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Necropsy incidence of emphysema in Uganda

ALED W. JONES and P. J. MADDA

Department of Pathology, Makerere University, PO Box 7072, Kampala, Uganda

Jones, A. W. and Madda, P. J. (1974). *Thorax*, **29**, 195–198. **Necropsy incidence of emphysema in Uganda.** The incidence and types of pulmonary emphysema and the degree of dust pigmentation of the lungs were investigated in a series of 183 necropsies in Uganda.

Emphysema was present in 43 (23·5%) lungs. Panlobular or centrilobular emphysema was found in 17 cases, an overall incidence of 9·3% (10·4% of the 135 males and 6·3% of the 48 females). It was generally of mild degree and the mean lung involvement, as assessed by a point counting method, was 9·2% in the 17 cases described above. Panlobular and centrilobular emphysema occurred in the older age groups; 13 of the 17 cases were 50 years old or more. The remaining 26 cases consisted of irregular (scar) emphysema which occurred in trace amounts (less than 1%).

Dust pigmentation was present in all 17 cases of emphysematous lungs and was generally more severe than in the non-emphysematous lungs.

The incidence of emphysema in this predominantly rural population is low and is similar to that found in Ibadan, Nigeria.

The necropsy incidence of emphysema has mostly been studied in the urban industrial environment. Surveys in London (Heard and Izukawa, 1964), Cardiff (Gough, Ryder, Otto, and Heller, 1967), Edinburgh (Heard and Hossain, 1970), Glasgow (Roberts and Scott, 1972), and Birmingham (Hasleton, 1972) have shown a high incidence of emphysema. A similar prevalence has been observed in urban surveys in Japan (Yamanaka, 1970), Boston, USA (Thurlbeck, 1963), Detroit, USA (Snider, Brody, and Doctor, 1962), Houston, USA (Boushy, Greenberg, and Jenkins, 1968), Denver, USA (Mitchell *et al.*, 1969), and Sydney, Australia (Smith, 1965).

The incidence of emphysema in non-industrial environments has been less well documented and there is some variation in the results. Hayes (1970), reporting a large series from Kingston, Jamaica, found an incidence approaching that of Boston, USA, while in Ibadan, Nigeria there was a low incidence (Alli, 1972).

Uganda is a non-industrial, developing country with a population of 10 million people (Uganda Census, 1969) occupying approximately 94,000 square miles. The overall population density is low and the people are mainly rural dwellers engaged primarily in agricultural and related pursuits. There is no heavy industry and the only mining is that of copper on a small scale in a well defined area in Western Uganda.

The present study describes the incidence and types of emphysema encountered at necropsy. The severity of lung dust pigmentation in the predominantly rural population was also investigated in order to assess whether it correlated in any way with the degree of emphysema.

MATERIALS AND METHODS

PATIENTS All the patients studied died in the New Mulago Hospital, Kampala and were over 10 years of age at their deaths. This is a teaching hospital which admits patients of all tribal groups from all regions of Uganda; however, the majority of patients come from Southern Uganda and in particular from Kampala and its surrounding districts. The Pathology Department, Makerere University, provides the necropsy service for New Mulago Hospital.

FIXATION OF LUNGS AND MACROSCOPIC POINT COUNTING Left lungs were collected from 183 unselected necropsies. The lungs were carefully removed from the thorax avoiding damage to the pleura. The pulmonary artery and veins were ligated and the lungs

were inflated with buffered 10% formalin at a pressure of 25–30 cm and the bronchus was clamped. The lungs were floated in formalin and allowed to fix for a minimum of 72 hours. Whole slice sagittal sections (1 cm thick) were cut. Five to seven slices were obtained from each lung, depending on its size, and the five most lateral slices were examined under water for pathological lesions and the presence and amount of emphysema. The types of emphysema noted were centrilobular, panlobular, and irregular (scar) varieties. Emphysema was quantitated by the macroscopic point counting technique used by Ryder, Dunnill, and Anderson (1971) in which emphysema is expressed as a percentage of the total lung parenchyma in five slices, excluding the large vessels and bronchi.

Blocks for histological sections were taken from areas of irregular emphysema and from other lesions as required.

LUNG PIGMENTATION The degree of dust pigmentation in all lungs was scored as zero, light, moderate or heavy using the following method. Each of the five lateral sagittal slices was graded from zero to three on the basis of the amount of pigment present, thus giving a maximum score of 15 for each lung. Scores of 1–5 were called light, 6–10 were moderate, and 11–15 heavy.

RESULTS

One hundred and eighty-three left lungs were examined from 135 males and 48 females. The ages of 170 subjects (125 males and 45 females) were known and these ranged from 10 to 82 years, the average being 39·9 years. The remaining 13 were adults of unspecified ages. Thirty-four (26·7%) out of 152 subjects were from a town or town area as distinct from a village environment.

INCIDENCE AND TYPE OF EMPHYSEMA Emphysema was found in 43 lungs (23·5%). Seventeen cases were either panlobular or centrilobular in type and the details of these cases are shown in Table I. Of these subjects, 13 were 50 years or more and the average age was 53·9 years. Diffuse emphysema occurred in 14 men (10·3%) and 3 women (6·3%).

The other 26 cases were of the irregular or scar type. In 24 of them the emphysema was seen in trace amounts only (less than 1%). The average age in the group was 44·8 years, which compares with a mean age of 37·3 for the non-emphysematous cases. The numbers and percentage incidence of all types of emphysema are summarized in Table II.

LUNG PIGMENTATION Dust pigment was deposited in both the emphysematous and non-emphysematous lungs. Twenty-one (12·4%) of the non-emphysematous lungs contained no pigment, but all 17 examples of diffuse emphysema were pigmented and in 59% this was of a heavy grade (Table III). In those lungs with centrilobular or panlobular emphysema, there was a considerably higher incidence of heavy grade pigmentation than in the non-emphysematous lungs. However, lungs with a heavy grade of pigment but no emphysema were also found.

DISCUSSION

Necropsy surveys have shown a high incidence of pulmonary emphysema in the industrial conurba-

TABLE I

CASES OF CENTRILOBULAR AND PANLOBULAR EMPHYSEMA

No.	Age	Sex	Type	%	Dust Pigment
1	48	M	C	19·6	H
2	24	M	C	15·4	H
3	65	F	C	17·7	H
4	60	M	C	8·6	H
5	60	M	C	3·0	H
6	35	M	C	2·0	M
7	60	F	P	26·0	H
8	60	M	P	3·5	L
9	52	M	P	16·8	M
10	50	M	P	6·1	L
11	72	M	P	5·0	H
12	45	M	C	>1·0	M
13	66	M	C	11·0	H
14	50	M	C	>1·0	H
15	50	M	C	>1·0	L
16	70	M	P	5·3	M
17	50	F	C	10·2	H

P=panlobular; C=centrilobular; L=light; M=medium; H=heavy.

TABLE II

TYPES OF EMPHYSEMA (NUMBERS)

	Male	Female	Male and Female
Emphysema: P and C	14	3	17
Irregular	22	4	26
Total	36	7	43
Number examined	135	48	183
Incidence of emphysema (%)			
Emphysema: P and C	10·4	6·3	9·3
Irregular	16·3	8·3	14·2
Total	26·7	14·6	23·5

P=panlobular; C=centrilobular.

TABLE III

EXTENT OF EMPHYSEMA AND DEGREE OF DUST PIGMENT

Dust Pigment Grade	Mean % Emphysema	Range	Mean Age	No. of Cases
Zero	—	—	—	0
Light	3·5	>1·0–6·1	53·3	3
Medium	6·3	>1·0–16·8	50·0	4
Heavy	11·8	>1·0–26·0	55·5	10
All grades	9·0	—	—	17

tions of North America and the United Kingdom. Two previous surveys carried out in non-industrial environments have produced dissimilar results. Alli (1972) found a low incidence of emphysema in Ibadan, Nigeria, which agrees with the present report from Uganda and shows an occurrence of 23·5% for all types of emphysema, a result which is comparable with that of 19·3% reported from Nigeria. However, the figure 23·5% includes a high proportion of cases with trace scar emphysema; if these cases are disregarded, the incidence of panlobular and centrilobular types is 9·3%, which also approximates to that found in Nigeria (8·8%). The extent of emphysema expressed as the average per patient per decade in men over 40 in this series is very low compared with that for London (Heard and Izukawa, 1964) and Edinburgh (Heard and Hossain, 1970) (Table IV).

TABLE IV

MEAN PERCENTAGE AREA OF EMPHYSEMA PER MALE PATIENT BY DECADE

Decade	Uganda	London	Edinburgh
40–49	0·9	3·0	5·4
50–59	1·3	24·0	9·4
60–69	3·1	34·2	32·0
70–79	1·5	33·1	18·2
80–89	1·0	17·0	36·5

In the other survey from a non-industrialized environment (Kingston, Jamaica) a high necropsy incidence of emphysema was reported (Hayes, 1970; Hayes and Summerell, 1969) which approached that seen in London and Boston, USA (Thurlbeck, 1963). Hayes found alveolar (panlobular) emphysema of all grades of severity in 84·8% of males; however, it was of a severe grade in only 1·8%. In this latter series Gough–Wentworth paper-mounted macrosections were studied, whereas gross lung sections were examined in the two African series. It is possible that the differing techniques accounted for some of the variation, although a real incidence difference remains which cannot be explained on this basis alone. It is more likely to be due to smoking and environmental differences than to racial or genetic factors. For Hayes (1970) found no difference in panlobular emphysema between the black population and the small group of white people in his series. Indirect evidence suggesting that this relatively high incidence may be linked to a heavier tobacco consumption than in Uganda is the intermediate bronchial carcinoma incidence of Kingston (Bras, Whimster, Patrick, and Woo-Ming, 1972) in comparison with the low incidence in Uganda (Doll, 1969) and the high incidence found in the United Kingdom and the USA.

The prevalence of emphysema in Uganda is thus low, and it is pertinent to examine this in the light of factors such as air pollution, smoking, α_1 antitrypsin deficiency, and pulmonary inflammatory diseases.

AIR POLLUTION There is no heavy industry in Uganda and only a small percentage of the population is involved in light industries in the major towns. Increasing use is being made of road transport but this does not yet approach the concentration found in the developed countries. A more likely source of air pollution and lung dust pigmentation is the smoke from cooking fires. In the rural areas, the fuels used for cooking are charcoal, wood, and paraffin. Cooking may or may not be carried out in a special cooking hut, the ventilation of which varies, and it is mainly women who are exposed. Wood fires are also burnt in the huts at night in certain areas of Uganda where the high altitude (over 6,000 feet above sea-level) creates a low night temperature, thus providing a further source of atmospheric pollution.

SMOKING Tobacco has been grown commercially in Uganda since the late 1920s, and both commercial cigarettes and local non-commercial tobacco are smoked. A survey of medical inpatients has shown that 48% of the men and 16·7% of the women smoked, but the majority of them were light smokers (Jones, 1972). A more comprehensive commercial market research survey in the rural areas (1968) showed that 53% of the males and 24% of the women smoked tobacco of some type. The annual number of commercial cigarettes sold in Uganda between 1956 and 1971 fluctuated between 1,027 and 1,583 million (US Department of Agriculture, 1957–71). Calculations based on the 1969 Uganda Census show that commercial cigarette consumption per adult per annum is between 150 and 200 cigarettes, which is very low compared with the United Kingdom figure of 3,740 to 4,030 (Todd, 1972).

α_1 ANTITRYPSIN DEFICIENCY There are no data on the incidence of this condition in Uganda; however, no examples of panlobular emphysema with a predominantly lower lobe distribution were noted in this series.

PULMONARY INFLAMMATORY DISEASES Pulmonary tuberculosis, bronchiectasis, and chest infections

are still common in Uganda, and it is presumed that irregular (scar) emphysema is the result of such infections. Extensive scar emphysema occurred in two cases only, as a complication of diffuse interstitial pulmonary fibrosis of unknown aetiology.

LUNG DUST PIGMENT Although dust pigmentation in lungs is common in industrial environments, it was expected that this would be rare in the Ugandan lungs; however, 88·5% showed pigmentation. The distributions of the severity of pigmentation in Uganda and London (Heard and Izukawa, 1962) are remarkably similar, but as the three grades of severity adopted in the two series were independently and arbitrarily chosen, the amounts of the pigment in the London and Ugandan lungs do not necessarily correspond.

The severity of lung pigmentation increases with age. Those with severe emphysema also tended to have heavy grade pigmentation, although similar heavy grade pigmentation was also shown in the absence of emphysema.

In Uganda diffuse emphysema is considerably less prevalent and less severe than in the United Kingdom and North America and less prevalent than in Jamaica. The absence of industrial air pollution may account for this. On the other hand, tobacco smoking and exposure to smoke from cooking fires may be relevant factors in producing the small amount of emphysema and lung dust pigmentation found in the present study. As in other environments, however, the exact mechanism remains obscure.

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Requests for reprints to: Dr. A. W. Jones, Pathology Department, Manchester University, Manchester M13 9PL.