A postoperative echocardiogram (Fig 4) showed normal echoes from the mitral valve and an absence of fluttering echoes inside the aortic root. Echoes from the prosthesis were seen inside the aortic root.

**DISCUSSION**

The syndrome of a flail aortic valve is a rare clinical entity and has been recognized only lately.1-11 It is seldom considered in the differential diagnosis of aortic regurgitation. Due to the lack of any characteristic auscultatory findings, as seen in patients with the syndrome of a floppy mitral valve, recognition of this condition characteristically has occurred only at the time of surgery or autopsy.

This syndrome may result from a variety of causes; and bacterial endocarditis, as in our case, seems to be the most common cause. Read et al6 emphasize that patients with a floppy mitral valve may have flail aortic cusps as well. Only recently have isolated case reports describing echocardiographic abnormalities in floppy or flail aortic valves appeared in the literature.11

The coarse fluttering and the saw-toothed or dragon-mouth appearance of the aortic cusps are especially well appreciated during systole. Furthermore, the wide separation of the two cusps in diastole corresponds to the extremely flail motion of the leaflets. The echo from the mitral valve shows the features of acute aortic regurgitation.12 Fluttering of the anterior mitral leaflet is not pronounced, probably due to early posterior descent in diastole. Also notable is the small amplitude of excursion of the mitral valve, the D-E slope.

Fluttering of the aortic cusps can be seen in other conditions (eg, severe coronary arterial disease or idiopathic hypertrophic subaortic stenosis); however, these are usually fine flutters. Vegetations on the aortic valve may also produce abnormal echocardiographic signals in the aortic root, but they are usually irregular patterns of varying intensity.

Slurring on the downstroke of the carotid pulse tracing is probably produced by the vibrations of the flail cusps lying in the path of the bloodstream during systole. To our knowledge, this is a new finding.

We think that the rapid downhill course of this patient’s condition began following tearing of his aortic cusps, resulting in acute aortic regurgitation. Surgery should not be unnecessarily delayed in these patients once they become symptomatic because of the likelihood of rapid deterioration in the clinical condition.

Patients suffering from significant, isolated aortic regurgitation, in the absence of aortic valvular calcification and with a negative VDRL test for syphilis, should be screened for this syndrome by echocardiographic studies. The incidence of the syndrome of a floppy aortic valve may be higher than commonly appreciated; and with the increasing use of ultrasound, the syndrome may be recognized earlier.

**REFERENCES**


**Pulmonary Arteriovenous Fistula**

**Preoperative Evaluation with a Swan-Ganz Catheter**


A balloon-tipped catheter was used in the preoperative assessment of a patient with a solitary pulmonary arteriovenous fistula and coexistent chronic obstructive pulmonary disease and ischemic heart disease. Studies before and two months following surgical excision of the fistula showed that the increase in arterial oxygenation (49 mm Hg vs 77 mm Hg) and the reduction in the fraction of the shunted cardiac output (37 percent vs 6 percent) closely approximated the predicted preoperative estimates.

Since their original description,12 pulmonary arteriovenous malformations have become a recognized, although unusual, cause of exercise intolerance and respiratory disability. With the development of modern

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diagnostic and surgical techniques, these anomalies have been diagnosed and corrected with increasing facility. The patient described herein had a large solitary pulmonary arteriovenous fistula, obstructive pulmonary disease, and ischemic heart disease. The coincidence of these conditions complicated her clinical evaluation. By occluding the fistula with a balloon-tipped catheter, it was possible before surgery to determine the degree of shunting and arterial hypoxemia caused by the malformation.

**Case Report**

A 51-year-old woman was seen for evaluation of dyspnea. This first occurred five years earlier, following an anterior myocardial infarction and subsequently progressed to the point where she was unable to work. There was no history of pulmonary disease or congenital malformations in the patient's family, but she did have a 40 pack-year smoking history.

The patient was a thin, mildly cachectic white woman with normal vital signs and no hemangiomas or telangiectasias. The veins in the neck were not distended. A diffuse lift was palpable in the fifth intercostal space at the anterior axillary line. The first heart sound was normal, and closure of the pulmonic valve was not increased. A gallop rhythm with a fourth heart sound was audible at the left sternal border. Auscultation of the lungs revealed scattered wheezes and a systolic bruit at the base of the left lung. The extremities were symmetrically clubbed and mildly cyanotic, but there was no polycythemia.

The electrocardiogram showed absent R waves in the right precordial leads. A retrocardiac shadow was present on the chest x-ray film, and tomograms showed a serpiginous density in the left lower lobe. Right cardiac catheterization revealed normal right-sided and wedge pressures. Pulmonary angiographic studies (Fig 1) demonstrated a large solitary fistula originating from the vessels of the left anterior and medial bronchopulmonary segments. Coexistent fistulae in the opposite lung were excluded by normal findings on a right-sided arteriogram.

Studies of pulmonary function showed a forced expiratory volume in one second (FEV1) of 0.8 L and a ratio of FEV1 to forced vital capacity of 57 percent, indicating a moderate obstructive impairment. Arterial blood gas analysis demonstrated a resting arterial oxygen pressure (PaO2) of 49 mm Hg with the patient breathing room air and a right-to-left shunt of 37 percent. Exercise induced even greater hypoxemia and shunting (43 mm Hg and 39 percent, respectively). With occlusion of the proximal end of the fistula via the balloon-tipped catheter (Fig 2), the PaO2 with the patient breathing room air increased from 49 to 66 mm Hg, and the shunt decreased from 37 to 9 percent (Table 1). Left cardiac catheterization with coronary arteriographic studies showed a large diffuse ventricular aneurysm and triple-vessel atherosclerotic disease. The results of a treadmill exercise test (Bruce's protocol) were normal.

Because of the marked shunting, with its resultant arterial

![Image](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21001/)

**Figure 1.** Arterial phase of left main pulmonary arterial injection, showing filling of pulmonary arterial branch (A) to left lower lobe, with shunting through arteriovenous malformation to large draining vein (V).

**Figure 2.** Upper, Single frame from 35 mm cine film, showing partially opaque arteriovenous malformation and occluding Swan-Ganz balloon (arrows). Lower, Diagram of cine frame, showing occluding balloon just above bifurcation of fistula, with tip of catheter in lateral limb, which is opaque (shaded area).
hypoxemia, and the considerable improvement that followed occlusion of the fistula, the malformation was excised. Surgery was accomplished uneventfully by removal of the basal segments of the left lower lobe, since the fistula was embedded well within the pulmonary parenchyma.

Two months after surgery, the patient was able to resume all but vigorous exercise. Studies at that time showed a PaO₂ of 77 mm Hg with the patient breathing room air and a right-to-left shunt of 6 percent (Table 1).

**DISCUSSION**

Pulmonary arteriovenous fistulas can be either solitary or multiple and are often associated with other vascular anomalies. Hereditary hemorrhagic telangiectasia is reported to coexist in 60 percent of these patients. When clinically significant, pulmonary arteriovenous malformations are often associated with the triad of cyanosis, exertional dyspnea, and digital clubbing.

The severity of the respiratory symptoms caused by pulmonary arteriovenous malformations can be correlated with their radiographic size, which is presumably an index of the degree of shunting through the abnormal vessel; however, the use of the Swan-Ganz catheter enables calculation of the actual degree of shunting through the individual malformation itself.

Significant pulmonary arteriovenous shunting without arteriographically demonstrable fistulas has been reported in patients with obstructive pulmonary disease. In view of the coexistent chronic obstructive pulmonary disease in this patient, quantitation of the shunt through the fistula was made to define the degree to which the fistula was responsible for the patient's hypoxemia. The fall in the right-to-left shunt to near normal levels during occlusion of the fistula via the balloon-tipped catheter demonstrated that the fistula was primarily responsible for the patient's hypoxemia.

The data obtained before surgery in this patient provided an accurate assessment of the improved arterial oxygenation and hemodynamics that would result upon excision of the fistula. Comparison of these data with the postoperative result showed that the rise in PaO₂ (86 mm Hg vs 77 mm Hg) and the fall in shunt fraction (9 percent vs 6 percent) was, in fact, better than initially anticipated. These discrepancies may be due either to the patient's having stopped smoking or the possibility that occlusion of the fistula at the time of catheterization was not complete (or both). It appears that preoperative occlusion of pulmonary arteriovenous malformations can provide an accurate estimation of the postoperative physiologic results.

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**REFERENCES**


**Endobronchial Metastasis from Cancer of the Breast**

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Endobronchial metastasis is reported to occur in less than 5 percent of the autopsies of patients dying with extra-thoracic malignant neoplasms. Frequently associated primary tumors include those of the kidney, pancreas, colon, ovary, and thyroid. To our knowledge, this is the first report of a case of cancer of the breast which metastasized to the mucosa of a major bronchus. The possible factors involved in the widespread, early unusual spread in this 25-year-old woman are discussed.

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