Nontraumatic avulsion of aortic valve commissure as a cause of acute aortic valve regurgitation

A case report

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Abstract

Background: Avulsion of the aortic valve commissure as a cause of acute aortic valve regurgitation is mostly due to trauma, infective endocarditis, or ascending aortic dissection. Nontraumatic avulsion of the aortic valve commissure is very rare. We reviewed the literature and analyzed potential risk factors of nontraumatic avulsion.

Case presentation: An 80-year-old male with hypertension was seen in the emergency department with acute onset dyspnea. Echocardiogram revealed left ventricular hypertrophy with adequate systolic function, prolapse of the noncoronary cusp, and incomplete coaptation of the right coronary and noncoronary cusps with severe aortic valve regurgitation. Surgery revealed an avulsion between the left coronary and noncoronary cusps. Histopathology examination of the aortic valve showed myxoid degeneration, fibrosis, and calcification. Examination of the ascending aorta revealed myxoid degeneration and fragmentation of elastic fibers. Aortic valve replacement was performed, and the patient was alive and well 4 years after surgery. A review of the literature showed that more than three-fourths of the similar cases occurred in males, and about half in patients with hypertension and those 60 years of age or older.

Conclusions: In the case of acute aortic regurgitation without a history of trauma, infection, or valvotomy, when 2 prolapsed aortic cusps are observed by echocardiography in the absence of an intimal tear of the ascending aorta, an avulsion of the aortic commissure should be suspected, especially in males with hypertension who are 60 years of age or older.

Abbreviations: ARD = aortic root dilatation, ARR = aortic root replacement, AVR = aortic valve replacement, F = female, L = left coronary cusp, M = male, N = noncoronary cusp, NA = not available, R = right coronary cusp.

Keywords: acute aortic valve regurgitation, aortic valve prolapse, avulsion of aortic valve commissure

1. Introduction

Acute aortic valve regurgitation (AR) caused by detachment of the aortic valve commissure from the aortic wall, also known as avulsion of the aortic valve commissure, is usually related to blunt chest trauma, infective endocarditis, or ascending aortic dissection.[1-4] Spontaneous aortic valve commissure avulsion is a rare condition. It had not been mentioned in recent guidelines or in cardiology textbooks as a cause of acute AR.[2-3] We present a case of acute AR resulting from nontraumatic avulsion of the aortic valve commissure, and review the relevant literature with a focus on potential risk factors and echocardiographic findings.

2. Case report

An 80-year-old male presented to the emergency department with dizziness and shortness of breath for 1 day. He had hypertension, but denied any history of dyspnea, fever, chills, or chest pain. Physical examination revealed tachycardia, a systolic-diastolic murmur grade 2/6 over the aortic area/left lower sternal border, bilateral rales of lungs without lower legs pitting edema, and a distended urinary bladder. An electrocardiogram showed sinus tachycardia and complete right bundle branch block. Chest X-ray showed an increase in the cardiothoracic ratio with pulmonary edema. Echocardiography revealed a hypertrophic interventricular septum, concentric left ventricular hypertrophy (LVH), adequate left ventricular systolic function with an ejection fraction of 68%, prolapse of the noncoronary cusp (NCC) (Fig. 1A), and incomplete coaptation of right coronary cusp (RCC) and NCC (Fig. 1B and C) with severe AR (Fig. 1D).
The patient underwent intubation for impending respiratory failure, and a cardiovascular surgeon was consulted. Cardiac catheterization revealed a normal coronary angiogram and left ventricular systolic function, as well as severe AR without aortic dissection. Chest computed tomography showed aneurysmal dilatation of the ascending aorta with aortic valve calcifications and moderate bilateral pleural effusions. The patient’s family consented to aortic valve replacement. At surgery, mild atherosclerotic changes of the aortic cusps and prolapse of the left coronary cusp (LCC) and NCC (Fig. 2A), as well as a transverse crack measuring approximately 0.8 cm in length over the LCC–NCC commissure (Fig. 2B) were noted. In addition, concentric LVH and a fusiform aneurysm of the ascending aorta (with a maximal diameter of 4.8 cm) were noted. Aortic valve replacement was performed with a Hancock-II 25 mm porcine valve and longitudinal aortoplasty.

Histopathology examination of the aortic valve showed myxoid degeneration, fibrosis, and calcification (Fig. 3A and B). Examination of the ascending aorta revealed myxoid degeneration and fragmentation of elastic fibers (Fig. 3C and D). Postoperatively, the patient was transferred to the intensive care unit with ventilator and inotropic (dobutamine) support and continuous intravenous dormicum sedation. The patient was eventually successfully extubated, and the dobutamine was tapered. He was then transferred to a general ward and discharged in good condition. He was classified as New York Heart Association Class I when last seen 4 years after the surgery.

3. Discussion

Acute AR can be secondary to trauma, infective endocarditis, type A aortic dissection, annuloaortic ectasia, rheumatic fever, syphilis, bicuspid aortic valve, iatrogenic secondary to a procedure (such as aortic balloon valvotomy), or a failed surgical valve repair.[2] Nontraumatic aortic valve commissure avulsion is rare, but should be considered in a case of AR.

The diagnosis of avulsion of the aortic commissure is difficult prior to surgery on the basis of imaging alone. Transthoracic or transesophageal echocardiography may demonstrate aortic valve prolapse with severe AR,[1,4] which is a nonspecific finding. A more specific finding is the presence of 2 prolapsed aortic cusps, and a limited intimal tear on the commissure may be observed just above the valves.[5] In addition to avulsion of a commissure, the possible etiologies of aortic valve prolapse include floppy valve, fraying valve, excessive tissue within a congenital bicuspid valve, ruptured cusp, laceration of the aorta, and ventricular septal defect with displacement of the aortic root.[1] As prolapse of the cusps may be observed on echocardiography, the commissural tear may mimic an intimal tear in a type A aortic dissection,[5] or a mass-like lesion.[6] In such a case, trans-
esophageal echocardiography may demonstrate a normal aortic valve with a dissection flap in the proximal ascending aorta just above the aortic valve, but without the intimal tear extending to the aortic root. This is different from a type A aortic dissection, in which an intimal tear may be noted in the ascending aorta. In a case of AR without a history of trauma, infection, or valvotomy, when 2 prolapsed aortic cusps are observed in the absence of an intimal tear of the ascending aorta, an avulsion of the aortic commissure should be suspected. Three-dimensional echocardiography may provide imaging information for diagnosis.[7]
Hypertension plays an important role in the formation of a nontraumatic aortic valve commissure avulsion. Using “avulsion” and “dehiscence” combining with “aortic valve commissure” as key words to search literature indexed in PubMed, we found 5 and 10 cases of nontraumatic aortic valve commissure avulsion respectively, and we identified 9 more cases from the references of the reports retrieved (Table 1). Including our case, of the 20 cases in which information regarding hypertension was available, 10 had hypertension. Other potential risk factors included male sex (17/22) and older age (13/22 at 60 years or older). The possible pathogenesis of avulsion of the aortic commissure includes high blood pressure, especially high diastolic pressure which avulses a weakened commissure that may be normal or have underlying atherosclerosis, fibrosis, hyalinosis, or pseudoxanthoma elasticum. The aortic valve cusps may be normal, or have mucoid tear or myxomatous changes.

Without exception, avulsion of the aortic commissure results in progressive congestive heart failure. Medical therapy failed in 3 early cases of avulsion of the aortic commissure, and the patients died. Surgery aimed at either repair or replacement of the aortic root dilatation, and used 2–0 sutures combined with BioGlue to reinforce the site of repair which was sutured in 2 layers. Shimamoto et al reported a novel method for repair of commissural detachment in 2 cases with annuloaortic ectasia and 1 case with a dilated sinotubular junction. They reimplemented the root in a Y-shaped graft, and used 2–0 polyester sutures for the first row and 4–0 polypropylene sutures for the second row. The 9- to 45-month follow-up results were fair. In our case, atherosclerotic changes within the commissure and aortic root were found at surgery. Therefore, we chose aortic valve replacement using a porcine valve, which achieved a good outcome at 4 years after surgery.

In conclusion, avulsion of the aortic valve commissure is a rare cause of acute aortic regurgitation. Transesophageal echocardiography may demonstrate 2 prolapsed aortic cusps with or without a limited intimal tear on the commissure just above the valves. Three-dimensional echocardiography may provide imaging information for diagnosis. Hypertension plays an important role in the formation of an avulsion in patients with atherosclerosis, medial necrosis, myxomatous changes, granulation, fibrosis, hyalinosis, or fibrosis. Surgery is the only reliable method available to treat this condition, which includes aortic valve repair, replacement, and aortic root replacement.
References

[1] Carter JB, Sethi S, Lee GB, et al. Prolapse of semilunar cusps as causes of aortic insufficiency. Circulation 1971;43:922–32.

[2] Nishimura RA, Otto CM, Bonow RO, et al. 2014 AHA/ACC guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014; 129:e521–643.

[3] Mann DL, Zipes DP, Libby P, et al. Braunwald’s Heart Disease: A Textbook of Cardiovascular Medicine. vol. 2. 10th ed. Philadelphia, PA: Saunders; 2015.

[4] Okamoto Y, Matsumoto M, Inoue H. An atypical cause of aortic valve prolapse. Ann Thorac Surg 2009;88:994–6.

[5] Kopersmith AC, Belkin RN, McClung JA, et al. Aortic valve commissural tear mimicking type A aortic dissection. J Am Soc Echocardiogr 2002;15:638–60.

[6] Akiyama K, Jun H, Naohito T, et al. Echocardiographic and surgical findings of spontaneous avulsion of the aortic valve commissure. Circ J 2004;68:254–6.

[7] Shimamoto T, Komiya T, Sakaguchi G, et al. Commissure detachment by three-dimensional echocardiography and successful treatment by aortic root and commissural repair. Eur J Cardiothorac Surg 2011;39:1074–6.

[8] Nakamura E, Nakamura K, Niina K, et al. Acute aortic regurgitation resulting from dehiscence of the aortic valve commissures. Ann Thorac Cardiovasc Surg 2010;16:294–6.

[9] Aoyagi S, Fukushima S, Oishi K. Aortic regurgitation due to non-traumatic rupture of the aortic valve commissures: report of two cases. J Heart Valve Dis 1995;4:99–102.

[10] Fukui T, Shimokawa T, Fumimoto KU, et al. Dehiscence of aortic valve commissure complicated by aortic regurgitation. J Thorac Cardiovasc Surg 2004;128:1178–9.

[11] Mok CK, Tso JW, Khin MA. Dehiscence of an atheromatous plaque at an aortic valve commissure: an unusual cause of acute aortic regurgitation. Br Heart J 1988;59:313–5.

[12] Ishikawa K, Midorikawa H, Kanno M, et al. Acute aortic regurgitation due to local avulsion of the aortic valve commissure. Ann Thorac Cardiovasc Surg 2012;18:478–80.

[13] Sakakibara Y, Gomi S, Mihara W, et al. Acute heart failure due to local dehiscence of aortic wall at aortic valvular commissure. Jpn J Thorac Cardiovasc Surg 2005;53:80–2.

[14] Hirata K, Kakazu M, Wake N, et al. Acute aortic valvular regurgitation secondary to avulsion of aortic valve commissure in a patient with pseudoxanthoma elasticum. Intern Med 2000;39:940–2.

[15] Shimamoto T, Komiya T, Sakaguchi G. A novel method for repairing aortic regurgitation due to commissural detachment. Ann Thorac Surg 2011;91:1628–9.

[16] Yamasaki M, Watanabe S, Abe K, et al. Commisural avulsion of the aortic valve caused by purulent pericarditis: report of a case. Surg Today 2014;44:1343–5.

[17] Satokawa H, Hoshino S, Iwaya F, et al. A case of aortic regurgitation due to spontaneous rupture of an aortic commissure. Kyobu Geka 1986;39:817–20.

[18] Munakata M, Hatakeyama M, Ono Y. Surgery for aortic regurgitation due to dehiscence of aortic valve commissure. Ann Thorac Cardiovasc Surg 2012;18:385–6.

[19] Cunha CR, Santos PC, Atik FA, et al. Acute aortic insufficiency due to avulsion of aortic valve commissure. Rev Bras Cir Cardiovasc 2012;27:160–2.

[20] Silverman KJ, Hutchins GM. Spontaneous dehiscence of an aortic commissure complicating idiopathic aortic root dilatation. Am Heart J 1979;97:367–70.

[21] Ishii H, Nakamura K, Nagahama H, et al. Two dehiscences of the aortic valve commissure and cusp with progressive acute aortic regurgitation. Ann Vasc Dis 2015;8:43–5.

[22] Charokopos N, Artemiou P, Antonitsis P, et al. Repair of aortic regurgitation caused by spontaneous avulsion of aortic valve commissure in a patient with idiopathic thrombocytopenic purpura. Thorac Cardiovasc Surg 2010;58:43–4.

[23] Newcomb AE, Rowland MA. Nontraumatic localized dehiscence of the proximal ascending aorta through an aortic valve commissure. Ann Thorac Surg 2004;78:321–3.