Title	Treatment of Co-existing Thoracic and Abdominal Aneurysms Using the Flow Reversal and Thromboexclusion Method : Case report
Author(s)	MINAMI, KAZUAKI; TATSUTA, NORIKAZU; KONISHI, YUTAKA; MATSUDA, KATSUHIKO; SHIMADA, ICHIRO; FIJITA, SHIRO; KITAO, YOSHIMI; FUJITA, TAKUJI; HIROSE, HIKARU; NISHIWAKI, NOBORU; YAMASATO, ARIO; MORI. KEIICHIRO; KUMADA, KAORU; HIKASA, YORINORI
Citation	日本外科宝函 (1983), 52(6): 870-878
Issue Date	1983-11-01
URL	http://hdl.handle.net/2433/208893
Right	
Type	Departmental Bulletin Paper
Textversion	publisher

Arch Jpn Chir 52(6), 870～878, Nov. 1983

Treatment of Co-existing Thoracic and Abdominal Aneurysms Using the Flow Reversal and Thromboexclusion Method: Case Report

Kazuaki Minami, Norikazu Tatsuta, Yutaka Konishi, Katsuhiko Matsuda, Ichiro Shimada, Shiro Fujita, Yoshimi Kitao, Takuji Fujita, Hikaru Hirose, Noboru Nishiwaki, Ario Yamasato, Keiichiro Mori, Kaoru Kumada and Yorinori Hikasa

The 2nd Department of Surgery, Faculty of Medicine, Kyoto University
(Director: Prof. Dr. Yorinori Hikasa)
Received for Publication, Sept. 1, 1983.

Introduction

Carpentier et al. developed a new method for dissecting aneurysms, i.e. flow reversal and thromboexclusion, to overcome the most frequent complications such as bleeding, suture line dehiscence, recurrent dissection, rupture, and ischemia. The principle of this method involves reversing the flow in the dissected aorta and producing subsequent thrombosis and exclusion of the lesion.

We operated upon a patient with co-existing thoracic and abdominal aneurysms which were not dissected or sclerotic using this method. This paper describes the results with some discussion.

Case Report

The patient, a 66-year-old male, was found to have an abnormal shadow lateral to the left border of the cardiac shadow and slight hypertension upon routine physical examination in June, 1981. He subsequently consulted a local doctor who detected a pulsating abnormal mass. Despite administration of hypotensor, the abnormal shadow on chest roentgenogram gradually became enlarged and he was referred to our hospital.

On June 23, 1982, cardiac catheterization (Table 1) and aortography confirmed the diagnosis of co-existing thoracic and abdominal aneurysms (Figs. 1 and 2). The abdominal aneurysm (Fig. 2) was larger than the one in the descending aorta (Fig. 1), with a great possibility of rupture.

On July 16, 1982, he underwent aneurysmectomy and reconstruction of the abdominal aorta with a Cooley's double velour Y-shaped graft (16×8 mm). The abdominal aneurysm was 10 cm

Key words: Co-existing thoracic and abdominal aneurysms, Flow reversal, Thromboexclusion, Permanent aortic clamping, Extra-anatomic bypass.
索引語：胸・腹部大動脈瘤，血流逆行，血栓性閉塞，永久的大動脈遮断，非解剖学的バイパス．
Present address: The 2nd Department of Surgery, Faculty of Medicine, Kyoto University, Sakyo-ku, Kyoto 606, Japan.

Table 1. Cardiac catheterization data

sites	Pressures (mmHg)		
	syst.	diast. (ed)	mean
PC wedge			21
r-PA	42	17	23
m-PA	39	18	25
RVout	40	6 (14)	
Ao asc	219	123	159
LV	227	0 (24)	

Cardiac Output 5.88 L/min
Cardiac Index 3.57 L/min/M²

syst.: systole, diast.: diastole, ed: end-diastole, PC wedge: pulmonary capillary wedge, r-PA: right pulmonary artery, m-PA: main pulmonary artery, RVout: right ventricle outflow tract, Ao asc: ascending aorta, LV: left ventricle

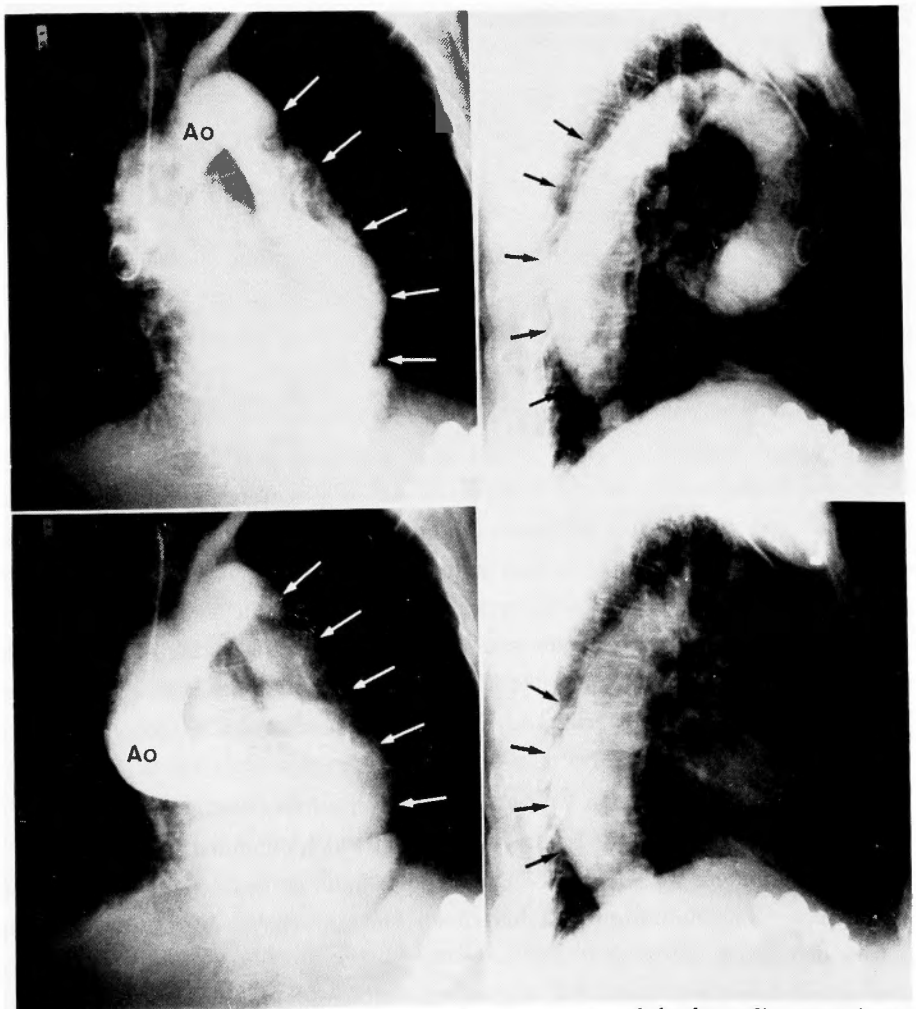

Fig. 1. Preoperative aortography showing a sclerotic aneurysm of the descending aorta (arrows) Ao: aorta

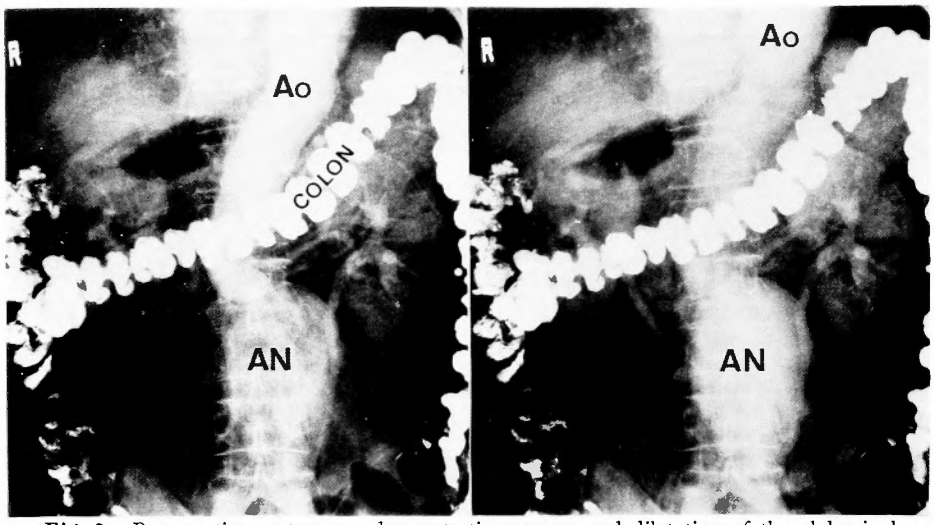

Fig. 2. Preoperative aortograms demonstrating aneurysmal dilatation of the abdominal aorta
The lesion extends from just below the level of the renal arteries to common iliac arteries.
Ao: aorta, AN: aneurysmal dilatation.

in length, with a diameter of 7 cm. The aneurysmal dilatation extended from the abdominal aorta just below the renal arteries to the bifurcation of the common iliac artery with two renal arteries on both sides.

The patient's postoperative course was uneventful and he was discharged on August 24, 1982.

On April 4, 1983, he was readmitted in order to undergo an operation for the thoracic aneurysm of the descending aorta. The chest roentgenography revealed an enlarged abnormal shadow compared to that seen 6 months earlier (Fig. 3). CT scan revealed calcification over the entire aortic wall and aneurysmal dilatation of the descending aorta which was not dissected (Fig. 4). However, the size of the aorta was within normal limits. Radioisotope (RI) angiography confirmed the findings from CT scan and aortography. In the treatment of the aortic aneurysm of this patient, difficulties were encountered due to the patient's age and reduced respiratory function (%VC or 83.5 and %FEV 1.0 of 73.3%). Therefore, we decided to adopt Carpentier's procedure, i.e. flow reversal and thromboexclusion, as this approach minimizes surgical damage.

On April 11, 1983, an operation was performed after surface cooling had lowered the esophageal temperature to 31°C. A single median incision which extended from suprasternal fossa to 5 cm below the umbilicus was made. The triangular ligament was divided so as to reflect the left lobe of the liver. The diaphragm was then divided towards the aortic hiatus and the right and left crura were separated.

The retroperitoneum was divided to expose the abdominal aorta (32–36 mm in diameter) proximal to the celiac trunk. As the aortic wall was neither calcified nor aneurysmal, we selected

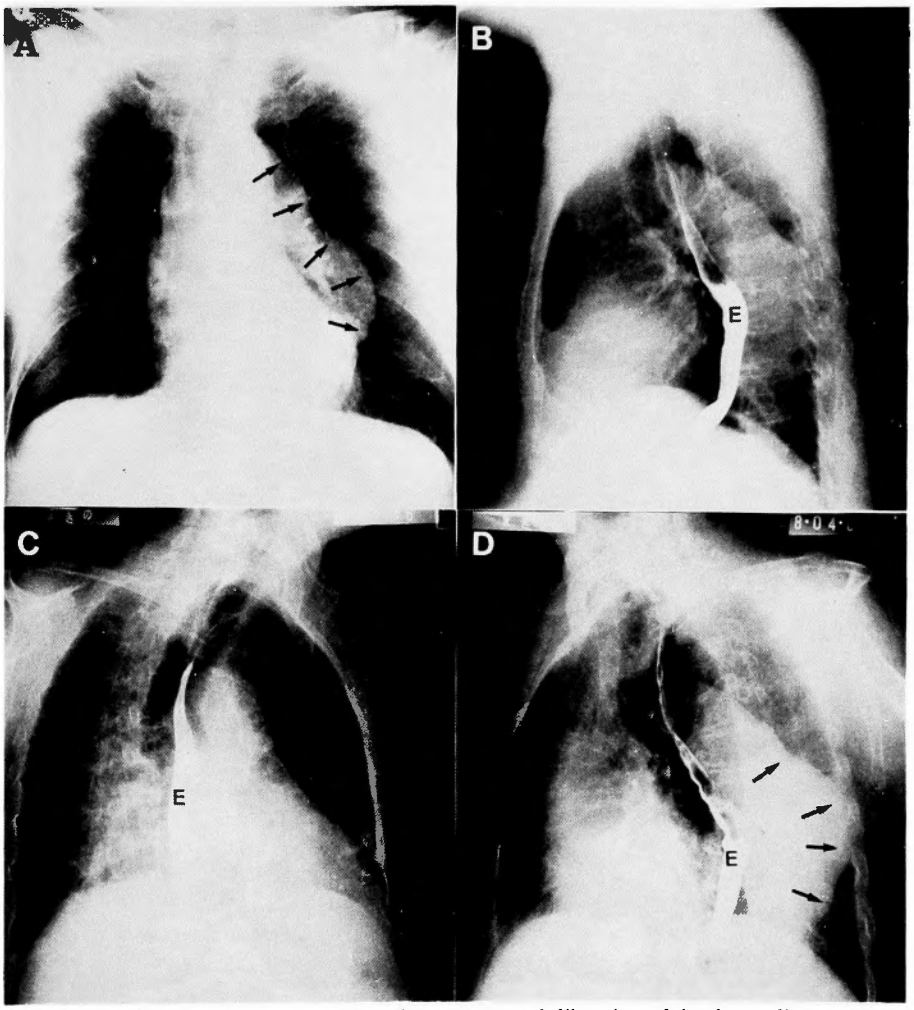

Fig. 3. Chest roentgenograms showing aneurysmal dilatation of the descending aorta (arrows)
E: esophagus.

the aorta just above the celiac trunk as the site for anastomosis. The abdominal aorta was partially clamped with Cooley's aortic forceps and then anastomosed side-to-end using a woven Dacron graft (20 mm in diameter). The graft started from the anastomosis of ascending aorta, turned downwards to the right side of the atrium, ran horizontally along the diaphragm, penetrated the diaphragm parallel to the aorta and ended at the anastomosis of abdominal aorta. The total length of the graft was 40 cm. The other end of the graft was cut obliquely and anastomosed side-to-end to the partially clamped ascending aorta. The intima of the ascending aortic wall was smooth and not aneurysmal.

Elongation of the thoracic descending aorta resulted in right deviation of the aorta distal to the left subclavian artery. Therefore, this anatomical deviation to the right permitted the descending aorta to be clamped distal to left subclavian artery without making additional incisions

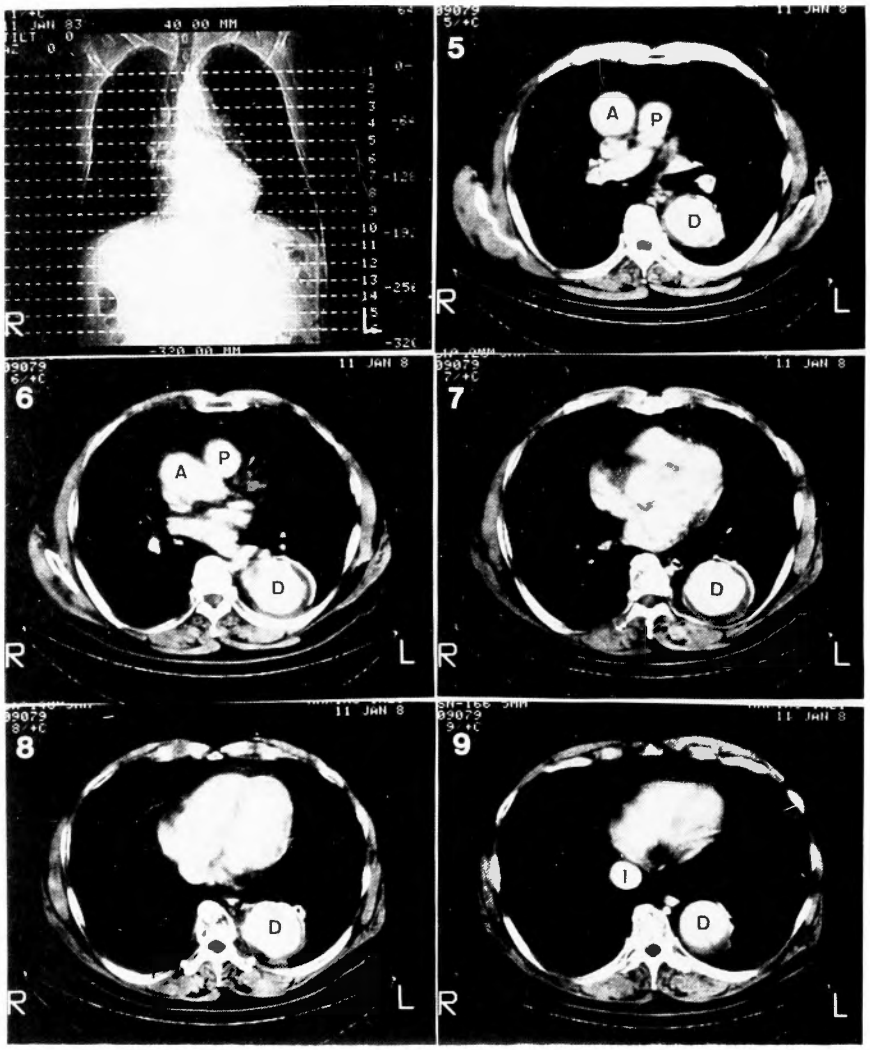

Fig. 4. Preoperative CT scan showing arteriosclerotic dilatation of the descending aorta
A: ascending aorta, P: pulmonary artery, D: descending aorta, I: inferior vena cava, No.: slice No

or changing the patient's position. The aortic arch and the thoracic descending aorta distal to left subclavian artery were adequately exposed. The root of the descending aorta was 30 mm in diameter and appeared normal. The permanent metalic aortic clamp (Matsuda Ika Kogyo Co., LTD., Japan) used in this operation was 5 cm long and covered with Teflon felt. Prior to clamping, the blood pressure was reduced to 80 mmHg in order to avoid possible rupture of the aorta. The clamp was gradually tightened until no thrill was palpable on the aortic wall distal to the clamp. Care was taken to preserve the left phrenic and recurrent laryngeal nerves. The screws and hinge at the ends of the clamp were covered with Teflon protectors.

During the operation, atrial fibrillation occurred two times, which necessitated defibrillation. Splenectomy was performed due to damage to the surface of the spleen.

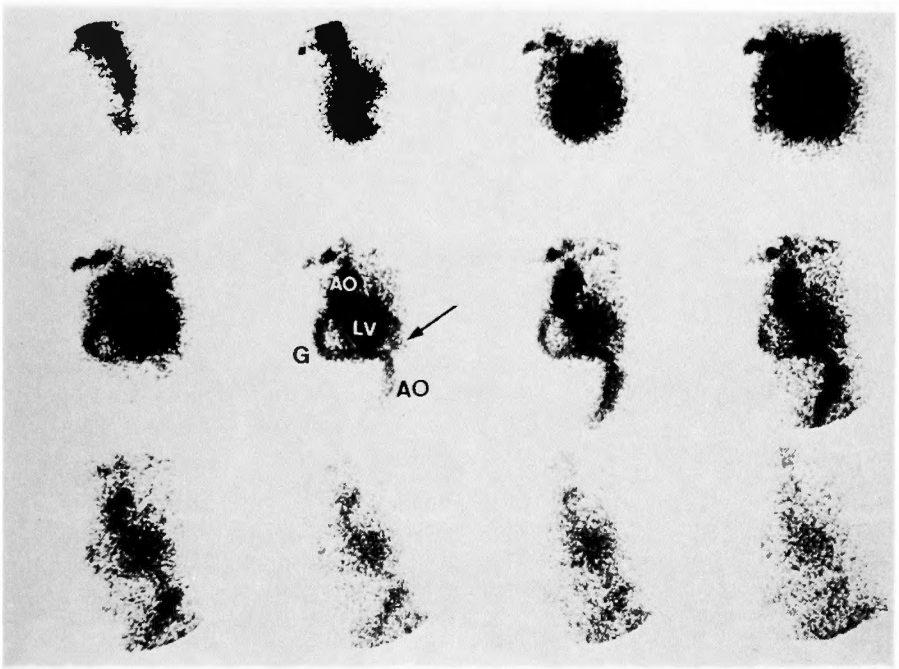

Fig. 5. Postoperative RI angiograms (Technetium 99 m labeled red cell used) recorded 17 days postoperatively reveal thromboexclusion of the lower two-thirds of the thoracic descending aorta. Arrow shows the portion of the aorta that is not yet thromboexcluded.
Ao: aorta, LV: left ventricle, G: graft

The postoperative course was relatively smooth. Ten days postoperatively 450 ml of bloody pleural effusion was suctioned. Hoarseness remained, perhaps resulting from inadvertent clamping of the left recurrent laryngeal nerve.

RI angiography performed 17 days postoperatively revealed thromboexclusion of the lower two-thirds of the thoracic descending aorta (Fig. 5). Thromboexclusion throughout the entire thoracic descending aorta was confirmed 1 month postoperatively by CT scan (Fig. 6) and two months later by angiography (Fig. 7). At three months, pulsation of lower extremity was satisfactory and there were no signs of paraplegia.

Discussion

The so-called extra-anatomic bypass method, first developed by BLAISDELL and HALL[1] in 1963, is a long bypass between the axillar artery and femoral artery. Recently, SHUMAKER et al.[6] (1968) and COOLEY et al.[3] (1976) developed a bypass between the ascending aorta and abdominal aorta, which has been performed in order to decrease stenosis of the descending aorta. This method has some advantages for patients in whom surgery would prove dangerous, because of infection or possible rupturing of the aneurysm.

CARPENTIER et al.[2] reported clinical and experimental studies in which complete thromboexclusion in the remaining semiclosed dissecting aneurysm of the aorta developed following

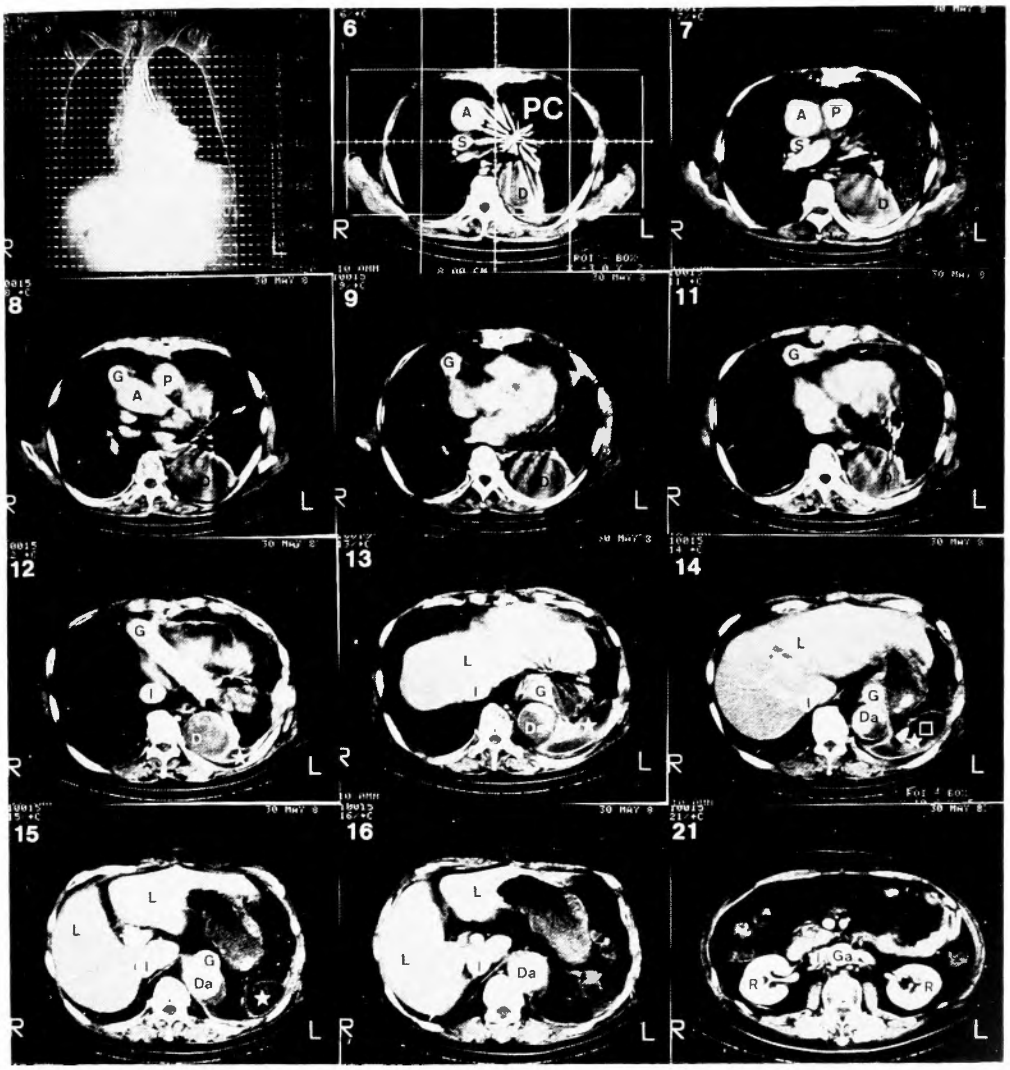

Fig. 6. Postoperative CT scan recorded 27 days postoperatively shows the thromboexclusion of the entire thoracic descending aorta. Thin mural thrombosis is found at the portion of the abdominal aorta just before the anastomosis between the graft and abdominal aorta. Fluid accumulation with thick wall is found lateral to the descending aorta near the diaphragm (stars in Slice No. 12-15); it may be lobulated pleural effusion.
Ao: ascending aorta, S: superior vena cava, D: descending aorta, P: pulmonary artery, G: graft, Da: abdominal aorta, I: inferior vena cava, L: liver, R: kidney, PC: permanent clamp, Da: abdominal aorta (graft)

permanent clamping. Slow growing thrombus in the long segment of the descending aorta might result in restoration of blood flow to the spinal cord and thus prevention of lower body paraplegia.

However, as complete thrombosis in the semiclosed aorta does not developed in all cases, rupture of the aorta may occur postoperatively. Furthermore, the force needed to close the

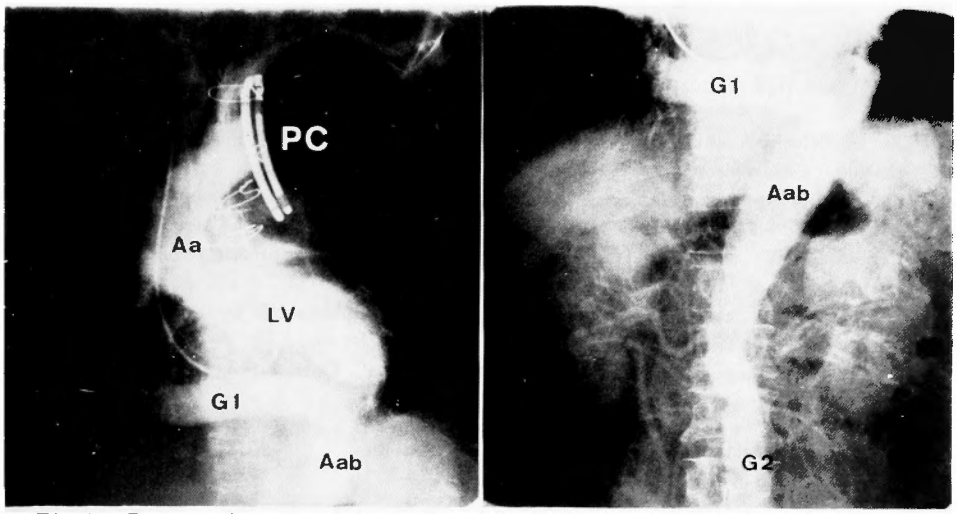

Fig. 7. Postoperative aortography performed 2 months postoperatively shows thromboexclusion throughout the entire thoracic descending aorta.
PC: permanent clamp, Aa: ascending aorta, LV: left ventricle, G1: graft, Aab: abdominal aorta, G2: abdominal graft

aorta with a permanent clamp is also a problem. Extensive strong closure of the aorta might result in rupture due to compression necrosis. Incomplete closure of the aorta might prevent thrombosis formation. KONO et al.[4] emphasized that thrombosis in the semiclosed aorta depends on the blood flow rate into the intercostal arteries; a high flow rate does not allow thrombosis formation. However, we encountered thrombosis in the long-segment of the stenotic descending aorta resulting from aortitis syndrome 22 days postoperatively following left ventricular apico-abdominal aorta bypass[5]. In aortitis syndrome, the low blood flow rate into the intercostal arteries, of which osti are stenotic or occlusive, and the absence of a postoperative pressure gradient between upper and lower portions of the body might provide a favorable condition for developing thrombosis.

In the cases with stenotic lesion such as in aortitis syndrome, infection, rupture and dissecting aneurysm of the descending aorta, this method is useful and good results can be expected.

Summary

Aneurysm of the descending aorta was successfully treated in a 66-year-old male with co-existing thoracic and abdominal aneurysms using the flow reversal and thromboexclusion method (Carpentier's method), 8 months after graft replacement of the abdominal aneurysmal aorta.

After discharge his postoperative course was uneventful. Despite the problems arising from aortic cross-clamping using a metalic clamp, this method appears to be suitable for patients with stenotic lesions such as in aortitis syndrome, infection, rupture and dissecting aneurysm of the descending aorta.

References

1) Blaisdell FW and Hall AD: Axillofemoral artery bypass for lower extremity ischemia. Surgery **54**: 563–568, 1963.
2) Carpentier A, Deloche A, et al: New surgical approach to aortic dissection; Flow reversal and thromboexclusion. J Thorac Cardiovasc Surg **81**: 659–668, 1981.
3) Cooley DA, Nappi G, et al: One stage repair of multiple lesions of the left ventricle and aorta. Cardiovascular disease, Bull Texas Heart Inst **3**: 289, 1976.
4) Kono N and Shioiri Y: Application of permanent extraanatomic bypass procedure for treatment of dissecting and thoracic aneurysm. IRYO **36**: 778–783, 1982.
5) Minami K, Tatsuta N, et al: Aortitis syndrome treated by apico-aortic bypass procedure: Case report. Arch Jpn Chir **52**: 244–255, 1983.
6) Shumacker HB Jr, King H, et al: Coarctation of the aorta. Curr. Probl. Surg., p. 16–48, Grune, New York, 1968.

和文抄録

胸・腹部大動脈瘤の外科治療
—Carpentier 法を用いた一治験例—

京都大学外科学教室第2講座（主任：日笠頼則教授）
南 一明，龍田 憲和，小西 裕，松田 捷彦，嶋田 一郎
藤田 士朗，北尾 義実，藤田 琢史，広瀬 光
西脇 登，山里 有男，森 敬一郎
熊田 馨，日笠 頼則

症例は66才男子で，動脈硬化性胸・腹部大動脈瘤に対し，二期的治療を行なった．

はじめに，腹部大動脈瘤に対し，腎動脈分枝部末梢側から総腸骨動脈まで，Y型人工血管で置換した．それから8カ月後，胸部下行大動脈瘤に対し，Carpentier らの Thromboexclusion 法，つまり上行大動脈と上腹部大動脈間のバイパス作製および胸部下行大動脈基部での永久的大動脈遮断を施行した．術後17日目のRI 血管造影で，胸部下行大動脈の中枢側2/3が血栓で閉塞され，術後1カ月の CT scan および術後2カ月後の血管造影で全胸部下行大動脈の血栓閉塞が認められた．対麻痺は発生しなかった．

本法は，解離性大動脈瘤の他に，感染や再々手術などのため開胸が出来ない場合，および本症のように高年令者の広範囲大動脈瘤に対しても有用で効果的手術法と考える．