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Case Report,

Consideration of the Femoral Artery Approachin Percutaneous Coronary Intervention of Acute St-Segment Elevation Myocardial Infarction in Kommerell's Diverticulum With A Right-Sided Aortic Arch: A Case Report

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Abstract:

Owing to vascular malformations, it is difficult to perform catheter operation following the radial artery approach in percutaneous coronary intervention for acute ST-segment elevation myocardial infarction (STEMI) with Kommerell's diverticulum on the right-sided aortic arch. However, only few studies have reported the use of the femoral artery approach to achieve early reperfusion; however, there is no established approach for patients with a right-sided aortic arch. In this study, we retrospectively analyzed the usefulness of the femoral artery approach in patients with STEMI and a right-sided aorta from January 2010 to March 2021.The total number of computed tomography (CT) cases was 180,514, of which 2 involved STEMI. In one of the two cases, the right radial artery approach was used. Therefore, only one patient with STEMI with a right-sided aortic arch underwent and operation using the femoral artery approach. In this patient, early revascularization was achieved with a door-to-balloon time of 70 min, suggesting the usefulness of the femoral artery approach.

Key words: Kommerell's diverticulum; ST-elevation myocardial infarction; right-sided aortic arch; femoral artery approach; door-to-balloon time

Introduction:

Kommerell's diverticulum is defined as >50% extension of the distal segment, which is found in 20%-60% of aberrant subclavian arteries that branch from the left or right side of the aorta [1,2).In a surgical and radiology series, a right-sided aortic arch with an aberrant left subclavian artery is reported to have an incidence between 0.04% and 0.4% [1).In Kommerell's diverticulum, 15% of cases with coronary artery disease have been reported; however, details are yet to be elucidated2).Currently, there are a few reports of ST-segment elevation myocardial infarction (STEMI) in Kommerell's diverticulum with a right-sided aortic arch [4).

Early revascularization with a goal of a 90-min door-to-balloon time is important for improving the prognosis of patients with STEMI3). Recent guidelines recommend a transradial approach to reduce percutaneous coronary intervention (PCI) complications 4).

In PCI for STEMI with Kommerell's diverticulum on the right-sided aortic arch, catheter operation is difficult to perform following the radial artery approach because of vascular malformations[4).However, only few studies have reported the use of femoral artery approach to achieve early reperfusion, and no approach has been established as being appropriate for patients with a right-sided aortic arch.

In this case study, we evaluated the usefulness of the femoral artery approach through a retrospective analysis of STEMI cases with a right-sided aorta from January 2010 to March 2021.We searched for patients with STEMI with a right-sided aortic arch who underwent computed tomography (CT) and operation using the femoral artery approach at our hospital. Of the 180,514 cases wherein CT was performed, 2 involved STEMI, and the right radial artery approach was used in one of these two cases[4]. Therefore, only one case was included, and door-to-balloon time was used as an index to determine whether early revascularization could be achieved.

Written informed consent was obtained from the patient to publish this case report.

The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the ethical committee of Omori Red Cross Hospital (protocol code: No.20-51, 25 February 2021).

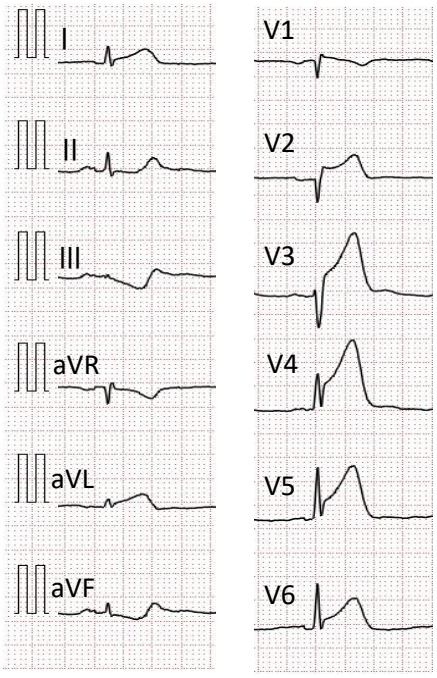


Figure1: Electrocardiogram on admission showing ST-elevation in leads I,aVL, V1-V6.

Case report:

A 67-year-old man presented at our hospital with chest pain while walking. At the time of admission, physical examination revealed a blood pressure of 167/116 mmHg, pulse rate of 65 beats/min, clear lung fields on auscultation, and no murmurs. The initial electrocardiogram (Figure 1) revealed ST-elevation in leads I, aVL, and V1-V6.The laboratory findings showed elevated levels of cardiac troponin I (34.0 pg/mL), creatine kinase (CK) (91 IU/L), CK-MB(10 IU/L), brain natriuretic peptide (53.1 pg/mL), low-density lipoprotein (136 mg/dL), and hemoglobin A1c (6.0%). He had a history of smoking; although chest radiographs (Figure 2) did not reveal any significant findings. Tran thoracic echocardiography revealed a low ejection fraction of 30%, asynergy from the middle anterior wall to the apical segment, and no significant valvular disease or pericardial effusion. Taken together, these findings suggested a diagnosis of acute STEMI.

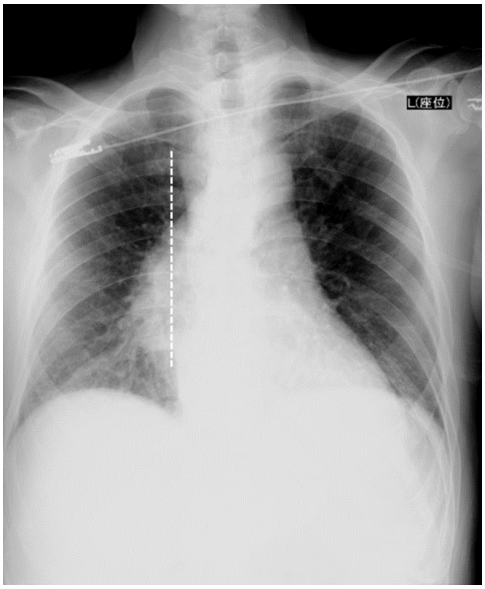


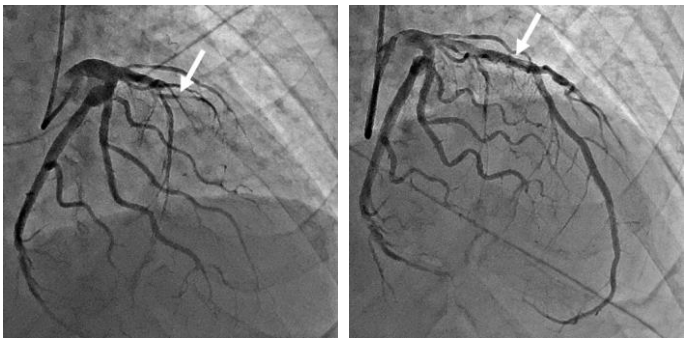
Figure2: Chest radiograph (AP view) showing the right-sided aortic arch (white dotted line).

Emergency coronary angiography (CAG) was performed from the right femoral artery to the left and right coronary artery using a diagnostic catheter (6Fr, JL40/JR40, GOODTEC ANGIOGRAPHIC CATHETER, Goodman Corporation, Japan)to promptly introduce circulatory assist devices against cardiac shock during PCI. Because of the meandering aorta, it was difficult to operate the catheter; thus, it took 10 min to engage the coronary artery since the femoral arterial puncture. CAG revealed total occlusion of the left anterior descending coronary artery (LAD) (#7 segment), 90% stenosis in the left circumflex artery (# 14) (Figure 3A), and hypo plastic right coronary artery. Emergency PCI was performed for LAD (#7). Engagement of a backup type catheter (6Fr, SPB3.75, ASAHI

Hyperion Guiding catheter, © ASAHI INTECC J-Sales, INC, Japan) was easily performed in the left coronary artery. After thrombus aspiration (TVAC, TVAC™Ⅱ, NIPRO Corporation, Japan) was performed and a drug-eluting stent (Synergy™3.5*28mm, Synergy™2.5*20mm, Boston Scientific Japan Corporation, Japan) placed, coronary arterial blood flow was successfully recanalized (Figure 3B).The door-to-balloon time was 70 min, and peak CK was 4376 IU/L. The patient was discharged 14 days after admission with an unremarkable clinical course.

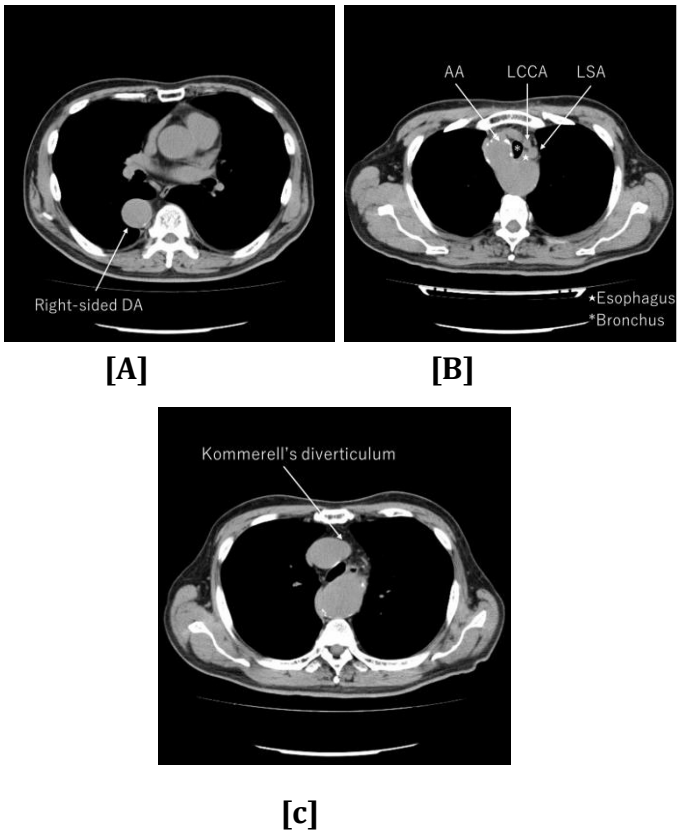
One year later, a follow-up CAG was performed upon the patient's request. Prehospital corona virus disease 2019 (COVID-19) screening using plain chest CT revealed a right-sided aortic arch for the first time (Figure 4).

Since catheter operation was difficult following the femoral artery approach during STEMI treatment, subsequent use of the left radial artery approach was permitted by avoiding the use of the dominant hand and anatomically examining whether catheter operation would be challenging. After left radial artery puncture, the catheter was engaged to the coronary artery within 1 min, and the catheter operation went smoothly.



[A] **[B]**

Figure 3
(A) Coronary angiogram showing total occlusion at the proximal lesion of the left anterior descending artery. (RAO 30°, CRA 24°) (White arrow)
(B) Coronary angiogram showing revascularization of the culprit lesion after the implantation of a drug-eluting stent. (RAO 29°, CRA 25°) (White arrow)
Right anterior oblique view (RAO), cranial view (CRA)



[A] **[B]**

[c]

Figure 4
Computed tomography (CT) showing the right-sided aortic arch and an aberrant left
Subclavian artery from Kommerell's diverticulum.

(A)Right-sided DA. CT axial view
(B)LSA, AA, esophagus, and bronchus. CT axial view
(C)Kommerell's diverticulum
Ascending aorta (AA), descending aorta (DA), left common carotid artery (LCCA), left subclavian artery (LSA)

Discussion:

In this case, early revascularization with a door-to-balloon time of 70 min was achieved using the femoral artery approach in a patient with STEMI with Kommerell's diverticulum on the right-sided aortic arch. The findings of this case suggested the usefulness of the femoral artery approach for right-sided aortic arch.Ithas been reported that the right-sided aortic arch has various processes 5). In this case, the right-sided aortic arch with an aberrant left subclavian artery, which runs in front of the esophagus, is classified as Type 2 5). No symptoms of esophageal or tracheal compression due to vascular malformation have been observed in this case.

Recent guidelines recommend the transradial approach for coronary intervention owing to its minimal invasiveness and few complications

4).However, if Kommerell's diverticulum with a right-sided aortic arch is suspected, confirming the vascular malformation by CT or considering an arterial approach other than the transradial approach seems desirable, should time permit early revascularization6).Reviewing chest radiographs at the time of admission for STEMI also suggested a right-sided aortic arch. However, at that time, we could not diagnose the malformation. As this was a case of STEMI with a decreased cardiac ejection fraction, the femoral artery was selected considering the usage of an intra-aortic balloon pump or a percutaneous cardiopulmonary support system. Although the catheter operation seemed difficult, early revascularization was still achieved. This case suggested the usefulness of the femoral artery approach.

Patients with vascular malformations, including a right-sided aortic arch, are rare. Therefore, there are no recommendations for vascular approach sites: the selection of approach sitesis made on a case-to-case basis. In this case, the right-sided aortic arch was incidentally diagnosed by plain CT for COVID-19 screening before the 1-year follow-up CAG after the onset of STEMI. Although CT revealed that the left subclavian artery passed through the front of the esophagus, the transradial approach was considered possible because of the mirror image-branching pattern of the aorta. As a result, CAG was performed with minimal invasiveness compared to the femoral artery approach. However, this is a consequential theory. Prompt treatment is required for STEMI, and sufficient consideration of approach site cannot be made in advance.

It is difficult to perform additional examinations, including CT for STEMI, which requires early revascularization. However, it is important to carefully consider applicable examinations, such as chest radiography, and the need for additional examinations in each case.

Conclusion:

This case of STEMI with Kommerell's diverticulum on the right-sided aortic arch suggests the usefulness of the femoral artery approach in achieving early revascularization within a 90 min door-to-balloon time.

Acknowledgments

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Disclosure Statement

All authors declare no conflict of interest.

References:

[1] Van Rosendael PJ, Stöger JL, Kiès P, et al: The clinical spectrum of kommerell's diverticulum in adults with a right-sided aortic arch: A case series and literature overview. J Cardiovasc Dev Dis 2021;**8**: 1-17. Doi:10.3390/jcdd8030025.

[2] Tanaka A, Milner R, Ota T: Kommerell's diverticulum in the current era: a comprehensive review. Gen Thorac Cardiovasc Surg 2015;**63**: 245-259. Doi:10.1007/s11748-015-0521-3.

[3] Erben Y, Brownstein AJ, Velasquez CA, et al: Natural history and management of Kommerell's diverticulum in a single tertiary referral center. J Vasc Surg 2020;**71**: 2004-2011. Doi:10.1016/j.jvs.2019.08.260.

[4] Abe K, Kusano T, Nakajima R, et al: Acute ST-segment elevation myocardial infarction in Kommerell's diverticulum with a right-sided aortic arch. J Coron Artery Dis 2021;**27**: 58-62. Doi:10.7793/jcad.20-00031.

[5] Hunt S, Baker D, Chin M, et al: ACC / AHA PRACTICE GUIDELINES — FULL TEXT ACC / AHA Guidelines for the Evaluation and Management of Chronic Heart Failure in the Adult: A Report of the American College of Cardiology / American Heart Association Task Force on Practice Guidelines Committe. Circulation 2001;**104**: 2996-3007. Doi:10.1016/j.jacc.2004.07.014.

[6] Kimura K, Kimura T, Ishihara M, et al: JCS 2018 guideline on diagnosis and treatment of acute coronary syndrome. Circ J 2019**;83**: 1085-1196. Doi:10.1253/circj.CJ-19-0133.

[7] Cinà CS, Althani H, Pasenau J, et al: Kommerell's diverticulum and right-sided aortic arch: A cohort study and review of the literature. J Vasc Surg 2004;**39**: 131-139. Doi:10.1016/j.jvs.2003.07.021.