GENERAL PRACTICE OBSERVED

Mobile Chest Radiography Service for General Practitioners

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Summary: In an eight-year period a mobile general practitioner chest x-ray referral service examined 100,000 patients referred by their family doctors. Of the patients examined, 8% were found to have previously undiagnosed significant thoracic disease. The incidence of pulmonary tuberculosis in need of treatment was 2.7 per thousand examinations (55% of them infectious). A total of 590 cases of primary cancer of lung were found. The incidence of this disease in men aged 45 and over was 19.4 per thousand examinations. A survey of general practitioners in the area concerned showed that they welcomed the service as a useful addition to their diagnostic facilities.

Introduction

In January 1959 the Surrey Mass Radiography Service introduced a mobile chest x-ray service for general practitioners working in the County of Surrey and the adjoining parts of Sussex and Hampshire. There were already six static miniature 100-mm. Odelca camera x-ray units in major chest clinics offering an open service for general practitioners, and many hospitals provided similar facilities in their general radiological departments. The need existed to provide a service directly geared to the requirements of general practice whereby the doctor could readily refer for chest radiography any patients who did not have any symptoms and signs of serious thoracic disease. By the end of January 1967 100,000 patients referred by their doctors had been examined through this service.

Organization

The mobile chest x-ray unit consists of a custom-built vehicle containing a 100-mm. Odelca mirror camera chest radiography set and a fully equipped dark-room. There is adequate space for the reception and examination of the patients and for the crew of three—a radiographer, a clerk, and a driver—dark-room technician. The x-ray films are processed while the unit is working; the radiographer can check on their quality, and the films are ready for interpretation when the unit returns to its base.

When the service started 19 sites were visited regularly each week. The sites were chosen at least 3 miles (4.8 km.) from existing static miniature camera units. In response to demands for an increase in the service five additional sites were added to the weekly schedule and some of the original sites were changed. Each visit lasted from 45 minutes to an hour and a quarter, the time depending on the size of the local population. Working throughout the year, except on public holidays and Christmas Eve, a service was provided on four days each week, the unit visiting up to six sites and travelling between 60 and 80 miles (96 and 130 km.) a day. Failure to visit a site because of bad weather or because of mechanical failure of the x-ray equipment or of the vehicle occurred less than once in every

200 visits. (Since October 1967 the service has been enlarged; it now operates on five days a week and visits 28 sites.)

Before the service opened a booklet explaining the method of work and its objects was sent to the general practitioners. It emphasized that there was no intention to replace, or in any way compete with, the local chest services, but that the aim was to increase the facilities whereby patients with little or no respiratory symptoms could have a chest x-ray examination. It was asked that patients should not be referred if (a) they were seriously ill, (b) they had symptoms and signs suggestive of serious respiratory disease, or (c) they were already attending for periodic examination at a hospital or chest clinic. It was suggested that a chest x-ray examination should be considered for patients (a) after any lower respiratory tract infection, (b) complaining of lassitude and fatigue without respiratory symptoms, and (c) with unexplained weight loss. An annual chest x-ray examination might be indicated for (a) diabetics, (b) chronic bronchitics, (c) postgastrectomy patients, (d) patients on regular treatment with steroids, and (e) men over 45 years of age, especially cigarette smokers.

Each general practitioner using the service is supplied with x-ray request forms on which is printed his name and address. When referring a patient the doctor fills in the patient's name and address on the form and adds any clinical details he feels may be helpful. The unit's time-table is printed on the back of the request form, which is handed to the patient. He is told to attend at a time and place that are most convenient to him and to return to the surgery two days after the x-ray film has been taken so that he may learn the result. The report on the chest x-ray film is posted back to the referring doctor the day after the film has been taken. If it is considered that further investigation may be required, a duplicate copy of the report and the x-ray film is also sent. The doctor can then file the report in the patient's notes and send the copy with the film to a hospital or chest clinic. Should the doctor make a specific request the x-ray service will fix an appointment at the appropriate hospital or chest clinic for any patient whose chest x-ray film is thought to show a significant abnormality.

Dual reading of the x-ray films is not practised, as this would result in delay in sending out the results. Interpretation of them is shared equally between us; we are practising chest physicians spending half the time reading miniature films and half in clinical medicine. We believe that this dual responsibility helps us to correlate the abnormalities seen on the chest x-ray film with their probable clinical significance, and to write a more helpful report to the general practitioners. Close liaison with our colleague chest physicians and thoracic surgeons ensures that our standards are maintained and shows that the x-ray reports and the advice given for the disposal of abnormal cases are generally correct.

We have not found that the local general practitioners are inhibited from arranging further investigation of their patients, should the clinical condition warrant it, by the receipt of a report that the chest x-ray picture appeared "satisfactory." Thus, for example, a patient breathless following acute airway obstruction may well have a normal chest x-ray picture; in such cases the mobile service suffers from the same disadvantage as does any open radiological service provided by a chest clinic

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or hospital. A misleading report may be made on any x-ray film when the patient is not seen by a clinician.

Every care is taken to ensure the greatest accuracy in reporting on chest x-ray films. This is helped by: (a) standardized radiographic technique; (b) the facility to compare current films with previous x-rays to detect early signs of disease (more than two million miniature chest x-ray films of residents in the area are held in our files and are readily available for comparison); (c) the co-operation of local general practitioners and chest physicians, who tell us of any patient developing significant chest disease within 12 months of having a "satisfactory" chest x-ray examination by the Surrey units so that the film may be reviewed to determine if the disease might have been discovered earlier; and (d) the re-scrutiny of the report, and where possible the film, when the final diagnosis is obtained by routine "follow-up" carried out three months after the film has been taken. The aim throughout has been to provide a prompt and reliable service for local general practitioners.

Results

Between 1 January 1959 and 29 January 1967 100,000 examinations were made of patients referred to the service by their own doctors: 51.8% were male and 48.2% female. The number referred increased each year, as shown in Table I. The results described in this paper concern only those newly diagnosed abnormalities that were found directly as a result of the patient's attendance at the unit. The results are compared with the findings by routine mass radiography in the same area.

Pulmonary Tuberculosis

The incidence of notified pulmonary tuberculosis in the area covered has fallen steadily during the period under review from 0.4 per thousand of the population in 1959 to 0.16 per thousand in 1966. This fall is reflected in the rate at which this disease has been found by the unit each year. In all, there were 268 cases of active pulmonary tuberculosis—that is, disease in need of treatment—an incidence of 2.68 per thousand examinations (Table I); 74% (199) required treatment in hospital and 55% (147) were infectious. A further 101 cases were considered to require close observation at a chest clinic. (It is not known how many of these cases were later—that is, after the three-month follow-up period—found to require treatment.) In the period 1959–66 the normal mass radiography service in Surrey made 881,751 examinations and 623 cases of active pulmonary tuberculosis were discovered (an incidence of 0.7 per thousand examinations); 54% of them required hospital treatment and 29.5% were infectious.

TABLE I.—Number of Cases of Active and Infectious Pulmonary Tuberculosis Found and Incidence per 1,000 Examinations

Year	No. Examined	Active P.T.*	Incidence per 1,000	Sputum Positive	Incidence per 1,000
1959	6,935	31	4.5	17	2.4
1960	9,100	35	3.8	19	2.1
1961	11,144	38	3.4	25	2.2
1962	11,177	31	2.8	19	1.7
1963	13,353	35	2.6	14	1.0
1964	14,482	37	2.6	20	1.4
1965	15,221	27	1.8	17	1.1
1966	16,921	31	1.9	14	0.8
Jan. '67	1,657	3	1.8	2	1.2
Total	100,000	268	2.7	147	1.5

* Pulmonary tuberculosis in need of treatment.

Primary Carcinoma of Lung

Primary carcinoma of lung was found in 590 patients. In the years 1959–66 normal mass radiography found 396 cases—an incidence of 0.45 per thousand examinations. Nearly all cases were found in those aged 45 years and over (Table II); in this age group the incidence in men is extremely high—

19.4 per thousand examinations, while in women the incidence is 4.1 per thousand examinations. The incidence rate has fluctuated during the period under review, showing no definite trend in men and tending to rise in women.

TABLE II.—Number of Cases of Primary Carcinoma of Lung Found in Those Aged 45 and Over and the Incidence per 1,000 Examinations

Year	Males			Females		
	No. Examined	No. of Cases	Incidence per 1,000	No. Examined	No. of Cases	Incidence per 1,000
1959	1,570	39	24.8	1,147	—	—
1960	2,282	49	21.5	1,642	2	1.2
1961	2,724	55	20.1	2,208	15	6.8
1962	2,928	48	16.4	2,614	6	2.8
1963	3,415	62	18.2	2,566	11	4.3
1964	3,587	84	23.4	2,738	8	2.9
1965	3,938	66	16.8	3,138	16	5.1
1966	4,622	83	17.9	3,580	20	5.6

In January 1967 nine cases in men and two cases in women were found.

Acute Lower Respiratory Tract Infections

A total of 5,671 patients showed radiographic changes associated with acute simple lower respiratory tract infections (72% of all the abnormalities found) (Table III). If all these patients had been referred immediately for further investigations the chest clinics would have been overloaded. By selection on the basis of sex, age, and x-ray appearance it has been possible to reduce to one-third the number referred. Where there is any doubt about the diagnosis of a simple inflammatory lesion on the x-ray film, further investigation is advised at once. If it is felt that the radiographic changes are almost certainly those of a transient pulmonary infection we suggest that the patient be referred back for a further film in three weeks' time to ensure that complete clearing has occurred. If resolution has not occurred by that time, full clinical investigation is advised. Experience has shown that this procedure is helpful to the chest physicians and general practitioners. Only on very rare occasions has the diagnosis of an underlying carcinoma of the bronchus been delayed.

TABLE III.—Analysis of Abnormal Findings in 100,000 Patients Referred

	Male	Female	Total
Pulmonary tuberculosis:			
Active disease	175	93	268
Sputum positive	97	50	147
In need of close chest clinic observation	69	32	101
Malignant neoplasms in thorax:			
Primary tumours	508	82	590
Secondary tumours	29	35	64
Non-malignant tumours	25	22	47
Intrathoracic lymph node enlargement (excluding sarcoidosis)	8	7	15
Sarcoidosis	47	57	104
Abnormalities of heart and great vessels:			
Congenital	6	7	13
Acquired	323	241	564
Pneumoconiosis:			
Without P.M.F.	8	—	8
With P.M.F.	1	—	1
Acute lower respiratory tract infections	3,410	2,261	5,671
Bronchiectasis	120	96	216
Pulmonary fibrosis (non-tuberculous)	68	47	115
Spontaneous pneumothorax	84	10	94
Abnormalities of diaphragm and oesophagus	30	72	102
Pleural effusion (non-tuberculous)	38	21	59
Total	4,949	3,083	8,032

Abnormalities of Heart and Great Vessels

Of 577 cases of abnormalities of the heart and great vessels found only 13 were congenital cardiac abnormalities. The majority of the abnormalities were enlarged hearts secondary to degenerative cardiovascular disease or hypertension, some showing signs of congestive failure. Comment is made in the x-ray reports on the size and appearance of the heart and aorta. The ease with which we can compare the recent chest x-ray film with earlier films ensures that early changes are appreciated and a more helpful report is sent to the general practitioner. Unfortunately, the three-month follow-up procedure that we

employ does not permit analysis of these abnormalities in greater detail. We know from many doctors using the service that reports on the appearance of the heart and the aorta are helpful.

Other Abnormalities

A further 825 significant abnormalities were found; of 47 non-malignant tumours, 21 were retrosternal enlargement of the thyroid; 10 of the 15 cases of "intrathoracic lymph node enlargement" were due to Hodgkin's disease; about 90% of the abnormalities of the diaphragm and oesophagus were herniae of the diaphragm. A record was not made of the site of the primary lesion in all cases of secondary tumours, and this is known in only 11 out of 29 cases in men—in four of these the primary growth was in the prostate—and in 20 out of 35 cases in women—in 14 of these the primary growth was in the breast.

It will be seen from Table III that 8,032 previously unknown abnormalities were found in the 100,000 people examined.

General Practitioners' Opinions of the Service

In January 1967 a questionnaire was sent to all general practitioners working in the area covered by the service. Their comments were invited specifically on the organization and administration of the service, on the accuracy and helpfulness of the reports, and for ways in which the service might be improved. Of 571 questionnaires sent out 424 (74.2%) were returned. (Reminders were not sent to those who did not reply.) The main criticism of the service—made by about 12%—concerned inadequate shelter for their patients waiting to be examined before the unit reached the site. Constructive suggestions were made about alternative sites and possible alterations to the time-table. The replies showed that the service provides a useful addition to the diagnostic facilities of the general practitioners working in the area. Such success as may have been achieved owes a great deal to the co-operation of the doctors for whom the service is provided.

Mass Radiography in England and Wales, 1959–65

The Subcommittee on Mass Radiography of the Medical Research Council (1954) recommended that mass radiography units should intensify their efforts to examine patients referred for a chest x-ray examination by their general practitioner. Until, from 1958 onwards, mobile mass radiography units were equipped with Odelca mirror-camera radiography sets they could not provide a satisfactory referral service. In Surrey 35-mm. miniature radiography sets were used until the end of 1958, and in the preceding five years fewer than 600 patients were referred by their family doctors.

There are now about 80 mass radiography units in England and Wales—either static or mobile—an increasing number of which provide a referral service for general practitioners. The Annual Reports of the Chief Medical Officer of the Ministry of Health for 1960 to 1966 show that in the seven-year period 1959–65 1,663,750 patients were referred to mass radiography units by their doctors. The overall incidence of significant

pulmonary tuberculosis—that is, disease in need of treatment or of close observation at a hospital or chest clinic—was 6.1 per thousand examinations and of cancer of the lung in men 11.6 per thousand. During this same seven-year period the Surrey general practitioner referral service made 81,412 examinations of patients (4.9% of the total for England and Wales); the incidence of significant pulmonary tuberculosis found was 3.9 per thousand and of cancer of the lung in men 10.1 per thousand. The findings of pulmonary tuberculosis reflect the incidence of this disease in the area; notifications of pulmonary tuberculosis per 100,000 of the population in England and Wales fell from 57.1 in 1959 to 28 in 1965 and in Surrey from 40 to 17. The death rate from cancer of the lung in men living in Surrey is about the national average.

Only 7.25% of all mass radiography examinations made in England and Wales between 1959 and 1965 were of patients referred by their general practitioners. The incidence of significant pulmonary tuberculosis in the remaining 92.75% was 1.01 per thousand examinations. The proportion of examinations made by the Surrey Mass Radiography Service of general practitioner referral patients rose from 6.5% in 1959, when the mobile service was first introduced, to 12.6% in 1965 (1959–65, 9.64%). That this increasing concentration on general practitioners' patients has not been detrimental to the work of the normal mass radiography service is shown by its finding 1.16 cases of significant pulmonary tuberculosis in every thousand people examined—that is, 15% above the national average in an area where the notification of this disease is about 70% of that for England and Wales as a whole.

Conclusions

A regular service to which a general practitioner can refer for chest x-ray examination those of his patients who do not have the symptoms and signs of serious thoracic disease provides a useful addition to his diagnostic resources. Even in an area well provided with chest clinics and hospitals, a supplementary service using a self-contained mobile x-ray unit will find unsuspected chest disease and help the doctor in the care of those of his patients who should have regular chest x-ray supervision. A referral service on which the general practitioner can rely must provide accurate reports on the chest x-ray film with the least possible delay.

We are grateful to the chest physicians in the area in which we work and to the general practitioners who use the service for their constructive criticisms and for providing the "follow-up" information that we require. Without their help an efficient service could never be provided. We would also like to thank our secretaries and the staff of the unit for the standard of work they consistently perform.

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