Isolated left ventricular pulsus alternans; an echocardiographic finding in a patient with discrete subaortic stenosis and infective endocarditis

Diskret subaortik darlık ve infektif endokardit bulunan bir hastada bir ekokardiyografi bulgusu: İzole sol ventriküler pulsus alternans

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Introduction

Pulsus alternans, alternating weak and strong beat in the presence of stable heart rate and QRS complex, is generally accepted as a finding of physical examination. It is most often associated with moderate or severe heart failure (1). After the introduction of echocardiography to clinical practice, there has been some debate about whether all alternating contractions are reflected in peripheral pulses (2). In this report, we present a case of echocardiographically detected left ventricular alternans, which has not been reflected in peripheral pulse.

Case report

A 21-year-old male patient has been admitted to our clinic with the complaint of dyspnea on exertion. Physical examination revealed 4/6 systolic murmur best heard over upper right sternal border, radiating to both sides of the neck, and fever of 38.8°C. After physical examination, the patient was referred to the echocardiography laboratory. The echocardiographic examination revealed a subaortic discrete membrane and a mobile mass over the noncoronary cusp of the aortic valve (Fig.1). The internal diameter of left ventricle was 65 mm and constant (Fig. 2). The ejection fraction measured by modified Simpson method was between 35% and 37% on consecutive 5 beats. Color flow Doppler examination showed moderate mitral and moderate aortic regurgitation. Doppler interrogation of the left ventricular outflow tract revealed two alternating peak gradients: 118 mmHg and 88 mmHg (Fig. 3). The high degree of gradient might be due to the contribution of deformed aortic valve to the stenosis. The re-examination of the peripheral pulse did not uncover any alternating pulse. In order to objectively document the pulse contours, we

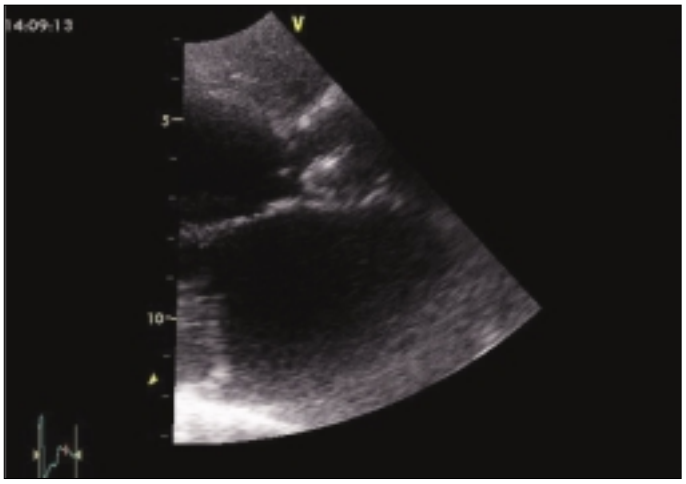

Figure 1. Subaortic discrete membrane and mass on aortic valve

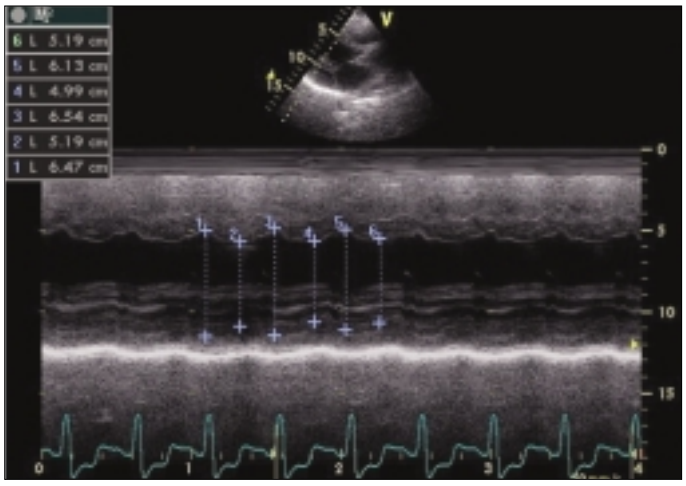

Figure 2. Two-dimensional long-axis and M-mode echocardiographic view of left ventricle shows absence of alternans in left ventricular diameter

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used pulse oximetry. Recording from index finger did not reveal any alternans (Fig. 4). The transesophageal echocardiography confirmed the diagnosis but add little to the transthoracic echocardiographic findings. The tissue Doppler examination of the mitral annulus showed decreased amplitude of systolic wave without any alternans (Fig. 5). Meanwhile, the blood culture was found to be positive for streptococcus viridans. The patient was regarded as high risk for surgical treatment and he now awaits surgery.

Discussion

The pulsus alternans was first described as beat-to-beat alternation in the arterial pressure pulse (3). It is frequently a part of clinical picture of heart failure. A recent study of Kodama et al revealed that it is present in about 20% of heart failure during rest and increasing up to 40% during dobutamine infusion (4). The mechanism underlying the alternans was firstly suggested to be a difference in diastolic length of myocardium (5). However, alternation of underlying systolic Ca transient is supported by previous study (6). According to both hypothesis, the contractile force of the ventricle alternates.

In our case, heart failure was documented by clinical picture, two-dimensional echocardiography, and tissue Doppler analysis. However, there were some contradicting properties of our case: firstly, there was no alternans in diastolic length as shown by M-mode echocardiography. Secondly, the tissue Doppler revealed no alternans in systolic wave amplitude. The former is against the first hypothesis about the mechanism of the alternans. The second one is against to both hypotheses, because there is no alternans in contractility. Whereas, Sengupta et al (7) had shown that pulsus alternans is reflected by alternans in both systolic and diastolic annular peak velocities. Another interesting feature of our patient was that the alternans in outflow tract gradient was not reflected as peripheral pulsus alternans as shown by pulse oximetry examination. This finding is in consistent with those of Cannon RO et al (2), who reported that left ventricular pulsus alternans was not always associated with neither significant systemic pulsus alternans nor right ventricular pulsus alternans. Absence of alternans in tissue Doppler imaging promoted us to examine the patient for other possible mechanisms. We noticed that there is an alternans in the mobility of the mass on the aortic valve (Fig. 6). We argued that the mobility of the mass might cause alternans by changing the effective steno-

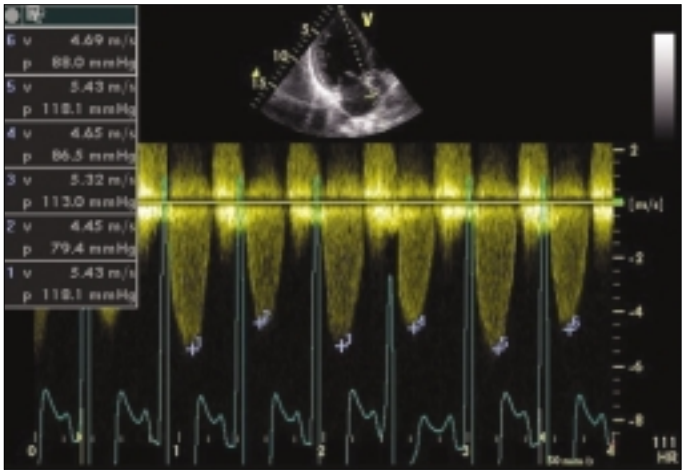

Figure 3. Left ventricular outflow tract pressure gradient is alternating between 118 mmHg and 88 mmHg

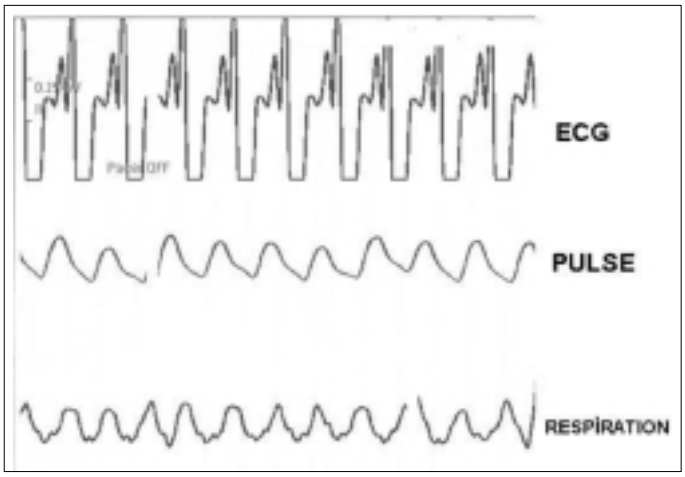

Figure 4. Absence of prominent alternans in peripheral pulse

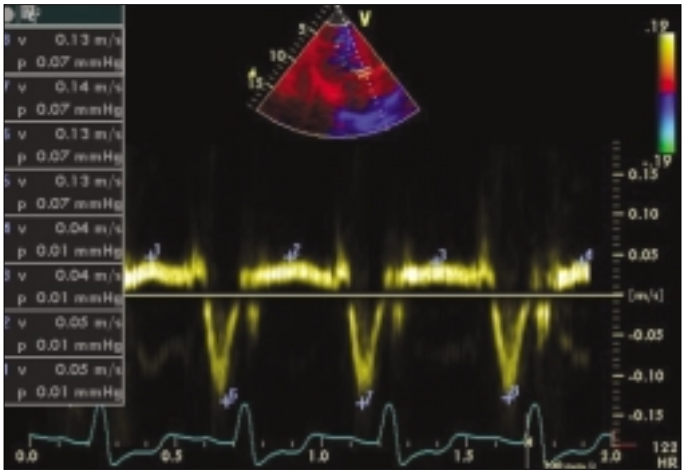

Figure 5. Tissue Doppler imaging flow shows no alternans in systolic and diastolic waves

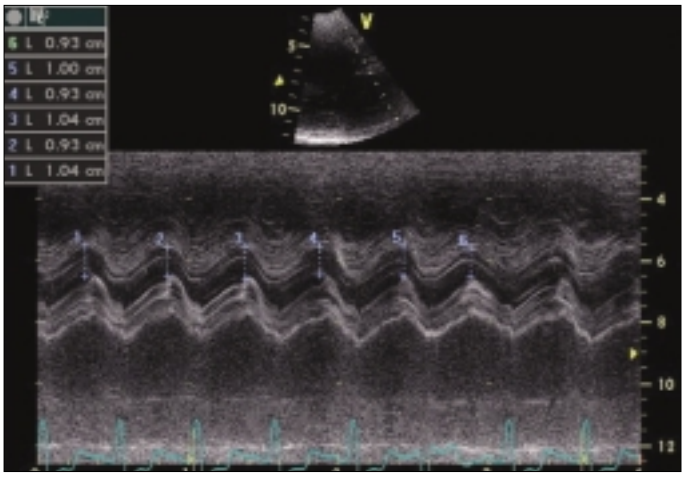

Figure 6. There is a possibility of alternans in the position of the mass. The measured distance is between anterior aortic wall and the mass

tic area. However, the amount of change in the beat-to-beat position of the mass was very little to explain the alternans and the casual relationship between alternating mobility of the mass and alternating pressure gradient was not clear.

In conclusion, we present a case with left ventricular pulsus alternans without any apparent alternans in contractile force. The mechanism underlying the pulsus alternans remains uncovered. This case is an interesting one that makes both hypotheses of pulsus alternans or value of systolic tissue wave amplitude as an index of contractility questionable.

References

1. Lab MJ, Seed WA. Pulsus alternans. Cardiovasc Res 1993; 27: 1407-12.
2. Cannon RO 3rd, Schenke WH, Bonow RO, Leon MB, Rosing DR.et al. Left ventricular pulsus alternans in patients with hypertrophic cardiomyopathy and severe obstruction to left ventricular outflow. Circulation. 1986; 73: 276-85.
3. Traube L. Ein fall von Pulsus bigeminus nebst Bemerkungen über die Leberscwellungen bei Kalppenfehlern und über acute Leberatrophie. Berlin Klin Wochenschr 1872; 9: 185-8.
4. Kodama M, Kato K, Hirono S, Okura Y, Hanawa H, Yoshida T, et al. Linkage between mechanical and electrical alternans in patients with chronic heart failure. J Cardiovasc Electrophysiol 2004; 15: 295-9.
5. Mitchell JH, Sarnoff SJ, Sonnenblick EH. The dynamics of pulsus alternans: alternating end-diastolic fiber length as a causative factor. J Clin Invest 42: 55-63
6. Lab MJ, Lee JA. Changes in intracellular calcium during mechanical alternans in isolated ferret ventricular muscle. Circ Res 1990; 66: 585-95
7. Sengupta PP, Jagdish JC, Mukherjee S, Arora R. Left ventricle dynamics during pulsus alternans: Insights from tissue velocity imaging. Indian Heart J 2002; 54: 304-5.