

## Thoracic and cardiovascular surgery in Japan during 2005

### Annual report by the Japanese Association for Thoracic Surgery

Committee for Scientific Affairs

Yuichi Ueda, MD · Hiroaki Osada, MD  
Harushi Osugi, MD

The Japanese Association for Thoracic Surgery has conducted annual surveys of thoracic surgery to reveal the statistics on 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 2005.

The incidence of hospital mortality was added to this survey to determine the nationwide status, which 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 geographic location and even though the patient is discharged from the hospital within those 30 days. Hospital mortality is death within any time interval after operation if the patient was 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 compli-

cations of the operation. [The definitions of these 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, and esophageal—and the pertinent data were examined and analyzed in 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 1896 institutions nationwide in early June 2005. The response rates by the end of December 2005 were 94.7%, 91.6%, and 86.0% for the cardiovascular, general thoracic, and esophageal categories respectively.

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Y. Ueda, MD  
Department of Cardiac Surgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

H. Osada, MD  
Department of Surgery, Division of Chest Surgery, St. Marianna University School of Medicine, Kawasaki, Japan

H. Osugi, MD  
Department of Gastroenterological Surgery, Osaka City University Graduate School of Medicine, Osaka, Japan

Questionnaires sent out and received back by the end of December 2006

	Sent out	Returned	Response rate
(A) Cardiovascular surgery	581	550	94.7%
(B) General thoracic surgery	702	643	91.6%
(C) Esophageal surgery	613	527	86.0%

Categories subclassified according to the number of operations performed

No. of operations performed	Category	
	Cardiovascular surgery	General thoracic surgery
1–24	71	122
25–49	129	145
50–99	150	179
100–149	87	113
150–199	47	38
≥200	66	46
Total	550	643

Esophageal Surgery

	Benign esophageal disease	Malignant esophageal disease	Total
1–4	236	226	203
5–9	37	127	139
10–19	11	85	107
20–29	4	27	35
30–39	0	13	11
40–49	0	11	12
≥50	0	15	20
Total	625	625	625

## 2005 Final report

### (A) Cardiovascular surgery

Figure 1 shows the development of cardiovascular surgery in Japan over the last 19 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 53,427 cardiovascular operations were performed at 550 institutions during 2005 alone and included 8 cardiac transplantation operations that were started from 2002. In comparison with 2004, the number of operations for thoracic aortic aneurysms increased by 9.2%, and that for valvular heart disease increased by 12.9%. Surgery for congenital heart disease decreased by 2.7%. However, operations for ischemic heart disease decreased by 7.1%, similar to that in 2004 (6.5%).

Data for individual categories are summarized in Tables 1 through 7. For 7,202 open-heart operations performed for congenital heart disease, the hospital mortality was 3.0%, decreasing from 3.9% in 2004. The hospital mortality for 1,445 palliative operations was 3.1%, similar to that in 2003 (3.2%). Isolated mitral valve repair constituted 25.6% of all valvular heart disease operations (14,252), which was decreased from 30.6% in 2004. Aortic valve replacement with a bioprosthesis increased. The hospital mortality associated with primary valve replacement was 3.5%, and that of primary valve repair was 0.9%. However, hospital mortality of redo operations was still high at 11.7%, which is somewhat higher than the 9.3% mortality in 2004. Isolated coronary artery bypass grafting was performed in 18,337 cases with an overall hospital mortality of 2.9%. The hospital mortality of primary elective surgery was 1.5%. Hospital mortality of primary emergency operations was 10.1%, which had increased from the 9.1% mortality in

2004. Off-pump coronary bypass grafting (OPCAB) was performed in 11,110 cases, constituting 60.6% of the total isolated coronary bypass grafting. In comparison with 2004, the percentage of OPCAB among total isolated coronary bypass grafting was at the same level. A total of 1,406 patients underwent surgery for complications of myocardial infarction, including 431 operations for a left ventricular aneurysm and 323 operations for ischemic mitral regurgitation. Operations for dissecting aneurysms were performed in 4,125 cases with an overall hospital mortality of 13.9%, similar to that in 2004 (13.1%). Operations for nondissecting aneurysms were carried out in 4,782 cases, with an overall hospital mortality of 9.7%, also similar to that in 2004 (9.2%). The hospital mortality due to unruptured aneu-

rysms was 6.8%, and that of ruptured aneurysms was 30.3%, which remained markedly high. The number of stent-graft procedures increased year by year. A total of 180 patients with a dissecting aortic aneurysm underwent stent-graft placement (endovascular stent grafting 118 cases; open stent grafting 62 cases). The hospital mortality rate was 6.1%. A total of 407 patients with a nondissecting aortic aneurysm underwent stent-graft placement (endovascular stent grafting 276 cases; open stent-grafting 131 cases). The hospital mortality rate was 6.9%.

In summary, the total number of cardiovascular operations increased during the year 2005 by 0.9% and were performed with steadily improving results in almost all categories compared to the result in 2004.

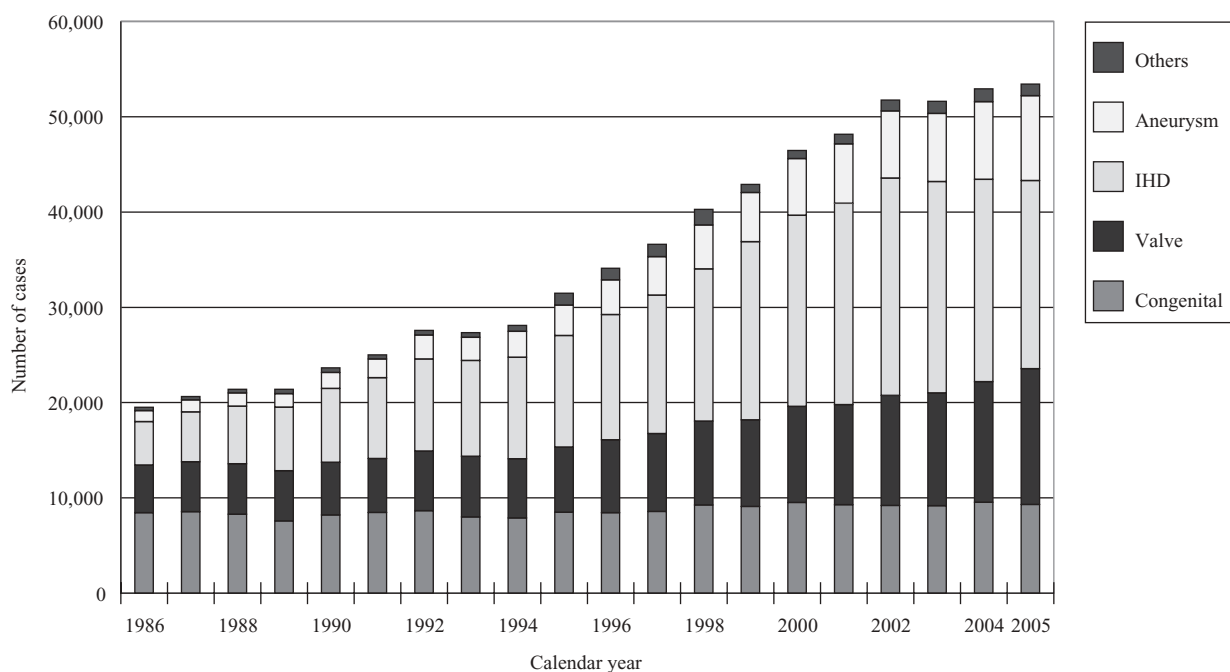


Fig. 1 Cardiovascular surgery

**Table 1** Congenital (total 9,287)

(1) CPB (+) (total 7,202)

in 2005

	Neonate			Infant			1–17 Years			≥18 years			Total		
	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
1 PDA	2	0	0	2	0	0	5	0	0	26	0	0	35	0	0
2 Coarctation (simple)	7	0	0	5	0	0	17	0	0	7	0	0	36	0	0
3 +VSD	29	1 (3.4)	1 (3.4)	36	1 (2.8)	1 (2.8)	10	0	0	2	0	0	77	2 (2.6)	2 (2.6)
4 +DORV	2	1 (50.0)	1 (50.0)	6	0	0	4	0	0	0	0	0	12	1 (8.3)	1 (8.3)
5 +AVSD	1	0	1 (100)	2	0	0	0	0	0	0	0	0	3	0	1 (33.3)
6 +TGA	5	1 (20.0)	1 (20.0)	2	1 (50.0)	1 (50.0)	0	0	0	0	0	0	7	2 (28.6)	2 (28.6)
7 +SV	2	0	0	5	0	0	0	0	0	0	0	0	7	0	0
8 +Others	3	1 (33.3)	1 (33.3)	10	2 (20.0)	3 (30.0)	2	0	0	0	0	0	15	3 (20.0)	4 (26.7)
9 Interrupt. of Ao (simple)	0	0	0	1	0	0	1	0	0	1	0	0	3	0	0
10 +VSD	33	2 (6.1)	4 (12.1)	10	0	0	4	0	0	2	0	0	49	2 (4.1)	4 (8.2)
11 +DORV	2	0	1 (50.0)	1	0	0	0	0	0	0	0	0	3	0	1 (33)
12 +Truncus	0	0	0	3	1 (33.3)	1 (33.3)	0	0	0	0	0	0	3	1 (33.3)	1 (33.3)
13 +TGA	4	1 (25.0)	1 (25.0)	0	0	0	1	0	0	0	0	0	5	1 (20.0)	1 (20.0)
14 +Others	5	2 (40.0)	2 (40.0)	5	0	1 (20.0)	2	0	0	0	0	0	12	2 (16.7)	3 (25.0)
15 Vascular ring	0	0	0	7	0	1 (14.3)	2	0	0	1	0	0	10	0	1 (10.0)
16 PS	0	0	0	4	0	0	22	0	0	10	0	0	36	0	0
17 PPA or critical PS	5	0	0	39	3 (7.7)	4 (10.3)	64	1 (1.6)	1 (1.6)	3	0	0	111	4 (3.6)	5 (4.5)
18 TAPVR	111	7 (6.3)	13 (11.7)	39	0	3 (7.7)	6	1 (6.7)	1 (16.7)	1	0	0	157	8 (5)	17 (11)
19 PAPVR ± ASD	2	0	0	10	0	0	63	0	0	32	1 (3.1)	1 (3.1)	107	1 (0.9)	1 (0.9)
20 ASD	4	0	0	62	0	0	939	0	1 (0.1)	871	3 (0.3)	5 (0.6)	1,876	3 (0.2)	6 (0.3)
21 Cor triatriatum	0	0	0	9	0	0	12	0	0	12	0	0	33	0	0
22 AVSD (partial)	1	0	0	18	1 (5.6)	1 (5.6)	52	0	0	29	0	0	100	1 (1.0)	1 (1.0)
23 AVSD (complete)	0	0	0	74	2 (2.7)	3 (4.1)	69	1 (1.4)	2 (2.9)	2	0	0	145	3 (2.1)	5 (3.4)
24 +TOF or DORV	1	0	0	8	1 (12.5)	2 (25.0)	21	0	0	0	0	0	30	1 (3.3)	2 (6.7)
25 +Others	0	0	0	3	1 (33.3)	1 (33.3)	9	0	1 (11.1)	4	0	0	16	1 (6.3)	2 (12.5)
26 VSD (subarterial)	0	0	0	100	0	0	270	0	0	42	0	0	412	0	0
27 VSD (perimemb./muscular)	9	0	0	694	2 (0.3)	3 (0.4)	439	0	0	77	0	0	1,219	2 (0.2)	3 (0.2)
28 VSD + PS	0	0	0	25	0	0	30	0	0	8	0	0	63	0	0
29 DCRV ± VSD	0	0	0	11	0	0	40	0	0	16	0	0	67	0	0
30 Aneurysm of sinus Valsalva	0	0	0	4	0	0	3	0	0	29	0	0	36	0	0
31 TOF	7	0	0	117	2 (1.7)	2 (1.7)	297	5 (1.7)	5 (1.7)	14	0	0	435	7 (1.6)	7 (1.6)
32 PA + VSD	4	0	0	35	1 (2.9)	2 (5.7)	89	2 (2.2)	3 (3.4)	2	0	1 (50.0)	130	3 (2.3)	6 (4.6)
33 DORV	8	0	0	74	4 (5.4)	4 (5.4)	130	4 (3.1)	5 (3.8)	2	0	0	214	8 (3.7)	9 (4.2)
34 TGA (simple)	102	5 (4.9)	7 (6.9)	8	0	0	3	0	0	0	0	0	113	5 (4.4)	7 (6.2)
35 +VSD	41	6 (14.6)	9 (22.0)	17	1 (5.9)	1 (5.9)	5	0	0	0	0	0	63	7 (11.1)	10 (15.9)
36 VSD + PS	1	0	0	6	0	0	19	0	0	2	0	0	28	0	0
37 Corrected TGA	2	0	0	11	1 (9.1)	1 (9.1)	36	1 (2.8)	1 (2.8)	7	0	1 (14.3)	56	2 (3.6)	3 (5.4)
38 Truncus arteriosus	13	5 (38.5)	5 (38.5)	9	2 (22.2)	3 (33.3)	7	0	1 (14.3)	0	0	0	29	7 (24.1)	9 (31.0)
39 SV	20	4 (20.0)	7 (35.0)	131	2 (1.5)	9 (6.9)	261	3 (1.1)	5 (1.9)	19	2 (10.5)	2 (10.5)	431	11 (2.6)	23 (5.3)
40 TA	13	1 (7.7)	2 (15.4)	25	1 (4.0)	1 (4.0)	79	1 (1.3)	1 (1.3)	15	1 (6.7)	1 (6.7)	132	4 (3.0)	5 (3.8)
41 HLHS	57	16 (28.1)	21 (36.8)	82	12 (14.6)	20 (24.4)	40	1 (2.5)	3 (7.5)	1	0	0	180	29 (16.1)	44 (24.4)
42 Aortic valve lesion	3	2 (66.7)	2 (66.7)	10	1 (10.0)	1 (10.0)	72	1 (1.4)	1 (1.4)	34	0	0	119	4 (3.4)	4 (3.4)
43 Mitral valve lesion	0	0	0	30	1 (3.3)	2 (6.7)	78	0	0	10	1 (10.0)	1 (10.0)	118	2 (1.7)	3 (2.5)
44 Ebstein	6	5 (83.3)	5 (83.3)	5	3 (60.0)	3 (60.0)	24	0	0	19	1 (5.3)	1 (5.3)	54	9 (16.7)	9 (16.7)
45 Coronary disease	2	0	0	15	0	0	17	0	0	16	0	0	50	0	0
46 Others	12	4 (33.3)	4 (33.3)	29	1 (3.4)	1 (3.4)	46	1 (2.2)	2 (4.3)	12	0	0	99	6 (6.1)	7 (7.1)
47 Redo VSD	0	0	0	7	0	0	7	0	0	12	0	0	26	0	0
48 PS release	0	0	0	6	0	0	49	0	1 (2.0)	19	1 (5.3)	1 (5.3)	74	1 (1.4)	2 (2.7)
49 RV-PA conduit replace	0	0	0	1	0	0	32	0	0	27	1 (3.7)	1 (3.7)	60	1 (1.7)	1 (1.7)
50 Others	2	1 (50.0)	1 (50.0)	24	1 (4.2)	3 (12.5)	51	1 (2.0)	2 (3.9)	29	1 (3.4)	1 (3.4)	106	4 (3.8)	7 (6.6)
Total	521	65 (12.5)	89 (17.1)	1,837	48 (2.6)	78 (4.2)	3,429	23 (0.7)	36 (1.0)	1415	12 (0.8)	16 (1.1)	7,202	148 (2.1)	219 (3.0)

CPB, Cardiopulmonary bypass; HD, hospital deaths; ( ), mortality %; PPA, pure pulmonary atresia; DCRV, double-chambered right ventricle; PA, pulmonary atresia; SV, single ventricle; TA, tricuspid atresia

**Table 1** Congenital (total 9,287)

(2) CPB (-) (total 2,085)

in 2005

		Neonate			Infant			1–17 Years			≥18 Years			Total		
		Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
1	PDA	284	10 (3.5)	12 (4.2)	176	2 (1.1)	2 (1.1)	103	0	0	6	0	0	569	12 (2.1)	14 (2.5)
2	Coarctation (simple)	26	1 (3.8)	1 (3.8)	26	0	0	16	0	0	3	0	0	71	1 (1.4)	1 (1.4)
3	+VSD	50	2 (4.0)	3 (6.0)	17	0	0	0	0	0	1	0	0	68	2 (2.9)	3 (4.4)
4	+DORV	14	1 (7.1)	2 (14.3)	9	0	0	0	0	0	0	0	0	23	1 (4.3)	2 (8.7)
5	+AVSD	4	0	0	2	0	0	0	0	0	0	0	0	6	0	0
6	+TGA	5	0	0	1	0	0	0	0	0	0	0	0	6	0	0
7	+SV	17	2 (11.8)	2 (11.8)	2	0	0	0	0	0	0	0	0	19	2 (10.5)	2 (10.5)
8	+Others	6	0	0	4	0	0	3	0	0	0	0	0	13	0	0
9	Interrupt. of Ao (simple)	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
10	+VSD	20	2 (10.0)	5 (25.0)	3	0	0	2	0	0	0	0	0	25	2 (8.0)	5 (20.0)
11	+DORV	1	1 (100)	1 (100)	1	0	0	0	0	0	0	0	0	2	1 (50)	1 (50)
12	+Truncus	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0
13	+TGA	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0
14	+Others	6	0	0	1	0	0	0	0	0	0	0	0	7	0	0
15	Vascular ring	1	0	0	6	0	0	6	0	0	2	0	0	15	0	0
16	PS	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0
17	PPA or critical PS	22	0	0	35	0	0	4	0	0	0	0	0	61	0	0
18	TAPVR	1	1 (100)	1 (100)	1	1 (100)	1 (100)	0	0	0	0	0	0	2	2 (100)	2 (100)
19	PAPVR ± ASD	0	0	0	1	0	0	2	0	0	0	0	0	3	0	0
20	ASD	3	0	0	0	0	0	0	0	0	6	0	0	9	0	0
21	Cor triatriatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	AVSD (partial)	3	0	0	2	0	0	0	0	0	0	0	0	5	0	0
23	AVSD (complete)	10	0	0	48	1 (2.1)	1 (2.1)	6	0	0	0	0	0	64	1 (1.6)	1 (1.6)
24	+TOF or DORV	6	0	1 (16.7)	12	0	0	2	0	0	0	0	0	20	0	1 (5.0)
25	+Others	4	0	0	9	0	0	1	0	0	0	0	0	14	0	0
26	VSD (subarterial)	3	0	0	4	0	0	0	0	0	0	0	0	7	0	0
27	VSD (perimemb./muscular)	23	1 (4.3)	1 (4.3)	66	0	0	2	0	0	1	0	0	92	1 (1.1)	1 (1.1)
28	VSD + PS	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
29	DCRV ± VSD	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0
30	Aneurysm of sinus Valsalva	0	0	0	9	0	0	0	0	0	0	0	0	9	0	0
31	TOF	21	0	0	109	1 (0.9)	1 (0.9)	24	0	0	1	0	0	155	1 (0.6)	1 (0.6)
32	PA + VSD	16	1 (6.3)	1 (6.3)	61	2 (3.3)	2 (3.3)	31	0	0	0	0	0	108	3 (2.8)	3 (2.8)
33	DORV	21	1 (4.8)	1 (4.8)	44	0	0	12	0	0	0	0	0	77	1 (1.3)	1 (1.3)
34	TGA (simple)	4	0	0	1	1 (100)	1 (100)	0	0	0	0	0	0	5	1 (20.0)	1 (20.0)
35	+VSD	5	0	0	8	0	0	1	0	0	0	0	0	14	0	0
36	VSD + PS	8	0	0	11	0	0	1	0	0	1	0	0	21	0	0
37	Corrected TGA	3	0	0	15	0	0	5	0	0	2	0	0	25	0	0
38	Truncus arteriosus	6	0	1 (16.7)	10	0	0	2	0	0	1	0	0	19	0	1 (5.3)
39	SV	50	2 (4.0)	3 (6.0)	81	4 (4.9)	4 (4.9)	15	0	2 (13.3)	5	0	0	151	6 (4.0)	9 (6.0)
40	TA	21	1 (4.8)	1 (4.8)	28	0	0	5	0	0	0	0	0	54	1 (1.9)	1 (1.9)
41	HLHS	45	1 (2.2)	4 (8.9)	18	1 (5.6)	1 (5.6)	3	0	0	0	0	0	66	2 (3.0)	5 (7.6)
42	Aortic valve lesion	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
43	Mitral valve lesion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	Ebstein	3	2 (66.7)	2 (66.7)	2	0	0	1	0	0	0	0	0	6	2 (33.3)	2 (33.3)
45	Coronary disease	2	0	0	3	0	0	1	0	0	1	0	0	7	0	0
46	Others	30	0	0	44	1 (2.3)	1 (2.3)	75	0	1 (1.3)	13	0	0	162	1 (0.6)	2 (1.2)
47	Redo VSD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	PS release	0	0	0	1	0	0	0	0	0	1	0	0	2	0	0
49	RV-PA conduit replace	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
50	Others	14	1 (7.1)	1 (7.1)	24	0	0	46	0	0	5	0	0	89	1 (1.1)	1 (1.1)
	Total	766	30 (3.9)	43 (5.6)	900	14 (1.6)	14 (1.6)	370	0	3 (0.8)	49	0	0	2,085	44 (2.1)	60 (2.9)

## (3) Main procedure

in 2005

		Neonate			Infant			1–17 Years		
		Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
1	SP shunt	141	3 (2.1)	4 (2.8)	396	11 (2.8)	14 (3.5)	99	0	0
2	PAB	208	9 (4.3)	17 (8.2)	211	2 (0.9)	2 (0.9)	7	0	0
3	Glenn ± α	6	0	0	185	6 (3.2)	7 (3.8)	151	0	0
4	PA reconstruction/plasty (including redo)	6	0	0	82	0	3 (3.7)	72	0	1 (1.4)
5	RVOT reconstruction/plasty	15	1 (6.7)	1 (6.7)	108	3 (2.8)	4 (3.7)	225	1 (0.4)	3 (1.3)
6	Rastelli procedure	7	2 (28.6)	2 (28.6)	26	2 (7.7)	2 (7.7)	94	4 (4.3)	7 (7.4)
7	Arterial switch procedure	150	13 (8.7)	17 (11.3)	31	2 (6.5)	3 (9.7)	6	1 (16.7)	1 (16.7)
8	Atrial switch procedure	0	0	0	0	0	0	1	0	0
9	Double switch procedure	0	0	0	0	0	0	9	0	0
10	Repair of anomalous origin of CA	1	1 (100)	1 (100)	10	0	0	4	0	1 (25.0)
11	Closure of coronary AV fistula	2	0	0	4	0	0	20	1 (5.0)	1 (5.0)
12	Fontan/TCPC	0	0	0	7	0	0	316	5 (1.6)	10 (3.2)
13	Norwood procedure	69	20 (29.0)	24 (34.8)	43	10 (23.3)	14 (32.6)	0	0	0
14	Ventricular septation	0	0	0	0	0	0	3	0	0
15	Left side AV valve plasty (including redo)	9	4 (44.4)	4 (44.4)	56	6 (10.7)	6 (10.7)	88	1 (1.1)	2 (2.3)
16	Left side AV valve replace (including redo)	1	1 (100)	1 (100)	12	2 (16.7)	3 (25.0)	30	0	2 (6.7)
17	Right side AV valve plasty (including redo)	5	1 (20.0)	1 (20.0)	10	0	0	30	1 (3.3)	1 (3.3)
18	Right side AV valve replace (including redo)	0	0	0	0	0	0	7	0	0
19	Repair of supraaortic stenosis	0	0	0	4	0	0	15	0	0
20	Repair of subaortic stenosis (including redo)	2	1 (50.0)	1 (50.0)	11	1 (9.1)	1 (9.1)	25	0	0
21	Aortic valve plasty ± VSD closure	1	0	0	3	0	0	28	0	0
22	Aortic valve replacement	0	0	0	1	1 (100)	1 (100)	26	0	1 (3.8)
23	AVR with annular enlargement	0	0	0	0	0	0	11	1 (9.1)	1 (9.1)
24	Aortic root replace (except Ross)	0	0	0	0	0	0	4	0	0
25	Ross procedure	0	0	0	3	1 (33.3)	1 (33.3)	23	0	0
	Total	623	56 (9.0)	73 (11.7)	1203	47 (3.9)	61 (5.1)	1294	15 (1.2)	31 (2.4)

		≥18 Years			Total		
		Cases	Deaths	HD	Cases	Deaths	HD
1	SP shunt	1	0	0	637	14 (2.2)	18 (2.8)
2	PAB	1	0	0	427	11 (2.6)	19 (4.4)
3	Glenn ± α	6	0	0	348	6 (1.7)	7 (2.0)
4	PA reconstruction/plasty (including redo)	20	0	0	180	0	4 (2.2)
5	RVOT reconstruction/plasty	13	0	0	361	5 (1.4)	8 (2.2)
6	Rastelli procedure	11	0	2 (18.2)	138	8 (5.8)	13 (9.4)
7	Arterial switch procedure	0	0	0	187	16 (8.6)	21 (11.2)
8	Atrial switch procedure	0	0	0	1	0	0
9	Double switch procedure	0	0	0	9	0	0
10	Repair of anomalous origin of CA	1	0	0	16	1 (6.3)	2 (12.5)
11	Closure of coronary AV fistula	12	0	0	38	1 (2.6)	1 (2.6)
12	Fontan/TCPC	27	2 (7.4)	2 (7.4)	350	7 (2.0)	12 (3.4)
13	Norwood procedure	1	0	0	113	30 (26.5)	38 (33.6)
14	Ventricular septation	0	0	0	3	0	0
15	Left side AV valve plasty (including redo)	19	1 (5.3)	1 (5.3)	172	12 (7.0)	13 (7.6)
16	Left side AV valve replace (including redo)	12	0	0	55	3 (5.5)	6 (10.9)
17	Right side AV valve plasty (including redo)	23	0	0	68	2 (2.9)	2 (2.9)
18	Right side AV valve replace (including redo)	17	0	0	24	0	0
19	Repair of supraaortic stenosis	2	0	0	21	0	0
20	Repair of subaortic stenosis (including redo)	3	0	0	41	2 (4.9)	2 (4.9)
21	Aortic valve plasty ± VSD closure	3	0	0	35	0	0
22	Aortic valve replacement	27	1 (3.7)	1 (3.7)	54	2 (3.7)	3 (5.6)
23	AVR with annular enlargement	3	0	0	14	1 (7.1)	1 (7.1)
24	Aortic root replace (except Ross)	3	0	0	7	0	0
25	Ross procedure	10	0	0	36	1 (2.8)	1 (2.8)
	Total	215	4 (1.9)	6 (2.8)	3335	122 (3.7)	171 (5.1)

HD, Hospital deaths; ( ), mortality %

**Table 2** Acquired [total 35,101: (1) + (2) + (4) + (5) + (6) + (7) + isolated ope. for arrhythmia in (3)]

(1) Valvular heart disease (total 14,252)

in 2005

	Valve	Cases	Operation				Replace		Plasty		Redo		
			Mechanical	Bioprosthesis	Plasty	With CABG	Deaths	HD	Deaths	HD	Cases	Deaths	HD
Isolated	A	6,025	2790	3185	50	1,086	126 (2.1)	176 (2.9)	0 (0.0)	1 (2.0)	213	16 (7.5)	20 (9.4)
	M	4,284	1402	567	2315	614	63 (3.2)	99 (5.0)	38 (1.6)	51 (2.2)	352	28 (8.0)	39 (11.1)
	T	199	22	53	124	14	6 (8.0)	9 (12.0)	2 (1.6)	4 (3.2)	47	5 (10.6)	7 (14.9)
	P	8	0	6	2	7	0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)	3	0	0
A + M	A	1106	664	423	19	126	54 (4.9)	68 (6.1)			69	7 (10.1)	9 (13.0)
	M		502	173	431								
A + T	A	124	66	58	0	16	6 (4.8)	7 (5.6)			28	3 (10.7)	5 (17.9)
	T		2	5	117								
M + T	M	1,927	771	415	741	137	54 (2.8)	83 (4.3)			198	15 (7.6)	16 (8.1)
	T		7	40	1880								
A + M + T	A	540	342	193	5	40	35 (6.5)	46 (8.5)			57	12 (21.1)	14 (24.6)
	M		268	108	164								
	T		4	10	526								
Others		39	11	16	12	6	3 (7.7)	6 (15.4)			17	2 (11.8)	5 (29.4)
Total		14,252	6851	5252	6386	2,046	347 (2.4)	494 (3.5)	40 (0.6)	57 (0.9)	984	88 (8.9)	115 (11.7)

HD, hospital deaths; ( ), mortality %

Number of redo cases is included in total case number of 14,252

(2) Ischemic heart disease [total 19,742: (A) + (B) + (C)]

(A) Isolated CABG [total 18,337: (a) + (b)]

(a) On-pump CABG (including planned on-pump beating-heart CABG at the time of incision) (total 7,227)

in 2005

	Primary, elective			Primary, emergency			Redo, elective		
	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
1VD	167	2 (1.2)	2 (1.2)	57	7 (12.3)	7 (12.3)	18	1 (5.6)	1 (5.6)
2VD	935	8 (0.9)	13 (1.4)	182	17 (9.3)	26 (14.3)	24	1 (4.2)	1 (4.2)
3VD	3,027	45 (1.5)	66 (2.2)	482	57 (11.8)	67 (13.9)	61	2 (3.3)	4 (6.6)
LMT	1,560	17 (1.1)	25 (1.6)	644	52 (8.1)	74 (11.5)	24	1 (4.2)	4 (16.7)
Kawasaki	9	0	0	2	0	0	0	0	0
Total	5,698	72 (1.3)	106 (1.9)	1367	133 (9.7)	174 (12.7)	127	5 (3.9)	10 (7.9)
Hemodialysis	270	10 (3.7)	20 (7.4)	105	26 (24.8)	28 (26.7)	8	0	1 (12.5)

	Redo, emergency			Artery graft only	Artery graft + SVG	SVG only	Others	Uncertain
	Cases	Deaths	HD					
1VD	7	0	1 (14.3)	177	17	55	0	0
2VD	6	1 (16.7)	2 (33.3)	455	620	69	1	0
3VD	15	4 (26.7)	4 (26.7)	777	2,686	122	0	0
LMT	7	2 (28.6)	3 (42.9)	676	1,426	131	2	0
Kawasaki	0	0	0	7	3	1	0	0
Total	35	7 (20.0)	10 (28.6)	2,092	4,752	378	3	0
Hemodialysis	2	1 (50.0)	2 (100.0)	62	281	36	0	6

HD, hospital deaths; ( ), mortality %

LMT includes LMT alone or LMT + other branch diseases

## (b) Off-pump CABG (total 11,110)

(The present section also 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 2005

	Primary, elective			Primary, emergency			Redo, elective		
	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
1VD	965	7 (0.7)	11 (1.1)	124	7 (5.6)	14 (11.3)	76	2 (2.6)	4 (5.3)
2VD	2,101	13 (0.6)	20 (1.0)	223	9 (4.0)	12 (5.4)	65	3 (4.6)	3 (4.6)
3VD	3,912	26 (0.7)	51 (1.3)	426	23 (5.4)	36 (8.5)	56	1 (1.8)	2 (3.6)
LMT	2,474	23 (0.9)	36 (1.5)	613	27 (4.4)	42 (6.9)	43	2 (4.7)	2 (4.7)
Kawasaki	8	0	0	0	0	0	2	0	0
Total	9,461	69 (0.7)	118 (1.2)	1,386	66 (4.8)	104 (7.5)	242	8 (3.3)	11 (4.5)
Hemodialysis	590	16 (2.7)	28 (4.7)	105	11 (10.5)	18 (17.1)	10	3 (30.0)	3 (30.0)

	Redo, emergency			Artery graft only	Artery graft + SVG	SVG only	Others	Uncertain
	Cases	Deaths	HD					
1VD	4	0	0	1,049	58	62	0	0
2VD	5	0	2 (40.0)	1,485	838	71	0	0
3VD	10	0	1 (10.0)	2,115	2,222	67	0	0
LMT	2	1 (50.0)	2 (100.0)	1,744	1,306	82	0	0
Kawasaki	0	0	0	8	1	1	0	0
Total	21	1 (4.8)	5 (23.8)	6,401	4,426	283	0	0
Hemodialysis	3	0	2 (66.7)	303	362	35	0	12

HD, hospital deaths; ( ), mortality %

LMT includes LMT alone or LMT + 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 296) in 2005

	Primary, elective			Primary, emergency			Redo, elective			Redo, emergency		
	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
Conversion during procedure to on-pump CABG	54	2 (3.7)	5 (9.3)	11	1 (9.1)	1 (9.1)	0	0	0	0	0	0
Conversion during procedure to on-pump beating-heart	175	9 (5.1)	9 (5.1)	45	7 (15.6)	10 (22.2)	9	4 (44.4)	4 (44.4)	2	0	0
Total	229	11 (4.8)	14 (6.1)	56	8 (14.3)	11 (19.6)	9	4 (44.4)	4 (44.4)	2	0	0
Hemodialysis	14	1 (7.1)	2 (14.3)	4	1 (25.0)	1 (25.0)	1	1 (100.0)	1 (100.0)	0	0	0

HD, hospital deaths; ( ), mortality %

## (B) Operation for complications of MI (total 1,406)

in 2005

	Chronic			Acute			Concomitant operation		
	Cases	Deaths	HD	Cases	Deaths	HD	CABG	MVP	MVR
Infarctectomy or aneurysmectomy	431	17 (3.9)	22 (5.1)	29	9 (31.0)	12 (41.4)	323	133	18
VSP closure	66	4 (6.1)	6 (9.1)	248	57 (23.0)	79 (31.9)	102	5	2
Cardiac rupture									
Papillary muscle rupture	41	0	0	25	8 (32.0)	9 (36.0)	8	1	16
Ischemic	20	0	0	148	47 (31.8)	52 (35.1)	22	4	1
Mitral regurgitation	323	16 (5.0)	24 (7.4)	57	12 (21.1)	18 (31.6)	331	261	55
Others	12	0	1 (8.3)	6	3 (50.0)	3 (50.0)	6	0	1
Total	893	37 (4.1)	53 (5.9)	513	136 (26.5)	173 (33.7)	792	404	93

HD, hospital deaths; ( ), mortality %

Acute, within 2 weeks from the onset of myocardial infarction



## (C) TMLR (total 0) in 2005

	Cases	Deaths	HD
Isolated	0	0	0
With CABG	0	0	0
Total	0	0	0

HD, hospital deaths

## (3) Operation for arrhythmia (total 2,638) in 2005

	Cases	Deaths	HD	Concomitant operation				
				Isolated	Congenital	Valve	IHD	Others
Maze	2,497	31 (1.2)	47 (1.9)	27	153	2,160	152	10
For WPW	6	0	0	2	2	2	0	
For ventricular tachyarrhythmia	49	3 (6.1)	3 (6.1)	2	1	8	38	
Others	86	0	1 (1.2)	2	8	66	10	
Total	2,638	34 (1.3)	51 (1.9)	33	164	2,236	200	10

HD, hospital deaths; ( ), mortality %

Except for 33 isolated cases, all remaining 2,605 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 136) in 2005

	CPB (+)			CPB (-)		
	Cases	Deaths	HD	Cases	Deaths	HD
Total	43	0	4 (9.3)	93	4 (4.3)	8 (8.6)

HD, hospital deaths; ( ), mortality %

## (5) Cardiac tumor (total 447) in 2005

	Cases	Deaths	HD	Concomitant operation			Others
				AVR	MVR	CABG	
Myxoma	320	5 (1.6)	5 (1.6)	2	4	15	38
Others	127	8 (6.3)	9 (7.1)	1	6	7	15
Total	447	13 (2.9)	14 (3.1)	3	10	22	53

HD, hospital deaths; ( ), mortality %

## (6) HOCM and DCM (total 132) in 2005

	Cases	Deaths	HD	Concomitant operation			
				AVR	MVR	MVP	CABG
Myectomy	50	3 (6.0)	4 (8.0)	22	13	0	4
Myotomy	2	0	0	0	0	2	0
No resection	40	0	1 (2.5)	9	4	28	3
Volume reduction surgery of the left ventricle	40	4 (10.0)	6 (15.0)	3	3	30	4
Total	132	7 (5.3)	11 (8.3)	34	20	60	11

HD, hospital deaths; ( ), mortality %

## (7) Other open-heart operation (total 359) in 2005

	Cases	Deaths	HD
Total	359	31 (8.6)	32 (8.9)

HD, hospital deaths; ( ), mortality %

**Table 3.** Thoracic aortic aneurysm (total 8,907)

(1) Dissecting (total 4,125)

in 2005

Stanford type	Acute						Chronic					
	A			B			A			B		
Replaced site	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD	Cases	Deaths	HD
Ascending	1,739	178 (10.2)	220 (12.7)	13	1 (7.7)	1 (7.7)	264	17 (6.4)	24 (9.1)	6	0	1 (16.7)
Ascending + arch	999	140 (14.0)	173 (17.3)	20	1 (5.0)	1 (5.0)	228	19 (8.3)	24 (10.5)	35	0	0
Arch + descending	15	4 (26.7)	6 (40.0)	15	7 (46.7)	7 (46.7)	27	7 (25.9)	10 (37.0)	55	7 (12.7)	8 (14.5)
Descending	8	1 (12.5)	4 (50.0)	61	20 (32.8)	23 (37.7)	42	3 (7.1)	5 (11.9)	218	8 (3.7)	16 (7.3)
Thoracoabdominal	5	2 (40.0)	2 (40.0)	11	3 (27.3)	3 (27.3)	21	1 (4.8)	2 (9.5)	122	18 (14.8)	22 (18.0)
Bypass	6	2 (33.3)	2 (33.3)	27	5 (18.5)	6 (22.2)	2	0	0	6	0	1 (16.7)
Stent graft**	44	3 (6.8)	3 (6.8)	30	2 (6.7)	2 (6.7)	16	1 (6.3)	1 (6.3)	90	5 (5.6)	5 (5.6)
1) transluminal**b	11	0	0	23	1 (4.3)	1 (4.3)	7	0	0	77	3 (3.9)	3 (3.9)
2) open stent	1	1 (100)	1 (100)	0	0	0	3	1 (33.3)	1 (33.3)	4	1 (25.0)	1 (25.0)
a) with total arch**c	32	2 (6.3)	2 (6.3)	7	1 (14.3)	1 (14.3)	6	0	0	9	1 (11.1)	1 (11.1)
b) without total arch**d												
Total	2,816	330 (11.7)	410 (14.6)	177	39 (22.0)	43 (24.3)	600	48 (8.0)	66 (11.0)	532	38 (7.1)	53 (10.0)

Stanford type	Concomitant operation					Redo		
	AVP	AVR	MVP	MVR	CABG	Cases	Deaths	HD
Ascending	190	214	4	6	129	85	14 (16.5)	21 (24.7)
Ascending + arch	132	106	3	2	68	61	14 (23.0)	17 (27.9)
Arch + descending	0	2	0	0	3	19	2 (10.5)	3 (15.8)
Descending	0	0	0	0	1	35	6 (17.1)	9 (25.7)
Thoracoabdominal	0	0	0	0	0	23	6 (26.1)	8 (34.8)
Bypass	0	0	0	0	0	2	0	0
Stent graft**	2	5	0	0	5	15	3 (20.0)	3 (20.0)
1) transluminal**b	0	0	0	0	0	12	1 (8.3)	1 (8.3)
2) open stent	0	1	0	0	1	2	2 (100.0)	2 (100.0)
a) with total arch**c	2	4	0	0	4	1	0	0
b) without total arch**d								
Total	324	327	7	8	206	240	45 (18.8)	61 (25.4)

HD, hospital deaths; ( ), mortality %

Acute, within 2 weeks from the onset

\*a = \*b + \*c + \*d

(2) Nondissecting (total 4,782 = 4,194 + 588)

in 2005

Replaced site	Unruptured			Ruptured			Concomitant operation				
	Cases	Deaths	HD	Cases	Deaths	HD	AVP	AVR	MVP	MVR	CABG
Ascending	1,182	28 (2.4)	40 (3.4)	54	8 (14.8)	11 (20.4)	96	818	41	31	140
Ascending + arch	1577	85 (5.4)	129 (8.2)	201	54 (26.9)	59 (29.4)	21	129	9	5	275
Arch + descending	237	22 (9.3)	29 (12.2)	50	12 (24.0)	19 (38.0)	1	1	0	2	22
Descending	536	24 (4.5)	37 (6.9)	155	40 (25.8)	46 (29.7)	0	0	0	0	16
Thoracoabdominal	295	28 (9.5)	36 (12.2)	74	19 (25.7)	27 (36.5)	0	0	0	0	2
Bypass	10	0	0	4	2 (50.0)	3 (75.0)	0	0	0	0	1
Stent graft**	357	10 (2.8)	15 (4.2)	50	11 (22.0)	13 (26.0)	0	2	0	1	11
1) transluminal**b	246	5 (2.0)	8 (3.3)	30	7 (23.3)	8 (26.7)	0	0	0	0	2
2) open stent	39	1 (2.6)	2 (5.1)	6	0	0	0	1	0	1	3
a) with total arch**c	72	4 (5.6)	5 (6.9)	14	4 (28.6)	5 (35.7)	0	1	0	0	6
b) without total arch**d											
Total	4,194	197 (4.7)	286 (6.8)	588	146 (24.8)	178 (30.3)	118	950	50	39	467

Replaced site	Redo			CPB(-)		
	Cases	Deaths	HD	Cases	Deaths	HD
Ascending	142	22 (15.5)	26 (18.3)	2	0	0
Ascending + arch	63	6 (9.5)	11 (17.5)	0	0	0
Arch + descending	16	3 (18.8)	4 (25.0)	0	0	0
Descending	45	4 (8.9)	8 (17.8)	10	0	0
Thoracoabdominal	28	1 (3.6)	5 (17.9)	3	1 (33.3)	1 (33.3)
Bypass	1	1 (100.0)	1 (100.0)	4	1 (25.0)	2 (50.0)
Stent graft**	34	1 (2.9)	2 (5.9)	167	4 (2.4)	4 (2.4)
1) transluminal**b	31	1 (3.2)	1 (3.2)	167	4 (2.4)	4 (2.4)
2) open stent	2	0	1 (50.0)	0	0	0
a) with total arch**c	1	0	0	0	0	0
b) without total arch**d						
Total	329	38 (11.6)	57 (17.3)	186	6 (3.2)	7 (3.8)

HD, hospital deaths; ( ), mortality %

\*a = \*b + \*c + \*d

**Table 4** Pulmonary thromboembolism (total 124) in 2005

	Cases	Deaths	HD
Acute	85	17 (20.0)	18 (21.2)
Chronic	39	7 (17.9)	7 (17.9)
Total	124	24 (19.4)	24 (19.4)

HD, hospital deaths; ( ), mortality %

**Table 5** Assisted circulation (total 1,474) in 2005

	Site	VAD								
		Device			Results					
		Centrifugal	VAS	Others	Not weaned			Weaned		
					Ongoing	Deaths	Transplant	Ongoing	Deaths	Transplant
Postcardiotomy	Left	22	12	0	2	21 (61.8)	0	6	5 (14.7)	0
	Right	3	1	0	0	3 (75.0)	0	0	1 (25.0)	0
	Biventricle									
Congestive heart failure	Right	4	1	0	1	4 (80.0)	0	0	0	0
	Left	3	2	0						
	Biventricle									
Respiratory failure	Left	17	53	0	26	21 (30.0)	1	17	4 (5.7)	1
	Right	0	0	0	0	0	0	0	0	0
	Biventricle									
Respiratory failure	Right	4	4	0	0	3 (37.5)	0	1	4 (50.0)	0
	Left	4	4	0						
Total		54	77	0	29	52 (39.7)	1	24	13 (9.9)	1

	Site	Heart-lung assist					
		Method		Results			
		PCPS	Others	Not weaned		Weaned	
				Deaths	Transplant	Deaths	Transplant
Postcardiotomy	Left	455	41	277 (55.8)	0	77 (15.5)	142
	Right						
	Biventricle						
Congestive heart failure	Right	775	14	386 (48.9)	0	110 (13.9)	293
	Left						
	Biventricle						
Respiratory failure	Right	59	11	32 (45.7)	0	8 (11.4)	30
	Left						
Total		1,288	66	695 (51.3)	0	193 (14.3)	465

( ), mortality %

**Table 6** Heart transplantation (total 8) in 2005

	Cases	Deaths	HD
Heart transplantation	8	0	0
Heart and lung transplantation	0	0	0
Total	8	0	0

HD, hospital deaths

**Table 7** Pacemaker + ICD (total 17,177) in 2005

	Pacemaker		ICD
	Univent	Bivent	
Initial	8,878	1,396	1,139
Exchange	4,886	668	210
Total	13,764	2,064	1,349

## (B) General thoracic surgery

It is notable that the overall volume of surgery performed in our country keeps increasing and exceeded 50,000 per year for the first time, being pushed up apparently by the steadily increasing number of surgeries for primary lung cancer, which comprise 45% of the total. This figure is important by itself, serving as a base on which we can predict the maximum number of board-certified chest surgery specialists needed in our country.

Altogether, 66% of patients with lung cancer who are operated on have adenocarcinoma. Video-assisted thoracic surgery (VATS) has been carried out for 64.0% for wedge resection and in 36.2% for lobectomy in patients with primary lung cancer; these rates seem to have increased for both procedures. Regardless of the approach, the 30-day plus hospital mortality is reported to be 1.3% for lobectomy for primary lung cancer, a rate that has decreased compared with that for 2004.

Tumors of colorectal origin comprise 47.2% of cases operated on for metastatic pulmonary tumor, and those of renal origin second to them. Zero mortality after tracheal surgery during 2005 should be noted, regardless of almost the same volume of patients operated on as in 2004. A total of 1,244 patients with thymoma were operated on during 2005, an increased of close to 200 cases from 2004. We apologize for a miscalculation regarding the number of “thymectomies without thymoma” in each Table 1 in the reports each year up to 2004; the numbers listed had to be corrected by subtracting the number of thymectomies for myasthenia gravis with thymoma from the total number of thymectomy for myasthenia gravis.

For the year 2005 we have listed descending necrotizing mediastinitis independently for the first time: 64

cases have been reported with an overall mortality of 17.2%, which is notably high. Practice in terms of volume reduction surgery for emphysema seems to stay low in volume but with acceptable mortality of 4.3%. Pneumothorax comprises 20.0% of all patients undergoing thoracic surgery. We should pay attention to the 0.3% mortality rate for primary spontaneous pneumothorax because it actually reflects the deaths of 27 patients. Lung transplantation has been done in an even smaller volume (i.e., only 9 patients) during 2005 than previously, and one-third of them succumbed to death.

Notably, VATS in general has been carried out in 52.1% of general thoracic surgeries during 2005, which is currently more than a half of the patients operated on. It should also be noted, however, that the mortality was reportedly 0.3%. More patients therefore died after VATS in 2005 than in 2004. Tracheobronchoplasty is being performed in increasing numbers: 97.4% in lung cancer patients. Those done for lung cancer included 597 of a total of 23,114, or 2.6%, with 3.0% mortality. Although a mortality rate of 3.4% for sleeve lobectomy is higher than that of conventional lobectomy, it is within the acceptable range of the worldwide average. The 4.8% mortality rate for sleeve pneumonectomy in lung cancer patients was the result of only one death among 21 patients thus operated on. The ratio of bronchoplastic procedures to conventional ones has been decreasing, but the absolute number of bronchoplastic procedures increased by more than 100 cases during the year 2005.

We are glad to announce that some analyses on the relation between mortality and patient volume per hospital have been done based on our recently accumulated annual survey data and are published elsewhere in this issue.

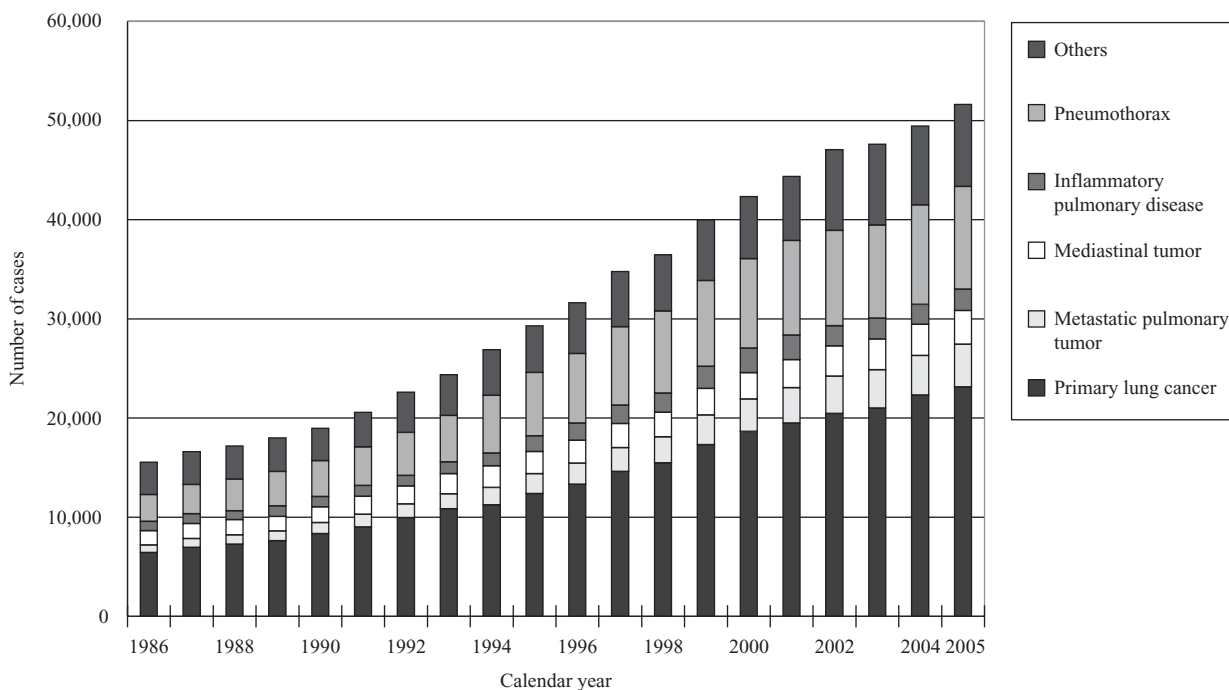


Fig. 2 General thoracic surgery

Table 1 Total entry cases of general thoracic surgery during 2005 in 2005

	Cases	%
Benign pulmonary tumor	943	1.8
Non-neoplastic benign disease	1,839	3.6
Primary lung cancer	23,114	45.0
Other primary malignant pulmonary tumor	377	0.7
Metastatic pulmonary tumor	4,330	8.4
Tracheal tumor	67	0.1
Mesothelioma	312	0.6
Chest wall tumor	713	1.4
Mediastinal tumor	3,383	6.6
Thymectomy without thymoma for MG	279	0.5
Inflammatory pulmonary disease	2,151	4.2
Empyema	1,238	2.4
Bullous disease excluding pneumothorax	702	1.4
Pneumothorax	10,371	20.2
Chest wall deformity	320	0.6
Diaphragmatic hernia including traumatic	130	0.3
Chest trauma excluding diaphragmatic hernia	352	0.7
Lung transplantation	9	0.0
Others	729	1.4
Total	51,359	100.0

**Table 2**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
1. Benign pulmonary tumor	943	0	0.0	0	0.0	650
Hamartoma	443	0	0.0	0	0.0	318
Others	500	0	0.0	0	0.0	332

HD, hospital deaths

**Table 3**

in 2005

	Cases	30-Day deaths	%	HD	%
2. Non-neoplastic benign disease	1,839	7	0.4	12	0.7

HD, hospital deaths

**Table 4**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
3. Primary malignant pulmonary tumor	23,491	127	0.5	225	1.0	
Lung cancer	23,114	126	0.5	221	1.0	
Adenocarcinoma	15,483	61	0.4	94	0.6	
Squamous cell carcinoma	5,331	43	0.8	79	1.5	
Large cell carcinoma (LCNEC)	720 (238)	6 (2)	0.8 0.8	19 (5)	2.6 2.1	
Small cell carcinoma	417	6	1.4	9	2.2	
Adenosquamous carcinoma	345	5	1.4	7	2.0	
Carcinoid	163	0	0.0	1	0.6	
Adenoid cystic carcinoma	30	0	0.0	0	0.0	
Mucoepidermoid carcinoma	35	0	0.0	0	0.0	
Carcinosarcoma	52	0	0.0	2	3.8	
Unclassified	171	2	1.2	4	2.3	
Multiple lung cancer	367	3	0.8	6	1.6	
Wedge resection	2,440	6	0.2	11	0.5	1,561
Segmental excision	1,608	5	0.3	10	0.6	753
Sleeve segmental excision	85	0	0.0	0	0.0	2
Lobectomy	17,561	83	0.5	147	0.8	6,358
Sleeve lobectomy	491	7	1.4	10	2.0	80
Pneumonectomy	620	22	3.5	31	5.0	26
Sleeve pneumonectomy	21	0	0.0	1	4.8	0
Pleuropneumonectomy	14	1	7.1	2	14.3	0
Others	274	2	0.7	9	3.3	58
Sarcoma	38	0	0.0	2	5.3	
AAH	155	0	0.0	0	0.0	
Others	184	1	0.5	2	1.1	

HD, hospital deaths

**Table 5**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
4. Metastatic pulmonary tumor	4,330	6	0.1	9	0.2	2,477
Colorectal	2,061	3	0.1	4	0.2	1160
Hepatobiliary/pancreatic	188	0	0.0	0	0.0	113
Uterine	152	0	0.0	0	0.0	104
Mammary	296	0	0.0	0	0.0	202
Ovarian	24	0	0.0	0	0.0	14
Testicular	58	1	1.7	2	3.4	32
Renal	360	1	0.3	1	0.3	208
Skeletal	141	1	0.7	1	0.7	69
Soft tissue	197	0	0.0	0	0.0	100
Otorhinolaryngological	230	0	0.0	0	0.0	136
Pulmonary	234	0	0.0	0	0.0	89
Others	389	0	0.0	1	0.3	250

HD, hospital deaths

**Table 6**

in 2005

	Cases	30-Day deaths	%	HD	%
5. Tracheal tumor	67	0	0.0	0	0.0

HD, hospital deaths

**Table 7**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
6. Mesothelioma	312	9	2.9	16	5.1	90
Localized	86	2	2.3	2	2.3	42
Diffuse	226	7	3.1	14	6.2	48

HD, hospital deaths

**Table 8**

in 2005

	Cases	30-Day deaths	%	HD	%
7. Chest wall tumor	713	3	0.4	9	1.3

HD, hospital deaths

**Table 9**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
8. Mediastinal tumor	3,383	6	0.2	10	0.3	1,133
Thymoma	1,430	3	0.2	4	0.3	249
Thymic cancer	177	1	0.6	1	0.6	15
Germ cell tumor	232	0	0.0	1	0.4	51
Benign	168	0	0.0	0	0.0	47
Malignant	64	0	0.0	1	1.6	4
Neurogenic tumor	403	0	0.0	1	0.2	269
Congenital cyst	493	1	0.2	1	0.2	315
Goiter	88	0	0.0	0	0.0	10
Lymphatic tumor	205	0	0.0	1	0.5	105
Others	355	1	0.3	1	0.3	119

HD, hospital death

**Table 10**

in 2005

	Cases	30-Day deaths	%	HD	%
9. Thymectomy for myasthenia gravis	554	1	0.2	1	0.2
Of the 554, with thymoma	275	1	0.4	1	0.4

HD, hospital deaths

**Table 11**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
10. Inflammatory pulmonary disease	2,151	10	0.5	12	0.6	1,289
Tuberculous infection	679	1	0.1	1	0.1	431
Fungal infection	343	5	1.5	7	2.0	130
Bronchiectasis	88	0	0.0	0	0.0	16
Others	1,041	4	0.4	4	0.4	712

HD, hospital deaths

**Table 12**

in 2005

	Cases	30-Day deaths	%	HD	%	Radical surgery
11. Empyema	1,238	24	1.9	58	4.7	809

HD, hospital deaths

**Table 13**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
12. Descending necrotizing mediastinitis	64	4	6.3	7	10.9	23

HD, hospital deaths



**Table 14**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
13. Bullous disease	702	2	0.3	6	0.9	431
Emphysematous bulla	540	2	0.4	4	0.7	332
Bronchogenic cyst	85	0	0.0	0	0.0	53
Emphysema with volume reduction surgery	47	0	0.0	2	4.3	30
Others	30	0	0.0	0	0.0	16

HD, hospital deaths

**Table 15**

in 2005

	Cases	30-Day deaths	%	HD	%	By VATS
14. Pneumothorax	10,371	23	0.2	29	0.3	9,060
Primary spontaneous	9,766	11	0.1	16	0.2	8,657
Secondary	605	12	2.0	13	2.1	403

HD, hospital deaths

**Table 16**

in 2005

	Cases	30-Day deaths	%	HD	%
15. Chest wall deformity	320	0	0.0	0	0.0
Funnel chest	289	0	0.0	0	0.0
Others	31	0	0.0	0	0.0

HD, hospital deaths

**Table 17**

in 2005

	Cases	30-Day deaths	%	HD	%	Traumatic
16. Diaphragmatic hernia	130	14	10.8	14	10.8	41

HD, hospital deaths

**Table 18**

in 2005

	Cases	30-Day deaths	%	HD	%
17. Chest trauma	352	27	7.7	27	7.7

HD, hospital deaths

**Table 19**

in 2005

	Cases	30-Day deaths	%	HD	%
18. Other respiratory surgery	665	4	0.6	13	2.0
Arteriovenous malformation*	71	0	0.0	0	0.0
Pulmonary sequestration	98	1	1.0	1	1.0
Others	496	3	0.6	12	2.4

HD, hospital deaths

\*In addition, six more cases treated by embolization

**Table 20**

in 2005

	Cases	30-Day deaths	%	HD	%
19. Lung transplantation	9	1	11.1	2	22.2

HD, hospital deaths

**Table 21**

in 2005

	Cases	30-Day deaths	%	HD	%
20. Video-assisted thoracic surgery	26,879	37	0.1	59	0.2

HD, hospital deaths

**Table 22**

in 2005

	Cases	30-Day deaths	%	HD	%
21. Tracheobronchoplasty	613	4	0.7	9	1.5
Trachea	69	0	0.0	0	0.0
Carinal reconstruction	11	0	0.0	0	0.0
Sleeve pneumonectomy	70	1	1.4	2	2.9
Bronchus	412	3	0.7	7	1.7
Others	51	0	0.0	0	0.0

HD, hospital deaths

**Table 23**

in 2005

	Cases	30-Day deaths	%	HD	%
22. Pediatric surgery	526	8	1.5	9	1.7

HD, hospital deaths

**Table 24**

in 2005

	Cases		30-Day deaths			HD			%	
23. Combined resection of neighboring organ(s)	1057		18			27			2.55	
Organ resected	Primary lung cancer					Mediastinal tumor				
	Cases	30-Day deaths	%	HD	%	Cases	30-Day deaths	%	HD	%
Aorta	10	0	0.0	1	10.0	4	0	0.0	0	0.0
SVC	33	3	9.1	4	12.1	50	0	0.0	1	2.0
PA	159	2	1.3	3	1.9	6	0	0.0	0	0.0
LA	48	2	4.2	4	8.3	3	0	0.0	0	0.0
Diaphragm	108	2	1.9	3	2.8	16	0	0.0	0	0.0
Chest wall (ribs only)	558	5	0.9	7	1.3	14	0	0.0	0	0.0
Vertebrae (including ribs)	27	2	7.4	2	7.4	4	0	0.0	0	0.0
Esophagus	13	1	7.7	1	7.7	4	1	25.0	1	25.0

HD, hospital deaths

### (C) Esophageal surgery

During 2005 alone, a total of 13,676 patients with esophageal disease were registered from 527 institutions (response rate 86%) affiliated with the Japanese Association for Thoracic Surgery and/or the Japan Esophageal Society. Among these institutions were 78 (14.9%) hospitals in which 20 or more patients underwent esophageal surgery. Of 4,166 patients with a benign esophageal disease, 864 (20.7%) underwent surgery, and 19 (0.5%) underwent endoscopic resection; 3,283 (78.8%) patients did not undergo any surgical treatment. Of 9,510 patients with a malignant esophageal tumor, 6,514 (68.5%) underwent surgery—esophagectomy in 5,163 (54.3%) and endoscopic mucosal resection (EMR) in 1,357 (14.3%); 2,991 (31.4%) patients did not undergo resection. The patients registered, particularly those undergoing nonsurgical therapy for a malignant esophageal disease, have been increasing since 1990 (Fig. 1).

Among the benign esophageal diseases (Table 1), esophageal varices, hiatal hernia, and reflux esophagitis are most common in Japan. Achalasia, benign esophageal tumors, spontaneous rupture of the esophagus, and congenital esophageal atresia are also common diseases that are surgically treated. 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 542 patients with a benign esophageal disease, with 30-day mortality in 11 (2.0%) and hospital mortality including 30-day mortality in 29 (4.0%). Thoracoscopic and/or laparoscopic surgery was performed in 322 patients, with 0% 30-day mortality rate and hospital mortality rate. The difference in these death rates between open and scopic surgery seem to be related to the condition that required the operation. Most of the deaths were found in patients with esophageal rupture or perforation that required open surgery. A total of 19 patients underwent endoscopic resection of a benign esophageal tumor without mortality.

Most of the malignant diseases were carcinomas (Table 2). Among esophageal carcinomas, the incidence of squamous cell carcinoma was 95.3%, and that of adenocarcinoma in the Barrett's esophagus was 1.6%. The resection rate for patients with a squamous cell carcinoma was 67.9%, and that for patients with an adenocarcinoma in the Barrett's esophagus was 89.8%.

According to location, cancer in the thoracic esophagus was most common (Table 3). Superficial esophageal cancer including mucosal and submucosal cancers was observed in 2,770 (29.1%) patients, whereas advanced esophageal cancer invading deeper than the submucosal

layer was observed in 6,740 (70.9%) patients. Among the patients with a superficial esophageal cancer, 1,118 (40.4%) underwent esophagectomy, and 1,357 (49.0%) underwent EMR; 295 (10.6%) patients underwent non-surgical treatment. The 30-day mortality rate and the hospital mortality rate after esophagectomy for patients with a superficial cancer were 1.0% and 1.6%, respectively. No patient died after EMR. Of the 6,740 patients with an advanced esophageal cancer, 4,045 (60.0%) underwent esophagectomy, with a 1.0% 30-day mortality rate and a 4.1% hospital mortality rate.

A double primary cancer was observed in 1,100 (11.6%) of 9,511 patients with an esophageal cancer. Synchronous cancer was found in 625 (6.6%) patients, and metachronous cancer was found in 477 (5.0%) patients. The stomach is the commonest site for synchronous and metachronous "other" malignancies (Table 3).

Among esophagectomy procedures, transthoracic esophagectomy by right thoracotomy was the most commonly adopted operation for patients with a superficial cancer as well as for those with an advanced cancer (Table 4). Transhiatal esophagectomy, which is commonly performed in Western countries, was chosen for only 5.8% of patients with a superficial cancer who underwent esophagectomy and for 1.9% of those with an advanced cancer in Japan. Thoracoscopic and/or laparoscopic esophagectomy was performed in 222 patients (16.4%) with a superficial cancer and in 393 patients (9.7%) with an advanced cancer. The number of cases of thoracoscopic and/or laparoscopic surgery for superficial or advanced cancer has been increasing recently (Fig. 2).

Combined resection of the neighboring organs during resection of an esophageal cancer was performed in 152 patients (Table 4). Resection of the aorta together with the esophagectomy was performed in two patients without mortality. Tracheal and/or bronchial resection combined with esophagectomy was performed in 11 patients, with 30-day mortality in 1 and hospital mortality in 2 (18%). Lung resection combined with esophagectomy was performed in 67 patients, with a 30-day mortality rate of 1.5% and a hospital mortality rate of 4.5%. During the period from 1996 (when the registration started) to 1989, the 30-day mortality rates were around 3%, whereas from 1999 to 2001 the rates were around 2%. Since 2002, the 30-day mortality rates have decreased to 1% (Table 5).

Salvage surgery after definitive (chemo)radiotherapy was performed in 214 patients, with the 30-day mortality rate at 3.7% and the hospital mortality rate at 10.7%.

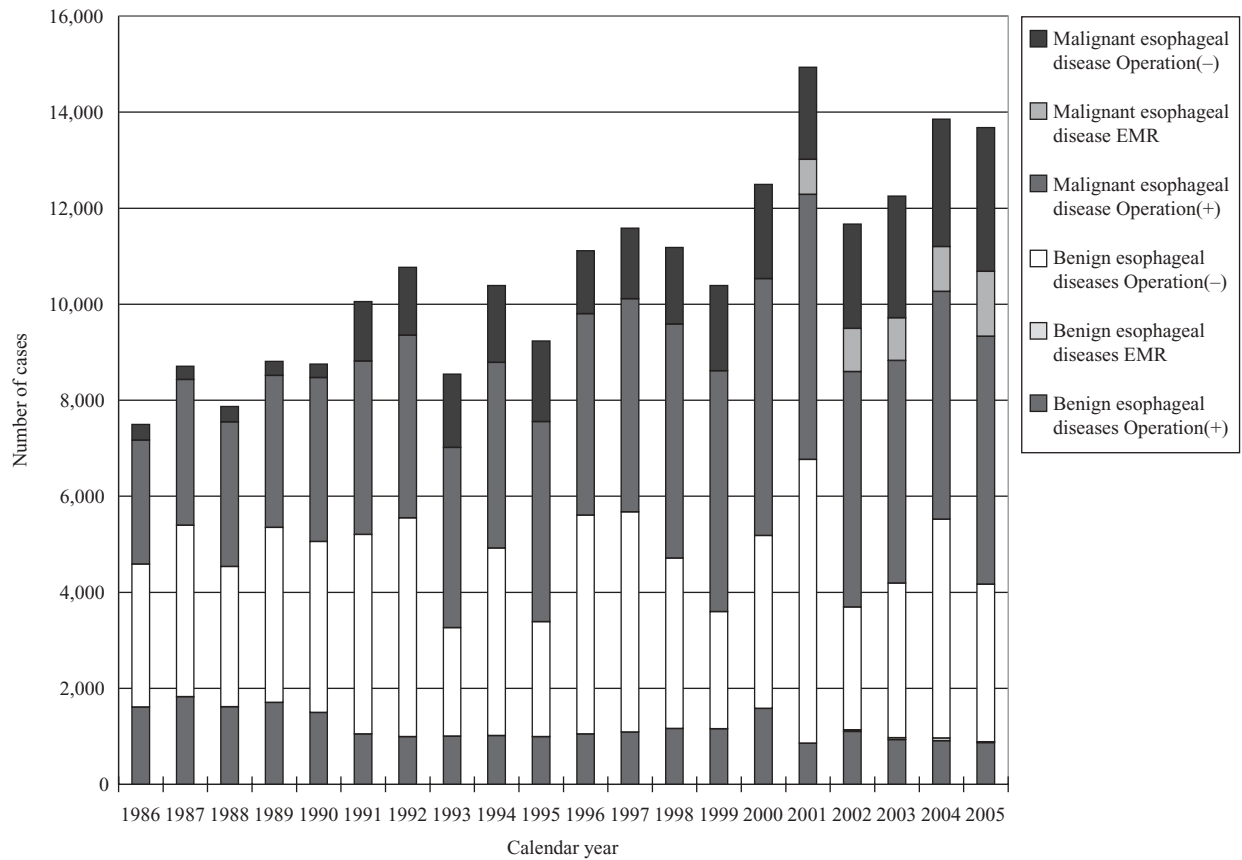


Fig. 1 Esophageal surgery

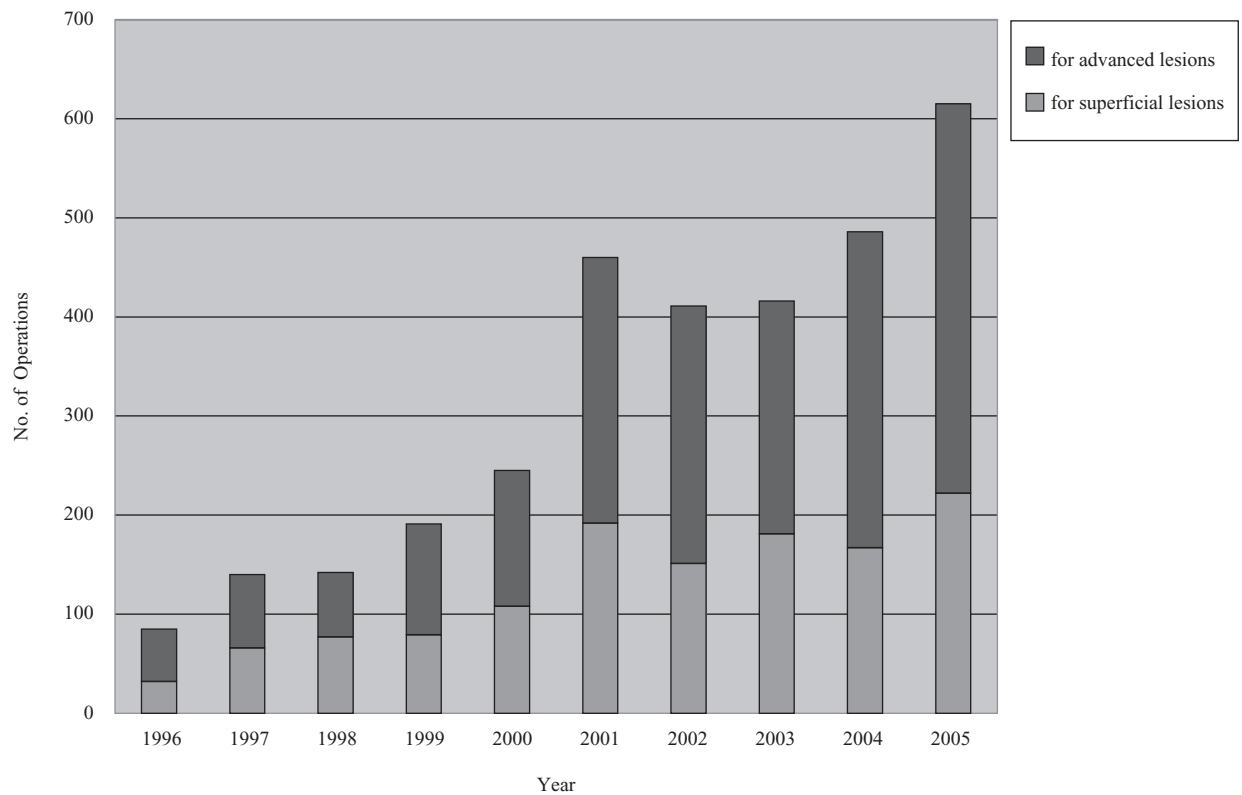


Fig. 2 Thoracoscopic and/or laparoscopic procedures

**Table 1** Benign esophageal diseases

in 2005

	Operation (+)									Endoscopic resection	Operation (-)	Total
	Total cases	Open surgery	Thoracoscopic and/or laparoscopic surgery	Direct deaths			Hospital deaths					
				Total	Open surg.	T/L	Total	Open surg.	T/L			
1. Achalasia	140	25	115	0	0	0	0	0	0		53	193
2. Benign tumor	77	42	35	0	0	0	0	0	0	19	79	175
(1) Leiomyoma	55	30	25	0	0	0	0	0	0	10	44	109
(2) Cyst	5	2	3	0	0	0	0	0	0	1	16	22
(3) Others	17	10	7	0	0	0	0	0	0	8	19	44
3. Diverticulum	22	16	6	0	0	0	0	0	0		64	86
4. Hiatal hernia	246	128	118	1	1	0	1	1	0		856	1,102
5. Spontaneous rupture of the esophagus	78	75	3	6	6	0	13	13	0		7	85
6. Esophageal perforation	43	40	3	3	3	0	6	6	0		17	60
7. Esophago-tracheal fistula	23	20	3	1	1	0	2	2	0		10	33
8. Congenital esophageal atresia	48	44	4	0	0	0	0	0	0		5	53
9. Congenital esophageal stenosis	6	6	0	0	0	0	0	0	0		13	19
10. Corrosive stricture of the esophagus	25	15	10	0	0	0	0	0	0		8	33
11. Esophagitis, esophageal ulcer	37	25	12	0	0	0	0	0	0		932	969
12. Esophageal varices	74	74	0	0	0	0	0	0	0		1,200	1,274
(1) Laparotomy	36	36	0	0	0	0	0	0	0		0	36
(2) Others				0							0	0
(3) Sclerotherapy				0							430	430
13. Others	45	32	13	0	0	0	0	0	0		39	84
Total	864	542	322	11	11	0	22	22	0	19	3,283	4,166

Direct death, death within 30 days; Hospital death, death during hospitalization; T/L, thoracoscopic and/or laparoscopic surgery

**Table 2** Malignant esophageal diseases (histologic classification)

in 2005

	Operation (+)	Operation (-)	Total
Carcinomas	6,451	2,985	9,436
1. Squamous cell carcinoma	6,107	2,885	8,992
2. Adenocarcinoma in the Barrett's esophagus	132	15	147
3. Other adenocarcinoma	117	27	144
4. Adenosquamous carcinoma	20	4	24
5. Adenoid cystic carcinoma	5	1	6
6. Basaloid (-squamous) carcinoma	39	9	48
7. Small cell carcinoma	20	26	46
8. Undifferentiated carcinoma (no-small cell type)	8	12	20
9. Others	3	6	9
Other malignancies	63	11	74
1. Malignant nonepithelial tumors	18	3	21
2. Carcinosarcoma	23	4	27
3. Malignant melanoma	16	4	20
4. Other malignant tumors	6	0	6
Total	6,514	2,996	9,510

**Table 3** Malignant esophageal disease

in 2005

	Operation (+)			EMR	Operation (-)	Total
	Cases	Direct death	Hospital death			
1. Esophageal cancer	5,163	52	184	1,357	2,991	9,511
Location						
(1) Cervical esophagus	224	4	14	44	203	471
(2) Thoracic esophagus	4,342	43	159	1,161	2,515	8,018
(3) Abdominal esophagus	383	2	6	89	67	539
(4) Multiple cancers	214	3	5	63	98	375
(5) Others/not described	0	0	0	0	108	108
Stage						
(A) Superficial cancer	2,475	11	18		295	2,770
(B) Advanced cancer	4,045	41	166		2,695	6,740
2. Multiple primary cancer	740	13	27		360	1,100
1) Synchronous	420	4	11		205	625
(1) Head and neck	122	0	2		68	190
(2) Stomach	206	2	5		71	277
(3) Others	89	2	4		55	144
(4) Triple cancers	3	0	0		3	6
(5) No data	0	0	0		8	8
2) Metachronous	322	9	16		155	477
(1) Head and neck	90	1	2		42	132
(2) Stomach	125	5	8		52	177
(3) Others	101	3	6		57	158
(4) Triple cancers	6	0	0		1	7
(5) No data	0	0	0		3	3

**Table 4** Malignant esophageal disease (surgical procedures)

in 2005

	Cases	Direct deaths	Hospital deaths
Superficial cancer			
1. Endoscopic mucosal resection	1,357	0	0
2. Esophagectomy	1,118	11	18
(1) Transhiatal esophagectomy	65	0	1
(2) Thoracoscopic and/or laparoscopic procedure	222	2	2
(3) Transthoracic (rt.) esophagectomy and reconstruction	743	8	14
(4) Transthoracic (lt.) esophagectomy and reconstruction	40	0	0
(5) Cervical esophageal resection and reconstruction	11	0	0
(6) Two-stage operation	4	0	0
(7) Others/not described	31	1	1
(8) Uncertain	2	0	0
Advanced cancer			
1. Endoscopic mucosal resection			
2. Esophagectomy	4,045	41	166
(1) Transhiatal esophagectomy	78	1	4
(2) Thoracoscopic and/or laparoscopic procedure	393	3	7
(3) Transthoracic (rt.) esophagectomy and reconstruction	3,124	32	129
(4) Transthoracic (lt.) esophagectomy and reconstruction	166	0	4
(5) Cervical esophageal resection and reconstruction	129	3	8
(6) Two-stage operation	48	1	8
(7) Others/not described	107	1	6
2. Combined resection of other organs	152	3	10
(1) Aorta	1	0	0
(2) Trachea, bronchus	11	1	2
(3) Lung	67	1	3
(4) Others	73	1	5
3. Salvage surgery	214	8	23

**Table 5** Mortality after combined resection of neighboring organs

Esophagectomy				Combined resection											
				Aorta			Tracheobronchus			Lung			Others		
1996	4,194	120	2.86%*	7	3	42.86%*	24	0	0%*	50	2	4.00%*	78	4	5.13%*
1997	4,441	127	2.86%	1	0	0%	34	5	14.71%	56	1	1.79%	94	3	3.19%
1998	4,878	136	2.79%	4	0	0%	29	0	0%	74	1	1.35%	128	2	1.56%
1999	5,015	116	2.31%	5	0	0%	23	2	8.70%	68	0	0%	122	1	0.82%
2000	5,350	81	1.51%	2	0	0%	23	2	8.70%	69	0	0%	96	1	1.04%
2001	5,521	110	1.99%	1	0	0%	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%	63	0	0%	63	1	1.59%
2003	4,639	45	0.97%	0	0	0%	24	2	8.33%	58	0	0%	88	1	1.14%
2004	4,739	64	1.35%	2	0	0%	17	0	0%	59	5	8.47%	119	2	1.68%
2005	5,163	52	1.01%	1	0	0%	11	1	9.09%	67	1	1.49%	73	1	1.37%
Total	48,844	917	1.88%	26	4	15.38%	231	15	6.49%	647	13	2.01%	960	18	1.88%

\*Mortality within 30 days

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#### Members of the Committee of Science

Yuichi Ueda, MD, Hiromasa Fujita, MD,  
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