

A Hospital Based Audit of Tuberculosis Deaths

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Summary

An audit was done on 54 tuberculosis patients presenting to Penang Hospital who died during 1993. Active tuberculosis was the cause of death in 29 (53.7%) and 48.3% were aged under 50 years. Tuberculosis was a contributory cause of death in 8 patients and in 17 patients tuberculosis was irrelevant to the cause of death. The diagnosis of tuberculosis was made after death in 17 patients (31.5%). Late diagnosis was the most important factor resulting in death. Only 41.4% of the deaths from active tuberculosis were correctly certified in government hospitals. Medically inspected and certified deaths from tuberculosis is an unreliable indicator of tuberculosis mortality because of inaccuracies in death certification, tuberculosis deaths occurring outside hospital and tuberculosis patients undiagnosed until after death.

Key Words: Tuberculosis, Mortality audit

Introduction

In 1950 the tuberculosis mortality rate for Peninsular Malaysia (medically inspected and certified deaths occurring in government hospitals) was 33.3 per 100 000 population and by 1980 this figure had declined to 5.4 per 100 000 population; in 1990 the mortality rate was 2.0 per 100 000 population¹. Most medically inspected and certified deaths occur in urban areas and it is probable that many tuberculosis deaths in rural areas (where two-thirds of the population reside) are not medically certified. Overall less than 50% of deaths in Malaysia are medically inspected and certified² and it has been estimated that the published mortality rate will have to be multiplied 4 to 5 times to obtain the actual mortality rate due to tuberculosis¹. Hence although tuberculosis is no longer among the top ten causes of death (medically inspected and certified) it cannot be assumed that it does not remain a significant public health problem in the country.

In 1993 the incidence rate for Malaysia of new tuberculosis cases (all forms) was 62.2 per 100 000

population and the death rate for tuberculosis patients was 4.6 per 100 000 population³. Deaths in tuberculosis patients while on treatment also do not accurately reflect the case fatality rate from active tuberculosis which would be a better indicator of the efficiency of the tuberculosis control programme. Deaths while on treatment would overestimate the case fatality rate since a proportion of patients die of other causes. Patients not diagnosed as tuberculosis until after death would not be included in the figure for deaths while on treatment and their numbers would increase the death rate from active disease.

The objectives of this study were to ascertain the number of deaths caused primarily by active tuberculosis and to obtain information on the characteristics of patients dying from the disease, as well as to assess the validity of published mortality figures for tuberculosis in Peninsular Malaysia.

Materials and Methods

An audit was done to ascertain the number of deaths

caused by active tuberculosis in patients presenting to Penang Hospital and the proportion correctly certified. Patients with tuberculosis who died between 1st January and 31st December 1993 were studied. All deaths in patients while on treatment for tuberculosis and deaths in patients not on treatment but with bacteriological or histological confirmation of tuberculosis (including autopsy documentation) were analysed. The patients' medical records, results of investigations and autopsy reports (whenever available) were closely scrutinised by the first author to elucidate the actual cause of death. The hospital death register was examined to determine the certified cause of death for patients who died in Penang Hospital. For patients who died in other hospitals the certified cause of death was obtained by requesting information from doctors in the hospital concerned and for patients who died outside hospital the certified cause of death was ascertained by searching the death certificate registers in the State Registration Department.

Results

Altogether 54 tuberculosis patients presenting to Penang Hospital died during 1993; 44 were males and 10 females. Thirty-three were Chinese patients, 12

Indian and 9 Malay. There were 41 patients with pulmonary tuberculosis, 3 had both pulmonary and extrapulmonary tuberculosis and 10 had extrapulmonary tuberculosis alone. All patients had bacteriological and/or histological evidence to support the diagnosis of tuberculosis except for 2 in whom the diagnosis was made on clinical grounds. Table I shows the site of tuberculous lesions in the 13 patients with extrapulmonary involvement and the methods of diagnosis in these patients. Table II shows an analysis of the actual cause of death in the 54 patients: 29 (53.7%) died of active tuberculosis, tuberculosis was a contributory cause though not the principal cause of death in 8 (14.8%) and in 17 patients (31.5%) tuberculosis was irrelevant to the cause of death. In 17 patients the diagnosis of tuberculosis was made only after death: the cause of death was active tuberculosis in 9 of these patients and the remaining 8 died of causes other than active tuberculosis. The diagnosis was made at autopsy in 6 patients who had died outside the hospital but were brought in for post-mortem examination. In the remaining 11 patients cultures of various body fluids for *M. tuberculosis* came back positive after death: sputum in 7 cases, cerebrospinal fluid, pericardial fluid, urine and knee aspirate in 1 each.

Table I
Site of lesions in patients with extrapulmonary disease

| Site | No. | Method of diagnosis |
|-----------------------------|-----|--|
| Pulmonary | 1 | pus & sputum direct smears |
| & | 1 | barium studies & sputum direct smears |
| Extrapulmonary | 1 | HPE postnasal space biopsy |
| Extrapulmonary disease only | 2 | craniotomy findings 1 csf <i>M. TB.</i> culture 1 |
| | 1 | HPE on craniotomy |
| | 1 | pericardial fluid <i>M. TB.</i> culture |
| | 1 | urine <i>M. TB.</i> culture |
| | 2 | knee aspirate <i>M. TB.</i> culture 1 pleural fluid <i>M. TB.</i> culture 1 |
| | 1 | HPE neck node biopsy |
| | 1 | postmortem HPE lung |
| | 1 | XR & clinical diagnosis |

Table II
Cause of death in 54 TB patients

| Cause of death | Antemortem diagnosis | Postmortem diagnosis | Total |
|---------------------------------|----------------------|----------------------|------------|
| Active tuberculosis | 20 (69.0) | 9 (31.0) | 29 (100.0) |
| TB contributory cause of death | 6 (75.0) | 2 (25.0) | 8 (100.0) |
| TB irrelevant to cause of death | 11 (64.7) | 6 (35.3) | 17 (100.0) |

Numbers in brackets are percentages

Among these 54 tuberculosis patients who died many had coexisting illnesses as follows: chronic respiratory disease in 12, circulatory disease in 10, malignant neoplasms in 6, central nervous disease in 4, gastrointestinal disease in 4, diabetes mellitus in 4, acquired immune deficiency syndrome in 3, mixed connective tissue disease, exfoliative dermatitis and primary immunodeficiency in 1 each. Nine patients had more than one coexisting medical illness. In addition, 7 patients were drug abusers, 4 were vagrants and 1 was an intravenous drug abuser and prostitute of no fixed abode.

Age distribution

An analysis of the age distribution of patients with tuberculosis who died shows that a higher proportion of deaths in young patients was caused by active tuberculosis whereas deaths in older patients were more likely to be caused by coexisting diseases (Table III). Nearly half of the deaths in patients who died of active tuberculosis occurred in patients under 50 years of age (14/29; 48%).

Patients with post-mortem diagnosis who died of active tuberculosis

The diagnosis of tuberculosis was made post-mortem in 9 patients who died of active tuberculosis. This included the 6 patients diagnosed at autopsy, one of whom had miliary tuberculosis and 5 of whom had pulmonary tuberculosis. These 6 patients were all men aged between 30 and 50 years and included 3 drug abusers and 2 vagrants. The remaining 3 patients

diagnosed after death had been admitted to the hospital but the diagnosis was missed before death. One was a 13-year-old girl who died in a private hospital of tuberculous meningitis, the second was a 45-year-old male drug abuser who died in the Coronary Care Unit of pericardial tamponade from a tuberculous pericardial effusion and the third was 60-year-old man who died at home of disseminated tuberculosis after discharge from hospital.

Patients who died of active tuberculosis while on treatment

Table IV shows the cumulative distribution of treatment duration in the 20 patients who died of active tuberculosis while on treatment. Only 3 of these deaths (15%) occurred later than 3 months after starting treatment: one was a 6-year-old boy with tuberculous meningitis in whom treatment was interrupted in another hospital before definitive diagnosis at craniotomy, another was a 40-year-old intravenous drug addict and prostitute who defaulted treatment despite repeated attempts to retrieve her, and the third was a 65-year-old man with a history of treatment for tuberculosis by a private doctor who died of advanced tuberculosis caused by multiply drug resistant organisms.

Among the 17 patients who died after being treated for less than 3 months, 9 were over 60 years of age. Advanced pulmonary tuberculosis was the cause of death in 14 patients and the other 3 had extrapulmonary disease. Of the 14 patients who had

Table III
Age distribution in TB patients who died

| Age group (years) | Died of active TB | TB contributory cause of death | TB irrelevant to cause of death |
|-------------------|-------------------|--------------------------------|---------------------------------|
| < 20 | 2 (6.9) | 1 (12.5) | 0 (0) |
| 20 - 49 | 12 (41.4) | 2 (25.0) | 5 (29.4) |
| ≥ 50 | 15 (51.7) | 5 (62.5) | 12 (70.6) |
| TOTAL | 29 (100.0) | 8 (100.0) | 17 (100.0) |

Numbers in brackets are percentages

Table IV
Cumulative distribution of treatment duration in patients who died of active TB

| No. (%) of patients with treatment duration up to: | | | | | |
|--|--------|---------|---------|----------|------------|
| 1 day | 1 week | 2 weeks | 1 month | 3 months | > 3 months |
| 2 (10) | 4 (20) | 7 (35) | 14 (70) | 17 (85) | 20 (100) |

advanced pulmonary tuberculosis, 2 were young patients with mental retardation, one was an intravenous drug abuser, 1 a vagrant and 2 were single men living alone; 1 patient was a chronic defaulter who had been on treatment intermittently since 1985 and 2 had relapsed pulmonary tuberculosis. The immediate cause of death in these patients (apart for 1 patient who died of massive haemoptysis) was mainly cardiorespiratory failure due to extensive pulmonary lesions with or without bronchopneumonia. Of the 3 patients who died with extrapulmonary tuberculosis, one was a 63-year-old man with disseminated tuberculosis who was treated for 1 day before death, 1 was a 36-year-old man who died of intestinal perforation from gut tuberculosis and the third was a 51-year-old man who died of a rapidly expanding intracranial tuberculoma.

Patients who did not die of tuberculosis

Table V shows the principal causes of death in patients who did not die of active tuberculosis. Tuberculosis

was a contributory cause of death in 8 patients, 4 of whom died of septicaemia, 1 ischaemic heart disease, 2 acquired immune deficiency syndrome and one primary immunodeficiency.

In 8 (32%) of these patients who died of causes other than active tuberculosis, the diagnosis of tuberculosis was made post-mortem. One of these patients was a 55-year-old woman who died of infarcted bowel from ischaemic colitis in another hospital, whose urine culture for *M. tuberculosis* came back positive after death. In the other 7 patients, results of sputum culture for *M. tuberculosis* came back positive after death: 5 of them were elderly patients over 60 years of age and 2 had atypical chest X-ray findings (predominantly in the lower lobes).

Certification of cause of death

Tables VIa and VIb show the accuracy of certification of cause of death for patients who died of active tuberculosis and for patients who died of other causes.

Table V
Causes of death in patients who did not die of active tuberculosis

| Principal cause of death | TB contributory cause of death | TB irrelevant to cause of death |
|-------------------------------------|---------------------------------------|---------------------------------|
| Ischaemic heart disease | 1 | 6 |
| Ischaemic colitis/infarcted bowel | - | 1 |
| Infective endocarditis | - | 1 (IVDA) |
| Carcinoma of bronchus | - | 5 |
| Nasopharyngeal carcinoma | - | 1 |
| Pneumonia/septicaemia | 4 | 1 |
| Cryptococcal meningitis | - | 1 |
| Acquired immune deficiency syndrome | 2 (pneumonia 1, meningitis in IVDA 1) | 1 (pneumonia) |
| Primary immunodeficiency | 1 | - |
| Total | 8 | 17 |

Table VIa
Certification of death in patients who died of active tuberculosis

| | Correct certification | Incorrect certification | Total |
|--|-----------------------|-------------------------|------------|
| Patients who died in government hospitals | 12* (70.6) | 5 (29.4) | 17 (100.0) |
| Patients who died outside government hospitals | 2** (16.7) | 10** (83.3) | 12 (100.0) |

Numbers in brackets are percentages

* 1 died outside Penang State

** 1 died in private hospital

Table VIb
Certification of death in patients who died of other causes

| | Correct certification | Incorrect certification | Total |
|--|-----------------------|-------------------------|------------|
| Patients who died in government hospitals | 13* (76.5) | 4 (23.5) | 17 (100.0) |
| Patients who died outside government hospitals | 4** (50.0) | 4 (50.0) | 8 (100.0) |

Numbers in brackets are percentages

* 1 died outside Penang State

** 1 died in private hospital

For patients who died of active tuberculosis in government hospitals, 5/17 (29.4%) were incorrectly certified as having died of other causes; this included 1 patient who was diagnosed after death. Conversely, with reference to patients who died in government hospitals from causes other than tuberculosis, 4/17 (23.5%) were erroneously certified as having died of tuberculosis, including 2 patients in whom tuberculosis was a contributory cause of death and 2 in whom tuberculosis was irrelevant to the cause of death. One of these deaths was attributed to tuberculosis because the patient was on treatment for pulmonary tuberculosis and the diagnosis of lung cancer was only confirmed on postmortem trucut lung biopsy. No other instances of overcertification of death from tuberculosis was encountered on searching the hospital death register. Of the 29 patients who died of active tuberculosis only 12 (41.4%) were correctly certified (in government hospitals) as dying of tuberculosis. If the 4 deaths erroneously attributed to tuberculosis were added, the percentage medically certified as being caused by tuberculosis would increase to 48.5%. For patients who died outside government hospitals, 16.7% (2/12) of those who died of active tuberculosis and 50% (4/8) of those who died from other causes had correct certification of cause of death.

Discussion

Tuberculosis remains an important cause of morbidity and mortality in Malaysia. This study indicates that the published mortality figures quoting medically inspected and certified deaths (occurring in government hospitals) would substantially underestimate the death rate from active tuberculosis. Penang Hospital is a general hospital serving a largely urban population yet only 41.4% of patients who died of active tuberculosis in 1993 were correctly certified by government hospitals. Another 41.4% of patients who died outside government hospitals was not included in the figure for medically inspected and certified tuberculosis deaths and the remaining 17.2% of patients died in Penang Hospital but were incorrectly certified as having died of other causes. Nearly one-third of patients (9/29; 31.0%) who died of active tuberculosis had the diagnosis made only after death and this was an important reason for incorrect certification of cause of death. Because of the low autopsy rate it is probable

that many patients die of tuberculosis in the community without the diagnosis ever being made and this is likely to be even more common in rural areas where health services are not as accessible as in Penang. In our study, the patients diagnosed as having died of tuberculosis at autopsy were all relatively young patients under 50 years of age, who were found dead outside the hospital. Older patients dying at home were probably not brought for autopsy but merely certified as dying of old age.

Overcertification of cause of death from tuberculosis occurred in 4 patients who were on treatment for tuberculosis at the time of death. The errors were due to doctors' inexperience in assigning the cause of death in patients with multiple pathology; death was attributed to tuberculosis if the cause of death was unclear and the patient was on treatment for tuberculosis. Overcertification of cause of death from tuberculosis has been reported in other studies^{4,5} and in order to avoid this, the clinical course of the disease and all relevant investigations should be taken into account. When in doubt doctors who have to certify deaths should consult with colleagues familiar with the details of the clinical history of the patient.

Tuberculosis is a curable disease provided that patients are diagnosed promptly and given adequate chemotherapy which they take correctly. Tuberculosis deaths are avoidable yet patients still die of this disease⁶. As in other series⁷⁻⁹, a significant proportion of cases were diagnosed after death. Furthermore most patients who died of active tuberculosis while on treatment (17/20; 85%) succumbed within 3 months of starting treatment and all had advanced disease indicating that delay in diagnosis was an important factor resulting in death. With the decline in the incidence of tuberculosis doctors may lack awareness and experience with tuberculosis and therefore not carry out appropriate investigations to make the diagnosis. Late diagnosis may also result from failure of doctors to recognise cases with atypical radiological findings, extrapulmonary disease and tuberculosis in elderly patients with coexisting disease.

In order to achieve earlier diagnosis and institution of treatment at a less advanced stage, doctors should maintain a high index of suspicion and consider a

therapeutic trial of anti-tuberculosis therapy for any patient whose clinical presentation is suggestive of tuberculosis^{10,11}.

Some patients in this series may have contributed to late diagnosis by delay in seeking medical treatment for their illness. This is particularly so for drug abusers, vagrants and patients with mental retardation. An earlier study on case-finding for pulmonary tuberculosis in Penang¹² has shown that drug abusers and those with little or no education tend to present late for treatment of symptoms of tuberculosis.

Although the majority of patients can be made to adhere to an effective drug regime by instituting health education, supervision of treatment and an efficient defaulter retrieval system, a small proportion of patients will be non-compliant despite all measures to ensure otherwise. In this study, one patient who was an intravenous drug abuser, prostitute and vagrant absconded from the ward and could not be located until information was received that she had died in a welfare home.

Failure in management of acute complications such as pericardial tamponade and perforated gut led to deaths which could have been prevented by early recognition and emergency treatment.

Nearly half of the deaths from active tuberculosis occurred in patients under 50 years of age (14/29; 48.3%). This is a cause for concern since most other series have found death from tuberculosis is more common in the elderly¹³⁻¹⁵. It must be emphasised that treatment for tuberculosis is an extremely cost-effective intervention for improving the health of populations and measures to strengthen the tuberculosis control programme will reduce mortality and morbidity in the economically productive age groups.

Conclusions and Recommendations

This hospital based audit of deaths in tuberculosis patients fully investigated 54 cases presenting to Penang

Hospital in 1993. More than half of the deaths (29/54; 53.7%) were caused by active tuberculosis and the diagnosis was made after death in 17 patients (31.5%). Tuberculosis was a contributory cause of death in 8 patients and in 17 patients tuberculosis was irrelevant to the cause of death. A substantial proportion of patients who died of active tuberculosis was under 50 years of age (48.3%) and older patients were more likely to have died of coexisting diseases such as ischaemic heart disease and malignant neoplasms. For patients who died after starting treatment, 17 patients died within 3 months of starting treatment and another 3 died more than 3 months after starting treatment. Delay in diagnosis was the most important single factor leading to death although a small proportion of deaths was the result of failure in management. Therefore the death rate from tuberculosis can be reduced by intensifying efforts to ensure early case-detection and compliance with an effective treatment regime.

Only 41.4% of deaths caused by active tuberculosis were correctly medically certified. The figure for medically inspected and certified deaths (in government hospitals) would underestimate the case fatality rate from active tuberculosis since it does not include cases who die before the diagnosis is established, those dying of tuberculosis in the community and those who died of tuberculosis erroneously certified as dying of other causes. Efforts must be made to increase the autopsy rate, the proportion of medically inspected and certified deaths as well as the accuracy of death certification, so that the medically inspected and certified death rate from tuberculosis will become a more reliable indicator of the tuberculosis case fatality rate.

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