Atrial Diastolic Friction*

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A typical triphasic pericardial rub was heard in a patient with acute myocardial infarction. Phonocardiograms during atrioventricular block demonstrated a fourth rub component in atrial diastole following every sufficiently isolated P wave.

A pericardial friction rub, recognized as such, permits a firm diagnosis of pericarditis. This is because most full-blown rubs present some or all of three distinctive features: tonal quality (grating, scraping, etc.), precordial distribution (different from most murmurs) and the common occurrence of friction sounds during three phases: atrial systole, ventricular systole and early ventricular diastole.1,2 Diphasic (“to and fro”) and monophasic rubs sometimes resemble murmurs. Because there are no triphasic murmurs, triphasic rubs do not resemble murmurs and are more typical of pericardial disease, as they occur in approximately two-thirds of cases with sinus rhythm.3 Thus, under ordinary circumstances, pericardial rubs can occur whenever heart chambers are in motion both actively (atrial and ventricular systole) and “passively” (ventricular diastole). Recently, under extraordinary circumstances, one of us (HJLM) identified pericardial friction during atrial diastole.

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Case Report

This white man of 70 years was admitted on July 11, 1973 to the coronary care center at St. Anthony’s Hospital, with acute inferior myocardial infarction. Shortly after admission, he developed ventricular fibrillation which was promptly terminated by DC countershock. On July 13, 1973, his neck veins were moderately distended, rales were present at his lung bases, he developed first degree A-V block progressing to type 1 second degree block and then atrial fibrillation with a ventricular response rate of 80/min. The next day, signs of congestive failure persisted, a triphasic pericardial rub developed and he was mentally confused, but his rhythm reverted to sinus with second degree block. On July 16, sinus tachycardia (rate 104) was present with type 1 block with 3:2 and 2:1 conduction. His confusion persisted and two days later, in sinus rhythm with first degree block, he signed his own release from the hospital.

Discussion

The presence of atrioventricular block (Fig 1) dissected atrial diastole from its usual graphic submersion in early ventricular systole. In addition to the common triphasic rub during atrial and ventricular systole and early ventricular diastole, every P wave sufficiently separated from a QRS is regularly followed, not only by a large systolic atrial rub (top PCG) and a prominent S₄ (lowest PCG), but also by a constant fourth rub component well separated from atrial systole (arrows).

Analysis of 40 consecutive cardiac cycles showed that the time from the onset of the P wave to the first atrial systolic rub vibration varied between 35 and 85 milliseconds, while the time from P to the major S₄ vibration was 125 to 140 msec. This P-S₄ interval is in the expected range4 and consistent with the production of S₄ as a ventricular event which follows atrial systole.5 The consistently much earlier atrial rub corresponds to the timing of atrial systole itself, although its onset was more variable. By contrast, the time from P to the onset

![Figure 1. Lead 2 electrocardiogram (bottom) and phonocardiograms in patient with quadriphasic pericardial friction (see text). Arrows = atrial diastolic rub component; "4" = fourth heart sound; P = P-waves.](image-url)

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of the atrial diastolic rub was fairly constant, measuring between 220 and 235 msec, corresponding to atrial diastole.

During such weak “passive” movements as the ventricular and, particularly, atrial diastoles, it is remarkable that pericardial rubs can occur. One may speculate whether their “obvious” mode of production—friction between parietal and visceral pericardia—adequately explains them. This consideration certainly arises in the presence of pericardial effusion which more often than not accompanies pericardial rubs. A atrial diastolic friction may accompany many, if not most pericardial rubs, but its timing guarantees that at usual atrioventricular conduction times it will be drowned by the powerful ventricular systolic rub.

REFERENCES

Direct Extension of Bronchogenic Carcinoma through the Pulmonary Veins*

Surgical Implications

We present two surgically treated cases of lung cancer that showed progression of the tumor through the pulmonary veins toward the left atrium. The surgical technique and the influence of improper handling on the production of systemic emboli are discussed.

The progression of lung tumors through the veins to the left atrium is an uncommon complication, but it should be kept in mind when making a diagnosis and during surgery because of the possibility of systemic tumor embolism.

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There are only eight published cases of tumor embolism from the pulmonary veins. Seven of these patients died during the operation or shortly thereafter.

We present two cases of carcinoma of the lung and tumor embolism of a pulmonary vein. Their evolution was different due to different intraoperative handling.

CASE REPORTS

CASE 1

The chest x-ray film of a 67-year-old man showed a parahilar tumor 7 cm in diameter with an irregular outline. Surgical intervention revealed a hard homogeneous tumor. While dissecting the upper pulmonary vein, a soft embolus was felt within. The vein was therefore ligated early in an area apparently free of embolus; it was then sectioned transversely, and a soft friable tumor embolus was removed. The pneumonectomy was completed.

The patient arrived at the recovery room with left hemiparesis and mild focal symptoms of brain lesions. Twenty-four hours later he presented signs of intracranial hypertension, and cerebral angiography demonstrated occlusion of the middle cerebral artery. An emergency craniotomy was performed, and massive infarction of almost the entire right hemisphere secondary to tumor embolism was found. The patient died two days later. The diagnosis from pathologic examination was epidermoid carcinoma.

CASE 2

In this 54-year-old man, the chest x-ray film showed a round irregular tumor 5 cm in diameter in the left upper lobe (Fig 1). The patient underwent left thoracotomy, and a parahilar tumor was found occluding the bifurcation of the upper lobar bronchus; it extended through the pulmonary vein without reaching the pericardial fold. With the previous