Hematoma of the Interatrial Septum with Heart Block Secondary to Dissecting Aneurysm of the Aorta
A Clinicopathologic Entity

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SUMMARY
Four patients with a hematoma of the interatrial septum secondary to acute dissecting aneurysm of the aorta are described. Hematoma of the interatrial septum presents with clinical features of acute dissecting aneurysm of the aorta and partial or complete heart block. Anatomically, the hematoma traverses the aortoatrial space to involve the A-V node and the bundle of His. Early operation is indicated.

Additional Indexing Words:
Hemopericardium  Cardiac tamponade

HEMATOMA of the interatrial septum was first described by Maguire,1 in 1887, as a complication of aortic valve stenosis. It can also occur from rupture of an aneurysm of the right coronary artery2 or from dissecting aneurysm of the ascending aorta.3-6 The hematoma involves the anterior part of the interatrial septum, extends to the A-V node and bundle, and ruptures into the pericardium. This paper describes four patients with hematoma of the interatrial septum to emphasize its pathologic anatomy and clinical implications.

Case Reports

Case 1
A female, aged 63 years, was admitted with severe chest pain and a history of hypertension. On admission she was in obvious distress, the blood pressure was 200/140, and all peripheral pulses were palpable and equal. Chest radiograph showed enlargement of the cardiac silhouette and widening of the mediastinum. The electrocardiogram demonstrated sinus rhythm with first-degree block and severe left ventricular hypertrophy.

At operation approximately 700 ml of bloody fluid and clots were found in the pericardial cavity. Cardiopulmonary bypass was established, and the ascending aorta which was the site of a large dissecting aneurysm was replaced by a woven Dacron graft. The patient expired 3 hours later.

Postmortem examination revealed an extensive dissection of the aorta starting from an intimal tear below the origin of the left common carotid artery. Distally, it involved all the major branches of the aorta and the right common iliac artery. Proximally, the dissection extended past the aortic root into the right atrial wall and interatrial septum producing a hematoma approximately 2 x 5 cm (fig. 1). This protruded into the cavity of the right atrium inferior and anterior to the fossa ovalis and to the attachment of the tricuspid valve near the region of the commissure between the posterior and septal cusps. Posteriorly, the hematoma surrounded the orifice of the coronary sinus. Superiorly, it involved the lower part of the fossa ovalis; anteriorly and inferiorly, it extended to the tricuspid annulus.

Case 2
A female, aged 62 years, a known hypertensive, was admitted with the complaint of severe chest
Figure 1

Photograph of specimen from case 1 showing hematoma (H) involving the anteroinferior angle of the interatrial septum and lower part of fossa ovalis (FO). The hematoma surrounded the orifice of the coronary sinus (CS) and extended to the ring of tricuspid valve. The diagram indicates the various structures (MS = membranous septum) in relation to the bundle of His (BH).
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Figure 2

Gross specimen from case 3. The intimal tear (IT) above the right coronary orifice (RCO) allows the hematoma (H) to extend circumferentially about the aorta. (A) Longitudinal section through the noncoronary cusp of the aortic valve (NCC). (B) Longitudinal section through the right coronary cusp (RCC). (C) Section through the left coronary cusp (LCC). (D) View from the right atrium and right ventricle showing the hematoma anterior to the fossa ovale (FO), adjacent to the tricuspid valve and in the region of the bundle of His.
Figure 3
Photomicrograph of specimen (case 4) showing hemorrhage in right atrial wall near the bundle of His.

Table 1

<table>
<thead>
<tr>
<th>Author</th>
<th>Etiology</th>
<th>ECG</th>
<th>Age(yr), sex</th>
<th>Site of intimal tear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maguire, 1887</td>
<td>Aortic stenosis; bacterial endocarditis</td>
<td>None</td>
<td>Not given</td>
<td>None</td>
</tr>
<tr>
<td>Pick, Menini, 1953</td>
<td>Dissecting aneurysm</td>
<td>A-V block</td>
<td>74, M</td>
<td>1.5 cm above the aortic ring</td>
</tr>
<tr>
<td>Orbison, Mostofi, 1956</td>
<td>Aortic stenosis; bicuspid, calcified aortic valve</td>
<td>Intermittent A-V block</td>
<td>35, M</td>
<td>None</td>
</tr>
<tr>
<td>Nissim, 1946</td>
<td>Dissecting aneurysm</td>
<td>None, heart rate was 36</td>
<td>71, M</td>
<td>4 cm above the aortic ring</td>
</tr>
<tr>
<td>Giraud, Latour, Puech, Hertault, 1958</td>
<td>Dissecting aneurysm</td>
<td>Sinus rhythm</td>
<td>64, M</td>
<td>Ascending aorta</td>
</tr>
<tr>
<td>Marano, Baila, Cardeza, 1945</td>
<td>Aneurysm of the right coronary</td>
<td>Sinus rhythm with ventricular ectopies</td>
<td>43, M</td>
<td>None</td>
</tr>
<tr>
<td>Wood, 1931</td>
<td>Dissecting aneurysm</td>
<td>A-V block (presumed)</td>
<td>61, M</td>
<td>9 cm below the origin of the left subclavian</td>
</tr>
<tr>
<td>Present</td>
<td>Dissecting aneurysm</td>
<td>A-V block</td>
<td>63, F</td>
<td>Distal end of aortic patch</td>
</tr>
<tr>
<td></td>
<td>Dissecting aneurysm</td>
<td>A-V block (presumed)</td>
<td>62, F</td>
<td>2 cm above aortic valve</td>
</tr>
<tr>
<td></td>
<td>Dissecting aneurysm</td>
<td>A-V block (presumed)</td>
<td>64, M</td>
<td>4 cm above aortic valve</td>
</tr>
<tr>
<td></td>
<td>Dissecting aneurysm</td>
<td>A-V block</td>
<td>77, M</td>
<td>Just above aortic valve</td>
</tr>
</tbody>
</table>
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pain radiating to the left subscapular region. Aortography demonstrated a dissecting aneurysm involving the entire thoracic aorta. She was treated conservatively with quanethidine sulfate (Ismelin), reserpine (Serpasil), and trimethaphan camsylate (Arfonad) drip and discharged from the hospital.

Two months later she was readmitted with severe chest pain followed by respiratory arrest. A second aortogram disclosed a dissection beginning above the aortic valve that extended to the level of the renal arteries.

Operation was done with replacement of the ascending aorta by a Teflon graft. The ECG showed sinus rhythm with a rate of 100 beats/min, but in 2 hours the heart rate dropped to 40–50 beats/min, followed by death.

Postmortem examination revealed extension of the aortic dissection proximally into the aortoatrial space and the interatrial septum. In addition, there was a superficial subendocardial hematoma involving the upper quarter of the left side of the interventricular septum.

Case 3

A man, aged 64 years, was known to have had systemic hypertension for many years. He developed severe chest pain and faintness. His blood pressure was 60/40 and his pulse rate was 30 beats/min. He died a few minutes after arrival at the hospital.

Postmortem examination showed an extensive dissecting aneurysm of the aorta starting from a transverse intimal tear 4 cm above the aortic valve. The dissection extended to the bifurcation of the aorta. Proximally the dissection extended into the aortoatrial space, surrounded the aorta, the orifices of both coronaries (fig. 2), and infiltrated the atrial wall in the region of the A-V node and bundle. Serial sections showed extensive hemorrhage involving the A-V node and bundle. The pericardial cavity contained approximately 500 ml of blood.

Case 4

A man, aged 77 years, was admitted because of sudden severe sternal chest pain with sweating, but no syncope. On admission he looked distressed, the pulses were faint, but equal in both arms, with a rate of 54 beats/min. The blood pressure was 110/55. The electrocardiogram showed first-degree heart block (a P-R interval of 0.34 sec) with a ventricular rate of 38 beats/min.

His clinical condition remained stable for 26 hours although his pulse rate continued to be slow. Ventricular asystole occurred suddenly, and attempts at resuscitation failed.

Postmortem examination showed dissection of the aorta starting from an intimal tear in the ascending aorta and extending distally into the abdominal aorta. Proximally the dissection extended into the aortoatrial space and infiltrated the interatrial septum in the region of the A-V node and bundle. Serial sections of this region (fig. 3) showed extensive hemorrhage infiltrating the region of the node and bundle of His (fig. 4).

Figure 4

Photomicrograph (case 4) at the noncoronary leaflet (posterior part). Note extension of hematoma from the aortoatrial space into the atrial wall to involve the A-V node and the bundle of His. The latter is seen surrounded by hemorrhage.
Figure 5

Dissection of a normal human heart showing relations of the aortoatrial space to the right atrial wall, the aortic wall, and membranous septum (Memb S); noncoronary cusp of aortic valve (NCC); left coronary cusp (LCC); and fossa ovale (FO).
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Discussion

Only 11 cases of interstitial hematoma of the interatrial septum have been reported since its original description by Maguire in 1887 (table 1). The hematoma involves the medial wall of the right atrium and the interatrial septum in close proximity to the central fibrous body of the heart, the A-V node, and the bundle of His. The atrial myocardium in this region (fig. 5) is formed of loosely arranged muscle bundles that allow for the expansion of the hematoma. Externally, the interstitial tissue of the right atrial wall communicates with an intrapericardial aortoatrial space which is bounded on one side by the right atrium and tricuspid valve ring, and on the opposite side by the noncoronary aortic sinus and membranous interventricular septum. This space is filled by loose areolar tissue and covered by visceral pericardium. A continuation of this space surrounds the aorta and correlates well with the spread of a dissecting hematoma.

Hematoma of the right atrial wall and interatrial septum results if an adjacent high-pressure chamber or vessel (the left ventricle, the noncoronary aortic sinus, or the right coronary artery) ruptures into this space (figs. 6, 7). Rupture from the left ventricular cavity may follow a subvalvular endocardial tear in patients with aortic valve stenosis, secondary to bacterial endocarditis or to "jet lesions."

Rupture from a dissection along the aorta is the most common cause of hematoma of the interatrial septum. The aortic media is continuous with the anulus of the aortic valve (fig. 7) except in the region of the commissures. This would be the site of rupture of a dissecting hematoma into the aortoatrial space. The hematoma extends through the interstitial tissue of the atrial myocardium to the subintimal layer of the right atrium and the interatrial septum. The aortoatrial space is separated from the pericardial space only by a thin layer of visceral pericardium which does not constitute an appreciable barrier to spread of the hematoma. This explains the presence of hemopericardium in patients with hematoma of the septum.8-10

Figure 6

Photomicrograph of a longitudinal section through the region of the anterior half of the noncoronary cusp (elastic stain) showing the relations of the aortoatrial space, the aortic media (darkly stained by elastic stain), and the aortic annulus. LV = left ventricle.

The clinical importance of hematoma of the interatrial septum is apparent when the dissection involves the region of the A-V node and bundle. In addition, the hematoma may rupture into the right atrium and produce an aorto-right-atrial shunt.11

The presence of A-V conduction defects should suggest the diagnosis of atrial hematoma and favor early operative treatment. It would seem reasonable to insert an intravenous endocardial pacing electrode in patients with a dissecting hematoma at the base of the aorta for use should conduction defects develop prior to operation.

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Figure 7

Photomicrograph of a section through the region of the commissure between the noncoronary and right coronary aortic cusps (elastic stain). The aortic “annulus” is deficient in this region. The membranous septum is continuous with the commissural tissue and the aortic media (darkly stained by the elastic stain). The arrow represents the path of rupture of a dissecting hematoma from the aortic media into the aortoatrial space.

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Circulation, 1972;46:537-545
doi: 10.1161/01.CIR.46.3.537
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
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