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Quality of survival in patients with surgically treated bronchial carcinoma

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ABSTRACT Quality of survival was studied in 69 surgically treated bronchial carcinoma patients (25% of a total of 273 patients in an unselected epidemiological sample). The Carlens vitagram index was used. The quality of survival in patients cured by pulmonary resection was excellent. It was poor in patients who underwent resection and subsequently died, and especially in patients who had non-resectional thoracotomies. The patients who were operated on and later died did not have a better quality of survival than non-surgically treated patients in the same stage. Thus pulmonary resection has no palliative effect in bronchial carcinoma patients who are not cured. The possible benefit of "removing the tumour burden" in patients treated with operation alone can, therefore, be dismissed. The only aim of the operation at present must be to cure.

Until recent years the quality of survival after different treatment regimens in malignant disease had received very little attention, the whole therapeutic effort being concentrated upon survival times alone. This has been the case with bronchial carcinoma, where only a few studies of the quality of survival have been made.[1-4] In an epidemiological investigation of a bronchial carcinoma population, an effort was made to define and measure the quality of survival.[5-10] The present communication deals with the surgically treated patients of this series.

A vitagram index was constructed and systematically applied.[5-8 11] In surgically treated bronchial carcinoma patients a vitagram index may be used to elucidate the quality of survival in the following groups. (1) Patients undergoing pulmonary resection who are cured. (2) Patients undergoing pulmonary resection who subsequently die from the disease. Does operation offer any palliation in this group? (3) Patients undergoing a non-resectional thoracotomy only. What is the impact of the surgical trauma in this group? Should this group be kept maximal or minimal?

As the vitagram index is a type of performance scale, it may also be used to describe the performance status of the patient before treatment. The patient's symptoms may have a bearing on the outcome, and so tests were made to see whether the pre-treatment performance status could be used as a prognostic index.

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Patients and methods

During the period 15 November 1971–14 November 1976 a prospective clinical study was conducted on the total unselected epidemiological sample of patients with bronchial carcinoma in the Swedish county of Uppsala.[5] The county had a mean population of 227 169 during the investigation. All patients with histologically or cytologically verified bronchial carcinoma according to the World Health Organisation classification groups I–V[12] were included. An estimation based on a check with the data in the Swedish Cancer Registry showed that the sample collected corresponded to at least 97% of the total bronchial carcinoma population of the county.

There were 273 cases of bronchial carcinoma. Sixty-nine of these underwent operation (25%). All patients were staged before operation according to the clinico-anatomical classification shown in table 1.[13]

The patients were reviewed one month after their operation and subsequently at three-monthly intervals. Intervening investigations were made when the patients deteriorated. At follow-up a Carlens vitagram was constructed (table 2).[5-11] The quality of survival was expressed as the total sum of vitagram points during the

Table 1 *Clinico-anatomical staging classification*

	I	*II*	*III*
Indolent	1	2	4
Obtrusive	2	3	4
Metastatic	4	4	4

I=no metastases.
II=local metastases (includes hilar and mediastinal lympho-glandular metastases).
III=distant metastases (includes metastases to parietal pleura, costal and thoracic wall metastases, and supraclavicular lympho-glandular metastases).
Indolent=no carcinoma symptoms or primary tumour symptoms during a period of > six months.
Obtrusive=primary symptoms during < six months or systemic symptoms or both.
Metastatic=symptoms of distant metastases.
1–4=clinico-anatomical stages.

Table 2 *The vitagram point index*

Quality of survival	*Points per month*
1 Fulltime working capability*	+20
2 Halftime working capability*	+16
3 Ambulatory without working capability†	+12
4 Confined to bed†	+ 8
5 Symptoms of bronchial carcinoma and/or side effects of specific carcinoma therapy during 1–4	− 4
6 Hospital treatment during 3–4	− 2

*Those above working age were assessed according to their real capacity
†Other reasons for incapacity for work, such as concurrent diseases, and for not working, such as social circumstances, were disregarded.

patients' remaining life, and also as the average sum of vitagram points per month. An attempt was also made to identify certain main types of vitagram typical of the patient not cured by operation. The initial vitagram point sum (=the sum of the vitagram points in the three days immediately before the first admission to hospital) was also calculated as an expression of initial pre-treatment performance status.

The results are based on a minimum observation period of 3·2 years and a maximum of 8·2 years. The expected five-year survival was based on the histopathological radicality of the operation using the life table method.[14] The operation was defined as not radical when the excised specimen showed tumour invading blood vessels, when the proximal bronchial ring was found not to be free of tumour tissue, when there was tumour growth in the pleura, and when there was tumour growth in lymph nodes with extracapsular extension.

Results

PRE-TREATMENT CHARACTERISTICS

The main pre-treatment characteristics have been described fully elsewhere.[15] The age distribution and the initial vitagram point sum are given in table 3 for the various subgroups.

SURGICAL TREATMENT

There were nine non-resectional thoracotomies, 18 pneumonectomies, and 43 lobectomies of varying extent. The surgical mortality (two-month mortality) was 7%.

Table 3 *Initial descriptive variables (mean, range, median)*

	Age (yr)	*Initial vitagram points*
Total n=69	61·5 (24–78)	1·4 (0·6–2·0) 1·6
Clinico-anatomical stage 1 n=30	64·0 (44–78)	1·7 (0·6–2·0) 2·0
Clinico-anatomical stage 2 n=39	59·5 (24–76)	1·2 (0·6–1·6) 1·2
WHO group I n=37	62·1 (31–78)	1·3 (0·6–2·0) 1·6
WHO group II n=6	51·7 (24–70)	1·3 (0·6–1·6) 1·6
WHO group III n=23	62·7 (44–73)	1·6 (0·6–2·0) 1·6
WHO group IV n=3	64·3 (58–76)	1·5 (0·8–2·0 1·6
Non-resectional thoracotomy n=19	60·6 (70–78)	1·2 (0·6–2·0) 0·8
Pneumonectomy n=18*	57·2 (24–73)	1·3 (0·6–2·0) 1·6
Lobectomy† n=43	63·3 (31–78)	1·5 (0·6–2·0) 1·6
Patients >70 years n=19	72·4 (70–78)	1·6 (0·6–2·0) 1·6
All deceased patients n=48	60·7 (24–78)	1·2 (0·6–2·0) 1·6
Survivors n=21	63·1 (45–73)	1·6 (0·6–2·0) 1·6
Expected five-year survivors n=20	62·7 (45–73)	1·5 (0·6–2·0) 1·6
Expected five-year survivors, four who have died of concurrent diseases included n=24	63·9 (45–75)	1·5 (0·6–2·0) 1·6

*One patient first underwent non-resectional thoracotomy and then after radiotherapy and iv bleomycin, pneumonectomy.
†Including procedures varying in extent.

Table 4 *Prognosis in deceased surgically treated patients distributed by different grouping variables (mean, range, median)*

	Total (n=48	*Non-resectional thora-cotomies n=9**	*Pneumon-ectomies n=16*	*Lobectomies n=24*	*Patients over 70 years n=14*	*Patients in clinico-anatomical stage 1 n=18*	*Patients in clinico-anatomical stage 2 n=30*	*Patients in WHO group I n=27*	*Patients in WHO group II n=6*	*Patients in WHO group III n=13*	*Patients in WHO group IV n=2*
Survival in months	12·3	7·5	13·0	12·3	11·1	13·4	10·8	11·7	9·5	14·1	4·7
	(0·0–41·3)	(0·0–17·2)	(3·9–41·3)	(0·5–30·0)	(0·5–23·3)	(0·5–30·0)	(0·0–41·3)	(0·0–41·3	(0·5–19·8)	(0·4–30·0)	(3·6–5·8)
	9·3	5·7	9·7	11·9	11·8	13·2	8·6	8·8	9·7	13·2	4·7
Total sum of vitagram points	114·9	52·7	104·8	141·0	114·3	147·2	95·5	105·9	85·4	159·8	31·2
	(0·0–477·1)	(0·0–144·1)	(20·1–319·6)	(0·7–477·1)	(0·9–336·0)	(0·7–477·1)	(0·0–351·5)	(0·0–336·0)	(0·9–237·1)	(0·7–477·1)	(25·8–37·9)
	75·2	39·4	71·3	109·0	103·2	117·3	57·0	59·7	81·6	115·8	31·2
Sum of vitagram points per month	7·8†	6·6†	7·4	8·3	8·3	8·3	7·1†	8·0†	7·2	8·9	6·9
	(1·8–15·9)	(5·1–8·4)	(3·7–12·0)	(1·8–15·9)	(1·8–14·5)	(1·8–15·9)	(2·0–14·6)	(1·9–14·6)	(1·8–12·0)	(1·8–15·9)	(6·5 7·2)
	7·3	6·6	6·9	7·3	8·4	9·0	6·7	7·0	7·5	7·3	6·9

*One patient who first had a non-resectional thoracotomy and then a pneumonectomy.
†n—1 because one patient with no survival is excluded.

FOLLOW-UP

At the time of writing there are 21 survivors (30%). The expected five-year survival, including the four patients who have died of concurrent diseases and showed no carcinoma at necropsy, is 35% (24 patients). The expected five-year survival computed by the life-table method[14] is 24±6% (see also fig 1[16]).

with cyclophosphamide or radiotherapy (tables 6–8). In almost all comparisons the patients who underwent operation had the lowest survival time and the poorest quality of survival. This difference did not reach statistical significance, however. Thus it is clear that non-curative operations, be they exploratory or resectional, have no positive palliative effect. If anything the effect is negative.

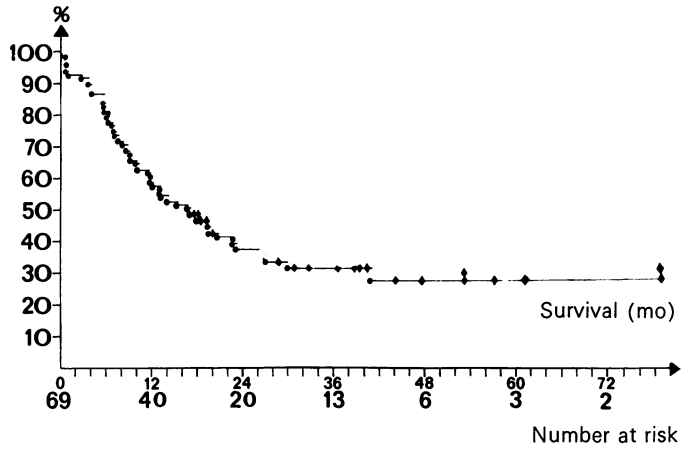

Fig 1 *Life table of the 69 surgically treated patients.*[16] ●=*time of death*, ◆=*trial time of survivors.*

QUALITY OF SURVIVAL

In the expected five-year survivors a very high quality of survival has been attained as measured by the vitagram index. Almost all the patients are capable of work, mostly fulltime (or corresponding activity in the elderly). A detailed study of the quality of survival was made in the group of surgically treated patients who subsequently died, both non-resectional thoracotomies and resections (table 4). Both the survival and the quality of survival were low in the patients submitted to non-resectional thoracotomy.

Examples of the different main types of vitagrams of the deceased surgically treated patients, illustrating their quality of survival, are given in fig 2. (The number of squares in the black area is equal to the total sum of vitagram points.) The distribution of these different main types of vitagram is given in table 5.

A comparison between deceased, surgically treated patients and deceased patients not treated surgically was made, both for the group with non-resectional thoracotomies and for the group with resections. The non-surgically treated patients were taken from the epidemiological sample and the comparison was made in two steps—firstly with a small group of placebo-treated patients, and secondly with a larger group consisting of both the placebo-treated patients and patients treated

Initial performance status levels expressed as initial vitagram point sums on admission to hospital are given for different subgroups in table 3. The initial performance status level was high for those groups with a favourable prognosis—that is, the survivors—and tended to be low in the groups with a poor prognosis, such as non-resectional thoracotomies.

Table 5 *Main types of vitagram (numbers of patients and %)*

Type of operation	*Type of vitagram*		
	Mainly rectangular (fig 2a)	*Mainly "boot" (fig 2b)*	*Mainly "castle" (fig 2c)*
Non-resectional thoracotomy n=9*	7 (79%)	1 (11%)	1 (11%)
Pneumonectomy n=18*	9 (50%)	5 (28%)	4 (22%)
Lobectomy† n=43	31 (72%)	5 (12%)	7 (16%)
Survivors n=21	21 (100%)	—	—
Non-survivors n=48	25 (52%)	11 (23%)	12 (25%)
Total n=69	46 (67%)	11 (16%)	12 (17%)

*=One patient first had a non-resectional thoracotomy and then, after radiotherapy and iv bleomycin, a pneumonectomy.
†=Including procedures of varying extent.

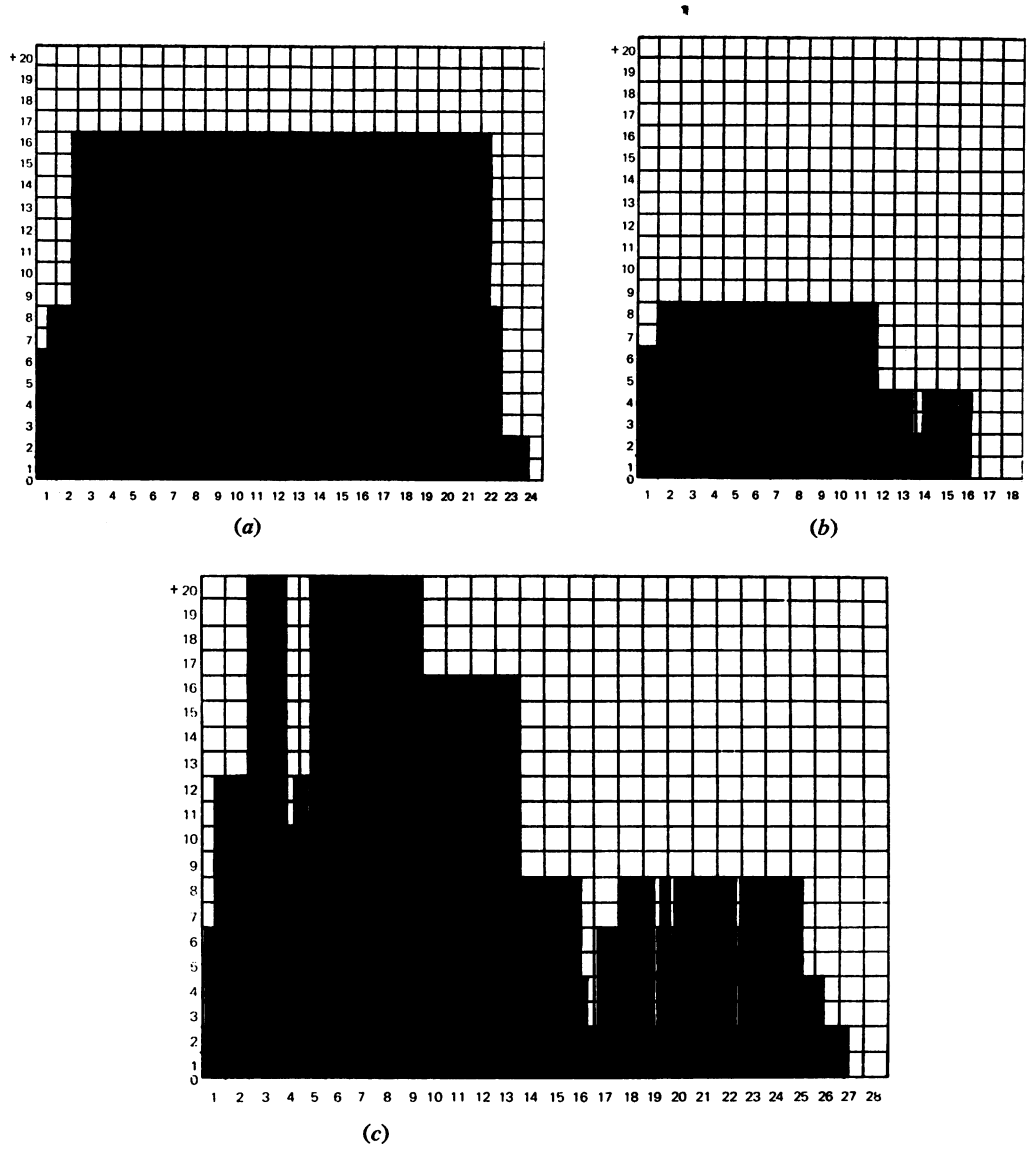

Fig 2 *(a) The mainly rectangular type of vitagram. (b) The mainly "boot" type of vitagram. (c) The mainly "castle" type of vitagram. Months on the x axis, points on the y axis.*

Table 6 *Patients with WHO histological group I carcinoma in clinico-anatomical stage 2 subjected to non-resectional thoracotomy compared with untreated patients and with the group of patients who were untreated or received radiotherapy or cyclophosphamide, all in the same stage and WHO group I*

	Patients with non-resectional thoracotomy (mean, range, median) n=7*	*Untreated patients (mean, range, median) n=12*	*Non-surgically treated patients with no treatment or radiotherapy or treated with cyclophosphamide (mean, range, median) n=25*
Survival in months	8·4	11·7	10·9
	(0·0–17·2)	(0·2–29·0)	(0·2–29·0)
	5·7	10·8	7·9
Total sum of vitagram points	60·2	115·5	91·3
	(0·0–144·1)	(0·6–489·1)	(0·6–489·1)
	56·7	80·2	49·0
Sum of vitagram points per month	6·8†	7·0	6·9
	(5·1–8·4)	(3·0–16·9)	(2·1–16·9)
	6·8	7·1	6·4

NS=not significant.
Survival difference between mean values 3·3 months (n=7 to n=12), $t=0·92$, $p>0·05$, NS.
Survival difference between mean values 2·5 months (n=7 to n=25), $t=0·77$, $p>0·05$, NS.
Difference in total sum of vitagram points between mean values 55·3 (n=7 to n=12), $t=1·05$, $p>0·05$, NS.
Difference in total sum of vitagram points between mean values 31·1 (n=7 to n=25), $t=0·74$, $p>0·05$, NS.
*Five patients received postoperative radiotherapy, mean dose 4540 rad (range 2400–6500).
†n=6, one patient with no survival excluded.

Table 7 *Deceased surgically treated patients in clinico-anatomical stage 1 compared with deceased non-surgically treated patients who received placebo and with the larger group of non-surgically treated patients who received placebo, radiotherapy, or cyclophosphamide, all in the same stage*

	Surgically treated patients (mean, range, median) n=18	*Non-surgically treated patients treated with placebo (mean, range, median) n=5*	*Non-surgically treated patients treated with placebo, radiotherapy or cyclophosphamide (mean, range, median) n=15*
Survival in months	13·4	19·8	19·1
	(0·4–30·0)	(3·8–35·8)	(1·9–50·4)
	13·2	15·2	14·0
Total sum of vitagram points	147·2	169·0	178·8
	(0·7–477·1)	(67·7–327·4)	(3·9–756·7)
	117·3	117·6	117·4
Sum of vitagram points per month	8·9	8·0	7·9
	(1·8–15·9)	(6·6–9·5)	(2·1–15·0)
	9·0	7·7	7·7

Survival difference between mean values 6·4 months (n=18 to n=5), $t=1·31$, $p>0·05$, NS.
Survival difference between mean values 5·7 months (n=18 to n=15), $t=1·41$, $p>0·05$, NS.
Difference in total sum of vitagram points between mean values 21·8 (n=18 to n=5), $t=0·33$, $p>0·05$, NS.
Difference in total sum of vitagram points between mean values 31·6 (n=18 to n=15), $t=0·56$, $p>0·05$, NS.

Discussion

Survival time has been the most frequently used indicator of results of operation in bronchial carcinoma. The quality of survival, less exactly described as "the quality of life", has mostly been mentioned only briefly,[17–19] or discussed in terms of postoperative symptoms and working capability.[1 3 4] Wilde and Baseler[2] reported that 27% of 383 operated patients attained full working capability. The survival time and the possibility of rehabilitation were directly related. In the present series the patients who have survived five years have almost all also been able to return to work (mostly fulltime).

The present method of measuring the quality of survival was proposed by Carlens *et al.*[11] It was systematically applied to our epidemiological sample.[5–8] A methodological and theoretical analysis of the method has also been published.[9 10] Two main methods have been used to express the quality of survival—the performance status in a percentage scale and the quantitative index as the Carlens vitagram point index. The total sum of vitagram points of the Carlens index expresses the performance level, the symptoms of car-

Table 8 *Deceased surgically treated patients in clinico-anatomical stage 2 compared with deceased non-surgically treated patients who received placebo and with the group of non-surgically treated patients who received placebo, radiotherapy, or cyclophosphamide, all in the same stage*

	Surgically treated patients (mean, range, median) n=30	*Non-surgically treated patients treated with placebo (mean, range, median) n=8*	*Non-surgically treated patients treated with placebo, radiotherapy, or cyclophosphamide (mean, range, median) n=27*
Survival in months	10·8	16·6	11·4
	(0·0–41·3)	(5·7–50·1)	(0·7–50·1)
	8·6	11·4	8·0
Total sum of vitagram points	95·5	189·5	105·6
	(0·0–351·5)	(30·7–849·0)	(1·5–849·0)
	57·0	86·4	49·0
Sum of vitagram points per month	7·1*	9·1	7·0
	(2·0–14·6)	(5·4–17·0)	(2·1–17·0)
	6·7	7·0	6·4

Survival difference between mean values 5·8 months (n=30 to n=8), $t=1·56$, $p>0·05$, NS.
Survival difference between mean values 0·6 months (n=30 to n=27), $t=0·24$, $p>0·05$, NS.
Differences in total sum of vitagram points between mean values 94·0 (n=30 to n=8), $t=1·62$, $p>0·05$, NS.
Difference in total sum of vitagram points between mean values 10·1 (n=30 to n=27), $t=0·28$, $p>0·05$, NS.
*n=29, one patient with no survival excluded (at operation death).

cinoma and/or its treatment, and the need for hospital care throughout the whole survival period. By following every index weight on its own—for example, working capability, symptoms, or stay in hospital—a continuity is achieved which is not possible by using a one point in time percentage performance status index. The total sum of vitagram points divided by the number of survival months gives the average sum of vitagram points per month, that is, the average level of the quality of survival during the total survival period or a level of compensatory good and bad days. Because of the varying appearance of the vitagrams in individual patients one criticism of expressing the quality of survival as a total sum of vitagram points is that, for instance, a long survival with a low vitagram level would give the same numerical value as a short survival with a high vitagram level. However, as main types of vitagrams could be defined, and as the main types were similarly distributed in our cases, the total sum of vitagram points can be accepted as a reasonably accurate method of expressing the quality of survival in bronchial carcinoma patients who have undergone surgery. As seen in the graphical illustrations there were three main vitagram shapes: the mainly rectangular type, with a sharp rise after the operation and the maintenance of the high level until shortly before death; the mainly "boot" type, with a high vitagram level after the operation followed by a fairly long period at a distinctly lower level until death; the "castle" type of vitagram characterised by repeated changes in the vitagram level (fig 2a, b, c).

The quality of survival in patients who have undergone resection and are cured is excellent, with few late sequelae, especially after lobectomies, where the patient is to be regarded as essentially normal. There are few major cancer operations which leave the patient so unharmed. Even after pneumonectomy symptoms are infrequent. In the patients who have undergone resection without cure, on the other hand, both the quality and the length of survival are poor. One of the major findings in the present study was that when we compared this group with non-surgically treated patients in the same clinico-anatomical stage of the disease, there was a tendency for the patients who had had resection to have a lower quality and shorter length of survival than the non-surgical patients. Thus lung resections which do not result in cure have no palliative effect. The possible beneficial effect of "removing the tumour burden" can be dismissed. Only very occasionally may there be an indication for a palliative resection.

The quality of survival and the survival time in non-resectional thoracotomies is poor as has been pointed out previously by Pool.[17] Vincent *et al*[19] reported a median survival of six months for 272 non-resectional thoracotomies. In the present series the median survival time was shorter in the patients with non-resectional thoracotomies than in either the group of untreated control patients in the same stage of the disease or a larger group comprising patients treated with radiotherapy or cyclophosphamide in addition to the untreated patients. Thus a non-resectional thoracotomy only adds to the burden of the patient. It is therefore logical to regard both non-

curative resections and, above all, non-resectional thoracotomies as surgical misjudgments, although understandable and unavoidable at the time of decision. Operation should be reserved for those patients who are considered curable. Efforts to increase the proportion of curable patients by early diagnosis, for instance, have to go hand in hand with efforts to reduce the number of non-resectional thoracotomies and non-curative resections.

One line along which it may be possible to work is that of preoperative predictors. Legha *et al*[20] found that the initial performance status was well correlated with survival after surgery. In this series the initial vitagram point sum immediately before admission to hospital, which is another expression of the pre-treatment performance status, showed a constant median level of about 1·6 points in the different groups, except for the non-resectional thoracotomy group where it was low. It is also known that there are several other good predictors of the final outcome in bronchial carcinoma—for example, TNM-classification, clinico-anatomical staging, histology, and involvement of the pulmonary circulation. It might thus be possible to combine these predictors to form an index which may express such a poor prognosis that many of these operations might be avoided. The value of such an index would have to be tested on a much larger series than ours.

One of the controversies regarding operations for bronchial carcinoma has been that of an upper age limit. Larsson[18] advocated an upper limit of 70 years. We have not followed this policy, but have accepted for operation carefully investigated patients over 70 years. Bates[21] reported upon the results of surgery in 87 patients over 70 years of age. The quality of life was assessed as satisfactory, but no method of measurement was given. In the present series the quality of survival in cured patients over 70 years of age was excellent. In patients submitted to resection who subsequently died the quality of survival was on a level with the best groupings. Thus in this carefully selected group of patients above 70 years of age, the period after operation was no worse than in the remaining surgically treated patients. Surgery for bronchial carcinoma above the age of 70 years is therefore indicated in well-investigated, carefully selected patients and gives just as good results as in younger age groups.

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