Is investigation of patients with haemoptysis and normal chest radiograph justified?

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Abstract
Background: Haemoptysis is a common clinical symptom. A small proportion of patients present with haemoptysis and normal chest radiograph. Investigation strategy for this group of patients is unclear. The aim of this study is to see whether further investigations for this group of patients are justified.

Methods: We conducted a retrospective analysis of consecutive patients presenting with haemoptysis and normal chest radiograph over a period of 56 months irrespective of their smoking status. These patients were investigated by Computed Tomography of Thorax and Fibreoptic Bronchoscopy.
Results: 275 episodes of haemoptysis with normal chest radiograph were investigated further in 270 patients (males-60%). The median age was 60 years. Twenty six patients were diagnosed to have respiratory tract malignancies (Larynx-1, Trachea-1, Lung-22, Carcinoid-1 and Leiomyoma-1). Eight (31%) of the 26 patients with respiratory tract malignancy had radical treatment. Fibreoptic Bronchoscopy was diagnostic of cancer in 14 (54%) of the 26 patients with malignancy. Computed Tomography of Thorax was suggestive of cancer in 24 (96%) of the 25 patients with malignancy.

Conclusion: We conclude that further investigation of haemoptysis in smokers is justified regardless of amount or frequency of haemoptysis based on 9.6% rate of malignancy in our consecutive series. We recommend that these patients are investigated with Computed Tomography of Thorax followed by Fibreoptic Bronchoscopy.

Introduction
Haemoptysis is a common and worrying clinical symptom. Haemoptysis is potentially life threatening and warrants further investigation. Haemoptysis can be due to varying aetiologies including lung cancer [1]. The optimal strategy for investigating patients with haemoptysis and normal chest radiograph (CXR) is unclear. Physicians tend to investigate these patients differently.

The prognosis for lung cancer remains poor with five year survival figures of 4-12% worldwide [2, 3]. The prospects for changing this are limited by a number of factors including, most notably the late presentation of patients with advanced disease and the lack of convincing evidence for screening asymptomatic individuals for lung cancer. Early diagnosis of lung cancer is crucial to allow curative resection. Further investigations of patients with haemoptysis and normal CXR may lead to early diagnosis.

In this retrospective study we analysed a group of patients with haemoptysis and normal CXR to see whether further investigations were justified.

Methods
We conducted a retrospective analysis of consecutive patients presenting with haemoptysis and normal CXR to Dewsbury and District hospital, West Yorkshire, United Kingdom between May 2001 and December 2005. The catchment population of our hospital is 175,000.

All patients presenting with haemoptysis and a normal CXR were investigated further in line with local guidance irrespective of their smoking status, age, quantity or frequency of haemoptysis. The U.K national guidelines [4] for management of lung cancer recommends urgent chest radiograph for patients presenting with haemoptysis. In our local policy for referral and management of lung cancer for general practitioners and general physicians, urgent referral to chest physicians was advised for all patients presenting with haemoptysis regardless of the CXR result. The patients were either referred from primary care locally or from secondary care in our hospital.
The patients were identified from the urgent suspected lung cancer referrals database and our Fibreoptic Bronchoscopy database. Patients with abnormal CXR were excluded. The CXR should have been reported normal by a radiologist or documented to be normal in medical notes by a chest physician. The outpatient CXRs are reported by our radiologists as a standard practice.

These patients were routinely investigated further by Computed Tomography of Thorax (CT), Fibreoptic Bronchoscopy (FOB) as well as history, clinical examination and blood investigations. The standard CT procedure in our institution for lung cancer staging during the study period was contrast enhanced contiguous 5 millimeter sections from lung apices to liver and adrenal glands. Fibreoptic bronchoscopy is performed either by the chest physician or by supervised trainees. From the clinical records the following variables were collected- age, sex, smoking history, comorbidities, symptoms (e.g. chest pain, weight loss), quantity/nature (streak, teaspoonful, tablespoonful), frequency and duration of haemoptysis (once only, recurrent-more than 1 week), history of chronic sputum production when available and the final diagnosis based on clinical, radiology and histology findings.

Results

275 episodes of haemoptysis with normal CXR were investigated further in 270 patients (males-60%). The median age was 60 years (interquartile range-22 years); 10% under the age of 40. 90% of these patients were either active smokers (156) or ex smokers (90). The details of nature and frequency of haemoptysis are as listed in Table 1. The details of associated symptoms and comorbidities are listed in Table 2. Fibreoptic bronchoscopy was performed in 269 patients (98%). CT was performed in 257 patients (94%). The results of FOB and CT are cross tabulated in table 3. Diagnoses of respiratory tract neoplasias and other diagnoses achieved are as listed in Tables 4 and 5 respectively.

| Nature of Haemoptysis | Number of Patients (percentage) | Frequency of Haemoptysis |
|-----------------------|--------------------------------|--------------------------|
|                       |                                | Once only | Less than a week | More than a week | Not known |
| Streaks               | 165 (60%)                      | 54        | 85               | 23               | 3         |
| Teaspoonful           | 52 (18.9%)                     | 10        | 33               | 8                | 1         |
| Tablespoonful         | 39 (14.2%)                     | 10        | 24               | 4                | 1         |
| Egg cup full          | 1 (0.4%)                       | 1         | 0                | 0                | 1         |
| Not specified         | 18 (6.5%)                      | 8         | 2                | 5                | 3         |

Data presented as numbers and percentage
### Table 2

| Symptoms                          | Number of Patients ( percentage ) |
|-----------------------------------|-----------------------------------|
| Weight loss                       | 11 (4%)                           |
| Chest pain                        | 11 (4%)                           |
| Cough                             | 195 (71%)                         |
| Purulent sputum                   | 41(15%)                           |

**Comorbidities**

| Ischaemic heart disease           | 30 (10.9%)                        |
| Chronic obstructive pulmonary disease | 32 (11.6)                        |
| Hypertension                      | 15 (5.4%)                         |
| Asthma                            | 12 (4.3%)                         |
| Diabetes                          | 9 (3.2%)                          |

Data presented as numbers and percentage

### Table 3

| Bronchoscopy Results          | CT Scan results |
|-------------------------------|-----------------|
|                               | Normal | ?Malignancy | Benign changes | Not done |
| Normal                        | 158    | 11#         | 49             | 15       |
| ?Malignancy*                  | 0      | 13          | 1              | 0        |
| ?Malignancy†                  | 4      | 6           | 3              | 1        |
| Benign changes                | 4      | 0           | 4              | 0        |
| Not done                      | 3      | 1‡          | 1              | 0        |

* Confirmed to be malignancy in bronchoscopy samples
† Benign pathology diagnosed from bronchoscopy samples
# Final diagnosis of malignancy made in 10
* Clinical diagnosis of lung malignancy

Data presented as numbers Bronchoscopy-269, CT-257

### Table 4

| Respiratory tract neoplasias diagnosed |  |
|----------------------------------------|---|
| Non small cell carcinoma              | 20 |
| Small cell carcinoma                  | 2  |
| Laryngeal carcinoma                   | 1  |
| Tracheal paraganglioma                | 1  |
| Carcinoid                             | 1  |
| Leiomyoma                              | 1  |

Data are presented as numbers (n=26)
Table 5

| Final Diagnosis for each episode of haemoptysis |
|-----------------------------------------------|
| Acute bronchitis                               | 174 |
| Respiratory tract malignancies                 | 26  |
| Bronchiectasis                                | 20  |
| Pneumonia                                     | 16  |
| Unexplained                                   | 16  |
| Epistaxis                                     | 5   |
| Tuberculosis                                  | 4   |
| Pulmonary fibrosis                            | 2   |
| Organizing pneumonia                          | 2   |
| Squamous metaplasia                           | 2   |
| Lymphoma                                      | 1   |
| Carcinoma of Thyroid                          | 1   |
| Chondroma                                      | 1   |
| Hamartoma                                      | 1   |
| Pulmonary emboli                              | 1   |
| Sarcoidosis                                   | 1   |
| Suture granuloma                              | 1   |
| Aspergilloma                                   | 1   |
| Data are presented as numbers (n=275)          |

Overall twenty six (9.6%) patients were diagnosed to have respiratory tract malignancy. Nine (35%) of the 26 patients with respiratory tract malignancy were suitable for radical treatment. Eight (31%) of the 26 patients with respiratory tract malignancy had radical treatment. One patient with T2N0M0 non small cell lung cancer refused radical treatment. Six patients had curative surgical resection (Lung-5, Trachea-1), one had radical radiotherapy and one had photodynamic therapy (PDT). Four other patients underwent surgical resection for probable malignancy, but the final histology showed suture granuloma(1), aspergilloma(1) and organising pneumonia(2). Two patients were diagnosed to have Papillary carcinoma of thyroid and Lymphoma incidentally. One patient required embolisation for life threatening haemoptysis of unknown cause.

Nineteen patients were diagnosed to have malignancy in the 28 patients with bronchoscopy findings suspicious of malignancy (Lung-17, Trachea-1, and Larynx-1). Follow up bronchoscopies were required in one patient and lung cancer diagnosed only on the third occasion. Two patients with squamous metaplasia had serial autofluorescence bronchoscopies which ruled out malignancy. FOB was diagnostic of cancer in 14 (54%) of the 26 patients with respiratory tract malignancy (1 patient declined FOB).

Twenty four cancers were diagnosed in the 30 patients who had CT findings suspicious of cancer. Among the 57 patients with abnormal CT scan not suggestive of malignancy, 30 did show unsuspected pulmonary pathology to explain the haemoptysis (Bronchiectasis-16, Pneumonia-11, Leiomyoma-1, Pulmonary embolism and Bronchiectasis-1, Tuberculosis-1). The patient with laryngeal carcinoma did not have a CT due to the suspicion of laryngeal cancer at bronchoscopy which was later confirmed.
by the Ear, Nose and Throat surgeons. CT was suggestive of cancer in 24 (96%) of the 25 patients with respiratory tract malignancy (patient with laryngeal cancer was referred to ENT team after bronchoscopy without CT). Investigations carried out following CT and FOB in 16 patients (20 procedures) are listed in Table 6.

Table 6

| Investigations following CT and FOB                  |
|-----------------------------------------------------|
| CT guided biopsy                                    | 1  |
| Follow up CT                                        | 10 |
| Followup Bronchoscopy                               | 4  |
| Autofluorescence Bronchoscopy                       | 2  |
| Video assisted Thoracoscopy                         | 1  |
| Mediastinoscopy                                     | 2  |

Data are presented as numbers (n=20)

Among the 26 patients diagnosed to have respiratory tract malignancy in our study, 22 were males (85%) and smokers with an average of 38 pack years. The median age of these patients was 69 years with age range 33-84 years. Thirteen of these patients reported only streak(s) of haemoptysis. Thirteen patients had only one or two episodes of haemoptysis in total prior to presentation. Seventeen of these patients had haemoptysis lasting less than a week. Only 5 of the 26 patients had recurrent haemoptysis of at least a tablespoonful.

Discussion

In this retrospective study 9.6% of patients were diagnosed to have respiratory tract malignancy. Inspite of our local policy, all the patients who presented with haemoptysis may not have been referred to us, leading to selection bias. Previous studies found 0-16% of cancer detection rate in patients presenting with haemoptysis and normal CXR [5-10].

Haemoptysis is the presenting symptom in up to 19% of the patients with lung cancer [11]. Poe et al found that coughing up more than 30mls of blood increased the diagnostic yield [12]. In our study only 5 patients with lung cancer had a tablespoonful, recurrent haemoptysis and more than half of the patients had only streak(s) with infrequent episodes of haemoptysis lasting less than a week. Fidan et al reported in a retrospective analysis of patients presenting with haemoptysis that just over 40% of patients with lung cancer presented with mild and non-recurrent haemoptysis [13].

Some studies looked at whether patients above a particular age should be investigated. Sood et al analysed all the studies published so far and concluded that age above 50, male sex and smokers of 40 pack years had the highest predictive value for bronchogenic carcinoma [14]. Contrarily, Cortese et al reported radiologically occult lung cancer in 5.5% of patients who were less than 50 years old [15]. A primary care cohort study reported higher positive predictive value for cancer in patients aged above 55 years when they present with haemoptysis irrespective of CXR appearance [16]. The median age of patients with lung cancer in our study is 69 years with male predominance (85%).
Both FOB and CT have definite important roles in evaluating haemoptysis in patients with abnormal CXR for bronchogenic carcinoma. Lung cancer detection rate of up to 21% with bronchoscopy alone in patients with haemoptysis and normal CXR has been reported [17-20]. Prospective studies by Tak et al and Haro et al indicate that FOB and CT are complementary, irrespective of CXR findings [6, 21, 22]. Even though FOB is a relatively straight forward procedure it still carries a small risk.

In a long term outcome study of patients with haemoptysis of unknown aetiology Herth et al reported that 6% of patients developed lung cancer over a mean follow up period of 6.6 years [23]. Santiago et al reported 4% of patients developing lung cancer over a six year period when the initial investigations were inconclusive [24]. All these patients were smokers and over 40 years of age. In our study, one patient developed lung cancer after a follow up period of 20 months. The mean follow up period in our study population was 36 months.

As far as we are aware, this study reports the largest group of consecutive patients with haemoptysis and normal CXR who were investigated with CT and FOB. Our study demonstrates the importance of investigating such patients. However our study is retrospective and the characteristics of the patient population prevents us from making recommendations with respect to non-smokers, females or younger people.

**Conclusion**

Haemoptysis is a valuable diagnostic clue to resectable lung cancer. More frequently haemoptysis is likely to be secondary to benign pulmonary pathology. Bronchoscopy is invasive; radiation is a safety concern of CT, particularly in young people. CT has the advantage of being more sensitive in diagnosing distant bronchial and parenchymal abnormalities, but FOB is better in evaluating mucosal abnormalities and providing material for pathological diagnosis. CT or Bronchoscopy could fail to detect abnormalities when the other modality did, as seen in this study. Even though CT and Bronchoscopy are complimentary, CT is more likely to detect abnormalities to explain the cause of haemoptysis.

We conclude that further investigation of haemoptysis in smokers with normal chest radiograph is justified regardless of amount or frequency of haemoptysis based on 9.6% rate of malignancy in our consecutive series. We recommend that these patients are investigated with CT followed by Bronchoscopy.

**Competing interests** - None
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