implantation of central venous access devices is both safe and convenient, especially in those patients needing chemotherapy and parenteral nutrition. The most common complications associated with these implants are venous thrombosis, extravasations, dislocation, obstruction, catheter leakage, and local or systemic infections. Among those complications, dislodged broken catheter is rare, with an estimated rate of 0-2.1%.[1,2] It is attributed to intermittent compression of the catheter between the clavicle and the first rib when the catheter has been inserted too far medially, leading to catheter erosion and fracture.[3] Although the complication rate is low, it can be fatal if the dislodged fragment migrates into the heart, causing emobilization.[3-5] Therefore the dislodged catheter should be removed as soon as possi-

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Division of Cardiology, Department of Internal Medicine, Tri-Service General Hospital, National Defence Medical Centre, Taipei, Taiwan.
Address correspondence and reprint requests to: Dr. Shu-Meng Cheng, Division of Cardiology, Departments of Internal Medicine, Tri-Service General Hospital, National Defense Medical Centre, No. 325, Section 2, Cheng-Kung Road, Neihu 114, Taipei, Taiwan. Tel: 886-2-8792-7160; Fax: 886-2-8792-7161.

ble if the patient's condition allows. One of the best ways to remove the fractured fragment is by percutaneous transcatheter technique, if the dislodged catheter has not adhered to the myocardium. However, an open thoracotomy retrieval or alternative warfarin therapy without retrieval might be the choice for management if the dislodged catheter is adhered to the myocardium firmly.[6,7]

Transcatheter removal of dislodged catheter is generally safe and least invasive.[8] There are a variety of transcatheter techniques to retrieve foreign bodies from the great vessels and heart. Most of these procedures can be carried out under local anesthesia and are well tolerated. It is a simple and safe way to remove foreign bodies for cancer patents with limited life expectancy.[9] In addition, several devices are available for transcatheter retrieval, including grasping forceps, urinary stone baskets and gooseneck snare, which were reported to enhance the success rate of percutaneous transcatheter retrieval up to 95%.[10] Because techniques dedicated to management the dislodged Port-A catheter are well-established, we present our experience with the strategies, methods, success rate, techniques of percutaneous retrieval of intravascular dislodged Port-A catheters in 47 patients in our hospital during the period from January 2005 to March 2006.

MATERIALS AND METHODS

Patients

We retrospectively reviewed all patients who were referred for retrieval of dislodged Port-A catheter from January 2005 to March 2006. There were a total of 47 patients referred from the outpatient department and ward. The enrolled patients' implantations were inserted from September 2001 to November 2005. There were totally 2764 patients who received implantations of Port-A catheters via the subclavian vein or the internal jugular vein during this period of time, and all the Port-A devices were placed by surgeons. All 47 patients had undergone catheter placement at our hospital and were hospitalized for retrieval of dislodged port-A fractured catheter.

Procedures

Before the procedures, the patients had undergone the chest roentgenogram, complete blood counts, Prothrombin time (PT), partial thromboplastin time (PTT) and electrocardiogram (ECG). The procedure would be arranged if no bleeding tendency existed.

The procedure for retrieval the dislodged catheter was performed under fluoro-imaging in the cardiologic intervention unit. ECG and blood pressure were monitored during the procedure. All patients had venous access (8 French vascular sheath) via the right femoral route under local anesthesia with 2% lidocaine. Six kinds of device were available, including loop snares (Amplatz platinum Goose-neck snare, Microvena, White Bear Lake, MN, USA), basket (Medi-tech, Boston, Mass, USA), pigtail (William Cook Europe, A/S, Bjaerberskov, Demark), flexible triple grasping forceps (Cook Europe, Gainesville, Florida, USA), grasping forceps (Boston Scientific, Watertown, MA, USA) and multipurpose catheter with self-made gooseneck loop using 0.014″ Floppy guide-wire, 300 cm (Guidant, Santa, CA, USA). The choice of device was made base on the operator's personal experience. Most dislodged catheters could be snared directly or following repositioning by a 6-French pigtail catheter. An exchange of devices would be allowed if initially chosen methods failed. Elapsed time for operation was defined as the difference between the time when the dislodged catheter was retrieved with the venous sheath and the time when the retrieval device was introduced into the sheath. After the dislodged fragments were retrieved, the venipuncture site was compressed for at least 10 minutes, followed by bed rest and sand bag compression for 2 hours. All patients were discharged during the next day if no complication occurred, and were examined at outpatient division one week after discharge and followed up for at least one month.

Data review

All the data were reviewed from the medical records during hospitalization and outpatient department for at least one month after patients were discharged.

RESULTS

Characteristics of the patients and implanted Port-A catheters

There were 22 women and 25 men enrolled. The av-

erage age was 56.0 years old (range from 23 to 82 years). A dislodged Port-A catheter was documented on chest roentgenogram PA view with average of 361.5 days (range from 46 to 1219 days) after placement of the device (summary in Table 1). Forty-six of the 47 (97.8%) dislodged Port-A catheters were successfully retrieved. Seventeen patients' Port-A catheters were implanted in the right subclavian vein, and the others patients, were implanted in the left subclavian vein. Six patients received cut-down approach to implant the Port-A and the rest (41/47) received percutaneous subclavian approach. Thirty-eight patients' Port-A devices had dislodged at the connection portion between base and catheter, the other nine patients's device were dislodged at the distal portion. In eight patients (8/47, 17%) the dislodged catheter was found incidentally at regular outpatient follow-up or immediately upon admission. Thirty-eight patients (38/47, 80.8%) were found because of increased resistance during routine irrigation. One patient was found with swelling over the Port-A catheter implant site when fluid was infused. Among those patients with increased resistance during routine irrigation, six patients (6/38, 15.8%) experienced palpitation, especially ones with end of dislodged catheter in the right ventricle (N = 2)/atria (N = 2) or had segment crossing the right ventricle (N = 2). One patient whose dislodged Port-A fragment was located in the left pulmonary artery had exertional dyspnea due to complicated pulmonary embolism.

Table 1. Patient characteristics

Sex	Male:Female = 25:22
Mean age	56.0 years old
Mean elapsed time	20.5 minutes
Mean retention day	361.5 days
Clinical symptoms	
No symptom	8
Irrigation resistance	38
Dyspnea	1
Method of implanting Port-A	
Cut-down approach	6
Percutaneous subclavian approach	41

Location of dislodged Port-A with device choice and time required for the procedure

The locations of bilateral tip of the dislodged catheter and the mean time required for this procedure are showed in Table 2. Thirty-four patients' dislodged catheter could be retrieved with loop snare directly, and the remaining patients (N = 12) needed an extra pigtail to reposition the fragment before snaring could be employed. The catheter fragment can be removed successfully in 30 patients with loop snare alone and in 11 patients in whom preceding repositioning was needed. The basket directly snared in 2 patients and snared after repositioning of fragment by pigtail in 1 patient. Multipurpose catheter with self-made wire loop had was used after failure to snare either end of dislodged catheter in two patients. The locations of those two dislodged catheter were in the pulmonary artery and left subclavian vein, respectively. One catheter stuck at the left subclavian vein was unable to be retrieved by any of the devices in our hospital. This patient received surgical intervention to remove both the Port-A device and its fractured catheter.

Overall, the mean time required for this procedure was 20.5 minutes. Obviously, a longer time was needed to retrieve the dislodged catheter when both of its ends were in certain location. Those catheters with one end in the inferior vena cava (IVC, N = 15) were easier to remove. All the dislodged catheter end in the IVC could be directly retrieved with either loop snare (N = 14) or basket (N = 1) alone. Depending on the position of the fractured catheter, antecedent reposting is sometime needed. This might be due to lack of free end and difficulty to hold the free ends in the RA, RV or hepatic vein (HV). There were four cases with distal end emobilized in the pulmonary artery (PA). Successful retrieval was achieved by grasping the PA proximal end in three cases. The fourth case needed Terumo wire (Radifocus Guide wire M; Terumo, Tokyo, Japan) to guide multipurpose catheter with self-made wire loop to grasp the distal end of the fractured catheter for deep embolization in the distal PA. There was one case with one end of the fractured catheter located in the coronary sinus and the other in the right atrium; loop snare attempting was unsuccessful. Later, we introduced a basket into the RA and rotated it, thus trapping the end of the fractured catheter within the basket. Successful retrieval was achieved.

Complications

During the procedure, one patient developed non-sustained ventricular tachycardia while the loop snare was passing though the right ventricle and subsided after the loop was repositioned to the RA without any medica-

Table 2. Summary of locations of fractured Port-A and the elapsed time of procedures

Location	Number	Device	N. need reposition	Elapsed time (minutes)
RA-IVC	11	Loop (N = 10)	0	9.6
		Basket (N = 1)		
SVC-RA	9	Loop (N = 7)	2	15.6
		Loop + Pigtail (N = 2)		
SV-SVC	5	Loop (N = 4)	0	16.6
		Failure (N = 1)		
RV-IVC	1	Loop (N = 1)	0	13.2
SVC-IVC	2	Loop (N = 2)	0	10.8
SV-IVC	1	Loop (N = 1)	0	8.1
SVC-RV	3	Loop (N = 1)	1	15.0
		Loop + pigtail (N = 1)		
		Multipurpose (N = 1)		
RA-CS	1	Basket (N = 1)	0	10.9
RA-SV	1	Loop (N = 1)	0	18.9
RA-RV	2	Loop + pigtail (N = 1)	2	18.2
		Basket + pigtail (N = 1)		
LPA	1	Multipurpose (N = 1)	0	144.9
RV-LPA	1	Loop (N = 1)	0	46.9
RA-LPA	1	Loop (N = 1)	0	53.5
RPA	1	Loop (N = 1)	0	109.5
RV-HV	1	Loop + pigtail (N = 1)	1	20.8
RA-HV	6	Loop + pigtail (N = 6)	6	16.9

Abbreviation: SV- subclavian vein, RA- right atria, RV- right ventricle, IVC- inferior vena cava, SVC- superior vena cava, HV- hepatic vein, RPA- right pulmonary artery, LPA- left pulmonary artery, CS- coronary sinus.

tion. One patient developed flail of tricuspid because of inability to grasp the distal end of fracture catheter situated in pulmonary artery. The valve might have been damaged by alternately holding the middle portion of the catheter fragment in the right ventricle followed by withdrawing it though the tricuspid valve. After the procedure, one patient with thrombocytopenia had complicated hematoma over the puncture site, which might have been due to displaced sand bag and flexion of the right lower leg when he was sleeping. However, surgical intervention was not required for this condition. Late complication was not found in all cases within one month after procedure.

DISCUSSION

Dislodgement of the Port-A system can occur for three reasons: pinch-off syndrome, use of incorrect equipment which damages the catheter, and using small syringes leading to increased pressure within the catheter.[11,12] To date, the complication rate for dislodged catheter of Port-A has remained low (0%-2.1%)[1,2] since the first reported by Turner et. al about half a century ago.[13] It is a rare complication but can be fatal. Early detection of dislodged catheter is fairly important to avoid fatal complication. Various presentations were described in previous reports, including infraclavicular pain, paraesthesias in the arm, cardiac arrhythmias, palpitation, withdrawal occlusion, swelling over Port-A, and resistance to infusion.[14-16] However, it might be clinically asymptomatic. One study by Biffi et al. showed only 3 cases among 178 devices implanted had dislodged catheters. Two of those cases presented as palpitation and chest discomfort, but one patient was asymptomatic.[17] In contrast, we found the most common presentation was increased resistance to infusion (38/47, 80.8%). The second most common clinical presentation was asymptomatic (8/47, 17%). Otherwise, the mean period from the implantation of Port-A to fracture of catheter was 361.5 days. This reminds us that once increased irrigation resistance is found at clinic, chest roentgenogram

should be taken. Annual chest X-ray is also recommended for early detection of this life-threatening complication.

The location of the foreign body within the cardiovascular system depends on the route of entry and gravity, the length and stiffness of the materials, the flow pattern of the vessel or cardiac chamber and the position of the patient at the time of the accident.[18] According to the report of Bessoud and his colleagues, the most common location of fractured tip was in the pulmonary artery.[8] This is different from our study, in which the most common locations of migrated fracture fragment were in the RA-IVC and SVC-RA, similar to the reports by Koseoglu et al and Liu et al.[19,20] The difference might be due to the different sources of patients. In our study, the all of the patients were from our own hospital, while in Bessoud et al's study, 39% of patients (39/100) were referred from other institutes, which might have resulted in fragments migrating more distally from the SVC for long-term stay of fragments in the body. But our study had fewer cases compared to Bessoud's study, therefore further more observations are needed to reach this conclusion. No matter how, when fractured dislodged fragment is found on chest roentgenogram, early removal as soon as possible is necessary to prevent its distal emobolization, which make retrieved more difficult.

Since the first report by Thomas et al. in 1964,[21] percutaneous transvenous approach has become the technique of choice to remove intravascular foreign bodies. Unless the dislodged catheter is adhered to the myocardium, requiring thoracotomy or life long anticoagulant therapy, in most cases, the fractured fragment can be removed by percutaneous transvenous approach with ease. The techniques for extraction of intravascular foreign objects have undergone significant changes, following the evolution of devices in the past decades.[8,22] Several devices are available for transcatheter retrieval, including grasping forceps, urinary stone baskets, pigtail catheters, gooseneck snare and even the new flexible triple grasping forceps. Among those devices, the most frequently used and versatile device is the gooseneck snare. Some authors have suggested that in most cases, fractured catheter can be retrieved easily by gooseneck snare, and if that fails, the likelihood of success with other devices would be low, especially for deeply emobolized fragments.[8] In our experience, the gooseneck snare was a more frequent and versatile device for retrieval of the fractured catheter. It could be snared directly in the most patients if it had one free end in the IVC or SVC. But, in some cases which both dislodged catheter free ends were not available. Those might be difficult to snare directly by the device. Bessoud et al. have advised that repositioning catheters with a pigtail catheter before retrieval is a useful maneuver for some difficult cases.[8] In our study, 21.3% (10/47) of cases needed repositioning by pigtail, especially when the dislodged fragment was embolizateded in the small vessels such that it was difficult to position the catheter to distal end, or the both ends were located in a special location, such as right heart chamber to hepatic vein. But fewer cases in our study needed pigtail to reposition dislodged Port-A catheter compared with previous reports.[8,19] That might be due to longer in size of dislodged fragments of Port-A than those of other central venous catheters and more operator experience to pass through the loop snare or multipurpose catheter to the pulmonary artery, as in performing right cardiac catheterization.

In one patient, there was failure to retrieve by all devices available in our hospital. Perhaps deep emobolization to the vessel wall and narrowing SVC made it difficult to pass a Terumo wire to the subclavian vein to guide the multipurpose catheter to the distal end of the fractured catheter. This was similar to previously reported cases with deep emobolization, lock on the distal end was the key reason for failure to retrieve the dislodged catheter.[8,22,23] However, it cannot be determined whether the catheter is deeply emobolization or not, until a retrieval device is placed close to the catheter. Therefore, retrieval should be attempted in all patients although it might fail sometimes.

The most frequent procedure-related complications were local hematoma over the venipuncture site or cardiac arrhythmia during positioning of the retrieved device within the heart.[19,22] In the present study, there were two patients who had complications. (2/47, 4.3%). One patient with thrombocytopenia (platelets: 2×10^4/ul) had hematoma at the venipuncture site after procedure despite platelet transfusion before the procedure was done. We had compressed the puncture site for at least 10 min-

utes and followed with sands bag compression for 2 hours in this patient. It seems this may not be good enough for patients with thrombocytopenia. The other patient was found to have flailed tricuspid valve following procedure, which might have resulted from the free ends of fractured fragments when we attempted to drag the catheter through the tricuspid valve with its middle portion, it might be due to increased contact dimension between catheter and tricuspid valve when grasping the middle portion of the catheter. In this regard, if the free end of the dislodged catheter is not easily held by the loop snare due to its specific location, two stage strategy might be required. Repositioning the dislodged fragment by pigtail catheter to expose its free end followed by grasping the distal end of the fragment by loop snare might avoid this complication.

CONCLUSION

This is the largest study of dislodged Port-A catheters location, incidence and the technique to retrieve via percutaneous transcather method by cardiologist. It showed that percutaneous endovascular retrieval of dislodged Port-A catheter is both safe and effective. This study also reminds us that the potential risk of damaging the valves and fatal tachycardia can occur during retrieval of fracture Port-A catheter. Cardiologists should be more aware of these complications than radiologists.

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經導管移除脫落人工靜脈血管 (Port-A) 斷片：47 個個案之經驗分析

蔡宗能　韓志陸　林維祥　曾炳憲　曹殿萍　楊世平　朱凱民　鄭書孟
台北市　三軍總醫院　內科部　心臟內科

目的　觀察人工靜脈血管 (Port-A) 脫落之發生率及斷片最常見的位置，並統計經導管移除斷片之可行性及安全性。

方法　收集 2005 年 1 月至 2006 年 3 月，47 位癌症患者因人工靜脈血管 (Port-A) 脫落而轉介到本院心臟科。所有患者均住院接受經導管移除脫落之人工靜脈血管斷片，且出院後持續追蹤至少一個月。本研究就人工靜脈血管斷片常見之脫落位置與移除之器械與手術方式加以分析討論。

結果　斷片最常見的位置為右心房到下腔靜脈之間 (11/47)。四十六位患者 (97.8%) 成功地經導管移除斷片，只有一位病人失敗而必須接受外科手術。多數患者都能以常備器械 (loop snares 和 pigtail catheters) 來移除斷片。在我們的經驗裡，大部分較為複雜的器械如 grasping forceps，baskets 或 flexible triple grasping forcep，在手術過程中並不會比 loop snare 易於使用，甚至可能會有血管破裂的危險。經導管移除脫落之人工靜脈血管斷片的後遺症很少 (2/47)，只有一位血小板低下患者術後發生右鼠蹊部部血腫，另外一位患者在斷片移除過程中，三尖瓣有輕微的裂損。

結論　人工靜脈血管斷片最常見於右心房到下腔靜脈之間，經導管移除脫落之人工靜脈血管斷片，是技術上比較簡單、也比較沒有後遺症的方法。因此在處理脫落之人工靜脈血管斷片時，我們認為經導管移除方式是可行的及與安全的，可作為第一優先選擇的治療方式。

關鍵詞：經導管移除、脫落之人工靜脈血管。