REVIEW

Journal of Pre-Clinical and Clinical Research, Vol 2, No 1, 009-012
www.jpccr.eu

Human tuberculosis in colonial Victorian and present-day Britain

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Abstract: Tuberculosis (TB) (consumption) is a particularly unpleasant disease that has seen a re-emergence in Britain, especially among immigrant populations. The objective of the review was to consolidate the principal and important articles written on TB in Britain over the last six decades, including its contraction in humans. The criteria used in the current review for selecting articles were both theoretically and practically motivated and adopted from proposed criteria in The International Classification of Functioning, Disability and Health for the 19th century; 20th century; and 21st century. Data was classified according to a normal distribution, with the 20th century expressing the greater readership. The results show that in the 1890s people became more aware of the threat of TB-infected meat. Tuberculin was the name used to describe the 'poison' produced by the bacilli. In February 2005, the British government announced proposals to implement existing health initiatives by screening visa applicants for TB from identified high-risk routes, and enforcing treatment of those positively diagnosed before being allowed entry into and stay in Britain. With increasing entry of foreign-born people into the UK it is essential that effective controls are established to prevent the spread of the disease. There are associations with a weakened immune system and TB, particularly amongst HIV positive individuals.

Key words: Britain, history, human, treatment, tuberculosis, Victorian

INTRODUCTION

Tuberculosis (TB) (consumption) is a particularly unpleasant disease that has seen a re-emergence in Britain, especially amongst immigrant populations. As a result, the screening of immigrants, asylum seekers and other entrants into Britain is currently high on the political and public health agenda [1]. Skeletal TB accounts for 14.29% of non-respiratory disease, and in 1971 there was an increase of 68% of TB among immigrants[2]. Immigrants frequently return home and it is hard to judge whether they received adequate therapy for TB [2].

Historically, TB was feared up to fairly recent times, and one good example is the feigning of symptoms of pulmonary TB by Mrs. Krystyna Skarbek to avoid imprisonment when the German Gestapo arrested her in January 1941 [3]. Other beliefs include cancer caused by TB. However, this notion was disproved by Mercer [4] who suggested that there are immunological elements in the defence mechanism for TB that prevent the development of cancer. TB exposure among British missionaries was also of concern, especially with an immunisation figure in 212 personnel of only 53% [5]. In 1984, greater safeguards were introduced for people with TB, although there has been growing public concern of the threat of the disease among visitors and immigrant groups [6]. Concerns globally over the emergence of a new pandemic of TB have also been voiced [7]. Affordable methods of diagnosis need to be developed in the third world, for instance, the use of chest x-ray, a course of 14 days of antibiotics, and clinical evaluation of a patient are useful for diagnosing sputum smear negative pulmonary TB cases [8].

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Received: 15 April 2008; accepted: 19 June 2008

In the UK, a single dose of Bacillus Calmette-Guérin (BCG) is administered intradermally into the lateral aspect of the abducted left upper arm [9]. Thereafter, a small bleb appears, and localised inflammation may occur within 2 weeks [9]. The lesion develops into a papule or shallow ulcer ca. 10 mm in diameter, heals within 12 weeks, and forming a small, flat scar [9]. No other immunisations should be administered in the same arm for 3 months due to the risk of lymphadenitis [9]. BCG should not be administered in patients with past history of TB: a positive pre-immunisation tuberculin test; anaphylactic reactions to vaccines; compromised immunity; generalised septic skin conditions; acute illness with fever; and HIV positive [9].

The aim of the review was to consolidate the principal and important articles written on TB in Britain over the last 6 decades, including its contraction in humans.

MATERIALS AND METHODS

The criteria used in the current review for selecting articles to be included were both theoretically and practically motivated and adopted from proposed criteria in The International Classification of Functioning, Disability and Health- ICF, 2001. These criteria were as follows:

- Articles were classified with internationally recognised impact factors as follows: > 5 (Class A), 5-1 (Class B) and <1 (Class C). Where articles were not published in journals, e.g. health documents, classification was limited to point 2 below.
- Articles were rated (1 – excellent, 5 – poor) concerning relevance therein of impact of lifestyle, stress and/or environmental factors predisposing contraction of TB among the British public.

- Criteria for selection of literature included yes-no responses to: the appropriateness of methodology; adequacy of subject numbers; specificity of gender, and/or age of subjects; and statistically significant response rates to survey questionnaires.
- The time frame used was 1963-2008 inclusive.
- A multi-factorial overview of the factors eschewed concerning the predisposition and contraction of TB were elucidated. We presumed that collective articles detailing known factors of TB prevalence were not necessarily correlated with functionality and health.
- Compilation of materials for the review started with published literature or easily accessible academic research.
- The articles were accessible from on line sources including Google, PubMed and Medline. In instances where abstracts were merely cited, attempts were made to gain the full-text article via Google search or inter-library loan.

Articles were categorised according to information discussed therein into 3 groups using the ICF criteria proposed above: 19th century; 20th century; and 21st century. In cases where there was an overlap of centuries all divisions were counted. The data utilised in each time period followed a normal distribution in terms of readership rating and/or impact factor. It was anticipated that the 20th century expressed a greater readership. A statistical method was not utilised but rather a count of appropriate articles chosen was tabulated (Table 1).

Ethical approval was deemed unnecessary as there were no foreseen and met costs, experiments, nor conflict of interest implicit in the literature searches.

RESULTS

The criteria for rejection of an article included a rating of 4 or 5 (point 2, ICF criteria) and/or 2 or more no responses to selection criteria (point 3, ICF criteria). In cases where the title and authorship of the article were given, but the abstract unobtainable, the article was rejected. Results are summarised in Table 1.

19th century. Charles Darwin contracted tuberculosis following one of his voyages and described the terrible inaptitude and poor condition he experienced. He sought water treatment and made a remarkable recovery, although his older daughter, who contracted it later, died [10]. In the 1890s, people became more aware of the threat of TB-infected meat [11]. Confusion, however, resulted concerning the localization of the infection which interfered with the sale of meat, and the belief that cooking made the meat safe to eat [11]. In 1888, George Cornet accepted that tubercle bacilli on dust particles might be directly inhaled into the lung after exposing guinea pigs to such dust partlicles, and at the end of the 19th century Carl Flügge caused experimental animals to inhale air containing counted numbers of tubercle bacilli [12]. The latter developed pulmonary TB.

Table 1 Selection results for articles of TB infection and prevalence in Britain

Time period	Total # journal articles	Total # health brochures	Inclusion #	Exclusion #
19th century	45	0	10	35
20th century	101	0	48	53
21st century	13	7	13	0
TOTAL	159	7 (7 utilised)	71 (48 utilised)	81 (19 non-utilised)

20th century. Kellogg [13] discussed the greatest of all dangers connected with germ transmission in milk which was caused by TB. The author further stated that TB bacilli thrive in milk, butter and cheese, and retains its vitality for many weeks. The author associated older populations in England as being more susceptible to TB by 20-30%. Post-mortem examinations revealed that 60% of people who died in hospitals had suffered at some time from TB, as evidenced by the characteristic lesions. He stated that many of the patients recover naturally due to favourable conditions and the natural recuperative powers of the body. Contraction of the TB microbes in inhaled dust by respiration is the most frequent way of contagion. Infected sputum may facilitate transmission to-and-from animals and man. Preparing milk consisted of raising the temperature several degrees above boiling in a saturated solution of common salt, placing the milk in tightly corked bottles for 10-20 min, and leaving them to cool in the solution. Kellogg [13] goes on to describe military TB as that expressed in frequent chills; fever; very frequent and weak pulse; exhausting perspiration; dry tongue; often delirium or stupor; great prostration; cough; shortness of breath; and finally oedema of the lungs. The author emphasises the lack of symptoms in the lungs due to most parts being equally affected. Post-mortem examination shows most parts of the body to be affected by tubercles. Death invariably occurs between 40-60 days. In Victorian times, the use of water treatment was common, via the use of sponge baths, compresses, etc. Cold water applied to the chest is a good remedy for shortness of breath and ice applied to the head is useful to allieve headaches [13]. Tuberculin was the name used to describe the 'poison' produced by the bacilli, and Professor Koch was foremost in increasing dosage injection experiments in guinea-pigs, although this was abandoned as a means of disease treatment in humans and adopted as a means of determining the presence of TB. Injection of tuberculin into a TB-infected cow resulted in a substantially raised body temperature within a few hours [13]. Patients in specialist TB wards were commonly laid out in rows and exposed to fresh air (Plate 1).

In 1916-1917, P. Chaussé postulated that only particles 2-15 μm in diameter were respirable as they remained suspended in air for up to 7 hours after expulsion from patients [12]. He advocated that 50 bacilli were essential to establish the

Plate 1 Fresh air was regarded as essential for the treatment of TB patients (Courtesy of: Office of the Ombudsman, Frankfort, Kentucky, USA).

presence of the disease. In the early 1900s, thoracoplasty was fashionable for the treatment of bilateral lung disease and haemoptysis [14]. Stevens' cure sometimes produced amazing cures and it was suggested that given the current high incidence of resistance to TB drugs, Stevens' cure should be re-evaluated [14].

In 1932, A. J. Vorwald introduced tubercle bacilli into the ear vein of rabbits, resulting in bacilli being ingested by polymorphonuclear leukocytes which stagnated in small accumulations in the fine pulmonary capillaries, resulting in the formation of tubercles [12].

In the early part of the 20th century, genital tuberculosis was diagnosed during necropsy, often caseating in the uterus [15]. Focal tuberculosis lesions in biopsy specimens or curettings taken from the endometrium revealed TB lesions, especially in infertile women. Bacteriological examination laid to rest any notion that the strain of TB was anything other than human, infection originating from the bloodstream during the active phase of a primary extragenital lesion, usually in the lung, and remaining inactive or activating within a decade [15].

William Pugh was the first in the UK to use the method of traction by suspension for the treatment of TB of the hip and knee [16]. He also developed carriages for the treatment of TB of the spine and hip, allowing easier carriage of children [16].

Between in 1928-1930, Bacillus Calmette-Guérin (BCG) in Britain initially received unfavourable reports from the renowned scientific figures A. Stanley Griffith and Georges Dreyer [17]. There were major contentions over the safety of BCG vaccine in man. Both the British Medical Research Council (MRC) and the British public authorities were unconvinced that evidence of apparent success with BCG from other countries necessitated its adoption. They argued that in Scandinavia the decline in TB may not have been due to positive effects of BCG, but to general hygiene and the high ratio of beds for treatment [18]. Major Greenwood was a great contester of Calmette's results from France, and suggested that the BCG babies in the study had no significant survival rate compared to their unprotected contemporaries [19]. Graham Wilson suggested that the British people had a significantly higher genetic immunity to TB [20], a notion that should be regarded with caution (Peter Reid, personal communication in 2008). BCG was also rejected in Britain for administrative reasons, led in 1933 by George Buchanan, and discounted by Calmette due to considerable limitation in applying BCG in practice. Buchanan argued that the number of TB deaths in infants under one year of age had more than halved between 1921-1930, and by 1938 there was a curative service of 40,000 beds for TB patients [17]. Many British specialists argued that BCG vaccination would create a false sense of security and it was more advisable to boost one's immunity via a healthy diet, with fresh air and exercise [17]. Specialists blamed degradation in life-style habits in young people and associations were made with sin [21]. Treatment regimes for TB were principally non-interventionist, adhering principally to 'sanatorium' treatment which included good food, fresh air and exercise, leading to scepticism towards adopting new treatments [17]. Due to the potential high infection rate among nurses, the profession suffered greatly diminished numbers which prompted the Ministry of Health to set up a committee to advise on clinical trials of BCG which were offered to British nurses from 1949. Trials were then performed on school children. A controlled trial encompassed 58,000 children aged 14-15½ years from North London, Birmingham and Manchester [22]. All were tested with tuberculin in an initial dose of 3 tuberculin units, and those with negative results were re-tested with 100 units [22]. All negatively reacting children were allotted at random either to be vaccinated with BCG or vole bacillus, or to act as controls. All children, including those initially TB positive, were carefully followed up and the late attack-rate of TB determined [22].

The indiscriminate use of anti-TB drugs has led to the emergence of drug-resistant strains of bacilli [23]. In 1908, the isolation of TB patients in British workhouse infirmaries and hospitals reduced the incidence of TB. Physicians followed a protocol of care: record of patient's temperature, night sweats, tubercle bacilli in sputum samples, and changes in X-ray revealed tubercular lesions in the lungs. Streptomycin treatment proved effective [23].

21st century. In February 2005, the British government announced proposals to implement existing health initiatives by screening visa applicants for TB from identified high-risk routes and enforcing treatment of those positively diagnosed before being allowed entry into and stay in Britain [24]. In the UK, the 1971 Immigration Act allows the request of a medical examination following entry into the UK if so warranted. However, only a quarter of immigrants are traced and screened for TB, and TB clinics often do not arrange screening for new arrivals due to lack of resources or time [1]. Other problems resulting in non-attendance include changes of address, language difficulties, and mistrust of authorities [25]. This review also demonstrated that a third of immigrants are referred to port health control units. Problems thus revealed include difficulties locating referred immigrants due to inadequate or incorrect addresses; ambiguity of existing guidelines on immigrant follow-up from countries with a low incidence of TB; and lack of resources to ensure follow-up of immigrants who did not receive chemoprophylaxis of BCG, despite having a significant chance of contracting TB [25]. The authors point out the difficulties in enforcing TB screening due to the lack of resources for districts with large immigrant populations. Immigrants into the UK who did not return to Asia experienced the highest incidence of TB in the first few years [26]. In the absence of adequate public health facilities, TB among the foreign-born will likely result in more significant transmission to the indigenous population [27].

Amazingly, genotypic analysis of pre-historic remains can identify the presence of *Mycobacterium tuberculosis* complex DNA amplified by IS6110 PCR [28]. In the mid- British Iron Age (600-100 BC) cattle, sheep, pigs, goats and deer were commonly present on farms.

A recent press report described how the British government's controversial system for TB testing in cattle is to be investigated by the High Court after a challenge issued by Somerset farm due to discrepancies between gamma interferon blood and skin tests [29]. The Department for the Environment, Food and Rural Affairs (Defra) have been ordered to retest the animals, offering the opportunity for second chances to other farmers who have had their herds test positive.

CONCLUSION

With the increasing entry of foreign-born people into the UK it is essential that effective controls are established to prevent

the spread of TB. Questions as to the necessity of badger culling should be addressed. There are associations with a weakened immune system and TB, particularly amongst HIV positive individuals. The Department of Health [30] suggests that TB can be controlled by: promptly diagnosing and treating people with the disease; ensuring that people with the disease complete their treatment; and enforcing BCG immunisation. The Department of Health [31] NHS toolkit recommends the establishment of effective TB delivery services, including: a lead clinician should manage treatment regimes; all patients must be allocated a case worker; TB should be treated by specialist physicians; transferred case management should be considered in areas with a low incidence of disease; NICE guidelines should be adhered to; and high-incident areas should liaise closely with children's units.

Conflict of interest. None recorded.

ACKNOWLEDGEMENTS

The cooperation of all authors who provided PDF's of requested articles is gratefully acknowledged. The referee provided some very useful comments.

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