LEFT VENTRICULAR PRESSURES IN PATIENTS WITH AORTIC INSUFFICIENCY STUDIED BY INTRACARDIAC CATHETERIZATION

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The purpose of this communication is to report on the pressure levels recorded within the cavity of the left ventricle in ten human subjects with aortic insufficiency. The technique of catheterization has been described in detail (1); it should be again emphasized that this may be a hazardous procedure. However, the Mexico workers have carried out 56 left ventricle catheterizations without incident. Pressure tracings were inscribed by means of the Brush Six Channel Oscillograph (2).

The recording reference point was the antecubital fossa of the outstretched and level arm, approximately 5 cm. below the level of the sternum. Figure 1 shows simultaneous pressure tracings from the left and right ventricles and femoral artery.

Obvious congestive failure was present in seven patients, and absent in three at the time of study. Numerous investigators (3-6) have shown by catheterization of the right side of the heart, that

**Fig. 1. A Representative Tracing Recorded by the Brush Six Channel Oscillograph Showing Phase of Respiration, Right Ventricular Pressure, Left Ventricular Pressure, Femoral Arterial Pressure and Lead 2 of the Electrocardiogram**

The chart speed was 25 mm./sec. Note the mechanical alterations present in the pressure tracings.

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TABLE I

Pressure levels within left ventricle, aorta (above value), right ventricle and right auricle in ten patients with aortic insufficiency.* All values are expressed in mm. of mercury.

<table>
<thead>
<tr>
<th>Patient, sex, age</th>
<th>Lt. ventricle</th>
<th>Aorta (above valve)</th>
<th>Rt. ventricle</th>
<th>Rt. auricle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients in Congestive Failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. R., M., 43</td>
<td>178/26</td>
<td>179/87</td>
<td>33/11.2</td>
<td>13/6.2</td>
</tr>
<tr>
<td>W. C., M., 48</td>
<td>150/18</td>
<td>146/51</td>
<td>38/7</td>
<td>9/1.5‡ (M.P. 7.1)</td>
</tr>
<tr>
<td>C. J., M., 50</td>
<td>112/30</td>
<td>114/65</td>
<td>64/14</td>
<td>15/7† (M.P. 12.2)</td>
</tr>
<tr>
<td>J. S., M., 65</td>
<td>190/15</td>
<td>191/75</td>
<td>46/11.2</td>
<td>11/8</td>
</tr>
<tr>
<td>E. T., F., 46</td>
<td>147/30</td>
<td>143/87</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. C., M., 62</td>
<td>117/27</td>
<td>136/67</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>L. J., M., 56</td>
<td>135/27</td>
<td>132/87</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Patient not in Congestive Failure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. R., M., 42†</td>
<td>190/0</td>
<td>193/70</td>
<td>56/—.5</td>
<td>9/2‡</td>
</tr>
<tr>
<td>J. D., M., 54</td>
<td>88.5/0</td>
<td>90/48</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>R. R., M., 49</td>
<td>117/4</td>
<td>114/80</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* In those cases in which right ventricular pressure is recorded, both right and left ventricular pressures were inscribed simultaneously. Aortic pressures were recorded just before introduction of the catheter into the left ventricle and again immediately after withdrawal.
† This patient had a low grade coarctation of the aorta with an insufficient bicupid aortic valve. All other patients had syphilitic aortic insufficiency.
‡ Right auricular pressures were not recorded simultaneously with right ventricular pressures.
§ The right auricular pressure is elevated but the right ventricular diastolic pressure, which is the best objective evidence for cardiac failure, is normal.

three subjects without failure may reasonably be explained by the assumption that during the slow development of rheumatic or syphilitic aortic insufficiency, the left ventricle can compensate for the relatively small and slowly incremental reflux of blood by an alteration in its distensibility. In this fashion diastolic filling pressure would be maintained within normal limits compatible with levels most efficient for cardiac function.

The consistent rise in left ventricular diastolic pressure noted in the seven patients in congestive failure is in keeping with Starling’s concept of the failure mechanism: a progressive accumulation of blood within the left ventricular cavity, accompanied by a progressive stretching of the myocardium until a critical point is reached where the muscle fibers offer an increasing resistance to the incoming blood, with a resultant rise in the intracavity diastolic pressure. The elevated diastolic pressure levels we have recorded are likewise in agreement with the demonstration by Nylin and Celander (8), that the human ventricles in congestive failure do not empty completely, permitting a large amount of residual blood to remain within the ventricular cavity following systole.

There are certain limitations in securing accurate pressure curves through the 100 cm. plastic catheter in use at the present time. This makes mandatory a repetition of this work with the use of more precise recording equipment, such as the catheter tip strain gauge, now under development in several laboratories.

SUMMARY

1. The pressure levels within the left ventricular cavity have been studied in ten human subjects with aortic insufficiency by catheterization of the left ventricle via the radial artery.

2. The three patients who exhibited no clinical evidence of congestive failure had normal left ventricular diastolic pressures.

3. The seven patients in obvious congestive failure demonstrated significant increases in diastolic pressure, averaging 25 mm. or mercury.

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BIBLIOGRAPHY