Coronary artery disease is one of the leading causes of death in Taiwan and its prevalence has increased in recent decades [1]. The management of significant coronary artery disease includes percutaneous transluminal coronary angioplasty (PTCA) and stent implantation in addition to conventional medical therapy and surgery. Complications of PTCA include myocardial infarction, cerebrovascular accident, arrhythmia, vascular complications, contrast reaction and mortality [2]. Entrapped devices, including catheters, balloons and guidewires, are rarely encountered but these may cause serious complications [3–5]. We present the case of a man who received PTCA that was complicated with a retained broken guidewire fragment in the right coronary artery (RCA). We discuss the treatment strategy along with the previous literature.

**CASE PRESENTATION**

An 85-year-old man had a history of diabetes mellitus, chronic kidney disease and benign prostate hyperplasia. He suffered from sudden onset chest pain and dyspnea. The characteristics of chest pain were oppressive sensation over the lower sternum, without radiation, and lasting for more than 30 minutes. He was sent to the emergency room after one episode of syncope. At the emergency room, initial vital signs showed his blood pressure was 121/78 mmHg, pulse rate was 70 beats/min, respiratory rate was 18 breaths/min and body temperature was 36.5°C. Chest auscultation revealed bilateral basal crackles and a regular heart sound without cardiac murmur or S3 gallop.

Serial 12-lead electrocardiography showed atrial fibrillation with a rapid ventricular rate and T wave inversion in leads III, aVF, V3 and V4. Chest X-ray...
revealed cardiomegaly and mild pulmonary congestion. Cardiac enzymes were elevated (peak values: CK, 560 U/L; CK-MB, 27.9 U/L; troponin I, 10.58 ng/mL). Non-ST segment elevation myocardial infarction was considered and heparinization was prescribed with oral aspirin and clopidogrel.

Early invasive strategy was favored because of elevated cardiac markers, and coronary angiography was performed. Right coronary angiography revealed 90% eccentric stenosis in segment 1–2 and 75% eccentric stenosis from the distal segment 3 to the posterior descending artery (PDA) (Figure A). Left coronary angiography revealed normal left main coronary artery, 50% concentric stenosis in the diagonal branch of the left anterior descending artery, and 90% eccentric stenosis in the obtuse marginal branch 1 (OM1) of the left circumflex artery (LCX) (Figure B). PTCA was arranged for the RCA and LCX lesions.

For PTCA in RCA, the proximal stenotic lesion was inflated initially with a 3.0×20-mm balloon after passing a floppy wire to the PDA. Because the 2.0×20-mm balloon was unable to cross the distal RCA lesion, another wire was used as the buddy wire to facilitate balloon passage. After successful ballooning of the distal RCA lesion, we tried to negotiate the passage of the second wire to the posterolateral (PL) branch in preparation for treating the distal RCA bifurcation lesion. However, the second wire did not pass into the PL branch. Therefore, we chose another hydrophilic wire but some resistance was found when this guidewire was advanced in the guiding catheter. Because the wire could not be moved further, we removed the wire and found that the tip was damaged, but we failed to notice that another broken wire tip was retained in the guiding catheter. Later, we placed another wire in the PL branch successfully. The broken tip was pushed into the proximal RCA when we advanced the balloon catheter (Figure C). We tried to retrieve the broken guidewire using a snare, but unsuccessfully. Thereafter, we decided to push the broken guidewire as distally

Figure. Coronary angiography. (A) Anteroposterior cranial view (AP0 CRA30) of the right coronary artery (RCA). (B) Right anterior oblique caudal view (RAO30, CAU20) of the left anterior descending artery. (C) Broken guidewire tip in the proximal RCA. (D) Broken guidewire tip located in the middle part of the Micro-Driver stent over the distal RCA. (E) After stent deployment. (F) No significant in-stent stenosis 3 months later.

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as possible with the balloon. The broken guidewire was finally advanced to the PDA. A Medtronic MicroDriver coronary stent (2.75 × 18 mm; Medtronic Inc., Minneapolis, MN, USA) was successfully crossed with the broken guidewire, which was located in the middle part of the stent (Figure D). The stent was deployed at 9 atmospheres for 20 seconds. Final angiography showed 15% residual stenosis (Figure E). We found no evidence of coronary artery dissection or perforation. The proximal RCA and LCX OM1 branch were successfully implanted with stents later. There were no peri-procedure complications and the patient was discharged 2 days after the coronary intervention.

Follow-up coronary angiography was arranged 3 months later and revealed no significant in-stent restenosis over the distal RCA stent (Figure F). He received regular cardiovascular clinic follow-ups and continued treatment with aspirin, β-blocker and angiotensin-converting enzyme inhibitor.

**DISCUSSION**

Retained fractured guidewire fragments are rarely encountered in percutaneous coronary interventions and occurs in approximately 0.1–0.2% of cases [6,7]. It is more common in procedures using special devices such as a rotablator or an X-sized thromboatherectomy catheter [8,9]. The possible complications include thrombosis, emboli, sepsis, vessel dissection, and perforation [3]. Doorey et al reported that retained guidewire fragments in patent coronary arteries may cause arterial narrowing despite systemic anticoagulation [10].

Management of the retained guidewire fragment includes cardiac surgery, retrieval with a snare loop technique, two-wire technique, stent deployment within a guide catheter or the fragment can be left in situ with observation [6,11–13]. There are usually no definite resolutions because of the varying conditions of the coronary circulation and the equipment used. Based on the risk-benefit comparison, the primary therapeutic option is interventional retrieval using specialized harvesting devices. Despite their thrombogenicity, catheter remnants, stents or fractured guidewires need not be removed unless they protrude into the ascending aorta, which increases the risk for thrombotic embolization to cerebral or other peripheral vessels [3]. Guidewire segments retained for a long time within the coronary circulation may be benign, particularly when they are entrapped with the total coronary occlusions or within a distal part of the vessel. It seems probable that the guidewire segment will become covered with an outgrowth of vascular endothelium, rendering the wire segments immobile and non-thrombogenic [4,14]. To eliminate the guidewire fragment from the lumen and reduce the risk for coronary thrombosis, sealing the fractured fragment to the vessel wall with the use of stents was described after unsuccessful retrieval of the proximal fragment in the ascending aorta [15,16]. In the event of unsuccessful interventional retrieval and persistent signs of ischemia, patients should be referred to surgery [3]. Some fractured coronary guidewire fragments with a proximal portion extending into the ascending aorta can be extracted [6]. Therefore, surgical interventions should be accompanied by transeosophageal echocardiography to evaluate the distal extent of the guidewire or catheter remnants in the aorta if needed. If the results are positive or equivocal, the aortic root should be opened and explored [17].

To the best of our knowledge, advancing the fracture guidewire fragments in the distal coronary artery and sealing them to the vessel wall with the use of stent has not been reported. Without interfering with the stent deployment in the proximal and distal stenoses, it was left in situ and there was no acute thrombosis, and ischemic symptoms did not occur. This case demonstrates effective management of a retained guidewire, and no complications occurred peri-procedurally.

**REFERENCES**


冠狀動脈氣球擴張整型術中，遺留於冠狀動脈導引線碎片的處理

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冠狀動脈介入性治療中，遺留於冠狀動脈的導引線碎片很罕見，但是會產生嚴重併發症，我們提出一位遭遇此併發症的 85 歲男性，藉由冠狀動脈支架置放被成功治療而沒有發生併發症，後續追蹤的冠狀動脈血管攝影顯示並沒有支架內再狹窄的情形。從事冠狀動脈介入性治療應了解如何處理此併發症。

關鍵詞：經皮冠狀動脈氣球擴張整型術，導引線斷裂，異物遺留，遺留導引線，支架
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