Left Atrial Pressure Pulses in the Presence of Myxoma

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Findings of transbronchial left heart catheterization in the presence of an atrial myxoma and a normal mitral valve are presented. The genesis and possible significance of unusual differences in contour between high and low left atrial pressure pulses are discussed.

SINCE successful removal of a left atrial myxoma is possible with open-heart surgery, accurate preoperative diagnosis is important. To the best of our knowledge, findings obtained on left heart catheterization in the presence of left atrial myxoma have not been reported. It is the primary purpose of this paper to present and briefly to discuss the left atrial pressure pulses obtained in the presence of a myxoma and a normal mitral valve.

Findings from right heart catheterization alone have shown, in general, evidence only of an obstructive left atrial lesion indistinguishable from mitral stenosis. Ellis et al. have noted in addition to elevated pulmonary capillary pressure, cyclic but irregular fluctuations over a wide range in pulmonary artery (50/21 to 90/30) and right ventricle (53/4 to 90/0) pressures in a case of left atrial myxoma, which was later successfully removed. These variations were independent of respiration, alterations in cardiac rhythm, and position. Together with variation of the v-wave peak in the wedge contour ranging from 25 to 40 mm. Hg, these findings were interpreted as evidence of varying degrees of obstruction of left atrial outflow.

The presence of left atrial myxoma may be strongly suspected in the presence of a characteristic combination of clinical features, which has been reported frequently and excellently reviewed by Harvey. In such a situation angiocardiography has proved to be a definitive method of diagnosis. Although left atrial myxomas have been successfully outlined by venous angiocardiography, this technic is not always successful. Ellis et al. were unable to visualize a suspected and later proved left atrial myxoma by angiocardiography. It is also unfortunate that all left atrial myxomas do not present the clinical picture required to arouse suspicion. The symptomatology and physical findings consequent to a tumor mass in the left atrium will obviously depend on such factors as mobility, size of pedicle, and relationship to mitral valve and pulmonary veins. If a relatively fixed position in relationship to the mitral valve is maintained, the resultant clinical picture is indistinguishable from mitral stenosis. This situation existed in the case to be presented. Unless routine venous angiocardiography is done, these lesions would remain undetected.

Discovery at the time of atriotomy for a planned mitral commissurotomy is the most common method of diagnosis. With discovery of the myxoma the procedure must be abandoned and preparations made for a second thoracotomy and cardiopulmonary bypass. Until technics have advanced to the stage that all mitral valvar surgery is done by an open method, the need for preoperative diagnosis will remain.

If a diagnosis could be established by pressure and pulse contour studies, those obtained in the left atrium would be most ideal for analysis. The following studies, including left heart catheterization, were carried out in a patient mistakenly diagnosed as having pure mitral stenosis. The clinical picture was devoid of any feature that might
reasonably arouse suspicion of an atrial myxoma but exploration revealed an entirely normal mitral valve and a large left atrial myxoma.

**Case Report**

C.S., a 51-year-old white man, was admitted to the Veterans Administration Hospital, Oteen, North Carolina, on April 18, 1958. Exertional dyspnea had been noted first in December 1956. At this time an apical diastolic murmur was heard and the patient was digitalized. During the ensuing 17 months he noted gradually increasing dyspnea with exercise and occasional episodes of severe paroxysmal dyspnea. These acute episodes were always related to exertion, gradually increased in frequency, and shortly prior to admission were accompanied by streaking hemoptysis. Pedal edema, rest dyspnea, and orthopnea did not occur. There was no history of syncope or respiratory symptoms related to positional changes. A past history of rheumatic fever was not elicited.

Physical examination revealed a blood pressure of 100/70 mm. Hg. The patient was comfortable in the supine position. There was no venous distention or dependent edema. There was no evidence of cardiomegaly or pulmonary congestion and the precordium was quiet. A low-pitched mid and late diastolic murmur merging with the first sound without appreciable presystolic accentuation, and localized at the apex, was present. Neither a mitral opening snap nor an apical systolic murmur was heard. There were no murmurs at the base. A thrill was not felt. The mitral first and pulmonic second sounds were accentuated. These findings were constant on repeated examination and positional change produced no variations. Physical examination was otherwise within normal limits.

Complete blood count, urine analysis, serum proteins and electrolytes, bromsulfalein excretion, antistreptolysin-O titer, C-reactive protein, maximal breathing capacity, timed vital capacity, and serology were all within normal limits or negative.

Fluoroscopic and radiographic examination (fig. 1) revealed left atrial enlargement, straightening of the left heart border, and prominence of the pulmonary artery. Aside from digitalis effect and left atrial hypertrophy the electrocardiogram was not remarkable.

Transbronchial left heart catheterization was performed on April 23, 1958, according to Morrow's technic.19 Pressure recordings (figs. 2 to 4) were made through a polyethylene catheter with a P23D Statham pressure transducer by means of a cathode ray photographic recording system. Mean left atrial pressures were obtained electronically. Concern over marked hypotension (systolic pressure 60 to 80 mm. Hg) during this procedure led to its termination without determination of cardiac output. At this time an elevated mean left atrial pressure and an obvious ventricular filling gradient without evidence of mitral regurgitation were considered the pertinent findings.

Thoracotomy was performed on May 6, 1958, with a diagnosis of uncomplicated mitral stenosis.
FIG. 2 *Top.* Left atrial pressure pulse obtained immediately after insertion of catheter through the transbronchial needle (high left atrial pressure pulse). *Time lines, 0.04 second.*

FIG. 3 *Middle.* Pressure recordings during withdrawal of catheter from aorta to left ventricle with simultaneous femoral artery pressure recording. *Time lines, 0.04 second.*

FIG. 4 *Bottom.* Pressure recordings during withdrawal of catheter from left ventricle to left atrium (low left atrial pressure pulse). *Time lines, 0.04 second.*
A firm, smooth, left atrial tumor, attached to the interatrial septum, was encountered. The mitral valve was entirely normal. There was no evidence of regurgitation. In view of the lack of preparation for cardiopulmonary bypass the operation was discontinued.

On August 19, 1958, this tumor (fig. 5) was removed through a right thoracotomy incision during extracorporeal circulation. It weighed 85 Gm. and measured 7.5 by 7 by 4 cm. with a 3 by 4 cm. attachment to the interatrial septum. During atrial closure, however, uncontrollable ventricular fibrillation developed and the patient died.

**Discussion**

In the retrospective analysis of these pressure tracings one is struck by certain unusual features. The elevated mean left atrial pressure and the atrioventricular diastolic filling gradient would be expected in the presence of any lesion obstructing left atrial outflow. However, the rapid initial y descent of the left atrial pressure pulse recorded above the tumor (fig. 2), immediately after insertion of the catheter through the Morrow needle, is striking. There is an average drop of 12 mm. Hg in the first 0.08 second of descent, with a mean left atrial pressure of 20 mm. Hg, a pulse rate of 82 per minute, and a normal sinus rhythm. This is followed by a distinct notching and a pressure plateau until atrial contraction.

In an analysis of the left atrial pressure pulse in mitral valve disease with stenosis and insufficiency Morrow et al.11 found that the ratio of the pressure fall during the first 0.10 second of the y descent to the mean left atrial pressure was of definite value in differentiating the predominant valvular lesion. There was a clear-cut separation of those patients with pure or predominant mitral stenosis. In this group the value of the resultant quotient was less than 0.5. Since the rapid y descent demonstrated in this patient would be anticipated in the presence of a predominantly regurgitant lesion, it is important to point out that no evidence of mitral insufficiency was found clinically or at atrial exploration. This rapid initial y descent would not ordinarily be expected in a purely stenotic valvular lesion and is interpreted as evidence of unobstructed left atrial outflow in early diastole.

Since the transbronchial technic for left heart catheterization was utilized, the catheter may be assumed to lie above the left atrial tumor immediately after insertion through the needle. Comparison of the left atrial pressure pulse at this level with tracings recorded at the time of pull-through from the left ventricle, when the catheter is below or lateral to the tumor, shows sharp differences in contour (fig. 6).

The broad base and short pedicle of this large myxoma would tend to fix it in a relatively constant relationship to the mitral valve. This might explain the lack of variability in physical findings and the absence of historical features suggestive of the presence of an intraatrial mass. While unobstructed early diastolic outflow might be expected, and is apparently demonstrated by the rapid initial y descent, subsequent downward displacement of the tumor into the mitral orifice establishes a ventricular filling pressure gradient. It is postulated that the variation in contour of the high and low left atrial complex is attributable to the difference in relationship of the tip of the catheter and the tumor. It is possible that during circumferential left atrial contraction

![Fig. 5. Gross appearance of resected left atrial myxoma which measured 7.5 by 7 by 4 cm. with a 3 by 4 cm. attachment to the atrial septum.](image)
LEFT ATRIAL PRESSURE IN MYXOMA

Fig. 6. High left atrial pressure pulse recorded above the myxoma (top) and low left atrial pressure pulse recorded below this tumor (bottom). Note the marked difference in contour.

A 2-chamber atrium was in effect created with different pressure relationships above and below the tumor. Thus the contour of the pressure pulse recorded with the catheter tip below the myxoma differs from that recorded above (fig. 7).

It is important to point out that this study was carried out in a patient assumed to have mitral stenosis. The clinical features often associated with left atrial myxoma were lacking. It is not our intention to imply that left heart catheterization or selective left atrial cardioangiography is the most desirable method of study in those cases where the existence of a myxoma may be suspected. The danger of dislodging emboli from a friable myxoma by needle insertion or high-

Fig. 7. Diagrammatic conception of the relationship of catheter tip to myxoma (above and below the tumor) during cardiac cycle with corresponding atrial pressure pulses.
velocity dye injection makes these procedures unsafe. Venous angiocardioography is the diagnostic procedure of choice in this situation.

SUMMARY
Left atrial pressure pulses obtained in the presence of an unsuspected left atrial myxoma are presented. The clinical picture was that of uncomplicated mitral stenosis. In addition to an elevated mean left atrial pressure and ventricular filling gradient they are characterized by a brief initial period of apparently unobstructed left atrial outflow and by differences in contour between high and low left atrial recordings. These dissimilarities are thought to reflect the different pressure relationships that occur above and below the tumor.

SUMMARIO IN INTERLINGUA
Es presentate pulsos de tension sinistro-atrial obtenite in le presentia de un non-suspicite myxoma sinistro-atrial. Le aspecto clinic esseva illo de non-complicate stenosis mitral. A parte un elevate valor medie del tension sinistro-atrial e un gradiente de replenation ventricular, constatationes characteristic esseva un breve periodo initial de apparentemente non obstruite effluxo sinistro-atrial e differentias de contorno inter registraiones sinistro-atrial alte e basse. Es opinate que iste dissimilaritates reflete le differente relationes de tension que occurre supra e infra le tumor.

REFERENCES
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