Diagnostic Auscultatory Complex in Coarctation of the Aorta

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In spite of numerous descriptions of the auscultatory and phonocardiographic findings in "adult" coarctation of the aorta (Reifenstein, Levine, and Gross, 1947; Wells, Rappaport, and Sprague, 1949; Brown *et al.*, 1959; Cleland *et al.*, 1956; Wood, 1956; Spencer, Johnston, and Meredith, 1958; Gasul, Arcilla, and Lev, 1966), no specific diagnostic auscultatory pattern has been outlined. The general conclusion has been that "auscultation is relatively unimportant in establishing the diagnosis of coarctation . . ." (Gardiner, 1959).

The purpose of this report is to draw attention to an auscultatory complex which appears diagnostic of coarctation. This consists of the combination of an early systolic ejection sound (click) with a mid-late systolic murmur (Fig. A-D) audible at the lower left sternal border and the apex. These two auscultatory signs have been noted before in coarctation but the diagnostic specificity of their association has not been recognized. The ejection click (Leatham and Vogelpoel, 1954; Cleland *et al.*, 1956; Wood, 1956; Gasul *et al.*, 1966; Hancock, 1966) may be immediately followed by an ejection systolic murmur of varying length. In other cases, however, it is followed, after a gap of at least 0.04 sec., by a mid-late systolic murmur. Such a murmur (Reifenstein *et al.*, 1947; Wells *et al.*, 1949; Wood, 1956; Spencer *et al.*, 1958; Segal and Likoff, 1964; Gasul *et al.*, 1966) is produced by flow either through collateral vessels or through the constricted segment of the aorta, and its delayed onset is due to the time taken for propagation of the pulse wave along the arterial system.

The association of an early systolic click with a delayed systolic murmur is not encountered in any

other disease except in coarctation. An ejection click due to such causes as stenosis or insufficiency of the pulmonary or aortic valve, idiopathic dilatation of the pulmonary artery, or pulmonary hypertension is commonly accompanied by an ejection systolic murmur with an early onset. Likewise, apart from coarctation, late systolic murmurs are not associated with early systolic clicks. Such murmurs are commonest in mild mitral incompetence (Barlow *et al.*, 1963; Segal and Likoff, 1964) when they may occasionally start with mid-late clicks. Delayed systolic murmurs also occur in pulmonary branch stenosis (Bousvaros and Palmer, 1965) and sometimes in idiopathic hypertrophic subaortic stenosis (Segal and Likoff, 1964). In the latter condition the murmur, rarely, has an explosive onset, simulating a click which, however, is not early but coincides with the peak of the percussion wave of the carotid sphygmogram (Hancock, 1966).

The auscultatory complex described here is not present in all patients with coarctation, but is not uncommon either, as it was encountered in 13 of 27 cases personally observed since 1960. It appears to be sufficiently specific and it should become a valuable complement to the difference in pulses between upper and lower limbs in establishing the diagnosis of "adult" coarctation of the aorta.

SUMMARY

The auscultatory signs of coarctation of the aorta have previously been considered evocative, but not specific of the diagnosis. The present report suggests that the association of an early systolic click with a delayed systolic murmur is encountered only in coarctation of the aorta. This diagnostic complex was present in 13 of a personally observed group of 27 patients. It should become a

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Phonocardiograms of four patients with adult coarctation illustrating the described complex. The systolic click is early coinciding with the onset of the carotid sphygmogram. The systolic murmur starts 0.04 to 0.08 sec. after the click. In A and B it is louder at the left sternal border than at the mitral area. In A the murmur spills beyond the second sound, presumably due to the delay in propagation of the arterial pulse wave to the periphery. In C the murmur is best shown at the mitral area; the second microphone records a continuous murmur at the left suprascapular area. In D both sound tracings represent two different (medium and high) frequency bands from the same microphone. Time lines: 0.04 sec. apart in A, B, and C, and 0.05 sec. between thick lines in panel D. Abbreviations: C=carotid sphygmogram, ECG=electrocardiogram, 3L5=third left interspace 5 cm. from midline etc., HF=high frequency band, MF=medium frequency, 1=first sound, ES=ejection sound, SM=systolic murmur, Cont. M=continuous murmur, A₂=aortic element of second sound.

valuable complementary sign in the diagnosis of this condition.

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