

Vascular Surgery in Japan: 2013 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 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-

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Table 1 New items or changes in 2013 annual report: modification of registry done in year 2012

New items	Table number	Status until 2012
Debranch for TEVAR/EVAR	Table 3-1, 3-2, 3-3, 3-4, 3-5	Not existed
Visceral artery bypass	Table 3-1	Not existed
Inernal iliac artery bypass	Table 3-1	Not existed
Thrombolysis	Table 4, Table 6-1	Not existed
Status of injured artery	Table 5-1	Not existed
Obstruction/stenosis	Table 5-1	Not existed
Bleeding without specification	Table 5-1	Not existed
Gasrtointestinal fistula	Table 5-1	Not existed
Non-gastrointestinal fistula	Table 5-1	Not existed
Others	Table 5-1	Not existed
Status of infected graft	Table 6-1	Not existed
Sepsis	Table 6-1	Not existed
Graft-gastrointestinal fistula	Table 6-1	Not existed
Graft-skin fistula	Table 6-1	Not existed
Others	Table 6-1	Not existed
IVC filter retrieval	Table 7-2	Not existed
Direct surgery of stenosis	Table 7-2, Table 7-3	Not existed
Endoluminal treatment of stenosis	Table 7-2, Table 7-3	Not existed
Others	Table 7-2, Table 7-3	Not existed
Arteriovenous access aneurysm repair	Table 8-4	Not existed
Modified items		
Deep vein thrombosis (including venous stenosis or obstruction)	Table 7-2	Deep vein thrombosis
Upper limb and cervical vein obstruction or stenosis	Table 7-3	Upper limb vein obstruction

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 Treatment for aneurysm
Table 2-1 Aortic aneurysm

Region of aortic aneurysm	Cases		Mortality		Ruptured aneurysm			Etiology									
	Male	Female	30-day mortality	Hospital mortality	Cases	30-day mortality	Hospital mortality	Degenerative* ⁴⁾		Connective tissue disease* ⁵⁾							
								Dissection* ³⁾	30-day mortality		Hospital mortality						
Ascending aorta* ¹⁾	78	38	40	9	11	13	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	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			Graft materials* ⁷⁾	
	Cases	Y-graft	T-graft	Stent graft	Hybrid* ⁶⁾	Polyester	ePTFE
Ascending aorta* ¹⁾	1	0	0	8	2	61	6
Aortic arch* ¹⁾	3	0	0	210	138	84	60
Descending thoracic aorta* ¹⁾	4	0	0	360	28	33	17
Thoracoabdominal aorta* ¹⁾	17	0	0	138	30	93	17
Abdominal aortic aneurysm* ²⁾	7,376	5,695	1,093	8,778	46	7,020	319
with renal artery reconstruction	246	195	35	9	7	239	19
with renal artery clamping	1,137	882	204	9	7	1,088	45

*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	Hospital mortality	Cases	Hospital mortality
Replacement	1,102	222	6,221	100
Exclusion with bypass	15	2	47	3
EVAR*8)	408	74	8,373	70
Hybrid	4	1	87	0

*8) EVAR: endovascular aneurysm repair.

Table 2-3 Peripheral artery aneurysm

Aneurysm	Gender		Mortality		Ruptured aneurysm		Etiology		Treatment procedure				Graft material for open surgery												
	Cases	Male	Female	30-day mortality	Hospital mortality	Cases	Hospital mortality	Degenerative	Vasculitis*9)	Infected	Traumas	Others	Replacement	Exclusion with bypass	Ligation/ resection	Stent graft	Coil embolization	Others	Polyester	ePTFE	Autogenous vessel	Others			
Aortic arch branches																									
Carotid	17	7	10	0	0	3	0	8	0	1	3	5	2	3	6	0	2	4	0	0	2	3	0	0	
Vertebral	2	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	0	
Subclavian	48	25	23	3	3	10	2	32	1	7	3	5	17	5	8	15	8	3	9	9	4	1	1	1	
Multiple in arch branches	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Others	11	5	6	0	1	3	0	4	0	1	1	5	0	1	3	5	3	1	0	1	0	1	0	0	
Upper limb artery																									
Axillar	22	11	11	0	0	3	0	15	0	2	1	4	8	6	7	2	0	1	1	5	8	0	0	0	
Brachial	174	90	84	3	2	44	0	44	1	14	59	56	29	9	77	2	0	63	2	14	20	0	0	0	
Forearm-hand	113	63	50	1	4	19	0	27	3	17	22	44	17	1	74	0	0	21	7	4	3	1	1	1	
Others	45	34	11	0	0	10	0	15	0	13	7	10	6	0	27	0	2	11	1	3	2	0	0	0	
Visceral artery																									
Celiac	40	30	10	2	3	7	2	38	0	0	1	1	12	3	9	1	16	2	8	3	4	0	0	0	
Hepatic	12	5	7	0	0	0	0	8	0	0	0	4	1	1	8	0	3	0	0	0	2	0	0	0	
Splenic	46	21	25	0	0	2	0	46	0	0	0	0	1	1	15	0	26	5	0	0	1	1	1	1	
Superior mesenteric	23	16	7	0	0	5	0	11	2	5	1	4	3	3	8	1	5	5	1	1	3	0	0	0	
Renal	50	31	19	1	2	2	1	44	0	0	0	6	11	4	8	5	18	9	2	4	10	0	0	0	
Others	423	361	62	6	7	30	3	378	1	4	3	37	75	5	43	159	193	10	71	7	0	1	0	1	
Lower limb artery																									
Femoral	473	357	116	10	16	122	5	204	1	57	94	117	155	41	181	17	14	92	71	90	34	1	1	1	
Popliteal	216	170	46	1	1	22	0	195	1	6	3	11	108	84	40	2	2	4	13	54	124	1	1	1	
Others	90	56	34	0	2	5	0	64	5	1	7	13	20	6	20	24	22	9	10	9	6	1	1	1	
Total	1,764	1,253	511	27	41	285	13	1,095	15	129	203	322	447	159	524	229	311	238	187	193	214	6	6	6	

*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

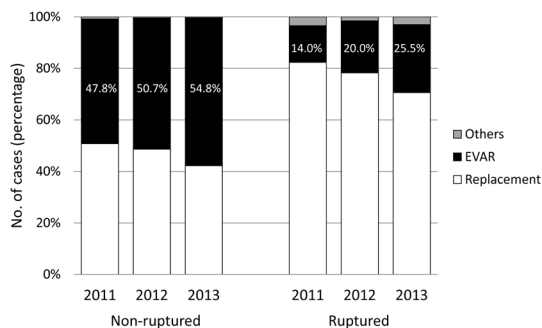


Fig. 1 Treatment procedure for non-ruptured and ruptured abdominal aortic aneurysm (AAA). Comparing year 2011 and 2012, proportion of EVAR selection increased especially in rupture case of AAA.

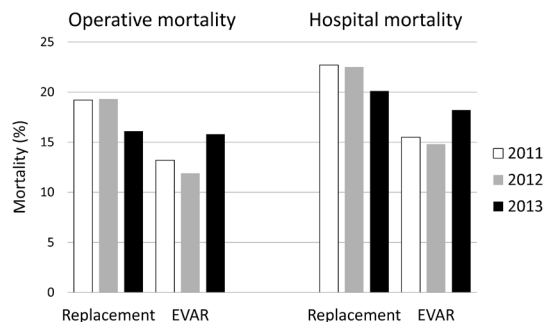


Fig. 3 Early clinical results of ruptured AAA in year 2013 comparing with those in year 2011 and 2012. Regarding the statistical difference of mortality rates between open repair (replacement) and EVAR, see main text.

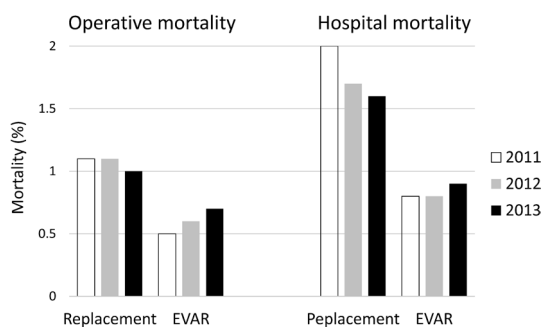


Fig. 2 Early clinical results of non-ruptured AAA in year 2013 comparing with those in year 2011 and 2012. Regarding the statistical difference of mortality rates between open repair (replacement) and EVAR, see main text. EVAR: endovascular aneurysm repair

(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) (Fig. 1). 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.

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 unruptured 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%,

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 2012.¹⁾ Among these cases, replacement surgery was performed in 7,376

Table 3 Reconstruction for chronic arterial occlusive diseases*10)

Table 3-1 Arterial reconstruction for aortic arches

Aortic branches	Gender		Mortality		Background		Etiology		Revascularization procedures										Graft materials*14)						
	Cases		30-day mortality		Dialysis	ASO	TAO	Vasculitis*11)	Debranch for EVAR/ Others TEVAR	CAS	CEA	PTA/ stent*13)	Replace-ment	Visceral artery bypass	Internal iliac artery bypass	Anatomical subclavian bypass	Carotid-subclavian bypass	Axillo-axillar bypass	Others	Polyester	ePTE	Autogenous veins	Others		
	Male	Female	Male	Female						Brain complication*12)	Cases	Brain complication*12)	Cases												
Carotid artery	47	41	6	0	0	41	0	1	0	5	0	9	0	28	0	0	0	0	0	2	0	0	0	0	0
Vertebral artery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subclavian artery	113	84	29	1	9	90	0	0	1	12	10	0	0	0	0	4	9	45	12	14	43	1	2	0	0
Multiple lesions of arch branches	7	2	5	0	1	6	0	0	1	0	0	0	0	0	0	0	1	0	1	4	1	1	0	0	0
Upper limb including axillar artery	90	57	33	2	51	74	0	0	0	4	12	0	0	1	0	0	0	13	26	7	9	10	1	0	0
Celiac/Superior mesenteric artery	67	50	17	1	8	55	0	0	0	5	7	0	0	0	0	0	0	2	4	12	1	0	0	0	0
Renal artery	125	100	25	0	4	104	0	2	0	5	14	0	0	0	0	2	0	0	6	4	0	0	0	0	0
Others	273	218	55	13	11	26	1	1	0	236	9	0	0	0	0	0	9	109	134	59	102	92	4	16	0
Total	705	539	166	17	82	391	1	4	2	256	51	9	0	29	0	0	32	119	195	108	135	146	17	18	0

Table 3-2 Arterial reconstruction for chronic lower limb ischemia

From aorta to lower limb arterial systems	Gender		Mortality		Etiology		Graft materials																		
	Cases		30-day mortality		Dialysis cases	TAO	Vasculitis	Takayasu arteritis	Debranch for TEVAR/ EVAR	Others	Polyester	ePTE	Autogenous veins	Others											
	Male	Female	Male	Female		ASO																			
Aorto-aortic bypass	53	45	8	0	2	49	0	0	0	0	0	0	4	39	14	2	1	0	0	0	0	0	0	0	0
Infrarenal aortic reconstruction (suprarenal clamp)	44	37	7	0	1	44	0	0	0	0	0	0	0	40	4	0	0	0	0	0	0	0	0	0	0
Aorto-femoral bypass*15)	603	501	102	8	30	586	3	1	0	4	9	0	0	442	169	29	6	0	0	0	0	0	0	0	0
Femoro-popliteal (above the knee) bypass	1,746	1,361	385	20	224	1,731	3	1	0	0	0	0	0	11	328	1,180	305	20	0	0	0	0	0	0	0
Infrapopliteal arterial bypass	1,809	1,356	453	33	512	1,748	19	13	0	0	0	0	0	29	121	350	1,399	53	0	0	0	0	0	0	0
Femoro-popliteal (below the knee) bypass	726	553	173	6	128	710	1	1	0	0	0	0	0	14	74	269	423	16	0	0	0	0	0	0	0
Femoro-crural/pedal bypass*16)	1,121	832	289	28	397	1,076	18	12	0	0	0	0	0	15	50	94	1,008	40	0	0	0	0	0	0	0
Others	179	139	40	3	22	166	0	2	0	0	0	0	0	11	77	66	28	3	0	0	0	0	0	0	0
Total	4,235	3,277	958	62	770	4,128	25	16	0	4	62	952	1,677	1,689	77	0	0	0	0	0	0	0	0	0	0

Table 3-3 Extra-anatomical bypass^{*(17)}

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

Table 3-4 Thromboendarterectomy^{*(19)} for chronic lower limb ischemia

Thromboendarterectomy	Cases	Gender		Mortality		Etiology			
		Male	Female	30-day mortality	Dialysis cases	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

Table 3-5 Endovascular treatment for chronic lower limb ischemia*⁽¹³⁾

Endovascular treatment	Cases		Mortality			Etiology			
	Male	Female	30-day mortality	Hospital mortality	Dialysis cases	ASO	TAO	Debranch for TEVAR/EVAR	Others
Aorto-iliac lesion* ⁽²⁰⁾	2,810	506	27	43	319	2,776	2	5	27
Femoro-popliteal lesion* ⁽²⁰⁾	2,344	675	36	61	597	2,327	2	1	14
Infrapopliteal-ankle lesion* ⁽²⁰⁾	1,157	402	17	51	515	1,130	4	0	23
Others	78	24	0	4	47	76	0	0	2
Total (number of regions underwent EVT)* ⁽²⁰⁾	5,585	1,349	69	124	1,196	5,510	6	6	63
Total (number of limbs underwent EVT)* ⁽²¹⁾	4,831	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 in 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 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

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 2013.¹⁾ 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–iliac 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.¹⁾ 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).²⁾ In 2013, endovascular treatment in the aorto–iliac region was performed in cardiovascular medicine departments in 5,343 cases.²⁾ 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

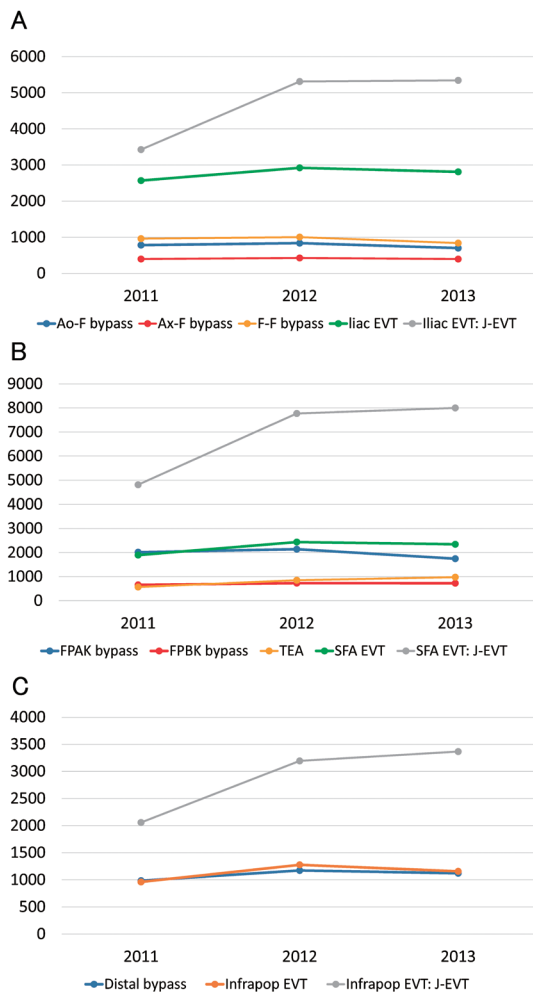


Fig. 4 The annual trends of the number of arterial reconstructions in aorto-iliac, femoro-popliteal, and crural/pedal region, comparing open repair and endovascular treatment. Ao-F: aorto-femoral, Ax-F: axillo-femoral, F-F: femoro-femoral crossover, EVT: endovascular treatment, FPAK: femoro-popliteal (above the knee), FPBK: femoro-popliteal (below the knee), SFA: superficial femoral artery, EA: endarterectomy

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 superficial femoral artery region was performed in 7,998 cases in 2013.²⁾ The femoral above-knee popliteal artery bypass and endovascular treatment performed by vascular surgeons in a total of 4,090 cases accounted for only 33.8% of total procedures in the superficial femoral region in 2013 (Fig. 4B). No major changes were found in the vascular grafts selected.

Revascularization below the knee joint: In 2013, femo-

ral below-knee popliteal artery bypass and femoro-crural/pedal artery bypass were performed in 726 and 1,121 cases in 2013, respectively, similar to 729 and 1,173 cases that underwent the respective procedures in 2012. Meanwhile, no major changes were found in the number of cases undergoing endovascular treatment; endovascular treatment was performed in 1,157 cases in 2013, a decrease by 120 from 1,277 cases in 2012. 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 below-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*23)	Gender		Mortality		Etiology			Procedure				Graft materials for open surgery					
	Cases		30-day mortality	Hospital mortality	Embolism	Thrombosis*24)		Thrombectomy± patch*25)	Bypass	Replacement	PTA±stent	Thrombolysis	Others	Autogenous vessel	Polyester	ePTFE	Others
	Male	Female				Thrombosis*24)	Others										
Carotid artery	10	9	1	0	0	2	8	2	6	1	0	0	1	3	1	4	0
Subclavian artery	53	36	17	0	0	18	14	34	12	3	5	1	1	1	2	11	0
Axillar artery	80	39	41	3	48	30	2	67	15	1	0	1	1	7	6	5	0
Brachial artery	692	328	364	21	330	349	13	595	9	3	25	2	76	7	12	7	2
Celiac/superior mesenteric artery	101	63	38	22	43	32	26	49	27	1	19	2	8	17	2	9	1
Renal artery	15	12	3	2	1	3	11	1	3	1	9	0	1	0	3	1	0
Abdominal aorta-iliac artery	863	617	246	95	304	419	140	509	274	24	162	19	28	15	161	150	2
Femoro-popliteal artery	2,539	1,645	894	195	1,037	1,387	115	2,096	324	31	260	48	128	132	166	194	11
Cruial artery*26)	736	491	245	59	311	404	21	575	76	5	105	31	46	57	24	30	4
Pedal artery*26)	54	38	16	7	9	29	1	38	11	0	7	2	7	3	6	6	0
Others	244	150	94	10	21	191	17	194	28	4	30	6	26	17	27	23	2
Total	4,688	2,960	1,728	331	457	2,502	331	3,589	662	67	508	81	288	226	344	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	Gender		Mortality		Cause of trauma				Procedure				Status of injured artery*27)				Prosthesis									
	Cases	Male	Female	30-day mortality	Hospital mortality	Traffic accident	Labor accident	iatrogenic	Others	Direct closure	Patch plasty	Replace-ment	Bypass	Endo-vascular	Ligation	Others	Obstruction/ stenosis*28)	Bleeding without specification*29)	GI fistula	Non-GI fistula	Pseudo-aneurysm	Others	Autogenous vessel	Polyester	ePTFE	Others
Carotid artery	27	16	11	4	5	1	2	17	7	15	0	0	1	4	6	2	1	10	1	3	4	9	0	1	0	0
Subclavian artery	24	15	9	6	6	5	0	16	3	11	0	1	2	5	3	2	1	13	0	2	3	5	1	1	1	0
Axillar artery	16	10	6	1	1	6	1	5	4	4	1	0	5	1	4	1	6	12	0	0	1	0	5	1	0	0
Brachial artery	276	161	115	6	10	4	10	230	32	199	3	10	16	10	31	12	22	56	0	9	156	46	23	0	4	0
Descending aorta (thoracic/thoracoabdominal)	36	21	15	14	14	4	6	12	8	0	1	3	13	4	8	5	5	21	2	0	6	3	0	3	0	0
Celiac/superior mesenteric artery	26	18	8	4	8	6	3	8	9	10	0	0	8	3	4	2	9	9	1	1	0	8	4	2	1	0
Renal artery	12	9	3	3	3	2	2	7	1	0	0	2	7	3	0	5	6	6	0	0	0	1	1	1	0	0
Abdominal aorta-iliac artery	159	98	61	27	30	19	10	101	29	42	6	17	21	53	18	15	31	89	1	10	18	21	4	15	18	0
Femoro-popliteal artery	688	445	243	99	120	24	30	545	89	520	20	23	48	16	43	40	75	185	0	9	230	211	47	9	24	2
Cranial artery	38	31	7	2	2	9	11	12	6	11	1	2	10	4	7	6	14	15	0	1	6	4	8	1	1	0
Others	182	120	62	16	23	13	32	76	61	70	1	4	3	15	67	29	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	95	28	50	3

Table 5-2 Venous trauma*27)

Injured veins	Cases		Cause of trauma				Procedure				Prosthesis				
	Traffic accident	Labor accident	iatrogenic	Others	Direct closure	Patch plasty	Replace-ment	Bypass	Endo-vascular	Ligation	Others	Autogenous vessel	Polyester	ePTFE	Others
Superior vena cava	2	0	1	0	1	2	0	0	0	0	0	0	0	0	0
Inferior vena cava	4	3	0	1	0	2	0	0	0	0	2	0	0	0	0
Brachiocephalic-subclavian vein	9	1	1	5	2	7	0	0	0	3	1	0	0	0	0
Iliac-femoral-popliteal vein	46	2	5	33	6	39	1	2	1	4	0	2	1	1	0
Others	47	2	4	21	20	16	1	1	1	26	4	1	0	2	0
Total	108	8	11	60	29	66	2	3	2	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

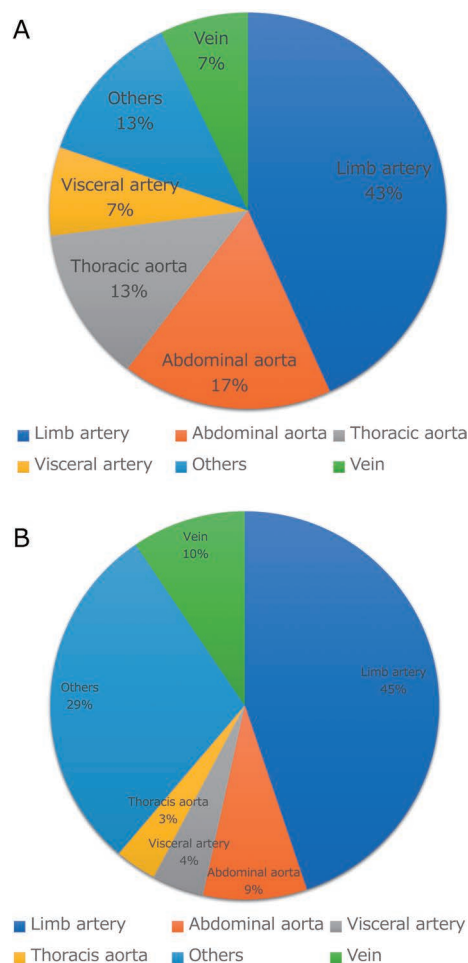


Fig. 5 Location of vascular injury in 2013. Injured vessels injured by traffic accident (A) and work-related accident (B).

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				Procedures for graft infection				Materials for revision or redo surgery			
		30-day mortality	Hospital mortality	Sepsis	Graft-GI fistula* ⁽³²⁾	Graft-skin fistula* ⁽³²⁾	Others	In-situ replacement	Extra-anatomical bypass	Others	Polyester	ePTFE	Autogenous vessel	Cryo-preserved homograft	Others
Descending thoracic aorta	3	0	0	0	1	0	2	0	0	3	0	1	0	0	0
Thoracoabdominal aorta	11	1	1	3	7	1	2	3	6	2	5	2	1	0	0
Abdominal aorta-iliac artery	41	5	8	16	11	6	9	0	0	0	16	10	3	0	2
Abdominal aorta-femoral artery	27	2	4	5	3	13	7	0	0	0	6	11	6	0	1
Femoro-distal artery	140	11	17	35	6	59	50	0	0	0	13	30	40	0	3
Others* ⁽³¹⁾	248	14	30	70	3	75	109	0	0	0	34	64	23	1	10
Total	470	33	60	129	31	154	179	3	6	5	74	118	73	1	16

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

*32) Including anastomotic disruption.

Abbreviation; GI: gastrointestinal

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 mortality	Degenerative	Takayasu arteritis* ⁽³⁴⁾	Other vasculitis* ⁽³⁵⁾	Infection	Others	Replacement	Exclusion and bypass	Stent graft	Others	Polyester	ePTFE	Autogenous vessel	Others
Aortic arch branch	2	0	0	0	0	0	2	0	1	0	1	1	0	0	0
Upper limb artery including axillary artery	31	0	4	0	0	4	23	6	0	1	24	4	6	6	2
Thoracic aorta	5	0	2	0	0	0	3	0	0	5	0	3	0	0	0
Splanchnic artery	1	1	0	0	0	0	1	0	0	0	1	0	0	0	0
Renal artery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abdominal aorta	15	1	9	0	0	0	6	0	1	10	4	4	3	0	1
Iliac artery	17	0	13	0	0	0	4	3	0	11	4	6	3	0	2
Femoral artery	41	1	26	0	0	2	13	21	1	19	16	8	3	3	3
Popliteal or more distal lower limb artery	17	0	9	0	0	0	8	5	0	0	12	1	2	4	0
Total	128	3	62	0	0	6	60	35	3	28	64	35	22	13	8

*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	Mortality		
		30-day mortality	Replacement	Others
Vesical artery	2	0	0	1
Upper limb artery	20	0	0	18
Lower limb artery	21	0	6	9
Others	6	0	0	6
Total	49	0	6	34

Table 6-4 Graft degeneration

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

Table 6-5 Repair operation for graft stenosis or acute thrombosis^{*(36)}

Initial procedure	Cases	Mortality			Repair procedure			Material for repair surgery				
		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 veins³⁾ (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 (4.8%). Surgical procedures involved replacement in 13 cases, patching in 5 cases, and bypass in 4 cases.

Table 7 Treatment for venous diseases**Table 7-1** Varicose veins

Varicose veins treatment	Cases ^{*37)}	Male	Female	30-day mortality
High ligation±sclerotherapy	4,346	1,430	2,916	0
Stripping±sclerotherapy	16,426	6,379	10,047	1
Valvuloplasty	0	0	0	0
EVLA ^{*38)} ±sclerotherapy	14,043	4,544	9,499	0
Others	1,171	282	899	0
Total	35,986	12,635	23,351	1

*37) Only one procedure can be registered in one leg.

*38) EVLA: endovenous laser ablation

Table 7-2 Deep vein thrombosis (including venous stenosis or obstruction)

Deep vein thrombosis treatment	Cases	Male	Female	30-day mortality
Thrombectomy	68	36	32	1
Catheter-directed thrombolysis ^{*39)}	39	17	22	0
Bypass (peripheral venous reconstruction)	6	2	4	0
IVC filter insertion ^{*40)}	305	132	173	4
IVC filter retrieval ^{*40)}	119	54	65	1
Direct surgery of stenosis ^{*41)}	6	4	2	0
Endoluminal treatment of stenosis ^{*41)}	20	8	12	0
Others	11	5	6	0
Total	506	226	280	6

*39) Including the catheter-directed thrombolysis using hydrodynamic thrombectomy catheter.

*40) Including temporary IVC filter.

*41) Including obstruction.

Table 7-3 Upper limb and cervical vein stenosis or obstruction

Treatment of vein stenosis or obstruction	Cases	Male	Female	30-day mortality
Thrombectomy	50	31	19	0
Catheter-directed thrombolysis ^{*42)}	6	5	1	0
Bypass	27	17	10	2
SVC filter insertion ^{*43)}	4	1	3	0
Direct surgery	10	5	5	0
Endoluminal treatment	66	40	26	2
Others	12	5	7	0
Total	162	96	66	4

*42) Including the catheter-directed thrombolysis using hydrodynamic thrombectomy catheter.

*43) Including temporary IVC filter.

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

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	1	0	1	0	0	0	0	0	0	0	0	0
Percutaneous shunting	4	2	2	0	0	0	0	0	0	0	0	2
Surgical recanalization	3	0	3	0	0	0	0	0	0	0	0	0
Total	8	2	6	0	0	0	0	0	0	0	0	2

Table 7-6 Other surgery

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

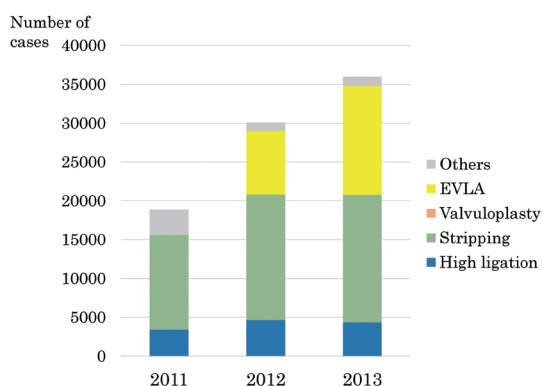


Fig. 6 Changes of varicose veins treatment in year 2011, 2012, and 2013.
EVLA: endovenous laser ablation

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)		
					Neurogenic	Venous	Arterial
Rib resection*46)	2	2	0	0	2	0	1
Rib resection+scaleneotomy	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.

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 8-4 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, Kunihiko Shigematsu, Ikuo Sugimoto, Hiroshi Banno, Naoki Fujimura, Akihiro Hosaka, Shinsuke Mii, Noriyasu Morikage, Terutoshi Yamoka, Tetsuro Miyata (Observer), Kimihiro Komori (Chief director of the Japanese Society for Vascular Surgery)

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Disclosure Statement

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

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