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Symposium on
Clinical Study on Vessel Surgery

Chairman : Prof. S. Kimoto

- 1) Surgical Treatment of Arterial Diseases in Extremity
- 2) Surgery of Small Blood Vessel
- 3) Surgery of Aorta
- 4) Graft Replacement in Venous System

1. Surgical Treatment of Arterial Diseases in Extremity[†]

KOICHI ISHIKAWA

[Department of Surgery, University of Tokyo, School of Medicine, Tokyo]

Indication of the vascular operations is discussed from the clinical experience of over five hundred cases of the arterial disorders in extremities.

1. OPERATIVE INJURIES OF THE ARTERIAL WALLS (Figure 1).

Intimal defects produced by operative injuries of the arterial walls are at first covered with blood clot and fibrin. The clot and the fibrin are then organized by granulation tissue, and the latter is then replaced by fibrous tissue and covered with endothelium, and finally changes to the pseudo-intima. During the course of the pseudo-intima formation there usually exists possibility of thrombotic occlusion.

The possibility becomes higher, if the diameter of the artery is small, if the extent of the intimal damage is wide, if the degeneration of the arterial wall is severe, if the blood pressure is low, if the blood flow is slow and if the artery is compressed from outside.

Because blood in the synthetic grafts easily clots when the blood flow in them becomes slow, postoperative thrombosis may occur more frequently in them than in other arterial operations. In arterial operations in extremity, use of the saphenous vein autograft is safer than that of the synthetic graft. Many surgeons prefer to use the suture apparatus of blood vessels in operations of organ transplantation or of organ transposition, whereas few surgeons use it in operation of arterial diseases. Microsurgery with the microscope is still limited in use.

2. ARTERIAL DISEASES IN EXTREMITY

Arterial surgery, especially arterial reconstruction, is indicated in the following conditions:

- a) strictures and occlusions of arteries caused by traumas, inflammations, atherosclerosis or compression from the outside of their walls,
- b) aneurysmal dilatations caused by traumas and atherosclerosis, and
- c) arteriovenous malformations and traumas. (Table I).

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Because arterial and arterio-venous aneurysm always grow until they rupture, all of them should be removed and discontinuity of arteries thereafter should be repaired with vascular grafts. Occlusions and strictures of the stem arteries may produce marked ischemic states in the peripheral tissues, and especially acute occlusions of them often cause widespread necrosis of the limbs.

Therefore, the occluded arteries should be reconstructed by means of thrombectomy, embolectomy, by-pass graft or decompression.

3. ARTERIAL INJURIES

Reconstruction of injured arteries is frequently more easily performed than that of diseased arteries, because neighboring parts of the arterial walls are usually healthy. Lacerations, contusions and stab wounds of stem arteries could be repaired.

Pulsating hematomas and traumatic arterial thrombosis should also be repaired. In the world there have been at least five cases in which re-suture of the amputated limbs was successfully performed.

Fig. 1.

(Example 1): 21M. Contusion of the right thigh by a rollershovel. Fracture of the femur, division of the femoral vessels, and laceration of the soft tissues. The femoral artery was repaired by anastomosis using a saphenous autograft, the femoral vein was anastomosed end-to-end, and the fracture of the femur was fixed with an intramedullary nail.

(Example 2): 19M. Autoaccident. His lower abdomen was run over. The intimal layer of the bifurcation of the abdominal aorta was cut off and the right common iliac artery was occluded by a thrombus and by intimal invagination. These were repaired by grafting of a Dacron graft.

4. ANEURYSM

The traumatic aneurysm often occur in the upper limbs, whereas the arteriosclerotic aneurysm frequently occur in the abdominal aorta and sometimes occur in the popliteal artery. These aneurysmal sacks should be removed. Kinking of the stem arteries may be sometimes repaired by their shortening.

(Example 3), 23M. A traumatic saccular aneurysm of the right radial artery appeared one month after a stab wound caused by a glass fragment. The sack was removed and saphenous autografting was performed.

(Example 4): 57M. Claudication in the right leg. A saccular atherosclerotic aneurysm of the right popliteal artery. Resection and grafting of a Dacron prosthesis.

5. ARTERIO-VEINUS ANEURYSM

Traumatic arterio-venous aneurysm may often occur in the brachial and in the femoral arteries. The fistulas and the aneurysmal sack should be removed, because rupture of sack or high output cardiac failure follow frequently.

(Example 5): 64M. A stab wound by a glass fragment in the right axilla in age 24. The fragment was removed in age 30. Since then, severe machinery thrill and engorgement of the superficial veins appeared in the right upperarm. Palpitation and shortness of breath occurred by going upstairs. The heart enlarged to both sides. The NICOLADONI-BRANHUM's sign is positive.

6. CONGENITAL ARTERIO-VEINUS ANEURYSM are usually difficult to treat, because there

always numberless fine anastomoses between arteries and veins.

(Example 6): 15F. A hemangioma in the left back since childhood. A fist size mass gradually appeared in the left infraclavicular region, which caused marked thrill and severe engorgement of veins of the left upperarm. Serial angiograms showed an arterio-venous hemangioma which had multiple communications with the subclavian and the intercostal vessels. The hemangioma was resected.

(Example 7): 27F. A small hemangioma on the left forefoot since childhood. Ulceration and massive bleeding occurred from there in age of 27. Arteriograms showed fine multiple arterio-venous fistulas between the dorsalis pedis vessels and the hemangioma. An excision of the engorged vessels failed to heal the ulcer. Then the PIROGOFF's amputation was performed.

7. ACUTE ARTERIAL OCCLUSIONS

Emboli of the peripheral arteries are usually easy to be removed successfully. The result of thrombectomies is not so good as that of embolectomies, because acute arterial thrombosis frequently occurs in the atherosclerotic arteries.

(Example 8): 17M. Nephrosis since 15 year of age. Acute thrombosis of the bifurcation of the abdominal aorta. Thrombosis was presumably induced by acute hemoconcentration. A thrombectomy was successfully performed six hours after the occlusion.

(Example 9): 71M. Auricular fibrillation since 51 year of age. Acute embolism in the right popliteal bifurcation. A 2 cm long embolus was successfully removed after ten hours.

8. CHRONIC ARTERIAL OCCLUSIONS

Chronic occlusions of peripheral arteries occur very frequently, and often cause spontaneous gangrene of toes and fingers or intermittent claudication in lower limbs for long period. Thromboendarterectomy and by-pass grafting of synthetic prostheses are methods of choice in the aorto-iliac thrombosis, whereas by-pass and patch grafting of saphenous veins are preferable in reconstruction of femoro-popliteal occlusions. Arteriosclerotic occlusions are often easy to be removed, because they often involve the aorto-iliac or the femoro-popliteal arteries, and these vessels are used to show intact medial

coats and circumscribed intimal thickening. Among 923 occluded arteries in our cases occlusions in 444 were in below knees and 169 were in below elbows. Histology of the 30 amputated limbs and the 15 operative specimens revealed severe degeneration of arterial walls and extreme narrowing of arterial diameters. Most of these were difficult to repair. In five cases arterial occlusions occurred during the courses of systemic angiitis.

(Example 10): 56M. Claudication of the both lower limbs since age of 54. An atherosclerotic occlusion was found in the bifurcation of the abdominal aorta which was repaired by thromboendarterectomy successfully.

9. COMPRESSIONS OF ARTERIES FROM OUTSIDE.

a) Stem arteries should sometimes be resected for radical operation of malignant lesions.

(Example 11): 22F. Recurrence of fibrosarcoma in the left adductor muscles. The muscles including the superficial femoral vessels were completely removed and the defect of the femoral artery was replaced with a Dacron graft.

b) In 16 cases of the neurovascular compression syndrome of the upper extremity, modes of arterial compression were detected by means of the digital plethysmography. Resections of the cervical rib, of the scalenus anticus muscle, of the first rib, of the pectoralis muscle, or of the clavicle were performed successfully in five cases, respectively.

c) A case of the cystic adventitial disease of the popliteal artery was successfully treated by removal of the cystic wall.

(Example 12): 32M. Claudication of the

right leg for 2 years. The right dorsalis pedis pulse frequently disappeared during the flexion of the right knee joint and directly after walking. Arteriograms showed a segmental arched narrowing of the right popliteal artery. A doughnut-like adventitial cyst surrounded the popliteal artery and constricted its lumen.

The content of the cyst was gelatinous. After complete removal of the cyst the arterial lumen became normal in size.

CONCLUSION: The natural courses of the arterial diseases add the indication of the arterial reconstruction are represented on the Table I. from our experience of 54 operations (Table II.).

TABLE II

	Limbs		Reconstruction
	Upper	Lower	
<i>Traumatic aneurysm</i>	4	3	7
<i>Congenital A-V-aneurysm</i>	10	7	5
<i>Arterial injury</i>	2	5	7
<i>Acute occlusion</i>	2	12	8
<i>Generalized angiitis</i>	2	4	0
<i>Chronic occlusion</i>	40	215	15
<i>Compression</i>	15	0	11
<i>Adventitial cys</i>		1	1
<i>Total</i>	75	322	54

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2. Surgery of Small Blood Vessel[†]

KIYOSHI INOKUCHI

[Department of Surgery (Director: Prof. K. Inokuchi), Kyushu University School of Medicine, Fukuoka]

The most important aspects of anastomosis are those of maximum safety, accuracy, and speed

regardless of size, type or location of vessels. Sufficiently thin suture material and very fine

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