

## Corrigan's Sign

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**A**ortic valve regurgitation is the backflow of blood from the aorta into the left ventricle through incompetent aortic cusps. The resulting increased end diastolic volume produces a pulse with a large stroke volume. Some of the most curious clinical signs originate from this process. Corrigan's sign (ie, Corrigan's pulse), a jerky carotid pulse characterized by full expansion followed by quick collapse (**Sidebar**), is just one of the signs of aortic valve regurgitation (**Table 1**). Specifically, Corrigan's sign is a predictor of advanced aortic regurgitation.

### HISTORIC PERSPECTIVE

Sir Dominic John Corrigan, Baronet, was born in Dublin, Ireland, in 1802. Corrigan obtained his medical degree from the University of Edinburgh (Edinburgh, Scotland) in 1825. He was appointed physician at the Jervis Street Hospital in Dublin and joined the Sick-Poor Institute of Dublin, where he taught medical theory and practice. Corrigan was created a baronet in 1866 and was a member of the British House of Commons from 1870 to 1874.<sup>1</sup>

Corrigan's medical contributions were great: his articles covered such topics as angina pectoris, mitral stenosis, and cirrhosis. He was also one of the first physicians to differentiate typhus from typhoid fever.<sup>1</sup> However, Corrigan is best recognized for his contribution to the understanding and recognition of aortic valve insufficiency. His article "Permanent Patency of the Aortic Valves" was published in the *Edinburgh Medical and Surgical Journal* in 1832.<sup>2</sup> In this article, Corrigan described a bounding, full carotid pulse with a rapid downstroke during late systole. Corrigan showed that this pulse was a sign of severe aortic valve regurgitation. Other physicians also recognized the significance of the bounding carotid pulse in aortic valve regurgitation, but Corrigan was the first physician to describe the sign and its meaning in detail.

### AORTIC VALVE REGURGITATION

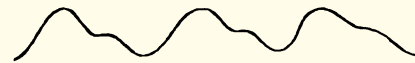
#### Etiology and Pathogenesis

Aortic valve regurgitation can be caused by diseases

### CORRIGAN'S PULSE

**Definition:** A jerky carotid pulse characterized by full expansion followed by quick collapse, which indicates aortic valve regurgitation.

**Normal pulse:** A rapid rise, which reflects the peak velocity of blood ejected from the left ventricle, followed by a steep decline. The descent is interrupted by a smoother, later diastolic wave. A normal radial pulse is visualized as:



**Positive response:** Corrigan's pulse is visualized as:



Adapted with permission from Greenberger NJ, Hinthorn DR: *History Taking and Physical Examination: Essentials and Clinical Correlates*. St. Louis: Mosby-Yearbook, 1993:168.

that affect either the aortic leaflets specifically or the aortic root preventing the apposition of the aortic leaflets. Rheumatic fever and infective endocarditis are common causes of aortic valve leaflet abnormalities. Marfan's syndrome, Ehlers-Danlos syndrome, and collagen-vascular diseases can cause aortic root dilatation and aortic regurgitation as well as abnormalities of the aortic valve leaflets. Age-induced annuloaortic ectasia as well as

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**Table 1.** Signs that Indicate Aortic Valve Regurgitation

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<b>Austin Flint murmur:</b> a mild diastolic rumble at the cardiac apex
<b>Corrigan's sign:</b> a jerky carotid pulse characterized by full expansion followed by quick collapse
<b>Duroziez's murmur:</b> a double murmur—a systolic murmur when the femoral artery is compressed proximally and a diastolic murmur when the femoral artery is compressed distally
<b>Hill's sign:</b> popliteal cuff systolic pressure exceeding brachial cuff systolic pressure by more than 40 mm Hg
<b>Müller's sign:</b> systolic pulsation of the uvula
<b>Musset's sign:</b> rhythmical bobbing movement of the head with each heartbeat
<b>Quincke's pulse:</b> visible capillary pulsations when patient's fingernail is pressed distally or when a glass slide is pressed to patient's lips
<b>Traube's sign:</b> booming systolic and diastolic sounds over the femoral arteries

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Data from Sapira JD: Quincke, de Musset, Duroziez, and Hill: some aortic regurgitations. *South Med J* 1981;74:459-467.

severe hypertension are common causes of aortic valve regurgitation.<sup>3-5</sup> Uncommonly, a bicuspid aortic valve can cause aortic regurgitation. Luetic aortitis and supra-valvular aortic stenosis are also rare causes of aortic valve regurgitation. Acute aortic valve insufficiency, a distinct entity, is most commonly caused by infective endocarditis, but may also be seen during the reverse propagation of a proximal (type I or II) aortic dissection.<sup>6,7</sup>

**Chronic aortic valve regurgitation.** In chronic aortic valve regurgitation, the left ventricle enlarges producing a greater total stroke volume, which is ejected into the aorta. The decline in left ventricular function causes the ventricle to dilate. The left ventricular end-diastolic volume increases without further elevation of the regurgitant volume and afterload mismatch occurs. Ultimately, the ejection fraction and forward stroke volume decline during rest and ventricular emptying is impaired. In advanced stages of chronic aortic regurgitation, the left atrium pressure, pulmonary artery wedge pressure, pulmonary artery pressure, and right atrium pressure rise and cardiac output falls, first during exercise and then during rest. Once cardiac output falls, the patient becomes symptomatic.<sup>3</sup>

**Acute aortic valve regurgitation.** In cases of acute aortic valve regurgitation, the left ventricle does not have the time to adapt to the increased diastolic volumes. Thus, the disorder often manifests as a murmur with signs of acute left ventricular failure instead of the

symptoms typically produced by the high-output state, such as Corrigan's sign.<sup>6,7</sup>

#### Clinical Presentation

Aortic valve regurgitation is usually suspected by the auscultating physician long before the condition becomes symptomatic. The typical presentation of aortic regurgitation is a diastolic blowing murmur heard most clearly at the left sternal border. Additionally, a diastolic rumble (Austin Flint murmur) is heard at the cardiac apex. This murmur is believed to be caused by the aortic jet impinging on the mitral valve, causing the mitral valve to vibrate. Physiologic stenosis of the mitral valve caused by the simultaneous filling of the left ventricle from the left atrium and the aorta may also contribute to the rumbling murmur heard on aortic failure.<sup>3</sup>

The typical murmur of aortic regurgitation is audible early. However, the peripheral signs, such as Corrigan's sign, appear in the advanced form of the disease. By this time, the patient is usually symptomatic.

#### WATER-HAMMER PULSE

The same hemodynamic phenomenon that gives rise to Corrigan's sign also produces a curious sign in the radial pulse that resembles the strike of a water hammer, a Victorian toy. Thus, the sign is called *water-hammer pulse*. However, only conditions of hyperdynamic circulation can reproduce this pulse. **HP**

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