Aneurysm of the Ascending Aorta with Obstruction of the Superior Vena Cava: Report of Case with Resection Using Extracorporeal Circulation*

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Recent surgical advances, including the ability to bypass the heart and lungs, have made possible resection of the ascending aorta for aneurysms. The bleak outlook for patients with untreated thoracic aneurysms has been properly stressed by many authors since the classic articles of Lemann1 in 1916 and Boyd2 in 1924. Resections for aneurysms of the ascending aorta prior to the introduction of the heart-lung bypass technic were limited to tangential resection of the aorta and aorticorrhaphy for saccular aneurysms with narrow necks and relatively healthy adjacent aortic walls.3-4 De Bakey and associates5 demonstrated the technical feasibility of resection of the ascending aorta for fusiform aneurysms with the aid of extracorporeal circulation. Reports of two successful attempts done by this group appeared in the literature in 1956 and 1957.

The present report is that of a patient having a large fusiform aneurysm of the ascending aorta which had ruptured to form an additional false aneurysm in the anterior mediastinum. The presence of these two masses caused the rather uncommon complication of compression and obstruction of the superior vena cava.

Report of Case

A 62-year-old white man was hospitalized immediately on admission to the Mayo Clinic on May 27, 1959. He was referred because of pain in the right side of the thorax of 4 months' duration and swelling of the face and neck for 6 weeks. He had been well except for a painful right shoulder diagnosed and treated as pariarthritis by the physician in his home locality in October, 1958. A roentgenogram of the thorax at that time showed only slight tortuosity of the ascending aorta. During January, 1959, the patient had begun to have dull intermittent pain in the right anterior and lateral part of the thorax, which became more severe in the following 4 months. The pain was located in the region of the third to the eighth rib on the right from the mid-clavicular line anteriorly to the mid-scapular line posteriorly and was not related to exertion, position, breathing, coughing or sneezing.

During mid-April, 1959, he noted the onset of swelling and a dusky cyanosis of his face and neck most noticeable after lying down for long periods. The size of his collar had increased from 14½ to 16 inches during the 6 weeks before admission. He had had blurring of his vision on arising in the mornings, but no headaches. A dry cough, slight huskiness of his voice, dyspnea after walking up half a flight of stairs, and occasional paroxysmal nocturnal dyspnea had developed in the 6 weeks prior to admission. On May 26, a roentgenogram of his thorax had revealed a mass, and he was referred with the presumptive diagnosis of a neoplasm.

On examination the patient appeared well-developed, well-nourished and younger than his stated age. His face, neck and upper part of the thorax appeared puffy and suffused with a dusky cyanosis. Both jugular veins were markedly distended, and many collateral veins could be seen on the anterior chest wall. Superficial venous stars were evident along the costal margins. Veins in the arms showed increased venous pressure. The veins of the right arm collapsed at 60 degrees from the horizontal and the left arm at 90 degrees. Blood pressure was 118 mm. Hg systolic and 70 diastolic in both arms; radial pulses were 64 beats per minute and were equal in amplitude; the oral temperature was 98.6° F. A slight tracheal tug, without any shift of the trachea, was evident. Percussion dullness and a systolic, pulsating prominence of the right pectoral area were present over the second through

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FIGURE 1: The thorax. 

a. Posteroanterior view demonstrating an aneurysm of the ascending aorta and the more lateral mass formed by the false aneurysm. 
b. Lateral view demonstrating the false aneurysm with its broad base lying against the anterior chest wall.

FIGURE 2: Aortogram demonstrating the catheter in the ascending aorta, the large fusiform aneurysm filled with contrast medium, and the false aneurysm that did not fill with the contrast medium.
the fifth ribs anteriorly. Heart tones were clearly audible in the area of dullness giving the erroneous initial impression of a dextrocardia. The second cardiac sound had a woody quality and was narrowly split. With the patient in the sitting position, a faint diastolic bruit was heard in the right upper anterior portion of the chest.

There was no evidence of aortic incompetence.

Laboratory examinations revealed 9300 leukocytes per cubic millimeter of blood, a normal differential count except for 8 per cent eosinophils, 13 per cent of hemoglobin per 100 ml., a sedimentation rate of 56 mm. in 1 hour (Westergren method), 36 mg. of urea per 100 ml. of blood and positive Wassermann, Hinton and Kahn reactions. The Kahn reaction was 4 plus with 1024 units. (The patient denied previous knowledge of syphilitic infection). Urinalysis was normal except for 6 erythrocytes and 3 pus cells per high-power field. The electrocardiogram was normal. Roentgenograms and fluorograms of the thorax (fig. 1) revealed a distinct globular anterior mediastinal mass attached to the anterior chest wall beneath the right costosternal border at the level of the third and fourth intercostal spaces. A separate mass situated more posteriorly suggested an aneurysm of the ascending aorta. A retrograde aortogram revealed a large aneurysm of the ascending aorta extending down to the aortic sinuses. The right aneurysm mass was not filled with opaque media and appeared to be separate from the aneurysm (fig. 2).

The patient returned on June 29, 1958, for surgical excision of his aneurysm. He had no new symptoms, but he complained of increased pain in the right anterior portion of the thorax and in the right arm, and of increased puffiness of the face. During the interim he had received a course of 10,000,000 units of penicillin as the first and only known treatment for the syphilitic infection prior to operation.

On July 1, 1959, resection of the ascending aortic aneurysm was performed. Extracorporeal circulation and intermittent perfusion of the coronary artery were used in the course of the operation. A woven (teflon) aortic prosthesis was inserted as the operation proceeded as follows: The right upper quadrant was exposed extraperitoneally. Primary median sternotomy was done, and extensive venous bleeding due to the obstruction of the superior vena cava was encountered. The aneurysm was located to the right of the sternum and was intimately adherent to the anterior chest wall. It began just above the aortic valve but did not include the sinuses of Valsalva. A "false" aneurysm originated from its anterolateral surface and extended to the right anterior part of the chest wall. This false aneurysm later was found to be filled with clotted blood.

Extracorporeal circulation was instituted after the right external iliac artery and the right atrium were cannulated. A tape was placed about the pulmonary artery and was used to occlude this vessel as complete heart-lung bypass was instituted. Circulation to the head and upper part of the trunk was maintained satisfactorily by retrograde aortic flow. The aorta was cross-clamped just proximal to the innominate artery. The fusiform aneurysm was excised, and a tubular, woven (teflon) prosthesis 1 1/2 inches in diameter was sutured in place in the aorta. The posterior half of the lower anastomosis was accomplished first, then the upper anastomosis and, finally, the anterior half of the lower anastomosis. After 15 minutes of cardiac asystole, the left coronary artery was perfused for 5 minutes. This was repeated after a 15-minute period of asystole. The coronary cannula was withdrawn as the anastomosis was rapidly completed; and the prosthesis was allowed to fill with blood. The pulmonary arteries were released, and excellent caval diastolic function was achieved. Protamine was given, and bleeding at the anastomotic sites was controlled gradually. There was no bleeding through the prosthesis itself. The cannulae were removed, and the external iliac artery was repaired. The clot filling the false aneurysmal sac was scooped away with the hand, leaving most of the thin wall intact. The sternum was reaproximated with four encircling needle wire sutures, and the remaining layers were sutured with silk. Temporary bilateral closed drainage of the chest was instituted.

The pathologist reported that the resected tissue was an "aneurysm in pieces, partially filled with laminated thrombus," and that there was marked chronic inflammation, probably syphilitic in origin.

The postoperative course was uncomplicated, and the patient was dismissed 15 days after operation. His only complaints were slight numbness of the ring and finger fingers of the left hand. He had no bruits, murmurs or other abnormal findings except absence of pulses in the ulnar artery and reduced pulses in the radial artery on the right resulting from the retrograde aortogram. All signs of obstruction of the superior vena cava had disappeared. A roentgenogram of the thorax revealed a normal aortic shadow.

**Comment**

The classic triad of symptoms of a thoracic aortic aneurysm, all three of which were present in the case just reported, are cough, present in 73 per cent of cases, dyspnea, in 70 per cent, and pain, in 67 per cent, according to Cranley and associates. Other common symptoms are dysphasia, loss of weight, anorexia and palpitation. Signs that may be present on examination are an area of dullness and abnormal pulsations over the aneurysm, a delay in one radial pulse, inequality of the pupils from irritation of the superior cervical sympathetic nerves, tracheal tug, a dull or woody first heart sound, a loud ringing type of second aortic sound, the signs of...
aortic regurgitation, a bruit, and an obstructive type of bronchial sounds. A humming-top murmur may be heard if the aneurysm has ruptured into the nearby pulmonary artery or vena cava. Congestive heart failure, compression of the pulmonary artery, and occasional effects of large aneurysms.

Cranley and associates, in 1954, reported on a series of 230 aneurysms encountered at necropsies performed between 1926 and 1952. In this series, 189 aneurysms (82 per cent) were syphilitic, 32 (14 per cent) arteriosclerotic, three (1.3 per cent) a combination of the two, five (2.2 per cent) were the result of mycotic infections, and one (0.4 per cent) was due to trauma. From 1926 to 1930 the incidence of syphilitic aneurysms in their series was one in 46 necropsies whereas from 1946 to 1950 it had dropped to one in 201 necropsies. The majority of recent reports on aneurysms show that arteriosclerosis is the most frequent cause of aneurysms. Eighty-nine per cent (189 cases) of the 189 syphilitic aneurysms in the series reported by Cranley and his associates were in the thoracic aorta and 11 per cent (20 cases) were abdominal. Eighteen of these 20 abdominal syphilitic aneurysms were located above the renal arteries. The vast majority (78 per cent) of the syphilitic thoracic aneurysms were found in the ascending aorta or the arch. Arteriosclerotic aneurysms, on the other hand, appear most commonly in the abdomen below the renal arteries. Twenty (62 per cent) of the 32 arteriosclerotic aneurysms in the series reported by Cranley and associates were in this location. Of the 12 thoracic arteriosclerotic aneurysms in their series, 10 were located in the distal portion of the arch or descending aorta.

De Bakey and associates, in 1958, reported on 50 aneurysms of the aortic arch resected by the various available techniques including extracorporeal circulation. The mortality rate in this series was 66 per cent. Factors favoring a high mortality rate were the age (especially an age of 60 years or more), a fusiform type of aneurysm, and arteriosclerosis as the etiologic agent. This high mortality rate, based on a relatively small number of cases, must be compared to the extremely high mortality rate from the untreated aneurysm. In 633 cases of saccular thoracic aneurysms Kampmeier stated that the average life expectancy after onset of symptoms was 6 to 9 months. Cranley and associates found that of 230 patients with untreated thoracic aneurysms, 59 per cent had died in 1 year, and 77 per cent in 2 years following onset of symptoms.

The complications of thoracic aneurysms are those of compression of nearby vital structures and of rupture. Cranley and associates gave statistics for 90 thoracic aneurysms causing compression or rupture; only one caused compression of the superior vena cava and one other ruptured into the superior vena cava. Compression of trachea, bronchus, lung and pulmonary artery, or rupture into the esophagus, pericardium, pleura, and pulmonary artery are considerably more common than is the syndrome of superior vena caval compression.

In an analysis of the causes of 274 cases of superior vena caval obstruction, Schechter found aortic aneurysms were second only to carcinoma as the most common cause. Twenty-seven (28 per cent) of the cases of the syndrome of superior vena caval obstruction were caused by aneurysms. However, in only one of Schechter's last 22 cases of superior vena caval syndrome, and in none of the 33 cases reported by Failor and associates in 1958, was aneurysm the etiologic agent. A more nearly accurate estimate of the frequency of aneurysms as the cause of compression of the superior vena cava within the past 5 to 10 years is less than 2 per cent.

SUMMARY

A large fusiform aneurysm involving the entire ascending aorta was successfully excised with the aid of extracorporeal circulation. Prior to operation the patient had a poultice on the chest wall, and presented an unusual roentgenographic picture caused by a large clot-filled false aneurysm which had arisen from a ruptured syphilitic fusiform aneurysm. Following excision of the aneurysm and resection of the aorta, the superior vena caval compression syndrome disappeared and the patient was able to return to normal activity after an uncomplicated convalescence.

RESUMEN

Se resecó un gran aneurisma fusiforme que incluía totalmente la aorta ascendente, con buen resultado, con la ayuda de la circulación extracorpórea.

Antes tenía una masa pulsatil en la pared anterior del tórax y presentaba un aspecto radiológico inusitado causado por un falso aneurisma lleno de coágulos que se había desarrollado a partir de la ruptura de un aneurisma sifilítico fusiforme. Después de la excisión del aneurisma y de la resección de la aorta, el síndrome de compresión de la vena cava superior desapareció y el enfermo tuvo la capacidad de volver a la actividad normal después de una convalecencia sin complicaciones.

RESUMÉ

Un volumineux anévrisme fusiforme compréhendant l’aorte ascendante dans sa totalité a été extirpé avec succès grâce à la circulation extra-corpsorelle. Avant l’opération, il existait une masse battante sur la paroi thoracique antérieure du malade. Le tableau radiologique étant inhabituel, il était dû à un volumineux pseudo-anévrisme empli de caillots qui était apparu à la suite de la rupture de l’anévrisme syphilitique.
ANEURYSM OF ASCENDING AORTA

fusiforme. Apres exéresè de l'anévrysme et résection de l'aorte, le syndrome de compression de la veine cave supérieure disparut et le malade fut en état de reprendre une activité normale après une convalescence sans complications.

ZUSAMMENFASSUNG

Ein grosses spindelförmiges Aneurysma, das die ganze aufsteigende Aorta betraf, wurde mit Hilfe des extracorporalen Kreislaufs erfolgreich exzidiert. Vor der Operation hatte der Patient eine pulsierende Masse an der vorderen Brustwand und bot ein ungewöhnliches Röntgenbild infolge eines grossen, mit einem Thrombus gefüllten falschen Aneurysmas, das von einem rupturierten syphilitischen spindelförmigen Aneurysma entstanden war. Nach der Exzision des Aneurysmas und Rezision der Aorta bildete sich das Kompressions-Syndrome der oberen Hohlvene zurück, und der Patient war imstande, nach einer komplikationslosen Rekonvaleszenz seine normale, aktive Lebensweise wieder aufzunehmen.

REFERENCES