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ANNUAL REPORT

Thoracic and cardiovascular surgery in Japan during 2006

Annual report by the Japanese Association for Thoracic Surgery

Committee for Scientific Affairs

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The Japanese Association for Thoracic Surgery has conducted annual surveys of thoracic surgery to reveal the statistics of the number of procedures according to the operative category throughout the country since 1986. Here we have summarized the results from our annual survey of thoracic surgery performed during 2006.

The incidence of hospital mortality was added to this survey to determine the nationwide status that could be useful not only for surgeons to compare their work with that of others but also for the Association to gain a better understanding of present problems as well as future prospects. Thirty-day mortality (sometimes termed operative mortality) is death within 30 days of operation regardless of the patient's location. Thirty-day mortality also includes death within 30 days of operation even though the patient is discharged from the hospital within 30 days of operation.

Hospital mortality is death within any time interval after operation if the patient is not discharged from the hospital. Hospital-to-hospital transfer is not considered discharge; transfer to a nursing home or a rehabilitation unit is considered hospital discharge unless the patient subsequently dies of complications of the operation. [The definitions of terms are based on the published guidelines of The Society of Thoracic Surgeons and the American Association for Thoracic Surgery. (Edmunds et al. Ann Thorac Surg 1996;62:932–5)]

Thoracic surgery was classified into three categories—cardiovascular, general thoracic, esophageal surgery—and the pertinent data were examined and analyzed for each group. Access to the computerized data is offered to all members of this Association. We honor and value your continued kind support.

Abstract of the survey

We sent out survey questionnaire forms to the departments of each category in all 1,877 institutions nationwide in early April 2007. The response rates by the end of December 2007 were 97.1%, 95.5%, and 93.5% for the cardiovascular, general thoracic, and esophageal categories, respectively.

This is the annual report by The Japanese Association for Thoracic Surgery from the Committee for Scientific Affairs.

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Questionnaires sent out and received back by the end of December 2007

	Sent out	Returned	Response rate
(A) Cardiovascular surgery	560	544	97.1%
(B) General thoracic surgery	763	729	95.5%
(C) Esophageal surgery	554	518	93.5%

Categories subclassified according to the number of operations performed

No. of operations performed	Cardiovascular surgery	General thoracic surgery	Esophageal surgery
1–24	68	145	441
25–49	104	167	48
50–99	164	201	20
100–149	90	104	4
150–199	39	52	5
≥200	79	60	0
Total	544	729	518

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(A) Cardiovascular surgery

Figure 1 shows the development of cardiovascular surgery in Japan over the last 20 years. Aneurysm surgery includes only operations for thoracic or thoracoabdominal aortic aneurysms. The number of pacemaker and assist device implantation operations is not included in the total number of surgical operations. A total of 53,741 cardiovascular operations were performed at 544 institutions during 2006 alone and included 10 cardiac transplantation operations, whose use was started in 2002. In comparison with 2005, the number of operations for thoracic aortic aneurysm increased by 4.7%, and that for valvular heart disease increased by 5.9%. Surgery for congenital heart disease increased by 1.9%. However, operations for ischemic heart disease decreased by 6.0%, which was similar to that in 2005 (7.1%).

Data for individual categories are summarized in Tables 1–7. For 7,386 open-heart operations performed for congenital heart disease, the hospital mortality was 2.9%, decreasing from 3.0% hospital mortality for this category in 2005. Mitral valve repair constituted 25.9% of all valvular heart disease operations (15,092), similar to that in 2005 (25.9%). Aortic valve replacement with a bioprosthesis was increasing. The hospital mortality for primary valve replacement was 3.6%, and that for primary valve repair was 0.8%. However, hospital mortality for redo operations was 9.6%, which although somewhat lower than the 11.7% mortality in 2005 was still high. Isolated coronary artery bypass grafting was performed in 17,941 cases, with an overall hospital mortality of 2.5%. The hospital mortality for primary elective surgery was 1.2%. Hospital mortality of primary emergency operation was 10.9%, which was slightly higher than the 10.1% mortality in 2005. Off-pump coronary bypass grafting (OPCAB) was performed in 11,021 cases, which constituted 61.4% of the total number of isolated coronary bypass grafting. In comparison with 2005, the percentage of OPCAB among the total number of isolated coronary bypass grafting was the same level. Altogether, 910 patients underwent surgery for complications of myocardial infarction, including 502 operations for a left ventricular aneurysm and 332 operations for ischemic mitral regurgitation. Operations for a dissecting aneurysm were performed in 4,350 cases, with an overall hospital mortality of 12.3%, which was similar to that in 2005 (13.9%). Operations for a nondissecting aneurysm were carried out in 5,026 cases, with an overall hospital mortality of 8.8%, which was also similar to that in 2005 (9.9%). The hospital mortality for unruptured aneurysms was 6.2%, and that for ruptured aneurysms was 26.6%, which remained markedly high. The number of stent graft procedures has increased year by year. A total of 179 patients with a dissecting aortic aneurysm underwent stent graft placement (endovascular stent grafting 125 cases, open stent grafting 54 cases). The hospital mortality rate was 4.5%. A total of 482 patients with

nondissecting aortic aneurysm underwent stent graft placement (endovascular stent grafting 336 cases, open stent grafting 146 cases). The hospital mortality rate was 7.5%.

In summary, total cardiovascular operations of a similar number were performed during 2006 with steadily improving results in almost all categories compared with those in 2005.

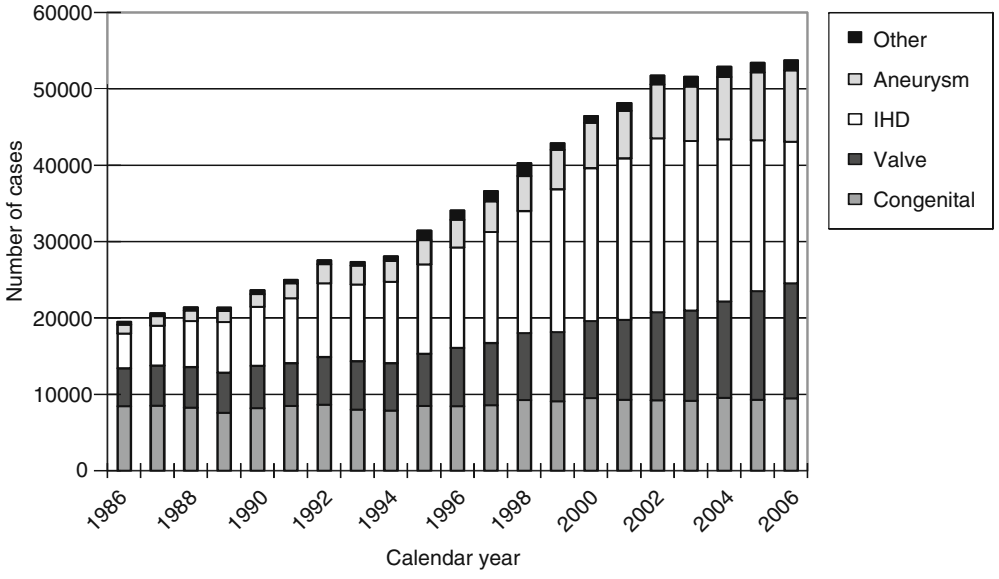

Fig. 1 Cardiovascular surgery

Table 1 Congenital (total 9,467)
(1) CPB(+) (total 7,386) in 2006

		Neonate			Infant			1–17 Years			≥18 Years			Total		
		Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1	PDA	0	0	0	4	1 (25.0)	1 (25.0)	0	0	0	26	0	0	30	1 (3.3)	1 (3.3)
2	Coarctation (simple)	4	0	0	7	0	0	11	0	0	8	0	0	30	0	0
3	+ VSD	28	2 (7.1)	2 (7.1)	37	2 (5.4)	2 (5.4)	4	0	0	1	0	0	70	4 (5.7)	4 (5.7)
4	+ DORV	5	3 (60.0)	3 (60.0)	4	0	1 (25.0)	1	0	0	0	0	0	10	3 (30.0)	4 (40.0)
5	+ AVSD	4	0	0	3	0	0	0	0	0	0	0	0	7	0	0
6	+ TGA	8	0	1 (12.5)	2	0	0	0	0	0	0	0	0	10	0	1 (10.0)
7	+ SV	5	0	0	4	0	0	3	0	0	0	0	0	12	0	0
8	+ Others	4	0	0	7	1 (14.3)	3 (42.9)	4	0	0	1	1 (100.0)	1 (100.0)	16	2 (12.5)	4 (25.0)
9	Interrupt. of Ao (simple)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	+ VSD	41	4 (9.8)	4 (9.8)	9	1 (11.1)	1 (11.1)	4	0	0	4	0	0	58	5 (8.6)	5 (8.6)
11	+ DORV	5	0	0	1	0	0	1	0	0	0	0	0	7	0	0
12	+ Truncus	2	2 (100.0)	2 (100.0)	1	0	0	0	0	0	0	0	0	3	2 (66.7)	2 (66.7)
13	+ TGA	3	2 (66.7)	2 (66.7)	1	0	0	0	0	0	0	0	0	4	2 (50.0)	2 (50.0)
14	+ Others	8	0	0	3	2 (66.7)	3 (100.0)	1	0	0	0	0	0	12	2 (16.7)	3 (25.0)
15	Vascular ring	1	0	0	5	0	1 (20.0)	3	0	0	1	0	0	10	0	1 (10.0)
16	PS	3	0	0	9	0	0	24	2 (8.3)	2 (8.3)	10	0	1 (10.0)	46	2 (4.3)	3 (6.5)
17	PA·IVS or critical PS	12	2 (16.7)	2 (16.7)	40	1 (2.5)	1 (2.5)	62	0	0	3	0	0	117	3 (2.6)	3 (2.6)
18	TAPVR	103	6 (5.8)	7 (6.8)	49	7 (14)	9 (18.4)	8	0	0	0	0	0	160	13 (8)	16 (10)
19	PAPVR ± ASD	0	0	0	7	2 (28.6)	2 (28.6)	59	0	0	14	0	0	80	2 (2.5)	2 (2.5)
20	ASD	13	0	0	70	2 (2.9)	2 (2.9)	839	0	0	910	1 (0.1)	2 (0.2)	1,832	3 (0.2)	4 (0.2)
21	Cor triatriatum	1	1 (100.0)	1 (100.0)	8	0	0	3	0	0	1	0	0	13	1 (7.7)	1 (7.7)
22	AVSD (partial)	2	0	0	19	0	0	62	0	0	28	1 (3.6)	1 (3.6)	111	1 (0.9)	1 (0.9)
23	AVSD (complete)	2	1 (50.0)	1 (50.0)	92	2 (2.2)	3 (3.3)	58	0	0	3	0	0	155	3 (1.9)	4 (2.6)
24	+ TOF or DORV	0	0	0	10	0	0	18	3 (16.7)	3 (16.7)	0	0	0	28	3 (10.7)	3 (10.7)
25	+ Others	1	0	0	4	0	1 (25.0)	10	1 (10.0)	1 (10.0)	0	0	0	15	1 (6.7)	2 (13.3)
26	VSD (subarterial)	6	0	0	130	0	0	313	0	0	44	0	0	493	0	0
27	VSD (perimemb./muscular)	18	0	0	668	2 (0.3)	2 (0.3)	432	2 (0.5)	3 (0.7)	93	0	0	1,211	4 (0.3)	5 (0.4)
28	VSD + PS	0	0	0	18	0	0	32	0	0	8	0	0	58	0	0
29	DCRV ± VSD	1	0	0	12	0	0	43	0	0	23	0	0	79	0	0
30	Aneurysm of sinus Valsalva	0	0	0	4	0	0	17	0	0	22	0	0	43	0	0
31	TOF	11	1 (9.1)	1 (9.1)	130	3 (2.3)	3 (2.3)	210	3 (1.4)	3 (1.4)	17	0	0	368	7 (1.9)	7 (1.9)
32	PA + VSD	4	1 (25.0)	1 (25.0)	41	0	1 (2.4)	77	0	0	6	0	0	128	1 (0.8)	2 (1.6)
33	DORV	8	2 (25.0)	2 (25.0)	79	2 (2.5)	3 (3.8)	93	2 (2.2)	2 (2.2)	5	0	0	185	6 (3.2)	7 (3.8)
34	TGA (simple)	98	3 (3.1)	5 (5.1)	7	0	0	6	0	0	3	0	0	114	3 (2.6)	5 (4.4)
35	+ VSD	34	3 (8.8)	4 (11.8)	11	0	0	9	0	1 (11.1)	1	0	0	55	3 (5.5)	5 (9.1)
36	VSD + PS	2	1 (50.0)	1 (50.0)	9	1 (11.1)	1 (11.1)	23	0	1 (4.3)	0	0	0	34	2 (5.9)	3 (8.8)
37	Corrected TGA	0	0	0	15	0	0	33	0	0	10	1 (10.0)	1 (10.0)	58	1 (1.7)	1 (1.7)
38	Truncus arteriosus	6	0	1 (16.7)	14	0	1 (7.1)	3	0	0	0	0	0	23	0	2 (8.7)
39	SV	34	12 (35.3)	14 (41.2)	165	4 (2.4)	9 (5.5)	341	7 (2.1)	12 (3.5)	29	3 (10.3)	3 (10.3)	569	26 (4.6)	38 (6.7)
40	TA	6	0	0	26	0	0	83	0	0	23	1 (4.3)	2 (8.7)	138	1 (0.7)	2 (1.4)
41	HLHS	72	18 (25.0)	26 (36.1)	87	0	5 (5.7)	40	0	2 (5.0)	0	0	0	199	18 (9.0)	33 (16.6)
42	Aortic valve lesion	10	1 (10.0)	4 (40.0)	20	2 (10.0)	2 (10.0)	103	1 (1.0)	2 (1.9)	35	1 (2.9)	1 (2.9)	168	5 (3.0)	9 (5.4)
43	Mitral valve lesion	2	0	0	35	4 (11.4)	5 (14.3)	64	1 (1.6)	2 (3.1)	13	0	0	114	5 (4.4)	7 (6.1)
44	Ebstein	9	4 (44.4)	4 (44.4)	9	1 (11.1)	1 (11.1)	27	1 (3.7)	1 (3.7)	12	0	0	57	6 (10.5)	6 (10.5)
45	Coronary disease	1	0	0	16	0	0	11	0	0	17	1 (5.9)	1 (5.9)	45	1 (2.2)	1 (2.2)
46	Others	14	2 (14.3)	3 (21.4)	21	0	1 (4.8)	42	1 (2.4)	1 (2.4)	13	0	2 (15.4)	90	3 (3.3)	7 (7.8)
47	Redo VSD	1	0	0	7	1 (14.3)	1 (14.3)	18	0	0	9	1 (11.1)	1 (11.1)	35	2 (5.7)	2 (5.7)
48	PS release	0	0	0	12	0	0	58	0	0	16	0	0	86	0	0
49	RV-PA conduit replace	0	0	0	3	0	0	35	0	0	14	0	0	52	0	0
50	Others	7	1 (14.3)	1 (14.3)	46	3 (6.5)	3 (6.5)	66	1 (1.5)	1 (1.5)	29	0	0	148	5 (3.4)	5 (3.4)
	Total	599	72 (12.0)	92 (15.4)	1,981	44 (2.2)	68 (3.4)	3,354	25 (0.7)	37 (1.1)	1,452	11 (0.8)	16 (1.1)	7,386	152 (2.1)	213 (2.9)

( ), % mortality; CPB, cardiopulmonary bypass; PDA, patent ductus arteriosus; VSD, ventricular septal defect; DORV, double outlet right ventricle; AVSD, atrioventricular septal defect; TGA, transposition of great arteries; SV, single ventricle; Interrupt. of Ao., interruption of aorta; PS, pulmonary stenosis; PA-IVS, pulmonary atresia with intact ventricular septum; TAPVR, total anomalous pulmonary venous return; PAPVR, partial anomalous pulmonary venous return; ASD, atrial septal defect; TOF, tetralogy of Fallot; DCRV, double-chambered right ventricle; TA, tricuspid atresia; HLHS, hypoplastic left heart syndrome; RV-PA, right ventricle–pulmonary artery

(2) CPB(–) (total 2,081) in 2006

		Neonate			Infant			1–17 Years			≥18 Years			Total		
		Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1	PDA	320	3 (0.9)	3 (0.9)	182	1 (0.5)	2 (1.1)	108	0	0	4	0	0	614	4 (0.7)	4 (0.7)
2	Coarctation (simple)	37	0	0	22	0	0	5	0	0	1	0	0	65	0	0
3	+ VSD	48	0	0	10	0	0	0	0	0	0	0	0	58	0	0
4	+ DORV	12	1 (8.3)	1 (8.3)	3	0	0	0	0	0	0	0	0	15	1 (6.7)	1 (6.7)
5	+ AVSD	8	0	0	5	0	0	0	0	0	0	0	0	13	0	0
6	+ TGA	8	0	0	0	0	0	0	0	0	0	0	0	8	0	0
7	+ SV	6	0	0	2	0	0	0	0	0	0	0	0	8	0	0
8	+ Others	6	1 (16.7)	1 (16.7)	0	0	0	0	0	0	1	0	0	7	1 (14.3)	1 (14.3)
9	Interrupt. of Ao (simple)	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
10	+ VSD	16	2 (12.5)	2 (12.5)	1	0	0	0	0	0	0	0	0	17	2 (11.8)	2 (11.8)
11	+ DORV	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0
12	+ Truncus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	+ TGA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	+ Others	7	0	0	0	0	0	0	0	0	0	0	0	7	0	0
15	Vascular ring	3	0	0	2	0	0	6	0	0	1	0	0	12	0	0
16	PS	1	0	0	1	0	0	1	0	0	0	0	0	3	0	0
17	PA-IVS or critical PS	37	1 (2.7)	2 (5.4)	26	1 (3.8)	0	4	0	0	0	0	0	67	2 (3.0)	3 (4.5)
18	TAPVR	1	0	0	1	0	1 (100)	0	0	0	0	0	0	2	0	0
19	PAPVR ± ASD	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
20	ASD	0	0	0	0	0	0	1	0	0	7	0	0	8	0	0
21	Cor triatriatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	AVSD (partial)	1	0	0	1	0	0	1	0	0	2	0	0	5	0	0
23	AVSD (complete)	10	0	0	35	0	1 (2.9)	2	0	0	0	0	0	47	0	0
24	+ TOF or DORV	4	1 (25.0)	1 (25.0)	12	0	0	3	0	0	0	0	0	19	1 (5.3)	1 (5.3)
25	+ Others	2	0	0	5	0	0	2	0	0	0	0	0	9	0	0
26	VSD (subarterial)	0	0	0	2	0	0	0	0	0	2	0	0	4	0	0
27	VSD (perimemb./muscular)	16	0	1 (6.3)	65	0	0	5	0	0	1	0	0	87	0	2 (2.3)
28	VSD + PS	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
29	DCRV ± VSD	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
30	Aneurysm of sinus Valsalva	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
31	TOF	14	0	0	109	0	1 (0.9)	20	0	0	1	0	0	144	0	1 (0.7)
32	PA + VSD	15	0	1 (6.7)	88	0	2 (2.3)	29	0	0	1	0	0	133	1 (0.8)	3 (2.3)
33	DORV	27	0	0	54	0	0	10	0	0	0	0	0	91	0	0
34	TGA (simple)	5	1 (20.0)	1 (20.0)	2	1 (50)	0	1	0	0	0	0	0	8	1 (12.5)	1 (12.5)
35	+ VSD	5	0	0	4	0	0	0	0	0	0	0	0	9	0	0
36	VSD + PS	4	0	0	10	0	1 (10.0)	1	0	0	0	0	0	15	0	1 (6.7)
37	Corrected TGA	9	0	1 (11.1)	24	0	0	9	0	0	0	0	0	42	0	1 (2.4)
38	Truncus arteriosus	9	0	0	6	0	0	0	0	0	0	0	0	15	0	0
39	SV	48	3 (6.3)	3 (6.3)	78	4 (5.1)	2 (2.6)	23	0	0	1	0	0	150	3 (2.0)	5 (3.3)
40	TA	21	1 (4.8)	1 (4.8)	31	0	0	8	0	0	0	0	0	60	1 (1.7)	1 (1.7)
41	HLHS	68	4 (5.9)	8 (11.8)	19	1 (5.3)	2 (10.5)	1	0	0	0	0	0	88	4 (4.5)	10 (11.4)
42	Aortic valve lesion	4	0	0	2	0	0	0	0	0	0	0	0	6	0	0
43	Mitral valve lesion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	Ebstein	3	3 (100.0)	3 (100.0)	6	0	0	0	0	0	0	0	0	9	3 (33.3)	3 (33.3)
45	Coronary disease	1	0	0	0	0	0	1	0	0	1	0	0	3	0	0
46	Others	33	0	0	59	1 (1.7)	0	73	0	0	12	0	0	177	0	0
47	Redo VSD	0	0	0	1	0	0	1	0	0	0	0	0	2	0	0
48	PS release	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
49	RV-PA conduit replace	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	Others	9	1 (11.1)	1 (11.1)	11	0	1 (9.1)	24	0	0	0	0	0	44	2 (4.5)	2 (4.5)
	Total	823	22 (2.7)	30 (3.6)	883	14 (1.6)	13 (1.5)	339	0	0	36	0	0	2,081	26 (1.2)	42 (2.0)

( ), % mortality; CPB, cardiopulmonary bypass; PDA, patent ductus arteriosus; VSD, ventricular septal defect; DORV, double outlet right ventricle; AVSD, atrioventricular septal defect; TGA, transposition of great arteries; SV, single ventricle; Interrupt. of Ao., interruption of aorta; PS, pulmonary stenosis; PA-IVS, pulmonary atresia with intact ventricular septum; TAPVR, total anomalous pulmonary venous return; PAPVR, partial anomalous pulmonary venous return; ASD, atrial septal defect; TOF, tetralogy of Fallot; DCRV, double-chambered right ventricle; TA, tricuspid atresia; HLHS, hypoplastic left heart syndrome; RV-PA, right ventricle–pulmonary artery

(3) Main procedures in 2006

		Neonate			Infant			1–17 Years		
		Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1	SP shunt	152	12 (7.9)	14 (9.2)	397	1 (0.3)	1 (0.3)	68	1 (1.5)	1 (1.5)
2	PAB	250	8 (3.2)	9 (3.6)	202	1 (0.5)	3 (1.5)	12	0	0
3	Bidirectional Glenn or hemi-Fontan ± α	6	0	0	235	3 (1.3)	8 (3.4)	216	2 (0.9)	2 (0.9)
4	PA reconstruction/repair (including redo)	11	1 (9.1)	1 (9.1)	64	2 (3.1)	2 (3.1)	108	0	0
5	RVOT reconstruction/repair	9	0	0	122	0	0	195	3 (1.5)	3 (1.5)
6	Rastelli procedure	7	0	1 (14.3)	28	1 (3.6)	2 (7.1)	66	1 (1.5)	2 (3.0)
7	Arterial switch procedure	133	7 (5.3)	11 (8.3)	22	1 (4.5)	1 (4.5)	5	1 (20.0)	1 (20.0)
8	Atrial switch procedure	4	0	0	0	0	0	1	0	0
9	Double switch procedure	0	0	0	3	0	0	7	0	0
10	Repair of anomalous origin of CA	1	0	0	11	0	0	6	0	0
11	Closure of coronary AV fistula	2	0	0	4	0	0	9	0	0
12	Fontan/TCPC	0	0	0	10	0	0	336	4 (1.2)	7 (2.1)
13	Norwood procedure	79	19 (24.1)	28 (35.4)	52	4 (7.7)	9 (17.3)	17	1 (5.9)	3 (17.6)
14	Ventricular septation	0	0	0	2	0	0	1	0	0
15	Left side AV valve repair (including redo)	4	1 (25.0)	1 (25.0)	63	2 (3.2)	2 (3.2)	98	2 (2.0)	2 (2.0)
16	Left side AV valve replace (including redo)	1	1 (100)	1 (100)	19	2 (10.5)	3 (15.8)	37	0	0
17	Right side AV valve repair (including redo)	5	0	0	17	0	0	44	0	1 (2.3)
18	Right side AV valve replace (including redo)	0	0	0	1	0	0	5	1 (20.0)	1 (20.0)
19	Repair of supraaortic stenosis	0	0	0	3	1 (33.3)	1 (33.3)	24	0	0
20	Repair of subaortic stenosis (including redo)	4	1 (25.0)	1 (25.0)	11	0	0	31	0	0
21	Aortic valve plasty ± VSD closure	6	0	0	15	0	0	17	0	0
22	Aortic valve replacement	0	0	0	1	0	0	32	0	0
23	AVR with annular enlargement	0	0	0	0	0	0	11	0	0
24	Aortic root replace (except Ross)	0	0	0	3	2 (66.7)	2 (66.7)	7	1 (14.3)	1 (14.3)
25	Ross procedure	0	0	0	2	0	0	34	0	0
	Total	674	50 (7.4)	67 (9.9)	1,287	20 (1.6)	34 (2.6)	1,387	17 (1.2)	24 (1.7)

		≥18 Years			Total		
		Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1	SP shunt	5	1 (20.0)	1 (20.0)	622	15 (2.4)	17 (2.7)
2	PAB	0	0	0	464	9 (1.9)	12 (2.6)
3	Bidirectional Glenn or hemi-Fontan ± α	15	0	0	472	5 (1.1)	10 (2.1)
4	PA reconstruction/repair (including redo)	6	0	0	189	3 (1.6)	3 (1.6)
5	RVOT reconstruction/repair	25	0	0	351	3 (0.9)	3 (0.9)
6	Rastelli procedure	5	0	0	106	2 (1.9)	5 (4.7)
7	Arterial switch procedure	1	0	0	161	9 (5.6)	13 (8.1)
8	Atrial switch procedure	0	0	0	5	0	0
9	Double switch procedure	0	0	0	10	0	0
10	Repair of anomalous origin of CA	4	0	0	22	0	0
11	Closure of coronary AV fistula	12	0	0	27	0	0
12	Fontan/TCPC	35	3 (8.6)	4 (11.4)	381	7 (1.8)	11 (2.9)
13	Norwood procedure	2	0	0	150	24 (16.0)	40 (26.7)
14	Ventricular septation	0	0	0	3	0	0
15	Left side AV valve repair (including redo)	14	0	0	179	5 (2.8)	5 (2.8)
16	Left side AV valve replace (including redo)	19	1 (5.3)	1 (5.3)	76	4 (5.3)	5 (6.6)
17	Right side AV valve repair (including redo)	25	1 (4.0)	2 (8.0)	91	1 (1.1)	3 (3.3)
18	Right side AV valve replace (including redo)	7	0	0	13	1 (7.7)	1 (7.7)
19	Repair of supraaortic stenosis	2	0	0	29	1 (3.4)	1 (3.4)
20	Repair of subaortic stenosis (including redo)	3	0	0	49	1 (2.0)	1 (2.0)
21	Aortic valve plasty ± VSD closure	10	0	0	48	0	0
22	Aortic valve replacement	20	1 (5.0)	1 (5.0)	53	1 (1.9)	1 (1.9)
23	AVR with annular enlargement	2	0	0	13	0	0
24	Aortic root replace (except Ross)	5	0	0	15	3 (20.0)	3 (20.0)
25	Ross procedure	9	0	0	45	0	0
	Total	226	7 (3.1)	9 (4.0)	3,574	94 (2.6)	134 (3.7)

( ), % mortality; SP, systemic–pulmonary; PAB, pulmonary artery banding; PA, pulmonary artery; RVOT, right ventricular outflow tract; CA, coronary artery; AV fistula, arteriovenous fistula; TCPC, total cavopulmonary connection; AV valve, atrioventricular valve; VSD, ventricular septal defect; AVR, aortic valve replacement

Table 2 Acquired [total (1) + (2) + (4) + (5) + (6) + (7) + isolated operation for arrhythmia in (3): 35,145]

(1) Valvular heart disease (total 15,092) in 2006

	Valve*	Cases	Operation				Replace		Repair		Redo		
			Mechanical	Bioprosthesis	Repair	With CABG	30-Day mortality	Hospital mortality	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
Isolated	A	6,361	2,707	3,599	55	1,240	125 (2.0)	174 (2.8)	4 (7.3)	5 (9.1)	272	17 (6.3)	21 (7.7)
	M	4,320	1,304	658	2,358	595	65 (3.3)	105 (5.4)	28 (1.2)	43 (1.8)	341	23 (6.7)	32 (9.4)
	T	240	20	73	147	10	5 (5.4)	11 (11.8)	3 (2.0)	5 (3.4)	52	3 (5.8)	7 (13.5)
	P	6	1	4	1	1	0 (0.0)	0 (0.0)	0	1 (100.0)	0	0	0
A + M	A	1,172	657	490	25	163	72 (6.1)	101 (8.6)			74	11 (14.9)	14 (18.9)
	M		486	221	465								
A + T	A	189	92	94	3	22	8 (4.2)	12 (6.3)			30	1 (3.3)	3 (10.0)
	T		4	8	177								
M + T	M	2,173	779	474	920	199	57 (2.6)	91 (4.2)			235	12 (5.1)	20 (8.5)
	T		8	47	2,188								
A + M + T	A	586	329	250	7	42	27 (4.6)	48 (8.2)			55	2 (3.6)	5 (9.1)
	M		273	145	168								
	T		0	16	570								
Others		45	18	13	14	3	2 (4.4)	3 (6.7)			13	1 (7.7)	1 (7.7)
Total		15,092	6,678	6,092	7,098	2,275	361 (2.4)	545 (3.6)	35 (0.5)	54 (0.8)	1,072	70 (6.5)	103 (9.6)

( ), % mortality; CABG, coronary artery bypass grafting; A, aortic valve; M, mitral valve; T, tricuspid valve; P, pulmonary valve

(2) Ischemic heart disease [total 18,856 (A) + (B) + (C)]

(A) Isolated CABG [total 17,941 (a) + (b)]

(a) On-pump CABG (including planned on-pump beating-heart CABG at the time of incision) (total 6,920) in 2006

	Primary, elective			Primary, emergency			Redo, elective		
	Cases	30-Day mortality	Hospital deaths	Cases	30-Day mortality	Hospital deaths	Cases	30-Day mortality	Hospital deaths
1VD	169	2 (1.2)	5 (3.0)	46	3 (6.5)	4 (8.7)	19	0	0
2VD	898	7 (0.8)	9 (1.0)	129	10 (7.8)	14 (10.9)	25	1 (4.0)	1 (4.0)
3VD	2,878	32 (1.1)	52 (1.8)	485	47 (9.7)	57 (11.8)	67	3 (4.5)	6 (9.0)
LMT	1,524	19 (1.2)	28 (1.8)	613	45 (7.3)	64 (10.4)	28	0	0
Kawasaki	13	0	0	0	0	0	1	0	0
Total	5,482	60 (1.1)	94 (1.7)	1,273	105 (8.2)	139 (10.9)	140	4 (2.9)	7 (5.0)
Hemodialysis	321	7 (2.2)	13 (4.0)	69	13 (18.8)	18 (26.1)	10	1 (10.0)	2 (20.0)

	Redo, emergency			Arterial graft only	Arterial graft + SVG	SVG only	Others	Uncertain
	Cases	30-Day mortality	Hospital deaths					
1VD	8	0	0	166	19	56	1	0
2VD	6	3 (50.0)	3 (50.0)	340	628	90	0	0
3VD	6	0	0	587	2,707	138	4	0
LMT	5	1 (20.0)	2 (40.0)	510	1,520	136	4	0
Kawasaki	0	0	0	12	1	0	1	0
Total	25	4 (16.0)	5 (20.0)	1,615	4,875	420	10	0
Hemodialysis	1	0	1 (100.0)	60	298	35	0	8

( ), % mortality; CABG, coronary artery bypass grafting; 1VD, one-vessel disease; 2VD, two-vessel disease; 3VD, three-vessel disease; LMT, left main trunk; SVG, saphenous vein graft

LMT includes LMT alone or LMT with other branch diseases

(b) Off-pump CABG (total 11,021)
(Includes cases of planned off-pump CABG in which (during surgery) the change is made to an on-pump CABG or on-pump beating-heart procedure) in 2006

	Primary, elective			Primary, emergency			Redo, elective		
	Cases	30-Day mortality	Hospital deaths	Cases	30-Day mortality	Hospital deaths	Cases	30-Day mortality	Hospital deaths
1VD	862	3 (0.3)	8 (0.9)	82	6 (7.3)	7 (8.5)	62	1 (1.6)	1 (1.6)
2VD	2,038	10 (0.5)	19 (0.9)	223	8 (3.6)	12 (5.4)	49	0	0
3VD	4,060	43 (1.1)	66 (1.6)	386	24 (6.2)	32 (8.3)	47	0	0
LMT	2,564	24 (0.9)	33 (1.3)	562	21 (3.7)	33 (5.9)	40	0	1 (2.5)
Kawasaki	11	0	0	0	0	0	0	0	0
Total	9,535	80 (0.8)	126 (1.3)	1,253	59 (4.7)	84 (6.7)	198	1 (0.5)	2 (1.0)
Hemodialysis	672	22 (3.3)	38 (5.7)	97	7 (7.2)	12 (12.4)	12	0	0

	Redo, emergency			Arterial graft only	Arterial graft + SVG	SVG only	Others	Uncertain
	Cases	30-Day mortality	Hospital deaths					
1VD	11	0	0	861	51	94	4	7
2VD	8	0	0	1,229	977	98	1	14
3VD	8	0	0	1,790	2,621	78	6	5
LMT	8	0	0	1,532	1,529	110	2	1
Kawasaki	0	0	0	9	2	0	0	0
Total	35	0	0	5,421	5,180	380	13	27
Hemodialysis	1	0	0	281	448	49	1	3

( ), % mortality; CABG, coronary artery bypass grafting; 1VD, one-vessel disease; 2VD, two-vessel disease; 3VD, three-vessel disease; LMT, left main trunk; SVG, saphenous vein graft
LMT includes LMT alone or LMT with other branch diseases

(c) Includes cases of conversion (during surgery) from off-pump CABG to on-pump CABG or on-pump beating-heart CABG (total 204) in 2006

	Primary, elective			Primary, emergency			Redo, elective			Redo, emergency		
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
Conversion to on-pump CABG arrest heart	56	3 (5.4)	3 (5.4)	12	2 (16.7)	2 (16.7)	1	0	0	0	0	0
Conversion to on-pump beating-heart CABG	148	10 (6.8)	12 (8.1)	32	6 (18.8)	9 (28.1)	3	0	0	0	0	0
Total	204	13 (6.4)	15 (7.4)	44	8 (18.2)	11 (25.0)	4	0	0	0	0	0
Hemodialysis	25	3 (12.0)	3 (12.0)	7	1 (14.3)	2 (28.6)	0	0	0	0	0	0

( ), % mortality; CABG, coronary artery bypass grafting

(B) Operations for complications of MI (total 910) in 2006

	Chronic			Acute			Concomitant operation		
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	CABG	MVP	MVR
Infarctectomy or aneurysmectomy	502	25 (5.0)	41 (8.2)	27	7 (25.9)	9 (33.3)	402	192	15
VSP closure	42	3 (7.1)	5 (11.9)	230	71 (30.9)	92 (40.0)	89	9	3
Cardiac rupture									
(1) Papillary muscle rupture	10	3 (30.0)	3 (30.0)	159	57 (35.8)	63 (39.6)	20	0	1
(2) Ischemic	18	0	1 (5.6)	45	17 (37.8)	23 (51.1)	28	10	36
Mitral regurgitation	332	23 (6.9)	38 (11.4)	35	13 (37.1)	16 (45.7)	320	270	36
Others	6	0	0	5	0	0	7	1	0
Total	910	54 (5.9)	88 (9.7)	501	165 (32.9)	203 (40.5)	866	482	91

( ), % mortality; MI, myocardial infarction; CABG, coronary artery bypass grafting; MVP, mitral valve repair; MVR, mitral valve replacement
Acute, within 2 weeks from the onset of myocardial infarction

(C) TMLR (total 5) in 2006

	Cases	30-Day mortality	Hospital mortality
Isolated	4	0	0
With CABG	1	0	0
Total	5	0	0

TMLR, transmyocardial laser revascularization

(3) Operations for arrhythmia (total 3,233) in 2006

	Cases	30-Day mortality	Hospital mortality	Concomitant operation						
				Isolated	Congenital	Valve	IHD	Others		
Maze	2,944	47 (1.6)	71 (2.4)	27	151	2,484	272	33	23	2
For WPW	2	0	0	0	2	0	0	0	0	0
For ventricular tachyarrhythmia	51	5 (9.8)	5 (9.8)	2	1	5	45	2	4	0
Others	236	4 (1.7)	6 (2.5)	124	6	86	21	4	5	0
Total	3,233	56 (1.7)	82 (2.5)	153	160	2,575	338	39	32	2

( ), % mortality; WPW, Wolff-Parkinson-White syndrome; IHD, ischemic heart disease
Except for 153 isolated cases, all remaining 3,080 cases are doubly allocated, one for this subgroup and the other for the subgroup corresponding to the concomitant operations

(4) Operation for constrictive pericarditis (total 133) in 2006

	CPB(+)			CPB(–)		
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
Total	47	5 (10.6)	6 (12.8)	86	7 (8.1)	12 (14.0)

( ), % mortality

(5) Cardiac tumors (total 424) in 2006

	Cases	30-Day mortality	Hospital mortality	Concomitant operation			
				AVR	MVR	CABG	Others
Myxoma	300	2 (0.7)	2 (0.7)	2	5	16	27
Others	124	4 (3.2)	8 (6.5)	3	6	4	21
Total	424	6 (1.4)	10 (2.4)	5	11	20	48

( ), % mortality; AVR, atrial valve replacement; MVR, mitral valve replacement; CABG, coronary artery bypass grafting

(6) HOCM and DCM (total 168) in 2006

	Cases	30-Day mortality	Hospital mortality	Concomitant operation			
				AVR	MVR	MVP	CABG
Myectomy	65	1 (1.5)	2 (3.1)	34	19	8	6
Myotomy	7	1 (14.3)	2 (28.6)	3	2	2	1
No resection	27	4 (14.8)	5 (18.5)	1	6	18	0
Volume reduction surgery of the left ventricle	69	5 (7.2)	9 (13.0)	5	5	45	12
Total	168	11 (6.5)	18 (10.7)	43	32	73	19

( ), % mortality; HOCM, hypertrophic obstructive cardiomyopathy; DCM, dilated cardiomyopathy; AVR, aortic valve replacement; MVR, mitral valve replacement; MVP, mitral valve repair; CABG, coronary artery bypass grafting

(7) Other open-heart operations (total 319) in 2006

	Cases	30-Day mortality	Hospital mortality
Total	319	25 (7.8)	28 (8.8)

( ), % mortality

Table 3 Thoracic aortic aneurysm (total 9,326)

(1) Dissection (total 4,350) in 2006

	Stanford type: acute						Stanford type: chronic		
	A			B			A		
Replaced site	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1. Ascending Ao	1,865	195 (10.5)	241 (12.9)	11	1 (9.1)	2 (18.2)	257	12 (4.7)	14 (5.4)
2. Ascending Ao + arch	1,012	121 (12.0)	145 (14.3)	21	5 (23.8)	7 (33.3)	246	13 (5.3)	19 (7.7)
3. Arch + descending Ao	12	3 (25.0)	3 (25.0)	17	7 (41.2)	7 (41.2)	32	2 (6.3)	2 (6.3)
4. Descending Ao	20	1 (5.0)	1 (5.0)	45	6 (13.3)	9 (20.0)	52	4 (7.7)	5 (9.6)
5. Thoracoabdominal Ao	4	0	0	14	5 (35.7)	5 (35.7)	21	3 (14.3)	4 (19.0)
6. Extraanatomical bypass	9	1 (11.1)	1 (11.1)	20	7 (35.0)	7 (35.0)	0	0	0
7. Stent graft*[a]	32	1 (3.1)	2 (6.3)	28	2 (7.1)	2 (7.1)	18	0	1 (5.6)
1) Transluminal*[b]	6	0	0	21	2 (9.5)	2 (9.5)	9	0	1 (11.1)
2) Open stent: a) With total arch*[c]	4	0	0	3	0	0	1	0	0
b) Without total arch*[d]	22	1 (4.5)	2 (9.1)	4	0	0	8	0	0
Total	2,954	322 (10.9)	393 (13.3)	156	33 (21.2)	39 (25.0)	626	34 (5.4)	45 (7.2)

	Stanford type: chronic			Concomitant operation					Redo		
	B										
Replaced site	Cases	30-Day mortality	Hospital mortality	AVP	AVR	MVP	MVR	CABG	Cases	30-Day mortality	Hospital mortality
1. Ascending Ao	10	0	0	213	189	5	9	140	77	10 (13.0)	12 (15.6)
2. Ascending Ao + arch	44	6 (13.6)	7 (15.9)	114	94	3	3	64	57	5 (8.8)	6 (10.5)
3. Arch + descending Ao	54	8 (14.8)	9 (16.7)	1	2	0	0	1	19	2 (10.5)	2 (10.5)
4. Descending Ao	244	18 (7.4)	19 (7.8)	0	1	0	0	4	23	5 (21.7)	5 (21.7)
5. Thoracoabdominal Ao	154	17 (11.0)	22 (14.3)	1	1	1	0	0	23	4 (17.4)	5 (21.7)
6. Extraanatomical bypass	7	0	0	0	0	0	0	0	1	0	0
7. Stent graft*[a]	101	1 (1.0)	3 (3.0)	0	0	0	0	2	11	0	1 (9.1)
1) Transluminal*[b]	89	0	2 (2.2)	0	0	0	0	0	10	0	1 (10.0)
2) Open stent: a) With total arch*[c]	4	0	0	0	0	0	0	0	0	0	0
b) Without total arch*[d]	8	1 (12.5)	1 (12.5)	0	0	0	0	2	1	0	0
Total	614	50 (8.1)	60 (9.8)	329	287	9	12	211	211	26 (12.3)	31 (14.7)

( ), % mortality; AVP, aortic valve repair; AVR, aortic valve replacement; MVP, mitral valve repair; MVR, mitral valve replacement; CABG, coronary artery bypass grafting

Acute, within 2 weeks from the onset

*a = *b + *c + *d

(2) Nondissection (total 5,026 = 4,382 + 644) in 2006

Replaced site	Unruptured			Ruptured			Concomitant operation				
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality	AVP	AVR	MVP	MVR	CABG
1. Ascending Ao	1,356	35 (2.6)	47 (3.5)	51	10 (19.6)	12 (23.5)	148	976	58	41	158
2. Ascending Ao + arch	1,544	70 (4.5)	100 (6.5)	202	38 (18.8)	51 (25.2)	39	139	9	11	294
3. Arch + descending Ao	237	26 (11.0)	34 (14.3)	63	23 (36.5)	28 (44.4)	2	5	2	0	26
4. Descending Ao	535	24 (4.5)	31 (5.8)	154	31 (20.1)	42 (27.3)	0	0	0	0	12
5. Thoracoabdominal Ao	311	28 (9.0)	36 (11.6)	70	16 (22.9)	23 (32.9)	0	0	0	0	1
6. Extraanatomical bypass	16	2 (12.5)	2 (12.5)	5	1 (20.0)	1 (20.0)	0	0	0	0	1
7. Stent graft*[a]	383	10 (2.6)	22 (5.7)	99	6 (6.1)	14 (14.1)	1	3	1	0	20
1) Transluminal*[b]	253	2 (0.8)	5 (2.0)	83	5 (6.0)	12 (14.5)	0	0	0	0	1
2) Open stent a) With total arch*[c]	31	1 (3.2)	6 (19.4)	6	0	0	0	0	0	0	2
b) Without total arch*[d]	99	7 (7.1)	11 (11.1)	10	1 (10.0)	2 (20.0)	1	3	1	0	17
Total	4,382	195 (4.5)	272 (6.2)	644	125 (19.4)	171 (26.6)	190	1,123	70	52	512

Replaced site	Redo			CPB (–)		
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
1. Ascending Ao	136	15 (11.0)	22 (16.2)	0	0	0
2. Ascending Ao + arch	82	11 (13.4)	15 (18.3)	0	0	0
3. Arch + descending Ao	7	2 (28.6)	4 (57.1)	3	1 (33.3)	1 (33.3)
4. Descending Ao	43	9 (20.9)	13 (30.2)	6	0	0
5. Thoracoabdominal Ao	29	5 (17.2)	5 (17.2)	5	1 (20.0)	1 (20.0)
6. Extraanatomical bypass	0	0	0	6	1 (16.7)	1 (16.7)
7. Stent graft*[a]	38	1 (2.6)	3 (7.9)	129	3 (2.3)	6 (4.7)
1) Transluminal*[b]	28	0	2 (7.1)	129	3 (2.3)	6 (4.7)
2) Open stent a) With total arch*[c]	4	0	0	0	0	0
b) Without total arch*[d]	6	1 (16.7)	1 (16.7)	0	0	0
Total	335	43 (12.8)	62 (18.5)	149	6 (4.0)	9 (6.0)

( ), % mortality; AVP, aortic valve repair; AVR, aortic valve replacement; MVP, mitral valve repair; MVR, mitral valve replacement; CABG, coronary artery bypass grafting
*a = *b + *c + *d

Table 4 Pulmonary thromboembolism (total 88) in 2006

	Cases	30-Day mortality	Hospital mortality
Acute	66	17 (25.8)	21 (31.8)
Chronic	22	3 (13.6)	3 (13.6)
Total	88	20 (22.7)	24 (27.3)

( ), % mortality

Table 5 Assisted circulation (total 1,424) in 2006

	Sites	VAD								
		Device			Results					
					Not weaned			Weaned		
		Centrifugal	VAS	Others	Ongoing	Deaths	Transplant	Alive	Deaths	Transplant
After cardiotomy	Left	15	11	1	3	21 (80.8)	0	3	0	0
	Right	5	1	0	0	2 (33.3)	0	2	2 (33.3)	0
	Biventricular									
	Right	3	2	0	0	5 (100.0)	0	0	0	0
	Left	0	5	0						
Congestive heart failure	Left	21	40	8	32	24 (39.3)	1	10	2 (3.3)	0
	Right	6	0	0	0	2	0	4	0	0
	Biventricular									
	Right	6	6	0	2	7 (37.5)	0	3	0	0
	Left	2	10	0						
Respiratory failure										
Total		58	75	9	37	61 (45.9)	1	22	4 (3.0)	0

	Sites	Heart-lung assist					
		Method		Results			
				Not weaned		Weaned	
		PCPS	Others	Deaths	Transplant	Deaths	Transplant
After cardiotomy	Left						
	Right						
	Biventricular						
	Right	461	36	294 (59.2)	0	72 (14.5)	131
	Left						
Congestive heart failure	Left						
	Right						
	Biventricular						
	Right	651	46	352 (50.5)	3	91 (13.1)	251
	Left						
Respiratory failure		79	9	29 (33.0)	0	17 (19.3)	42
Total		1,191	91	675 (52.7)	3	180 (14.0)	424

( ), % mortality; VAS, ventricular assist system; VAD, ventricular assist device

Table 6 Heart transplantation (total 10) in 2006

	Cases	30-Day mortality	Hospital mortality
Heart transplantation	10	0	0
Heart and lung transplantation	0	0	0
Total	10	0	0

( ), % mortality

Table 7 Pacemaker + ICD (total 16,955) in 2006

	Pacemaker			ICD
	Univentricular	Biventricular	CRTD	
Initial	7,876	1,872	67	1,052
Exchange	4,898	785	29	376
Total	12,774	2,657	96	1,428

ICD, implantable cardioverter-defibrillator; CRTD, cardiac resynchronization therapy device with incorporated ICD device

(B) General thoracic surgery

It is notable that the overall volume of surgery performed in our country keeps increasing and has now approached 60,000 per year. This increase has been attributed mainly to the steady increase in the number of surgeries for primary lung cancer, which comprises 45% of the total. As the future Japanese population will be constituted of more elderly people, this trend will remain unchanged for many years to come unless measures to prevent lung cancer have a significant effect. In all, 67% of cases were adenocarcinomas. More and more resections are performed using video-assisted thoracic surgery (VATS); this year 70% of wedge resections and 41% of lobectomies were done using VATS. The 30-day mortality remains as low as 0.3% for lobectomy performed for primary lung cancer; and we are proud of our thoracic surgeons for this significant achievement. The low mortality indicates not only good surgical practice but also the appropriate choice of surgical patients and superb postoperative care. Further improvement in thoracic surgery may require a good training program established nationwide (especially for VATS techniques).

Tumors of colorectal origin consistently comprise 47.1% of cases operated on for metastatic pulmonary tumor, the largest group by a wide margin. A total of 1,440 patients with thymoma were operated on during 2006, which shows a steady increase since the last year. This figure includes patients with myasthenia gravis.

Pneumothorax comprises 21% of all general thoracic surgeries. There were only 13 cases of lung transplantation in 2006, a disappointingly small number, probably due to the shortage of donors with brain death. In Japan, lung transplantation from living donors outnumbers that from donors with brain death.

A total of 33,495 operations were performed using VATS in general thoracic surgery, comprising 56.6% of the total. This procedure will be used more in the coming years, and whether VATS yields the same overall results as open thoracic surgery remains to be seen. Fewer tracheobronchoplasties were performed this year than in the previous year, possibly reflecting a decrease in the more centrally located tumors.

The overall mortality associated with general thoracic surgery is quite low. However, we should maintain our efforts to decrease the mortality further while maintaining the curability of our operations.

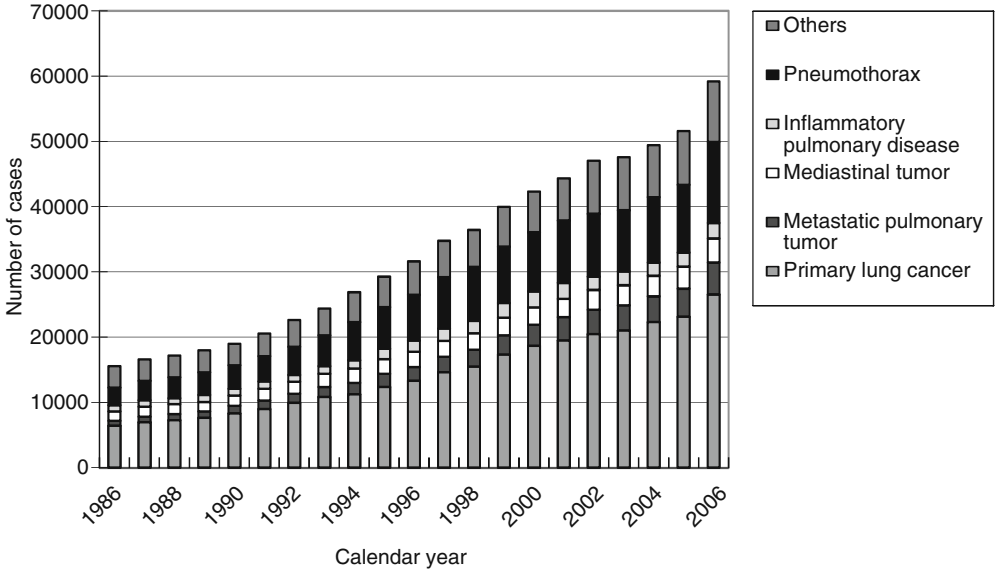

Fig. 1 General thoracic surgery

Table 1 Total entry cases of general thoracic surgery during 2006 in 2006

	Cases	%
Benign pulmonary tumor	1,075	1.8
Nonneoplastic benign disease	2,660	4.5
Primary lung cancer	26,531	44.8
Other primary malignant pulmonary tumor	331	0.6
Metastatic pulmonary tumor	4,912	8.3
Tracheal tumor	70	0.1
Mesothelioma	318	0.5
Chest wall tumor	702	1.2
Mediastinal tumor	3,704	6.3
Thymectomy for MG without thymoma	347	0.6
Inflammatory pulmonary disease	2,383	4.0
Empyema	1,517	2.6
Bullous disease excluding pneumothorax	756	1.3
Pneumothorax	12,396	20.9
Chest wall deformity	352	0.6
Diaphragmatic hernia including traumatic	126	0.2
Chest trauma excluding diaphragmatic hernia	336	0.6
Lung transplantation	13	0.0
Others	691	1.2
Total	59,220	100.0

MG, myasthenia gravis

Table 2 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
1. Benign pulmonary tumor	1,075	0 (0.0)	0 (0.0)	759
Hamartoma	433	0 (0.0)	0 (0.0)	336
Others	642	0 (0.0)	0 (0.0)	423

( ), % mortality

Table 3 in 2006

	Cases	30-Day mortality	Hospital mortality
2. Nonneoplastic benign disease	2,660	9 (0.3)	10 (0.4)

( ), % mortality

Table 4 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
3. Primary malignant pulmonary tumor	26,854	104 (0.4)	231 (0.9)	
Lung cancer	26,531	103 (0.4)	230 (0.9)	
Adenocarcinoma	17,905	58 (0.3)	114 (0.6)	
Squamous cell carcinoma	5,886	31 (0.5)	87 (1.5)	
Large-cell carcinoma	835	3 (0.4)	7 (0.8)	
(LCNEC)	(274)	(0) (0.0)	(1) (0.4)	
Small-cell carcinoma	490	4 (0.8)	7 (1.4)	
Adenosquamous carcinoma	375	0 (0.0)	4 (1.1)	
Carcinoid	167	1 (0.6)	0 (0.0)	
Adenoid cystic carcinoma	34	0 (0.0)	0 (0.0)	
Mucoepidermoid carcinoma	24	0 (0.0)	0 (0.0)	
Carcinosarcoma	36	0 (0.0)	1 (2.8)	
Unclassified	89	1 (1.1)	2 (2.2)	
Multiple lung cancer	402	2 (0.5)	2 (0.5)	
Others	278	3 (1.1)	6 (2.2)	
Wedge resection	3,107	7 (0.2)	13 (0.4)	2,173
Segmental excision	1,804	3 (0.2)	5 (0.3)	897
Sleeve segmental excision	16	0 (0.0)	2 (12.5)	5
Lobectomy	20,158	70 (0.3)	162 (0.8)	8,199
Sleeve lobectomy	451	3 (0.7)	7 (1.6)	42
Pneumonectomy	647	13 (2.0)	31 (4.8)	22
Sleeve pneumonectomy	21	0 (0.0)	0 (0.0)	0
Pleuropneumonectomy	10	0 (0.0)	0 (0.0)	0
Others	317	4 (1.3)	7 (2.2)	80
Sarcoma	43	2 (4.7)	2 (4.7)	
AAH	175	0 (0.0)	1 (0.6)	
Others	113	1 (0.9)	0 (0.0)	

( ), % mortality; VATS, video-assisted thoracic surgery; LCNEC, large-cell neuroendocrine carcinoma; AAH, atypical adenomatous hyperplasia

Table 5 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
4. Metastatic pulmonary tumor	4,912	9 (0.2)	19 (0.4)	2,982
Colorectal	2,312	2 (0.1)	4 (0.2)	1,393
Hepatobiliary/pancreatic	187	1 (0.5)	1 (0.5)	113
Uterine	213	0 (0.0)	0 (0.0)	145
Mammary	310	0 (0.0)	0 (0.0)	224
Ovarian	50	0 (0.0)	0 (0.0)	33
Testicular	65	0 (0.0)	0 (0.0)	43
Renal	399	0 (0.0)	0 (0.0)	267
Skeletal	142	0 (0.0)	1 (0.7)	69
Soft tissue	215	1 (0.5)	2 (0.9)	116
Otorhinolaryngological	260	1 (0.4)	3 (1.2)	166
Pulmonary	295	3 (1.0)	6 (2.0)	133
Others	464	1 (0.2)	2 (0.4)	280

( ), % mortality

Table 6 in 2006

	Cases	30-Day mortality	Hospital mortality
5. Tracheal tumor	70	0 (0.0)	1 (1.4)

( ), % mortality

Table 7 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
6. Tumor of pleural origin	318	3 (0.9)	7 (2.2)	103
Solitary fibrous tumor	91	0 (0.0)	0 (0.0)	51
Malignant pleural mesothelioma	227	3 (1.3)	7 (3.1)	52

( ), % mortality

Table 8 in 2006

	Cases	30-Day mortality	Hospital mortality
7. Chest wall tumor	702	1 (0.1)	4 (0.6)

( ), % mortality

Table 9 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
8. Mediastinal tumor	3,704	7 (0.2)	14 (0.4)	1,449
Thymoma	1,440	2 (0.1)	2 (0.1)	295
Thymic cancer	185	1 (0.5)	5 (2.7)	17
Germ cell tumor	239	1 (0.4)	2 (0.8)	58
Benign	168	0 (0.0)	1 (0.6)	49
Malignant	71	1 (1.4)	1 (1.4)	9
Neurogenic tumor	478	0 (0.0)	0 (0.0)	334
Congenital cyst	630	0 (0.0)	1 (0.2)	433
Goiter	94	0 (0.0)	0 (0.0)	13
Lymphatic tumor	232	2 (0.9)	3 (1.3)	127
Others	406	1 (0.2)	1 (0.2)	172

( ), % mortality

Table 10 in 2006

	Cases	30-Day mortality	Hospital mortality
9. Thymectomy for myasthenia gravis	593	0 (0.0)	2 (0.3)
With thymoma	246	0 (0.0)	0 (0.0)

( ), % mortality

Table 11 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
10. Inflammatory pulmonary disease	2,383	7 (0.3)	14 (0.6)	1,474
Tuberculous infection	646	1 (0.2)	2 (0.3)	404
Fungal infection	334	1 (0.3)	4 (1.2)	141
Bronchiectasis	112	0 (0.0)	1 (0.9)	47
Others	1,291	5 (0.4)	7 (0.5)	882

( ), % mortality

Table 12 in 2006

	Cases	30-Day mortality	Hospital mortality	Radical surgery
11. Empyema	1,517	15 (1.0)	50 (3.3)	995

( ), % mortality

Table 13 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
12. Descending necrotizing mediastinitis	80	4 (5.0)	7 (8.8)	35

( ), % mortality

Table 14 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
13. Bullous disease	756	0 (0.0)	1 (0.1)	520
Emphysematous bulla	580	0 (0.0)	1 (0.2)	413
Bronchogenic cyst	97	0 (0.0)	0 (0.0)	69
Emphysema with volume reduction surgery	35	0 (0.0)	0 (0.0)	25
Others	44	0 (0.0)	0 (0.0)	13

( ), % mortality

Table 15 in 2006

	Cases	30-Day mortality	Hospital mortality	By VATS
14. Pneumothorax	12,396	15 (0.1)	32 (0.3)	11,289
Primary spontaneous	11,503	6 (0.1)	15 (0.1)	10,582
Secondary	893	9 (1.0)	17 (1.9)	707

( ), % mortality

Table 16 in 2006

	Cases	30-Day mortality	Hospital mortality
15. Chest wall deformity	352	0 (0.0)	0 (0.0)
Funnel chest	317	0 (0.0)	0 (0.0)
Others	35	0 (0.0)	0 (0.0)

( ), % mortality

Table 17 in 2006

	Cases	30-Day mortality	Hospital mortality	Traumatic
16. Diaphragmatic hernia	126	3 (2.4)	4 (3.2)	40

( ), % mortality

Table 18 in 2006

	Cases	30-Day mortality	Hospital mortality
17. Chest trauma	336	32 (9.5)	32 (9.5)

( ), % mortality

Table 19 in 2006

	Cases	30-Day mortality	Hospital mortality
18. Other respiratory surgery	691	2 (0.3)	4 (0.6)
Arteriovenous malformation	86	0 (0.0)	0 (0.0)
Pulmonary sequestration	101	0 (0.0)	0 (0.0)
Others	504	2 (0.4)	4 (0.8)

( ), % mortality

Table 20 in 2006

	Cases	30-Day mortality	Hospital mortality
19. Lung transplantation	13	1 (7.7)	2 (15.4)
Single lung	3	0 (0.0)	0 (0.0)
Bilateral lungs	2	0 (0.0)	1 (50.0)
Living donor	8	1 (12.5)	1 (12.5)

( ), % mortality

Table 21 in 2006

	Cases	30-Day mortality	Hospital mortality
20. Video-assisted thoracic surgery	33,495	37 (0.1)	70 (0.2)

( ), % mortality

Table 22 in 2006

	Cases	30-Day mortality	Hospital mortality
21. Tracheobronchoplasty	607	7 (1.2)	12 (2.0)
Trachea	62	3 (4.8)	4 (6.5)
Carinal reconstruction	6	0 (0.0)	0 (0.0)
Sleeve pneumonectomy	82	0 (0.0)	1 (1.2)
Bronchus	430	4 (0.9)	7 (1.6)
Others	27	0 (0.0)	0 (0.0)

( ), % mortality

Table 23 in 2006

	Cases	30-Day mortality	Hospital mortality
22. Pediatric surgery	479	3 (0.6)	4 (0.8)

( ), % mortality

Table 24 in 2006

	Cases		30-Day deaths	%	Hospital mortality	%
23. Combined resection of neighboring organ(s)	1,120		16	1.43	23	2.05
Organ resected	Primary lung cancer			Mediastinal tumor		
	Cases	30-Day mortality	Hospital mortality	Cases	30-Day mortality	Hospital mortality
Aorta	16	0 (0.0)	1 (6.3)	6	6 (100.0)	2 (33.3)
Superior vena cava	58	0 (0.0)	2 (3.4)	88	2 (2.3)	3 (3.4)
Pulmonary artery	149	1 (0.7)	1 (0.7)	2	1 (50.0)	0 (0.0)
Left atrium	54	2 (3.7)	2 (3.7)	1	0 (0.0)	0 (0.0)
Diaphragm	117	1 (0.9)	2 (1.7)	15	0 (0.0)	0 (0.0)
Chest wall (including ribs)	549	3 (0.5)	8 (1.5)	15	0 (0.0)	1 (6.7)
Vertebra	37	0 (0.0)	1 (2.7)	3	0 (0.0)	0 (0.0)
Esophagus	8	0 (0.0)	0 (0.0)	2	0 (0.0)	0 (0.0)

( ), % mortality

Table 25 in 2006

	Cases	30-Day mortality	Hospital mortality
24. Operation of lung cancer invading the chest wall of the apex	141	2 (1.4)	3 (2.1)

( ), % mortality
Includes tumors invading the anterior apical chest wall and posterior apical chest wall (superior sulcus tumor, so-called Pancoast type)

(C) Esophageal surgery

During 2006 alone, a total of 11,610 patients with esophageal disease were registered from 518 institutions (response rate 93.5%) affiliated with the Japanese Association for Thoracic Surgery and/or to the Japan Esophageal Society. Among these institutions were 95 (18.3%) in which 20 or more patients underwent esophageal surgery during the year of 2006, indicating a slight shift of esophageal operations to higher-volume institutions when compared to the data of 2005 (14.9%)[1] (Table 1). Of 2,231 patients with a benign esophageal disease, 755 (33.8%) underwent surgery, and 25 (1.1%) underwent endoscopic resection; the other 1,451 (65.0%) patients did not have any surgical treatment (Table 2). Of 9,379 patients with a malignant esophageal tumor, 6,548 (69.8%) underwent resection—esophagectomy in 5,236 (55.8%) and endoscopic mucosal resection (EMR) including endoscopic submucosal dissection (ESD) in 1,312 (14.0%)—and 2,831 (30.2%) patients did not undergo resection (Tables 3, 4). The decrease in patients with benign esophageal disease is obvious when looking at the figures for hiatal hernia, esophagitis, and esophageal varices.[1] This decrease in registered cases of benign esophageal diseases for these few years may indicate that more of these patients are being treated in medical departments (Fig. 1).

Among benign esophageal diseases (Table 2), esophageal varices, esophagitis (including reflux esophagitis), and hiatal hernia were the most common in Japan. Achalasia, benign esophageal tumors, spontaneous rupture of the esophagus, and congenital esophageal atresia are also common diseases that were treated surgically. Thoracoscopic and/or laparoscopic procedures have been widely adopted for benign esophageal diseases, in particular achalasia, hiatal hernia, and benign tumors. Open surgery was performed in 466 patients with a benign esophageal disease, with 30-day mortality in 7 (1.5%) and hospital mortality (including 30-day mortality) in 19 (4.1%). Thoracoscopic and/or laparoscopic surgery was performed in 289 patients, with 30-day mortality in 2 (0.7%) and hospital mortality in 4 (1.4%). The difference in these death rates between open and scopic surgery seems to be related to the conditions requiring open surgery. Most of the deaths were found in patients with spontaneous esophageal rupture, which required open surgery.

Most of the malignant diseases were carcinoma (Table 3). Among esophageal carcinomas, the incidence of squamous cell carcinoma was 92.2%, and that of adenocarcinoma (including Barrett's cancer) was 3.6%. The resection rate among patients with a squamous cell carcinoma was 69.0%, and that for patients with an adenocarcinoma was 86.5%.

According to location, cancer in the thoracic esophagus was the most common (Table 4). Of the 3,036 patients (32.4% of total esophageal malignancies) with superficial esophageal cancer (in the mucosal and submucosal layers), 1,398 (46.0%) underwent esophagectomy, and 1,312 (43.2%) underwent EMR. Advanced esophageal cancer (invading deeper than the submucosal layer) was observed in 6,307 (67.2%) patients. The 30-day mortality and hospital mortality rates after esophagectomy for patients with a superficial cancer were 0.6% and 1.3%, respectively. There were no EMR-related deaths. Of the 6307 patients with advanced esophageal cancer, 3,822 (60.6%) underwent esophagectomy, with 1.4% 30-day mortality rate and 3.7% hospital mortality rate.

Multiple primary cancers were observed in 1,310 (14.0%) of all the 9,379 patients with esophageal cancer. Synchronous cancer was found in 802 (8.6%) patients, and metachronous cancer (found before esophageal cancer) was observed in 508 (5.4%). The stomach is the commonest site for both synchronous and metachronous other malignancies followed by head and neck cancer (Table 4).

Among esophagectomy procedures, transthoracic esophagectomy through a right thoracotomy was the technique most commonly adopted for patients with a superficial cancer as well as for those with an advanced cancer (Table 5). Transhiatal esophagectomy, commonly performed in Western countries, was adopted in only 5.5% of Japanese patients with a superficial cancer who underwent esophagectomy and in 1.9% of those with an advanced cancer. Thoracoscopic and/or laparoscopic esophagectomy was adopted for 297 patients (21.2%) with superficial cancer and for 434 patients (11.4%) with advanced cancer. The number of cases of thoracoscopic and/or laparoscopic surgery for superficial or advanced cancer has been increasing for several years (Fig. 2).

Combined resection of neighboring organs with an esophageal cancer was performed in 201 patients (Tables 5, 6). Resection of the aorta together with the esophagectomy was not performed in 2006. Tracheal and/or bronchial resection combined with esophagectomy was performed in 17 patients, with no hospital mortality. Lung resection combined with esophagectomy was performed in 62 patients, with the 30-day mortality rate 3.2% and the hospital mortality rate 4.8%.

Salvage surgery after definitive (chemo-)radiotherapy was performed in 200 patients, with the 30-day mortality rate 3.0% and the hospital mortality rate 8.0% (Table 5).

Lastly, despite the efforts of the Committee to cover wider patient populations for this annual survey, for most of the institutions that responded to the questionnaire it was the departments of thoracic or esophageal surgery that provided the data. It should be noted that a larger number of patients with esophageal diseases have likely been treated medically and endoscopically. We will continue our efforts to achieve a more complete survey through active collaboration with the Japan Esophageal Society and other related societies.

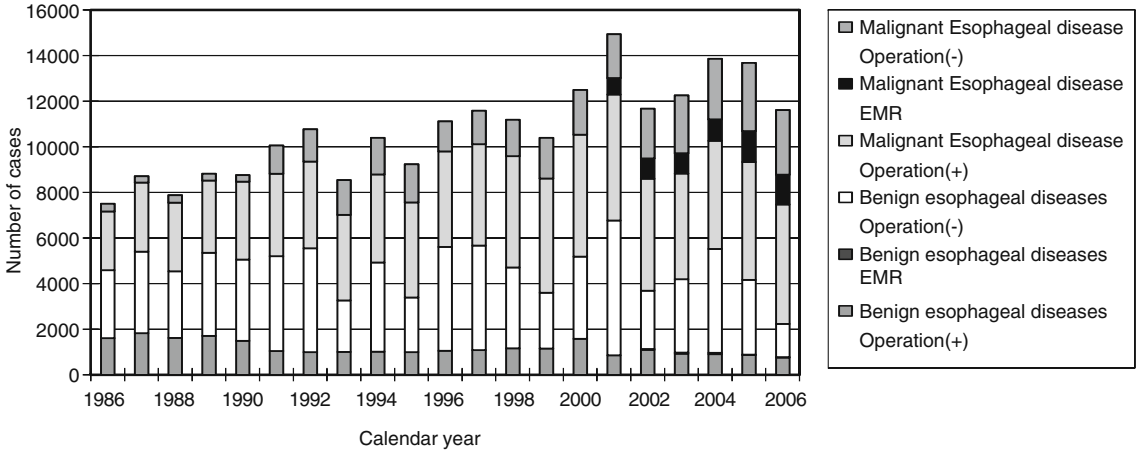

Fig. 1 Annual trend of inpatients with esophageal disease

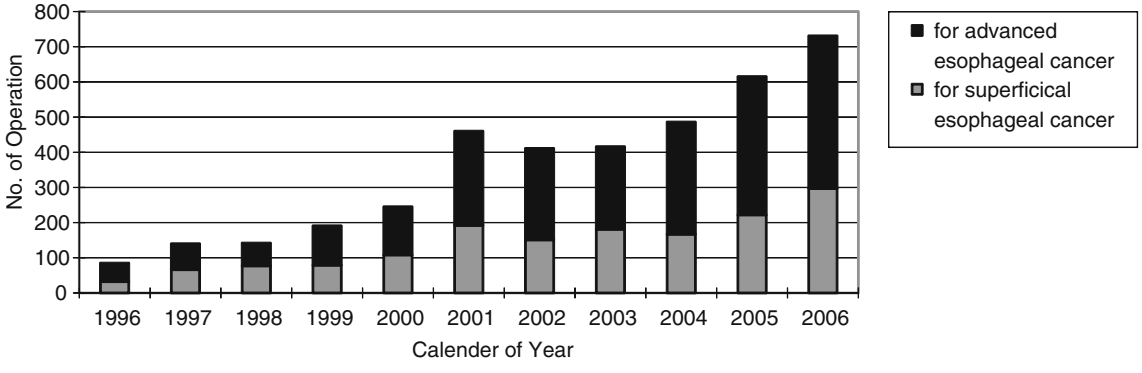

Fig. 2 Annual trend of video-assisted esophagectomy for esophageal malignancy

Table 1 Number of esophageal operations performed in 2006 in participating institutions in 2006

No. of esophageal operations			
during 2006 at the institution	Benign esophageal disease	Malignant esophageal disease	Benign + malignant disease
1–4	195	218	202
5–9	31	106	117
10–19	15	85	104
20–29	1	31	28
30–39	1	20	26
40–49	0	10	12
≥50	0	25	29
Total	243	495	518

Table 2 Benign esophageal disease in 2006

	Operation (+)									Endoscopic resection	Operation (–)	Total
	No. of patients			30-Day mortality			Hospital mortality					
	Total	Open	T/L	Total	Open surgery	T/L	Total	Open surgery	T/L			
1. Achalasia	128	21	107	0	0 (0.0)	0	0	0 (0.0)	0		44	172
2. Benign tumor	58	35	23	0	0 (0.0)	0	0	0 (0.0)	0	25	48	131
(1) Leiomyoma	39	19	20	0	0 (0.0)	0	0	0 (0.0)	0	12	31	82
(2) Cyst	5	3	2	0	0 (0.0)	0	0	0 (0.0)	0	2	5	12
(3) Others	13	12	1	0	0 (0.0)	0	0	0 (0.0)	0	11	12	36
(4) Not specified	1	1										1
3. Diverticulum	20	16	4	0	0 (0.0)	0	0	0 (0.0)	0		18	38
4. Hiatal hernia	204	98	106	1	1 (1.0)	0	2	1 (1.0)	1		186	390
5. Spontaneous rupture of the esophagus	76	70	6	4	4 (5.7)	0	9	9 (12.9)	0		8	84
6. Esophageal perforation	0	0	0	0	0 (0.0)	0	0	0 (0.0)	0		0	0
7. Esophago-tracheal fistula	23	23	0	0	0 (0.0)	0	2	2 (8.7)	0		9	32
8. Congenital esophageal atresia	47	47	0	1	1 (2.1)	0	2	2 (4.3)	0		4	51
9. Congenital esophageal stenosis	3	3	0	0	0 (0.0)	0	0	0 (0.0)	0		4	7
10. Corrosive stricture of the esophagus	6	6	0	0	0 (0.0)	0	0	0 (0.0)	0		16	22
11. Esophagitis, esophageal ulcer	50	27	23	1	0 (0.0)	1	2	1 (3.7)	1		417	467
12. Esophageal varices	83	67	16	1	0 (0.0)	1	1	0 (0.0)	1		639	722
(1) Laparotomy	28	26	2	0	0 (0.0)	0	0	0 (0.0)	0			28
(2) Others	0			0							0	0
(3) Sclerotherapy				0							639	639
13. Others	57	53	4	1	1 (1.9)	0	5	4 (7.5)	1		58	115
Total	755	466	289	9	7 (1.5)	2	23	19 (4.1)	4	25	1,451	2,231

( ), % mortality
T/L, thoracoscopic and/or laparoscopic

Table 3 Malignant esophageal disease (histological classification) in 2006

	Resection (+)	Resection (–)	Total
Carcinomas	6,445	2,780	9,225
1. Squamous cell carcinoma	5,966	2,679	8,645
2. Basaloid (-squamous) carcinoma	53	6	59
3. Carcinosarcoma	38	6	44
4. Adenocarcinoma in a Barrett's esophagus	187	22	209
5. Other adenocarcinoma	109	24	133
6. Adenosquamous carcinoma	34	3	37
7. Adenoid cystic carcinoma	7	1	8
8. Small-cell carcinoma	30	34	64
9. Undifferentiated carcinoma (non-small-cell type)	13	4	17
10. Others	8	1	9
Other malignancies	38	8	46
1. Malignant nonepithelial tumors	13	1	14
2. Malignant melanoma	23	5	28
3. Other malignant tumors	2	2	4
Not specified	65	43	108
Total	6,548	2,831	9,379

Resection, including endoscopic resection

Table 4 Malignant esophageal disease (clinical characteristics) in 2006

	Operation (+)			EMR	Operation (–)	Total
	Cases	30-Day mortality	Hospital mortality			
1. Esophageal cancer	5,236	63 (1.2)	162 (3.1)	1,312	2,831	9,379
A. Location						
(1) Cervical esophagus	192	2 (1.0)	7 (3.6)	41	221	454
(2) Thoracic esophagus	4,397	57 (1.3)	145 (3.3)	1,059	2,393	7,849
(3) Abdominal esophagus	393	2 (0.5)	5 (1.3)	81	92	566
(4) Multiple cancers	244	2 (0.8)	5 (2.0)	82	89	415
(5) Others/not described	10	0 (0.0)	0 (0.0)	49	36	95
B. Tumor depth						
(1) Superficial cancer	1,398	8 (0.6)	18 (1.3)	1,312	326	3,036
(2) Advanced cancer	3,822	55 (1.4)	141 (3.7)		2,485	6,307
(3) Not specified	16	0 (0.0)	3 (18.8)		20	36
2. Multiple primary cancers	938	6 (0.6)	15 (1.6)		372	1,310
A. Synchronous	594	3 (0.5)	7 (1.2)		208	802
(1) Head and neck	165	1 (0.6)	1 (0.6)		69	234
(2) Stomach	279	1 (0.4)	3 (1.1)		65	344
(3) Others	123	1 (0.8)	3 (2.4)		56	179
(4) Triple cancers	27	0 (0.0)	0 (0.0)		18	45
B. Metachronous	344	3 (0.9)	8 (2.3)		164	508
(1) Head and neck	83	1 (1.2)	2 (2.4)		47	130
(2) Stomach	137	1 (0.7)	3 (2.2)		47	184
(3) Others	105	1 (1.0)	2 (1.9)		57	162
(4) Triple cancers	19	0 (0.0)	1 (5.3)		13	32

( ), % mortality
EMR, endoscopic mucosal resection (including endoscopic submucosal dissection)

Table 5 Malignant esophageal disease (surgical procedures) in 2006

	Cases	30-Day mortality	Hospital mortality
Superficial cancer			
1. Endoscopic mucosal resection	1,312	0 (0.0)	0 (0.0)
2. Esophagectomy	1,398	8 (0.6)	18 (1.3)
(1) Transhiatal esophagectomy	77	0 (0.0)	1 (1.3)
(2) Thoracoscopic and/or laparoscopic procedure	297	3 (1.0)	5 (1.7)
(3) Transthoracic (rt.) esophagectomy and reconstruction	915	5 (0.5)	11 (1.2)
(4) Transthoracic (lt.) esophagectomy and reconstruction	46	0 (0.0)	1 (2.2)
(5) Cervical esophageal resection and reconstruction	18	0 (0.0)	0 (0.0)
(6) Two-stage operation	10	0 (0.0)	0 (0.0)
(7) Others/not specified	35	0 (0.0)	0 (0.0)
Advanced cancer			
1. Endoscopic mucosal resection	0	0	0
2. Esophagectomy	3,822	55 (1.4)	141 (3.7)
(1) Transhiatal esophagectomy	72	2 (2.8)	2 (2.8)
(2) Thoracoscopic and/or laparoscopic procedure	434	3 (0.7)	13 (3.0)
(3) Transthoracic (rt.) esophagectomy and reconstruction	2,891	46 (1.6)	110 (3.8)
(4) Transthoracic (lt.) esophagectomy and reconstruction	148	1 (0.7)	3 (2.0)
(5) Cervical esophageal resection and reconstruction	108	1 (0.9)	5 (4.6)
(6) Two-stage operation	62	0 (0.0)	3 (4.8)
(7) Others/not specified	107	2 (1.9)	5 (4.7)
Combined resection of other organs	201	5 (2.5)	9 (4.5)
(1) Aorta	0	0 (0.0)	0 (0.0)
(2) Trachea, bronchus	17	0 (0.0)	0 (0.0)
(3) Lung	62	2 (3.2)	3 (4.8)
(4) Others	122	3 (2.5)	6 (4.9)
Salvage surgery	200	6 (3.0)	16 (8.0)

Table 6 Mortality after combined resection of neighboring organs in 2006

	Esophagectomy			Combined resection											
				Aorta			Tracheobronchus			Lung			Others		
Year	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1996	4,194	120	2.86%	7	3	42.86%	24	0	0.00%	50	2	4.00%	78	4	5.13%
1997	4,441	127	2.86%	1	0	0.00%	34	5	14.71%	56	1	1.79%	94	3	3.19%
1998	4,878	136	2.79%	4	0	0.00%	29	0	0.00%	74	1	1.35%	128	2	1.56%
1999	5,015	116	2.31%	5	0	0.00%	23	2	8.70%	68	0	0.00%	122	1	0.82%
2000	5,350	81	1.51%	2	0	0.00%	23	2	8.70%	69	0	0.00%	96	1	1.04%
2001	5,521	110	1.99%	1	0	0.00%	26	1	3.85%	83	3	3.61%	99	2	2.02%
2002	4,904	66	1.35%	3	1	33.33%	20	2	10.00%	63	0	0.00%	63	1	1.59%
2003	4,639	45	0.97%	0	0	0.00%	24	2	8.33%	58	0	0.00%	88	1	1.14%
2004	4,739	64	1.35%	2	0	0.00%	17	0	0.00%	59	5	8.47%	119	2	1.68%
2005	5,163	52	1.01%	1	0	0.00%	11	1	9.09%	67	1	1.49%	73	1	1.37%
2006	5,263	63	1.20%	0	0	0.00%	17	0	0.00%	62	2	3.23%	122	3	2.46%
Total	54,107	980	1.81%	26	4	15.38%	248	15	6.05%	709	15	2.12%	1,082	21	1.94%

a, number of patients who underwent the operation
b, number of patients who died within 30 days after operation
c, direct operative mortality: b/a ratio (%)

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