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Review article

Oesophageal squamous cell carcinoma: I. A critical review of surgery*

RICHARD EARLAM AND J. R. CUNHA-MELO†

SUMMARY

Authors writing on oesophageal cancer include adenocarcinoma to a variable extent—between 1 and 75 per cent —but the true incidence of this histological type is about 1 per cent. Most adenocarcinomas are gastric in origin, involving the lower oesophagus, have a lower operative mortality than in the middle or upper one-third of the oesophagus and poorer prognosis than squamous cell carcinoma, but there is no alternative treatment to surgery. Squamous cell carcinoma of the oesophagus, separated incompletely but as far as possible, has been analysed by reviewing data on 83 783 patients in 122 papers. After trying to standardize the data, it appears that of 100 patients with the condition, 58 will be explored and 39 have the tumour resected, of whom 13 will die in hospital. Of the 26 patients leaving hospital with the tumour excised, 18 will survive for 1 year, 9 for 2 years and 4 for 5 years. Oesophageal resection for squamous cell carcinoma has the highest operative mortality of any routinely performed surgical procedure today.

Carcinoma of the oesophagus is rare and has a poor prognosis. Both these factors probably explain why the operation of oesphagogastrectomy is still accepted as standard treatment in spite of its having the highest mortality of any operation routinely performed. A young surgeon faced with oesophageal carcinoma must decide whether he can improve on the results of the previous generations using newer surgical techniques, intensive care units, modern antibiotics and prophylactic subcutaneous heparin, but it is extremely unlikely that a modern surgeon can beat the older surgeon in pure surgical competence. Should he change direction and try other methods? Radiotherapy is of real use in squamous cell carcinoma, but there is no alternative at the moment to surgery for the treatment of adenocarcinoma of the oesophagus. The purpose of this study is to review the literature on oesophageal carcinoma during the 20-year period of 1960–79 in order to find out the facts about the incidence, treatment and prognosis of squamous cell carcinoma of the oesophagus. Additionally, the classic papers from the 1950 decade have been included. There is no perfect study, so the details must be gleaned from many sources. Detailed statistics are avoided because the original patient population varies greatly. Numbers and percentages are presented as a mean with one standard deviation to show the great variation and an attempt has been made to show what happens to any one hundred patients in a community, including all those with the disease rather than selecting the less advanced cases.

Review of 83 783 patients (*Table I*)

No previous review of the literature has ever accumulated more than 15 000 patients (2, 7, 122). This present study is not fully comprehensive since certain articles have been excluded due to obvious selection of patients, but it is a good representation of events in many countries. The result of treatment in 83 783 patients from 122 papers is presented in the old-fashioned way mixing squamous cell and adenocarcinoma of the oesophagus. Adenocarcinoma of the cardia and lower oesophagus has been excluded if sufficient details are given, otherwise it is included in the figures. Thus, the total number of papers reviewed was more than double the number detailed in *Table I*. Similar to all prior reviews this paper demonstrates that with adenocarcinoma of the lower third of the oesophagus there is a low operative mortality but a poorer prognosis than with squamous cell carcinoma (20, 24, 33, 55). Also, the higher the anastomosis in the chest, the higher the operative mortality (32, 55, 59, 67, 79, 123–126): this can only be reduced by making the anastomosis in the neck (127, 128). An attempt has been made to confine remarks to squamous cell carcinoma of the oesophagus excluding adenocarcinoma as far as possible. The reasons for this are (*a*) the majority of adenocarcinomas of the oesophagus actually arise from the stomach, (*b*) there is no alternative treatment to surgery, (*c*) the percentage varies greatly between each series, (*d*) the operative mortality is much lower than with the higher squamous cell carcinoma so the inclusion of adenocarcinoma to such a variable extent will affect the figures given for all oesophageal cancer and (*e*) the natural history and prognosis of adenocarcinoma is worse than that of squamous cell oesophageal cancer.

* Part II of this paper, 'A critical review of radiotherapy', will appear in the July issue.

† The London Hospital, Whitechapel, London E1.

Table I: DATA FROM 122 PAPERS ON OESOPHAGEAL CANCER SURGERY (83 783 PATIENTS)

First author	Ref.	Year	Country	Patients	% op.	% resect.	% resect. mort.	Survival (%) 1 yr	2 yr	5 yr
Adams	(1)	1965	USA	391	30	17	12			2
Akakura	(2)	1970	Japan	346		54	17	26	14	10
American Joint Committee	(3)	1975	USA	917				24	10	5
Amman	(4)	1971	England	240	63	51				
Anabtawi	(5)	1964	Canada	63	62	33	29	8	2	1
Angorn	(6)	1978	S. Africa	924	13	11				
Appelquist	(7)	1972	Finland	701	54	24	23			4
Appelquist	(7)	1972	Finland	4423		3				1
Beattie	(8)	1967	USA	461		30				2
Belsey	(9)	1974	England	198	85	76	26	20		2
Block	(10)	1964	USA	40	98	63	32			8
Boyd	(11)	1958	USA	335	37	28	26			2
Buck	(12)	1973	USA	118	26	19	35			
Burn	(13)	1971	England	3000	70				18	6
Buschke	(14)	1954	USA	371				12	4	
Carey	(15)	1972	USA	37	100	11				
Cederquist	(16)	1978	Denmark	966	15	7	45	8	5	2
Clark	(17)	1968	USA	82	54	34				
Cliffton	(18)	1960	USA	110	35	17				
Coetze	(19)	1966	S. Africa	244						
Collis	(20)	1971	England	837	54	48	19		11	4
Chinese	(21)	1976	China	1228	100	94	1			
Curto-Cardus	(22)	1970	Spain	69	86	64	34	16	12	3
Dor	(23)	1963	France	68		46	83			
Dunlop	(24)	1961	Australia	180		69	26	22	14	10
Efskind	(25)	1965	Norway	210	100	51	10			
El Domeiri	(26)	1970	USA	75	71	59	39			
Ellis	(27)	1960	USA	909	46	27	20			5
Franklin	(28)	1964	England	129	71	45	57		2	1
Garlock	(29)	1954	USA	270	80	34	42			2
Gary-Bobo	(30)	1978	France	755	30	22	12	23	11	5
Giuli	(31)	1972	France	1071	100	73	35	7	4	1
Goodner	(32)	1969	USA	4854	33	19				
Goodner	(32)	1969	USA	1241	34	21	24			1
Groves	(33)	1965	USA	87		70	20	30	10	7
Guernsey	(34)	1969	USA	40	65	58	22		5	3
Guinn	(35)	1971	USA	155	34	26	17			2
Gunnlaugsson	(36)	1970	USA	1657	55	35	13	25	21	4
Gutgemann	(37)	1953	Germany	6217		45	33			
Hankins	(38)	1972	USA	234	21	18	54	27	6	1
Humphrey	(39)	1968	USA	592	65	41	24			1
Hunt	(40)	1978	S. Africa	387				10		
Inberg	(41)	1971	Finland	59						
Jackson	(42)	1979	England	292	75	74	19	18	9	5
Johnson	(43)	1962	USA	160	100	83	10			9
Just-Viera	(44)	1976	Puerto Rico	4342						1
Kasai	(45)	1978	Japan	430	100	72	16	26	22	12
Kay	(46)	1963	USA	119	50	34	40			2
Keith	(47)	1960	USA	64	42	14				
Killen	(48)	1964	USA	164	44	30	50	7	3	2
Kock	(49)	1967	Sweden	146	82	58	29			10
Kraft-Kinz	(50)	1969	Germany	388		28	11			4
Kyllonen	(51)	1965	Finland	224	52	17	34	6		1
Lawler	(52)	1969	USA	263	47	33	33	23	4	2
Lederman	(53)	1966	England	293		19		3	2	
Leon	(54)	1971	USA	548	59	26		11	3	
LeRoux	(55)	1961	Scotland	428	71	61	36			10
Leverment	(56)	1974	England	452	84	69	34	51		
Loeb	(57)	1965	England	111	56	36				
Logan	(58)	1963	Scotland	853	73	60	29			5
Lortat-Jacob	(59)	1969	France	4000	44	26	53	17		3
Lowe	(60)	1972	USA	600	31			6		1
Marchand	(61)	1978	S. Africa	207	62	45	61			
Marcial	(62)	1966	Puerto Rico	413	31	11		24		4
Marks	(63)	1976	USA	415	33	24			7	5
Martinez	(64)	1964	Puerto Rico	1944		15		3	2	1
McKeown	(65)	1978	England	403	97	92	11			
Milburn	(66)	1968	USA	516	51	25				6

Table 1 (*cont.*)

First author	Ref.	Year	Country	Patients	% op.	% resect.	% resect. mort.	Survival (%) 1 yr	2 yr	5 yr
Milburn	(66)	1968	USA	117	38	29				
Miller	(67)	1962	England	405	67	43	49			5
Milne	(68)	1978	England	600	96	84	27			
Mohansingh	(69)	1976	Scotland	969	78	62	15	10		
Moor	(70)	1968	S. Africa	390	20	5	14		2	
Morrison	(71)	1959	USA	74	46	26	37			1
Moseley	(72)	1968	USA	56	45	38	27	4	2	2
Mullard	(73)	1960	England	140	94	65	40	26	9	
Mustard	(74)	1956	Canada	381	35	26	48	19	7	2
Nakayama	(75)	1974	Japan	6282	66	40	5		6	1
Nealon	(76)	1967	USA	365	75	57				3
Ogilvie	(77)	1960	England	200						
Ong	(78)	1969	China	520	60	27	18			5
Parker	(79)	1976	USA	609	28	19	41		6	2
Parrochia	(80)	1970	Chile	196	66	20	40			
Pearson	(81)	1969	Scotland	1644		26				3
Pelletier	(82)	1972	Canada	75	76	48		9	5	4
Petrov	(83)	1967	Russia	1344	36	18	56			1
Petrovsky	(84)	1967	Russia	227		60	21			4
Pettit	(85)	1957	USA	212	50	23		3		1
Picconi	(86)	1979	USA	89	93	91	10			
Pinch	(87)	1966	USA	57	47	25	50			
Pizzocaro	(88)	1970	Italy	443	30	17	35	7	4	2
Plested	(89)	1968	USA	34	62	56	16	12		
Postlethwait	(90)	1957	USA	253	45	27	45			
Procter	(91)	1968	S. Africa	523		20	50			
Rambo	(92)	1975	USA	486		32		22	11	6
Rappaport	(93)	1964	USA	75		49				
Robertson	(94)	1967	Canada	75	48	44	24			7
Rodriguez	(95)	1969	USA	53	70	43	35	11	6	
Ross	(96)	1974	England	182	45	26				
Rossetti	(97)	1972	Switzerland	482	41					4
Roussel	(98)	1977	France	1402	31	22				
Sanfelippo	(99)	1973	USA	432	61	41				
Segol	(100)	1977	France	8	100	100	13	75	38	13
Seitz	(101)	1973	Germany	164	35				3	
Seymor	(102)	1965	USA	328	28	17	57			
Shedd	(103)	1955	USA	180	41	17	12			
Skinner	(104)	1976	USA	110		53	43	21		3
Smith	(105)	1975	Australia	41	63			29		5
Spath	(106)	1970	Germany	388	28					4
Stoller	(107)	1977	Canada	127	43			11	6	1
Stone	(108)	1977	USA	86	79	60	12			7
Sweet	(109)	1954	USA	450	100	67	17	28	13	4
Takita	(110)	1977	USA	153	26					1
Turnbull	(111)	1968	USA	1859						2
Van Houtte	(112)	1977	Belgium	136		12	13	19	5	
Vander-Vennet	(113)	1965	USA	150	35	24	69			1
Wahlers	(114)	1975	Germany	205				21	3	1
Watson	(115)	1963	Canada	37		24				
Webb	(116)	1975	Scotland	52	100	44	30	25	13	2
Wilkins	(117)	1975	USA	40	100	60	25			
Wilson	(118)	1970	USA	40	50	45	6			
Wosornu	(119)	1970	Scotland	66	77	56	24			5
Younghusband	(120)	1970	Australia	191	57	39	17		16	6
Zacho	(121)	1965	Denmark	204	86	46	22		11	
Zenker	(122)	1966	Germany	6310		26				2

% operations	58±24 (mean±1 s.d.)
% resected	39±22 (mean±1s.d.)
% resection mortality	29±16 (mean±1 s.d.)
% 1-year survival	18±13 (mean±1 s.d.)
% 2-year survival	9±7 (mean±1 s.d.)
% 5-year survival	4±3 (mean±1 s.d.)

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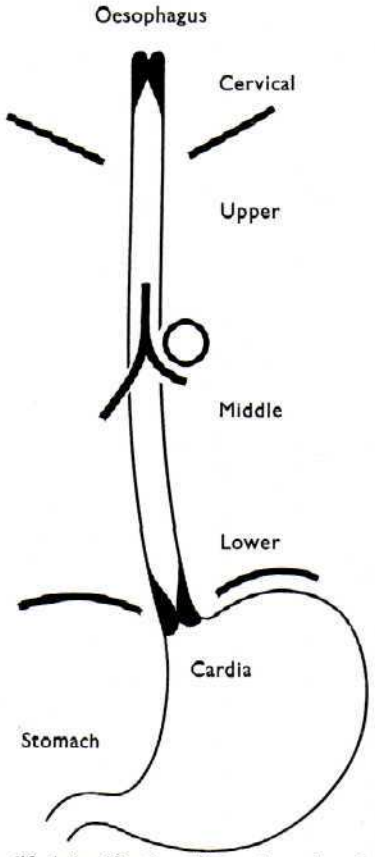

Fig. 1. A simplified classification of oesophageal carcinoma by anatomical site.

Patient selection

It is proposed that true events in the history of carcinoma of the oesophagus can only be deduced from a study that includes every patient in a community. None of the papers has achieved this, so they all must have a bias in their patient selection. By far the best study is one from Finland (7), in which an attempt was made to follow all the patients in the country on an epidemiological basis. Squamous cell carcinoma of the oesophagus has greater variation of incidence between countries than any other carcinoma and varies up to 200 times (129). In England and Wales, 3709 patients died with oesophageal carcinoma in 1978, representing an incidence of 7·4 per 100 000 (130). There is not a great variation between the counties of England so the incidence in the North-East Thames Region, obtained from death certificates, of 220 per annum in a population of 3·7 million is typical of the country. It will be clear from this figure that the numbers for each author in *Table I* are very small in relation to their population and must represent selection and therefore bias.

With such a variation in the incidence, the question arises as to whether the disease is different where it is most common. In that area of China, Linshien province, where oesophageal carcinoma is frequent (21) good results are obtained in early cases; there are no details of the results of treatment on the southern shore of the Caspian (129) but in South Africa, where there has been a modern epidemic, patients present late and the results are poor (131) even with excellent specialized units. There is no evidence that the natural history varies in different parts of the world.

The age of the patient is usually over 60 years. The prognosis is worse in patients under 40 years (67) and the complications of treatment are greater when the patient is older (69). Places with a high incidence do not necessarily have a lower age of presentation. Males are almost invariably more commonly afflicted with this disease than females, but the incidence varies from 10 : 1 (129, 132, 133) to 1 : 1 (134). In all places with a high incidence males are more frequent, except in Gonbad on the southern shore of the Caspian Sea in Iran (129). It used to be said that women predominate when the disease is located proximally because of the high female incidence of post-cricoid carcinoma, but this is no longer true since its incidence is falling. The prognosis after surgery is better in females (8, 12, 67). Clinical details are discussed exhaustively elsewhere (7). Dysphagia is the commonest symptom but the term must include any obstruction to normal swallowing, with or without pain. Regurgitation and vomiting may be difficult to differentiate but should be included with 'dysphagia' which then is the presenting symptom in over 95 per cent. The average duration of symptoms prior to diagnosis in England is 7·5 months (135), the range 3–6 months in Finland and USA (7, 90), 2–4 months in South Africa (40) and the mean weight loss is 10 kg (29). This is incredible in a modern age where any form of dysphagia should be investigated, ideally as an emergency, by radiology. The cause of diagnostic delay in the majority is due to the patient (40). The message is that the diagnosis must be made before there is any change in eating habits. In spite of this, however, there is no evidence that the stage or the length of the tumour bears any relationship to the duration of the symptoms (7, 120). Nor does the prognosis depend on the duration of the history (7, 136).

Classification of oesophageal carcinoma

Anatomically the gullet was originally divided into three equal parts but there is now a suggestion that it should be divided anatomically into four (*Fig.* 1). The cervical part extends from the crico-pharyngeal sphincter to the clavicle and the thoracic part is divided into three portions. The upper oesophagus extends to the bifurcation of the trachea distal to the arch of the aorta. Below this, the middle and lower oesophagus are divided into two equal portions with no definite landmarks. At the upper end, the cervical part would automatically include any post-cricoid carcinoma. Since this is a pathological entity, more common in females, separation would help in the analysis of its epidemiology and management.

At the lower end, confusion reigns. Most authors will exclude an obvious carcinoma of the stomach extending upwards but it is clear that there is a different definition of what actually represents carcinoma of the oesophagus because in the papers detailed in *Table I* the incidence of adenocarcinoma varies between 1 and 75 per cent and the majority give insufficient information. However, true adenocarcinoma of the oesophagus does exist, arising either from islets of mucous epithelium or in the rarer columnar cell lined oesophagus. The incidence of this true adenocarcinoma of the body of the oesophagus is about 1 per cent (32, 111, 137–140). This figure is based on much evidence and includes a reassessment of the large series from the Mayo Clinic.

The American Joint Committee for Cancer Staging has suggested that every adenocarcinoma of the lower 10 cm of the oesophagus should be excluded from oesophageal cancer and considered as gastric cancer (3). In death certification there is also confusion because under the heading 'oesophagus' there are five divisions: upper, middle and lower one-thirds, gastro-oesophageal junction, oesophagus—no further details. Cardia is classified under stomach. No histological details are requested which means that in the age of universal endoscopy and biopsy the accuracy of death certificates has not yet improved. It is proposed that the terms cardia and gastro-oesophageal junction, which are almost synonymous anyway, are avoided in the classification of oesophageal carcinoma and that emphasis is placed on whether the tumour is squamous cell or adenocarcinoma. For all practical purposes it would be simpler if oesophageal carcinoma was divided on the basis of four anatomical locations where the histology was known to be squamous cell or undifferentiated, plus one group for other tumours and true adenocarcinoma of the oesophagus and a sixth for oesophageal carcinoma anatomical site and histology—no further details. Adenocarcinoma of the cardia or gastro-oesophageal junction should be categorized under stomach (cardia). It would then be easier to study whether surgery or radiotherapy was the better therapy for squamous cell carcinoma of the lower one-third of the oesophagus since these are not at the moment subdivided in the majority of the articles cited in *Table I*. Additionally, it would help with epidemiology. For example, post-cricoid carcinoma and gastric carcinoma are becoming rarer, whereas oesophageal squamous cell carcinoma is increasing in frequency.

In the literature there is very little information about staging or grading of tumours. The Japanese Society for Oesophageal Disease have a very detailed grading system (141, 142) but a major disadvantage is that most of the tumours seen outside Japan have spread through the muscle and fall into stage 4. One of the first classifications used for staging tumours was Dukes' subdivision of rectal carcinoma (143). Although this is simple, practical and effective, it has rarely been used for the oesophagus. The American Joint Committee on Cancer Staging has suggested grading based on the TNM system, a development of Dukes' classification which has more practical application than the Japanese system (3, 67, 120, 144). Broder's classification (145) according to the degree of histological differentiation has been used in only one study (138) but probably does not help to assess prognosis (12). Lymphocytic infiltration is considered by some to be an indication of a better prognosis (12, 20). The ESR is also said to be important, high levels indicating extensive tumours (7); some surgeons do not operate when it is over 25 mm in the first hour (146) but the majority do not record it. The length of the tumour measured radiologically affects operability, resection and survival (6, 7, 20, 40, 67, 131, 136, 147–149). The reason most likely lies in the relationship between tumour length and spread through the muscle coat to the adventitia. It is extremely rare to discover tumours confined to the mucosa alone because they have usually spread both around the circumference and laterally before symptoms occur. A radiological sign of local spread is axis deviation (156) which indicates an inoperable growth. If the length of the tumour is less than 5 cm, 50 per cent will have developed lymph node metastases and, if longer than 5 cm, 90 per cent will have nodes involved (150–152). With no definitive epidemiological study available, it is nevertheless likely that less than 5 per cent of all tumours are confined within the muscle coat, shorter than 5 cm in length (148, 153, 154) with no involved nodes nor distant metastases (100) comparable to Dukes' A. Apart from length, which only correlates roughly with spread through the muscle, there is no other preoperative method of assessing the stage of a tumour, which is of importance when comparing the results of surgery and radiotherapy, because similar tumours must be compared. Considering lymph node involvement, again there are no epidemiological studies, but the majority have local nodes involved which implies that a minimum of 80 per cent are at least Dukes' C (3, 155). Distant metastases or local spread to the trachea or bronchus must indicate an extensive tumour which cannot be removed surgically. Over 10 per cent had tracheo-oesophageal fistulas at the time of presentation in one series (40). The American Joint Committee on Cancer Staging placed over 40 per cent into stage III on the basis of local spread to mediastinum, trachea or lungs, recurrent laryngeal, phrenic or sympathetic nerve involvement and distant metastases. All these factors must indicate inoperability. Any grading or staging should help in selecting patients for surgery as well as assessing prognosis. It is clear that any paper which gives a percentage figure of 100 per cent for operable tumours has either included many whom other authors would consider inoperable or has not included all the patients with oesophageal cancer in a community.

Surgery

Definition of the terminology used is important. Unless a patient dies of some other cause after surgery and is shown to be tumour-free the word 'cure' should not be used in oesophageal carcinoma. Similarly 'radical' as a term is not explicit enough. Operable implies that preoperatively there is some hope of removing the majority of the tumour surgically. Resectable means that at the time of operation the growth can be resected technically. Palliative surgery as a term is used for bypass procedures or making a stoma. Intubation, although it is also palliative, is a separate procedure with or without laparotomy or thoracotomy.

From the papers in *Table I* there is a very wide spread of the percentage figure for patients who are operable, but the mean figure of 58 per cent of the total is accepted. The resection rate is much lower and is only 39 per cent of the total. This means that up to 33 per cent of patients subjected to thoracotomy have widespread tumour that is impossible to remove and they will therefore have no resection. The broad spectrum of figures is produced on the one hand by aggressive surgeons who are exploring as many patients as possible to resect as many as possible and on the other hand by conservative surgeons who do not want to subject patients to an unnecessary procedure which carries its own risk of death. The latter wish to keep the percentage figures of operability and resectability almost equal.

No details will be given about contraindications to surgery, except to point out that the generally accepted concept nowadays is that everyone should have an operation unless he is unfit due to his general condition or because the tumour has spread too far. Evidence of the latter must always be sought by the necessary bronchoscopy which may reveal tracheal infiltration. Tracheo-oesophageal fistula and recurrent laryngeal

nerve palsy are obvious later signs of local spread. In assessment of operability most authors ignore the length of the tumour, ESR, scalene node biopsy (152, 157, 158), coeliac axis node biopsy and evidence of mediastinal spread by tomography or mediastinoscopy. Results of the use of computerized axial tomography have not yet been published.

Factors involved in obtaining good results with resection should include the complete removal of the tumour with the adventitia free from cancer cells, clear edges of the section proximally and distally, local lymph nodes uninvolved and no distant metastases. Such a tumour would be equivalent to a Dukes' A classification. The problem is that even small, completely resected tumours may have distant metastases and this does not depend on the length of the tumour (30, 100, 159). It is obvious that the original stage of the tumour is a most important factor. The surgeon cannot alter this, because nothing much can be done about excising the mediastinal spread. The percentage of tumours resected with adventitial spread (incomplete because of the tumour) is at least 50 per cent (2). The surgeon's main influence is on the complete successful resection longitudinally. The percentage resected with residual tumour in the cut ends (incomplete because of the surgeon) varies from 17 to 28 per cent with a mean of 25 per cent (2, 7, 49, 76, 131, 134). The length resected above and below the tumour is very important. Figures vary from 5 cm (7, 154) to 15 cm (40) but at least 12 cm should be taken (67, 154). This distance applies to the length *in situ* before resection and before fixation: 12 cm *in situ* can contract to 4 cm after a few days in formalin (67). Carcinoma of the cardia may require less (67) but obviously a cervical carcinoma cannot be completely excised if 12 cm is to be removed above and below the tumour. Those who have studied the importance of length in regard to resection and complete longitudinal removal of the tumour say that a tumour longer than 8 cm cannot be resected (7) and longer than 6 cm is noncurable (75). An even more conservative estimate from groups with great experience is that 5 cm is the upper limit of resection (128, 146, 148, 153). If this preoperative assessment were to be followed then the percentage of patients resected would more closely approximate those undergoing thoracotomy and unnecessary operations would be avoided.

Postoperative mortality is usually defined as death in hospital (121, 160) but others define it as within 1 month of surgery. The number of days spent in hospital after surgery ranges between 15 and 35 with a mean of 3 weeks (42, 126). The greatest confusion, however, concerns what the figure for percentage mortality applies to. The mean figure, gleaned from the literature in *Table I*, is a 29 per cent postoperative mortality for those patients in whom a resection is performed. Operation without resection also has a high mortality of at least 17 per cent (55). The mortality from surgery expressed as a percentage of the total number of patients is 13 per cent. These figures emphasize the facts that out of any original 100 patients in a community with oesophageal cancer 58 will be operated upon, 39 will have their tumour resected, 13 of these will die in hospital and 26 will survive the resection and go home.

Survival after resection

The only way to obtain comparable figures is to analyse data on an epidemiological basis. An example of the confusion is given by one study which expresses a 5-year survival rate, but the only patients included are those who survived resection alone and then, if they were actually alive 1 year later, had colonic replacement. The figures usually quoted refer to a 1-year and 5-year survival, but there are sufficient papers to be able to assess the 2-year survival as well. Eighteen per cent of the original number, which includes all the patients with oesophageal carcinoma in a community, survive 1 year. Thirty-one per cent of the total operated and 45 per cent of those resected live for 1 year. If the percentage is expressed as the number of those who have been resected, survived and returned home, then the percentage increases to 70 per cent. When the resection has been successful with no microscopical evidence of tumour in the margins of the specimen then 75 per cent live one year (49). The figures for 2-year survival are as follows: 8 per cent of the original total, 14 per cent of those operated upon, 20 per cent of those having a resection and 29 per cent of those leaving hospital after a resection. For 5-year survival figures the mean is 4 per cent of the original total, 9 per cent of those operated upon, 12 per cent of those resected and 18 per cent of those leaving hospital after a resection.

Obviously a patient with a favourable tumour removed by a successful surgeon has the best chance of surviving 5 years, so it helps to analyse what factors bring patients into this group. Squamous cell tumours lower in the oesophagus have a better prognosis than higher up. This is due to the increased operative mortality the more proximal the tumour. Adenocarcinoma in the lower one-third has a worse prognosis than squamous cell carcinoma, but that may be due to biological predetermination of its natural history rather than to the surgeon.

Tumours less than 5 cm in length (2, 40, 67, 127, 161) with no invasion through the adventitia are rare. It is difficult to assess how frequently such cases arise in a community but they probably represent under 5 per cent of the total at the time of presentation (2, 3, 31, 39, 148) and there is no evidence that the degree of differentiation affects their 5-year survival. If the patient survives the resection having such a tumour, he will be well on the way to living 5 years. This statement of the obvious is necessary because the 29 per cent who do not survive surgery include a proportion of those with small tumours. No evidence exists to show that results are improving over the 20 years studied, but there is a definite trend to better results late in any one individual surgeon's series (20, 78, 125, 136).

Quality of life after surgery

Emphasis has previously been placed on crude survival rates in an attempt to assess the quantity of life remaining after treatment. Quality is more difficult to measure and requires sophisticated techniques, so the papers are few. Since the original symptom in the majority is dysphagia, it is presumed that removal of this should produce a good quality of life, but there is really no objective evidence available. In most detailed follow-up studies 30 per cent have recurrent dysphagia (135) and up to 20 per cent need oesophageal dilatation (42). Dysphagia cannot be completely excluded by leaving no microscopical tumour in the cut ends because fibrous strictures can still occur at the anastomosis. No details are available about whether a patient resumes his previous work, but the impression is that hardly any resected patient actually goes back to work. One paper takes the assessment of the quality of the remaining life

further by measuring the ability to enjoy leisure activities and to sleep properly at night without regurgitation or coughing (107).

Palliative surgery

In any study based on all the patients in a community 58 per cent are operated upon and 40 per cent resected, which means in effect that 60 per cent of all patients with oesophageal carcinoma still have the original tumour *in situ* and need some form of medical help and symptomatic treatment. This section deals very briefly with operative palliative surgery. Technical details are dealt with excellently in a most comprehensive modern book entirely dedicated to oesophageal surgery (162). Intubation either perorally or at the time of operation will not be discussed. Nor will the management of the remainder be mentioned, in whom neither palliative surgery nor intubation is used, except to emphasize that this particular part of the treatment of oesophageal carcinoma numerically affects the majority and clinically is the most difficult since it involves humane terminal care. A good family doctor is an absolutely essential part of this management.

Palliative surgery is best defined as surgery performed without resection of the whole tumour by means of a bypass or a stoma. The operative mortality after bypass operations is at least 30 per cent (163) and after stoma formation 10–43 per cent (113). The survival time after a bypass operation is 2–6 months (146) and after a stoma, less than 3 months (113). These survival times are not exact because the selection of patients in different series is not comparable. Many will accept the rationale of bypass surgery at the time of thoracotomy when the tumour is technically inoperable but very few consider that any form of stoma, whether to divert secretions or allow feeding via a gastrostomy or a jejunostomy, is justifiable.

Conclusion

Nobody questions the use of surgery for obstruction to the oesophagus by adenocarcinoma. There is no alternative treatment to resection and if this is technically impossible a Celestin tube can be inserted or a bypass procedure carried out. The mortality for resection of a lower oesophageal adenocarcinoma should be well under 10 per cent (125, 127). It is acceptable because there is no alternative but many other authors give a higher operative mortality. The majority of papers on oesophageal carcinoma do not separate off adenocarcinoma and therefore do not give the true picture of what happens with oesophageal squamous cell carcinoma. The operative mortality of oesophageal cancer surgery is high and if adenocarcinoma of the lower oesophagus, with its lesser risk, is excluded, then the hospital mortality for the squamous cell carcinomas is 29 per cent. The figure of 29 per cent resection mortality includes oesophageal squamous cell cancer at all levels, but it is clear that the figure for lower resections must be similar to that for adenocarcinoma. Unfortunately, most of the authors cited in *Table I* do not clarify this point or give a separate mortality figure in regard to histology and the level of the tumour. It is, however, clear that these operations have the greatest operative mortality of any routinely performed surgical procedure.

Out of any 100 patients, including all in the community who actually go to visit a doctor, 58 will be explored, 39 resected, 26 leave hospital with the tumour excised, 18 survive for 1 year, 9 for 2 years and 4 for 5 years. If there is any surgeon, accepting all the patients in the population he serves, who can improve upon these figures, he has not yet written an article with his results. The first question to be asked is whether these figures can be accepted as correct by surgeons. If they are taken as true, the second question follows; would the patient, being properly informed, consent to surgical exploration with a 29 per cent operative mortality and an 18 per cent chance of surviving 1 year or would he ask whether there was any other available treatment?

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References

1. ADAMS W. E.: The surgical treatment of carcinoma of the esophagus; need for a more aggressive attitude. *J. Thorac. Cardiovasc. Surg.* 1965; **50**: 141–4.
2. AKAKURA I., NAKAMURA Y., KAKEGAWA I. et al.: Surgery of carcinoma of the esophagus with preoperative radiation. *Chest* 1970; **57**: 47–57.
3. AMERICAN JOINT COMMITTEE: Clinical staging system for carcinoma of the esophagus. *CA* 1975; **25**: 50–7.
4. AMMAN J. F. and COLLIS J. L.: Palliative intubation of the esophagus. Analysis of 59 cases. *J. Thorac. Cardiovasc. Surg.* 1971; **61**: 863–9.
5. ANABTAWI I. N., BRACKNEY E. L. and ELLISON R. G.: Carcinoma of the esophagus treated by continued radiation and surgery. *J. Thorac. Cardiovasc. Surg.* 1964; **48**: 205–10.
6. ANGORN I. B., BRYER J. U., HEGARTY M. M. et al.: Carcinoma of the esophagus in Natal Bantu; a local review. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 248–57.
7. APPELQUIST P.: Carcinoma of the oesophagus and gastric cardia. A retrospective study based on statistical and clinical material from Finland. *Acta Chir. Scand.* 1972; Suppl. 430: 1–92.
8. BEATTIE E. J. JUN. and GOODNER J. T.: Treatment of carcinoma of the esophagus. *Am. Surg.* 1967; **33**: 100–4.
9. BELSEY R. and HIEBERT C. A.: An exclusive right thoracic approach for cancer of the middle third of esophagus. *Ann. Thorac. Surg.* 1974; **18**: 1–15.
10. BLOCK G. E. and LANCASTER J. R.: Adenocarcinoma of the cardioesophageal junction. *Arch. Surg.* 1964; **88**: 852–9.
11. BOYD D. P., ADAMS H. D. and SALZMAN F. A.: Carcinoma of the esophagus. *N. Engl. J. Med.* 1958; **258**: 271–4.
12. BUCK B. A. and FLETCHER W. S.: Esophageal cancer: results of therapy in an indigent population. *J. Surg. Oncol.* 1973; **5**: 101–11.
13. BURN J. I.: Cancer of the stomach and oesophagus. Data concerning management and results. *Br. J. Surg.* 1971; **58**: 798–800.
14. BUSCHKE F.: Surgical and radiological results in the treatment of esophageal carcinoma. *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 1954; **71**: 9–24.
15. CAREY J. S., PLESTED W. G. and HUGHES R. K.: Esophagogastrectomy. Superiority of the combined abdominal-right thoracic approach (Lewis Operation). *Ann. Thorac. Surg.* 1972; **14**: 59–68.
16. CEDERQUIST C., NIELSEN J., BERTHELSEN A. et al.: Cancer of the esophagus II. Therapy and outcome. *Acta Chir. Scand.* 1978; **144**: 233–40.
17. CLARK R. L. and LOTT S.: Comparative study of symptom relief in esophageal cancer, with development of useful index of palliation. *Radiology* 1968; **90**: 971.
18. CLIFFTON E. E., GOODNER J. T. and BRONSTEIN E.: Preoperative irradiation for cancer of the esophagus. *Cancer* 1960: **13**: 37–45.

19. COETZE T.: Carcinoma of the esophagus. *S. Afr. J. Surg.* 1966; **4**: 107–22.
20. COLLIS L.: Surgical treatment of carcinoma of the oesophagus and cardia. *Br. J. Surg.* 1971; **58**: 801–4.
21. COORDINATING GROUP FOR RESEARCH ON ESOPHAGEAL CANCER: Early diagnosis and surgical treatment of esophageal cancer under rural conditions. *Chin. Med. J.* 1976; **2**: 113–16.
22. CURTO-CARDUS J., FERNANDEZ L. S., SANCHEZ D. G. et al.: Findings and results in surgery of cancer of the esophagus. *Rev. Esp. Enferm. Apar. Dig.* 1970; **32**: 505–28.
23. DOR V. and HUMBERT P.: 1 year of esophageal surgery. Statistics of the Marseilles Thoracic Surgical Clinic. *Arch. Fr. Mal. App. Dig.* 1963; **53**: 458–61.
24. DUNLOP E. E.: Carcinoma of the oesophagus—reflections upon surgical treatment. *Ann. R. Coll. Surg. Engl.* 1961; **29**: 28–53.
25. EFSKIND L. and HELSINGEN N. JUN.: Carcinoma of the lower portion of the esophagus. *Acta Chir. Scand.* 1965; Suppl. 356: 110–16.
26. EL-DOMEIRI A., MARTINI N. and BEATTIE E. J. JUN.: Esophageal reconstruction by colon interposition. *Arch. Surg.* 1970; **100**: 358–62.
27. ELLIS F. H. JUN., JACKSON R. C., KRUEGER J. T. JUN. et al.: Treatment of carcinoma of the esophagus and cardia. *Mayo Clin. Proc.* 1960; **35**: 653–63.
28. FRANKLIN R. H., BURN J. I. and LYNCH G.: Carcinoma of the oesophagus. A review of 129 treated patients. *Br. J. Surg.* 1964; **51**: 178–83.
29. GARLOCK J. H. and KLEIN S. H.: The surgical treatment of carcinoma of the esophagus and cardia. An analysis of 457 cases. *Ann. Surg.* 1954; **139**: 19–34.
30. GARY-BOBO J., PUJOL H., SOLASSOL C. et al.: Le traitement radio-chirurgical du cancer de l-'oesophage thoracique. A propos de 143 cases. *J. Radiol. Electrol. Med. Nucl.* 1978; **59**: 343–5.
31. GIULI R., ESTENNE B., CLOT P. et al.: Bilan de 135 interventions pour cancer du cardia: valeur de la gastrectomie totale. *Sem. Hôp. Paris* 1972; **26**: 849–55.
32. GOODNER J. T.: Surgical and radiation treatment of cancer of the thoracic esophagus. *Am. J. Roentgenol. Radium Ther. Nucl. Med.*, 1959; **105**: 523–8.
33. GROVES L. K.: Carcinoma of the esophagus. 1965: evaluation of treatment. *Ann. Thorac. Surg.* 1965; **1**: 416–31.
34. GUERNSEY J. M., DOGGET R. L. S., MASON G. R. et al.: Combined treatment of cancer of the esophagus. *Am. J. Surg.* 1969; **117**: 157–61.
35. GUINN G. A., JORDAN P. H. and STEWART C. V.: Appraisal of therapy for carcinoma of the esophagus. *Am. J. Surg.* 1971; **122**: 703–5.
36. GUNNLAUGSSON G. H., WYCHULIS A. R., ROLAND C. et al.: Analysis of the records of 1,657 patients with carcinoma of the esophagus and cardia of the stomach. *Surg. Gynecol. Obstet.* 1970; **130**: 997–1005.
37. GUTGEMANN A.: Zur Frage der radikalen und palliativen Operation des Oesophaguscarcinoms. *Langenbecks Arch. Chir.* 1953; **276**: 357–64.
38. HANKINS J. R., COLE F. N., WARD A. et al.: Carcinoma of the esophagus. The philosophy for palliation. *Ann. Thorac. Surg.* 1972; **14**: 189–97.
39. HUMPHREY C. R. and CLIFFTON E. E.: Carcinoma of the distal part of esophagus and cardia of the stomach. *Surg. Gynecol. Obstet.* 1968; **127**: 737–43.
40. HUNT J. A.: An integrated approach to the treatment of squamous oesophageal cancer in S. A. black patients. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 17–43.
41. INBERG M. V., LINNA M. I., SCHEININ T. M. et al.: Anastomostic leakage after excision of esophageal and high gastric carcinoma. *Am. J. Surg.* 1971; **122**: 540–4.
42. JACKSON J. W., COOPER D. K. C., GUVENDIK C. et al.: The surgical management of malignant tumours of the oesophagus and cardia: a review of the results in 292 patients treated over a 15-year period (1961–1975). *Br. J. Surg.* 1979; **66**: 98–104.
43. JOHNSON J., KIRBY C. K. and BLAKEMORE W. S.: The surgical treatment of carcinoma of the esophagus and cardiac end of the stomach. *Surg. Clin. North Am.* 1962; **42**: 1397–405.
44. JUST-VIERA J. O. and SILVA J. E.: Long-term survival of patients with carcinoma of the oesophagus in Puerto Rico. *Am. Surg.* 1976; **42**: 62–5.
45. KASAI M., MORI S. and WATANABE T.: Follow-up results after resection of thoracic esophageal carcinoma. *World J. Surg.* 1978; **2**: 543–51.
46. KAY S.: A ten year appraisal of the treatment of squamous cell carcinoma of the esophagus. *Surg. Gynecol. Obstet.* 1963; **117**: 167–71.
47. KEITH H. B.: Carcinoma of the esophagus. *Arch. Surg.* 1960; **80**: 434–7.
48. KILLEN D. A., EDWARDS W. H. and DANIEL R. A.: Carcinoma of the esophagus. *J. Thorac. Cardiovasc. Surg.* 1964; **48**: 491–7.
49. KOCK N. G., LEWIN E., PETTERSSON S. et al.: Carcinoma of the thoracic esophagus and cardia. A review of 146 cases. *Acta Chir. Scand.* 1967; **133**: 375–80.
50. KRAFT-KINZ J.: Experiences with the surgical therapy of esophagus carcinoma. *Langenbecks Arch. Chir.* 1969; **324**: 285–93.
51. KYLLONEN K. E. J. and VIRKKULA L.: On operative treatment of carcinoma of the esophagus. *Acta Chir. Scand.* 1965; Suppl. 356: 117–20.
52. LAWLER M. R. JUN., GOBBEL W. G. JUN., KILLEN D. A. et al.: Carcinoma of the esophagus. *J. Thorac. Cardiovasc. Surg.* 1969; **58**: 609–13.
53. LEDERMAN M.: Carcinoma of the esophagus with special reference to the upper third. I. Clinical considerations. *Br. J. Radiol.* 1966; **39**: 193–7.
54. LEON W., STRUG L. H. and BRICKMAN I. D.: Carcinoma of the esophagus. A disaster. *Ann. Thorac. Surg.* 1971; **11**: 583–92.
55. LEROUX B.T.: An analysis of 700 cases of carcinoma of the hypopharynx, the oesophagus and the proximal stomach. *Thorax* 1961; **16**: 226–55.
56. LEVERMENT J. N. and MEARNS MILNE D.: Oesophagogastrectomy in the treatment of malignancy of the thoracic oesophagus and cardia. *Br. J. Surg.* 1974; **61**: 683–8.
57. LOEB J. J.: Carcinoma of esophagus. *Lancet* 1965; **85**: 425–7.
58. LOGAN A.: The surgical treatment of carcinoma of the esophagus and cardia. *J. Thorac. Cardiovasc. Surg.* 1963; **46**: 150–61.
59. LORTAT-JACOB J. L.: Surgical treatment of esophageal cancer. Record of 23 years of experience. *Bull Acad. Nat. Med. (Paris)* 1969; **153**: 17–22.
60. LOWE W. C.: Survival with carcinoma of the esophagus. *Ann. Intern. Med.* 1972; **77**: 915–18.
61. MARCHAND P. E.: Cancer of the oesophagus. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 217–43.
62. MARCIAL V. A., TOME J. M., UBINAS J. et al.: The role of radiation therapy in esophageal cancer. *Radiology* 1966; **87**: 231–9.
63. MARKS R. D. JUN., SCRUGGS H. J. and WALLACE K. M.: Preoperative radiation therapy for cancer of the esophagus. *Cancer* 1976; **38**: 84–9.
64. MARTINEZ I.: Cancer of esophagus in Puerto Rico. Mortality and incidence analysis, 1950–1961. *Cancer* 1964; **17**: 1278–88.
65. MCKEOWN K. C.: Carcinoma of the oesophagus. *Ann. R. Coll. Surg. Engl.* 1978; **60**: 301–3.
66. MILLBURN L., FABER L. P. and HENDRICKSON F. R.: Curative treatment of epidermoid carcinoma of the esophagus. *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 1968; **103**: 291–9.
67. MILLER C.: Carcinoma of thoracic oesophagus and cardia. A review of 405 cases, *Br. J. Surg.* 1962; **49**: 507–22.
68. MILNE D. M.: Experiences with oesophagogastrectomy in the treatment of cancer of the oesophagus. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 428–38.

69. MOHANSINGH M. P.: Mortality of oesophageal surgery in the elderly. *Br. J. Surg.* 1976; **63**: 579–80.
70. MOOR N. G.: Preliminary report of survey conducted by the Johannesburg Group of Hospitals on cancer of the oesophagus in the African. Aims, policies and results. *S. Afr. Med. J.* 1968; **42**: 892–4.
71. MORRISON D. R.: The treatment of carcinoma of the esophagus; a comparison of surgery and X-ray. *Surgery* 1959; **46**: 516–20.
72. MOSELEY R. V.: Squamous carcinoma of the esophagus. *Surg. Gynecol. Obstet.* 1968; **126**: 1242–6.
73. MULLARD K. S.: Carcinoma of oesophagus treated by excision. *Lancet* 1960; **1**: 677–9.
74. MUSTARD R. A. and IBBERSON O.: Carcinoma of the esophagus. A review of 381 cases admitted to Toronto General Hospital 1937–1953 inclusive. *Ann. Surg.* 1956; **144**: 927–40.
75. NAKAYAMA K.: Surgical treatment of esophageal malignancy. In: Bockus H. L.: *Gastroenterology*, 3rd ed. Philadelphia: Saunders, 1974: 307–18.
76. NEALON T. F. and CAMISHION R. C.: Combined radiation and surgery to treat carcinoma of the esophagus. *Am. J. Gastroenterol.* 1967; **48**: 380–91.
77. OGILVIE H.: The surgery of the oesophagus. *Br. J. Surg.* 1960; **47**: 457–66.
78. ONG G. B. and KWONG K. H.: The Lewis-Tanner operation for cancer of the oesophagus. *J. R. Coll. Surg. Edinb.* 1969; **14**: 3–19.
79. PARKER E. F. and GREGOIRE H. B.: Carcinoma of the esophagus. Long term results. *JAMA* 1976; **235**: 1018–20.
80. PARROCHIA E., VARELA N. and JIRON A.: Cancer of the esophagus. Review of 196 cases. *Rev. Invest. Clin.* 1970; **22**: 261–79.
81. PEARSON J. G.: The value of radiotherapy in the management of esophageal cancer. *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 1969; **105**: 500–13.
82. PELLETIER L. C., BRUNEAU J., CHOLETTE J. P. et al.: Cancer of the esophagus: therapeutic results. *Can. J. Surg.* 1972; **15**: 30–6.
83. PETROV B. A.: Resection of the thoracic esophagus for cancer. *Cancer* 1967; **20**: 789–92.
84. PETROVSKY B. V. and VANTSIAN E. N.: Our experience in the surgical treatment of malignant and benign esophageal tumours. *Surgery* 1967; **62**: 833–8.
85. PETTIT H. S.: Carcinoma of esophagus; statistical study. *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 1957; **77**: 818–25.
86. PICCONE V. A., LE VEEN H. H., AHMED N. et al.: Reappraisal of esophagogastrectomy for esophageal malignancy. *Am. J. Surg.* 1979; **137**: 32–8.
87. PINCH L. W., CHRISTIANSEN K. H. and STAINBACK W. C.: Carcinoma of the esophagus. A twenty year study. *Am. J. Surg.* 1966; **111**: 704–7.
88. PIZZOCARO G. and RAVASI G. L.: Surgical treatment of carcinoma of the esophagus and of the cardia; evaluation of the immediate and remote results. *Tumori* 1970; **56**: 279–89.
89. PLESTED W. G., TILDON T. T. and HUGHES K.: A philosophy of treatment of esophageal carcinoma. *Am. Surg.* 1968; **34**: 650–6.
90. POSTLETHWAIT R. W., SEALY W. C., EMLET J. R. et al.: Squamous cell carcinoma of the esophagus. *Surg. Gynecol. Obstet.* 1957; **105**: 465–72.
91. PROCTER D. S. C.: Carcinoma of the oesophagus. A review of 523 cases. *S. Afr. J. Surg.* 1968; **6**: 137–59.
92. RAMBO V. B., O'BRIEN P. H., MILLER M. C. et al.: Carcinoma of the esophagus. *J. Surg. Oncol.* 1975; **7**: 355–65.
93. RAPPAPORT I.: One stage colonic interposition following total esophagectomy. *Surg. Gynecol. Obstet.* 1964; **118**: 602–7.
94. ROBERTSON R., COY P. and MOKKHAVESA S.: The results of radical surgery compared with radical radiotherapy in the treatment of squamous carcinoma of the thoracic esophagus. The case for preoperative radiotherapy. *J. Thorac. Cardiovasc. Surg.* 1967; **53**: 430–40.
95. RODRIGUEZ-ANTUNEZ A. and GROVES L. K.: High-dose preoperative irradiation of esophageal cancer. *Radiology* 1969; **92**: 377–80.
96. ROSS W. M.: Radiotherapy of carcinoma of the oesophagus. *Proc. R. Soc. Med.* 1974; **67**: 395–8.
97. ROSSETTI M.: Erfahrungen bei der chirurgischen Behandlung des Oesophaguscarcinoma. *Chirurg* 1972; **43**: 489–93.
98. ROUSSEL A., GIGNOUX M., VERWAERDE J. C. et al.: Esophageal cancer in Western France. Retrospective analysis of 1400 cases. *Bull. Cancer (Paris)* 1977; **64**: 61–6.
99. SANFELIPPO P. M. and BERNATZ P. E.: Celestin tube palliation for malignant esophageal obstruction. *Surg. Clin. North Am.* 1973; **53**: 921–6.
100. SEGOL P., VERWAERDE J. C., BOREL B. et al.: Traitement radiochirurgical du cancer limite de l'oesophage. *Chirurgie* 1977; **103**: 791–7.
101. SEITZ H. D. and KÖHNLEIN H. E.: Clinical aspects and therapy of esophageal carcinoma. *Zentralbl. Chir.* 1973; **98**: 721–31.
102. SEYMOUR E. A. and PETTIT H. S.: Preoperative X-ray therapy in cancer of the esophagus. *Radiology* 1965; **85**: 952–5.
103. SHEDD D. P., CROWLEY L.G. and LINDSKOG G. E.: A ten year study of carcinoma of the esophagus. *Surg. Gynecol. Obstet.* 1955; **101**: 55–8.
104. SKINNER D. B.: Esophageal malignancies, experience with 110 cases. *Surg. Clin. North Am.* 1976; **56**: 137–47.
105. SMITH F. S., GIBSON P. and NICHOLLS T. T.: Carcinoma of the oesophagus: preoperative irradiation followed by planned resection for lesions in the middle and lower thirds. An interim report. *Aust. NZ J. Surg.* 1975; **45**: 176–8.
106. SPATH F.: Present surgical possibilities in thoracic esophageal neoplasms and prognosis. *Brun's Beitr. Klin. Chir.* 1970; **218**: 289–94.
107. STOLLER J. L., TOPPIN D. I. and FLORES A. D.: Carcinoma of the esophagus; a new proposal for the evaluation of treatment. *Can. J. Surg.* 1977; **20**: 454–9.
108. STONE R., RANGEL D. M., GORDON H. E. et al.: Carcinoma of the gastroesophageal junction. A ten year experience with esophagogastrectomy. *Am. J. Surg.* 1977; **134**: 70–6.
109. SWEET R. H.: Late results of surgical treatment of carcinoma of the esophagus. *JAMA* 1954; **155**: 422–5.
110. TAKITA H., VINCENT R. G., CAICEDO V. et al.: Squamous cell carcinoma of the esophagus. A study of 153 cases. *J. Surg. Oncol.* 1977; **9**: 547–54.
111. TURNBULL A. D. M. and GOODNER J. T.: Primary adenocarcinoma of the esophagus. *Cancer* 1968; **22**: 915–18.
112. VAN HOUTTE P.: Radiotherapy of oesophagus cancer. A review of 136 cases treated at the Institut Bordet. *Acta Gastroenterol. Belg.* 1977; **40**: 121–8.
113. VANDER-VENNET K. R.: Epidermoid carcinoma of esophagus: review of 150 cases. *Am. Surg.* 1965; **31**: 487–92.
114. WAHLERS B. and KOPPERFELS R.: Radiotherapy of esophageal neoplasms. *Strahlentherapie* 1975; **149**: 252–61.
115. WATSON T. A.: Radiation treatment of cancer of the esophagus. *Surg. Gynecol. Obstet.* 1963; **117**: 346–54.
116. WEBB J. N. and BUSUTTIL A.: Adenocarcinoma of the oesophagus and of the oesophagogastric junction. *Br. J. Surg.* 1975; **65**: 475–9.
117. WILKINS E. W. and BURKE J. F.: Colon esophageal bypass. *Am. J. Surg.* 1975; **129**: 394–400.
118. WILSON S. E., PLESTED W. G. and CAREY J. S.: Esophagogastrectomy versus radiation therapy for mid-esophageal carcinoma. *Ann. Thorac. Surg.* 1970; **10**: 195–202.
119. WOSORNU J. L. and FRASER K. G.: Carcinoma of the thoracic oesophagus and cardia. A 7-year review of 66 cases. *Br. J. Surg.* 1970; **57**: 42–4.
120. YOUNGHUSBAND J. D. and ALUWIHARE A. P. R.: Carcinoma of the oesophagus: factors influencing survival. *Br. J. Surg.* 1970; **57**: 422–30.
121. ZACHO A. and FISCHERMANN K.: Surgical treatment of malignancies of the oesophagogastric junction. *Acta Chir. Scand.* 1965; Suppl. 356: 121–9.

122. ZENKER R., SEIDEL W., BORST H. et al.: Ergebnisse der chirurgischen Behandlung des Oesophaguskarcinoms. *Thoraxchir. Vasc. Chir.* 1966; **14**: 247–54.
123. ANSARI Z.: Carcinoma of the esophagus. Diagnosis and treatment. *Geriatrics* 1971; **26**: 98–104.
124. COLLIS J. L.: Carcinoma of the esophagus and cardia. *Acta Chir. Belg.* 1966; **2**: Suppl. 2: 77–82.
125. MCKEOWN K. C.: Total three-stage oesophagectomy for cancer of the oesophagus. *Br. J. Surg.* 1976; **63**: 259–62.
126. ONG G. B., LAM K. H., WONG J. et al.: Factors influencing morbidity and mortality in esophageal carcinoma. *J. Thorac. Cardiovasc. Surg.* 1978; **76**: 745–54.
127. NAKAYAMA K.: Statistical review of 5 year survivals after surgery for carcinoma of the esophagus and cardiac portion of the stomach. *Surgery* 1959; **45**: 883–98.
128. MCKEOWN K. C.: Trends in oesophageal resection for carcinoma. *Ann. R. Coll. Surg. Engl.* 1972; **51**: 213–39.
129. DAY N. E.: Some aspects of the epidemiology of esophageal cancer. *Cancer Res.* 1975; **35**: 3304–7.
130. EARLAM R. J. and CUNHA-MELO J. R.: The epidemiology of oesophageal cancer. Unpublished (1979).
131. HUNT J. A.: Squamous cancer of the oesophagus in urban South African blacks. A preliminary report of baseline studies. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema; 1978; 287–311.
132. GILLIS C. R. and HOLE D. J.: International, geographical and local differences in carcinoma of the oesophagus. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema; 1978; 60–76.
133. AUDIGIER J. C., TUYNS A. J. and LAMBERT R.: Epidemiology of oesophageal cancer in France. Increasing mortality and persistent correlation with alcoholism. *Digestion* 1975; **13**: 209–19.
134. JOHNSON G. J. A. and LIPWORTH L.: End results in cancer of the esophagus. *Natl Cancer Inst. Monogr.* 1964; **15**: 221–33.
135. LEROUX B. T.: The influence of resection on the natural history of carcinoma of the hypopharynx, oesophagus and proximal stomach. *Surg. Gynecol. Obstet.* 1962; **115**: 162–70.
136. PARKER E. F., GREGOIRE H. B. JUN., ARRANTS J. E. et al.: Carcinoma of the esophagus. *Ann. Surg.* 1970; **171**: 746–50.
137. UYS C. J.: In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 149–50.
138. BOTHA J. B. C., BOWEN R. M. and UYS C. J.: The pathology of carcinoma of the oesophagus. A survey of 1632 cases in Cape Town. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 117–31.
139. RAPHAEL H. A., ELLIS F. H. JUN. and DOCKERTY M. B.: Primary adenocarcinoma of the esophagus. *Ann. Surg.* 1966; **164**: 785–96.
140. HANKINS J. R., COLE F. N., ATTAR S. et al. Adenocarcinoma involving the esophagus. *J. Thorac. Cardiovasc. Surg.* 1974; **68**: 148–58.
141. JAPANESE SOCIETY FOR ESOPHAGEAL DISEASES: Guide lines for the clinical and pathologic studies on carcinoma of the esophagus. Part 1. Clinical classification. *Jap. J. Surg.* 1976; **6**: 69–78.
142. JAPANESE SOCIETY FOR ESOPHAGEAL DISEASES: Guide lines for the clinical and pathologic studies on carcinoma of the esophagus. Part II. Pathologic classification. *Jap. J. Surg.* 1976; **6**: 79–86.
143. DUKES C. E.: The classification of cancer of the rectum. *J. Pathol. Bacteriol* 1932; **35**: 323–32.
144. SCHULTZ M. D. and SCHMITZ R. L.: Clinical staging system for carcinoma of the esophagus. Report of the task force on carcinoma of the esophagus. American Joint Committee for Cancer Staging and End Results Reporting, Chicago 1973.
145. BRODERS A. C.: Carcinoma grading and practical application. *Arch. Pathol.* 1926; **2**: 376–81.
146. SMIT B. J., LEVIN W. and MCQUAIDE J. et al.. Treatment of carcinoma of the esophagus in Port Elizabeth (Eastern Province). In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 263–71.
147. NAKAYAMA K. and KINOSHITA Y.: Cancer of the GI tract. II Esophagus; treatment localised and advanced. Surgical treatment combined with preoperative concentrated irradiation. *JAMA* 1974; **227**: 178–80.
148. ENDO M., KINOSHITA Y. and NAKAYAMA K.: Recent progress in the diagnosis and the surgical treatment of the thoracic oesophageal cancer. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978; 312–16.
149. GOODNER J. T.: Cancer of the gastrointestinal tract II. Esophagus; treatment localised and advanced. Surgical principles of resection and reconstruction. *JAMA* 1974; **227**: 176–9.
150. FLEMING J. A. C.: Carcinoma of the thoracic oesophagus. Some notes on its pathology and spread in relation to treatment. *Br. J. Radiol.* 1943; **16**: 212–16.
151. FLEMING J. A. C.: Radiotherapy in cancer of the thoracic oesophagus. *Thorax* 1947; **2**: 206–15.
152. RUBIN P.: Cancer of the gastrointestinal tract. II. Esophagus. Treatment—localised and advanced. Pretreatment laparotomy. *JAMA* 1974; **227**: 184–5.
153. KINOSHIMA Y., ENDO M. and NAKAYAMA K.: Surgical treatment and combined radiotherapy for thoracic oesophageal carcinoma following the survival rate. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 417–27.
154. NICKS R., GREEN D. and MCCLATCHIE G.: A clinicopathological study of some factors influencing survival in cancer of the oesophagus. A survey of ten years' experience. *Aust. NZ J. Surg.* 1973; **43**: 3–13.
155. PEARSON J. G.: Radiotherapy of oesophageal cancer. *Mod. Trends Surg.* 1971; **3**: 33–45.
156. AKIYAMA H., KOGURE T. and ITAI Y.: The esophageal axis and its relationship to the resectability of carcinoma of the esophagus. *Ann. Surg.* 1972; **176**: 30–6.
157. MULDER D. S.: Carcinoma of the esophagus: advantages of the prospective treatment protocol. *Can. J. Surg.* 1977; **20**: 400–1.
158. MURRAY G. F., WILCOX B. R. and STAREK P. J. K.: The assessment of operability of esophageal carcinoma. *Ann. Thorac. Surg.* 1977; **23**: 393–9.
159. APPELQUIST P.: Carcinoma of the oesophagus and gastric cardia at autopsy in Finland. *Ann. Clin. Res.* 1975; **7**: 334–40.
160. CEDERQUIST C., NIELSEN J., BERTHELSEN A. et al.: Cancer of the oesophagus I. 1002 cases, survey and survival. *Acta Chir. Scand.* 1978; **144**: 227–31.
161. PEARSON J. G.: Present status and future potential of radiotherapy in the management of oesophageal cancer. In: SILBER W.: *Carcinoma of the Oesophagus*. Rotterdam: Balkema, 1978: 334–9.
162. SHACKLEFORD R. T.: *Surgery of the Alimentary Tract. I. Esophagus*. Philadelphia: Saunders, 1978.
163. ONG G. B.: Unresectable carcinoma of the oesophagus. *Ann. R. Coll. Surg. Engl.* 1975; **56**: 3–14.

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