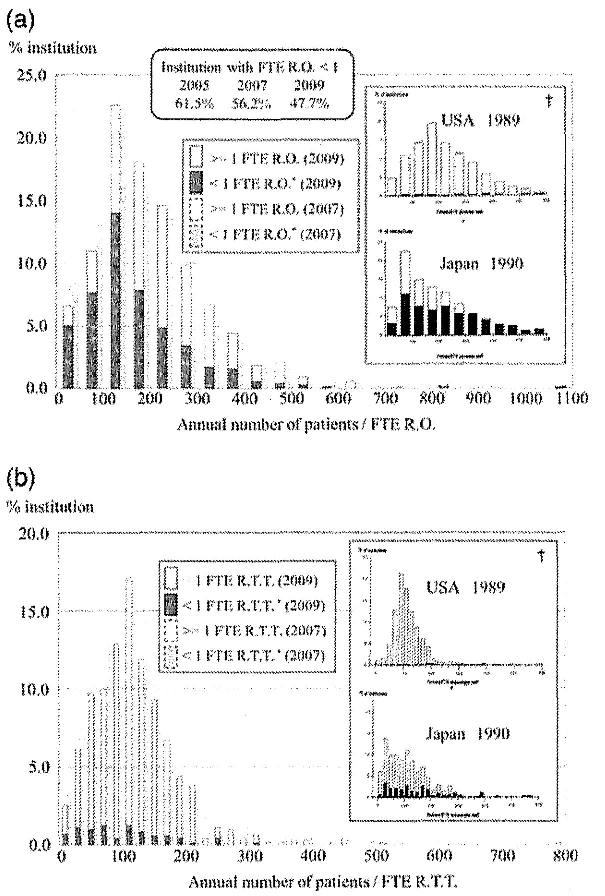

Fig. 1. (**a**) Percentage distribution by institution for patient load/ full-time equivalent (FTE) radiation oncologists (ROs) in Japan; (**b**) corresponding percentage distribution for patient load/full-time equivalent (FTE) radiotherapy technologists in Japan (a) Spacing of the bars represents intervals of 50 patients/FTE radiation oncologist. Open bars represent institutions with one or more FTE staff member, and solid bars represent institutions with less than one FTE radiation oncologist. The number of FTEs for institutions with less than one FTE staff member was calculated as the equivalent of one FTE to avoid overestimating patient load per FTE RO or staff. (b) *Spacing of the bars represents intervals of 20 patients/FTE staff. †Corresponding data for the USA and Japan are shown for reference [3]. Originally published in Int. J. Radiat. Oncol. Biol. Phys. 34(1): 235–242.

metastasis ranged from 10.4% for A2 to 15.7% for B2. Overall, more patients with bone metastasis were treated with radiation at non-academic than at academic institutions. The number of patients with brain metastasis decreased slightly by –4.7% compared with 2007 [6].

Geographic patterns

Figure 3 shows the geographic distributions for 47 prefectures of the annual number of patients (new plus repeat) per 1000 population arranged in increasing order of the number of JASTRO-certified ROs per 1 000 000 population [20]. There were significant differences in the use of RT, from 1.1 patients per 1000 population (Saitama) to 2.3 (Tokyo). The average number of cancer patients per 1000 population per quarter ranged from 1.57 to 1.80 ($P = 0.1585$). The more JASTRO-certified physicians there were in a given area, the more RT tended to be used for cancer patients, although the correlation was of borderline significance. Similar trends were clearly observed in 2005 [5] and 2007 [6]. Compared with 2005 and 2007, the utilization rate of RT increased in every prefecture in 2009. However, the rates in 2007 and 2009 were not related to prefectural population density as was also observed in the data for 1990 [3].

DISCUSSION

In 1990, there were fewer facilities for radiation treatment and fewer patients treated with radiation in Japan than in the USA. Over the next 19 years, however, the number of patients in Japan increased significantly by a factor of 3.2 [3]. On the other hand, the utilization rate of radiation for new cancer patients remained at 27.6%, less than half that recorded in the USA and European countries, although the rate increased slightly by 0.75% per year between 2007 [6] and 2009. For implementation of the Cancer Control Act, comparative data of the structure of radiation oncology in Japan and in the USA as well as relevant PCS data proved to be very helpful.

Compared with 1990, the number of Linac systems increased significantly by a factor of 2.62 and increased by 1.1% over 2007 [6], while the number of systems using telecobalt decreased to only nine and remained stable. Furthermore, the use of various functions of Linac, such as dual energy, 3DCRT (MLC width <1 cm) and IMRT, improved significantly. The number of high dose rate (HDR) RALS in use has increased and ^{60}Co RALS has been largely replaced with ^{192}Ir RALS. In 2009, CT simulators had been installed in 82.1% of institutions throughout the country for a 15.7% increase over 2007 [6] and exceeded the number of X-ray simulators (51.6%). Radiotherapy planning systems (RTPs) were used at 96.0% of institutions for an increase in the number of RTPs of 6.59 times compared with 1990 [3]. Maturity of the functions of Linac and installation rates of CT simulators and systems using ^{192} Ir RALS also improved further compared with 2007 [6], but were still closely correlated with the PCS institutional stratification, which could therefore aid accurate differentiation between structural maturity and immaturity and the identification of structural targets for improvement.

The staffing patterns in Japan also improved in terms of numbers. However, institutions with less than one FTE radiation oncologist on their staff still account for 47.7% nationwide, although this represents an 8% decrease

Table 5. Primary sites of cancer treatment with RT in 2009 by PCS institutional stratification for new patients

Primary site	**A1 (*n* = 69)**		**Comparison with data of 2007[a] (%)**	**A2 (*n* = 66)**		**Comparison with data of 2007[a] (%)**	**B1 (*n* = 256)**		**Comparison with data of 2007[a] (%)**	**B2 (*n* = 253)**		**Comparison with data of 2007[a] (%)**	**Total (*n* = 644)**		**Comparison with data of 2007[a] (%)**
	n	%		*n*	%		*n*	%		*n*	%		*n*	%	
Cerebrospinal	1906	3.8	−5.7	994	5.4	38.1	4812	6.2	−13.6	1349	5.4	−3.4	9061	5.3	−6.6
Head and neck (including thyroid)	6444	12.8	−1.2	2500	13.6	17.7	7601	9.8	21.4	1560	6.3	−5.7	18 105	10.6	9.3
Esophagus	3247	6.5	−5.8	1196	6.5	1.4	3735	4.8	−8.2	1416	5.7	−3.9	9594	5.6	−5.7
Lung, trachea and mediastinum	7880	15.7	5.6	2771	15.0	−2.8	15 855	20.4	−5.7	5801	23.3	−0.7	32 307	18.9	−2.0
Lung	7335	14.6	8.0	2438	13.2	−0.6	14 358	18.5	−1.3	5060	20.4	−6.2	29 191	17.0	0.0
Breast	10 869	21.7	5.2	3637	19.7	−0.7	19 373	24.9	11.8	5955	24.0	18.8	39 834	23.3	9.6
Liver, biliary tract, pancreas	1948	3.9	1.0	806	4.4	19.6	2907	3.7	3.6	980	3.9	−4.2	6641	3.9	3.2
Gastric, small intestine, colorectal	2167	4.3	4.4	945	5.1	−6.9	3783	4.9	−6.2	1384	5.6	−7.6	8279	4.8	−4.0
Gynecologic	3430	6.8	3.5	1135	6.2	7.3	2914	3.7	−4.7	737	3.0	−5.6	8216	4.8	0.0
Urogenital	7167	14.3	5.8	2470	13.4	−1.1	10 019	12.9	2.8	3394	13.7	13.4	23 050	13.5	4.7
Prostate	5926	11.8	9.9	1888	10.2	8.0	7618	9.8	8.6	2487	10.0	20.3	17 919	10.5	10.4
Hematopoietic and lymphatic	2639	5.3	1.9	963	5.2	7.0	3264	4.2	−10.1	1083	4.4	15.8	7949	4.6	−1.3
Skin, bone and soft tissue	1269	2.5	−12.8	496	2.7	2.5	1590	2.0	−15.4	738	3.0	−1.7	4093	2.4	−10.4
Other (malignant)	541	1.1	−39.5	241	1.3	1.7	852	1.1	−5.0	307	1.2	5.1	1941	1.1	−16.3
Benign tumors	675	1.3	−31.7	278	1.5	4.5	1112	1.4	−13.7	155	0.6	−16.7	2220	1.3	−18.6
Pediatric <15 y (included in totals above)	461	0.9	4.8	145	0.8	25.0	349	0.4	−6.7	137	0.6	8.7	1092	0.6	3.4
Total	50 182	100	0.8	18 432	100	4.3	77 817	100	0.6	24 859	100.0	4.3	171 290	100	1.5

Abbreviations as in Table 2.

[a]Rate of increase compared with the data of 2007. Calculating formula: $\frac{data\ of\ 2009\ (n) - data\ of\ 2007\ (n)}{data\ of\ 2007\ (n)} \times 100\ (\%)$

[b]Total number of new patients different with these data, because no data on primary sites were reported by some institutions.

Table 6: Distribution of specific treatments and numbers of patients treated with these modalities by PCS stratification of institutions

Specific therapy	A1 ($n = 70$)		A2 ($n = 70$)		B1 ($n = 280$)		B2 ($n = 280$)		Total ($n = 700$)		Comparison with data of 2007[a] (%)
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
Intracavitary RT											
Treatment facilities	64	91.4	28	40.0	58	20.7	1	0.4	151	21.6	
Cases	1864		421		848		6		3139		–3.0
Interstitial RT											
Treatment facilities	55	78.6	20	28.6	32	11.4	2	0.7	109	15.6	
Cases	2482		550		993		45		4070		23.3
Radioactive iodine therapy for prostate											
Treatment facilities	50	71.4	16	22.9	29	10.4	1	0.4	96	13.7	
Cases	1842		360		856		22		3080		14.5
Total body RT											
Treatment facilities	63	90.0	31	44.3	65	23.2	21	7.5	180	25.7	
Cases	798		235		620		137		1790		4.9
Intraoperative RT											
Treatment facilities	15	21.4	6	8.6	4	1.4	3	1.1	28	4.0	
Cases	135		21		9		8		173		–31.1
Stereotactic brain RT											
Treatment facilities	43	61.4	26	37.1	94	33.6	39	13.9	202	25.8	
Cases	1660		658		9671		1866		13 855		10.4
Stereotactic body RT											
Treatment facilities	51	72.9	26	37.1	71	25.4	17	6.1	165	23.6	
Cases	1087		185		1125		140		2537		1.9
IMRT											
Treatment facilities	47	67.1	10	14.3	36	12.9	8	2.9	101	14.4	
Cases	1855		94		1961		386		4296		34.8
Thermoradiotherapy											
Treatment facilities	7	10.0	5	7.1	4	1.4	4	1.4	20	2.9	
Cases	185		38		137		31		391		15.0

PCS = Patterns of Care Study; RT = radiotherapy; IMRT = intensity-modulated radiotherapy.

[a]Rate of increase compared with the data of 2007. Calculating formula: $\frac{\textit{data of } 2009\,(n) - \textit{data of } 2007\,(n)}{\textit{data of } 2007\,(n)} \times 100\,(\%)$

compared with 2007 [6]. In other words, nearly half the institutions in Japan still rely on part-time radiation oncologists. There are two reasons for this. First, although the number of FTE radiation oncologists grew by 13.7 % over the last 2 years, the number of cancer patients who require radiation has also increased by 10% over the same period. Second, specialist fees for radiation oncologists in academic institutions are not covered by the Japanese medical care insurance system, which is strictly controlled by the government. Therefore, most radiation or other oncologists at academic institutions must work part-time at affiliated hospitals in the B1 and B2 groups to earn a living. To reduce the number of institutions that rely on part-time radiation oncologists and thus may encounter problems with their quality of care, a reform of Japan's current medical care system based on treatment outcome is required, especially as it applies to staff at academic institutions. However, great care is needed to ensure that the long-term success of radiation oncology in Japan and patient benefits are well balanced with costs. For this reason, personal identification of ROs in both A and B institutions was included and recorded in the 2007 and 2009 surveys for further detailed analysis of patient load and real cost [7]. There were significant differences in the average practice index for patients between ROs working mainly in main university hospitals and in affiliated hospitals (1.07 vs 0.71: $P < 0.0001$). Under the current Japanese national medical system, patterns of work by ROs at academic facilities appear to be problematic for fostering true specialization of ROs. On the other hand, according to the increase in the number of cancer patients who require RT, B1 institutions are gradually offering full-time positions for ROs. However, the speed of offers for second or third positions are slow in individual institutions due to tight budgets in most B1 institutions. Therefore, monitoring these structural data is necessary to convince local government to improve working environments for ROs. Even under these conditions, however, the number of FTE ROs increased by 2.57 times compared with 1990 [3], and by 13.7% over 2007 [6]. On the other hand, patient load per FTE RO also increased by 1.35 times to 231.9 during the same period 1990–2009, but registered a –0.67% decrease compared

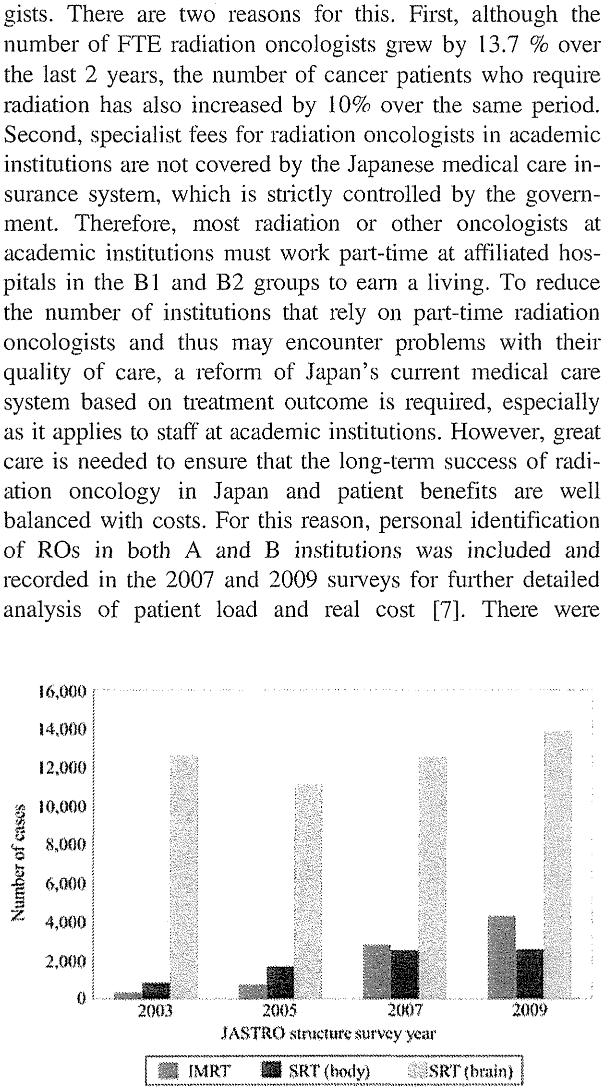

Fig. 2. Trends in numbers of patients treated with SRT for brain, SRT for body and IMRT by survey year

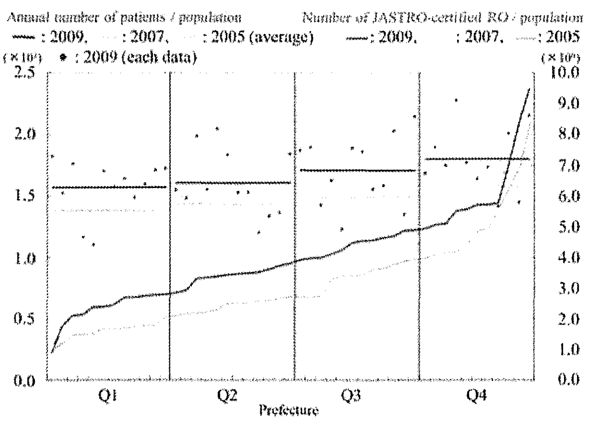

Fig. 3. Geographic distribution for 47 prefectures of annual numbers of patients (new plus repeat) per 1000 population in increasing order for JASTRO-certified radiation oncologists (RO)/ 1 000 000 population by prefecture Q1, 0–25%; Q2, 26–50%; Q3, 51–75%; and Q4, 76–100%. Horizontal lines show average annual number of patients (new plus repeat) per 1000 prefectural population per quarter.

Table 7: brain metastasis or bone metastasis patients treated with RT in 2007 by PCS institutional stratification

Metastasis	Patients										Comparison with data of 2007[a] (%)
	A1 ($n = 70$)		A2 ($n = 70$)		B1 ($n = 280$)		B2 ($n = 280$)		Total ($n = 700$)		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
Brain	3534	5.2	1363	6.0	12 394	12.2	3043	9.7	20 334	9.3	–4.3
Bone	6948	11.2	2419	10.6	12 618	12.4	4921	15.7	26 906	12.4	–3.8

Data presented as number of patients, with percentages in parentheses.
[a]Rate of increase compared with the data of 2007. Calculating formula: $\frac{data\ of\ 2009\ (n) - data\ of\ 2007\ (n)}{data\ of\ 2007\ (n)} \times 100\ (\%)$

with 2007 [6]. This may reflect the growing popularity of RT due to an increase in the elderly population and recent advances in technology and improvement in clinical results. The caseload ratio in Japan has therefore already exceeded the limit of the Blue Book guidelines of 200 patients per radiation oncologist and improved only slightly in 2009 [21, 22]. The percentage distribution of institutions by patient load per RO showed a slightly high percentage for smaller patient load/RO than that in the USA in 1989 [3], but also showed a major shift to a larger size in 2009 compared with 1990. In Japan, the patterns are now becoming similar to those of the USA in 1989 [3], indicating that Japanese radiation oncology is catching up quickly with western systems and growing steadily in spite of limited resources. Furthermore, additional recruiting and education of ROs continue to be top priorities for JASTRO. The distribution of patient load per RT technologist shows that only 17.3% of institutions met the narrow guideline range (100–120 patient per RT technologist) and the rest showed a dense distribution around the peak level. Compared with the distribution in the USA in 1989, nearly 18% of institutions in Japan had a relatively low caseload of 10–60, because there are still a large number of smaller B2-type institutions, which account for nearly 40% of institutions that do not attain the range specified by the guidelines. As for medical physicists, an analysis of patient load for FTE staff similar to that for RT technologists remains difficult, because the number of the former was very small and they were working mainly in metropolitan areas. However, RT technologists in Japan have been acting partly as medical physicists. Their training duration has changed from 3 to 4 years over the last decade, and graduate and postgraduate courses have been introduced. Currently, RT technologists who have obtained a master's degree or those with enough clinical experience can take the examination for qualification as a medical physicist, as can those with a master's degree in science or engineering like in the USA or Europe. A unique, hybrid education system for medical physicists has thus been developed in Japan since the Cancer Control Act actively started to support improvement in quality assurance and quality control (QA/QC) specialization for RT. However, the validity of this education and training system remains to be proven, not only for QA/QC but also for unique research and developmental activities. The discrepancy between FTE medical physicists and the number of registered medical physicists in Japan reflects the fact that their role in the clinic is not recognized as a full-time position only for medical physics services.

Analysis of the distribution of primary sites for RT showed that the number of lung cancer patients at A1-type institutions increased by 8% compared with 2007. On the other hand, more head and neck cancer patients were treated at A1-, A2- or B1-type institutions, but the rates of increase compared with 2007 were high for A2 and B1 institutions. The increase in the number of lung cancer patients at A1 institutions in 2009 was noteworthy and the same goes for that of prostate cancer patients or breast cancer patients at A1-, A2-, B1- and B2-type institutions. This suggests that stereotactic body RT (SBRT) for lung cancer at A1 and 3DCRT for prostate cancer or breast-conserving therapy for breast cancer (BCT) at A1, A2, B1 and B2 were used more frequently in 2009. Especially in B2-type institutions, breast cancer patients (18.8%) and prostate cancer patients (20.3%) increased at two of the highest rates. This indicates that treatments such as 3DCRT and BCT were disseminated widely to B2-type institutions as a standard. The number of patients with brain or bone metastasis did not increase compared with 2007 [6]. The use of specific treatments and the number of patients treated with these modalities were significantly affected by institutional stratification, with more specific treatments being performed at academic institutions. These findings indicate that significant differences in patterns of care, as reflected in structure, process and possibly outcome for cancer patients continued to be prevalent in Japan in 2009. However, these differences point to opportunities for improvement. The Japanese PCS group published structural guidelines based on PCS data [22] and we are using the structural data obtained in 2009 to revise the Japanese structural guidelines for radiation oncology in the near future. The use of intraoperative RT decreased significantly from 2005 to 2007 and showed a similar rate of decrease (35%) between 2007 and 2009, while that of thermoradiotherapy increased slightly by 15% compared with 2007 [6]. These two modalities are thus not considered mainstay treatments in Japan. The numbers of patients with bone metastasis or brain metastasis in 2009 decreased, compared with those in 2007. Within the limited resources of departments of radiation oncology, more efforts may be made, focusing on radical treatment than palliative ones. Also general treatments such as bisphosphonates or narcotic drugs such as opioids for bone metastasis may relatively reduce the candidates for RT. The reason for the reduction in use of RT for brain metastasis is unknown.

Geographic patterns showed that there were significant differences among prefectures in the use of RT, and the number of JASTRO-certified physicians per population was associated with the utilization of RT in 2005 [5], 2007 [6] and 2009, so that a shortage of radiation oncologists or medical physicists on a regional basis will remain a major concern in Japan. Compared with 2005 [5] and 2007 [6], however, the utilization rate of radiation for new cancer patients in 2009 showed further increase. JASTRO has been making every effort to recruit and educate radiation oncologists and medical physicists through public relations, to establish and conduct training courses at academic institutions, to become involved in the national examination for physicians and to seek an increase in the coverage of fees for ROs by the government-controlled insurance scheme.

In conclusion, the Japanese structure of radiation oncology has clearly and steadily improved over the past 19 years in terms of installation and use of equipment and its functions, but shortages of man power and differences in maturity depending on type of institution and caseload remain. Structural immaturity is an immediate target for improvement, while for improvements in process and outcome, the PCS or National Cancer Database (NCDB), which are currently operational and the subject of close examination, can be expected to perform an important function in the future of radiation oncology in Japan.

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SPECIAL ARTICLE

Comprehensive Registry of Esophageal Cancer in Japan, 2004

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Preface

Japan was struck by the Great East Japan Earthquake, which resulted in almost twenty thousand deaths and missing persons, 1 year ago. We would like to express our heartfelt condolences and sympathies to all the people who have been affected by this disaster. We pray that the regions affected will recover as soon as possible and that the physicians working diligently in the affected areas remain in good health and spirits.

We deeply appreciate the cooperation of many physicians with the registry of esophageal cancer cases; nevertheless, the recovery from the Great East Japan Earthquake is ongoing. The Comprehensive Registry of Esophageal Cancer in Japan, 2004, was finally published here, despite some delay.

The registry of esophageal cancer cases has required some adjustments to comply with the Act for the Protection of Personal Information, which was promulgated in 2003 and began to be enforced in 2005. The most important point was "anonymity in an unlinkable fashion" using encryption with a hash function. The new registration

These data were first made available on June 1, 2004, as the Comprehensive Registry of Esophageal Cancer in Japan, 2004. Not all the pages are reprinted here; however, the original table and figure numbers have been maintained.

The authors were members of the Registration Committee for Esophageal Cancer, the Japan Esophageal Society, and made great contributions to the preparation of this material.

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system was completed in 2008, and the registry itself resumed the registry of cases of esophageal cancer that had been treated in 2001. This was the fourth time that the new registration system was used to prepare a Comprehensive Registry of Esophageal Cancer in Japan. The physicians in charge of the registration seem to have become accustomed to the new system.

Here, we have briefly summarized the Comprehensive Registry of Esophageal Cancer in Japan, 2004. A total of 5,066 cases were registered from 214 institutions in Japan. Comparing the Comprehensive Registry in 2004 to the Comprehensive Registry in 2003, the number of registered cases, surgical cases, and registered institutions increased by 407, 159, and 15, respectively. As for the histologic type of cancer according to biopsy specimens, squamous cell carcinoma and adenocarcinoma accounted for 88.7 and 2.9 %, respectively. Regarding clinical results, the 5-year survival rates of patients treated using endoscopic mucosal resection, concurrent chemoradiotherapy, radiotherapy alone, chemotherapy alone, or esophagectomy were 83.7, 26.4, 15.5, 8.6, and 50.2 %, respectively. Concerning the approach used to perform an esophagectomy, 18.0 % of the cases were treated endoscopically, that is, thoracoscopically, laparoscopically, or mediastinoscopically. Regarding the reconstruction route, the retrosternal, the posterior mediastinal, and the intrathoracic route were used in 36.0, 35.5 and 16.4 % of the cases, respectively. The operative mortality was 1.3 % (35 out of 2,669 cases).

We hope that this Comprehensive Registry of Esophageal Cancer in Japan for 2004 will help to improve all aspects of the diagnosis and treatment of esophageal cancer.

Contents

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I. Clinical factors of esophageal cancer patients treated in 2004

Institution-registered cases in 2004

Institution
Aichi Cancer Center
Aizawa Hospital
Akita University Hospital
Asahikawa Medical College Hospital
The Cancer Institute Hospital of JFCR
Chiba Cancer Center
Chibaken Saiseikai Narashino Hospital
Chiba University Hospital
Dokkyo Medical University Hospital

continued

Institution
Fuchu Hospital
Fujioka General Hospital
Fujita Health University
Fukui Red Cross Hospital
Fukui University Hospital
Fukuoka Saiseikai General Hospital
Fukuyama Hospital
Foundation for Detection of Early Gastric Carcinoma
Genwakai Himawari A Clinic
Gifu Prefectural General Medical Center
Gunma Central General Hospital
Gunma University Hospital
Hachioji Digestive Disease Hospital
Hakodate Goryokaku Hospital
Hamamatsu University School of Medicine, University Hospital
Health Insurance Naruto Hospital
Hiratsuka City Hospital
Hiratsuka Kyosai Hospital
Hiroshima City Asa Hospital
Hiroshima University Research Institute for Radiation Biology Medicine
Hitachi General Hospital
Hokkaido kin-ikyo chuo Hospital
Hokkaido University Hospital
Hokusatsu-byouin
Hyogo Cancer Center
Hyogo College of Medicine
Hyogo Prefectural Nishinomiya Hospital
Ibaraki Prefectural Central Hospital.
Ida Municipal Hospital
Iizuka Hospital
Inazawa City Hospital
International University of Health and Welfare Mita Hospital
Ishinomaki Red Cross Hospital
Iwakuni Medical Center
Iwate Medical University Hospital
Japanese Red Cross Shizuoka Hospital
Japanese Red Cross Society Onoda Hospital
Jichi Medical University Hospital
Jikei University Hospital
Juntendo University Hospital
Junwakai Memorial Hospital
Kagawa Prefectural Central Hospital
Kagawa University Hospital
Kagoshima University Hospital
Kanazawa University Hospital
Kansai Medical University Hirakata Hospital
Kansai Rosai Hospital
Kashiwa Kousei General Hospital

continued

Institution
Kawasaki Medical School Hospital
Keio University Hospital
Keiyukai Sapporo Hospital
Kikuna Memorial Hospital
Kinki Central Hospital
Kinki University Hospital
Kinki University Nara Hospital
Kinki University Sakai Hospital
Kiryu Kosei General Hospital
Kitakyushu Municipal Medical Center
Kitano Hospital
Kitasato Institute Hospital
Kitasato University Hospital
Kobe City Medical Center General Hospital
Kobe University Hospital
Kochi University Hospital
Kumamoto University Hospital
Kurashiki Central Hospital
Kurume University Hospital
Kuwana City Hospital
Kyorin University Hospital
Kyosai Tachikawa Hospital
Kyoto University Hospital
Kyushu Central Hospital of the Mutual Aid Association of Public School Teachers
Kyushu University Hospital
Matsuda Hospital
Matsudo City Hospital
Matsushita Memorial Hospital
Matsuyama Red Cross Hospital
Mie University Hospital
Minoh City Hospital
Mito Red Cross Hoapital
Murakami General Hospital
Nagahama City Hospital
Nagano Red Cross Hospital
Nagaoka Chuo General Hospital
Nagoya City University Hospital
Nagoya Daiichi Red Cross Hospital
Nanpuh Hospital
Nara Medical University Hospital
National Cancer Center Hospital
National Cancer Center Hospital East
National Defense Medical College Hospital
National Hospital Organization Chiba Medical Center
National Hospital Organization Kure Medical Center
National Hospital Organization Kyushu Cancer Center
National Hospital Organization Matsumoto National Hospital
National Hospital Organization Nagasaki Medical Center

continued

Institution
National Hospital Organization Nagoya Medical Center
National Hospital Organization Osaka National Hospital
National Institute of Radiological Sciences
Nihon University Itabashi Hospital
Niigata Cancer Center Hospital
Niigata City General Hospital
Niigata Prefectural Shibata Hospital
Niigata University Medical and Dental Hospital
Nippon Medical School Musashi Kosugi Hospital
Nippon Medical School Tama Nagayama Hospital
Nishi-Kobe Medical Center
Nomura Hospital
NTT West Osaka Hospital
Numazu City Hospital
Ohta General Hospital Foundation Ohta Nishinouchi Hospital
Oita Red Cross Hospital
Oita University Hospital
Okayama Saiseikai General Hospital
Okayama University Hospital
Osaka City University Hospital
Osaka General Medical Center
Osaka Koseinenkin Hospital
Osaka Medical Center for Cancer and Cardiovascular Diseases
Osaka Prefectural Hospital Organization Osaka General Medical Center
Osaka University Hospital
Otsu Red Cross Hospital
Rinku General Medical Center
Ryukyu University Hospital
Saga University Hospital
Saiseikai General Hospital
Saiseikai Kyoto Hospital
Saiseikai Gose Hospital
Saitama City Hospital
Saitama Medical Center Jichi Medical University
Saitama Medical University Hospital
Saitama Medical University International Medical Center
Saitama Red Cross Hospital
Saitama Social Insurance Hospital
Saku Central Hospital
Sano Kousei General Hospital
Sato Clinic
Sapporo Medical University
Sawara Hospital
Seikei-kai Chiba Medical Center
Sendai City Hospital
Sendai Medical Center
Shiga Medical Center for Adults
Shiga University of Medical Science Hospital

continued

Institution
Shikoku Cancer Center
Shimane University Hospital
Shimizu Welfare Hospital
Shinbeppu Hospital
Shinshiro Municipal Hospital
Shinshu University Hospital
Shizuoka Cancer Center
Shizuoka City Shimizu Hospital
Shizuoka City Shizuoka Hospital
Shouzankai-Saiki Hospital
Showa Inan General Hospital
Showa University Hospital
Showa University Northern Yokohama Hospital
Social Insurance Omuta Tenryo Hospital
Social Insurance Tagawa Hospital
Social Insurance Yokohama Central Hospital
Sonoda Daiichi Hospital
St. Luke's International Hospital
Sugita Genpaku Memorial Obama Municipal Hospital
Suita Municipal Hospital
Takasago Municipal Hospital
Tenri Hospital
Tochigi Cancer Center
Toho University Omori Medical Center
Toho University Hospital
Tohoku Kosai Hospital
Tohoku University Hospital
Tokai University Hospital
Tokushima Red Cross Hospital
Tokushima University Hospital
Tokyo Dental College Ichikawa General Hospital
Tokyo Medical and Dental University Hospital

continued

Institution
Tokyo Medical University Hospital
Tokyo Metropolitan Cancer and Infectious Center Komagome Hospital
Tokyo Metropolitan Health and Medical Corporation Toshima Hospital
Tokyo University Hospital
Tokyo Women's Medical University Hospital
Tonan Hospital
Toranomon Hospital
Tottori Prefectural Central Hospital
Tottori University Hospital
Toyama Prefectural Central Hospital
Toyama University Hospital
Tsuchiura Kyodo Hospital
Tsukuba University Hospital
Tsuruoka Municipal Shonai Hospital
University Hospital, Kyoto Prefectural University of Medicine
University of Miyazaki Hospital
University of Occupational and Environmental Health
Wakayama Kenritsu University Hospital
Yamagata Prefectural and Sakata Municipal Hospital Organization
Yamagata Prefectural Central Hospital
Yamagata University Hospital
Yamaguchi University Hospital
Yamanashi University Hospital
Yamaguchi-ken Saiseikai Shimonoseki General Hospital
Yao Municipal Hospital
Yatsu Hoken Hospital
Yokohama City University Hospital
Yokohama City University Medical Center
Yokohama Rosai Hospital
(Total 214 institutions)

Patient Background

Table 1 Age and gender

* **Excluding 49 missing cases of gender**

Age	Male	Female	Unknown	Cases (%)	
~29	6	0	0	6	(0.1%)
30~39	9	6	0	15	(0.3%)
40~49	148	27	0	175	(3.5%)
50~59	975	150	0	1125	(22.8%)
60~69	1758	236	0	1994	(40.3%)
70~79	1200	183	0	1383	(28.0%)
80~89	174	53	0	227	(4.6%)
90~	12	7	0	19	(0.4%)
Total	4282	662	0	4944	
Missing	57	16	0	73	

Table 12 Tumor location

* **Excluding 178 treatment unknown, missing cases of treatment types**

Location of tumor	Endoscopic treatment (%)		Chemotherapy and/or radiotherapy (%)		Surgery				Total (%)	
					Palliative operation (%)		Esophagectomy (%)			
Cervical	13	(2.4%)	112	(7.3%)	3	(2.5%)	101	(3.8%)	229	(4.7%)
Upper thoracic	55	(10.2%)	198	(12.9%)	20	(16.7%)	298	(11.2%)	571	(11.8%)
Middle thoracic	296	(55.0%)	680	(44.2%)	55	(45.8%)	1242	(46.9%)	2273	(46.9%)
Lower thoracic	142	(26.4%)	314	(20.4%)	32	(26.7%)	799	(30.2%)	1287	(26.6%)
Abdominal	13	(2.4%)	26	(1.7%)	9	(7.5%)	148	(5.6%)	196	(4.0%)
EG	4	(0.7%)	2	(0.1%)	0		24	(0.9%)	30	(0.6%)
EG-Junction(E=G)	0		1	(0.1%)	0		20	(0.8%)	21	(0.4%)
Cardia (G)	0		1	(0.1%)	0		2	(0.1%)	3	(0.1%)
Others	0		0		0		0		0	
Unknown	15	(2.8%)	205	(13.3%)	1	(0.8%)	15	(0.6%)	236	(4.9%)
Total	538		1539		120		2649		4846	
Missing	9		5		1		7		22	

EG: esophago-gastric

Table 15 Histologic types of cancer according to biopsy specimens

*** Excluding 178 treatment unknown, missing cases of treatment types**

Histologic types	Endoscopic treatment (%)		Chemotherapy and/or radiotherapy (%)		Surgery				Total (%)	
					Palliative operation (%)		Esophagectomy (%)			
Not examined	36	(6.8%)	5	(0.3%)	2	(1.7%)	5	(0.2%)	48	(1.0%)
SCC	456	(86.0%)	1263	(82.4%)	111	(92.5%)	2446	(92.7%)	4276	(88.7%)
SCC	355	(67.0%)	801	(52.3%)	79	(65.8%)	1380	(52.3%)	2615	(54.3%)
Well diff.	16	(3.0%)	73	(4.8%)	4	(5.0%)	252	(9.6%)	345	(7.2%)
Moderately diff.	65	(12.3%)	250	(16.3%)	20	(16.7%)	575	(21.8%)	910	(18.9%)
Poorly diff.	20	(3.8%)	139	(9.1%)	8	(6.7%)	239	(9.1%)	406	(8.4%)
Adenocarcinoma	18	(3.4%)	16	(1.0%)	2	(1.7%)	105	(4.0%)	141	(2.9%)
Undifferentiated	0		15	(1.0%)	1	(0.8%)	6	(0.2%)	22	(0.5%)
Carcinosarcoma	0		1	(0.1%)	2	(1.7%)	8	(0.3%)	11	(0.2%)
Malignant melanoma	1	(0.2%)	2	(0.1%)	0		10	(0.4%)	13	(0.3%)
Other tumors	3	(0.6%)	19	(1.2%)	0		14	(0.5%)	36	(0.7%)
Dysplasia	0		0		0		0		0	
Unknown	16	(3.0%)	211	(13.8%)	2	(1.7%)	44	(1.7%)	273	(5.7%)
Total	530		1532		120		2638		4820	
Missing	18		18		1		31		68	

SCC: squamous cell carcinoma

Table 19 Organs with metastasis in cM1 case (UICC-cTNM 5th)

*** Excluding 178 treatment unknown, missing cases of treatment types**

Metastatic organs	Endoscopic treatment (%)		Chemotherapy and/or radiotherapy (%)		Surgery				Total (%)	
					Palliative operation (%)		Esophagectomy (%)			
PUL	10	(27.8%)	86	(17.1%)	5	(45.5%)	11	(5.9%)	112	(15.3%)
OSS	0		14	(2.8%)	0		1	(0.5%)	15	(2.0%)
HEP	6	(16.7%)	94	(18.7%)	3	(27.3%)	16	(8.6%)	119	(16.2%)
BRA	1	(2.8%)	5	(1.0%)	0		1	(0.5%)	7	(1.0%)
LYM	15	(41.7%)	255	(50.8%)	3	(27.3%)	140	(75.7%)	413	(56.3%)
MAR	0		1	(0.2%)	0		0		1	(0.1%)
PLE	1	(2.8%)	5	(1.0%)	0		1	(0.5%)	7	(1.0%)
PER	0		0		0		3	(1.6%)	3	(0.4%)
SKI	0		3	(0.6%)	0		1	(0.5%)	4	(0.5%)
OTH	3	(8.3%)	21	(4.2%)	0		5	(2.7%)	29	(4.0%)
Unknown	0		18	(3.6%)	0		6	(3.2%)	24	(3.3%)
Lesions	36		502		11		185		734	
Missing	1		5		0		6		12	
One organ	18	(69.2%)	369	(85.4%)	7	(77.8%)	172	(96.6%)	566	(87.8%)
Two organs	6	(23.1%)	58	(13.4%)	2	(22.2%)	5	(2.8%)	71	(11.0%)
Three organs	2	(7.7%)	3	(0.7%)	0		1	(0.6%)	6	(0.9%)
Four organs~	0		2	(0.5%)	0		0		2	(0.3%)
Unknown	0		0		0		0		0	
Total cases	26		432		9		178		645	
Missing	1		5		0		6		12	

PUL: pulmones, OSS: ossis, HEP: hepar, BRA: brain, LYM: lymph node, MAR: marrow,

PLE: pleural membrane, PER:peritoneal membrane, SKI: skin, OTH: others

Table 20 Clinical stage (UICC-cTNM 5th)

* **Excluding 178 treatment unknown, missing cases of treatment types**

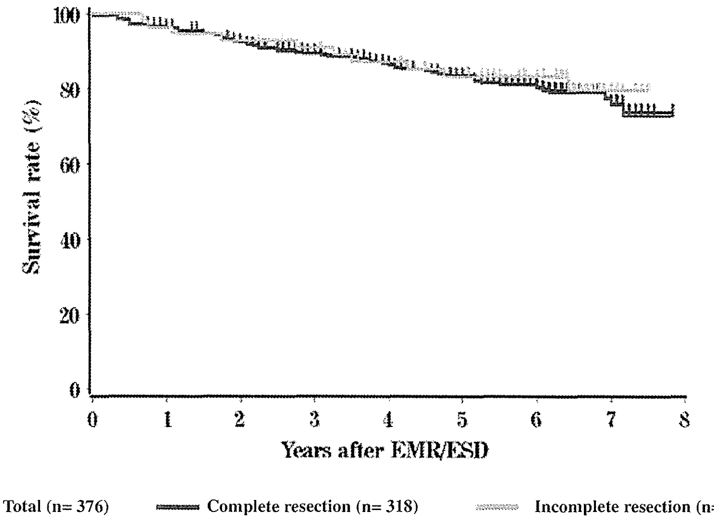
cStage	Endoscopic treatment (%)		Chemotherapy and/or radiotherapy (%)		Surgery				Total (%)	
					Palliative operation (%)		Esophagectomy (%)			
0	88	(16.2%)	4	(0.3%)	0	(0.0%)	19	(0.7%)	111	(2.3%)
I	369	(68.0%)	203	(13.2%)	13	(10.7%)	619	(23.3%)	1204	(24.7%)
IIA	7	(1.3%)	185	(12.0%)	13	(10.7%)	493	(18.5%)	698	(14.3%)
IIB	4	(0.7%)	103	(6.7%)	11	(9.1%)	344	(12.9%)	462	(9.5%)
III	30	(5.5%)	559	(36.3%)	70	(57.9%)	952	(35.8%)	1611	(33.1%)
IV	3	(0.6%)	117	(7.6%)	3	(2.5%)	34	(1.3%)	157	(3.2%)
IVA	6	(1.1%)	91	(5.9%)	1	(0.8%)	71	(2.7%)	169	(3.5%)
IVB	16	(2.9%)	204	(13.2%)	4	(3.3%)	76	(2.9%)	300	(6.2%)
Unknown	20	(3.7%)	75	(4.9%)	6	(5.0%)	53	(2.0%)	154	(3.2%)
Total	543		1541		121		2661		4866	
Missing	5		9		0		8		22	

II. Clinical results of patient treated with endoscopy in 2004

Table 21 Treatment modalities in patients receiving endoscopy

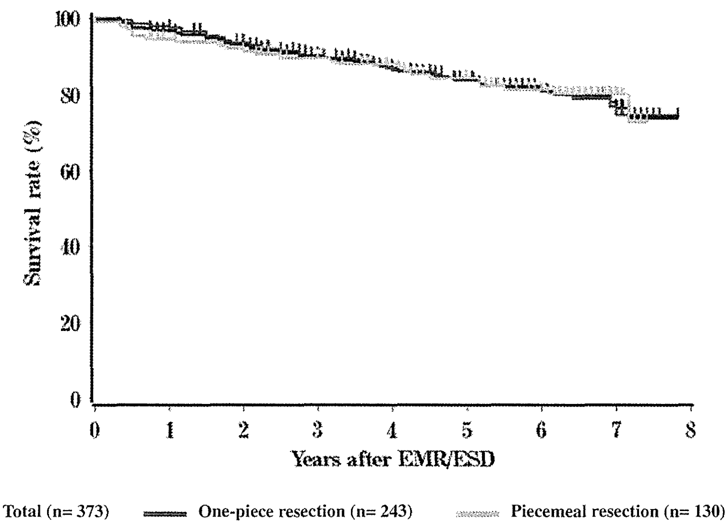
Treatment modarities	Cases (%)	
Endoscopic treatment only	438	(80.7%)
Endoscopic treatment + Radiotherapy	27	(5.0%)
Endoscopic treatment + Chemotherapy	16	(2.9%)
Endoscopic treatment + Chemoradiotherapy	54	(9.9%)
Endoscopic treatment + Chemoradiotherapy + Others	3	(0.6%)
Endoscopic treatment + Others	5	(0.9%)
Total	543	
Missing	5	

Fig. 1 Survival of patients treated by EMR/ESD



	Years after EMR/ESD							
	1	2	3	4	5	6	7	8
Total	96.5%	92.5%	89.4%	86.5%	83.7%	80.7%	76.4%	74.0%
Complete resection	96.5%	92.5%	89.4%	86.5%	83.7%	80.2%	75.7%	73.0%
Incomplete resection	96.5%	93.0%	91.2%	87.4%	83.4%	83.4%	79.7%	79.7%

Fig. 2 Survival of patients in relation to type of EMR/ESD



	Years after EMR/ESD							
	1	2	3	4	5	6	7	8
Total	96.5%	92.8%	89.9%	86.9%	83.9%	80.9%	76.5%	73.9%
One piece resection	97.5%	93.7%	90.1%	86.3%	83.8%	80.7%	74.5%	74.5%
Piecemeal resection	94.6%	91.3%	89.7%	87.9%	84.2%	81.2%	80.0%	72.8%

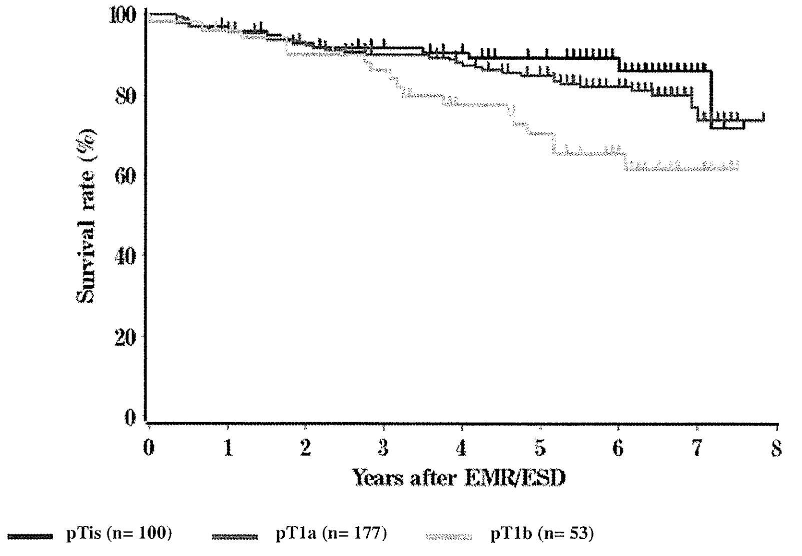


Fig. 3 Survival of patients treated by EMR/ESD in relation to the pathological depth of tumor invasion (pT)

	Years after EMR/ESD							
	1	2	3	4	5	6	7	8
pTis	95.9%	92.8%	91.8%	90.6%	89.4%	86.1%	86.1%	71.7%
pT1a	96.0%	92.5%	90.1%	87.6%	85.0%	82.1%	73.8%	73.8%
pT1b	96.2%	90.1%	86.0%	77.6%	70.4%	65.3%	61.5%	61.5%

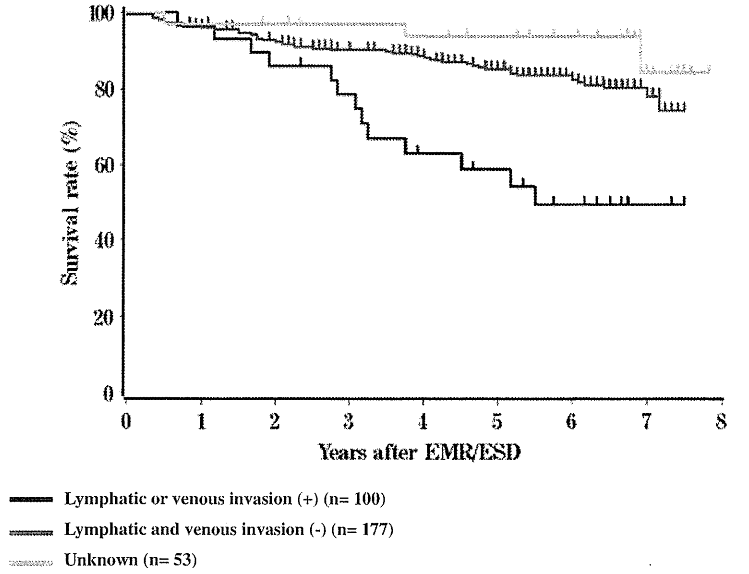


Fig. 4 Survival of patients treated by EMR/ESD in relation to the lymphatic or venous invasion

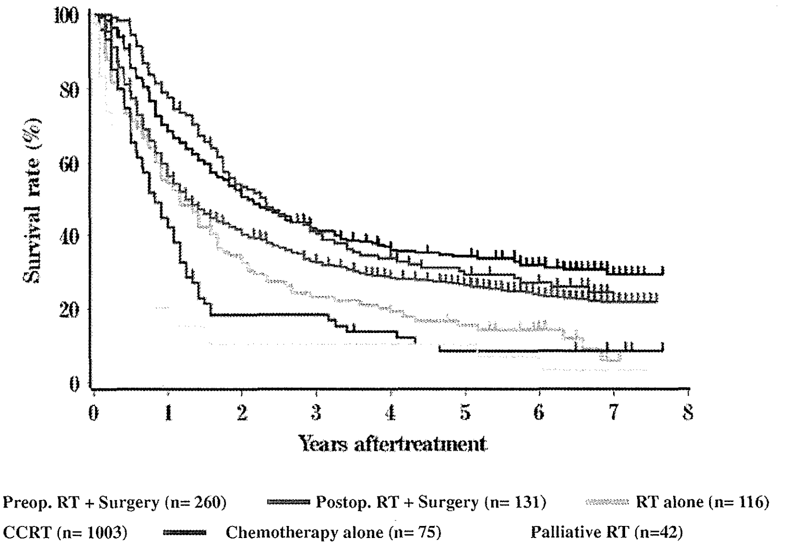
	Years after EMR/ESD							
	1	2	3	4	5	6	7	8
Lymphatic or venous invasion (+)	96.7%	85.9%	78.5%	62.9%	58.7%	49.3%	49.3%	49.3%
Lymphatic and venous invasion (-)	96.1%	92.4%	90.2%	88.2%	85.3%	82.4%	78.1%	74.2%
Unknown	97.1%	97.1%	97.1%	93.7%	93.7%	93.7%	84.3%	84.3%

III. Clinical results in patients treated with chemotherapy and/or radiotherapy in 2004

Table 34 Dose of irradiation with or without chemotherapy (non-surgically treated and curative cases)

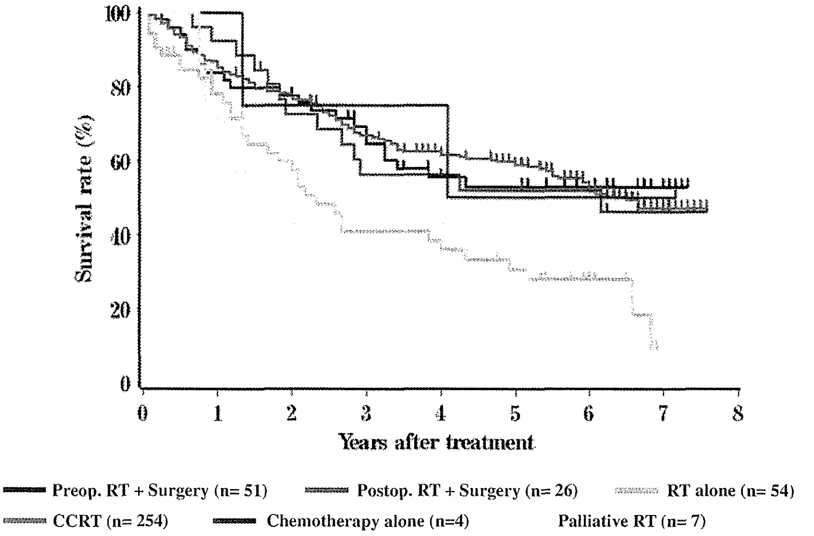
Dose of irradiation (Gy)	Chemotherapy with (%)		Chemotherapy without (%)		Preope RT (%)		Postope RT (%)	
0	0		0		0		0	
-29	6	(1.2%)	4	(4.7%)	15	(4.9%)	9	(5.3%)
30-39	12	(2.4%)	3	(3.5%)	78	(25.3%)	15	(8.8%)
40-49	26	(5.3%)	5	(5.8%)	179	(58.1%)	43	(25.1%)
50-59	58	(11.8%)	4	(4.7%)	10	(3.2%)	42	(24.6%)
60-69	366	(74.4%)	61	(70.9%)	24	(7.8%)	60	(35.1%)
70-	24	(4.9%)	9	(10.5%)	2	(0.6%)	2	(1.2%)
Total	492		86		308		171	
Median (min - max)	60 (2 - 106)		61 (8 - 84)		40 (1.2 - 96)		50 (1.2 - 70)	
Missing	2		0		12		9	

Fig. 5 Survival of patients treated by chemotherapy and/or radiotherapy



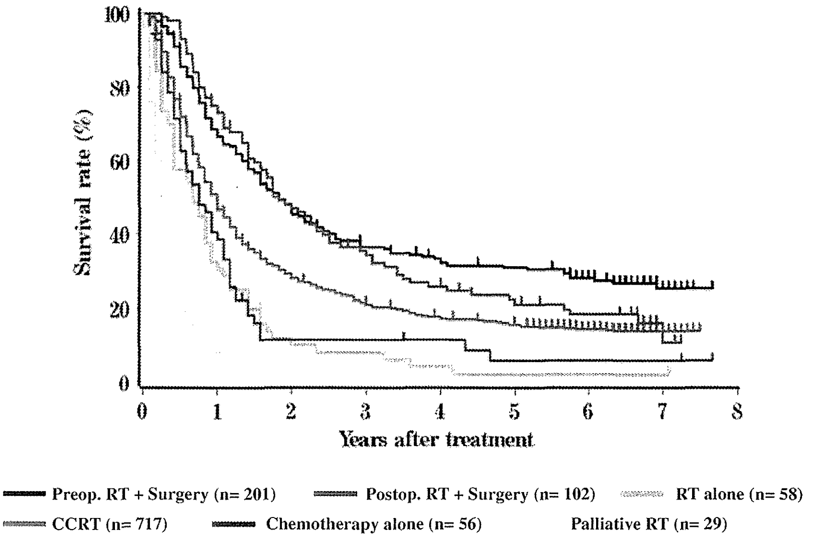
	Years after treatment							
	1	2	3	4	5	6	7	8
Preop. RT + Surgery	69.0%	51.0%	41.3%	36.1%	34.3%	31.9%	29.4%	29.4%
Postop. RT + Surgery	77.5%	53.5%	40.5%	33.8%	29.4%	27.2%	22.0%	22.0%
RT alone	54.4%	33.5%	23.2%	19.0%	15.5%	14.3%	6.0%	6.0%
CCRT	56.5%	40.7%	32.7%	28.3%	26.4%	23.7%	21.8%	21.8%
Chemotherapy alone	42.3%	18.3%	18.3%	13.7%	8.6%	8.6%	8.6%	8.6%
Palliative RT	20.4%	10.2%	10.2%	10.2%	10.2%	3.4%	3.4%	3.4%

Fig. 6 Survival of patients treated by chemotherapy and/or radiotherapy (cStage I–IIA)



	Years after treatment							
	1	2	3	4	5	6	7	8
Preop. RT + Surgery	83.8%	77.7%	64.7%	55.6%	53.1%	53.1%	53.1%	53.1%
Postop. RT + Surgery	92.3%	72.5%	56.4%	52.1%	52.1%	52.1%	46.3%	46.3%
RT alone	78.0%	59.8%	41.1%	36.2%	30.8%	30.8%	28.0%	9.3%
CCRT	86.0%	77.5%	66.7%	61.6%	58.9%	52.4%	47.3%	47.3%
Chemotherapy alone	100.0%	75.0%	75.0%	75.0%	75.0%	50.0%	50.0%	50.0%
Palliative RT	71.4%	42.9%	42.9%	42.9%	42.9%	21.4%	-	-

Fig. 7 Survival of patients treated by chemotherapy and/or radiotherapy (cStage IIB–IVB)



	Years after treatment							
	1	2	3	4	5	6	7	8
Preop. RT + Surgery	67.0%	45.9%	36.5%	32.1%	31.0%	28.1%	25.2%	25.2%
Postop. RT + Surgery	73.0%	47.0%	34.4%	25.8%	21.1%	18.2%	10.6%	10.6%
RT alone	30.5%	9.9%	7.9%	4.0%	2.0%	2.0%	2.0%	2.0%
CCRT	46.9%	28.2%	21.1%	17.1%	15.6%	14.2%	13.7%	13.7%
Chemotherapy alone	38.7%	11.3%	11.3%	11.3%	5.7%	5.7%	5.7%	5.7%
Palliative RT	7.8%	0.0%	-	-	-	-	-	-

IV. Clinical results in patients treated with esophagectomy in 2004

Table 45 Tumor location

Locations	Cases (%)	
Cervical	101	(3.8%)
Upper thotacic	298	(11.3%)
Middle thoracic	1242	(46.9%)
Lower thoracic	799	(30.2%)
Abdominal	148	(5.6%)
EG	24	(0.9%)
EG-Junction (E=G)	20	(0.8%)
Unknown	15	(0.6%)
Total lesions	2647	
Total cases	2647	
Missing	7	

EG: esophago-gastric

Table 46 Approaches to tumor resection

Approaches	Cases (%)	
Cervical approach	115	(4.3%)
Right thoracotomy	2143	(80.8%)
Left thoracotomy	43	(1.6%)
Left thoracoabdominal approach	61	(2.3%)
Laparotomy	86	(3.2%)
Transhiatal (without blunt dissection)	24	(0.9%)
Transhiatal (with blunt dissection)	74	(2.8%)
Sternotomy	14	(0.5%)
Others	79	(3.0%)
Unknown	14	(0.5%)
Total	2653	
Missing	16	

Table 47 Endoscopic surgery

Endoscopic surgery	Cases (%)	
None	2154	(81.8%)
Thoracoscopy-assisted	265	(10.1%)
Laparoscopy-assisted	81	(3.1%)
Thoracoscopy + Laparoscopy-assisted	108	(4.1%)
Mediastinoscopy-assisted	15	(0.6%)
Thoracoscopy + Mediastinoscopy-assisted	0	
Laparoscopy + Mediastinoscopy-assisted	1	(0.0%)
Others	3	(0.1%)
Unknown	7	(0.3%)
Total	2634	
Missing	35	

Table 48 Fields of lymph node dissection according to the location of the tumor

* **Excluding pharynx and missing 35 cases of locations**

Locations	Cevical		Upper thoracic		Middle thoracic		Lower thoracic		Abdominal		EGJ		Total	
Region of lymphadenectomy	Cases (%)		Cases (%)		Cases (%)		Cases (%)		Cases (%)		Cases (%)		Cases (%)	
None	10	(10.0%)	18	(6.1%)	46	(3.7%)	22	(2.8%)	5	(3.4%)	0		101	(3.9%)
C	31	(31.0%)	0		9	(0.7%)	4	(0.5%)	0		0		44	(1.7%)
C+UM	23	(23.0%)	4	(1.4%)	0		1	(0.1%)	0		0		28	(1.1%)
C+UM+MLM	4	(4.0%)	7	(2.4%)	19	(1.5%)	5	(0.6%)	0		0		35	(1.3%)
C+UM+MLM+A	22	(22.0%)	179	(60.7%)	532	(43.1%)	258	(32.3%)	17	(11.4%)	2	(4.5%)	1010	(38.6%)
C+UM+A	2	(2.0%)	5	(1.7%)	1	(0.1%)	0		0		0		8	(0.3%)
C+MLM	0		0		0		0		0		0		0	
C+MLM+A	1	(1.0%)	1	(0.3%)	3	(0.2%)	3	(0.4%)	0		0		8	(0.3%)
C+A	2	(2.0%)	1	(0.3%)	2	(0.2%)	1	(0.1%)	0		0		6	(0.2%)
UM	0		1	(0.3%)	3	(0.2%)	4	(0.5%)	1	(0.7%)	0		9	(0.3%)
UM+MLM	0		3	(1.0%)	22	(1.8%)	7	(0.9%)	4	(2.7%)	0		36	(1.4%)
UM+MLM+A	2	(2.0%)	65	(22.0%)	523	(42.4%)	353	(44.2%)	39	(26.2%)	7	(15.9%)	989	(37.8%)
UM+A	0		0		3	(0.2%)	2	(0.3%)	0		0		5	(0.2%)
MLM	0		0		8	(0.6%)	7	(0.9%)	0		0		15	(0.6%)
MLM+A	1	(1.0%)	7	(2.4%)	44	(3.6%)	98	(12.3%)	57	(38.3%)	21	(47.7%)	228	(8.7%)
A	0		3	(1.0%)	10	(0.8%)	29	(3.6%)	25	(16.8%)	14	(31.8%)	81	(3.1%)
Unknown	2	(2.0%)	1	(0.3%)	8	(0.6%)	4	(0.5%)	1	(0.7%)	0		16	(0.6%)
Total	100		295		1233		798		149		44		2619	
Missing	1		3		9		1		1		0		15	

C: bilateral cervical nodes

UM: upper mediastinal nodes

MLM: middle-lower mediastinal nodes

A: abdominal nodes

Table 49 Extent of lymph node dissection

Grade of dissection (D)	Cases (%)	
DX	42	(1.6%)
D0	127	(4.8%)
DI	355	(13.4%)
DII	1234	(46.7%)
DIII	885	(33.5%)
Total	2643	
Missing	26	

Table 50 Reconstruction route

Reconstruction route	Cases (%)	
None	40	(1.6%)
Antethoracic	236	(9.2%)
Retrosternal	919	(36.0%)
Intrathoracic	419	(16.4%)
Posterior mediastinal	906	(35.5%)
Others	21	(0.8%)
Unknown	12	(0.5%)
Total	2553	
Missing	73	

Table 51 Organs used for reconstruction

Organs used for reconstruction	Cases (%)	
None	49	(1.8%)
Whole stomach	104	(3.8%)
Gastric tube	2189	(79.7%)
Jejunum	115	(4.2%)
Free jejunum	62	(2.3%)
Colon	99	(3.6%)
Free colon	22	(0.8%)
Skin graft	1	(0.0%)
Others	97	(3.5%)
Unknown	8	(0.3%)
Total lesions	2746	
Total cases	2655	
Missing	14	