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Contents

Thrice Monthly Volume 9 Number 8 March 16, 2021

REVIEW

1761 Cardiac rehabilitation and its essential role in the secondary prevention of cardiovascular diseases Winnige P, Vysoky R, Dosbaba F, Batalik L

ORIGINAL ARTICLE

Case Control Study

1785 Association between homeobox protein transcript antisense intergenic ribonucleic acid genetic polymorphisms and cholangiocarcinoma

Lampropoulou DI, Laschos K, Aravantinos G, Georgiou K, Papiris K, Theodoropoulos G, Gazouli M, Filippou D

Retrospective Study

- 1793 Risk factors for post-hepatectomy liver failure in 80 patients Xing Y, Liu ZR, Yu W, Zhang HY, Song MM
- 1803 Outcomes of laparoscopic bile duct exploration for choledocholithiasis with small common bile duct Huang XX, Wu JY, Bai YN, Wu JY, Lv JH, Chen WZ, Huang LM, Huang RF, Yan ML

Observational Study

1814 Three-dimensional finite element analysis with different internal fixation methods through the anterior approach

Xie XJ, Cao SL, Tong K, Zhong ZY, Wang G

1827 Bedside cardiopulmonary ultrasonography evaluates lung water content in very low-weight preterm neonates with patent ductus arteriosus

Yu LF, Xu CK, Zhao M, Niu L, Huang XM, Zhang ZQ

CASE REPORT

Conservative endodontic management using a calcium silicate bioceramic sealer for delayed root fracture: 1835 A case report and review of the literature

Zheng P, Shen ZY, Fu BP

1844 Brain magnetic resonance imaging findings and radiologic review of maple syrup urine disease: Report of three cases

Li Y, Liu X, Duan CF, Song XF, Zhuang XH

1853 A three-year clinical investigation of a Chinese child with craniometaphyseal dysplasia caused by a mutated ANKH gene

Wu JL, Li XL, Chen SM, Lan XP, Chen JJ, Li XY, Wang W

1863 Intradural osteomas: Report of two cases Li L, Ying GY, Tang YJ, Wu H



Conton	World Journal of Clinical Cases
Conten	Thrice Monthly Volume 9 Number 8 March 16, 2021
1871	Gastroesophageal varices in a patient presenting with essential thrombocythemia: A case report
	Wang JB, Gao Y, Liu JW, Dai MG, Yang SW, Ye B
1877	Chest pain showing precordial ST-segment elevation in a 96-year-old woman with right coronary artery occlusion: A case report
	Wu HY, Cheng G, Cao YW
1885	Subcutaneous panniculitis-like T-cell lymphoma invading central nervous system in long-term clinical remission with lenalidomide: A case report
	Sun J, Ma XS, Qu LM, Song XS
1893	Imaging findings of primary pulmonary synovial sarcoma with secondary distant metastases: A case report
	Li R, Teng X, Han WH, Li Y, Liu QW
1901	Severe community-acquired pneumonia caused by <i>Leptospira interrogans</i> : A case report and review of literature
	Bao QH, Yu L, Ding JJ, Chen YJ, Wang JW, Pang JM, Jin Q
1909	Bilateral common peroneal neuropathy due to rapid and marked weight loss after biliary surgery: A case report
	Oh MW, Gu MS, Kong HH
1916	Retroperitoneal laparoscopic partial resection of the renal pelvis for urothelial carcinoma: A case report
	Wang YL, Zhang HL, Du H, Wang W, Gao HF, Yu GH, Ren Y
1923	17α -hydroxylase/17,20 carbon chain lyase deficiency caused by p.Tyr329fs homozygous mutation: Three case reports
	Zhang D, Sun JR, Xu J, Xing Y, Zheng M, Ye SD, Zhu J
1931	Epithelioid angiomyolipoma of the pancreas: A case report and review of the literature
	Zhu QQ, Niu ZF, Yu FD, Wu Y, Wang GB
1940	Computed tomography imaging features for amyloid dacryolith in the nasolacrimal excretory system: A case report
	Che ZG, Ni T, Wang ZC, Wang DW
1946	Epidural analgesia followed by epidural hydroxyethyl starch prevented post-dural puncture headache: Twenty case reports and a review of the literature
	Song LL, Zhou Y, Geng ZY
1953	Extracorporeal membrane oxygenation for coronavirus disease 2019-associated acute respiratory distress syndrome: Report of two cases and review of the literature
	Wen JL, Sun QZ, Cheng Z, Liao XZ, Wang LQ, Yuan Y, Li JW, Hou LS, Gao WJ, Wang WJ, Soh WY, Li BF, Ma DQ
1968	Human parvovirus B19-associated early postoperative acquired pure red cell aplasia in simultaneous pancreas-kidney transplantation: A case report
	Wang H, Fu YX, Song WL, Wang Z, Feng G, Zhao J, Nian YQ, Cao Y



Contor	World Journal of Clinical Case	
Conten	Thrice Monthly Volume 9 Number 8 March 16, 2021	
1976	Diabetes insipidus with impaired vision caused by germinoma and perioptic meningeal seeding: A case report	
	Yang N, Zhu HJ, Yao Y, He LY, Li YX, You H, Zhang HB	
1983	Madelung disease: A case report	
	Chen KK, Ni LS, Yu WH	
1989	Laryngopharyngeal reflux disease management for recurrent laryngeal contact granuloma: A case report	
	Li K, Chen WY, Li YY, Wang TL, Tan MJ, Chen Z, Chen H	
1996	Mycobacterium abscessus infection after facial injection of argireline: A case report	
	Chen CF, Liu J, Wang SS, Yao YF, Yu B, Hu XP	
2001	Inadvertent globe penetration during retrobulbar anesthesia: A case report	
	Dai Y, Sun T, Gong JF	
2008	Systemic lupus erythematosus combined with primary hyperfibrinolysis and protein C and protein S deficiency: A case report	
	Liao YX, Guo YF, Wang YX, Liu AH, Zhang CL	
2015	Interstitial lung disease induced by the roots of Achyranthes japonica Nakai: Three case reports	
	Moon DS, Yoon SH, Lee SI, Park SG, Na YS	

III



Contents

Thrice Monthly Volume 9 Number 8 March 16, 2021

ABOUT COVER

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CASE REPORT

Chest pain showing precordial ST-segment elevation in a 96-year-old woman with right coronary artery occlusion: A case report

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Abstract

BACKGROUND

Typically, right coronary artery (RCA) occlusion causes ST-segment elevation in inferior leads. However, it is rarely observed that RCA occlusion causes STsegment elevation only in precordial leads. In general, an electrocardiogram is considered to be the most important method for determining the infarct-related artery, and recognizing this is helpful for timely discrimination of the culprit artery for reperfusion therapy. In this case, an elderly woman presented with chest pain showing dynamic changes in precordial ST-segment elevation with RCA occlusion.

CASE SUMMARY

A 96-year-old woman presented with acute chest pain showing precordial STsegment elevation with dynamic changes. Myocardial injury markers became positive. Coronary angiography indicated acute total occlusion of the proximal nondominant RCA, mild atherosclerosis of left anterior descending artery and 75% stenosis in the left circumflex coronary artery. Percutaneous coronary intervention was conducted for the RCA. Repeated manual thrombus aspiration was performed, and fresh thrombus was aspirated. A 2 mm × 15 mm balloon was used to dilate the RCA with an acceptable angiographic result. The patient's chest pain was relieved immediately. A postprocedural electrocardiogram showed alleviation of precordial ST-segment elevation. The diagnosis of acute isolated right ventricular infarction caused by proximal nondominant RCA occlusion was confirmed. Echocardiography indicated normal motion of the left ventricular anterior wall and interventricular septum (ejection fraction of 54%), and the right ventricle was slightly dilated. The patient was asymptomatic during the 9-mo follow-up period.

CONCLUSION



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Cardiologists should be conscious that precordial ST-segment elevation may be caused by occlusion of the nondominant RCA.

Key Words: Precordial ST-segment elevation; Electrocardiogram; Isolated right ventricular infarction; Right coronary artery occlusion; Chest pain; Case report

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Core Tip: It is rarely observed that right coronary artery occlusion causes ST-segment elevation only in precordial leads without inferior lead elevation. Electrocardiograms are often used by cardiologists to identify the infarct-related artery. This case emphasizes the importance for cardiologists to be conscious that occlusion of the nondominant right coronary artery can cause precordial ST-segment elevation. Recognizing this is helpful for discriminating the culprit artery for timely reperfusion therapy.

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INTRODUCTION

Precordial ST-segment elevation usually indicates occlusion of the left anterior descending (LAD) artery^[1-3]. However, ST-segment elevation in V1-V4 on a 12-lead electrocardiogram (ECG) may occur in acute isolated right ventricular infarction caused by right coronary artery (RCA) occlusion, which is a very rare event in clinical practice and accounts for no more than 3% of myocardial infarctions^[4-6].

Here, we report a case in which precordial ST-segment elevation occurred in an elderly woman with acute total occlusion of the proximal nondominant RCA. ECG is considered to be the most important method for identifying the infarct-related artery. Therefore, a comprehensive ECG evaluation can improve the accuracy of diagnosis, shorten the time from door to balloon and improve the prognosis of patients.

CASE PRESENTATION

Chief complaints

A 96-year-old woman presented with a 4 h history of substernal chest pain along with diaphoresis.

History of present illness

The patient had substernal chest pain along with diaphoresis four hours before admission to the emergency department. On the way to the emergency department, the patient was free of symptoms after sublingual administration of nitroglycerin. A standard 12-lead ECG obtained on admission indicated an ectopic atrial fibrillation rhythm and convex ST-segment elevation in V1-V4 (Figure 1A). No previous ECG was available for comparison. Assessment of initial myocardial injury markers showed that the troponin T level was less than 40 ng/L (0-40), the troponin I level was 0.007 ng/mL (0-0.030), the myoglobin level was 57.4 ng/mL (14.3-65.8), and the creatine kinase MB level was 5.0 ng/mL (0.6-6.3). The patient was transferred to the cardiovascular intensive care unit for further monitoring and evaluation after treatment with 300 mg of aspirin and 300 mg of clopidogrel. Intermittent chest pain was relieved with sublingual nitroglycerin. Approximately two hours after admission, the patient progressed to severe recurrent chest pain.



Figure 1 Twelve-lead electrocardiograms showed dynamic changes in precordial ST-segment elevation before coronary angiography. A: Electrocardiogram obtained on admission; B: Electrocardiogram obtained two hours after admission.

History of past illness

The patient had a history of hypertension for 30 years and type 2 diabetes for 20 years.

Personal and family history

The patient had no relevant personal history. The patient had no family history of inherited diseases or premature coronary heart disease.

Physical examination

Vital signs were stable. A pulmonary examination showed clear lung auscultation. A cardiac examination showed an irregular rate and rhythm without rubs, murmurs or gallops. No jugular vein engorgement or peripheral edema was found.

Laboratory examinations

The troponin T level increased to 167 ng/L. The peak troponin T level was more than 2000 ng/L, and the peak troponin I level was 15.107 ng/mL.

Imaging examinations

Echocardiography showed normal motion of the left ventricular anterior wall and interventricular septum (ejection fraction of 54%). The right ventricle was slightly dilated.

A twelve-lead ECG indicated ST-segment elevation in V1-V4 with dynamic changes compared with the former results (Figure 1B). A suspected anterior wall myocardial infarction caused by LAD artery occlusion was first considered. Emergent coronary angiography demonstrated complete occlusion of the proximal nondominant RCA



with thrombus without reverse perfusion and collateral circulation at the distal end (Figure 2A). The left coronary artery showed 75% stenosis in the left circumflex artery and mild atherosclerosis of the LAD artery (Figure 2B). We realized that the infarctrelated artery was the RCA.

FINAL DIAGNOSIS

The diagnosis of acute isolated right ventricular infarction caused by proximal nondominant RCA occlusion was confirmed.

TREATMENT

Primary percutaneous coronary intervention (PCI) was conducted with a JR4.0 (6 French) guiding catheter in the RCA. Repeated manual thrombus aspiration was performed, and fresh thrombus was aspirated (Figure 2C). Intracoronary tirofiban 10 μ g/kg was also administered during the procedure. A 2 mm × 15 mm balloon was used for dilatation. Restoration of Thrombolysis in Myocardial Infarction blood flow to grade 2 was achieved with an acceptable angiographic result (Figure 2D). Because of the small RCA, heavy thrombus load and acceptable angiographic results, coronary stent implantation was not attempted.

The patient was administered 100 mg aspirin, 75 mg clopidogrel, 20 mg atorvastatin, 47.5 mg metoprolol and 2.5 mg rivaroxaban bid to treat atrial fibrillation.

OUTCOME AND FOLLOW-UP

The patient's chest pain was relieved immediately by PCI. A postprocedural ECG showed alleviation of precordial ST-segment elevation (Figure 3A). An ECG indicated complete resolution of precordial ST-segment elevation 4 d after PCI (Figure 3B).

No complications occurred during the patient's hospitalization. The patient was asymptomatic at the 1, 3, 6 and 9 mo follow-up visits.

DISCUSSION

In this case, the RCA had a short total length. Due to the decreased RCA territory, the left coronary artery supplied the inferior wall. Therefore, the typical inferior lead STsegment elevation was not clearly presented, while isolated precordial ST-segment elevation was presented for this acute total occlusion of the proximal nondominant RCA causing an isolated right ventricular infarction.

ECG is essential to identify the infarct-related artery in acute coronary syndrome and is necessary for clinical decisions, such as correct distinction of the acute myocardial infarction type, treatment strategy (proper fluid infusion for right ventricular infarction and limited fluid infusion for left ventricular infarction) and prognosis as well as for timely initiation of reperfusion therapy[7-11]. Although some algorithms are used to identify the culprit artery with excellent results, the accuracy is insufficient under certain conditions, including old myocardial infarction, coronary artery anomaly, left bundle block and pacing on an ECG^[12]. Typically, an elevated STsegment across the precordial leads is caused by acute occlusion of the LAD artery. For dominant RCA occlusion, the forces of inferior infarction hide the anterior forces of right ventricular infarction, causing typical inferior ST-segment elevation without precordial ST-segment elevation. Because nondominant RCA supplies the isolated right ventricle, occlusion of the artery does not cause inferior wall infarction, and precordial ST-segment elevation may emerge^[13-16]. Similarly, right ventricular expansion caused by isolated right ventricular infarction leading to counterclockwise cardiac rotation was also discussed^[17].

However, precordial ST-segment elevation alone due to isolated right ventricular infarction is very rare and can occur under certain conditions except for acute occlusion of the nondominant RCA, including acute occlusion of the branch from the RCA (right ventricular marginal branch, right ventricular branch or conus branch)^[6,13,18-20], acute occlusion of a proximal RCA with the inferior wall protecting



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Figure 2 Coronary angiographic results. A: Acute total occlusion of the proximal portion of the right coronary artery (orange arrow); B: Mild atherosclerosis of the left anterior descending artery and 75% stenosis in the left circumflex artery; C: Fresh thrombus was acquired from the right coronary artery; D: Coronary angiography showed restoration of the right coronary artery after percutaneous coronary intervention.

collaterals from the left coronary artery^[15,21,22] or anomalous origination of the coronary artery with occlusion^[12,16]. Although it is a very rare phenomenon, isolated right ventricular infarction may cause serious adverse cardiac events, including right ventricular dysfunction, severe tricuspid regurgitation, rupture of the right ventricular free wall, malignant ventricular arrhythmias, severe bradycardia, cardiogenic shock and sudden death^[23,24]. Because the patient's symptoms disappeared on admission, the initial myocardial injury markers were negative, and the patient was a 96-year-old woman, the family members of the patient asked for drug treatment first. Approximately two hours after admission, the patient progressed to severe recurrent chest pain and underwent emergent PCI. Notably, however, ST-segment elevation myocardial infarction is a clinical diagnosis. If within the indicated time frames and without contraindication, PCI for ST-segment elevation myocardial infarction should be performed as soon as possible, and there is no need to wait for positive cardiac enzymes. The infarct-related artery should be systematically treated during the initial intervention. Full revascularization can benefit patients with multivessel disease undergoing primary PCI, but the optimal timing of treatment of the nonculprit lesion is unclear. Patients with multivessel disease should undergo routine revascularization of nonculprit artery lesions before hospital discharge. However, for patients with cardiogenic shock, routine revascularization of nonculprit artery lesions is not recommended during primary PCI^[25].

Although not common in proximal nondominant RCA occlusion, the ECG changes observed in our case may cause erroneous infarct-related artery definition and delayed treatment in serious situations. Isolated right ventricular infarction may be difficult to identify, thus requiring a high degree of clinical suspicion and careful evaluation of ECG characteristics^[26]. Even with the ideal setting of choosing the appropriate diagnostic and guiding catheters in emergent PCI, only a few minutes would be required to change catheters. Therefore, overemphasizing the importance of

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Figure 3 Twelve-lead electrocardiograms showed alleviation of precordial ST-segment elevation after percutaneous coronary intervention. A: Electrocardiogram obtained fourteen hours after percutaneous coronary intervention; B: Electrocardiogram obtained 4 d after percutaneous coronary intervention.

identifying the potential culprit artery by ECG before PCI is not warranted.

CONCLUSION

Occlusion of a nondominant RCA may be followed by ST-segment elevation in precordial leads. Internists, especially interventional cardiologists, should be aware of this scenario to discriminate the infarct-related artery for timely reperfusion therapy.

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