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Case Report

Endovascular Treatment Using a Small Amount of Contrast Medium in a Patient with a Posterior Communicating Artery Ruptured Dissecting Aneurysm and Chronic Kidney Disease: A Case Report

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Objective: We report a rare case of a patient with a ruptured posterior communicating artery (P-com A) dissecting aneurysm and chronic kidney disease (CKD) treated by endovascular embolization using a small amount of contrast medium.
Case Presentation: An 88-year-old female patient had sudden onset of headache and vomit due to subarachnoid hemorrhage. MRI revealed a ruptured dissecting aneurysm of the right P-com A. The patient had CKD of severity grade 4. Endovascular treatment was performed using only 10 mL of diluted contrast medium with injection through a microcatheter. The postoperative course was uneventful, and no deterioration of renal function occurred.
Conclusion: With minimal amount of contrast medium, endovascular treatment could be safely and effectively performed for patients with P-com A dissecting aneurysms and severe CKD.

Keywords dissecting aneurysm, posterior communicating artery, coil embolization, chronic kidney disease, contrast medium

Introduction

Dissecting cerebral aneurysms are one of the source of subarachnoid hemorrhage. Cerebral artery dissection may induce aneurysmal dilatation and luminal stenosis leading to subarachnoid hemorrhage or cerebral infarction.[1)] Vertebral artery is the most common location of cerebral artery dissection in Japan.[2,3)] Dissecting posterior communicating artery (P-com A) aneurysms are rare.[4–7)] In this study, we report a patient with a ruptured P-com A dissecting aneurysm and chronic kidney disease (CKD) treated by endovascular embolization using a small amount of contrast medium.

Case Presentation

An 88-year-old female patient had sudden onset of headache and vomit. A brain CT obtained in a referral hospital revealed subarachnoid hemorrhage. She was brought to our hospital for treatment. She had past history of hypertension and renal dysfunction. She was alert and scaled as World Federation of Neurosurgical Societies (WFNS) grade 1. There was no motor paralysis. The height, body weight, and body mass index (BMI) were 148 cm, 40 kg, and 18.26, respectively. Serum creatinine (Cr) level, estimated glomerular filtration rate (eGFR), and creatinine clearance (CCr) were 1.3 mg/dL, 29.8 mL/min/1.73 m^2, and 19 mL/min, respectively. The severity of CKD was evaluated as Grade 4. A CT revealed right side-dominant subarachnoid hemorrhage (Fisher Group 3) (**Fig. 1A**). An MRA demonstrated a pearl and string sign in the right

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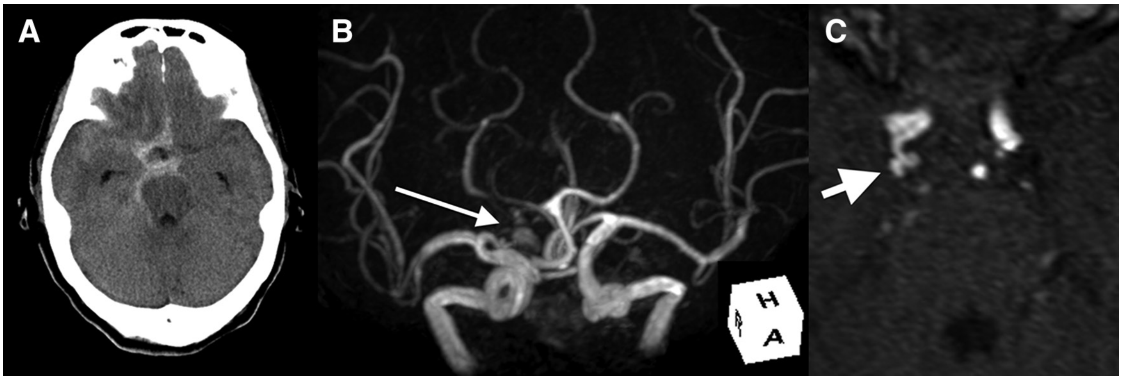

Fig. 1 (**A**) CT showing subarachnoid hemorrhage (Fisher Grade 3). (**B** and **C**) MRA showing a pearl and string sign in the right P-com A (arrows). The maximum diameter of the aneurysm was approximately 7 mm.

P-com A with a maximum diameter of the dilatation of 7 mm (**Fig. 1B** and **1C**).

Considering her advanced age, location, and configuration of the lesion and concomitant Grade 4 CKD, endovascular treatment was selected. We adopted a strategy to perform endovascular treatment by markedly reducing the volume of contrast medium in order to prevent the contrast-induced nephropathy (CIN). Contrast medium was infused through a microcatheter avoiding injection through the large lumen catheter to reduce the amount of contrast medium. The contrast medium was diluted to 50%. General anesthesia was selected to minimize body movement avoiding intra-operative rupture, although a procedure under local anesthesia could be better for renal function.

Under general anesthesia, the right femoral artery was punctured and an 8-Fr long sheath was inserted. An 8-Fr Optimo (Tokai Medical Products, Aichi, Japan) was guided into the right proximal internal carotid artery (ICA). A 6-Fr Cerulean DD6 (Medikit, Tokyo, Japan) was co-axially advanced to the distal right ICA. An Excelsior SL-10 straight (Stryker, Kalamazoo, MI, USA) was introduced proximal to the carotid siphon. MRA fusion images made on workstation (ZIOSTATION Z840; AMIN, Tokyo, Japan) were used as a 3D roadmap. Contrast medium of 6.3 mL, which was diluted to 66%, was infused through the Excelsior SL-10 and rotational DSA was performed (**Fig. 2A** and **2A'**). The Excelsior SL-10 was guided to an area before the right P-com A using 3D roadmap and 1 mL of contrast medium, which was diluted to 50%, was infused through the Excelsior SL-10 (**Fig. 2B** and **2B'**). As the obtained images had insufficient quality, selective imaging through Excelsior SL-10 guidance into the right P-com A was needed to investigate the details of the lesion. Excelsior SL-10 was guided into the right P-com A, and 0.5 mL of 50%-diluted contrast medium was slowly infused through the Excelsior SL-10 (**Fig. 2C** and **2C'**). The entire right P-com A exhibited a pearl and string sign. Stenosis was observed immediately after the origin of P-com A, connecting to a small aneurysmal dilatation. A flexion and an additional stenosis were following, and then a large aneurysmal dilatation was observed suggesting the site of rupture. The proximal bending and stenosis of P-com A prevented the microcatheter from introducing into the large aneurysmal dilatation. While placing the Excelsior SL-10 in the right P-com A, catheterization using a Marathon (Medtronic, Minneapolis, MN, USA) into the large aneurysmal dilatation was attempted, but not accomplished. Therefore, the strategy was switched to perform coil embolization (endovascular trapping) from both sides of the lesion by additionally inserting a microcatheter into the distal right P-com A through the right posterior cerebral artery (PCA). The left femoral artery was punctured and a 6-Fr long sheath was inserted. A 6-Fr FUBUKI (Asahi Intecc, Aichi, Japan) was guided to the right vertebral artery. The Marathon was guided to the distal basilar artery, and 2 mL of 50%-diluted contrast medium was simultaneously infused through both the basilar artery and the right P-com A (**Fig. 2D** and **2D'**). The Marathon was guided to the large aneurysmal dilatation of the right P-com A via the right PCA. Endovascular trapping including the aneurysmal dilatation was accomplished using a total of 21 coils through the two microcatheters. Superselective angiographies using 50%-diluted contrast medium through both the right P-com A and the right PCA confirmed complete occlusion of the lesion and patency of all the normal branches (**Fig. 3A** and **3B**). During the procedure, 11.3 mL of contrast medium was used in total.

Sedation was continued until the day after the procedure. After cessation of the sedative, her consciousness was clear and there were no neurological deficits. The Cr level, eGFR, and CCr the day after the procedure were

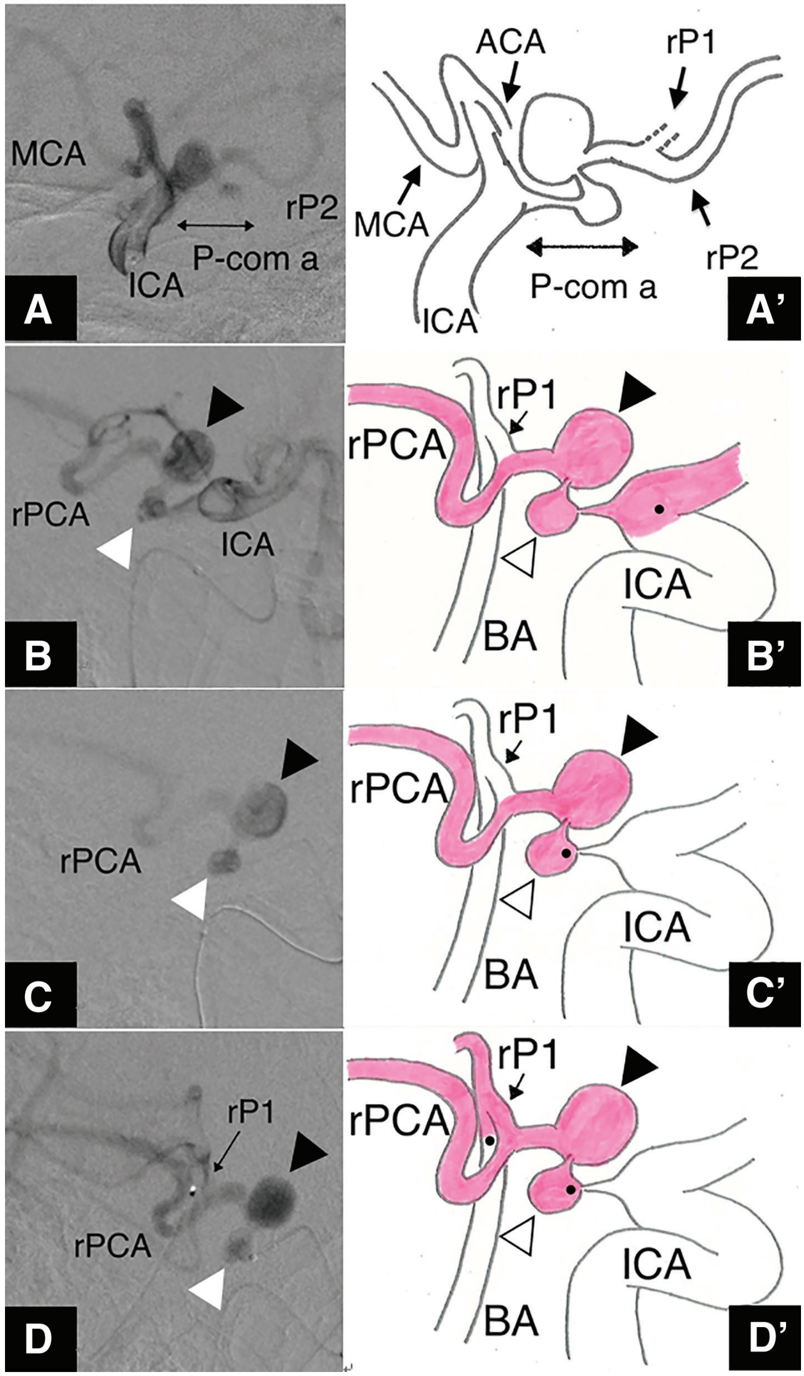

Fig. 2 (**A**) 3D digital angiography (lateral view) recorded from a microcatheter in the right ICA. (**A'**) Schematic illustration of (**A**). (**B**) Right CAG (caudal 22 degree view, left anterior oblique 70 degree view) from the microcatheter positioned close to the right P-com A. (**B'**) Schematic illustration of (**B**). (**C**) Right CAG (caudal 22 degree view, left anterior oblique 70 degree view) from the microcatheter in the right P-com A. (**C'**) Schematic illustration of (**C**). (**D**) The access route indicated on angiography (caudal 22 degree view, left anterior oblique 70 degree view) was confirmed by simultaneous injection from the BA and the right ICA using two microcatheters positioned close to the right P-com A. (**D'**) Schematic illustration of (**D**). Painted areas in the illustrations show contrast-enhanced blood vessels and aneurysms on angiography. Dots show the tip of the catheter. Black arrowheads indicate larger aneurysm and white arrowheads indicate smaller aneurysm. ACA: anterior cerebral artery; BA: basilar artery; CAG: carotid angiography; ICA: internal carotid artery; MCA: middle cerebral artery; P-com A: posterior communicating artery; rP1: right posterior cerebral artery first segment; rP2: right posterior cerebral artery second segment; rPCA: right posterior cerebral artery

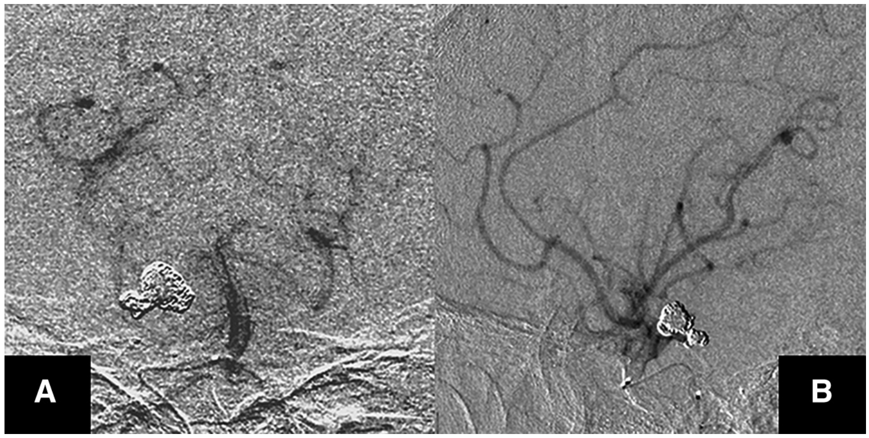

Fig. 3 (**A**) Angiography via the microcatheters placed in the BA (AP view). (**B**) Angiography of right ICA (lateral view). Dissecting aneurysms were completely embolized and the main blood vessels were preserved. AP: anteroposterior; BA: basilar artery; ICA: internal carotid artery

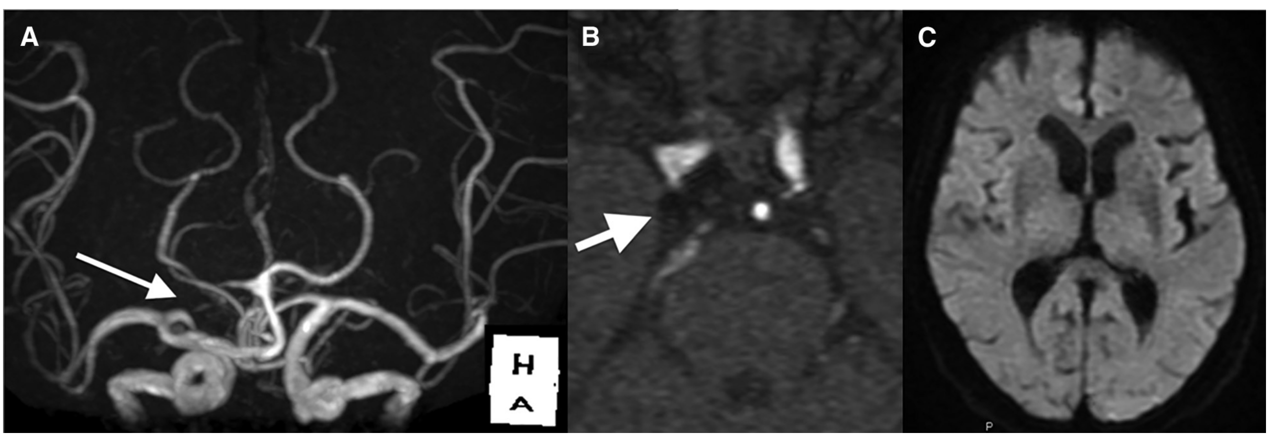

Fig. 4 (**A** and **B**) Postoperative MRA confirming disappearance of the aneurysm (arrows). (**C**) Postoperative MRI (diffusion-weighted image) showing no ischemic lesions.

1.25 mg/dL, 31 mL/min/1.73 m^2, and 20 mL/min, respectively. MRI 7 days after the procedure confirmed the disappearance of the lesions including aneurysmal dilatation (**Fig. 4A** and **4B**) and no additional ischemic lesions (**Fig. 4C**). The Cr level, eGFR, and CCr 7 days after the procedure were 1.11 mg/dL, 35 mL/min/1.73 m^2, and 22 mL/min, respectively. The postoperative course was favorable, and the patient was discharged 36 days after the procedure with modified Rankin Scale 0.

Discussion

Dissecting aneurysms of the P-com A

We reported a rare case of a ruptured dissecting aneurysm of P-com A. Vertebral artery is the most common location of cerebral arterial dissection in Japan.[2,3] Mizutani reported 117 patients with acute-phase dissecting cerebral artery aneurysms, 87 of whom had dissecting vertebral artery aneurysms.[2] According to his report, a ruptured dissecting aneurysm of P-com A was observed in only one case. Few studies have reported dissecting aneurysms of P-com A. Nakao et al.[4] reported a patient with an unruptured dissecting P-com A aneurysm with headache as the initial symptom, and Duncan et al.[6] presented a patient with an unruptured dissecting P-com A aneurysm causing cerebral infarction. Kadooka et al.[7] reported a patient with a ruptured dissecting P-com A aneurysm with subarachnoid hemorrhage. Dissecting aneurysms of P-com A may also induce various symptoms other than subarachnoid hemorrhage same as other locations.

Treatments for dissecting aneurysms include clipping and trapping by direct surgery, and endovascular trapping and stent-assisted coil embolization through the endovascular route.[8] As the previous study indicated early rerupture within 24 hours of the onset,[9] early surgical intervention should be performed. Recently, endovascular trapping and stent-assisted coil embolization have been increasingly reported according to the advancement of endovascular treatment.[7,8,10,11]

In the present case, as the diameter of the parent vessel was small and tortuous, the preservation of the parent vessel was thought to be difficult. Therefore, endovascular trapping was planned. We attempted to introduce a microcatheter into the large aneurysmal dilatation, rupture site via the ICA, but the proximal bending and stenosis of P-com A prevented the catheter from catheterization. Endovascular trapping through both proximal and distal P-com A was therefore performed with keeping short-segment embolization in mind to avoid infarction of perforating artery of P-com A. Postoperative MRI confirmed the disappearance of the aneurysms and no additional ischemic lesions. The patient developed no neurological deficits.

Endovascular treatment for patients with CKD

The present patient had Grade 4 CKD. Reduction of the dose of contrast medium was mandatory to reduce the risk of CIN. There have been few reports regarding neuro-endovascular treatment involving dose reduction of contrast medium for non-dialysis patients with CKD other than several studies of carotid artery stenting.[12,13] There is only one report published by Kohta et al.[14] regarding endovascular treatment of cerebral aneurysms. They mainly infused diluted contrast medium through a microcatheter to reduce the dose of contrast medium but also performed angiography through a large-diameter (6 Fr) catheter. We injected minimal amount of contrast medium for making angiographies only through a microcatheter to reduce the dose of contrast medium. For initial 3D rotationally angiography, a 66%-diluted contrast medium was injected using an injector to obtain the high-quality images in a range not exceeding the maximum infusion pressure of the catheter. A 50%-diluted contrast medium was used thereafter in reference to a report published by Kohta et al.[14] Concerning the amount of contrast medium, a total of 6.3 mL (contrast medium volume: 4.2 mL) was used for 3D rotatory angiography. Approximately 1 mL/session (contrast medium volume: approximately 0.5 mL) was used for other sessions of angiography. During the procedure, 12 sessions of angiography, including 3D rotatory angiography, were performed, and total of 11.3 mL of contrast medium was used.

The maximum volume of contrast medium for CKD patients was reported to be 5 × body weight (kg)/serum Cr level (mg/dL),[15] the same value as the eGFR,[16] and two-fold the CCr.[17] In the present case, the preoperative serum Cr level, eGFR, and CCr were 1.3 mg/dL, 29.8 mL/min/1.73 m^2, and 19 mL/min, respectively. We considered that the volume of contrast medium should be within 29.8 mL based on the recommendation published by Nyman et al.[16] In the present case, 11.3 mL of contrast medium was used; it was much less than that of recommendation by Nyman et al.[16]

There are also drawbacks regarding to decrease in the volume of contrast medium. As noted by Kohta et al.,[14] opacifications of vessels seemed to be insufficient during injection of a small amount of contrast medium through the large caliber vessels such as the ICA or the basilar artery, while opacifications of vessels were sufficient during injection through the small caliber vessels such as the middle cerebral artery. When blood vessels are poorly opacified, ≥50% contrast medium or infusion through a large-diameter catheter should be considered. Furthermore, the image quality was improved by increasing the radiation dose for fluoroscopy, although the radiation exposure was increased. The use of biplane angiography is mandatory to reduce the amount of contrast medium. Perioperative fluid management is also important to reduce the risk of CIN. In the present case, sufficient amount of physiological saline was administered[18] following the procedure, while sufficient fluid replacement could not be achieved before the procedure for prevention of re-rupture.

There was no deterioration of the renal function through the above strategies. Optimal concentration of contrast medium, appropriate selection of catheter for contrast-medium infusion, and appropriate imaging conditions are important to reduce the risk of CIN.

Conclusion

We reported a rare case of a ruptured dissecting aneurysm of P-com A with CKD. Endovascular trapping may be safe and effective for ruptured dissecting aneurysms of the P-com A. In the present case, endovascular procedure was performed by reducing the dose of contrast medium for reducing the risk of CIN. Recently, endovascular treatments in patients with renal dysfunction may increase in Japan. Thus, the procedure introduced in this article may be useful.

Disclosure Statement

The authors declare no conflicts of interest.

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