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FACTORS INFLUENCING SURVIVAL OF PATIENTS AFTER RADICAL SURGERY FOR GASTRIC CANCER

A regional study of 406 patients over a 10-year period

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The present retrospective report presents a review of prognostic factors influencing the survival of 406 gastric cancer patients radically operated on in the Tartu Oncology Hospital, Estonia in 1978–1987. All patients underwent total (n = 170) or subtotal (n = 236) gastrectomies with extensive lymphadenectomy (260 R2- and 146 R3-resections) according to the General Rules for the Gastric Cancer Study in Surgery and Pathology established by the Japanese Research Society for Gastric Cancer, introduced in our hospital at the end of the 1970s and now used as the unavoidable procedure for curative gastric cancer surgery. The 30-day postoperative mortality was 5.9% and the overall 5-year survival 46.1%. The male:female ratio was 0.95 and the mean age 62.4 years. Only 7.6% of all our patients operated on had early gastric cancer with a 5-year survival of 80.7% whereas 76.8% had T3–T4 tumours with a 5-year survival of 41.0%. Lymph node involvement was found in 44.6% of the patients. Independent favourable prognostic factors were (the 5-year survivals are presented within parentheses): limited (N0–N1) lymph node involvement (56.4 vs. 22.6%), pT 1–2 stage (62.8 vs. 41.0%), papillary, tubular or poorly differentiated histological pattern (51.9 vs. 33.1%), subtotal gastrectomy (55.9 vs. 32.4%) and age below 70 years (51.9 vs. 35.2%). Sex of patients, Borrmann type, size and site of tumour were not statistically associated with prognosis at multivariate analysis. Our results also suggested that besides predetermined prognostic factors, the surgical policy had a great impact on the prognosis of gastric cancer patients. We conclude that gastrectomy with combined resections of neighbouring organs directly invaded and with extensive lymphadenectomy at least up to the second node group might be the procedure of choice for advanced gastric cancer.

Marked variability of the gastric cancer incidence is observed as well as a general tendency to decrease. In Estonia this decline has been less expressed than in most of the neighbouring North-European countries (1–4). The morbidity rate in our country has changed from 53.1 in males and from 39.4 in females per 100 000 in the 1970s to 41.9 in males and 32.0 in females in the 1980s (5, 6). Most cases of gastric cancer were detected in advanced stages, and only very rare cases were operated in early stages. It is thus essential to analyse the results of gastric cancer treatment and improve the results of therapy.

The high survival rates in Japan are attributed to a successful screening programme for the detection of early gastric cancer, better staging and more aggressive surgical treatment with extended lymphadenectomy (7). Extended lymph node dissection (so-called R2 and R3 resections) became standard treatment in Japan for all cases of advanced gastric cancer in the middle of the 1970s and most of the Japanese authors have pointed out the relationship between extensive lymph node dissection and better cure

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results (8–11). In the opinion of many authors adjuvant chemotherapy has offered no significant benefit in curative treatment of gastric cancer (12–14).

In Europe, extensive screening programs have not been established and the therapeutic results can be improved only by using extensive surgical techniques. Thanks to the good results shown in Japanese studies the practice of extended lymphadenectomy has gained increased acceptance in many European hospitals in recent years (1, 16, 17).

In our hospital the principles of extended lymphadenectomy were introduced at the end of the 1970s and we consider this procedure necessary in curative gastric cancer surgery. In the present retrospective report we have analysed the influence of different prognostic factors on the survival of gastric cancer patients with reference to the effectiveness of extensive surgical procedures.

Material and Methods

Among 690 patients with primary gastric cancer (with the exception of stomach stump cancer), treated surgically at the Department of Oncosurgery, Tartu Hospital of Oncology, Estonia during the 10-year period from 1978 to 1987, 406 (58.8%) underwent curative resection (18) with extended (R2 or R3) lymphadenectomy. The following cases were excluded from the present study: patients who underwent bypass procedures or palliative resections due to distant metastases or technical inoperability; those who underwent gastrectomies with only group 1 lymph node dissection (R1 lymphadenectomy) because of high operative risk, i.e. non-curative procedures in our conception; and some of those who underwent R4 lymphadenectomy (i.e. dissection of N4, mainly the para-aortal lymph nodes) with very high postoperative mortality or early recurrence of malignancy. All the clinico-pathological data were collected from case histories and from the database of the Estonian Cancer Registry.

Depth of invasion was classified as pT1 (tumour confined to mucosa and submucosa), pT2 (invasion of proper muscle layer and subserosa), pT3 (invasion into serosa) and pT4 (invasion of contiguous structures) according to the UICC rules (19). Advanced gastric cancer was defined as 'invasion or deeper invasion of the tumour into muscularis propria by histopathological examination' (18). Tumour location was divided into upper, middle and lower third or total involvement of the stomach. Histology was classified as papillary and well or moderately differentiated tubular adenocarcinoma, interpreted as the intestinal type, and poorly differentiated adenocarcinoma, signet-ring cell or mucinous tumours, interpreted as the diffuse type, and undifferentiated carcinomas (18). The macroscopical types of tumour were classified according to Borrmann's classification as type 1—polypoid, type 2—ulcerated, type 3—ulcerated with partially diffuse infiltrating border, and type 4—diffusely invading tumour. Lymph nodes from different anatomical positions (lymph node stations 1–16) were divided into 4 N-groups (N1, N2, N3 and N4) according to the location of the primary tumour (18). In each case only the most distant lymph node station affected is mentioned.

The operative procedures were performed according to the recommendations of Japanese surgeons (8, 9, 18). Operation with curative intention was defined as 'removal of all macroscopic cancer i.e., primary tumour with margins histologically free of cancer and all involved lymph nodes' (18). The required cancer-free distance at the proximal margin was more than 5 cm in circumscribed tumours and more than 8 cm in infiltrative tumours. Total gastrectomy was regarded as indicated when the proximal distance from the cardia was less than required or in Borrmann types 3 and 4 (8). Extended lymph node dissection was carried out according to the recommendations of the Japanese Research Society for Gastric Cancer (18). Dissection, called R2 lymphadenectomy, always included the perigastric nodes, excluding the left cardial nodes in distal gastrectomy and nodes located along the left gastric, common hepatic, splenic and coeliac arteries. In cases of non-antral location the nodes in the splenic hilum were also removed. The nodes of group 3 (R3 lymphadenectomy) from the hepatoduodenal ligament, behind the pancreatic head and the root of mesenterium were dissected in cases of palpable changes in the perigastric lymph nodes. If needed, frozen sections were examined before making decisions about the extent of lymphadenectomy. In cases of lymph node metastases, the aim was to obtain a margin of at least one uninvolved group of lymph nodes distal to the most peripherally involved group. The lymph nodes were always removed en bloc with the stomach and surrounding fatty tissue.

The statistical data analysis was made in the SPSS system, using uni- and multivariate (Cox regression) analyses of variance, the significances were calculated by the χ^2-method and Student's t-tests.

Results

The 30-day postoperative mortality for all radically operated patients was 5.9 (24 of 406): it was highest for R3 lymphadenectomy (11.0%), followed by total gastrectomy (10.6%) and proximal subtotal gastrectomy (10.0%), and was relatively low for R2 lymphadenectomy (3.1%) and for distal subtotal gastrectomy (2.2%). Table 1 shows the distribution of the prognostic factors and the 5-year survival rates for the patients who underwent curative surgery and Table 2 presents the results of the univariate analysis of the influence of these factors on survival. Univariate analysis showed as favourable factors age below 70 years, tumour location in the lower or middle part of the stomach, Borrmann I–II type, tumour size less than 4 cm, intestinal histological type, pT 1–2 stage, limited (N0–N1)

Table 1

5-year survival rates in relation to different prognostic factors

Prognostic factor	Patients		5-year survival	
	n	(%)	n	(%)
Sex				
Male	198	48.8	93	46.9
Female	208	51.2	94	45.2
Age, years				
30–39	7	1.7	5	71.4
40–49	49	12.2	22	44.9
50–59	106	26.1	59	55.7
60–69	119	29.3	57	47.9
70–79	115	28.3	42	36.5
>79	10	2.5	2	20.0
Location				
Antrum	200	49.3	103	51.5
Corpus	140	34.5	67	47.9
Cardia	42	10.3	12	28.6
Total	24	5.9	5	20.8
Borrmann type				
I	17	4.2	13	76.5
II	176	43.3	101	57.4
III	105	25.9	40	38.1
IV	108	26.6	33	30.6
Tumour diameter (cm)				
<4	57	14.0	41	71.9
4–7	192	47.3	85	44.3
8–12	123	30.3	53	43.1
>12	34	8.4	8	23.5
Histologic type				
Papillary adenocarcinoma	7	1.7	4	57.1
Tubular adenocarcinoma				
well differentiated	52	12.8	33	63.5
moderately differ.	112	27.6	57	50.9
Poorly differentiated adenocarcinoma	108	26.6	51	47.2
Mucinous adenocarcinoma	23	5.7	7	30.4
Signet ring cell carcinoma	30	7.4	11	36.7
Undifferentiated carcinoma	74	18.2	24	32.4
pT category				
pT1	31	7.6	25	80.7
pT2	63	15.5	34	54.0
pT3	218	53.7	96	44.0
pT4	94	23.2	32	34.0
pN category				
pN0	225	55.4	135	60.0
pN1	57	14.0	24	42.1
pN2	99	24.4	25	25.3
pN3	25	6.2	3	12.0
Gastrectomy				
Distal subtotal	226	55.7	127	56.2
Proximal subtotal	10	2.5	5	50.0
Total	170	41.8	55	32.4
Lymph node removal				
R2	260	64.0	137	52.7
R3	146	36.0	50	34.3
Extent of lymphadenectomy relative to nodal stage (R minus N)				
0	81	20.0	19	23.5
1	77	19.0	24	31.2
2	195	48.0	115	59.0
3	53	13.0	29	54.7

Table 2

Univariate analysis of prognostic factors influencing the 5-year survival of gastric cancer patients

Prognostic factor	Favourable (5-year survival)	Unfavourable (5-year survival)	p-value
Sex			NS[1]
Age	< 70 (51.9%)	> 70 (35.2%)	<0.01
T	1–2 (67.8%)	3–4 (41.0%)	<0.0001
N	0–1 (56.4%)	2–3 (22.6%)	<0.00001
Histologic type	intestinal (55.0%)	diffuse (39.6%)	<0.01
Borrmann type	I–II (59.1%)	III–IV (34.3%)	<0.0001
Size of tumour	< 4 cm (71.9%)	⩾ 4 cm (41.8%)	<0.0001
Site of tumour	antrum and corpus (50.0%)	cardia and total (25.8%)	<0.0001
Gastrectomy	subtotal (55.0%)	total (32.4%)	<0.00001
Lymphadenectomy	R2 (52.7%)	R3 (34.3%)	<0.00001
R minus N[2]	2–3 (58.1%)	0–1 (27.2%)	<0.00001

[1] Not significant, [2] Extent of lymphadenectomy relative to nodal stage

lymph node involvement, subtotal gastrectomy, R2 versus R3 lymphadenectomy and an extent of lymphadenectomy more than one N-group from the involved lymph nodes. The influence of age of patient at operation, tumour sites, and different histological types were statistically less marked than other factors. The year of operation and the sex of patients did not significantly influence survival. The overall 5-year survival was 46.1% including the 30-day postoperative mortality. The male:female ratio was 0.95 (198:208) and the mean age was 62.4 years (range 31–80 years). We observed a decreased survival with increasing age of the patients at time of the operation. Of our patients 49.3% had cancer with antral location and only 10.3% with cardial location. During the observed 10-year period we did not notice significant changes in the locational distribution of tumours. The survival rates were nearly two times higher in the cases with antral or middle location than in those with cardial location or total involvement of the stomach. The ratio of the circumscribed and the infiltrative macroscopic types of tumours according to the Borrmann classification was 1:1 and the difference of the 5-year survival rates between these two groups was significant. The 5-year survival rates diminished with increasing tumour size. Significantly different survival rates were found only between tumours smaller than 4 cm and larger ones. The mean diameter of the removed tumours was 6.2 cm and ranged from 1 to 23 cm.

The most common histologic types were moderately differentiated tubular adenocarcinoma (27.6%) and poorly differentiated adenocarcinoma (26.6%). The survival rates were noticeably higher in cases of papillary and well or moderately differentiated adenocarcinoma. The 5-year survival rate was also relatively high (47.2%) in cases of poorly differentiated adenocarcinoma that one might suspect to have poor prognosis. The 5-year survival rate was 30.4–36.7% for patients with the cancers of mucinous, signet-ring cell type or undifferentiated structure.

Only 7.6% of all our patients operated on had early (T1) gastric cancer with a 5-year survival rate of 80.7% whereas 76.8% had T3–T4 tumours with a 5-year survival of 41.0%. Lymph node involvement was found in 44.6% of the patients and in 31% of the node-positive cases it extended to N1-nodes, in 54.7% to N2-nodes and in 13.8% to N3-nodes. The 5-year survival rates differed much depending on the presence of lymph node metastases and were strongly correlated with the extent of the nodal involvement.

In this material 226 distal subtotal, 170 total and 10 proximal subtotal gastrectomies were performed. Neighbouring organs were resected in 176 cases (42.9%), most frequently the spleen (141 cases) and the distal part of the pancreas (28 cases). In 64.0% of the cases the patients underwent dissection of N1 and N2 nodes (R2-resection) and in 36.0% so-called R3-resections. The 5-year survival rate 52.7% for R2-resections and 34.3% for R3-resections. Comparing the lymphadenectomies with different extension as to the extent of lymph node involvement (R minus N), extensive lymphadenectomy had a favourable effect only when it encompassed more than one uninvolved group of lymph nodes. The 5-year survival was 27.2%, when R minus N was equal to 0 or 1 and 58.1%, when it was equal to 2 or 3.

In the multivariate analysis using Cox's regression model (Table 3), all factors tested by the univariate analysis were used. This analysis identified 5 prognostic variables that significantly influenced the risk of death. Among these, lymph node involvement was the most important independent prognostic factor, followed by extent of gastrectomy, depth of invasion, histological type of cancer and age of patients.

Table 4 shows the relationship between the 5-year survival rate and the presence of lymph node metastases and the level of intramural cancer invasion. In general, the 5-year survival rate correlated well with both the extent of

Table 3

Results of the Cox regression multivariate analysis of prognostic factors after curative surgery

Variable	Relative risk of death (95% confidence interval)	p-value to remove
Nodal involvement		0.0000
N0	1.0	
N1	1.57 (1.04–2.37)	
N2	2.48 (1.81–3.41)	
N3	3.98 (2.45–6.48)	
Extent of gastrectomy		0.0003
Subtotal	1.0	
Total	1.68 (1.27–2.23)	
Depth of invasion		0.0098
T1	1.0	
T2	2.04 (0.84–4.96)	
T3	2.27 (0.99–5.23)	
T4	3.24 (1.38–7.62)	
Histologic type		0.017
Papillary or tubular	1.0	
Poorly differentiated	1.01 (0.70–1.43)	
Others[1]	1.51 (1.09–2.09)	
Age, years		0.017
<70	1.0	
>69	1.42 (1.07–1.88)	
Did not significantly improve model		p-value to enter
Borrmann type		0.11
Location		0.24
Size		0.52
Extent of lymphadenectomy		0.059
R minus N factor		0.47
Sex		0.46

[1] Mucinous, signet-ring cell and undifferentiated carcinomas

Table 4

Incidence of cases with lymph node metastases and the 5-year survival rates in relation to pT stage (number of cases and 5-year survival rates)

	T1		T2		T3		T4		Total	
	n	5-yr survival	n	5-yr survival	n	5-yr survival	n	5-yr survival	n	5-yr survival
N0	28	82.1	37	64.9	106	56.6	54	51.9	225	60.0
N1	0	–	7	71.4	45	42.2	5	0.0	57	42.1
N2	3	66.7	10	30.0	57	28.1	29	13.8	99	25.3
N3	0	–	9	22.2	10	10.0	6	0.0	25	12.0
Total	31	80.7	63	54.0	218	44.0	94	34.0	406	46.1

lymph node metastases and the depth of tumour penetration. There was a significant difference of the 5-year survival rates between the node-positive and the node-negative groups, 28.7% and 60.0% respectively, and also between the early and the advanced cases of cancer, 80.7% and 43.2% respectively. The highest 5-year survival rate was found in patients with early gastric cancer without lymph node metastases (82.1%) and the lowest rate in patients with T3–T4 tumours with N3-positive nodes (6.3%). The extent of lymph node involvement showed a correlation with the T stage.

Discussion

A decline in operative mortality rates after radical gastric cancer surgery over the past 30 years has been demon-

strated throughout the world (20), but it is still regarded as unacceptably high by many practitioners. The overall 30-day postoperative mortality for our patients—5.9%—is higher than the one reported after comparable surgery in Japan, but it is equal to the rates published in non-Japanese series (2, 12, 15, 16, 21). The postoperative mortality was high after R3 lymphadenectomy and total gastrectomy (11.0% and 10.6% respectively). Although we achieved the higher radicality partly at the cost of a higher mortality, we do not consider these mortality rates as reasons to avoid extensive surgery, the more so as there are no effective alternative methods.

Differences in the incidence of early gastric cancer, in the extent of surgical resections and in the epidemiological factors are considered responsible for the variation in the survival rates of patients who have undergone curative surgical treatment of gastric carcinoma (4, 20, 22). In our study, however, multivariate analysis indicated that extent of lymphadenectomy (R2 or R3) by itself or relative to the stage of nodal involvement, as well as location, size and Borrmann type of tumour were not independent prognostic factors. This study included only patients in whom extensive (R2 or R3) lymphadenectomy was performed and therefore this factor could not influence the survival rates in the analysed cases. Size and Borrmann type of tumour had a strong correlation with prognosis. However, since these factors are closely related to depth of invasion and lymph node metastases, they had no independent prognostic significance when the analysis was adjusted for other variables. Multivariate analysis identified five prognostic factors as independent and important predictors of recurrence and death of patient. Three of these important factors—depth of invasion, nodal involvement and histological pattern—are inherent pathologic features of the tumour at the time of operation.

After curative gastrectomy in patients without peritoneal dissemination or liver metastasis, gastric wall invasion and lymph node involvement have proved to be the most important predictors of tumour progression (9, 18). Lymph node involvement is often stated to be one of the main prognostic factors (16, 23, 24) and our data confirm this statement. The extent of lymph node involvement among our patients showed the dependence on the T stage. Significant differences existed in survival rates relative to the nodal status. Despite the extensive lympha-denectomy used in all cases, the cure results in N3 positive cases were quite modest. However, the frequency of metastases in N2 and N3 nodes determined the necessity of extensive node dissection. In the present study the R2-lymphadenectomy had a significantly more favourable effect on the prognosis than R3-lymphadenectomy by the univariate but not by multivariate analysis. This result can be explained by the fact that R2-lymphadenectomy was more frequently associated with subtotal gastrectomies and limited (N0–N1) lymph node involvement (78.5% of the R2-cases), while most R3-lymphadenectomies were performed in combination with total gastrectomy and only 53.4% of these cases were associated with limited nodal involvement. The concept that lymphadenectomy is bene-ficial only when it widely encompasses the disease is not new (12). The present study suggested that extensive lymph node dissection (R2 or R3) offered more benefit to patients with no or limited (N1) nodal disease and that the distal distance of lymphadenectomy to the metastatic nodes was important.

We have attempted to determine the extent of nodal disease before gastrectomy by frozen-section examination of macroscopically suspicious nodes around the stomach. However, the postoperative histological examination of the removed lymph nodes showed that incidental biopsies during the operation cannot be relied on because of large number of false-negative and false-positive results. The histological examination of lymph nodes during the observed period implied only one-step sectioning of enlarged nodes and therefore some micrometastases might have remained undetected. At present all removed nodes undergo microscopical examination and the three-step-sectioning method has been introduced to make the data concerning lymphogenic spread more precise.

Serosal invasion is considered to be a predictor of poor prognosis for gastric cancer involvement (2, 22). From the results of the present study we may conclude that a proper muscular layer (pT2) is associated with a high incidence of lymph node metastases and the survival rates in these cases come closer to the rates for T3 than for T1 cases. Therefore we agree with the Japanese surgeons and consider the pT2-tumours to be advanced. Patients with serosal invasion (pT3) had a relatively favourable prognosis, especially when there were no lymph node metastases—the 5-year survival rate for those patients was 56.6%. Tumours with invasion of contiguous structures (pT4) had also good survival (34.0% at 5-years) particularly cases without nodal involvement. Therefore we think that combined resection of neighbouring organs directly invaded by gastric cancer is an effective method. We do not know exactly how splenectomy influences the postoperative course. Most splenectomies were associated with total gastrectomies and R3-lymphadenectomies with a high postoperative morbidity and low survival rates because of the advanced carcinomas.

Multivariate analysis showed that the histological type of cancer was an independent and important prognostic factor. A high frequency of the intestinal type is connected with a high-risk population and a higher survival rate (23). In our series the intestinal types: diffuses types ratio was 1.06 (171 : 161) which is comparable to that in most reports from high-risk areas (4, 9, 15, 16). The frequency of cases with signet-cell carcinoma was relatively low in our series (7.4%) compared to other series reported (8, 16, 22). In 68.7% of all cases the tumours had histological patterns

(papillary, tubular or poorly differentiated adenocarcinoma) with higher 5-year survival rates than the overall rate.

Contrary to most reports (7, 8, 22, 26) we found carcinomas in the upper third of the stomach only in 10.3% of our cases. Proximal tumours have penetrated into the serosa and have lymph node metastases more often than tumours in the distal stomach (22, 26). For early diagnosis of cancer of the upper third of the stomach there is a special need for screening programs as asymptomatic course of the disease is common. The traumatic thoracoabdominal approach with combined gastrectomy in the treatment of cardial tumours also contributes to the high frequency of inoperable cases, particularly in elderly patients who frequently suffer from concomitant diseases. This also accounts for the low number of operable cardial cancer. The overwhelming majority of tumours in our series were located in the lower (49.3%) and middle (34.5%) part of the stomach, where it is easier to guarantee radicality of resection. The survival rate in cases of non-cardial carcinoma was in our series twice as high compared to cases with cardiac location or total involvement of the stomach. Although the tumour location was a prognostic indicator in the univariate analysis, it was not a significant factor in the multivariate analysis because of the close connection with other parameters, perhaps mainly the extent of gastrectomy. We still think that distribution of both tumour locations and histological types may be closly linked to the relatively good survival results in our study. In addition to the predetermined prognostic factors, the surgical strategy probably also had an impact on the prognosis. Of the three surgical treatment factors found to be prognostically significant by univariate analysis, only the type of gastrectomy remained as an important prognostic indicator at the Cox analysis. Total gastrectomy was associated with a much higher risk of death than subtotal gastrectomy (5-year survival 34.4% vs. 0.9%). This large difference is probably mainly explained by various tumour parameters, as Borrmann type of growth, and size and invasion of the primary tumour. We performed total gastrectomy mainly in cases with infiltrative types and deep invasion while subtotal gastrectomy was peferred in limited tumours. In our study the extent of lymph node involvement also correlated significantly with the depth of tumour invasion, Borrmann type and tumour size. However, it did not correlate with the histologic type or the location of the cancer. The small number of proximal subtotal gastrectomies—10—(2.5% of the cases) can be accounted for by the fact that this operation in principle was performed only in cases with small circumscribed tumours and the incidence of such tumours in the cardial region was very low, partly because of diagnostic problems.

The high 5-year survival rate for patients in the 30–39-year group (71.4%) after extensive radical surgery requires a special comment. Because of the more aggressive course of the disease in young people, the number of curatively operated patients in this age group was relatively low (1.7%) and the overall prognosis was worse than in other age groups. On the other hand, the results suggest that it is the young patients who benefit most from extensive surgery; 30.8% of our patients were over 70 years old. We found a rather low 5-year survival rate in the old (35.2% in patients > 70 years) and the very old (20% in patients > 80 years) age groups. Recurrent gastric cancer is probably the dominating official cause of death among elderly patients operated on for gastric cancer. However, too few autopsies are made in these patient groups and the real cause of death may be other than gastric cancer. Aggressive surgery with extensive lymphadenectomy does not always seem to contribute to a favourable prognosis in elderly patients, who usually have concomitant systemic cardiovascular and respiratory disorders and who are therefore at high risk for postoperative complications.

The male : female rate of gastric cancer patients in Estonia is 1.35, while in most reports it is said to be 1.5 or more (3, 8, 9, 10, 16, 22). The male : female ratio in the radically operated cases was 0.95 (198 : 208). That means that there were relatively fewer male patients suitable for radical surgery as males tend to come less for their health and turn later to doctors than females.

To conclude, the present study showed that the prognosis of gastric cancer patients depended on three pathologic features of tumour: lymph node metastasis, depth of invasion and histologic type. Our results demonstrate rather high 5-year survival rates, in some relatively advanced tumour groups (T2N3, T3N2, T4N0). One possible explanation for this outcome may be the relatively well functioning network of specialized oncological care in Estonia, where most gastric cancer patients are operated on by surgical oncologists with similar concept of operative policy. We think that combined en bloc resection of neighbouring organs directly invaded by gastric cancer is an effective treatment method. We would like to emphasize that curative gastric resection should be regularly combined with extensive lymphadenectomy up to the second lymph node group when no lymph node involvement is found. When there are clear macroscopic changes in the perigastric nodes, R3-lymphadenectomy is indicated. When metastases in non-perigastric nodes are found on the frozen-sections examination before gastrectomy, the lymph node dissection should ideally have a margin of at least one uninvolved group of lymph nodes distal to the most peripheral involved group of node stations, although it does not always gaurantee a favourable prognosis. In our patients the muscularis propria layer or deeper invasion was associated with a high incidence of lymph node metastases and low survival rates. Therefore we favour extensive lymph node dissection in all cases of advanced cancers of the stomach. Aggressive surgery with extensive lymphadenectomy can safely be performed in

young patients, whereas in elderly patients with concomitant systemic disorders this approach must be used more selectively.

The relatively high 5-year survival rates preseneted in our study may, at least partly, be due to the high frequency of intestinal histological types and lower or middle location of the tumours in the stomach. The incidence of early gastric cancer among radically operated patients in Estonia is extremely low. We are of the opinion that a screening program for early detection of gastric cancer should be started. At present a decrease in the mortality of the gastric cancer can be achieved only by extensive surgery.

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