Vascular Surgery in Japan: 2013 Annual Report by the Japanese Society for Vascular Surgery

The Japanese Society for Vascular Surgery Database Management Committee Member, NCD Vascular Surgery Data Analysis Team

Objectives: This is an annual report indicating the number and early clinical results of annual vascular treatment performed by vascular surgeon in Japan in 2013, as analyzed by database management committee (DBC) members of the JSVS.

Materials and Methods: To survey the current status of vascular treatments performed by vascular surgeons in Japan, the DBC members of the JSVS analyzed the vascular treatment data provided by the National Clinical Database (NCD), including the number of treatments and early results such as operative and in-hospital mortality.

Results: In total 100,470 vascular treatments were registered by 1,045 institutions in 2013. This database is composed of 7 fields including treatment of aneurysms, chronic arterial occlusive disease, acute arterial occlusive disease, vascular injury, complication of previous vascular reconstruction, venous diseases, and other vascular treatments. The number of vascular treatments in each field was 19,439, 13,276, 4,688, 1,563, 1,777, 37,643, and 23,971, respectively. In the field of aneurysm treatment, 16,694 cases of abdominal aortic aneurysm (AAA) including common iliac aneurysm were registered, and 52.9% were treated by endovascular aneurysm repair (EVAR). Among AAA cases, 1,598 (9.6%) cases were registered as ruptured AAA. The operative mortality of ruptured and un-ruptured AAA was 17.9%, and 1.0%, respectively. 25.5% of ruptured AAA were treated by EVAR, and the EVAR ratio was gradually increasing, but the operative mortality of open repair and EVAR for ruptured AAA was 16.1%, and 15.8%, respectively. Regarding chronic arterial occlusive disease, open repair was performed in 7,437 cases, including 1,121 distal bypasses to the crural or pedal artery, whereas endovascular treatment (EVT) were performed in 5,839 cases. The EVT ratio was gradually increased at 44.0%. Venous treatment including 35,986 cases with varicose vein treatments and 506 cases with lower limb deep vein thrombosis were registered. Regarding other vascular operations, 22,572 cases of vascular access operations and 1,185 amputation surgeries were included.

Conclusions: The number of vascular treatments increased since 2011, and the proportion of endovascular procedures increased in almost all field of vascular diseases, especially EVAR for AAA, EVT for chronic arterial occlusive disease, and endovenous laser ablation (EVLA) for varicose veins. (This is a translation of Jpn J Vasc Surg 2019; 28: 273–292.)

Keywords: peripheral arterial disease, stent graft, endovascular treatment, aneurysm, varicose vein treatment

Introduction

After the National Clinical Database (NCD) was founded, registration of surgical cases began in 2011. In light of this, the Japanese Society for Vascular Surgery (JSVS) summarized data pertaining to vascular surgery and published the results as annual reports. This is the JSVS’s 2013 annual report, describing summarized data and the analysis results of vascular surgery cases registered in the NCD between January and December 2013. The summary and analysis were performed by members of the JSVS Database Management Committee.

Methods

Vascular surgery cases were identified from surgery cases registered in the NCD in 2013 at the request of the JSVS, which is a member society of the NCD. Members of the JSVS Database Management Committee reviewed and analyzed the extracted cases. Vascular surgery cases registered in the NCD in 2013 fell into the following seven categories: (1) revascularization for aneurysms, (2) revascularization for chronic arterial occlusion, (3) revascularization for acute arterial occlusion, (4) treatment for vascular trauma, (5) surgery for complications after re-
vascularization, (6) venous surgery, and (7) other vascular diseases and related surgery. The cases in each category were summarized based on different criteria such as treatment procedures, causal factors, operative death, in-hospital death, and materials used. An operative death was defined as death occurring within 30 days after surgery; the number of operative deaths included all cases of death regardless of the cause or whether the patient was hospitalized, as long as it occurred within 30 days after surgery. An in-hospital death was defined as death occurring at any time during the same hospital stay as the surgery.

Some discrepancies were found in the numerical values presented in tables. For example, cases with different causal factors or those with different materials used did not always add up to the total number of cases included. The JSVS Database Management Committee and NCD thoroughly investigated the issue and concluded that the discrepancies were attributable to the following four reasons: (1) making multiple choices was permitted, (2) making no choices (leaving a blank space) was permitted, (3) data entry errors (incorrect input or omission) by the data entry operator, and (4) instances of multiple materials being used or multiple sites being affected/treated in a single case. Since 2013, various measures have been implemented to minimize the issues, including changing the layout of choices or creating new possible choices to prevent data entry errors and modifying the program to prohibit the registration of cases with blank fields, wherever possible, to prevent omissions.

Table 1 lists the categories/attributes for which the registration or summary method was modified in 2013.

### Data Summary/Analysis Results

In 2013, the total number of vascular surgery cases registered in the NCD was 100,470 (an increase of 4.7% over the previous year), exceeding 100,000 cases for the first time. These cases accounted for 7.7% of all the surgical cases registered that year. Further, the number of institutions that registered vascular surgery cases was 1,045, accounting for 30.3% of those that registered any type of surgery cases in the NCD. Of the 1,045 institutions, 434 (41.5%) were cardiovascular surgery training-certified facilities that contributed to data registration in 2013. The summary and analysis results of 2013 data for each category are described below. Statistical analysis was performed using the Chi-squared test, and a level of p<0.05 was considered to indicate statistical significance.
### Table 2-1  Aortic aneurysm

| Region of aortic aneurysm | Cases | Gender | 30-day mortality | Hospital mortality | Ruptured aneurysm | Dissection | Degenerative | Etiology | Inflammatory | Vasculitis | Infected connective tissue disease | Others |
|---------------------------|-------|--------|-------------------|--------------------|-------------------|------------|-------------|----------|--------------|-----------|-------------------------------|--------|
|                           |       | Male   | Female            |                    | Cases | Male   | Female | Cases | Male   | Female | Cases | Male | Female | Cases | Male | Female | Cases |
| Ascending aorta*1)        | 78    | 38     | 40                |                    | 9     | 11     | 5      | 5     | 62     | 67    | 5      | 7     | 0     | 0     | 0     | 2     | 9     |
| Aortic arch*1)            | 396   | 302    | 94                |                    | 13    | 19     | 37     | 6      | 5      | 104   | 350   | 12    | 18    | 4     | 1     | 7     | 16    | 18    |
| Descending thoracic aorta*1) | 423   | 311    | 112               |                    | 15    | 17     | 60     | 9      | 10     | 170   | 355   | 12    | 13    | 5     | 1     | 16    | 20    | 26    |
| Thoracoabdominal aorta*1) | 259   | 195    | 64                |                    | 21    | 30     | 38     | 10     | 13     | 68    | 225   | 16    | 25    | 2     | 1     | 10    | 11    |
| Abdominal aortic aneurysm*2) | 16,694 | 13,813 | 2,881             |                    | 437   | 556    | 1,598  | 286    | 342    | 676   | 15,835 | 401   | 508   | 268   | 15    | 260   | 37    | 279   |
| with renal artery reconstruction | 271 | 226    | 45                |                    | 7     | 10     | 25     | 3      | 4      | 21    | 246   | 7     | 10    | 5     | 0     | 6     | 4     | 10    |
| with renal artery clamping | 1,164 | 996    | 168               |                    | 48    | 64     | 163    | 31     | 38     | 62    | 1,079  | 40    | 55    | 30    | 3     | 22    | 9     | 21    |

*1) These data are not including cases recorded in JCVSD Database in which most cardiac surgeons were entering their cases.
*2) Including common iliac artery aneurysm.
*3) Including both acute and chronic aortic dissection.
*4) Most likely atherosclerosis.
*5) Connective tissue abnormalities such as Marfan syndrome.

### Table 2-1  Aortic aneurysm (continued)

| Region of aortic aneurysm | Treatment procedure | Replacement | Exclusion with bypass | Stent graft | Hybrid*6) | Polyester | ePTFE | Others |
|---------------------------|---------------------|-------------|-----------------------|-------------|-----------|-----------|-------|--------|
|                           |                     | Cases       | Y-graft | T-graft | Cases | Exclusion | Stent | Hybrid | Polyester | ePTFE | Others |
| Ascending aorta*1)        |                     | 1           | 0       | 0       | 0     | 8        | 2     | 61     | 6        | 2     | 2     |
| Aortic arch*1)            |                     | 3           | 0       | 0       | 5     | 210      | 138   | 84     | 60       | 3     | 3     |
| Descending thoracic aorta*1) |                     | 4           | 0       | 0       | 0     | 360      | 28    | 33     | 17       | 2     | 2     |
| Thoracoabdominal aorta*1) |                     | 17          | 0       | 0       | 4     | 138      | 30    | 93     | 17       | 5     | 5     |
| Abdominal aortic aneurysm*2) |                     | 7,376       | 5,695   | 1,093   | 62    | 8,778    | 46    | 7,020  | 319      | 82    | 82    |
| with renal artery reconstruction |                     | 246         | 195     | 35      | 4     | 9        | 7     | 239    | 19       | 6     | 6     |
| with renal artery clamping |                     | 1,137       | 882     | 204     | 8     | 9        | 7     | 1,088  | 45       | 18    | 18    |

*6) Debranch bypass surgery combined with two staged TEVAR is counted as one case of hybrid treatment.
*7) Only for open surgery.
### Table 2-2 Abdominal aortic aneurysm mortality classified by treatment procedures

| Procedure for aneurysm repair | Ruptured aneurysm | Non-ruptured aneurysm |
|-------------------------------|-------------------|-----------------------|
|                               | Cases | 30-day mortality | Hospital mortality | Cases | 30-day mortality | Hospital mortality |
| Replacement                    | 1,102 | 177              | 222               | 6,221 | 61              | 100               |
| Exclusion with bypass          | 15    | 2                | 2                | 47    | 2                | 3                |
| EVAR *8)                      | 408   | 64               | 74               | 8,373 | 63              | 70               |
| Hybrid                        | 4     | 1                | 1                | 87    | 0                | 0                |

*8) EVAR: endovascular aneurysm repair.

### Table 2-3 Peripheral artery aneurysm

| Anatomical area | Cases | Male | Female | 30-day mortality | Hospital mortality | Biology | 30-day mortality | Hospital mortality | Treatment procedure | Graft material for open surgery |
|----------------|-------|------|--------|------------------|--------------------|---------|------------------|--------------------|---------------------|-----------------------------|
| Aortic arch branches |       |      |        |                  |                    |         |                  |                    |                     |                             |
| Carotid         | 17    | 7    | 10     | 0                | 0                  | 8       | 0                | 1                  | 3                   | 5                          |
| Vertebral       | 2     | 1    | 1      | 0                | 0                  | 0       | 0                | 1                  | 0                   | 1                          |
| Subclavian      | 48    | 25   | 23     | 3                | 3                  | 10      | 2                | 2                  | 32                  | 17                         |
| Multiple in arch branches | 0     | 0    | 0      | 0                | 0                  | 0       | 0                | 0                  | 0                   | 0                          |
| Others          | 11    | 5    | 6      | 1                | 0                  | 3       | 0                | 1                  | 4                   | 1                          |
| Upper limb artery |      |      |        |                  |                    |         |                  |                    |                     |                             |
| Axillary        | 22    | 11   | 11     | 0                | 0                  | 3       | 0                | 0                  | 15                  | 2                          |
| Brachial        | 174   | 90   | 84     | 3                | 2                  | 44      | 0                | 0                  | 44                  | 14                         |
| Forearm-hand    | 113   | 63   | 50     | 1                | 4                  | 19      | 0                | 1                  | 27                  | 17                         |
| Others          | 45    | 34   | 11     | 0                | 0                  | 10      | 0                | 0                  | 15                  | 6                          |
| Lower limb artery |      |      |        |                  |                    |         |                  |                    |                     |                             |
| Femoral         | 473   | 357  | 116    | 10               | 16                 | 122     | 5                | 10                 | 204                 | 157                        |
| Popliteal       | 216   | 170  | 46     | 1                | 1                  | 22      | 0                | 1                  | 195                 | 16                         |
| Others          | 90    | 56   | 34     | 0                | 2                  | 5       | 0                | 1                  | 64                  | 5                          |

| Total           | 1,764 | 1,253| 511    | 27               | 41                 | 285     | 13                | 23                 | 1,095               | 15                          |

*9) Including TAO, Takayasu aortitis, collagen disease related vasculitis, Behcet disease, fibromuscular dysplasia.

Abbreviations: Y-graft: Y-shape artificial graft, T-graft: straight artificial graft, Polyester: polyester artificial graft such as Dacron graft, ePTFE: expanded polytetrafluoroethylene graft.
1. Treatment of Aneurysms (Table 2)

1) Thoracic aortic aneurysms

Most cases of surgery for thoracic aortic aneurysms are registered in the Japan Cardiovascular Surgery Database (JCVSD), which is managed by the JCVSD Organization. Among these cases, those performed by vascular surgeons are summarized in this vascular surgery database through the NCD (Table 2). Therefore, at present, cases of surgery for thoracic aortic aneurysms performed in Japan are registered in a fragmented manner, hampering accurate understanding of the overall view. The NCD and JCVSD need to collaborate to find a better way of case registration that facilitates the understanding of the nationwide status of surgery for thoracic aortic aneurysms.

2) Abdominal aortic aneurysms (Table 2-1 and 2-2)

A total of 16,694 cases of surgery for abdominal aortic aneurysms (including common iliac artery aneurysms) were registered in the NCD in 2013, indicating no major change from the 15,745 cases registered in 2012. Among these cases, replacement surgery was performed in 7,376 (44.2%) and stent grafting (endovascular aortic aneurysm repair, EVAR; including hybrid surgery) was performed in 8,824 (52.9%); a major characteristic of the 2013 data is that EVAR cases accounted for more than 50% of the total number of cases of surgery for abdominal aortic aneurysms (47.6% in 2012). Meanwhile, the number of replacement surgery cases decreased by nearly 1,000 compared with the previous year, underlining the effect of the widespread use of EVAR.

Fig. 1 Treatment procedure for non-ruptured and ruptured abdominal aortic aneurysm (AAA). Comparing year 2011 and 2012, proportion of EVAR selection increased especially in rupture case of AAA.

Fig. 2 Early clinical results of non-ruptured AAA in year 2013 comparing with those in year 2011 and 2012. Regarding the statistical difference of mortality rates between open repair (replacement) and EVAR, see main text.

EVAR: endovascular aneurysm repair

Fig. 3 Early clinical results of ruptured AAA in year 2013 comparing with those in year 2011 and 2012. Regarding the statistical difference of mortality rates between open repair (replacement) and EVAR, see main text.

Of the replacement surgery cases, 1,137 (15.4%) required renal artery clamping and 246 (3.3%) required renal artery reconstruction. Given the increasing popularity of EVAR, the number of cases of pararenal abdominal aortic aneurysms requiring renal artery clamping was expected to increase. However, no major change was observed in 2013.

Among cases of ruptured abdominal aortic aneurysms, the percentages of operative deaths and in-hospital deaths after replacement surgery were 1.0% and 1.6%, respectively, and those after EVAR (including special and hybrid procedures) were 0.7% and 0.9%, respectively (not significant for the operative mortality; p < 0.001 for the in-hospital mortality) (Fig. 2). Among cases of replacement surgery, the operative and in-hospital mortality rates were higher in the subgroup requiring renal artery clamping (1.7% and 2.7%) than in the subgroup not requiring renal artery clamping; the rates were similar in a subgroup requiring renal artery reconstruction.

The number of cases of surgery for ruptured abdominal aortic aneurysms was 1,598. Among these cases, the operative and in-hospital mortality rates were 17.9% and 21.4%, respectively, which were similar to those recorded in 2012. EVAR was performed in 412 cases (25.5%) in 2013, showing that it was continuously used for treatment in an increased proportion of cases with rupture (14% in 2011 and 20% in 2012). Notably, the operative and in-hospital mortality rates after EVAR for ruptured cases increased from 11.9% and 14.8% to 15.8% and 18.2%,
| Table 3-1 Arterial reconstruction for aortic arches |
|----------------------------------------------|
| **Gender** | Male | Female | 30-day mortality |
|------------|------|--------|------------------|
| **Revascularization procedures** | | | |
| Carotid artery | | | |
| | | | |
| Vertebral artery | | | |
| | | | |
| Common carotid artery | | | |
| | | | |
| Subclavian artery | | | |
| | | | |
| Other | | | |
| **Graft materials** | | | |
| Autogenous veins | | | |
| Others | | | |
| **Total** | | | |

| Table 3-2 Arterial reconstruction for chronic lower limb ischemia |
|----------------------------------------------|
| **Gender** | Male | Female | 30-day mortality |
|------------|------|--------|------------------|
| **Revascularization procedures** | | | |
| Aorta–aortic bypass | | | |
| Inferior mesenteric artery | | | |
| Other | | | |
| **Graft materials** | | | |
| Autogenous veins | | | |
| Others | | | |
| **Total** | | | |
### Table 3-3 Extra-anatomical bypass*\(^{17}\)

| Extra-anatomical bypass                  | Cases       | Gender | Mortality | Dialysis cases | Etiology | Graft materials |
|-----------------------------------------|-------------|--------|-----------|----------------|----------|-----------------|
|                                         |             | Male   | Female    | 30-day mortality | ASO | TAO | Debranch for TEVAR/EVAR | Others | Polyester | ePTFE | Autogenous veins | Others |
| Carotid subclavian bypass               | 119         | 96     | 23        | 7              | 4      | 7   | 0              | 108 | 4       | 60      | 58      | 3    | 8    |
| Axillo-axillary bypass                  | 195         | 144    | 51        | 8              | 11     | 50  | 0              | 137 | 8       | 82      | 111     | 1    | 13   |
| Axillo-femoral bypass*\(^{18}\)         | 396         | 289    | 107       | 12             | 47     | 376 | 2              | 0   | 18      | 143     | 239     | 22   | 1    |
| Femoro-femoral crossover bypass         | 838         | 675    | 163       | 9              | 59     | 800 | 3              | 5   | 30      | 271     | 532     | 51   | 10   |
| Others                                  | 137         | 112    | 25        | 3              | 17     | 127 | 3              | 0   | 7       | 39      | 61      | 18   | 1    |
| Total                                   | 1,599       | 1,247  | 352       | 34             | 133    | 1,331| 8              | 195 | 65      | 552     | 959     | 95   | 27   |

### Table 3-4 Thromboendarterectomy*\(^{50}\) for chronic lower limb ischemia

| Thromboendarterectomy                  | Cases       | Gender | Mortality | Dialysis cases | Etiology |                        |
|----------------------------------------|-------------|--------|-----------|----------------|----------|------------------------|
|                                        |             | Male   | Female    | 30-day mortality | ASO | TAO | Debranch for TEVAR/EVAR | Others |
| Aorto-iliac lesion                     | 74          | 55     | 19        | 0              | 7       | 71         | 0   | 1 | 2    |
| Femoro-popliteal lesion                | 978         | 760    | 218       | 13             | 201     | 962        | 5   | 1 | 10   |
| Others                                 | 111         | 85     | 26        | 3              | 21      | 106        | 3   | 0 | 2    |
| Total                                  | 1,152       | 893    | 259       | 16             | 229     | 1,129      | 7   | 2 | 14   |
| Endovascular treatment | Cases | Gender | Mortality | Dialysis cases | Etiology |
|------------------------|-------|--------|-----------|----------------|----------|
|                        |       | Male   | Female    | 30-day mortality | Hospital mortality | ASO | TAO | Debranch for TEVAR/EVAR | Others |
| Aorto-iliac lesion*20) | 2,810 | 2,304  | 506       | 27             | 43       | 319 | 2,776 | 2 | 5 | 27 |
| Femoro-popliteal lesion*20) | 2,344 | 1,669  | 675       | 36             | 61       | 597 | 2,327 | 2 | 1 | 14 |
| Infrapopliteal-ankle lesion*20) | 1,157 | 755    | 402       | 17             | 51       | 515 | 1,130 | 4 | 0 | 23 |
| Others                 | 78    | 54     | 24        | 0              | 4        | 47  | 76    | 0 | 0 | 2 |
| Total (number of regions underwent EVT)*20) | 5,585 | 4,236  | 1,349     | 69             | 124      | 1,196 | 5,510 | 6 | 6 | 63 |
| Total (number of limbs underwent EVT)*21) | 4,831 | 3,725  | 1,106     | 58             | 96       | 940 | 4,761 | 4 | 6 | 60 |

*10) Bypass surgery combined with endovascular treatment is counted in both bypass category (Table 3-2) and endovascular category (Table 3-5).
*11) Including TAO, Takayasu arteritis, Coarctation of aorta, collagen disease related vasculitis, Behcet disease, fibromuscular dysplasia.
*12) Postoperative irreversible brain complication.
*13) Including percutaneous transluminal angioplasty (PTA), stent, and other endovascular means such as catheter atherectomy.
*14) Only for open surgery.
*15) Including aorto-iliac bypass or ilio-femoral bypass.
*16) Including popliteal-crural (or pedal) bypass.
*17) Cases underwent extraanatomical bypass because of graft infection should not be included this category. Those cases are listed in vascular complication (Table 6).
*18) A case underwent axillo-femoro-femoral crossover bypass is counted as one case. A case combined with additional contralateral side of axillo-femoral bypass as second staged surgery is counted as 2 cases.
*19) Including patch plasty.
*20) When endovascular treatment performed for multiple regions, the case should be counted in each regions (If a case undergone endovascular treatment in both aorto-iliac and femoro-popliteal region, this case can be counted one in aorto-iliac, and one in femoro-popliteal region).
*21) Counting the patients number not treated regions. When a case undergone endovascular treatment in multiple region, the case is counted as one case.

Abbreviations: ASO: arteriosclerosis obliterans, TAO: thromboangiitis obliterans (Buerger’s disease), CAS: carotid artery stenting, CEA: carotid endarterectomy, PTA: percutaneous transluminal angioplasty, EVT: endovascular treatment, IIA: internal iliac artery
respectively, in 2012 (Fig. 3). For the first time, no significant differences between replacement surgery and EVAR were noted for the operative or in-hospital mortality rate in 2013. This may be attributable to the fact that EVAR is being increasingly adopted for hemodynamically unstable cases.

3) Peripheral arterial aneurysms (Table 2-3)
In total, 1,764 cases of surgery for peripheral arterial aneurysms were registered in the NCD in 2013. The male to female ratio was 1,253 : 511, indicating a higher rate of incidence in men. The specific sites affected were: lower limb arteries in 779 cases, abdominal visceral arteries in 594 cases, upper limb arteries in 354 cases, and branches of the aortic arch in 78 cases, amounting to 1,805 cases in total and suggesting the involvement of synchronous multiple aneurysms in 41 cases. Regarding specific arteries affected, the largest proportion of cases was accounted for by aneurysms in the femoral artery (26.8%), followed by “other” (24.0%), which included abdominal visceral arteries. A large proportion of cases in the “other” category was presumably accounted for by internal iliac artery aneurysms; the registration method is being revised to address this issue. A total of 802 cases (45.5%) were symptomatic, and 285 cases (16.2%) involved ruptured aneurysms, which frequently occurred in the thigh and upper limbs in 2013, as the same proportion in 2012. The surgical procedures used included ligation/resection (29.7%), replacement (25.3%), coil embolization (17.6%), and stent grafting (13.0%). The proportion of cases requiring stent grafting has increased since 2012. In addition, a total of 1,908 cases were treated with different procedures, suggesting that multiple procedures were combined for the treatment of a single aneurysm or that different procedures were used for the treatment of synchronous multiple aneurysms in approximately 8% of the cases of surgery for peripheral arterial aneurysms.

2. Revascularization for Chronic Arterial Occlusion (Table 3)
1) Aortic arch branch/upper limb/abdominal visceral artery
Compared with 2012, major changes in the number of cases were found in categories of the carotid artery and others in 2013. Apart from some minor changes, no significant changes in the different criteria, such as sex distribution, disease causes, and surgical procedures, were noted in other categories (vertebral artery, subclavian artery, multiple lesions of the aortic arch branches, axillary artery–upper limb artery, and renal artery). The number of cases of carotid artery occlusion treated by revascularization markedly decreased from 116 cases in 2012 to 47 cases in 2013. In addition to the 40% decrease in the number of cases, there were also major changes in the surgical procedures used. In 2012, approximately 80% of cases of carotid artery occlusion underwent carotid endarterectomy (CEA) and approximately 10% underwent carotid stenting (CAS). In contrast, in 2013, 60% of cases underwent CEA and 20% cases underwent CAS. These changes suggest a shift from CEA, which is performed in vascular surgery departments, to CAS, which is mainly performed in neurosurgery departments. In the category of others, the number of cases substantially increased from 73 in 2012 to 273 in 2013. The increase was mostly accounted for by debranching surgery associated with thoracic endovascular aneurysm repair (TEVAR)/EVAR (236 cases). Thus, the increased number of cases categorized as “other” was likely due to the increase in TEVAR/EVAR cases requiring debranching.

2) Anatomical bypass, extra-anatomical bypass, and endovascular treatment in the aorta to lower limb regions
Aorto-iliaic region: Anatomical revascularization surgery in the aorto–iliac region decreased from 837 cases in 2012 to 700 cases in 2013 by approximately 11%; however, no change was noted for the specific types of vascular grafts used. The extra-anatomical bypass such as axillo–femoral bypass and femoro–femoral bypass decreased from 427 and 1,004 cases in 2012 to 396 and 838 cases, respectively, in 2013. This indicated that the use of extra-anatomical bypass tended to slightly decrease. The decreases in the anatomical and extra-anatomical revascularization cases were presumed to reflect an increase in instances of endovascular treatment. However, the number of cases of endovascular treatment performed by vascular surgeons gradually decreased from 2,922 in 2012 to 2,810 in 2013. To identify the reason why both the use of anatomical/extra-anatomical revascularization and endovascular treatment tended to slightly decrease from the previous year, we compared our data with those in the J-EVT registry, which was derived from the University hospital Medical Information Network (UMIN) database and is published on the website of the Japanese Association of Cardiovascular Intervention and Therapeutics (CVIT). In 2013, endovascular treatment in the aorto–iliac region was performed in cardiovascular medicine departments in 5,343 cases. The anatomical/extra-anatomical revascularization and endovascular treatment performed by vascular surgeons in a total of 4,744 cases accounted for 47.0% of total procedures in the aorto–iliac region in 2013 (Fig. 4A).

Superficial femoral artery region: The number of cases treated by femoral above-knee popliteal artery bypass decreased from 2,139 cases in 2012 to 1,746 cases in 2013.
by a margin of 393 cases (18%), while no major decrease was noted for the use of endovascular treatment in this region (2,436 cases in 2012 and 2,344 cases in 2013).

Possible reasons for the decreased use of bypass surgery in this region are treatment strategies shifting from bypass surgery to less invasive endovascular treatment. In the J-EVT registry described above, endovascular treatment in the crural artery region was performed in 3,367 cases in 2013.2) The femoral above-knee popliteal artery bypass, femoro-crural/pedal artery bypass, and endovascular treatment performed by vascular surgeons in a total of 3,004 cases accounted for 47.2% of total procedures in these regions in 2013 (Fig. 4C). Because no substantial differences were noted in the proportion of dialysis patients, it appears that critical limb ischemia develops at a constant rate in the presence of diabetes or dialysis as a basal condition.

Thromboendarterectomy: Cases of thromboendarterectomy performed on lesions in the iliac artery and femoro-popliteal regions increased in number from 59 and 851 in 2012 to 74 and 978 in 2013, respectively. The number of cases of thromboendarterectomy in the femoro-popliteal region presumably increased in the common femoral artery lesions.

3. Revascularization for Acute Arterial Occlusion (Table 4)

In 2013, 4,688 acute arterial occlusion cases, excluding vascular trauma, were registered in the NCD. Of these cases, approximately 80% occurred in vessels peripheral to the abdominal aorta. Thrombosis and embolism each accounted for approximately 50% of cases, as the same proportion in the previous years. There were a total of 5,387 cases of occlusion in different regions, suggesting that occlusion occurred at multiple sites in approximately 700 cases (15%). Thrombolysis, which was added to the procedure options this year, was performed in 81 cases (1.7%). The proportion of percutaneous transluminal angioplasty (PTA) with or without stenting has seen an increase over the recent years, but it remained unchanged in 2013 (10.8%) from the percentage in 2012 (10.6%). Synthetic grafts were used in 71.6% of the cases of femoral popliteal artery bypass surgery and in 50% of the cases of crural artery bypass surgery. By comparison, synthetic grafts were used in 86.4% and 12.8% of the femoral above-knee popliteal artery bypass and femoro-crural/pedal artery bypass for chronic arterial occlusion; interestingly, synthetic grafts were used very frequently among cases of crural artery bypass surgery for acute arterial occlusion. While it is likely that this was in order to shorten the period between onset and revascularization,
Table 4  Revascularization for acute arterial occlusive disease\(^{22}\)

| Obstructive artery\(^{22}\) | Cases | Gender | 30-day mortality | Hospital mortality | Etiology | Procedure | Graft materials for open surgery |
|-----------------------------|-------|--------|------------------|--------------------|----------|-----------|---------------------------------|
|                             |       | Male   | Female           |                    |          |           | Autogenous vessel                |
|                             |       | 4,688  | 2,960           | 1,728              | 331      | 457       | Polyester                        |
|                             |       | 1,855  | 2,502           | 331                | 3,589    | 662       | ePTFE                           |
|                             |       | 508    | 81              | 288                | 226      | 344       | Others                          |
|                             |       | 374    | 20              |                     |          |           |                                 |

\(^{22}\) Cases with non-traumatic acute arterial occlusion are listed in this table. Please see Table 5-1 for acute arterial occlusion by trauma.

\(^{23}\) The most proximal occluded artery name is described in case whose primary occluded artery could not be identified.

\(^{24}\) Cases with acute worsening occlusion of chronic arterial occlusive disease are excluded. Treatment for those cases are listed in Table 3.

\(^{25}\) If either thrombectomy or patch plasty is performed, cases are listed in this section.

\(^{26}\) Including acute occlusion of dorsalis pedis or planter artery.
### Table 5 Treatment for vascular trauma

#### Table 5-1 Arterial trauma

| Injured artery                  | Cases | Gender | Mortality | Cause of trauma | Procedure | Status of injured artery | Prosthesis |
|--------------------------------|-------|--------|-----------|----------------|-----------|--------------------------|------------|
|                               |       | Male   | Female    | Traffic accident | Labor accident | Iatrogenic | Others | Direct closure | Patch plasty | Replace-ment | Bypass | Endo-vascular | Ligation | Others | Obstruction/ stdenois*27 | Bleeding without specification*28 | GI fistula | Non-GI fistula | Pseudoaneurysm | Others | Autogonous vessel | Polyester | ePTFE | Others |
| Carotid artery                | 27    | 16     | 11       | 4              | 5            | 2          | 17       | 15     | 0          | 0           | 1          | 4          | 6         | 2       | 1           | 10        | 1           | 3            | 4         | 9            | 0         | 1         | 0         | 0         |
| Subclavian artery             | 24    | 15     | 9        | 6              | 3            | 0          | 16       | 11     | 0          | 1           | 2          | 5          | 3         | 2       | 1           | 13        | 0           | 2            | 3         | 5            | 1         | 1         | 1         | 0         |
| Axillary artery               | 16    | 10     | 6        | 1              | 5            | 4          | 4        | 1      | 0          | 5           | 1          | 4         | 1         | 6       | 6           | 12        | 0           | 1            | 0         | 5            | 1         | 0         | 1         | 0         |
| Brachial artery               | 276   | 161    | 115      | 6              | 10           | 4          | 10       | 230    | 32         | 199         | 3          | 10         | 16        | 10      | 31         | 12        | 23          | 56          | 0           | 9            | 198        | 40          | 23          | 0         | 4         | 0         | 0         |
| Descending aorta             | 36    | 21     | 15       | 14             | 14           | 4          | 6        | 12     | 6          | 1           | 3          | 13         | 4         | 8       | 5           | 21        | 2           | 0            | 6         | 3            | 0         | 3         | 0         | 0         |
|                               |       | 27     |          |                |              |            |          |        |             |             |             |            |           |          |         |             |           |             |               |           |              |             |           |             |           |           |           |
| Carotid-external carotid artery | 159  | 58     | 101      | 101            | 39           | 6          | 1        | 25     | 36         | 51          | 2          | 10         | 16        | 5        | 12         | 12        | 17          | 98          | 0           | 3            | 198        | 40          | 23          | 0         | 4         | 0         | 0         |
| Femoral-popliteal artery       | 688   | 445    | 243      | 191            | 100          | 10         | 9        | 7      | 81         | 4           | 10         | 16         | 10        | 21       | 13         | 12        | 22          | 56          | 0           | 9            | 198        | 40          | 23          | 0         | 4         | 0         | 0         |
| Iliaco-iliac artery            | 36    | 31     | 7        | 2              | 9            | 11         | 12       | 6      | 11         | 1           | 2          | 10         | 6         | 7        | 14         | 15        | 0           | 1            | 6         | 4            | 8          | 1         | 1         | 0         |          |
| Others                        | 182   | 120    | 62       | 16             | 23           | 13         | 32       | 76     | 61         | 70          | 1         | 4          | 15        | 67       | 17         | 98        | 1           | 2            | 28         | 42          | 5          | 0         | 2         | 1         |          |
| Total                         | 1,455 | 921    | 534      | 171            | 211          | 91         | 98       | 1,016  | 250        | 886         | 32         | 58         | 105       | 124      | 183        | 115       | 171         | 500          | 6           | 37          | 450        | 345        | 96          | 28        | 50        | 3         |          |

*27) Iatrogenic pseudoaneurysm in endovascular treatment is listed in Table 5-1.

*28) Including arterial dissection.

*29) Without GI fistula or non-GI fistula.

*30) Cases with vessel injury involving both vein and accompanying artery are listed in Table 5-1.

Abbreviation; GI: gastro-intestinal

#### Table 5-2 Venous trauma*27)

| Injured veins                    | Cases | Traffic accident | Labor accident | Iatrogenic | Others | Direct closure | Patch plasty | Replace-ment | Bypass | Endo-vascular | Ligation | Others | Autogonous vessel | Polyester | ePTFE | Others |
|---------------------------------|-------|-----------------|----------------|------------|--------|----------------|--------------|--------------|--------|--------------|----------|--------|-------------------|-----------|-------|--------|
| Superior vena cava              | 2     | 0               | 1              | 0          | 1      | 2              | 0            | 0            | 0      | 0            | 0        | 0      | 0                 | 0         | 0     | 0      |
| Inferior vena cava              | 4     | 3               | 0              | 1          | 0      | 2              | 0            | 0            | 0      | 0            | 0        | 0      | 0                 | 0         | 0     | 0      |
| Brachiocephalic-subclavian vein | 9     | 1               | 1              | 5          | 2      | 7              | 0            | 0            | 0      | 3            | 1        | 0      | 0                 | 0         | 0     | 0      |
| Iliac-femoral-popliteal vein    | 46    | 2               | 5              | 33         | 6      | 39             | 1            | 2            | 1      | 4            | 0        | 2      | 1                 | 1         | 0     | 2      |
| Others                          | 47    | 2               | 4              | 21         | 28     | 16             | 1            | 1            | 1      | 26           | 4        | 1      | 0                 | 2         | 0     | 0      |
| Total                           | 108   | 8               | 11             | 60         | 29     | 66             | 2            | 3            | 2      | 1            | 33       | 7      | 3                 | 1         | 3     | 0      |

*27) Iatrogenic pseudoaneurysm in endovascular treatment is listed in Table 5-1.

*28) Including arterial dissection.

*29) Without GI fistula or non-GI fistula.

*30) Cases with vessel injury involving both vein and accompanying artery are listed in Table 5-1.

Abbreviation; GI: gastro-intestinal
the concrete reasons are unknown. The overall mortality was 7.1%. Although only 101 cases (2.2%) of acute occlusion of the celiac artery/superior mesenteric artery system were registered, these cases were characterized by the highest operative mortality (21.8%) with poor outcomes. The operative mortality after revascularization in the lower limbs was 11.0% in the abdominal aorto-iliac artery region, 7.7% in the femoro-popliteal region, 8.0% in the crural artery, and 13.0% in the pedal artery. Lower limb artery lesions in the pedal arteries were associated with the highest operative mortality. The details, however, are unknown because only 54 such cases were registered and concomitant occlusive lesions in multiple regions may have occurred.

4. Treatment for Vascular Trauma (Table 5)
The sites of vascular trauma, reasons for trauma, surgical procedures used, and vascular grafts used for NCD-registered cases in 2013 are shown in Table 5. A total of 1,563 cases of artery and vein traumas were registered. The most common cause for vascular trauma was iatrogenic (1,076 cases, 69%). Traffic accidents and work-related injuries accounted for 99 cases (6%) and 109 cases (7%), respectively. The most common site of vascular trauma was lower limb arteries (46%), followed by upper limb arteries (20%), and abdominal aorto-iliac arteries (10%). In total, 1,617 cases were registered for different treatment procedures; 59% of the total cases were accounted for by direct closure. Vascular grafts were used in 183 cases, and autologous vessels were used in approximately 54% of these cases.

1) Iatrogenic vascular trauma
The most common site of iatrogenic vascular trauma was lower limb arteries (approximately 52%), followed by upper limb arteries (approximately 23%). The majority of these cases are likely to have been caused because of complications at puncture sites associated with examinations and treatments that use catheters.

2) Traffic accidents (Fig. 5A)
The most frequently injured sites from traffic accidents were the upper and lower limb arteries, accounting for approximately 43%. This is likely because the vessels of the upper and lower limbs are close to the body surface and are susceptible to injury from direct external force. The second most frequently injured site was abdominal aorto-iliac arteries (17%), followed by descending/thoracoabdominal aorta (13%) and visceral artery (7%).

3) Workplace accidents (Fig. 5B)
This category of vascular trauma in the NCD database are believed to include injuries from industrial accidents such as falling from heights or being caught in machinery. The upper and lower limb arteries, which are close to the body surface and susceptible to injury by external force, accounted for 45% of the injured regions.

We summarized the registration status of vascular injuries in the NCD database of 2013. There were no major changes from the 2011 report in terms of the total number of registered cases, causes of trauma, areas of trauma, or types of vascular grafts used. Because only a small number of cases are registered as traffic accident-related or workplace accident-related trauma, we cannot confidently assert that our data reflects the actual number of cases. This is likely because these types of vascular trauma are often initially treated by surgeons from the emergency departments and orthopedic surgeons without the involvement of vascular surgeons. Going forward, we hope to collaborate and share databases with emergency medicine organizations in order to obtain more accurate data.
### Table 6 Revascularization for vascular complication after revascularization

#### Table 6-1 Graft infection

| Position of infected graft                  | Cases | Mortality | Status of infected graft | Procedure for graft infection | Materials for revision or redo surgery |
|--------------------------------------------|-------|-----------|--------------------------|-------------------------------|----------------------------------------|
|                                           |       | 30-day    | Hospital                 | Extra-anatomical bypass       |                                        |
|                                           |       | mortality | mortality               | Others                        |                                        |
|                                           |       | Sepsis    |                         | In-situ replacement           |                                        |
|                                           |       |           |                         | Others                        |                                        |
| Descending thoracic aorta                 | 3     | 0         | 0                       | 0                             | 1                                      |
| Thoracoabdominal aorta                    | 11    | 1         | 1                       | 3                             | 2                                      |
| Abdominal aorta–iliac artery              | 41    | 5         | 8                       | 16                            | 11                                     |
| Abdominal aorta–femoral artery            | 27    | 2         | 4                       | 5                             | 13                                     |
| Femoro-distal artery                      | 140   | 11        | 17                      | 35                            | 6                                      |
| Others*31                                 | 248   | 14        | 30                      | 70                            | 3                                      |
| Total                                     | 470   | 33        | 60                      | 129                           | 31                                     |

*31) Cases with graft infection involving aortic arch branch or upper limb artery are listed on this column.

#### Table 6-2 Anastomotic aneurysm*33

| Location of anastomotic aneurysm | Cases | Mortality | Cause of aneurysm treated at the primary operation | Repair procedure | Material for repair surgery |
|----------------------------------|-------|-----------|----------------------------------------------------|------------------|------------------------------|
|                                  |       | 30-day    | Degenerative                                        |                  |                              |
|                                  |       | mortality | Takayasu arteritis*34                                |                  |                              |
|                                  |       |           | Other vasculitis*35                                  |                  |                              |
|                                  |       |           | Infection                                          |                  |                              |
|                                  |       |           | Others                                              |                  |                              |
|                                  |       |           | Replacement                                        |                  |                              |
|                                  |       |           | Exclusion and bypass                                |                  |                              |
|                                  |       |           | Stent graft                                         |                  |                              |
|                                  |       |           | Others                                              |                  |                              |
| Aortic arch branch               | 2     | 0         | 0                                                   | 0                | 0                            |
| Upper limb artery including axillar artery | 31 | 0       | 4                                                   | 0                | 23                           |
| Thoracic aorta                   | 5     | 0         | 2                                                   | 0                | 0                            |
| Splanchnic artery                | 1     | 1         | 0                                                   | 0                | 3                            |
| Renal artery                     | 0     | 0         | 0                                                   | 0                | 0                            |
| Abdominal aorta                  | 15    | 1         | 9                                                   | 0                | 0                            |
| Iliac artery                     | 17    | 0         | 13                                                  | 0                | 0                            |
| Femoral artery                   | 41    | 1         | 26                                                  | 0                | 2                            |
| Popliteal or more distal lower limb artery | 17 | 0     | 9                                                   | 0                | 0                            |
| Total                            | 128   | 3         | 62                                                  | 0                | 6                            |

*33) Cases with infected pseudoaneurysm located at the anastomotic site to the artificial graft are listed in Table 6-1.

*34) Including the atherosclerotic aneurysm.

*35) Including TAO, collagen disease, Behcet disease, and fibromuscular dysplasia.
### Table 6-3 Autogenous graft aneurysm

| Revascularization area | Cases | 30-day mortality | Repair procedure |
|------------------------|-------|------------------|------------------|
|                        |       | Mortality         | Replacement | Bypass | Others |
| Vascular artery        | 2     | 0                | 0            | 1      | 1      |
| Upper limb artery      | 20    | 0                | 0            | 2      | 18     |
| Lower limb artery      | 21    | 0                | 6            | 6      | 9      |
| Others                 | 6     | 0                | 0            | 0      | 6      |
| Total                  | 49    | 0                | 6            | 9      | 34     |

### Table 6-4 Graft degeneration

| Revascularization area | Cases | 30-day mortality | Initial revascularization procedure | Degenerative material | Repair procedure | Material for repair surgery |
|------------------------|-------|------------------|-------------------------------------|-----------------------|------------------|-----------------------------|
|                        |       | Mortality         | Replacement | Bypass | Stent graft | Others | Polyester | ePTFE | Others | Replacement | Bypass | Stent graft | Patch plasty | Others | Polyester | ePTFE | Others |
| Descending thoracic aorta | 0     | 0                | 0            | 0      | 0          | 0      | 0         | 0      | 0      | 0            | 0      | 0          | 0           | 0      | 0         | 0     | 0     |
| Thoracoabdominal aorta  | 0     | 0                | 0            | 0      | 0          | 0      | 0         | 0      | 0      | 0            | 0      | 0          | 0           | 0      | 0         | 0     | 0     |
| Abdominal aorta-femoral artery | 9    | 0                | 7            | 2      | 0          | 0      | 7         | 2      | 0      | 5            | 3      | 0          | 1           | 4      | 5         | 3     | 0     |
| Femoral-popliteal artery | 9     | 0                | 2            | 7      | 0          | 0      | 2         | 6      | 1      | 2            | 6      | 0          | 1           | 1      | 5         | 3     | 0     |
| Others                 | 17    | 1                | 4            | 4      | 2          | 9      | 3         | 12     | 2      | 3            | 3      | 0          | 12          | 3      | 5         | 2     | 0     |
| Total                  | 35    | 1                | 13           | 13     | 2          | 9      | 12        | 20     | 3      | 10           | 12     | 0          | 1           | 14     | 7         | 14    | 5     |

### Table 6-5 Repair operation for graft stenosis or acute thrombosis

| Initial procedure | Cases | 30-day mortality | Patch± thrombectomy | Replacement | Bypass | PTA± stent | Thrombolysis | Others | Polyester | ePTFE | Autogenous vessel | Others |
|-------------------|-------|------------------|----------------------|--------------|--------|------------|--------------|--------|-----------|-------|------------------|--------|
| Reconstruction of aorta or its primary branches | 82 | 2 | 22 | 6 | 34 | 25 | 1 | 12 | 28 | 26 | 4 | 4 |
| Revascularization of upper limb | 462 | 4 | 76 | 31 | 12 | 240 | 0 | 126 | 4 | 59 | 12 | 14 |
| Revascularization of lower limb | 558 | 11 | 223 | 48 | 160 | 185 | 8 | 37 | 55 | 136 | 194 | 2 |
| Total | 1,095 | 17 | 320 | 84 | 203 | 449 | 9 | 174 | 87 | 217 | 210 | 20 |

*36) Including stenosis such as the anastomotic stenosis, graft stenosis or occlusion, and restenosis at the site of endarterectomy.
5. Surgical Treatment for Vascular Complications after Revascularization (Table 6)

Cases involving peripheral arteries of upper and lower limbs were mainly analyzed because only a small number of registered cases involved the thoracic and thoracoabdominal aortic regions.

1) Artificial graft infection

Artificial graft infections most frequently occurred in regions classified as “other” (52.8%), which included the upper limb arteries. A major proportion of these cases are presumably accounted for by artificial graft infections of internal shunts for dialysis. The second most frequently affected region was the femoro-distal artery. Rates of infection for different types of artificial grafts could not be calculated because the respective denominators were unknown. Because repair procedures were not specified in the majority of cases, they could not be discussed. The overall operative and in-hospital mortality rates were 7.0% and 12.8%, respectively.

2) Anastomotic aneurysms (non-infectious)

Anastomotic aneurysms most frequently occurred in the femoral arteries (32.0%), followed by the axillary arteries—upper limb arteries. The most frequent cause was atherosclerosis among cases with lesions in the lower limb arteries, while the “other” category was most frequent among those with the lesions in upper limb arteries.

3) Autogenous graft aneurysms

There was no difference in the number of registered cases between autogenous graft aneurysms in the upper limb arteries and those in the lower limb arteries. Revascularization (replacement/bypass surgery) was performed in approximately 50% of the registered cases in the lower limb arteries, while it was performed in only 10% of the cases in the upper limb arteries.

4) Artificial graft deterioration

Thirty-five cases of artificial graft deterioration were registered. As primary surgical procedures, replacement and bypass were equally frequently used (in 13 cases each), while stent grafting was used only in 2 cases.

5) Stenosis/occlusion of vascular grafts

PTA with and without stenting was the most frequently used repair procedure among the cases of upper limb arterial reconstruction (51.9%). Among the cases of lower limb arterial reconstruction, patch/thrombectomy was most commonly employed (40.0%), followed by PTA with and without stenting and bypass surgery.

6. Venous Surgery (Table 7)

1) Varicose veins (Table 7-1)

Compared with 2012, a total of 35,986 cases were registered in 2013, representing an approximate 20% increase. The male to female ratio was 1:1.8. Stripping (with and without sclerotherapy) was performed in 16,426 cases, making it the most common surgical procedure, as was the case in the previous year. Notably, the use of endovenous laser ablation (EVLA) both with and without sclerotherapy increased to 14,043 cases, highlighting a major change in treatment of varicose veins (Fig. 6).

2) Lower limb deep vein thrombosis (including deep vein stenosis/obstruction) (Table 7-2)

A total of 506 surgery cases were registered, among which inferior vena cava filter placement was the most commonly employed procedure (305 cases, 60%). Filter retrieval, which was added to possible procedure choices this year, was performed in 119 cases (23%). This presumably reflects the effect of a notice from the Ministry of Health, Labour and Welfare in December 2010 about recommendation for periodic inspection and removal of permanent vena cava filter. Thrombectomy, catheter-directed thrombolysis, and bypass surgery (peripheral vein revascularization) were performed in 68 cases (13%), 39 cases (8%), and 6 cases (1%), respectively, with no appreciable changes observed in 2013 compared with 2012. Release of venous stenosis both by the direct approach and by endovascular treatment, which were newly added choices, were performed in 20 and 11 registered cases, respectively.

3) Upper limb/cervical vein stenosis/obstruction (Table 7-3)

In 2013, 162 surgery cases were registered, which is comparable to those registered in 2012. Procedures for the release of venous stenosis were newly added to the available options, and endovascular treatment (66 cases, 41%) was more commonly used than the direct approach (10 cases, 6%).

4) Vena cava reconstruction (Table 7-4)

Forty-two surgery cases were registered in 2013, which represented a 50% decrease from 2012. The procedures that were registered included: 11 cases of superior vena cava/primary branch reconstruction (26%) and 31 cases of inferior vena cava/primary branch reconstruction (74%). The most frequent cause was tumors (38 cases, 90%). The outcomes improved compared with the previous year; no operative deaths and two in-hospital deaths (48%). Surgical procedures involved replacement in 13 cases, patching in 5 cases, and bypass in 4 cases.
5) Budd–Chiari syndrome (Table 7-5)
Surgery cases registered in 2013 (8 cases) were as few as those registered in 2012. Shunt surgery, percutaneous shunt creation, and open repair were used in 1, 4, and 3 cases, respectively.

6) Others (Table 7-6)
Venous aneurysms of deep veins and aneurysms of abdominal visceral veins were added in 2013; the number of cases registered in the respective categories was 64 and 2. There were 873 other cases, of which the details are unknown.

7. Other Vascular Diseases and Related Surgery (Table 8)
Compared with 2012, the use of some surgical procedures decreased in 2013.

1) Popliteal artery entrapment syndrome (Table 8-1)/cystic adventitial disease (Table 8-2)
Cases of popliteal artery entrapment syndrome and cystic
### Table 7-4  Vena cava reconstruction

| Vena cava reconstruction | Cases | 30-day mortality | Hospital mortality | Etiology | Treatment procedures | Material for open surgery |
|--------------------------|-------|------------------|--------------------|----------|----------------------|--------------------------|
|                          |       |                  |                    | Tumor    | Patch plasty | Bypass | Replacement | PTA±stent | Others | Autogenous vessel | Polyester | ePTFE | Others |
| SVC reconstruction       | 11    | 0                | 2                  | 10       | 1            | 4      | 2           | 1        | 1      | 0               | 8         | 0     | 3     |
| IVC reconstruction       | 31    | 0                | 0                  | 28       | 2            | 1      | 4           | 1        | 9      | 0               | 17        | 2     | 0     |
| Total                    | 42    | 0                | 2                  | 38       | 3            | 1      | 5           | 4        | 13     | 2               | 18        | 3     | 16    |

Abbreviations; IVC: inferior vena cava, SVC: superior vena cava

### Table 7-5  Budd–Chiari syndrome

| Treatment | Cases | Gender | 30-day mortality | Hospital mortality | Material for open surgery |
|-----------|-------|--------|------------------|--------------------|--------------------------|
|           |       | Male   | Female           |                    | Polyester | ePTFE | Autogenous vessel | Others |
| Shunting  | 1     | 0      | 1                | 0                  | 0         | 0     | 0               | 0      |
| Percutaneous shunting | 4 | 2      | 2                | 0                  | 0         | 0     | 0               | 0      |
| Surgical recanalization | 3 | 0      | 3                | 0                  | 0         | 0     | 0               | 0      |
| Total     | 8     | 2      | 6                | 0                  | 0         | 0     | 0               | 2      |

### Table 7-6  Other surgery

| Treatment                              | Cases | Gender | 30-day mortality | Hospital mortality | Material for open surgery |
|----------------------------------------|-------|--------|------------------|--------------------|--------------------------|
|                                        |       | Male   | Female           |                    | Polyester | ePTFE | Autogenous vessel | Others |
| Plication of deep venous aneurysm*44)  | 64    | 39     | 25               | 1                  | 1          | 0     | 0               | 0      |
| Plication of abdominal venous aneurysm | 2     | 0      | 2                | 0                  | 0          | 0     | 0               | 0      |
| Others                                 | 873   | 451    | 422              | 23                 | 54         | 0     | 0               | 0      |
| Total                                  | 939   | 490    | 449              | 24                 | 55         | 0     | 0               | 0      |

*44) Including patch plasty.
adventitial disease have been increasing in number for the past 2 years, and the increases have been believed to reflect the improved diagnostic sensitivity. In 2013, registered cases of both conditions markedly decreased from 49 to 32 cases (35% decrease) and from 63 to 28 cases (56% decrease), respectively. Because the number of cases has been small, next-year data are awaited to conclude whether the trend has changed.

2) Thoracic outlet syndrome (Table 8-3)
In 2013, the number of registered cases again decreased from the previous year (5 cases). Except for bypass surgery, these procedures are mostly performed in orthopedic surgery departments. Thus, the data may not reflect the actual number of cases.

3) Vascular access surgery (Table 8-4)
A similar number of surgery cases were registered as in the previous year; the mortality rate was also similar. Shunt aneurysm repair was added to surgical procedures in 2013. Going forward, trends in data for this procedure along with long-term shunt prognosis need to be carefully investigated.

4) Lymphedema surgery (Table 8-5)
Because this procedure is also performed in plastic surgery and other departments, virtually no changes from the previous year were noted.

5) Sympathectomy (Table 8-6)
In 2013, sympathectomy was performed only in 29 cases, and remained on a downward trend; this finding is likely to reflect very limited indications of this surgical procedure.

6) Amputation of the upper limb (Table 8-7) and lower limb (Table 8-8)
The number of cases of upper/lower limb amputation has been increasing in recent years similar to that of severe lower limb ischemia that have also increased. In 2013, lower limb amputation decreased from 1,390 to 1,185 cases by 15%, while figures for upper limb amputation remained nearly unchanged. Particularly, the number of cases of transtibial (below-knee)/transfemoral (above-knee) amputation decreased, and it is likely that these procedures are being performed in orthopedic surgery and other departments. Data collection across different specialties urgently needs to be performed in order to improve outcomes in the treatment of severe lower limb ischemia.

| Table 8 Other vascular diseases |
|--------------------------------|
| **Table 8-1 Popliteal artery entrapment syndrome** |
| Treatment | Cases | 30-day mortality |
| Myotomy | 12 | 0 |
| Revascularization | 29 | 1 |
| **Total** | **32** | **1** |

| **Table 8-2 Adventitial cystic disease** |
| Treatment | Cases | 30-day mortality |
| Cyst excision±patch plasty | 17 | 1 |
| Replacement | 9 | 0 |
| Bypass | 3 | 0 |
| **Total** | **28** | **1** |

| **Table 8-3 Thoracic outlet syndrome (TOS)** |
| Treatment | Cases | Male | Female | 30-day mortality | Type of TOS*45) |
| Rib resection*46) | 2 | 2 | 0 | 0 | 2 | 0 | 1 |
| Rib resection + scalenectomy | 2 | 1 | 1 | 0 | 1 | 1 | 0 |
| Bypass | 2 | 2 | 0 | 0 | 1 | 0 | 2 |
| **Total** | **5** | **4** | **1** | **0** | **3** | **1** | **2** |

*45) In the case with mixture type, the type having the most significant impact on the clinical symptom is listed. But, if the impacts are similar, multiple response is allowed.
*46) Including cervical rib.
### Table 8-4 Vascular access operation

| Treatment                                              | Cases     | 30-day mortality |
|--------------------------------------------------------|-----------|------------------|
| Arteriovenous access creation by autogenous material   | 11,186    | 125              |
| Arteriovenous access creation by artificial material*47 | 2,537     | 58               |
| Open surgery for access repair                         | 2,037     | 28               |
| Endovascular access repair                             | 5,986     | 31               |
| Arterial transposition                                 | 447       | 14               |
| Arteriovenous access aneurysm repair                   | 379       | 4                |
| **Total**                                              | **22,572**| **260**          |

*47) Including cases with access repair using artificial graft.

### Table 8-5 Surgery for lymphedema

| Treatment                  | Cases | Male | Female | 30-day mortality |
|----------------------------|-------|------|--------|------------------|
| Lymphovenous anastomosis   | 51    | 5    | 46     | 0                |
| Lymph drainage operation   | 3     | 3    | 0      | 0                |
| Resection                  | 46    | 28   | 18     | 0                |
| **Total**                  | **100**| **36**| **64**| **0**            |

### Table 8-6 Sympathectomy

| Sympathectomy               | Cases | 30-day mortality |
|----------------------------|-------|------------------|
| Thoracic sympathectomy     | 21    | 0                |
| Lumbar sympathectomy       | 8     | 0                |
| **Total**                  | **29**| **0**            |

### Table 8-7 Amputation of upper limb

| Amputation level           | Cases | 30-day mortality |
|----------------------------|-------|------------------|
| Digit                      | 16    | 1                |
| Forearm/Upper arm          | 4     | 3                |
| **Total**                  | **20**| **4**            |

### Table 8-8 Amputation of lower limb*48)

| Amputation level           | Cases | 30-day mortality | Etiology | ASO | DM-ASO | TAO | Others |
|----------------------------|-------|------------------|----------|-----|--------|-----|--------|
| Toe                        | 493   | 13               | 158      | 294 | 4      | 27  |        |
| Transmetatarsal            | 181   | 6                | 42       | 127 | 1      | 11  |        |
| Lisfranc/Chopart           | 33    | 3                | 13       | 16  | 0      | 4   |        |
| Syme                       | 3     | 0                | 3        | 0   | 0      | 0   |        |
| Below-Knee                 | 199   | 12               | 74       | 108 | 1      | 16  |        |
| Through-Knee/Above-Knee    | 272   | 21               | 120      | 116 | 2      | 34  |        |
| Hip                        | 4     | 2                | 1        | 2   | 0      | 1   |        |
| **Total**                  | **1,185**| **57**| **421**| **663**| **8**| **93**|        |

*48) Amputations not due to ischemia are not included.

Abbreviations; ASO: arteriosclerosis obliterans, DM-ASO: diabetic ASO, TAO: thromboangiitis obliterans (Buerger’s disease)
Conclusions

Following our reports in 2011, when the NCD registration began, and 2012, we described the overall representation of vascular surgery in 2013 in this report. Although only simple statistics are shown, these data summarize the present state of vascular surgery in Japan and will aid in understanding changes in vascular treatment over time.

One of the major goals of participating in the NCD is to improve the quality of medicine using NCD data. Going forward, several issues need to be investigated in order to achieve this goal. The first task is to further refine the entry items. The current entry items were designed based on questions in vascular surgery questionnaires that were in use since before the establishment of the NCD. However, they are insufficient in evaluating the quality of current medical services. As data are entered in the midst of busy clinical work, one of our next tasks is to refine entry items to only those that are essential for the vascular surgery registry. The other task is to determine an indicator for vascular treatment quality. Because the operative mortality rate is fortunately low for most vascular surgery procedures other than major vascular surgery, it cannot be used as an indicator. Therefore, an important future objective is adding a function to the NCD for comparing the risk adjusted quality indicator of vascular treatment at each institution with national standards. In 2018, the JSVS initiated two model studies to tackle these future tasks: “Japanese registry of patients treated with endovascular or open repair for ruptured abdominal aortic aneurysm” and “Retrospective study on treatment and prognosis of infected aneurysms of the abdominal aorta and common iliac artery.” The JSVS also started an open call in 2018 for proposals of new vascular surgery research projects using NCD data. In addition to this, an on-site visit program was initiated to improve data reliability. We hope to continue to further develop the vascular surgery database of the NCD with the help of all JSVS members. We sincerely hope that this database will assist in providing high-quality medical services to patients with vascular diseases.

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Appendix

Team responsible for analyzing the 2013 annual report as follows;

Database Management Committee of the Japanese Society for Vascular Surgery: Nobuya Zempo (Chairman), Nobuyoshi Azuma (Vice-chairman), Yukio Obitsu (Vice-chairman), Yoshinori Inoue, Hitoshi Okazaki, Hideaki Obara, Hirono Satokawa, Kunihiro Shigematsu, Ikuo Sugimoto, Hiroshi Banno, Naoki Fujimura, Akihiro Hosaka, Shinsuke Mii, Noriyasu Morikage, Terutoshi Yamakawa, Tetsuro Miyata (Observer), Kimihiro Komori (Chief director of the Japanese Society for Vascular Surgery)

NCD Vascular Surgery Data analyzers: Arata Takahashi

Disclosure Statement

None of the authors or co-authors has any conflicts of interest associated with this manuscript.

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