

Outcome of gastric carcinoma detected by gastric mass survey in Japan

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SUMMARY The outcome was studied of gastric carcinoma found in six selected mass survey groups. One-hundred-and-thirty-seven cases of gastric carcinoma were detected and followed-up post-operatively for 16 years at the longest. They consisted of 55 cases of early and 74 of advanced carcinoma with eight cases of unknown depth of involvement. Early carcinoma amounted to 42.6% of the cases with known depth of involvement. The relative five-year and 10-year survival rates calculated by the method of Ederer *et al.* (1961) in the 137 cases were 0.628 and 0.642, respectively, and those for early carcinoma were 0.959 and 1.016. These survival rates are remarkably high. The five-year survival rate in those who were followed-up after operation for more than five years (83 cases) was 0.554, which is much higher than that of the outpatient cases, who presented themselves for medical advice with some symptoms. The good prognosis is largely explained by a high incidence of early gastric carcinoma in the cases detected in the mass survey. Where methods of screening were concerned, the use of the gastrocamera markedly improved the detection rate of gastric carcinoma.

In 1974 deaths from cancer in Japan totalled 133 702, a death rate per 100 000 of 122.2, making it second only to cerebrovascular accident as the most common cause of death. In the age group 35 to 64 years, cancer was the most frequent cause of death, carcinoma of the stomach being the most frequent, comprising 40.6% in the male, and 34.0% in the female (Hirayama and Watanabe, 1975).

The Japanese show an increasing interest in gastric cancer and gastric mass survey with photofluorography of the stomach was started in Japan in 1956 for its early detection (Ariga *et al.*, 1957). The present authors used it for the first time in 1960 (Sakita *et al.*, 1960), have been engaged in gastrocamera mass survey ever since (Kaneko *et al.*, 1970), and a considerable number of cases of gastric carcinoma have been accumulated. The outcome of gastric carcinomas detected by mass survey was studied to assess the part played by mass survey in lowering the death rate from this disease. Furthermore, cases of gastric carcinoma detected by mass survey were compared with non-mass survey cases.

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Methods

Six mass survey groups, A-F, were studied. The number of examinations and methods of survey are given in Table 1. Among these groups, B consisted of the inhabitants of one of Tokyo's satellite cities, and the other five groups were office workers who underwent mass survey at their place of work.

Mass survey was performed once a year on volunteers of each group. Photofluorography, photographic recording of fluoroscopic images on small films, of the stomach was carried out after giving 250 ml barium meal. Six exposures were taken in a certain sequence of positions.

Gastrocamera examination was performed, without pharyngeal anaesthesia, by using an instrument of small calibre specially devised for gastric mass survey, on the same day of, and immediately preceding, photofluorography.

In the cases of gastric carcinoma detected by mass survey, relative five-year and 10-year survival rates were calculated according to the method of Ederer and his colleagues (1961).

Table 1 Subjects and screening methods

Mass survey group	Mass survey starting in	Total no. examinations (at Jan. 1976)	Primary screening
A	1959	34 844	Photofluorography + gastrocamera
B	1961	14 961	Photofluorography + gastrocamera
C	1961	14 811	Photofluorography
D	1963	16 285	Photofluorography
E	1967	6 857	Photofluorography
F	1967	2 799	Photofluorography + gastrocamera
		Total 90 557	

Table 2 Age distribution of subjects and incidence of gastric carcinoma

Method of screening	Age (yr)					Total
	-29	30-39	40-49	50-59	60-	
Photofluorography + gastrocamera (groups A, B, and F)						
No. examinations	1 465	5 560	21 210	15 761	8 608	52 604
Gastric cancer	0	9	27	35	27	98
Rate (%)	0.00	0.16	0.13	0.22	0.31	0.19
Photofluorography (groups C, D, and E)						
No. examinations	4 774	8 969	16 674	6 789	747	37 953
Gastric cancer	1	7	13	12	6	39
Rate (%)	0.02	0.08	0.08	0.18	0.80	0.10
Total						
No. examinations	6 239	14 529	37 884	22 550	9 355	90 557
Gastric cancer	1	16	40	47	33	137
Rate (%)	0.02	0.11	0.11	0.21	0.35	0.15

Table 3 Type of gastric carcinoma detected by mass survey

Method of survey	Early carcinoma						Advanced carcinoma (Borrmann)				Depth of involvement unknown	
	I	IIa	IIa+IIc	IIc	IIc+III	III+IIc	I	II	III	IV		
Photofluorography + gastrocamera	6	3	1	7	11	8	2	7	22	1	22	8
Photofluorography	1	1	1	5	11	0	0	1	13	2	4	0
Total	7	4	2	12	22	8	2	8	35	3	26	8
Total 137 cases	55						74					

Results

Gastric carcinoma was detected in 137 cases (105 male and 32 female), comprising 0.15% of 90 557 examinations. The age distribution of the subjects and of those with gastric cancer is given in Table 2.

The depth of involvement and gross type in the 137 cases are shown in Table 3. Early gastric carcinoma was found in 55 cases. The criteria of early gastric carcinoma were based on the Japan Endoscopy Society Classification—namely, involvement limited to the submucosa at the deepest. Among them, 42 cases had a depressed type of lesion (IIc, IIc + III, and III + IIc), and 13 had a protruded type (I, IIa, and IIa + IIc). Advanced carcinoma was detected in 74 cases, Borrmann III type being most frequent (35 cases). The gross type was not known in 26 cases

because of unresectability or other reasons. Depth of involvement was not known in eight cases, because they were operated on at other hospitals and sufficient histopathological data were not obtained. Excluding those eight cases, early carcinoma amounted to 42% of 129 cases. All the cases of early gastric carcinoma were, needless to say, resectable. In the 74 cases of advanced carcinoma, however, 11 cases (14.8%) were unresectable.

Table 4 shows five- and 10-year survival rates of the 137 cases. Observed five- and 10-year survival rates of total carcinoma cases were 0.580 and 0.543 respectively. Those rates for early and advanced carcinoma are also given in the Table. Expected survival rates were calculated from the life tables published by the Ministry of Health and Welfare of Japan; relative survival rates were calculated by

Table 4 Five- and 10-year survival rates of 137 cases of gastric carcinoma

	Observed		Expected*		Relative	
	5-year	10-year	5-year	10-year	5-year	10-year
Total carcinoma	0.580	0.543	0.923	0.846	0.628	0.642
Early carcinoma	0.900	0.871	0.938	0.857	0.959	1.016
Advanced carcinoma	0.322	0.272	0.917	0.818	0.351	0.333

*Calculated from the life tables published by the Ministry of Health and Welfare of Japan.

dividing observed survival rates by expected survival rates. Relative five- and 10-year survival rates of total carcinoma were 0.628 and 0.642, respectively. Those of early carcinoma cases were 0.959 and 1.016, and of advanced carcinoma 0.351 and 0.333. The survival rates differed markedly between early and advanced carcinoma. However, no apparent differences were noted between relative five- and 10-year survival rates.

In order to compare our results with those in other reports, observed five-year survival rates for the cases with a lapse of five postoperative years, the conventionally used five-year survival rate, were calculated (Table 5).

To compare the cases of gastric carcinoma detected by mass survey with non-mass survey cases occurring in the same population, two work-place survey groups (C and F) were selected, because all the gastric carcinoma patients occurring in the population of those groups had been accurately registered.

Seventy-two percent of the population underwent mass survey; gastric carcinoma occurred also in those who were not subjected to mass survey: those non-mass survey cases eventually developed symptoms and sought medical consultation, which led to detection of their gastric carcinoma. Thirty-two cases, in total, of gastric carcinoma were found in those groups, of which 24 cases (75%) were by mass survey (Table 6). In eight non-mass survey cases, seven failed to take the opportunity of mass survey.

In the other case, carcinoma was overlooked at the survey one year before. In the carcinomas detected by

Table 5 Observed survival rate in five postoperative years in present series

	Carcinoma			Depth of involvement unknown
	Total	Early	Advanced	
No. cases	83	34	41	8
No. deaths within 5 yr	34	4	28	2
No. lost to follow-up	3	0	1	2
No. alive at 5 post-operative yr	46	30	12	4
Observed survival rate	0.554	0.882	0.293	

Table 6 All carcinoma cases detected in groups C and F

	Early carcinoma	Advanced carcinoma	Total
Mass survey cases	14	10	24 (75%)
Non-mass survey cases	1	7	8 (25%)
Total	15	17	32 (100%)

Table 7 Observed survival rate of gastric carcinoma in five postoperative years

Authors	Mass survey group	Outpatient group
Ikeguchi <i>et al.</i> (1972)	0.524 (11/21)	0.16
Kita (1973)	0.343 (23/67)	
Nishida and Shimamoto (1973)	0.588 (30/51)	0.093
Fujii <i>et al.</i> (1973)	0.667 (36/54)	0.40
	0.500 (15/30)*	0.284*
Chuma and Shimamoto (1973)	0.346 (18/52)*	0.240*
Present series	0.554 (46/83)	0.27†
	0.293 (12/41)*	0.243*†

*Advanced carcinoma cases only.

†From First Department of Surgery, Tokyo University Hospital (Ishikawa *et al.* 1970).

Table 8 Ratio of early carcinoma to total gastric carcinoma

Authors	Mass survey group (%)	Outpatient group (%)
Mashimo <i>et al.</i> (1972)	32.8 (99/302)	
Matsuda <i>et al.</i> (1972)	35.2 (32/91)	25
Iwatsuki (1972)	35.2 (44/125)	
Yamagata (1973)	36.5 (288/789)	
Okui and Teshima (1973)	40.5 (62/153)	
Maeda and Iwasaki (1973)	42.0 (21/50)	23.4
Hiraoka (1973)	37.8 (14/37)	
Ariga (1973)	43.8 (788/1798)	
Present series	42.6 (55/129)	22.7 (140/617)

mass survey a high incidence of early carcinoma (14 of 24 cases) was noted.

Discussion

The outcome of gastric carcinoma detected by gastric mass survey must be compared with that of

outpatient cases to evaluate the significance of gastric mass survey. In the present series, relative five-year survival rates were 0.628 for total carcinoma cases, 0.959 for early and 0.351 for advanced carcinoma cases. The end results of gastric carcinoma were also studied at the National Cancer Centre of Japan by accumulating the data on resected cases of gastric carcinoma from all the major institutes in Japan. According to this study, the relative survival rate for 5815 cases of gastric carcinoma resected from 1963 to 1966 was 0.391, that for intramucosal carcinoma 0.938, for carcinoma with involvement down to the submucosa 0.833, and for advanced carcinoma 0.330 (Miwa, 1975). In that report, however, the unresectable cases amounting to 27% were excluded and the actual survival rate, therefore, must be much lower. In the present series 11 unresectable cases (8.0%) were included in assessing the end results. The favourable prognosis for carcinoma detected by survey in the present series becomes the more evident.

There are several reports on the end results of gastric carcinoma detected by mass survey in Japan expressed in the conventional five-year survival rates (Table 7). The figures show observed five-year survival rates in the cases with a lapse of five or more post-operative years. Those survival rates for mass survey groups are also higher than for outpatient groups at all institutes, thus demonstrating the importance of gastric mass survey.

Why is the prognosis so good for carcinomas detected at mass survey? The morphological features of the lesions are not different from those of outpatient cases: the depressed type of lesion associated with IIC comprises 77% of early carcinoma cases and Borrmann III type lesion is seen most frequently in advanced carcinoma cases found at mass survey; this tendency for the depressed type of carcinoma to predominate is similar to that in outpatient cases.

In mass survey cases, however, the percentage of early carcinoma is extremely high in contrast with outpatient cases. Table 8 reviews the ratio of early to total carcinoma in mass survey and outpatient groups reported in Japan: at any institute, its percentage is higher in the mass survey groups. In the cumulative data from the National Cancer Centre quoted earlier, this ratio is 13.4%. This high incidence of early carcinoma partly explains the good prognosis of carcinoma detected at mass survey.

Secondly, even for advanced carcinomas the prognosis is better in mass survey than in outpatient groups, as shown in Table 7. As a reason for a better five-year survival rate in the mass survey group a higher incidence of carcinoma with relatively limited involvement (down to the muscle layer) is adduced (Yamaguchi and Koshi, 1971).

For a proper evaluation of the role of gastric mass survey, a study must be made in a population in which all the cases of gastric carcinoma are registered; for this reason, the groups of work-place mass survey are suitable for this kind of study, as the subjects' work is stable and their medical status is well investigated.

Analysis of the selected groups of work-place mass survey showed that three-fourths of the carcinoma cases were detected by mass survey and the majority were early carcinoma in contrast with the low incidence of this type of carcinoma in non-mass survey cases. Those facts strongly support the importance of mass survey.

There are two main problems with gastric mass survey: one is the failure of the expected subjects to take part in the survey. All people of cancer age should be encouraged to take the opportunity of mass survey. The other is the problem of overlooking carcinoma in the cases that are examined. To overcome this problem, we have already emphasised the importance of repeated annual surveys (Kaneko *et al.*, 1975). Many cases of early carcinoma were actually detected through repetition of the survey.

As far as the methods of survey are concerned, the detection rate of gastric carcinoma was 0.10% by photofluorography alone, whereas, when photofluorography and gastrocamera examination were combined, it rose to 0.19% (Table 2); thus a considerable difference existed between them. Similar results were reported also by Sakita (1967). Endoscopy must be introduced to gastric mass survey.

References

- Ariga, K. (1973). Follow-up study of gastric carcinoma. *Gastric Cancer*, **25**, 14-21.
- Ariga, K., Honda, T., Shintani, S., Ito, K., and Sato, K. (1957). Gastric mass survey. *Japanese Medical Journal*, **1754**, 13-19.
- Chuma, Y., and Shimamoto, F. (1973). End results of gastric carcinoma detected by gastric mass survey. *Gastric Cancer*, **26**, 8-9.
- Ederer, F., Axtell, L. M., and Cutler, S. J. (1961). The relative survival rate: a statistical methodology. *National Cancer Institute Monograph*, No. 6, 101-121.
- Fujii, A., Saito, T., Fuchigami, A., and Nishi, M. (1973). End results of gastric carcinoma detected by gastric mass survey. *Japanese Journal of Cancer Clinics*, **19**, 852-858.
- Hiraoka, C. (1973). Evaluation of gastric mass survey and follow-up study of gastric carcinoma detected by it. *Gastric Cancer*, **26**, 18-20.
- Hirayama, T., and Watanabe, M. (1975). Future prospects of cancer problem in Japan. *Japanese Journal of Cancer Clinics*, **21**, 962-968.
- Ikeguchi, S., Matsuzawa, Y., Arakawa, S., Momo, A., Takamura, T., Tsuda, H., Yasui, A., Sawada, Y., and Shida, S. (1972). End results of gastric carcinoma detected by gastric mass survey. *Gastric Cancer*, **23**, 57.
- Ishikawa, K., Kusama, S., Muto, T., and Huruyama, E. (1970). Outcome of gastric carcinoma. *Journal of Japan Society for Cancer Therapy*, **5**, 149-152.

- Iwatsuki, S. (1972). Type of gastric carcinoma detected by mass survey. *Gastric Cancer*, **23**, 55.
- Kaneko, E., Niwa, H., Goto, Y., Nakamura, T., Fujino, M., Kasumi, A., Yoshida, A., Matsumoto, M., Utsumi, Y., and Yoshitoshi, Y. (1970). Evaluation of gastrocamera in gastric mass survey. *Gastric Cancer*, **20**, 81-86.
- Kaneko, E., Niwa, H., Umeda, N., and Nakamura, T. (1975). Prognostic study of gastric carcinoma detected by gastric mass survey. *Internal Medicine*, **36**, 139-143.
- Kita, S. (1973). Gastric carcinoma detected by mass survey in Okayama prefecture. *Gastric Cancer*, **26**, 11-12.
- Maeda, H., and Iwasaki, M. (1973). Follow-up study of gastric carcinoma detected by work-place survey. *Gastric Cancer*, **26**, 12-14.
- Mashimo, N., Iizuka, H., Sekiguchi, T., Higuchi, T., Kobayashi, J., Takesawa, H., Inui, S., Kouchi, M., Shimoda, M., Yamada, S., Mime, A., Takei, A., and Shichijo, K. (1972). Type of gastric carcinoma detected by mass survey. *Gastric Cancer*, **23**, 53-54.
- Matsuda, C., Endo, K., Takahashi, K., Hurusawa, M., Kanazawa, K., Goto, H., Mito, S., Shoji, K., Unno, K., and Atami, A. (1972). Morphological features of gastric carcinoma detected by mass survey. *Gastric Cancer*, **23**, 52.
- Miwa, K. (1975). End results of gastric carcinoma. *Japanese Journal of Gastroenterology*, **72**, 1161-1163.
- Nishida, M., and Shimamoto, Y. (1973). End results of gastric carcinoma detected by mass survey. *Gastric Cancer*, **26**, 17-18.
- Okui, K., and Teshima, H. (1973). Survival rate of gastric carcinoma detected by mass survey in local district group. *Gastric Cancer*, **26**, 10-11.
- Sakita, T. (1967). Mass survey of gastric cancer by the gastrocamera. *Proceedings of the General Assembly of the 17th Japan Medical Congress, Nagoya*, vol. 2, pp. 712-717. Igaku Shoin: Tokyo.
- Sakita, T., Ashizawa, S., Utsumi, Y., Yamanaka, M., Tanaka, K., Mori, S., Niwa, H., Omori, K., Kusaka, H., Yoshiya, K., Kaneko, E., and Fujita, K. (1960). Gastric mass survey employing the gastrocamera. *Gastroenterological Endoscopy*, **2**, 68.
- Yamaguchi, M., and Koshi, S. (1971). Comparison of gastric cancer cases between those discovered in gastric mass survey and in outpatients and their prognosis. *Stomach and Intestine*, **6**, 751-758.
- Yamagata, H. (1973). Follow-up study of gastric carcinoma detected by mass survey in local district group. *Gastric Cancer*, **26**, 9-10.