Vascular Surgery in Japan: 2015 Annual Report by the Japanese Society for Vascular Surgery

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Objectives: This is an annual report indicating the number and early clinical results of annual vascular treatment performed by vascular surgeon in Japan in 2015, 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 JSYS analyzed the vascular treatment data provided by the National Clinical Database (NCD), including the number of treatments and early results such as operative and hospital mortality.

Results: In total 124,299 vascular treatments were registered by 1,038 institutions in 2015. 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 22,041, 15,671, 4,779, 2,313, 857, 48,837, and 29,801, respectively. In the field of aneurysm treatment, 18,907 cases of abdominal aortic aneurysm (AAA) including common iliac aneurysm were registered, and 57.6% were treated by endovascular aneurysm repair (EVAR). Among AAA cases, 1,850 (9.8%) cases were registered as ruptured AAA. The operative mortality of ruptured and un-ruptured AAA was 16.0%, and 0.6%, respectively. 33.6% 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 16.6%, and 14.5%, respectively. Regarding chronic arterial occlusive disease, open repair was performed in 8,230 cases, including 1,194 distal bypasses to the crural or pedal artery, whereas endovascular treatment (EVT) was performed in 7,441 cases. The EVT ratio was gradually increased at 47.4%. Venous treatment including 47,046 cases with varicose vein treatments and 531 cases with lower limb deep vein thrombosis were registered. Regarding other vascular operations, 29,801 cases of vascular access operations and 1,511 lower limb 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 2020; 29: 161–179.)

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

Introduction

The National Clinical Database (NCD; a general incorporated association) was inaugurated in 2011 and initiated the registration of surgical cases. In response, the Japanese Society for Vascular Surgery (JSYS) started tallying NCD-registered cases of vascular surgery and presenting annual reports on vascular surgery at academic conferences.1–7 This paper documents the results of tallying and analysis, which was conducted by the members of the JSVS Database Management Committee, of the NCD-registered cases of vascular surgery performed from January to December 2015.

Methods

From the NCD-registered surgical cases in 2015, data on the cases of vascular surgery were extracted with the commission of the JSYS (an NCD-affiliated organization). On the basis of these data, the cases were classified into the following seven categories, and the tallied results were checked and analyzed by the members of the JSVS Database Management Committee. The categories were as follows: 1) revascularization for arterial aneurysm, 2) revascularization for chronic arterial occlusion, 3) revas-
cularization for acute arterial occlusion, 4) treatment for vascular trauma, 5) surgery for revascularization-related complications, 6) venous operation, and 7) other vascular diseases and related operations.

The tallied results presented include the numbers of cases by surgical modality, causes of disease, operative death count, hospital death count, and materials used. An operative death refers to any death in which the patient died within 30 days of surgery. Regardless of the cause of death or hospitalization status, all mortalities within 30 days of surgery are included. A hospital death signifies any postoperative death during the hospitalization irrespective of the time of occurrence.

The table presented contains some discrepant values, such as the total of the causes of disease and used materials that are inconsistent with the total number of cases. These inconsistencies were thoroughly investigated by the committee and the NCD and were eventually attributed to any of the following four reasons: 1) allowing multiple choices, 2) allowing blank entries, 3) omissions or erroneous entries by the data inputter, and 4) using multiple materials for a single operation or treating multiple sites. Since 2013, measures have been taken to avoid errors, such as allocating/newly introducing options that are less prone to misunderstanding and constructing a program that prohibits blank entries from being registered as much as possible.

Table 1 lists the items whose registration/tallying methods have been altered since 2015.

### Tallying/Analysis Results

The total number of NCD-registered cases of vascular surgery was 124,299 in 2015 (9.5% increase from the previous year), exceeding 120,000 for the first time and accounting for 8.5% of the total NCD-registered surgical cases in the same year. Moreover, the number of institutions that registered the cases of vascular surgery amounted to 1,038, showing that 28.0% of the institutions registering surgical operations registered the cases of vascular surgery. Of these 1,038 institutions, 500 (48.2%) were certified training facilities for cardiovascular surgery that contributed to our data as of 2015. The analysis results are interpreted by various categories as mentioned below. For statistical analysis, a chi-squared test was used, with a p value of <0.05 regarded as statistically significant.

### Ethical Review

The NCD-registered data on vascular surgery is disclosed and analyzed on an opt-out basis. Our vascular surgery annual report was approved by the ethical review board of Kansai Medical University Hospital on April 6, 2020 (reference number: 2019276).

#### 1. Treatment for Arterial Aneurysm (Table 2)

1) **Thoracic aortic aneurysm**

Most of the data on thoracic aortic aneurysm are registered in the Japan Cardiovascular Surgery Database (JCVSD), and some of the cases handled by vascular surgeons are registered in this cardiovascular surgical database via the NCD (Table 2). Therefore, surgical operations for thoracic aortic aneurysm performed throughout Japan are presently being registered in a fragmented manner, thus making it...
Table 2-1 Aortic aneurysm

| Region of aortic aneurysm       | Cases | Male | Female | 30-day mortality | Hospital mortality | Cases | 30-day mortality | Hospital mortality | Dissection*3) | Degenerative*2) | Inflammatory | Vasculitis | Infected | Connective tissue disease*5) | Others |
|--------------------------------|-------|------|--------|------------------|--------------------|-------|------------------|--------------------|---------------|----------------|--------------|------------|----------|-----------------------------|--------|
| Ascending aorta*1)             | 88    | 52   | 36     | 9                | 7                  | 11    | 2                | 3                  | 62            | 76             | 8            | 5          | 0        | 0                | 0       |
| Aortic arch*1)                 | 458   | 357  | 101    | 31               | 40                 | 38    | 9                | 12                 | 155           | 394            | 24           | 31         | 0        | 0                | 8       |
| Descending thoracic aorta*1)   | 526   | 371  | 155    | 18               | 25                 | 60    | 7                | 9                  | 211           | 436            | 13           | 19         | 2        | 1                | 13      |
| Thoracoabdominal aorta*1)      | 332   | 254  | 78     | 24               | 35                 | 51    | 10               | 12                 | 98            | 279            | 17           | 28         | 3        | 1                | 15      |
| Abdominal aortic aneurysm*2)   | 18,907| 15,588| 3,348    | 405           | 531               | 1,850 | 296              | 368                | 807           | 18,095         | 361           | 466        | 264      | 13               | 269     |
| with renal artery reconstruction| 378   | 317  | 61     | 13               | 23                 | 40    | 6                | 9                  | 50            | 348            | 12           | 21         | 9        | 0                | 9       |
| with renal artery clamping     | 1,374 | 1,170| 204    | 63               | 90                 | 204   | 41               | 54                 | 93            | 1,265          | 52           | 75         | 33       | 2                | 46      |

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 | Graft materials*7) |
|---------------------------|---------------------|--------------------|
|                           | Replacement         | Exclusion with bypass | Stent graft | Hybrid*6) | Polyester | ePTFE | Others |
|                           | Cases | Y-graft | T-graft | Exclusion with bypass | Stent graft | Hybrid*6) | Polyester | ePTFE | Others |
| Ascending aorta*1)        | 2     | 0       | 0       | 0           | 11      | 7       | 55      | 9     | 6     |
| Aortic arch*1)            | 12    | 0       | 0       | 0           | 2       | 260     | 149     | 79    | 66    |
| Descending thoracic aorta*1) | 26   | 0       | 0       | 0           | 4       | 452     | 40      | 34    | 17    |
| Thoracoabdominal aorta*1) | 50    | 0       | 0       | 0           | 13      | 174     | 28      | 114   | 26    |
| Abdominal aortic aneurysm*2) | 8,126| 5,880   | 1,132   | 63          | 10,821  | 62      | 6,985   | 393   | 85    |
| with renal artery reconstruction | 357 | 269    | 47      | 11          | 20      | 12      | 337     | 36    | 7     |
| with renal artery clamping | 1,350| 1,038   | 223     | 13          | 19      | 11      | 1,298   | 63    | 13    |

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                  | 1,225 | 203              | 251               | 6,826 | 65              | 100                 |
| Exclusion with bypass        | 14    | 4                | 4                 | 49    | 2               | 3                   |
| EVAR*                        | 621   | 90               | 114               | 10,224 | 43             | 61                  |
| Hybrid                       | 7     | 1                | 2                 | 55    | 0               | 0                   |

*8) EVAR: endovascular aneurysm repair

Fig. 1 Treatment procedure for non-ruptured and ruptured abdominal aortic aneurysm (AAA). Comparing year 2011, 2012, 2013, and 2014, proportion of EVAR selection was gradually increased in 2015.

Fig. 2 Early clinical results of non-ruptured AAA in year 2015 comparing with those in year 2011, 2012, 2013, and 2014. 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 2015 comparing with those in year 2011, 2012, 2013, and 2014. Regarding the statistical difference of mortality rates between open repair (replacement) and EVAR, see main text.

difficult to grasp the accurate overview of the situation. In the future, we need to consult with the JCVSD to facilitate the construction of the overview regarding the nationwide status of thoracic aortic aneurysm surgery.

2) Abdominal aortic aneurysm (Tables 2-1 and 2-2)

In 2015, the total number of NCD-registered surgical cases of abdominal aortic aneurysm (including iliac artery aneurysm) was 18,907, which was increased from 15,745 in 2012, 16,694 in 2013, and 17,973 in 2014 (year-on-year increases of approximately 1,000). The surgical cases break down into 8,126 (43.0%) cases of replacement and 10,883 (57.6%) cases of stent-graft deployment (endovascular aneurysm repair; EVAR) (including hybrids). Since surpassing the majority in 2013, the number of EVAR cases has been continuously increasing (47.6% in 2012, 52.9% in 2013, and 55.7% in 2014). The number of replacement cases has almost flattened out, with the increases in EVAR directly equaling the increases in the total number (Fig. 1).

Of all replacement cases, 1,350 required renal artery clamping (16.6%) and 357 required renal arterial reconstruction (4.4%). With the widespread adoption of EVAR, the cases of pararenal arteriopathy requiring renal artery clamping are expected to increase. In fact, the percentage has slightly yet steadily increased from 14.2% in 2012 to 15.4% in 2013 and 15.8% in 2014.

Regarding the treatment results of non-rupture cases, the operative and the hospital mortalities from replacement were 1.0% and 1.5%, respectively, and those from EVAR (including special and hybrid techniques) were 0.4% and 0.6%, respectively (Fig. 2). When replacement involved renal artery clamping, the mortalities were aggravated to 1.9% and 3.1%, respectively. When reconstruction was added to these procedures, the mortalities were further aggravated to 2.2% and 4.4%, respectively.

The number of cases of rupture surgery was 1,850, with...
| Aneurysm                  | Cases | 30-Day Mortality | Hospital Mortality | 30-d Mortality | Hospital Mortality | Degenerative Vascularitis*9 | Infected | Traumatic | Others | Replacement | Exclusion with bypass | Ligation/Resection | Stent graft | Coil embolization | Others | Polyester | ePTFE | Autogenous vessel | Others |
|--------------------------|-------|------------------|--------------------|-----------------|------------------|-------------------------|----------|-----------|--------|-------------|----------------------|-----------------|------------|------------------|--------|-----------|-------|-------------------|--------|
| Aortic arch branches     |       |                  |                    |                 |                  |                         |          |           |        |             |                      |                 |            |                  |        |           |       |                   |        |
| Carotid                  | 7     | 4                | 3                  | 0               | 0                | 0                       | 2        | 0         | 2      | 1           | 2                    | 2               | 0          | 2                | 0      | 3         | 0     | 0                 |        |
| Vertebral                | 0     | 0                | 0                  | 0               | 0                | 0                       | 0        | 0         | 0      | 0           | 0                    | 0               | 0          | 0                | 0      | 0         | 0     | 0                 |        |
| Subclavian               | 32    | 23               | 9                  | 0               | 0                | 0                       | 24       | 2         | 1      | 1           | 4                    | 6               | 6          | 3                | 12     | 6         | 2     | 5                 | 7      |
| Multiple in arch branches| 3     | 2                | 1                  | 0               | 0                | 0                       | 0        | 0         | 1      | 0           | 0                    | 0               | 1          | 1                | 1      | 1         | 0     | 0                 |        |
| Others                   | 8     | 7                | 1                  | 2               | 2                | 1                       | 1        | 1         | 3      | 0           | 2                    | 1               | 2          | 3                | 0      | 1         | 0     | 0                 |        |
| Upper limb artery        |       |                  |                    |                 |                  |                         |          |           |        |             |                      |                 |            |                  |        |           |       |                   |        |
| Axillary                 | 16    | 8                | 8                  | 0               | 1                | 0                       | 0        | 12        | 2      | 1           | 0                    | 2               | 11         | 4                | 0      | 0         | 1     | 2                 | 5      |
| Brachial                 | 197   | 106              | 91                 | 5               | 8                | 3                       | 0        | 42        | 0      | 26          | 56                   | 73              | 34         | 10               | 104    | 0         | 1     | 55                | 3      |
| Forearm-hand             | 108   | 59               | 49                 | 1               | 1                | 0                       | 0        | 29        | 2      | 8           | 35                   | 34              | 4          | 0                | 73     | 0         | 2     | 33                | 0      |
| Others                   | 52    | 30               | 22                 | 0               | 0                | 0                       | 0        | 15        | 0      | 9           | 7                    | 21              | 1          | 2                | 38     | 0         | 1     | 11                | 0      |
| Visceral artery          |       |                  |                    |                 |                  |                         |          |           |        |             |                      |                 |            |                  |        |           |       |                   |        |
| Celiac                   | 38    | 30               | 8                  | 2               | 1                | 0                       | 0        | 26        | 1      | 4           | 1                    | 6               | 11         | 2                | 8      | 6         | 13    | 3                 | 5      |
| Hepatic                  | 19    | 11               | 8                  | 1               | 1                | 1                       | 1        | 12        | 0      | 4           | 0                    | 3               | 2          | 2                | 8      | 0         | 8     | 3                 | 1      |
| Splenic                  | 63    | 32               | 31                 | 2               | 2                | 1                       | 1        | 15        | 0      | 4           | 0                    | 4               | 2          | 2                | 18     | 0         | 39    | 5                 | 0      |
| Superior mesenteric      | 24    | 17               | 7                  | 1               | 1                | 0                       | 0        | 18        | 2      | 2           | 0                    | 2               | 4          | 8                | 11     | 0         | 3     | 1                 | 4      |
| Renal                    | 68    | 42               | 26                 | 0               | 1                | 0                       | 0        | 60        | 0      | 2           | 0                    | 6               | 14         | 3                | 15     | 3         | 29    | 11                | 1      |
| Others                   | 519   | 444              | 75                 | 5               | 6                | 3                       | 0        | 465       | 5      | 6           | 5                    | 38              | 86         | 10               | 50     | 194       | 253  | 15                | 76     |
| Lower limb artery        |       |                  |                    |                 |                  |                         |          |           |        |             |                      |                 |            |                  |        |           |       |                   |        |
| Femoral                  | 475   | 373              | 102                | 10              | 15               | 1                       | 0        | 235       | 3      | 41          | 75                   | 121             | 191        | 24               | 155    | 11        | 7     | 100               | 93     |
| Popliteal                | 270   | 196              | 75                 | 1               | 2                | 0                       | 0        | 243       | 3      | 4           | 11                   | 9               | 142        | 96               | 32     | 2         | 2     | 12                | 29     |
| Others                   | 112   | 87               | 25                 | 5               | 6                | 0                       | 0        | 72        | 5      | 7           | 8                    | 20              | 29         | 12               | 32     | 10        | 16    | 16                | 23     |
| Total                    | 1,979 | 1,444            | 535                | 35              | 48               | 10                      | 3        | 3        | 1,292  | 24           | 118                  | 200             | 345        | 530              | 169    | 546       | 238  | 382               | 268    |

*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
the operative and hospital mortalities being 16.0% and 19.9%, respectively. These results were almost identical to those obtained in 2014 (16.1% and 18.7%, respectively). EVAR was performed for 628 (33.6%) cases. Although the ratio of EVAR for rupture cases was increasing in the past few years, it slightly flattened out this year (14% in 2011, 20% in 2012, 25.5% in 2013, and 30.1% in 2014). The operative and hospital mortalities from EVAR for rupture cases were 14.5% and 18.5%, respectively. Although there was a slight year-on-year aggravation tendency (11.9% and 14.8% in 2012, 15.8% and 18.2% in 2013, and 17.1% and 20.3% in 2014), a slight improvement was observed from 2014 to 2015. Since the ratios of surgical modalities remained unchanged, surgical techniques might have improved (stabilized) at institutions that introduced EVAR for rupture cases (Fig. 3).

3) Peripheral artery aneurysm (Table 2-3)

Overall, 1,979 cases were registered. There were more male patients than female patients (with a ratio of 1,444 to 535). By region, most cases (857) concerned the lower limb arteries, followed by 731 cases concerning the abdominal visceral arteries, 373 cases concerning the upper limb arteries, and 50 cases concerning the aortic arch branching. The total number was 2,011; thus, it was inferred that 32 aneurysms simultaneously developed in multiple regions. By artery, 23.6% of the cases occurred in the femoral artery, 13.4% in the popliteal artery, and 9.8% in the brachial artery. In the “others” category of the abdominal visceral arteries (25.8%), the majority is considered to be an internal iliac arterial aneurysm. Therefore, modifications should be made to the registration method. Overall, 42.8% were symptomatic, and the most prevalent cause of illness was degenerative disease (65.3%). By surgical modality, 25.6% were ligation/dissection, 17.9% were coil embolization, 11.2% were stent grafting, and 7.8% were exclusion bypass. Given that the total number of surgical cases was 2,133, it was surmised that 7.2% received a combination of modalities or different modalities for simultaneously occurring aneurysms. Overall, the same trend as 2014 was observed in 2015.

2. Revascularization for Chronic Arterial Occlusion (Table 3)

1) Arch branching, upper limb arteries, and abdominal visceral arteries (Table 3-1)

Compared with 2014, 2015 saw increases in cases concerning the carotid artery, subclavian artery, aortic arch branching multiple lesions, axillary artery to upper limb artery, and renal artery. Despite some fluctuations, no significant changes were noted in the other vertebral, celiac,
### Table 3-2 Arterial reconstruction for chronic lower limb ischemia

| From aorta to lower limb arterial systems | Gender | Mortality | Dialysis cases | Etiology | Graft materials | Previous reconstruction | Revision reason |
|------------------------------------------|--------|-----------|----------------|----------|----------------|-------------------------|----------------|
|                                          | Cases  | Male      | Female         | ASO      | TAO Vascular     | Polyaester ePTFE        | Autogenous veins |
| Aorto-aortic bypass                      | 41     | 29        | 12             | 0        | 4               | 35                      | 3              |
| Infrarenal aortic reconstruction (suprarenal clamp) | 37     | 33        | 4              | 0        | 1               | 34                      | 1              |
| Aorto-femoral bypass††                   | 562    | 445       | 117            | 4        | 33              | 545                     | 0              |
| Femoropopliteal (above the knees) bypass | 1,810  | 1,327     | 483            | 13       | 254             | 1,791                   | 3              |
| Infrapopliteal arterial bypass           | 1,872  | 1,380     | 492            | 33       | 605             | 1,610                   | 21             |
| Femoropopliteal (below the knees) bypass | 726    | 516       | 210            | 12       | 168             | 709                     | 2              |
| Femorocrural/bial bypass††               | 1,194  | 900       | 294            | 22       | 454             | 1,148                   | 19             |
| Others                                   | 98     | 74        | 24             | 3        | 17              | 91                      | 2              |

| Total                                    | 4,257  | 3,159     | 1,098          | 50       | 850             | 1,447                   | 18             |

†† Including aorto-femoral bypass or ilio-femoral bypass.

### Table 3-3 Extra-anatomical bypass*††

| Extra-anatomical bypass                  | Gender | Mortality | Dialysis cases | Etiology | Graft materials | Previous reconstruction | Revision reason |
|------------------------------------------|--------|-----------|----------------|----------|----------------|-------------------------|----------------|
| Carotid-subclavian bypass                | 147    | 115       | 32             | 7        | 10              | 16                      | 0              |
| Axillo-axillary bypass                   | 238    | 186       | 52             | 6        | 15              | 51                      | 0              |
| Axillo-femoral bypass†                   | 372    | 249       | 123            | 8        | 46              | 346                     | 2              |
| Femorofemoral crossover bypass           | 825    | 661       | 164            | 9        | 85              | 783                     | 4              |
| Others                                   | 114    | 92        | 22             | 2        | 10              | 104                     | 0              |

| Total                                    | 1,592  | 1,224     | 368            | 27       | 157             | 1,269                   | 5              |

*†† Including carotid-subclavian bypass or axillo-subclavian bypass.

†† Including axillo-femoral bypass or ilio-femoral bypass.
### Table 3-4  Thromboendarterectomy* for chronic lower limb ischemia

| Thromboendarterectomy | Gender | Mortality | Dialysis | Etiology | Previous reconstruction | Revision reason |
|-----------------------|--------|-----------|----------|----------|-------------------------|-----------------|
|                       | Male   | Female    | 30-day   | ASO      | TAO                     | Other           |
|                       | Cases  |         | mortality| cases    | cases                   |                 |
| Aorto-iliac lesion    | 55     | 44       | 11       | 8        | 52                     | 2               |
| Femoro-popliteal lesion| 960    | 705      | 255      | 7        | 233                    | 952             |
| Others                | 476    | 356      | 119      | 16       | 119                    | 423             |
| Total                 | 1,496  | 1,086    | 379      | 23       | 353                    | 1,404           |

*19) Including patch plasty.

## Table 3-5  Endovascular treatment for chronic lower limb ischemia* 

| Endovascular treatment | Gender | Mortality | Dialysis | Etiology | Previous reconstruction | Revision reason |
|------------------------|--------|-----------|----------|----------|-------------------------|-----------------|
|                        | Male   | Female    | 30-day   | ASO      | TAO                     | Other           |
|                        | Cases  |         | mortality| cases    | cases                   |                 |
| Aorto-iliac lesion*20) | 3,284  | 2,646    | 638      | 23       | 31                     | 394             |
| Femoro-popliteal lesion*20) | 3,229  | 2,194    | 1,035    | 36       | 77                     | 904             |
| Infrapopliteal-ankle lesion*20) | 1,803  | 1,181    | 622      | 34       | 84                     | 878             |
| Others                 | 197    | 128      | 69       | 2        | 6                      | 83              |
| Total (number of regions underwent EVT)*20) | 7,441  | 5,458    | 1,983    | 73       | 155                    | 1,857           |
| Total (number of limbs underwent EVT)*21) | 6,417  | 4,795    | 1,622    | 54       | 117                    | 1,473           |

*20) When endovascular treatment performed for multiple regions, the case should be counted in each regions (If a case underwent 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 underwent 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.
and superior mesenteric arteries. In 2015, debranching associated with TEVAR/EVAR was added as a new item, and the following cases were registered: 39 cases of ascending aorta-brachioccephalic artery-left common carotid artery (-left subclavian artery) bypass, 125 cases of right axillary (subclavian)-left common carotid artery (-left subclavian artery) bypass + right common carotid-left common carotid artery bypass + left common carotid-left subclavian artery bypass, 172 cases of right axillary (subclavian)-left axillary (subclavian) bypass, and 21 cases of abdominal aorta-superior mesenteric-renal artery bypass. However, the increase in the cases of carotid artery-related surgery was mainly attributed to the increase in the cases of carotid artery-subclavian artery bypass and axillo-axillary artery bypass (possibly debranching). Since a debranching-related item was newly introduced in 2015, such cases were registered separately from cases applicable to the other existing items. Therefore, caution is required for increases or decreases in the number of cases in each item. However, the number of cases of arch branching bypass (possibly related to debranching) has been greatly increasing per year. This may signify that stent-graft deployment for anatomically complex aortic aneurysms has been performed increasingly (Table 3-6).

2) Anatomical bypass for the aorta-lower limb artery region (Table 3-2), extra-anatomical bypass (Table 3-3), and endovascular treatment (Table 3-5)

Aortoiliac area: The number of cases performing anatomical bypass for aortoiliac area lesions decreased from 733 in 2014 to 640 in 2015 (approximately 15% decrease). Nevertheless, there were no changes in the surgery items, including synthetic vascular grafts. Regarding extra-anatomical revascularization procedures, as represented by axillo-femoral artery bypass and femoro-femoral artery bypass, the numbers of cases increased from 345 and 890 in 2014 to 372 and 825 in 2015, respectively. Hence, the number of cases slightly increased in the former and decreased in the latter. However, the total number did not change significantly, and the details remained unchanged. The rate of revascularization in the past was 13% for anatomical bypass, which was less frequent than 23% for

| Table 3-6 | Debranch for TEVAR or EVAR |
|-----------|---------------------------|
| Debranch for TEVAR or EVAR | Cases |
| Ascending aorta-brachioccephalic-left common carotid (-left subclavian) arterial bypass | 39 |
| Right axillar-left common carotid (-left axillary) arterial bypass | 125 |
| Right common carotid-left common carotid (-left subclavian) arterial bypass | 172 |
| Left common carotid-left subclavian arterial bypass or transposition | 21 |
| Abdominal aorta (iliac) (-celiac)-superior mesenteric-renal arterial bypass | 21 |
extra-anatomical bypass. This ratio was unchanged from the previous years. The decrease in the cases of anatomical reconstruction was nearly equal to the increase in the cases of endovascular treatment; thus, it was inferred that the actual number of revascularization procedures was not greatly changed in this region (Fig. 4A).

3) Superficial femoral artery
The number of cases performing femoral above-knee popliteal artery bypass was almost unchanged from 1,859 in 2014 to 1,810 in 2015. Overall, 26% of the patients had a previous history of revascularization, and 70% of the synthetic vascular grafts were made of ePTFE, whereas 19% used autogenous veins (Fig. 4B).

4) Revascularization below the knee joint
Of the revascularization cases performed below the knee joint, the numbers of cases of femoral below-knee popliteal artery bypass and femoro-crural/pedal artery bypass were 699 and 1,210 cases in 2014 and 726 and 1,194 cases in 2015, respectively. The number of cases of revascularization below the knee joint (including cases of distal bypass) did not change significantly from 2014 (Figs. 4B and 4C). Of the cases of femoro-crural/pedal artery bypass, 39% required dialysis, which was a slight increase from the previous year. This suggests a slight increase in bypass cases for more serious patients. Moreover, 40% had a history of revascularization, which was more than the history of above-knee bypass. For vascular graft, 86% used autogenous veins.

5) Thromboendarterectomy (Table 3-4)
The number of cases performing thromboendarterectomy in the lower limb artery system in the femoropopliteal artery region was 1,039 in 2014, which decreased by 8% to 960 in 2015. However, since this report included replaced items, the number of cases using other modalities greatly increased from 121 in 2014 to 476 in 2015. These cases probably included several instances of femoral re-construction with graft. Therefore, it was likely that more lesions in the common femoral artery, which are difficult to address with endovascular treatment, were treated as a whole (Fig. 4B).

6) Endovascular treatment (Table 3-5)
The total number of cases performing endovascular treatment increased by approximately 1,000 (17%) from 2014, 25% of which were performed for dialysis cases. While an almost equal number of revascularization procedures (bypass and thromboendarterectomy) were performed compared with the numbers in 2014, there was a marked increase in cases performing endovascular treatment. In particular, endovascular treatment was in-

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Table 4
Revascularization for acute arterial occlusive disease

| Procedure | Male | Female | 30-day mortality | Hospital mortality | Embolism | Thrombosis | Thrombectomy | PTA ± stent | Thrombolysis | Others | Graft materials for open surgery |
|-----------|------|--------|-----------------|-------------------|----------|------------|--------------|-------------|--------------|--------|-------------------------------|
| Carotid artery | 10 | 4 | 6 | 1 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 |
| Subclavian artery | 53 | 31 | 22 | 1 | 2 | 18 | 20 | 9 | 3 | 6 | 1 | 6 | 1 | 6 | 1 |
| Axillar artery | 85 | 39 | 46 | 2 | 5 | 34 | 24 | 29 | 27 | 37 | 9 | 6 | 1 | 6 | 1 |
| Brachial artery | 699 | 320 | 379 | 24 | 29 | 207 | 239 | 18 | 26 | 18 | 8 | 1 | 8 | 1 |
| Celiac/superior mesenteric artery | 112 | 78 | 34 | 16 | 30 | 16 | 30 | 16 | 30 | 16 | 30 | 16 | 30 | 16 | 30 |
| Renal artery | 37 | 23 | 14 | 4 | 20 | 11 | 20 | 11 | 20 | 11 | 20 | 11 | 20 | 11 | 20 |
| Femoral-popliteal artery | 2,661 | 1,569 | 1,092 | 221 | 283 | 36 | 283 | 36 | 283 | 36 | 283 | 36 | 283 | 36 | 283 | 36 |
| Distal bypass | 37 | 23 | 14 | 4 | 20 | 11 | 20 | 11 | 20 | 11 | 20 | 11 | 20 | 11 | 20 | 11 |
| Total | 4,779 | 2,940 | 1,837 | 367 | 476 | 1,855 | 2,592 | 332 | 550 | 345 | 714 | 522 | 714 | 522 | 714 | 522 |

* Including cases with chronic arterial occlusive disease.
### Table 5 Treatment for vascular trauma

#### Table 5-1 Arterial trauma

| Injured artery | Cases | Gender | Mortality | Cause of trauma | Procedure | Status of injured artery*1,2,3 | Prosthesis |
|----------------|-------|--------|-----------|-----------------|-----------|------------------------------|------------|
|                |       | Male   | Female    |                 |           |                              |            |
|                |       | 30-day mortality | Hospital mortality | Traffic accident |劳工事故 |     Iatrogenic   | Others   | Direct closure | Patch | Replace-ment | Bypass | Endo-vascular | Ligation | Others | Obstruction/stenosis*4 | Bleeding without specification*5 | GI fistula | Non-GI fistula | Pseudo-aneurysm | Others | Autogenous vessel | polyester | ePTFE | Others |
| Carotid artery | 29    | 19     | 10       | 6               | 6         | 2               | 0         | 16              | 11    | 12            | 1     | 6             | 1     | 16          | 2           | 2        | 3                  | 5           | 1         | 0        | 2         | 0          |
| Subclavian artery | 56    | 36     | 20       | 5               | 9         | 4               | 2         | 41              | 9     | 28            | 2     | 1             | 2     | 12          | 8           | 5        | 7                  | 30          | 0         | 0        | 7         | 12         |
| Axillary artery  | 29    | 17     | 12       | 0               | 3         | 1               | 2         | 17              | 9     | 13            | 0     | 0             | 9     | 3           | 1           | 6        | 9                  | 10          | 1         | 0        | 5         | 5          |
| Brachial artery  | 340   | 200    | 140      | 6               | 12        | 7               | 11        | 274             | 48    | 232           | 2     | 8             | 22    | 8           | 44          | 35       | 42                 | 66          | 0         | 6        | 197       | 42         |
| Deep cervical artery (thoracic/thoracoabdominal) | 45 | 32 | 13 | 12 | 12 | 17 | 7 | 7 | 14 | 6 | 0 | 2 | 1 | 22 | 6 | 9 | 5 | 22 | 5 | 1 | 8 | 6 | 0 | 2 | 1 |
| Celiac/ superior mesenteric artery | 36 | 25 | 11 | 2 | 3 | 13 | 2 | 13 | 8 | 10 | 0 | 2 | 5 | 18 | 2 | 0 | 12 | 18 | 2 | 0 | 3 | 3 | 3 | 1 | 2 |
| Renal artery | 19 | 16 | 3 | 0 | 0 | 3 | 1 | 6 | 9 | 2 | 0 | 1 | 2 | 8 | 0 | 6 | 6 | 11 | 0 | 0 | 3 | 2 | 1 | 0 | 2 |
| Abdominal aorta-iliac artery | 246 | 147 | 99 | 20 | 26 | 28 | 17 | 137 | 64 | 54 | 8 | 30 | 34 | 107 | 12 | 25 | 47 | 105 | 9 | 11 | 22 | 60 | 9 | 38 | 26 |
| Femoro-popliteal artery | 1,045 | 655 | 390 | 141 | 196 | 30 | 44 | 708 | 173 | 754 | 38 | 40 | 70 | 46 | 64 | 69 | 120 | 270 | 2 | 16 | 380 | 318 | 81 | 22 | 43 |
| Crural artery | 50 | 39 | 11 | 1 | 2 | 6 | 13 | 19 | 12 | 18 | 2 | 2 | 13 | 6 | 5 | 6 | 16 | 15 | 0 | 0 | 15 | 6 | 13 | 0 | 3 |
| Others | 302 | 179 | 123 | 21 | 28 | 23 | 31 | 140 | 108 | 199 | 5 | 6 | 9 | 42 | 91 | 55 | 27 | 143 | 3 | 18 | 90 | 63 | 9 | 3 | 3 |
| Total | 2,167 | 1,345 | 822 | 213 | 294 | 129 | 125 | 1,459 | 454 | 1,233 | 98 | 90 | 154 | 269 | 238 | 216 | 696 | 23 | 54 | 689 | 515 | 142 | 65 | 86 |

27) Iatrogenic pseudoaneurysm in endovascular treatment is listed in Table 5-1.
28) Including arterial dissection.
29) Without GI fistula or non-GI fistula.

*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

| Injured veins | Cases | Cause of trauma | Procedure | Prosthesis |
|---------------|-------|-----------------|-----------|------------|
| Superior vena cava | 6 | 0 | 0 | 4 | 2 | 2 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 2 |
| Inferior vena cava | 10 | 0 | 1 | 5 | 4 | 6 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| Brachiocephalic-subclavian vein | 11 | 1 | 1 | 9 | 0 | 6 | 0 | 1 | 0 | 2 | 3 | 1 | 0 | 1 | 0 | 0 |
| Iliac-femoral-popliteal vein | 62 | 1 | 1 | 52 | 8 | 34 | 2 | 7 | 2 | 4 | 10 | 8 | 7 | 2 | 2 | 0 |
| Others | 60 | 3 | 1 | 33 | 23 | 24 | 0 | 3 | 4 | 1 | 33 | 8 | 3 | 0 | 4 | 0 |

Total 146 5 4 102 35 72 5 12 6 7 48 18 11 3 7 2
Increasingly being applied to occlusive arterial diseases. In fact, endovascular treatment accounts for 46% of all the revascularization procedures for chronic arterial occlusion. In the crural artery region, particularly, 1,803 cases underwent endovascular treatment in 2015, which was a marked 40% increase from 1,283 cases in 2014. The increase rate was 19% in the femoropopliteal artery region, whereas the number was almost unchanged from 2014 in the iliac artery region. In the regions below the inguinal ligament, the number of endovascular treatment cases increased significantly.

3. Revascularization for Acute Arterial Occlusion (Table 4)

The number of acute arterial occlusion cases excluding vascular trauma was 4,779. The lesions below the abdominal aorta accounted for approximately 80% overall, with the cases of thrombosis and embolism being half each. This result was consistent with that of the previous years. Given that the total number of obstruction cases in all regions was 5,527, 748 (13.5%) probably had obstruction in multiple sites, and this ratio was also consistent with that of the previous years. The number of cases performing thrombolytic therapy (which was added as a new item in 2013) was 62 (70 in the previous year). Overall, the percentage of percutaneous transluminal angioplasty (PTA)±stent cases was 14.9%, showing a year-on-year increasing trend (12.6% in the previous year). The implementation rate of intravascular treatment (PTA±stent; thrombolysis) was 25.9% in the abdominal aorta-iliac artery region (23.3% in the previous year) and 15.8% in the femoropopliteal artery region (13.1% in the previous year).

The use rate of synthetic vascular grafts in bypass surgery was 68.6% (67.6% in the previous year) in the femoropopliteal artery and 55.1% (54.8% in the previous year) in the crural artery regions. Even in the crural artery, synthetic vascular grafts were used in more than half the cases of acute arterial occlusion, and this was consistent with the results of previous years.

The operative and hospital mortalities were 12.3% and 15.0% in the abdominal aorta-iliac artery region, 8.5% and 10.9% in the femoropopliteal artery region, 9.1% and 13.3% in the crural artery region, and 20.0% and 27.3% in the pedal artery region, respectively. Compared
### Table 6-1 Graft infection

| Position of infected graft | Cases | 30-day mortality | Hospital mortality | Sepsis | Graft-GI fistula | Graft-skin fistula | Others | Procedure for graft infection | Material for revision or redo surgery |
|----------------------------|-------|-----------------|-------------------|--------|----------------|-------------------|--------|-----------------------------|----------------------------------|
| Descending thoracic aorta  | 3     | 0               | 0                 | 2      | 1              | 0                 | 0      | 0                          | 1                                |
| Thoracoabdominal aorta     | 18    | 1               | 2                 | 6      | 7              | 4                 | 4      | 0                          | 1                                |
| Abdominal aorta-iliac artery | 57   | 5              | 10                | 23     | 22             | 6                 | 15     | 21                         | 0                                |
| Abdominal aorta-femoral artery | 51 | 5         | 9                 | 16     | 7              | 17                | 13     | 11                         | 0                                |
| Femoro-distal artery       | 118   | 7              | 11                | 32     | 3              | 56                | 33     | 22                         | 0                                |
| Others                     | 278   | 16             | 26                | 53     | 6              | 114               | 118    | 26                         | 15                               |

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

### Table 6-2 Anastomotic aneurysm

| Location of anastomotic aneurysm | Cases | 30-day mortality | Degenerative | Takayasu arteritis | Other vasculitis | Infection | Others | Repair procedure | Material for repair surgery |
|----------------------------------|-------|------------------|--------------|--------------------|-----------------|-----------|--------|-----------------|-----------------------------|
| Aortic arch branch               | 2     | 0                | 0             | 0                  | 0               | 0         | 0      | Replacement     | 1                           | 0                           |
| Upper limb artery including axillar artery | 28 | 0           | 3              | 0                  | 0               | 2         | 23     | Exclusion and bypass | 18                          | 1                           | 5                           | 8                           |
| Thoracic aorta                   | 5     | 0                | 2              | 0                  | 0               | 0         | 3      | Stent graft      | 1                           | 0                           | 0                           | 0                           |
| Splanchnic artery                | 5     | 1                | 3              | 0                  | 0               | 1         | 1      | Others          | 3                           | 0                           | 0                           | 1                           |
| Renal artery                     | 3     | 0                | 1              | 0                  | 0               | 0         | 2      | Others          | 0                           | 0                           | 1                           | 0                           |
| Abdominal aorta                  | 36    | 1                | 28             | 1                  | 2               | 1         | 4      | Others          | 11                          | 0                           | 20                          | 0                           |
| Iliac artery                     | 23    | 4                | 15             | 0                  | 1               | 1         | 6      | Others          | 4                           | 1                           | 10                          | 8                           |
| Femoral artery                   | 50    | 3                | 30             | 0                  | 0               | 7         | 13     | Others          | 20                          | 3                           | 2                           | 25                          |
| Popliteal or more distal lower limb artery | 18 | 0            | 8              | 0                  | 1               | 1         | 8      | Others          | 3                           | 2                           | 0                           | 13                          |

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

*33) Including the atherosclerotic aneurysm.

*34) Including TAO, collagen disease, Behcet disease, and fibromuscular dysplasia.
with the cases performing elective revascularization, prognosis was clearly poor. Particularly, the operative and hospital mortalities for pedal arterial occlusion significantly increased from those of the previous year (5.1%/15.3%).

Of the 112 cases in the abdominal artery-superior mesenteric artery region, the operative mortality was 14.3% and the hospital mortality was 17.9%, showing an extremely poor prognosis similar to those of the previous years. The implementation rate of endovascular treatment was only 18.8% in this region, with surgical therapies such as thrombectomy and bypass surgery being the primary modalities.

4. Treatment for Vascular Trauma (Table 5)

Table 5 lists the sites of vascular trauma, causes of injury, surgical modalities, and types of vascular grafts used as registered in the NCD in 2015. The total number of cases of arterial/venous trauma was 2,313. The most prevalent cause of vascular trauma was iatrogenic, accounting for 1,561 (67%) cases, followed by traffic accidents in 134 (6%) cases and occupational hazards in 129 (6%) cases. The most prevalent site of vascular injury was the lower limb arteries, accounting for 1,095 (47%) cases, followed by 425 (18%) cases in the upper limb arteries and 246 (10%) cases in the abdominal-iliac artery. Therapeutic modalities were registered in 2,426 cases. By modality, direct suture was used in 1,305 (54%) cases, ligation in 286 (12%) cases, and endovascular treatment in 276 (11%) cases (Fig. 5A). Vascular grafts were used in 326 cases, and 47% of the vascular grafts used were autogenous vessels.

1) Iatrogenic vascular trauma (Fig. 5B)

Of the 1,561 cases and 1,571 sites of iatrogenic vascular trauma, the most prevalent site was the lower limb arteries (817 cases; 52%), followed by the upper limb arteries (332 cases; 21%). Therefore, the lower and upper limb arteries combined accounted for 74%, most of which probably occurred as complications of paracentesis associated with endovascular catheterization and treatment.

2) Traffic accident injury (Fig. 5C)

Of the 134 cases and 139 sites of traffic accident injuries, the most prevalent site was the upper and lower limb arteries (48 cases; 35%), followed by the abdominal aorta-iliac artery (28 cases; 20%), the descending aorta-thoracoabdominal aorta (17 cases; 12%), and visceral arteries (16 cases; 12%). Situated close to the body surface, blood vessels in the four extremities are frequently subjected to external force and, hence, are susceptible to injury. However, unlike the other causes, the prevalent sites of traffic accident injuries include the thoracic/abdominal aortic regions that are protected by the rib cage and abdominal wall. This is probably because traffic accidents involve high-energy trauma due to sudden collision and deceleration.

3) Occupational hazard injury (Fig. 5D)

Occupational hazard injuries mainly include accidents at work, such as falling from high place and getting stuck in working machinery. Overall, 129 cases and 134 sites were registered. By site, 72 (54%) cases occurred in the arteries in the four extremities, which were close to the body...
surface and subject to external force.

4) Summary
This report presented an overview of the registration status of vascular trauma cases in the NCD database in 2015. Compared with 2014, the overall number of registered cases slightly increased. Nevertheless, there were no significant differences in the causes/sites of trauma, types of vascular grafts, and therapeutic modalities.

5. Surgery for Revascularization Complications (Table 6)
As with reports of the previous years (up to 2014), the number of registered cases concerning the chest to thoracoabdominal region was small. The number of revascularization complications in this region could not be examined.

1) Vascular graft infection (Table 6-1)
As vascular graft infection, 525 cases were registered. 53.0% of which were the others region, including the arch branching and upper limb artery. In this region, the most prevalent condition of infection is the cutaneous fistula of vascular grafts, many of which were inferred to be infection in the shunts for dialysis. 22.5% of graft infection were femoro-distal artery. The overall operative mortality was 6.5%, and in-hospital mortality was 11.0%.

2) Arterial aneurysm in anastomotic sites (non-infectious) (Table 6-2)
There were 164 cases reported as aneurysm in anastomotic sites. By region, the most prevalent was the femoral artery, followed by the abdominal aorta, axillary artery-upper limb artery, and iliac artery. In the peripheral region beyond the abdominal aorta, arterial sclerosis was the most prevalent cause of illness.

3) Autogenous vascular graft aneurysm (Table 6-3)
According to the report of autogenous vascular graft aneurysm, there were 21 cases in the upper and 39 cases in the lower limb arteries. The abdominal visceral artery was not reported as a site. By modality, 28.6% of the cases used replacement/bypass surgery in the upper and 25.6% in the lower limb arteries. The other regions were the most prevalent, but the details remained unclear.

4) Degradation of vascular grafts (Table 6-4)
In 2015, 97 cases of vascular graft degradation were registered, which was a considerable increase from 52 in 2014. By initial modality, the number of replacement cases increased from 19 to 29, bypass surgery cases from 19 to 46, and stent-graft surgery from 3 to 6 (2014 vs. 2015). Degradation of polyester and ePTFE was also reported; however, the degradation rate could not be calculated because the statistical parameter was unknown.

6. Venous Operation (Table 7)
1) Varicose veins in the lower extremities (Table 7-1)
The number of varicose vein operations markedly in-
increased since 2011, reaching 47,046 cases in 2015, which was a 2.5-fold increase from 2011. By modality, the numbers of stripping (± sclerotherapy) operations and high ligation operations decreased, whereas the number of endovenous laser ablation (EVLA) (± sclerotherapy) increased to 27,849 (59.2%) cases (Fig. 6). This was probably due to the insurance coverage of 1470-nm laser devices that took effect in 2014 in Japan. Given that radiofrequency ablation apparatuses were also approved in 2014, endovascular cauterization techniques such as EVLA and radiofrequency ablation was considered to become the mainstream for treating varicose veins in the

| Table 7-2 | Deep vein thrombosis (including venous stenosis or obstruction) |
|-----------|---------------------------------------------------------------|
| Deep vein thrombosis treatment | Cases | Male | Female | 30-day mortality |
| Thrombectomy | 64 | 34 | 30 | 0 |
| Catheter-directed thrombolysis*37) | 51 | 23 | 28 | 0 |
| Bypass (peripheral venous reconstruction) | 6 | 2 | 4 | 0 |
| IVC filter insertion*38) | 311 | 143 | 168 | 5 |
| IVC filter retrieval*38) | 135 | 62 | 73 | 1 |
| Direct surgery of stenosis*39) | 2 | 1 | 1 | 0 |
| Endoluminal treatment of stenosis | 32 | 10 | 22 | 0 |
| Others | 11 | 4 | 7 | 0 |
| Total | 531 | 240 | 291 | 6 |

*37) Including the catheter-directed thrombolysis using hydrodynamic thrombectomy catheter.
*38) Including temporary IVC filter.
*39) Including obstruction.

| Table 7-3 | Upper limb vein stenosis or obstruction |
|-----------|---------------------------------------------------------------|
| Treatment of vein stenosis (obstruction) | Cases | Male | Female | 30-day mortality |
| Thrombectomy | 22 | 10 | 12 | 0 |
| Catheter-directed thrombolysis*40) | 1 | 0 | 1 | 0 |
| Bypass | 12 | 8 | 4 | 0 |
| SVC filter insertion*41) | 1 | 0 | 1 | 0 |
| Direct surgery of stenosis | 2 | 2 | 0 | 0 |
| Endoluminal treatment of stenosis | 67 | 47 | 20 | 3 |
| Others | 15 | 9 | 6 | 0 |
| Total | 115 | 74 | 41 | 3 |

*40) Including the catheter-directed thrombolysis using hydrodynamic thrombectomy catheter.
*41) Including temporary IVC filter.

| Table 7-4 | Vena cava reconstruction |
|-----------|---------------------------------------------------------------|
| Vena cava reconstruction | Cases | Mortality | Etiology | Treatment procedures | Material for open surgery |
| | | 30-day mortality | Hospital mortality | Tumor | Thrombus | Others | Patch plasty | Bypass | Replacement | PTA± stent | Others | Autogenous vessel | Polyester | ePTFE | Others |
| SVC reconstruction | 19 | 1 | 2 | 16 | 2 | 1 | 2 | 4 | 7 | 5 | 1 | 4 | 8 | 2 |
| IVC reconstruction | 56 | 3 | 5 | 51 | 0 | 5 | 7 | 0 | 9 | 2 | 40 | 2 | 4 | 8 | 3 |
| Total | 75 | 4 | 7 | 67 | 2 | 6 | 9 | 4 | 16 | 7 | 41 | 3 | 8 | 16 | 5 |

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

| Table 7-5 | Budd-Chiari syndrome |
|-----------|---------------------------------------------------------------|
| Treatment | Cases | Gender | Mortality | Material for open surgery |
| | | Male | Female | 30-day mortality | Hospital mortality | Polyester | ePTFE | Autogenous vessel | Others |
| Shunting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Percutaneous shunting | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| Surgical recanalization | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |

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lower extremities.\footnote{3}

2) Deep vein thrombosis (including deep vein stenosis/obstruction) (Table 7-2)
Overall, 531 surgical cases were registered, of which 311 (58.6\%) received inferior vena cava filter placement. Then, 135 (25.4\%) cases had filter removal. Catheter-directed thrombolysis (CDT) was performed in 51 (9.6\%)
cases. Endovascular treatment for stenosis was performed in 11 (2.1%) cases, which were slightly increased from the previous year. By surgical modality, thrombectomy, bypass (peripheral vein revascularization), and venous stenosis removal (direct delivery) operations were performed in only 64 (12.1%), 6 (1.1%), and 2 (0.4%) cases, respectively.

3) Venous stenosis/obstruction in the upper extremities and the cervical region (Table 7-3)
The number of surgical operations was 115, which decreased from 2014. The most prevalent surgery was venous stenosis removal by endovascular treatment, which was performed in 67 (58.3%) cases.

4) Vena cava reconstruction (Table 7-4)
The number of surgical operations was 75. Of these, 56 (74.7%) were inferior and 19 (25.3%) were superior vena cava/primary branch reconstructions. The most prevalent cause of illness was tumor, which occurred in 67 (89.3%) cases. There were 4 operative (5.3%) and 7 hospital (9.3%) deaths, which were fewer than those in 2014. By surgical modality, there were 16 cases of replacement, 9 cases of patch plasty, and 4 cases of bypass; the use of ePTFE was most prevalent.

5) Budd-Chiari syndrome (Table 7-5)
Percutaneous shunting was performed in only 2 cases, both of which were implemented in the Kyushu region.

6) Others (Table 7-6)
Deep venous aneurysm plication was performed in 64 cases in 2013, 25 cases in 2014, and 14 cases in 2015, showing year-on-year decreases.

7. Other Vascular Diseases and Related Surgical Operations (Table 8)
Compared with 2014, no significant changes were noted in 2015, other than the significant increase in the number of vascular access surgeries.

1) Popliteal artery entrapment syndrome and adventitial cyst (Tables 8-1, 8-2)
These are rare diseases to begin with; as such, no great changes were noted between 2014 and 2015.

2) Thoracic outlet syndrome (Table 8-3)
It continues to be a rare disease, with only 10 cases reported both in 2014 and 2015.

3) Vascular access surgery (Table 8-4)
The number of operations increased by 3,000 from the previous year, and it was expected to continue increasing as the dialysis population grows.

4) Lymphedema surgery (Table 8-5)
Compared with 2013, the number almost halved in 2014 but returned to the original level in 2015.

5) Sympathectomy (Table 8-6)
The number of surgeries was 25 in 2015, which was almost unchanged from the levels in 2013 and 2014.
6) Upper/lower limb amputation (Tables 8-7, 8-8)
The number of upper limb amputations was unchanged in 2015, whereas that of lower limb amputations increased successively from the past 2 years. This suggests an increase in critical limb ischemia cases.

Conclusion
Since 2011 when NCD registration was initiated, the overview of vascular surgery has been reported annually. This report reveals the overview in 2015 and gives the reader a glimpse of the present state of vascular surgery that has been changing over the years.

One major purpose of participating in the NCD is to improve the quality of medical services by the effective use of its data. Since data items need to be entered between busy work hours, entries should be limited to only the critical data items. However, the number of entry items has been increasing yearly from 2011 to 2015 to improve the evaluation of the quality of medical care. Fortunately, the operative mortality from vascular surgery (except surgical operations for aorta) was low; hence, this could not be used as an evaluation index. The future goal is to implement a new function in the NCD for comparing the quality of risk-adjusted vascular surgical treatment provided at our institution with the national standards.

In 2018, the JSVS initiated a nationwide multicenter observational study on therapeutic options for laparotomy and stent-graft deployment for ruptured abdominal aortic aneurysm. The organization also started a retrospective study on infectious abdominal aortic aneurysm and common iliac artery aneurysm as a model study; in 2019, it started another retrospective study on the therapeutic modalities for popliteal artery entrapment syndrome and its prognosis. Through these studies, the JSVS has been attempting to solve various challenges. In addition, a clinical research promotion study was initiated in 2018, in which the modalities for synthetic vascular graft/stent-graft infection in the abdominal aortic region and its prognosis were investigated. For patients with arteriosclerosis obliterans and critical limb ischemia, the effects of malignant neoplasms on their prognosis were examined. For patients with ischemic limbs, the factors affecting the development of bypass wound complications were analyzed. In 2019, a multicenter observational study was initiated on cooperation between medical institutions engaged in emergency care for the aortic and peripheral arteries. The results of bypass surgery for patients with critical ischemia caused by collagen disease and angiitis in Japan were disclosed. In addition, in 2019, we started accepting novel research topics in the vascular surgical field from the public using the NCD data. To improve the reliability of the data, site visits also started in 2018.

In the future, the JSVS wishes to further develop the vascular surgery database on the NCD in collaboration with our dedicated members. We sincerely hope that this database will be of help to providing high-quality medical care for patients suffering from vascular diseases.

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Appendix
Team responsible for analyzing the 2015 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, Jin Okazaki, Hideaki Obara, Hirono Satokawa, Kunihiro Shigematsu, Ikuo Sugimoto, Hiroshi Banno, Naoki Fujimura, Akihiro Hosaka, Shin-suke Mii, Noriyasu Morikage, Terutoshi Yamaoka, Tetsuro Miyata (Observer), Kimihiro Komori (Chief director of the Japanese Society for Vascular Surgery)

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Conflicts of Interest
None of the authors or co-authors have any conflict of interest to declare.

Additional Remarks
This annual report was published in the Japanese Journal of Vascular Surgery Vol. 29 (2020) No. 3; however, after publication errors in the numerical data and resulting errors in the table were detected, the corrections in the report were published in Vol. 30 (2021) No. 5 of the same journal. This English translation reflects those corrections.

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