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NEW APPROACH TO THE ANEURYSM ORIGINATING IN THE ASCENDING AORTA, ERODING THE STERNUM AND EXTENDING TO THE CERVIX

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ABSTRACT

When operating on a false aneurysm arising in the ascending aorta, protruding over the sternum, and eroding the sternum, the problems are how to approach the aneurysm and how to preserve the myocardium and the brain safely. In the present case, the operation was performed for the first time, to the best of our knowledge, safely by flipping up the eroded upper half of the sternum with separated clavicles and ribs, under a femoro-femoro (F-F) bypass and isolated brain perfusion.

Key Words: aneurysm eroding the sternum, approach to the thoracic aneurysm, false aneurysm

THE CASE

A 54-year-old man was admitted to the Nagoya University Hospital complaining of a pulsating tumor in the cervical region accompanied with dysphagia. In August 1985, an abnormal shadow was detected in the upper mediastinum on a chest X-ray film. From June 1986, the patient developed dysphagia and in September became aware of a pulsating tumor in the right cervical region. The pulsating tumor, protruding over the sternum, was 7×4×2 cm on the day of admission. Blood pressure was 140/70 mmHg, and the blood sedimentation rate per hour had a value of 70 mm. The serological test for syphilis was negative. An aneurysm of the ascending aorta was diagnosed by a digital subtraction angiography (DSA) examination (Fig. 1) and by a nuclear magnetic resonance (NMR) image (Fig. 2). In a computed tomography (CT) scan of the sternum, the aneurysm was observed to adhere to the posterior surface of the sternum, which had already been partially destroyed, especially at the level of the first rib (Fig. 3a). The greatest compression was found on the trachea at the level of the sternoclavicular joint, where the sectional area was as small as 6×10 mm (Fig. 3b). The entrance to the aneurysm had a diameter of 3.5 cm and was situated within 1 cm from the origin of the innominate artery. The size of the aneurysm protruding into the cervical region continued to increase and the skin color turned purple (Fig. 4). A rupture was threatened and an operation was performed on November 25, 1986, described as follows.

After the blood pressure was lowered to 60 mmHg with trimetaphan camsilate to prevent rupture, an endotracheal tube of 6 mm in diameter was inserted beyond the narrow segment of the trachea compressed by the aneurysm, under direct observation with a bronchial fiberscope. At first, the right femoral artery, femoral vein and bilateral common carotid arteries were exposed for cannulation. A Y-shaped skin incision was made, oblique incisions along the

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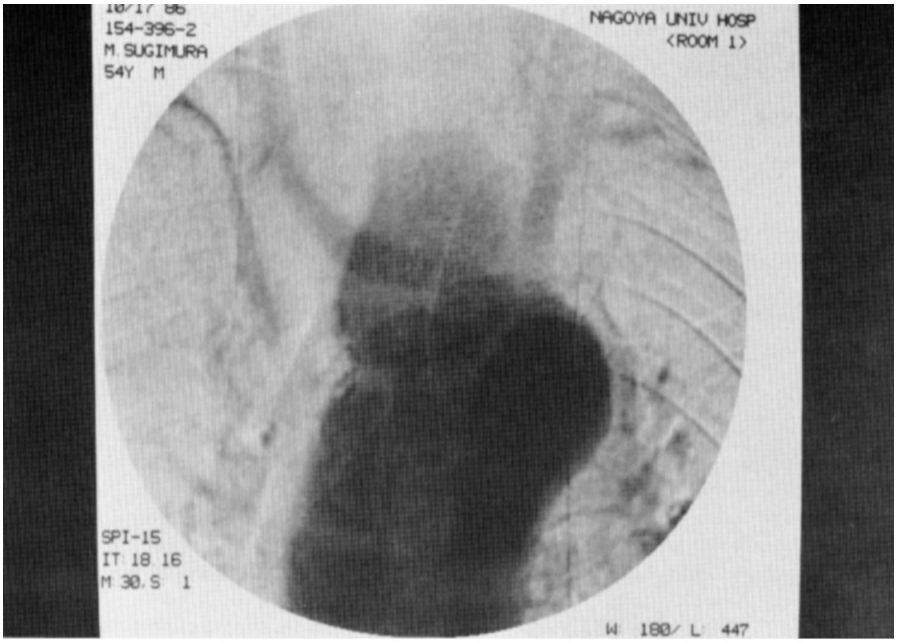

Fig. 1. DSA picture indicates the aneurysm which originated from the ascending aorta.

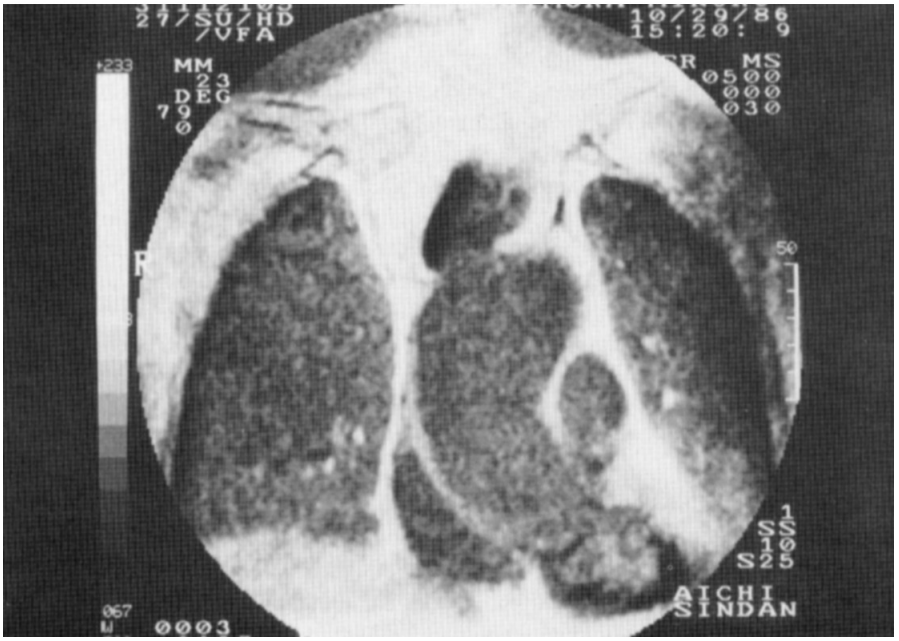

Fig. 2. The NMR image exhibits the aneurysm protruding over the sternum. The ascending aorta is dilated.

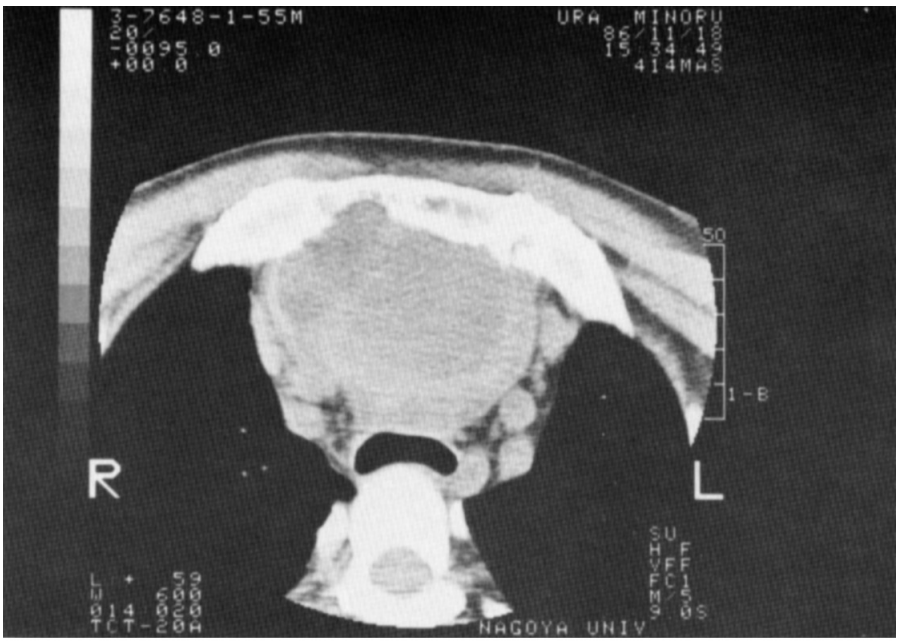

Fig. 3a A CT image of the sternum at the level of the first rib. The aneurysm adheres to the back of the sternum and is destroying it.

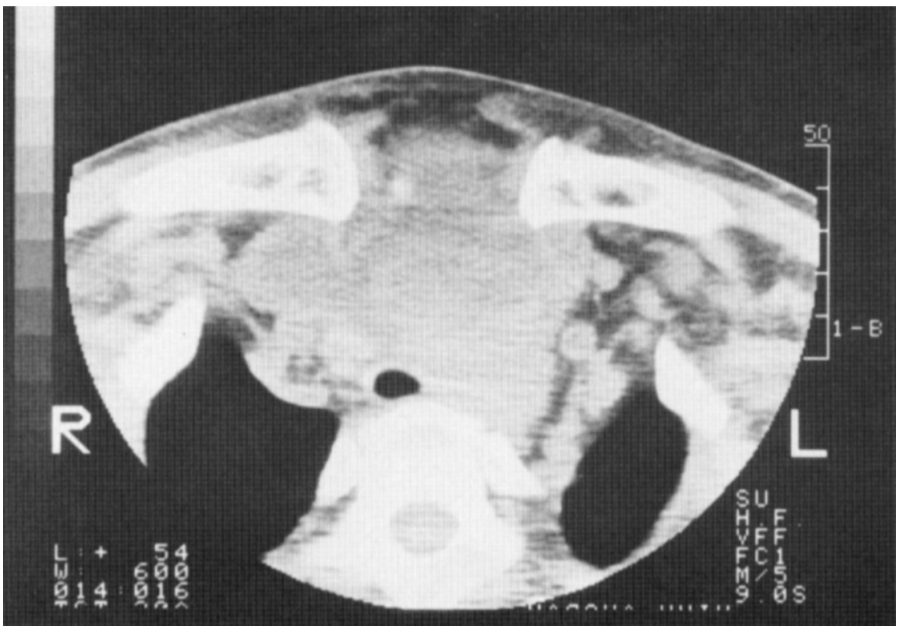

Fig. 3b The trachea is compressed at the level of the clavicle. The sectional area is only about 6 X 10 mm.

Fig. 4. Pulsating mass protruding over the sternum.

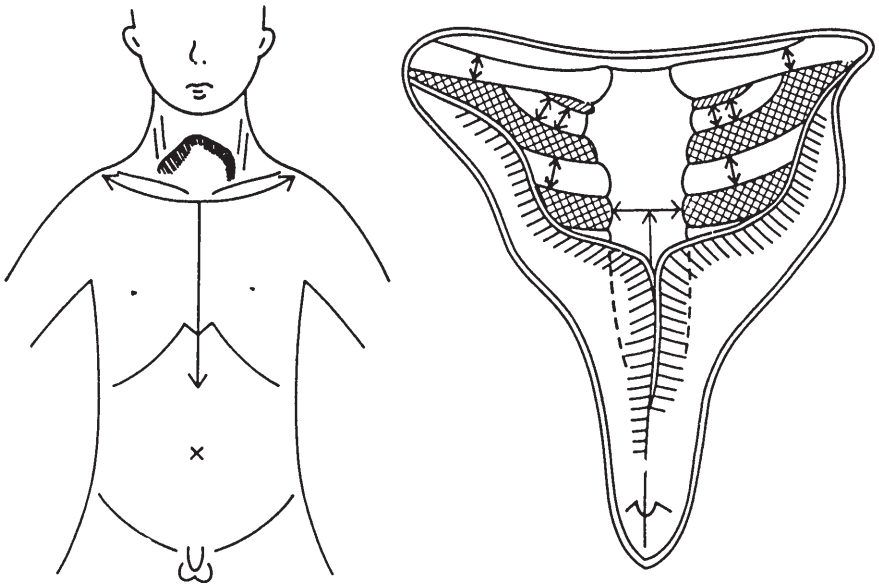

Fig. 5. The schema exhibits the approach to the aneurysm.
Left : A Y-shaped skin incision was made.
Right : Both pectoralis majors were peeled as far as the third costal cartilage region. The sternum was transversed and the vertical incision was made on the lower part. The clavicles, first and second ribs were cut.
: M. perctralis major
: Mn. intercostales externi

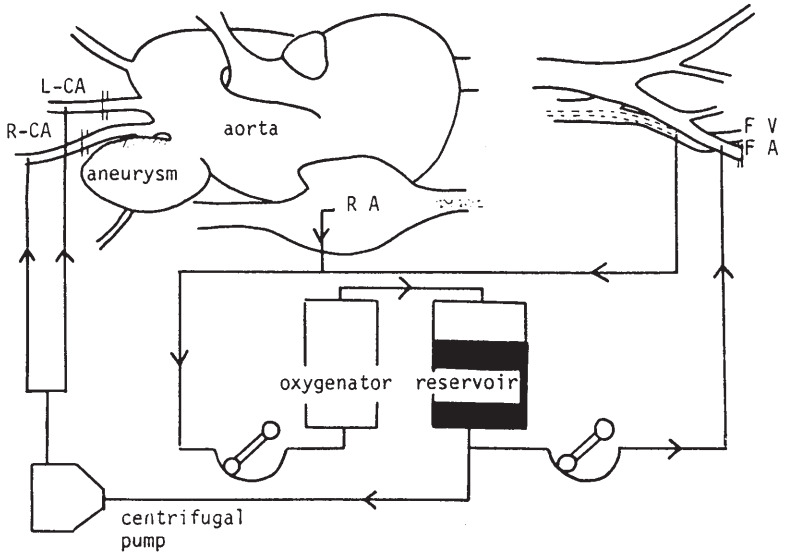

Fig. 6. The schema represents the cardiopulmonary by-pass and isolated brain perfusion with centrifugal pump.
R-CA : a. carotis communis dextra
L-CA : a. carotis communis sinistra
FA : a. femoralis
FV : v. femoralis
RA : right atrium

clavicles and a median incision on the anterior chest. Both pectoralis majors were peeled off from the bilateral clavicles and from the sternum as far as the third costal cartilage region. The clavicles were peeled periosteally and the subclavius muscles were dissected. After dissecting the second intercostal muscles from the sternum, the sternum was transversed. Then a vertical incision was made to the sternum as far as the second rib from the lower part (Fig. 5). When an incision was made in the pericardium, the aorta was found to be enlarged to a diameter of about 6 cm and its wall was thick and rigid. Clavicles and the second ribs on both sides were cut with a wire saw, while the first ribs were cut bit by bit with rongeurs. A 26 Fr. cannula was inserted into the right atrium from the right femoral vein and a femoro-femoral bypass was started. Brain perfusion was performed by using a centrifugal pump to send blood to both carotid arteries. After a venting cannula was set in the main pulmonary artery, another cannula for blood removal from the right atrium was inserted, then deep hypothermia was induced (Fig. 6). When ven-

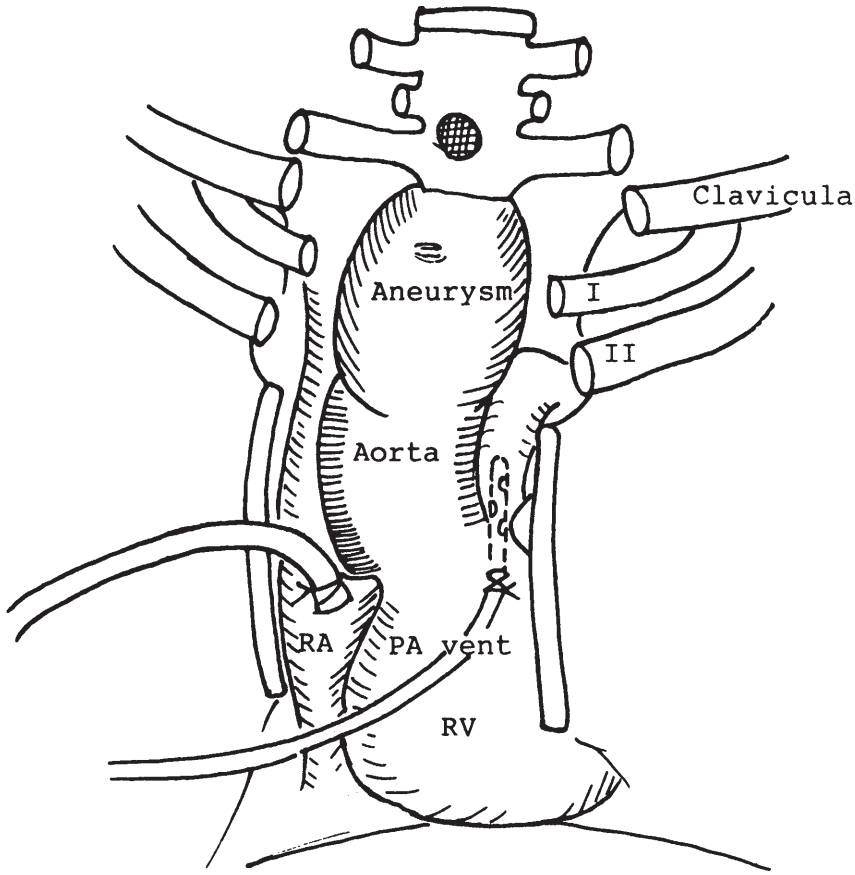

Fig. 7. The schema of the approach to the aneurysm.
The pericardium is opened by making prior median sternal splitting below the eroded region and separating the medial portion of the clavicles, and the first and second costal cartilages on both sides of the sternum. The upper half of the destroyed sternum was dissected from the aneurysm under a F-F bypass and isolated brain perfusion, and with a venting cannula and cardioplegic circuit in place.
▨: the most eroded portion of the sternum

tricular fibrillation began, the upper half of the sternum was raised upward, and dissection between the sternum and the aneurysm was started. There was bleeding from the eroded sternal region when it was flipped up (Fig. 7). After the aortic cross clamping, oxygenated glucose-insulin-potassium (GIK) solution was injected into the ascending aorta to obtain the cardioplegia. The entrance to the aneurysm was searched for and found, and a deposit of calcium was noticed by palpation along the margin of the aneurysmal neck. A 33 mm occlusion ballooon catheter was then inserted into the descending aorta from the neck, and patch closure with prosthetic graft was performed safely. The nasopharyngeal temperature was as low as 21.6°C. Isolated brain perfusion time was 108 min; there was no neurologic deficit. The cardioplegic time was 51 min, and the F-F by-pass time was 188 min. The postoperative course was good and uneventful. The pathological specimen showed a false aneurysm. Sixteen months after the operation, the patient has no signs or symptoms of recurrence.

COMMENT

It is well known that an aneurysm of the aorta of the thoracic region has a tendency to destroy the sternum or vertebra (1, 2). When an aneurysm adheres to or erodes the sternum, the most important problem is how to approach it. There are many reports of incisions into the cervical region continuing to a vertical splitting of the sternum and severing of the unilateral clavicle for the treatment of injuries of the aortic arch, or including the three branches of the aortic region, and for false aneurysm operations (3, 4, 5, 6, 7, 8). One study reports using the sterno-clavicular flap for trauma to the subclavian vessel (9). In our case, the destruction of the sternum was advanced and the neck of the aneurysm was large. Calcium deposits were found around the entrance by preoperative study and it was believed to be dangerous to clamp the aortic wall with a side clamp. We therefore used the occlusion balloon catheter for a bloodless operative field. Isolated brain perfusion was necessary to operate safely in the present case. In our hospital, the profond hypothermia as low as 20°C (10) are used in the cases of aneurysm of the aortic arch for protecting the brain and the myocardium routinely. We have encountered no neurological problems. The major points in the present method, which we believe is superior to those methods in which a vertical incision is made in the sternum after circulatory arrest is conducted under hypothermia, are summarized as follows:

1) By performing extracorporeal circulation and brain perfusion beforehand, and by dissecting the destroyed region of the sternum and the region of the tumor, it is possible to deal with the next step safely even if serious bleeding occurs during dissection.
2) An important problem in the past methods was the time required for setting of the myocardial protection measures, if needed. With our method, the base region of the aorta is exposed before dissecting the crucial point. Taping, insertion of a venting cannula and insertion of an additional cannula in the right atrium are possible when blood flow is insufficient in the F-F by-pass.

We believe that this new approach is preferable to the severe erosion of the sternum by the aneurysm.

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