

## THE INCIDENCE OF INTRATHORACIC TUMOURS IN LEEDS

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(With 1 Graph)

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### INTRODUCTION

IN 1928-9 was published the result of an investigation into the incidence of tumours of the respiratory tract based on an analysis of the post-mortem records of the General Infirmary at Leeds between the years 1891 and 1927 inclusive. It was shown that there had been no increase in intrathoracic cancer at post-mortem during this period, that the incidence was not as high in Leeds as it was in Manchester and that the disease affected men more commonly than women in the proportion of  $3\frac{1}{2} : 1$ . It was also shown that there was a general tendency towards an increase in lung cancer in post-mortem statistics of other hospitals, especially in Germany.

Since that paper was published the enquiry has been continued and the cases coming to autopsy during the succeeding five-year period 1928-32 have been scrutinised and carefully recorded. During this time numerous papers have been written on the subject and much interest aroused in these tumours both in this country and abroad.

### DEFINITION

As doubt has been expressed (Rosahn, Davidson) as to the meaning of the term "intrathoracic cancer" it should be stated that only those tumours are included which are malignant and which appear to arise in lung, pleura,

bronchial tree or mediastinal glands, and that cases of Hodgkin's disease and cancer of the oesophagus are definitely excluded. (Two cases of Hodgkin's sarcoma were included in the original series, but none has occurred in the present series.) The author prefers the term "intrathoracic cancer" to "primary lung cancer" for the reason that in many cases it is quite impossible even after microscopical examination to determine the exact point of origin of a tumour occupying the mediastinum and the hilum of the lung. This is more likely to be the case when metastasis to bronchial and mediastinal glands has taken place and the growth therein is so exuberant as to obliterate the site of origin and mode of spread of the disease. Such cases cannot logically be excluded from a consideration of the incidence of tumours of the lungs and bronchial tree and yet they cannot accurately be termed "primary lung tumours."

Occasionally tumours are described which from their anatomical relationships appear to have arisen in the thymus gland. In these cases, however, the mediastinal glands or hilum of the lung or lung parenchyma are also involved, so that again it is impossible to be certain of their point of origin. In the present series, only one tumour was encountered in which the possibility of a thymic origin was considered and it was decided that the evidence was not sufficiently conclusive for a definite diagnosis to be made.

## INCIDENCE

### (1) *Incidence at Leeds*

(a) *In relation to post-mortems.* During the five-year period 1928–32, fifty cases of intrathoracic cancer have come to post-mortem at the Leeds General Infirmary. This represents a ratio of intrathoracic cancer to all post-mortems of 1.38 per cent., which is the highest figure recorded in any five-year period of the last 37 years (Table I). But as it is only just slightly higher than that recorded for the period 1908–12, it is unlikely to be of significance unless sustained for several more years.

There is a slight yearly variation in the number of post-mortems as shown in Table II, but a high proportion of persons dying in the hospital (80.7 per cent.) is still submitted to post-mortem examination. It is less than during the previous five-year period (91.6 per cent.) and is the lowest figure recorded since 1898–1902 (77.6 per cent.). Two factors are probably responsible: since 1928 patients dying in hospital obviously as the result of a street accident have only been submitted to post-mortem examination in special circumstances, and the number of patients brought to the hospital dead is tending to decrease. Otherwise no known selective factor has been at work.

It is to be noted that the age of the patients coming to autopsy has undergone a certain amount of variation during the 25 years 1908–32 (Table III). The percentage of cases in the age groups 0–19, 40–49, and 70–89 years has remained fairly stationary, but there has been a gradual slight fall in the number of cases in the groups 20–29 and 30–39, compensated by a similar

**Table I. Incidence of intrathoracic cancer at post-mortem (Leeds) in five-year periods from 1891 to 1932 inclusive.**

Year	Intrathoracic cancers at autopsy				Cancers in all sites at autopsy				Post-mortems		Total admissions to wards of hospital
	Total	M.	F.	% of all post-mortems	Total	M.	F.	% of all post-mortems	Total	% of deaths in hospital	
1891-1892	2	2	0	0.81	28*	18	9	12.82	226	73.8	671
1893-1897	10*	6	3	1.05	132*	74	56	14.14	938	81.1	1882
1898-1902	12	9	3	1.12	177*	96	78	16.92	1040	77.6	2252
1903-1907	18	15	3	0.86	364	222	142	17.47	2083	87.8	2373
1908-1912	31	23	8	1.30	375	235	140	15.67	2393	90.6	2642
1913-1917	31	22	9	1.27	401	251	150	16.43	2440	82.5	2956
1918-1922	24	18	6	0.91	389	245	144	14.75	2638	84.1	3136
1923-1927	44	34	10	1.17	552	347	205	14.67	3762	91.6	4107
1928-1932	50	39	11	1.38	670	427	243	18.56	3627	80.7	4492

\* The sex in some of these cases was not stated.

**Table II. Yearly incidence of intrathoracic cancer at post-mortem (Leeds) from 1928 to 1932 inclusive.**

Year	Intrathoracic cancers at autopsy				Cancers in all sites at autopsy				Post-mortems		Total admissions to wards of hospital
	Total	M.	F.	% of all post-mortems	Total	M.	F.	% of all post-mortems	Total	% of deaths in hospital	
1928	10	9	1	1.45	110	68	42	15.9	691	78	886
1929	12	10	2	1.45	131	76	55	15.8	827	85	968
1930	9	4	5	1.26	132	73	59	18.5	714	81	878
1931	10	9	1	1.39	156	113	43	21.7	718	82	876
1932	9	7	2	1.33	141	97	44	20.8	677	76	884
1928-1932	50	39	11	1.38	670	427	243	18.6	3627	80.7	4492

gradual rise in the groups 50-59 and 60-69. Thus it appears that the sample of patients at post-mortem is not strictly comparable throughout the period. The change is towards a greater expectation of life such as is seen in the figures for the whole population.

Table III. *Percentage incidence of male and female autopsies in decades (Leeds) in five-year periods from 1908 to 1932.*

Year	Age																	
	0-9		10-19		20-29		30-39		40-49		50-59		60-69		70-79		80-89	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1908-1912	18.2	21.5	8.4	10.4	10.0	11.8	14.2	14.0	14.4	13.5	17.9	18.0	12.2	8.5	4.2	1.6	0.6	0.7
1913-1917	16.7	21.6	9.5	10.8	8.3	12.1	12.4	12.8	14.6	15.3	18.2	14.6	14.7	9.2	4.7	3.0	0.7	0.7
1918-1922	17.0	20.0	10.4	11.2	8.1	10.4	10.2	13.2	14.5	15.2	19.3	12.3	14.3	13.4	5.6	3.7	0.2	0.5
1923-1927	19.6	25.4	9.1	7.6	8.2	8.8	9.9	11.2	14.1	13.3	17.5	16.9	16.1	13.0	5.0	2.9	0.7	0.6
1928-1932	20.4	24.4	6.9	7.4	7.6	8.8	7.8	8.7	14.2	12.7	19.2	18.1	17.9	13.5	5.9	5.0	0.8	0.5

(b) *In relation to cancer in other sites.* The relation of intrathoracic cancer to cancer in all sites is 7.5 per cent., a figure very similar to those found in previous years (Table I). A rather high percentage (9.1) in 1928 and 1929 was not sustained in the succeeding 3 years (Table II).

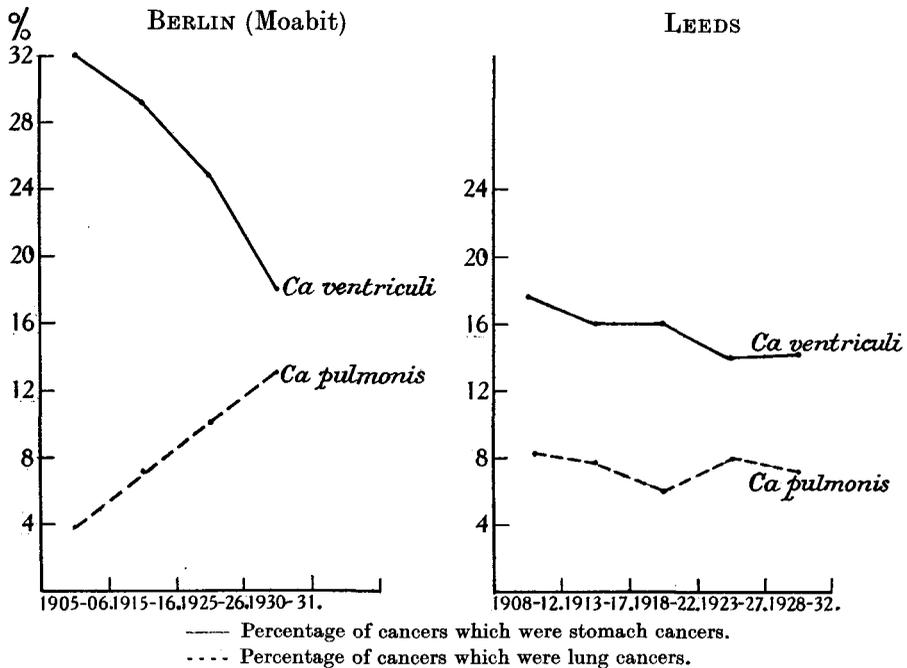
The percentage of total cancers compared with total post-mortems has increased considerably during the last 5 years in comparison with the years 1923-7 and is the highest recorded (Table I). In reviewing the whole period, a slight gradual increase was noticed until 1903-7, followed by a corresponding gradual fall until 1923-7. No adequate explanation of these fluctuations can be found.

It has been observed by Peters that although the incidence of cancer in all sites at post-mortem is not increasing to any great extent, the marked rise in lung cancer has been compensated by a fall in stomach cancer, with the result that in the Moabit Hospital, Berlin, cancer of the stomach in 1930-1 was not very much more common than cancer of the lung, taking both sexes together. The accuracy of this observation by Peters is open to question owing to the fact that he took the figures of isolated years at ten-year intervals instead of recording all the figures for the whole period. In Leeds, whether the sexes are considered separately or together, there has been remarkably little variation in the incidence of cancer in the common sites, such as large intestine, rectum, stomach, oesophagus, brain, pancreas and gall bladder (Graph I and Table IV).

Table IV. *Comparison of incidence of cancer in various sites at post-mortem (Leeds).*

Year	Total cancers	Large intestine		Rectum		Stomach		Oeso-phagus		Brain		Pancreas		Gall bladder		Intra-thoracic	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
		1908-1912	375	64	14.9	34	12.5	54	17.8	24	4.6	20	7.9	20	4.0	13	3.4
1913-1917	401	55	18.4	28	16.3	56	16.0	26	3.8	17	6.5	16	5.0	7	3.1	31	7.7
1918-1922	389	63	16.2	43	11.1	63	16.2	20	5.1	28	7.2	18	4.6	21	5.4	24	6.2
1923-1927	552	102	13.7	90	7.0	88	14.0	21	6.5	36	4.2	27	4.0	17	1.7	44	8.0
1928-1932	670	100	17.1	84	9.1	119	14.4	31	6.4	53	5.3	27	5.3	23	3.5	50	7.5

(c) *In relation to admissions.* Another method of estimating the incidence of intrathoracic cancer is by means of its relation to the number of cases admitted to the hospital wards. It will be seen from Table I that with the steady increase in admissions since 1899 there has been a corresponding increase in the actual number of lung cancers at post-mortem, so that the percentage ratio has only undergone minor variations.



Graph I. Comparison of incidence of cancer of stomach and lung in Berlin and Leeds, 1905-32.

It was previously shown that there had been a steady increase in the number of cases of intrathoracic cancer diagnosed in the wards each year since 1914, and it was suggested that improved methods of diagnosis and the greater clinical interest taken in these cases during recent years were the factors which might account for this contrasting result with post-mortem incidence at Leeds. The percentage of cases diagnosed as intrathoracic cancer compared with total admissions has been maintained but not augmented during the last 5 years when on an average thirty-two cases a year were diagnosed (Table V).

Table V. *Incidence of intrathoracic cancer diagnosed in the wards (Leeds) in five-year periods from 1914 to 1932 inclusive.*

Year	Intrathoracic cancers			Total admissions	Percentage of admissions diagnosed as intrathoracic cancer
	Total	M.	F.		
1914-1917	31	21	10	38,101	0.084
1918-1922	61	51	10	46,410	0.132
1923-1927	137	102	35	59,845	0.226
1928-1932	160	135	25	68,586	0.234

*(2) Incidence in other towns*

The difficulties which arise when the figures from different towns are compared are considerable, and have been discussed by the author and very fully by Ask-Upmark. From reading the various papers which have been written, it would seem that information about the following points would facilitate comparisons:

(1) If it were known how many of the patients dying in hospital came to post-mortem examination, the part played by selection of material could be assessed. This question was discussed only in eight papers, six of which were written in English. Peters (Moabit Hospital, Berlin) states that autopsies are performed on cases dying in all departments of the hospital and that there is no intentional selection. Ask-Upmark (Lund) states that a post-mortem examination is made almost without exception on cases dying in the hospital. Junghanns (Friedrichstadt Hospital, Dresden) finds that 10 per cent. of all admissions to hospital are autopsied. This is nearly twice as many as in Leeds (5·7 per cent.), where a very high percentage of deaths comes to post-mortem, so that it may be concluded that selection is not important in Dresden. Rosahn (Boston City Hospital), Faulds (Glasgow Royal Infirmary), Duguid (Manchester Royal Infirmary) and Simpson (London Hospital) all state that some selection of cases for autopsy occurs in these hospitals.

(2) A definition of the type of tumour included as intrathoracic or lung tumour is necessary. One person collecting cases from the records will naturally select the same type of case throughout the period, so that comparisons within this period are possible, but when the figures of two authors have to be compared, it is essential to know whether the same tumours are under consideration.

(3) The distribution of the sex of the cases throughout the year period should be given so that any difference in incidence between the sexes can be estimated.

(4) Local conditions which might affect the numbers of respiratory tumours in a district should be mentioned.

Ask-Upmark considers that the only reliable method of estimating the incidence of lung tumours is by their relation to tumours in general at post-mortem, rather than by their relation to all autopsies, which he says are too much influenced by changing conditions in the hospital to provide a stable background for a discussion of tumours in a special site. The criticism which can be levelled against this method is that an increase in tumours in general would mask an increase in respiratory tumours, and no attempt is made in Ask-Upmark's paper to determine whether such an increase has occurred. Actually most authors would agree that the post-mortem incidence of all tumours has not increased greatly in recent years.

It was previously shown (Bonser, 1928-9) that until 1927 in one Canadian, one American and fifteen European towns an increase in lung and bronchial cancer at post-mortem had been recorded, whereas in five European towns

Table VI. *Incidence of lung cancer in towns other than Leeds.*

1	2	3	4	5	6	7	8	9
Country and town	Hospital	Author	Has increase been reported?	Nature and time of increase, if any	Lowest	Years	Highest	Years
GERMANY	Urban and Moabit	Feilchenfeld*, Redlich*, Bejach*, Wahl*, Peters	Yes	Stationary 1895-1913, small increase 1913-22, sudden increase 1922-31	0.44	1895-1900	2.2	1927-1931
Berlin	Charité	Hanf*	Yes	Gradual rise 1903-25	0.2	1903-1905	1.28	1921-1925
	Friedrichshain	Biberfeld*, Herz	Yes	Gradual rise 1897-1925, sudden increase 1925-9	0.36	1897-1906	1.58	1925-1929
	Neukölln	Sonnenfeld, Kühn	Yes	Gradual decrease 1909-20, sudden increase 1921-9	0.20	1912-1915	2.11	1926-1929
Hamburg	Eppendorf	Kikuth*	Yes	Gradual rise 1889-1923	0.02	1889-1893	0.86	1919-1923
	Barmbeck	Breckwoldt*	No	Period of observation 1914-25	0.14	1918-1921	0.52	1922-1925
Magdeburg	Sudenburger	Homann	Slight	Gradual slight increase 1906-27	0.15	1906-1909	0.61	1925-1927
Cologne	Augusta	Eichengrün, Esser*	Slight	Stationary or decreasing 1902-19, sudden rise 1919-30	0.15	1914-1919	0.81	1919-1925
	Not stated	Metzmacher	Yes	Stationary 1918-27, sudden rise 1928-30	0.34	1918-1922	0.90	1928-1930
Heidelberg	Path. Inst.	Katz	Yes	Stationary 1906-21, sudden increase 1922-6	0.71	1906-1911	1.46	1922-1926
Jena	Path. Inst.	Berblinger*, Bilz*, Berblinger	Yes	Stationary 1910-19, sudden increase 1920-4, stationary 1920-31	0.80	1910-1919	0.99	1915-1924
Göttingen	Path. Inst.	Egenolf, Simmross	Yes	Gradual rise 1852-1927, sudden increase 1927-31	0.05	1852-1879	1.55	1927-1931
Dresden	Friedrichstadt	Rau*, Jung-hanns	Yes	Gradual rise 1893-1922, sudden rise 1923-7	0.49	1898-1902	1.43	1928-1927
	Johannstädter	Langbein	Yes	Gradual rise 1902-25, sudden rise 1926-30	0.82	1902-1905	3.06	1928-1930
Chemnitz	State	Briese*, Schönherr	Yes	Gradual rise 1898-1927	0.46	1898-1916	1.56	1925-1927
Zwickau	State	Lipschitz	Yes	Stationary 1909-18, sudden rise 1919-28	1.0†	1909-1913	2.0†	1924-1928
Leipzig	Path. Inst.	Seyfarth*, Schlesinger	Yes	Gradual rise 1900-23, definite decrease 1924-9	0.67	1900-1906	1.54	1919-1923
POLAND	2 hospitals	Syrek	Yes	Gradual rise 1901-30	0.09	1901-1905	0.68	1926-1930
Cracow	St. Lazarus							
	Univ. Clinic	Nowicki	Slight	Gradual rise 1896-1920, decrease 1921-30	0.07	1896-1900	0.60	1916-1920
Lemberg	Path. Inst.	Brandt	Yes	Stationary 1901-10, sudden rise 1911-25	0.2	1901-1905	1.9	1916-1920
LATVIA	First State							
Riga								

State	Ask-Upmark	No	Yes	Period of observation	0-16	1896-1900	1-17	1926-1930
SWEDEN Lund		No	Yes	Gives only percentage of malignant lung tumours to total malignant tumours, period of observation 1890-1930	0-16	1896-1900	1-17	1926-1930
AUSTRIA Vienna	Ferency and Matolcsy*, Zacherl, Rogers	Yes	No	Gradual rise 1896-1925, sudden increase 1926-30	0-16	1896-1900	1-5	1929-1930
Innsbruck	Marchesani*	No	No	Period of observation 1869-1931	0-14	1901-1910	0-58	1919-1927
HUNGARY Budapest	Gruber, Sitzen	Slight	Slight	Stationary 1894-1923, slight increase 1924-7	0-07	1899-1903	0-63	1924-1927
CZECHOSLOVAKIA Prague	Wolff*, v. Zalka	Yes	Yes	Gradual rise 1895-1931	0-19	1895-1899	1-02	1925-1931
Troppau	Holzer*, Dismann	Slight	Slight	Gradual rise 1912-23	0-11	1912-1914	0-57	1921-1923
RUSSIA Leningrad	Materna*	No	Yes	Period of observation 1900-24	0-16	1915-1919	0-37	1920-1924
Rostov	Wilinski	Yes	Yes	Stationary 1901-20, sudden increase 1921-9	0-03	1906-1910	1-6	1926-1929
SWITZERLAND Zürich	Derischanoff	Yes	Yes	Gradual rise 1906-26	0-11	1906-1910	0-97	1921-1925
Basel	Probst	Yes	Yes	Gradual rise 1900-24	0-2	1900-1911	0-63	1915-1923
HOLLAND Town not stated	Staehelein*	Yes	Yes	Gradual rise 1910-25	0-15	1910-1913	0-95	1922-1925
AMERICA Boston	De Vries*	Yes	Yes	Gradual rise 1910-28	0-46	1910-1914	1-03	1925-1928
Michigan	Rosahn	Yes	Yes	Gradual rise in course of 2450 autopsies	0-1	Autopsy 1-1000	0-8	Autopsy 2001-2450
Minnesota	Weller	Yes	Yes	Gradual rise 1899-1921	0-0	1899-1911	0-9	1919-1921
CANADA Toronto	Barron*	Yes	Yes	Period of observation 1910-27	0-5	1910-1920	1-0	1921-1927
JAPAN Tokio	Klotz	Yes	Yes	Gradual rise 1887-1923, sudden increase 1924-32	0-1	1889-1893	2-01	1929-1932
GREAT BRITAIN London	Suzuki	Yes	Yes	Gradual rise 1867-1923, sudden increase 1924-8	0-39	1867-1873	2-43	1924-1928
Manchester	Maxwell and Nicholson	Yes	Yes	Stationary 1907-20, sudden rise 1921-5	0-62	1907-1910	1-76	1921-1925
Newcastle-upon-Tyne	Simpson	Yes	Yes	Gradual rise 1885-1926	1-58	1886-1890	3-28	1921-1925
Leeds	Duguid* Peet	Yes	Yes	Period of observation 1920-9	0-93	1920-1904	1-83	1925-1929
Glasgow	Bonsler	No	No	Period of observation 1891-32	0-86	1903-1907	1-38	1928-1932
	Faulds	No	No	Period of observation 1909-28	1-2	1909-1913, 1919-1928	1-7	1914-1918
Victoria	Gillespie	Yes	Yes	Sudden rise 1909-18, and again 1919-28	0-51	1899-1908	2-91	1919-1928

\* References to these authors are given in the previous paper (Bonser 1928-9).  
 † These figures are the percentage of intrathoracic cancers in adult autopsies.

there had been no increase. Records relating to forty-three general hospitals in thirty-five towns in fourteen countries have now been published and an attempt is made to summarise the results in Table VI. An indication is given in each case of the nature of the increase (whether gradual or sudden) and of when it took place. A record is also made of the lowest and highest percentages of lung cancers compared with total post-mortems, so that the extent of the increase can be judged.

From only six of the forty-three hospitals is no increase reported. These are Innsbruck, Hamburg, Lund, Leningrad, Leeds and Glasgow. In five other hospitals the increase is regarded by the author as being slight—Cologne, Magdeburg, Lemberg, Budapest and Troppau. In three of these latter cases—Cologne, Magdeburg and Troppau—Ask-Upmark states that the figures do not bear analysis. This author also concludes that the increase recorded at Heidelberg and Riga is not proved. In conclusion, therefore, of forty-three hospitals from which post-mortem figures are available a definite increase in lung and bronchial cancer is reported from thirty-two.

In comparing the figures of British hospitals with those of other countries it is seen from Table VI that the lowest figure in Britain is at St Bartholomew's with 0.39 per cent. of post-mortems in 1867-73, whereas in Germany a figure of 0.05 was recorded from Göttingen in 1852-79. The highest figure in Britain is in Manchester, 3.28 per cent. in 1921-5, whereas in Dresden 3.06 per cent. occurred in 1926-30. If an average is taken, of four British hospitals with records of the years 1900-4, 1.16 per cent. of post-mortems were intrathoracic cancer. Of twenty hospitals in other countries in approximately the same year periods, only 0.34 per cent. was recorded. Of six British hospitals, in more recent years (1920-30) an average of 2.15 per cent. of intrathoracic cancer is obtained. In comparison, of thirty-four hospitals in other countries an average of 1.24 per cent. is obtained. Thus, the suggestion put forward in the previous paper, that at the beginning of the century the continental figures were of a lower order than the British ones, is confirmed and, even though there has been such a marked increase in many towns, the figures abroad still do not reach such a high level as those in Britain.

An exception to this finding is observed in the figures from Saxony in Germany, comprising the towns Dresden, Chemnitz, Zwickau and Leipzig. The earliest observation is from 1893-7 (by Junghanns in Dresden) when a percentage of 0.68 of all post-mortems was given. From 1900 to 1904, in the four towns, an average of 0.64 per cent. occurred, and from 1925 to 1930 an average of 1.81 per cent. These figures are not very different from those of the British hospitals. The authors comment upon the unusual magnitude of the Saxony figures compared with the rest of Germany. Schönherr (Chemnitz) and Lipschitz (Zwickau) both mention the proximity of the Schneeberg mines, but neither thinks that the occupational disease is the cause of the high figures in these towns. Dresden and Leipzig are situated about 60 miles from Schneeberg, and Chemnitz and Zwickau 20 and 10 miles respectively. Lipschitz

states that the mines at Schneeberg are now practically at a standstill, but as the latent period before the development of lung cancer in the miners is prolonged (15-25 years), one would not expect a recent closing of the mines to affect the figures as yet. Junghanns (Dresden), Schönherr and Lipschitz regard the atmospheric pollution from factories and motor traffic in these large towns as the cause of the high figures recorded.

In 1930, Šikl published a report of occupational lung cancer in the pitchblende miners in Joachimstal, Czechoslovakia. The mines have been worked since 1516 and have yielded silver, cobalt, nickel, bismuth and arsenic, and pitchblende since the discovery of radium by Madame Curie at the beginning of this century. The miners number about 320, of whom eighty are retired. Until 1921, no particular frequency of lung cancer was observed (Uhlig), but in 1929 Löwy described two cases in Joachimstal miners. One of these came to post-mortem at the German Pathological Institute at Prague (from which Holzer and Dissmann's figures quoted above are collected) and the other was autopsied at the Nonnenbruch Clinic in Prague. Šikl describes autopsies on ten miners (of fifteen who died prior to 1930) and states that cancer of the lung or pleura was found in eight cases. The average age was 48 years and the duration of work in the mines varied from 13 to 23 years. He does not state where the autopsies on the ten recent cases took place, but as Prague is situated about 80 miles from Joachimstal and is the nearest large town, it seems likely that at any rate some of them would find their way to the hospitals there. A gradual rise in the percentage of intrathoracic cancer in Prague was observed by Holzer and Dissmann, culminating in a figure of 1.02 per cent. for the years 1925-31. These figures are considerably below the ones observed in Saxony.

(3) *Comparison of incidence in the male and female sex*

In Table VII are given the death-rates from cancer of the lung and mediastinum per million of the population (standardized) from 1900 to 1930 taken

Table VII. *Mortality from intrathoracic cancer in England and Wales. Rates per million population, standardized\*.*

Year	Lung		Mediastinum		Lung and mediastinum	
	Male	Female	Male	Female	Male	Female
1901-1910	10.2	7.0	8.1	4.5	18.3	11.5
1911-1920	12.7	7.0	9.2	4.6	21.9	11.6
1921-1930	25.2	9.6	12.6	5.8	37.8	15.4
1926	23.3	9.2	13.3	6.0	36.6	15.2
1927	26.8	9.7	12.9	6.0	39.7	15.7
1928	32.0	10.4	13.3	5.4	45.3	15.8
1929	33.4	11.9	12.1	5.6	45.5	17.5
1930	40.2	13.9	13.1	5.3	53.3	19.2

\* The term "standardized death-rate" means the death-rate corrected for differences of sex and age constitution of the population.

from the *Registrar-General's Statistical Review* (1930). If the rates for the two sites are added together<sup>1</sup>, it is seen that the male mortality from intrathoracic cancer has been doubled since 1901–10 and more than doubled if the figures for the last five years are considered apart from the decennium in which they occur, while the female mortality has not risen to the same degree and is not tending to rise much further at the present moment. From this it can be inferred that factors are at work which are augmenting the intrathoracic cancer death-rate in males quite apart from the question of more accurate clinical diagnosis, for this latter factor must operate equally upon the sexes.

Renaud discusses the cancer death-rate for the whole of Switzerland and finds that in 1901–10 0.6 per cent. of all deaths from cancer in males were due to cancer of the lung and pleura (these figures do not include deaths from sarcoma). This figure rose to 1.4 per cent. in 1920. By contrast, the percentage of female cancers which were diagnosed as lung and pleural cancer in 1901–10 was 0.5 and in 1920 it was 0.6. Renaud observes that cancer is as frequent in males as in females in absolute numbers and rather more frequent relative to the total population. Thus the sex differentiated increase in intrathoracic cancer recorded in England by the Registrar-General has also been observed in Switzerland.

A search of the literature for information on this point in post-mortem statistics has yielded the following results.

Egenolf has collected together the lung cancer cases of 34 authors and finds that 2319 occurred in males and 788 in females. This gives a ratio of 2.94 : 1. It seems certain (although it is often not specifically stated) that more male post-mortem examinations are performed than female (in Leeds in the proportion of 3 : 2) but it may be concluded that intrathoracic cancer does actually occur more frequently in the male sex. Dissmann, in discussing the Prague figures, states that in 1895–1924 the ratio of male to female lung cancers was 2.04 : 1, whereas in 1925–31 it was 4.7 : 1 (sixty-six male and fourteen female cases). He regards this as evidence that there has been an increase in the male sex in recent years.

Eleven authors consider the incidence of intrathoracic tumours at post-mortem in each sex separately. Of four hospitals—Leeds, Glasgow (Royal Infirmary), Innsbruck and Leningrad—in which no increase in total intrathoracic cancer has been observed over a considerable period (Table VI), there is evidence to show that there has also been no appreciable increase or decrease in the incidence in either sex when considered separately. It is to be noted that there is some irregularity in both sexes at Glasgow and Innsbruck (Table VIII). At Leningrad, by collecting material from five hospitals, Wilinski shows that in relation to total cancers in each sex there has been no

<sup>1</sup> These figures are not strictly correct, as the Registrar-General's rates are standardized separately for lung and for mediastinum. In view of the difficulty of differentiating clinically between the two types of tumour and of the change in conception of their site of origin in recent years, it seems preferable to consider the tumours arising in these two sites together.

alteration in the percentage incidence of lung cancer in either sex between 1900 and 1924. This is also true for Leeds (Table VIII).

Table VIII. *Incidence of male and female lung cancer at Leeds, Glasgow (Royal Infirmary) and Innsbruck.*

Leeds							Glasgow (Royal Infirmary)						
Year	Autopsies		Lung cancers		%		Year	Autopsies		Lung cancers		%	
	M.	F.	M.	F.	M.	F.		M.	F.	M.	F.	M.	F.
1908-1912	1542	829	23	8	1.5	0.95	1909-13	1166*	609*	16	5	1.4	0.8
1913-1917	1573	858	22	9	1.4	1.00	1914-18	1167	583	20	9	1.7	1.5
1918-1922	1728	912	18	6	1.0	0.66	1919-23	1174	573	13	9	1.1	1.6
1923-1927	2374	1388	34	10	1.4	0.72	1924-8	1356	766	22	6	1.6	0.8
1928-1932	2197	1430	39	11	1.8	0.76							

Innsbruck						
Year	Autopsies		Lung cancers		%	
	M.	F.	M.	F.	M.	F.
1869-1880	716	611	2	1	0.28	0.16
1881-1890	721	561	4	2	0.55	0.36
1891-1900	1537	1146	4	2	0.26	0.17
1901-1910	2075	1467	3	2	0.14	0.14
1911-1918	2905	1653	7	8	0.24	0.48
1919-1927	2055	1717	13	9	0.63	0.52
1926-1931	1344	1030	9	3	0.29	0.29

\* Figures in these columns supplied by Dr Faulds in a personal communication.

The figures of seven hospitals in which an increase in the total incidence of intrathoracic cancer has been observed during this century show that with two exceptions the increase favours one sex more than the other. At Dresden and Berlin (Moabit), from which hospitals the largest figures are available, there has been a greater increase in the male than in the female sex (Table IX). Both the authors comment upon this fact and regard it as interesting and important. Similarly at Jena and Budapest the figures point towards a greater increase in the male sex, but it is to be noted that the total numbers of tumours in females are very small, a criticism which applies also to the following three hospitals (Table X).

At Glasgow (Victoria) it is shown that until the end of the war the increase was considerable in the male sex, but since this time the figures have remained nearly stationary. On the other hand a slight increase occurred in females until the end of the war and was followed by a great rise after the war, so that from 1919 to 1928 the incidence in females was greater than it was in males. At Newcastle, in comparing the half-decade 1925-9 with the previous half-decade, Peet records a rather greater increase in females (3 : 1) than in males (2 : 1). At Riga (where the figures are only approximate because they are taken from a small graph) the increase was observed equally in both sexes (Table X).

Of the figures just quoted, those of Dresden, Newcastle and Riga refer to

Table IX. *Incidence of intrathoracic cancer in male and female sex at Dresden, Berlin, Jena and Budapest.*

Town	Hospital	Author	Year	Male intrathoracic cancer			Female intrathoracic cancer		
				Total	% of male autopsies	% of male cancers	Total	% of female autopsies	% of female cancers
Dresden	Friedrichstadt	Junghanns	1893-1897*	20	1.00	11.63	5	0.36	2.49
			1898-1902*	17	0.74	10.38	4	0.24	2.33
			1903-1907	24	0.84	10.71	10	0.38	2.97
			1908-1912	28	0.90	9.93	13	0.44	3.71
			1913-1917	37	1.34	14.02	7	0.28	2.46
			1918-1922	46	1.63	17.58	9	0.30	2.64
			1923-1927	74	2.38	22.41	16	0.48	3.23
Berlin	Moabit	Peters	1905-1908	12	0.31	3.7	4	0.10	1.2
			1908-1913	24	0.35	3.5	9	0.13	1.3
			1913-1917	21	0.50	4.7	6	0.14	1.4
			1917-1922	20	0.44	5.1	4	0.09	1.0
			1922-1927	45	1.20	10.3	12	0.32	2.8
			1927-1931	84	1.81	13.1	19	0.41	2.3
			1910-1914	6	0.26	—	2	0.09	—
Jena	Berblinger	1915-1919	9	0.27	—	1	0.03	—	
		1920-1924	19	0.78	—	5	0.21	—	
		1925-1929	27	0.80	—	4	0.12	—	
		1930, 1931	8	0.81	—	1	0.11	—	
		1894-1898	2	0.11	—	0	0.00	—	
		1899-1903	1	0.03	—	1	0.03	—	
		1904-1908	5	0.17	—	4	0.14	—	
Budapest	v. Zalka	1909-1913	11	0.26	—	3	0.08	—	
		1914-1918	13	0.32	—	2	0.05	—	
		1919-1923	12	0.22	—	2	0.04	—	
		1924-1927	19	0.50	—	5	0.13	—	
		% of all autopsies							% of all autopsies
									% of all cancers

\* The figures for these years refer to autopsies performed at one of the two institutions included under the name Friedrichstadt. The remaining figures refer to autopsies performed at both institutions.

the relation of intrathoracic tumours in each sex compared with total post-mortems or total cancers in each sex separately. Those of Berlin, Jena, Budapest and Glasgow (Victoria) refer to intrathoracic tumours in each sex compared with total post-mortems or total cancers in both sexes together. This latter method is less valuable in that it presupposes uniformity throughout the period of the sex incidence of both autopsies and cancers.

Further information with regard to this question is desirable, and until it is available no definite conclusions can be drawn, but it may be stated that where an increase in intrathoracic cancer has been recorded, the general tendency is towards a greater increase in the male than in the female sex. This is apparent in the Registrar-General's figures for England and Wales, and has also been observed in Switzerland. It is seen in the two largest published series of post-

Table X. *Incidence of intrathoracic cancer in male and female sex at Newcastle, Riga and Glasgow (Victoria Infirmiry).*

Town	Hospital	Author	Year	Male intra-thoracic cancer			Female intra-thoracic cancer		
				Total	% of male autopsies	% of male cancers†	Total	% of female autopsies	% of female cancers†
Newcastle		Peet	1920-1924	19	1.3*	—	2	0.25*	—
			1925-1929	37	2.5*	—	8	0.81*	—
Riga		Brandt and Jekabson	1900-1904	127	—	6	14	—	1.0
			1905-1909		—	7		—	1.5
			1910-1914		—	14		—	1.8
			1915-1919		—	13		—	1.5
			1920-1924		—	17		—	2.5
			1925-1929		—	18		—	4.0
Glasgow	Victoria	Gillespie	1899-1908	5	0.25	—	5	0.25	—
			1909-1918	10	1.27	—	3	0.37	—
			1919-1928	18	1.38	—	20	1.58	—

\* These figures supplied by Dr Peet in a personal communication.

† These figures are taken from a small graph and are therefore only approximate.

mortem figures (Dresden and Berlin (Moabit), Table IX). Of the smaller series of figures, in two the increase appears to be greater in males than in females (Jena and Budapest), in one both sexes are equally affected (Riga) and in two there is an increase in both sexes but it is rather greater in the female (Newcastle and Glasgow, Victoria). Where no increase in intrathoracic cancer has been recorded at post-mortem, there has been no significant alteration in incidence in either sex (Leeds, Glasgow (Royal), Innsbruck and Leningrad, Table VIII).

A differentiation in incidence between the sexes would appear to be independent of the various factors brought forward hitherto as causes of the apparent increase (for example better diagnosis and greater interest in this type of cancer). It is suggested that if such differentiation were extended and confirmed it could be regarded as evidence in favour of the real nature of the increase.

## SEX AND AGE

Of fifty cases occurring in Leeds between 1928 and 1932, thirty-nine (78 per cent.) occurred in males and eleven (22 per cent.) in females. This is in close accord with cases previously recorded and with those of other authors. The proportion of male to female autopsies in Leeds from 1928 to 1932 is very nearly 3 : 2, so that the preponderance of male over female cases is a real one. No cases were observed under 25 years of age, but as six cases under 21 years occurred between 1891 and 1927, it has not been thought useful to estimate the incidence of this disease in relation to adult post-mortems only, a point greatly stressed by other authors (Peters, Rosahn). Of fifty tumours, seventeen occurred between 50 and 59 years and thirteen between 40 and 49 years. More than twice as many (fourteen) occurred between 20 and 39 as between 60 and 79 years (six).

## OCCUPATION

The occupation of thirty-seven of the male patients is recorded in the proportion of twenty indoor to seventeen outdoor workers. No relation between occupation and this disease is known (except in so far as the Schneeberg and Joachimstal miners are concerned), and the variety of occupations amongst the fifty cases now being described does not suggest any causal relationship.

## HISTOLOGY

The pathology and histology of a series of intrathoracic tumours occurring at Leeds are discussed in a recent publication (Bonser, 1934). Evidence is there presented in support of the idea that the oat cell tumours are epithelial in nature and arise from bronchial epithelium. Reasons are also given for including three "small oat cell tumours" in the ordinary oat cell group. Of fifty tumours which occurred at the General Infirmary at Leeds between 1928 and 1932, twenty-four were classified as oat cell (including two small oat cell), thirteen as spheroidal cell, six as squamous cell tumours, and seven as adenocarcinoma (including several of papillary type). Thus, if it is conceded that the oat cell tumours are carcinomatous, no cases of sarcoma have occurred at Leeds during the past five years. During this time a detailed study of the morbid anatomical and histological appearances has been made. If only one slide had been available, it is probable that the two cases classified as small oat cell tumours would previously have been classified as lymphosarcomata.

## CONCLUSIONS

1. An analysis of post-mortem records at the Leeds General Infirmary has shown that there has been no increase during 41 years in the incidence of intrathoracic cancer compared with total post-mortems, total cancers or total admissions to hospital.

2. By contrast, a definite increase in lung and bronchial cancer is reported from at least thirty-two general hospitals out of a total of forty-two in other

parts of the world from which records are available. With the exception of four towns in Saxony, Germany, the incidence of this type of cancer in other countries at the beginning of the century was very much lower than it was in Great Britain. It is shown that in spite of the great increase recorded the figures abroad still do not reach such a high level as those in Britain.

3. Evidence of some degree of sex differentiation in the increase in intrathoracic cancer is given and it is believed that further information on this point would be of value. It is pointed out that the various causes suggested hitherto (for example, better diagnosis and greater interest in this type of cancer) cannot be held responsible for this difference between the sexes, which suggests that the increase may be a real one.

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## REFERENCES

- ASK-UPMARK, E. (1932). *Acta path. et microbiol. Scandinav.* **9**, 159.  
 BERBLINGER, W. (1931). *Med. Klin.* **27**, 1337.  
 BONSER, G. M. (1928-9). *J. Hygiene*, **28**, 340.  
 — (1934). *J. Path. and Bact.* **38**, 209.  
 BRANDT, M. (1926). *Virchows Arch.* **262**, 211.  
 BRANDT, M. and JEKABSON, K. (1930). *Ztschr. f. Krebsf.* **32**, 280.  
 BUSCHBECK, H. (1931). *Ibid.* **34**, 678.  
 DAVIDSON, M. (1930). *Cancer of the lung and other intrathoracic tumours*. Bristol: Wright.  
 DERISCHANOFF, S. (1932). *Ztschr. f. Krebsf.* **35**, 481.  
 DISSMANN, E. (1932). *Ibid.* **36**, 563.  
 DUGUID, J. B. (1927). *Lancet*, ii, 111.  
 EGENOLF, W. (1930). *Ztschr. f. Krebsf.* **31**, 397.  
 FAULDS, J. S. (1929-30). *J. Hygiene*, **29**, 362.  
 GILLESPIE, M. (1932). *Glasgow Med. J.* **117**, 296 and **118**, 26.  
 GRUBER, G. B. (1928). *Wien. klin. Wchnschr.* ii, 1641 and 1686.  
 HERZ, F. (1930). *Med. Klin.* **26**, 1666.  
 HOLZER, H. (1925). *Ibid.* **21**, 1235.  
 HOMANN, E. (1929). *Ergebn. d. inn. Med. u. Kinderh.* **35**, 206.  
 JUNGHANNS, H. (1929). *Ztschr. f. Krebsf.* **28**, 573.  
 KATZ, K. (1927). *Ibid.* **25**, 368.  
 KLOTZ, O. (1927). *Canad. Med. Assoc. J.* **17**, 989.  
 KÜHN, C. (1930). *Ztschr. f. Krebsf.* **31**, 276.  
 LANGBEIN (1933). *Inaug.-Diss.* Leipzig, cited by Buschbeck.  
 LIPSCHITZ, M. (1929). *Deutsche med. Wchnschr.* **41**, 1708.  
 LÖWY, J. (1929). *Med. Klin.* **25**, 141, cited by Šikl.  
 MAXWELL, J. and NICHOLSON, W. A. (1929). *St Barth. Hosp. Rep.* **62**, 204.  
 METZMACHER (1930). *Diss.* Köln, cited by Peters.  
 NOWICKI, W. (1932). *Ztschr. f. Krebsf.* **37**, 83.  
 PEET, E. W. (1931). *Newcastle Med. J.* **11**, 97.  
 PETERS, W. (1932). *Ztschr. f. Krebsf.* **37**, 587.  
 PROBST, R. (1927). *Ibid.* **25**, 431.

- REGISTRAR-GENERAL (1930). *Statistical Review*, New Annual Series, No. 10, Text, 57.
- RENAUD, A. (1926). *Schweiz. med. Wchnschr.* **7**, 132.
- ROGERS, W. L. (1932). *Arch. Int. Med.* **49**, 1058.
- ROSAHN, P. D. (1930). *Amer. J. Med. Sci.* **179**, 803.
- SCHLESINGER, M. (1930). *Ztschr. f. Krebsf.* **31**, 517.
- SCHÖNHERR, E. (1928). *Ibid.* **27**, 436.
- ŠIKL, H. (1930). *Ibid.* **32**, 609.
- SIMMROSS, E. (1932). *Virchows Arch.* **285**, 183.
- SIMPSON, S. L. (1928–9). *Quart. J. Med.* **20**, 413.
- SITZEN, A. E. (1932). *Ztschr. f. Krebsf.* **36**, 313.
- SONNENFELD, A. (1926). *Ergebn. d. ges. Med.* **8**, 546.
- SUZUKI, T. (1933). *Gann*, **27**, 190.
- SYREK, A. (1932). *Ztschr. f. Krebsf.* **36**, 409.
- UHLIG, M. (1921). *Virchows Arch.* **230**, 76, cited by Šikl.
- WELLER, C. V. (1929). *Arch. Path.* **7**, 478.
- WILINSKI, M. N. (1930). *Ztschr. f. Krebsf.* **31**, 72.
- ZACHERL, S. (1931). *Wien. klin. Wchnschr.* ii, 967.
- V. ZALKA, E. (1928). *Ztschr. f. Krebsf.* **26**, 130.

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