Dilated Right Pulmonary Veins in Mitral Insufficiency*

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A review of 50 proved cases of mitral insufficiency from the standpoint of the right pulmonary veins uncovered seven cases with localized dilatation of the central right pulmonary veins. In three cases this involved all the central right pulmonary veins; while in four it was confined to the right superior veins. In all seven cases there was mitral regurgitation with contrast substance refluxing into the dilated right pulmonary veins. This reflux is suggested as a possible cause of this venous dilatation.

Multiple studies have been published describing changes in the caliber of the pulmonary veins in mitral stenosis and left heart failure. These have emphasized the dilatation of the superior pulmonary veins and the decrease in caliber of the inferior pulmonary veins as correlated with pulmonary venous and arterial pressures.1,2

Multiple reports of localized dilatations or varicosities of pulmonary veins have been published.3-11 These varicosities have usually involved either the right inferior pulmonary vein or the left superior pulmonary vein. In a few of these cases there was associated mitral stenosis or left heart failure thus suggesting that some varicosities may represent an accentuated localized venous dilatation in cases of chronic pulmonary venous hypertension.9,11

Also, of interest is a report by Hipona and Janish12 of a case of varicocity of the right inferior pulmonary vein in a patient with mitral insufficiency. The varicosity enlarged over a period of seven years with progression of the mitral insufficiency, but disappeared following prosthetic replacement of the mitral valve. Similarly, Khalaf, Chapman, and Ernst13 illustrate a case of mitral insufficiency with giant left atrium from which radiated enormously dilated right pulmonary veins which expanded during systole on cineangiographic study.

Regurgitation of contrast substance during angio-ography into the pulmonary veins has been re-ported. Ross and Criley3 and Arvidsson14 both indicate that in the presence of normal and stenotic valves roentgen opaque material refluxes into the pulmonary veins with atrial systole, but with mitral regurgitation systolic pulmonary reflux is also present.

The author recently studied two cases of mitral insufficiency with apparent masses in the right hilum caused by dilated pulmonary veins. These cases stimulated a review of a series of cases of mitral insufficiency from the standpoint of the appearance of the right pulmonary veins. This consisted of the roentgenographic evaluation of this pulmonary venous dilatation and its possible relationship to the mitral insufficiency.

Material

Fifty cases of mitral insufficiency due to rheumatic valvulitis were studied. The diagnosis of mitral insufficiency was proven either by left ventricular cineangiography or surgical exploration, or both. The degree of mitral insufficiency was graded on left ventricular cineangiography by the criteria of Sellers and co-workers.10 The severity of mitral insufficiency at surgery was graded on the basis of the surgical operative report.

Roentgen evaluation of the right pulmonary veins was made on the plain films, both erect and supine and on the frontal angiograms. In a few cases tomograms were also available.

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ROENTGEN FINDINGS

Seven of the 50 cases studied demonstrated venous dilatation apparently confined to the central right pulmonary veins. In two cases both the central superior and inferior pulmonary veins were dilated; in three cases only the superior veins were dilated and in one case there appeared to be superior, middle and inferior veins of which the superior and middle veins were dilated.

The dilated veins were demonstrable in the supine roentgenogram (Fig 2A) but in two cases were also seen in the erect posteroanterior view (Fig 1). At times they suggested a hilar mass which was due not only to the venous dilatation, but also to associated tortuosity with superimposed multiple venous segments some of which were visualized end on. Tomography was thus useful in evaluating the nature of these hilar densities.

When dilated, the right inferior pulmonary veins were occasionally superimposed on the left atrium as a small double density. The dilated right superior pulmonary veins usually were seen extending laterally from the superior lateral contour of the left atrium into the right hilum.

Left ventricular angiocardiography in these seven cases demonstrated ++ mitral regurgitation with opacification of the dilated right pulmonary veins by the regurgitating contrast substance (Fig 2B, 3B). In none of these cases was there any detectable regurgitation into the left pulmonary veins.

In one patient in whom venous angiocardiography was also performed the discrepancy in size between the central right and left pulmonary veins was
In minimal pure right heart failure, the right pulmonary veins are associated with dilatation and dilatation of the inferior pulmonary veins. The venous dilatation was as prominent in some of these cases as in those with moderate venous dilatation due to mitral insufficiency. In the remaining 33 cases studied, no detectable abnormality of the pulmonary veins was noted.

Left ventricular angiocardiography showed regurgitation into the central right pulmonary veins, especially the right superior veins in all cases with 3+ or 4+ mitral insufficiency. Regurgitation into the veins was questionable or not detected in those with lesser degrees of mitral insufficiency. Of the 43 cases mentioned above, 20 were classified as 3+ or 4+ mitral insufficiency.

Regurgitation into the left pulmonary veins was not seen except for two cases in which it was questionably present.

**Discussion**

This study indicates that in a small percentage of cases of mitral insufficiency, especially those with severe regurgitation, the central right pulmonary veins may become selectively dilated. Based on this retrospective analysis of cases of mitral insufficiency, it would appear that this dilatation is probably due to chronic regurgitation into the central right pulmonary veins. This finding was demonstrated by angiocardiography in all of the seven cases studied.

Although the opacified left atrial appendage to some extent obscures the left pulmonary veins in the frontal angiocardiogram, comparison of the angiocardiograms with the overexposed plain roentgenograms indicated that opacification of the left pulmonary veins was not present. The localization of the abnormality to the right pulmonary veins can be explained by the direction of the regurgitant flow. Since the plane of the mitral valve faces posteriorly, superiorly and to the right the regurgitant stream is directed toward the right pulmonary veins, especially the superior right pulmonary veins. All seven cases showed dilatation of the superior veins while in three the inferior veins were also dilated but not as prominently as the superior veins.

The findings described must be distinguished from the superior pulmonary venous dilatation noted in mitral stenosis and left heart failure. This pattern of venous dilatation can be distinguished from that reported in this study by the fact that it is seen in both upper lung zones, is not confined to the central portions and is associated with a decrease in the size of the vessels in the lower zones. It is postulated that shunting of blood to the upper lobes accounts for the increased venous size. It must be
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admitted that three of the cases with right pulmonary venous dilatation apparently due to mitral regurgitation did have a history consistent with episodes of left heart failure so that some of the venous dilatation noted may have been due to this mechanism superimposed upon that due to regurgitation.

The roentgenographic problem occasionally posed by the dilated right pulmonary veins in mitral insufficiency is their differentiation from avascular pulmonary hilar masses. This is similar to the problem in localized pulmonary dilatations or varicosities.

Roentgen differential diagnosis is simple, however, because of the other manifestations of mitral heart disease such as left atrial and left ventricular enlargement which are usually quite prominent in these cases because of the severity of the mitral insufficiency. In addition, tomography can be utilized to demonstrate the tributary branches of the dilated central pulmonary veins.

REFERENCES
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12. Khalaf JD, Chapman CB, and Ernst R: Clinoradiographic approach to diagnosis of mitral regurgitation, Prog Cardiovasc Dis, 5:539, 1962

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