Tuberculosis in a child – search for the infected adult nearby; case report, Portugal, 2007

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Tuberculosis (TB) transmission in a non-household setting is difficult to detect, because contact with the source case is often not obvious. Here, we report on a case of a four-year-old child who got infected through sporadic non-household exposure at a coffee shop. The source case was a woman who had suffered from weight loss, productive cough and fatigue for two months before being diagnosed with TB. Screening the child's contacts revealed two active TB cases within its family. Overall 148 contacts were screened for both cases and 18 cases of latent TB infection detected. The connection between the child and the source case, who were not aware of their contact, was confirmed by molecular fingerprinting. Our case report illustrates the difficulty in detecting non-household transmission between individuals that do not have significant contact, and draws attention to the need to look for the infected adult whenever a child falls ill with TB. This report is a reminder of the importance to consider possibly neglected ways of TB transmission and highlights once again the need of early diagnosis of TB.

Introduction

Childhood tuberculosis (TB) is an indicator of public health programme performance and all cases in children can be considered signals of missed opportunities. The most important missed opportunities are:

- failure to detect the infectious case;
- delayed reporting of an adult source case;
- failure to identify contacts of infectious cases with children;
- delayed or incomplete evaluation of children exposed to TB; and
- inadequate treatment of latent TB infection (LTBI) [1].

TB in young children (under five years) is often transmitted from a family or household member [2]. Therefore, screening procedures in cases of childhood TB should always start with the search for the source case within the family/household [3]. The transmission of TB to children through non-household exposure is difficult to ascertain. In many instances, public health authorities experience difficulties in establishing the contact with the source case as most of the affected are not aware of the contact which leads to the infection.

This paper describes a case of a four-year-old child who became infected through exposure at a coffee shop, which she visited sporadically in the company of a family member. It illustrates the difficulty in detecting non-household transmission between individuals that did not have significant contact. Moreover, it demonstrates the need to look for the infected adult whenever a child is diagnosed with TB.

Case reports

Case 1 (child)

In September 2007, a four-year-old child came to our practice after having had a temperature around 37, 5-38ºC for 15 days (Figure 1).

Chest radiography showed a right hiliar enlargement. TB was confirmed by bronchoalveolar lavage analysis, which was smear and culture positive. The *Mycobacterium tuberculosis* (MTB) isolate was susceptible to all first-line drugs. The clinical strain was genotyped using mycobacterial interspersed repetitive unit-variable-number tandem repeat (MIRU-VNTR) typing [4] and IS6110 restriction fragment-length polymorphism (IS6110-RFLP) typing [5]. The patient was treated with isoniazid, rifampicin and pyrazinamide by means of directly observed treatment (DOT).

Contact tracing after diagnosis

Upon diagnosis, the parents were interviewed and asked to describe the daily activities and routines of the child at home, at school and in its social environment. The parents were not aware of any contact with TB patients. Initially we considered three relatives (the parents and grandmother) and later on an additional 11 close members of the family as well as 30 pupils and nine staff from the school as contacts of the child. All identified contacts were offered a screening programme which included a symptom questionnaire, a tuberculin skin test (PPD RT23 SSI) and chest radiography. The tuberculin skin text was considered positive if after 72 hours an induration >10 mm was visible, and an interferon gamma assay was performed in all positive cases. One case of LTBI was identified among the contacts, a school staff who was subsequently treated with isoniazid for 6 months.

Case 2 (adult source case)

In October 2007, a woman in her early forties presented at our clinic with progressive weakness, weight loss and a persistent productive cough for the past two months (Figure 1). Chest

radiography showed bilateral pulmonary infiltrates and cavities. The sputum was smear and culture positive for M. tuberculosis and the isolate was susceptible to all first-line drugs. The strain was genotyped using MIRU-VNTR [4] and IS6110-RFLP. The patient began treatment with isoniazid (INH), rifampicin (RIF) and pyrazinamide (Z) and ethambutol (E) in form of DOT.

Contact tracing

Eight close non-household contacts were identified and offered screening as described above. Two of them had LTBI and were treated with isoniazid for six months. Afterwards, contact screening was broadened to include casual contacts defined as exposure/contact for less than eight cumulative hours during the symptomatic period from August 2007. An additional 20 persons were identified and screened. LTBI was diagnosed in five contacts and active pulmonary TB was diagnosed in two.

Case 1 and case 2 were apparently unrelated. However, it was noticed that both patients lived in the same geographic area. Further questioning identified a coffee shop as a place where both individuals would spend time occasionally. At first, it seemed there was little chance of a connection between them. The visits to the coffee shop were rare and short. In order to clarify the situation and to enable other public health measures, clinical isolates of both patients were genotyped. Strain typing was done through the use of MIRU-VNTR and IS6110-RFLP standard methods [4, 5]. Both fingerprinting results showed that the two clinical isolates had identical fingerprinting (Table 1 and Figure 2), and therefore were epidemiologically related.

Lane 1: Molecular marker (1kb marker): 10.000 bp, 8000 bp, 6000 bp, 5000 bp, 4000 bp, 3500 bp, 3000 bp, 2000bp
Lane 2: M. tuberculosis isolate from case 1 (child)
Lane 3: M. tuberculosis isolate from case 2 (adult source case)

Contact tracing after results from genotyping

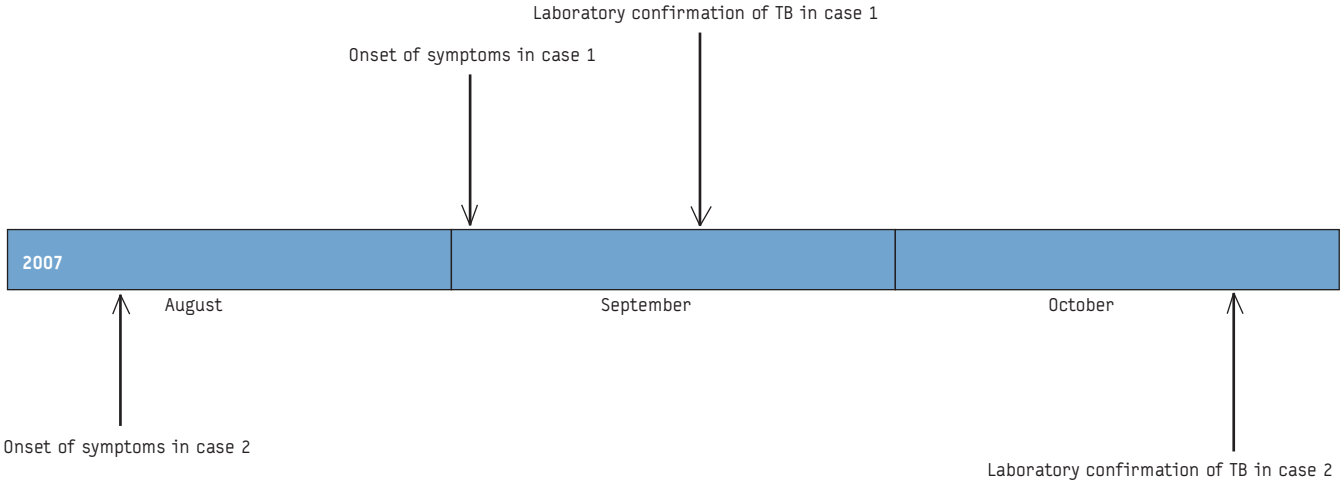
After the results from genotyping had revealed the connection between the two cases, and the coffee shop was identified as the place where the two cases had met, a new investigation was conducted directed at the coffee shop customers. Sixtyseven people were screened and LTBI was diagnosed in ten of them. Consequently, eight individuals were treated with isoniazid for 6 months. Two cases with LTBI had underlying conditions such as alcoholism and chronic hepatic disease which meant that they were at risk for developing hepatic toxicity from being treated with isoniazid. They were kept under clinical surveillance by the clinic as outpatients for 2 years.

Discussion and conclusion

The two main factors determining the risk of progression from latent to active TB are patient age and immune status. Immaturity of both the innate and adaptive immune systems of young children plays a critical role in increased susceptibility to active TB. Children below five years of age who are infected, have the highest risk of

Figure 1

Timeline of onset of symptoms and of diagnosis of tuberculosis in case 1 (child) and case 2 (adult source case), Portugal 2007



Table

Results of mycobacterial interspersed repetitive unit-variable-number tandem repeat (MIRU-VNTR) typing (15 loci), tuberculosis cases Portugal, 2007

	Mtub04	ETRC	MIRU04	MIRU40	MIRU10	MIRU16	Mtub21	QUB11b	ETRA	Mtub30	MIRU26	MIRU31	Mtub39	QUB26	QUB4156
Case 1 (child)	1	4	2	1	N/A	1	3	2	2	1	4	3	2	N/A	2
Case 2 (adult source case)	1	4	2	1	N/A	1	3	2	2	1	4	3	2	N/A	2

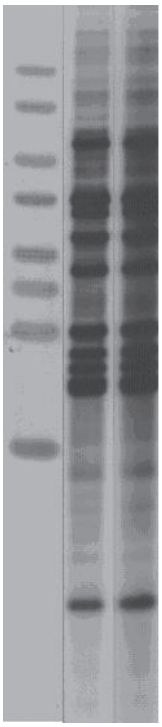
Legend: N/A= not available

progression to disease [6, 7]. The two strategies for managing TB in children are searching for secondary cases in close contacts and searching for the infectious adult source case. Whenever a TB case in a small child is diagnosed, family members are interviewed to identify contacts in the sphere of the patient's daily activities. The public health authority investigation team visits the child's home, school or other identified places where the child has social contacts in order to identify those at risk and to find the infected adult. Progression from primo-infection to illness in children under five years old is very fast, so one can be sure that there is an infectious adult nearby who transmitted the disease to the child [6, 7].

Due to the low probability of transmission between very young children, screening of other children is usually largely unproductive. There is however evidence that TB in young children is occasionally transmissible particularly in the presence of cavitation, consolidation or bronchial lesions [8, 9]. Although case 1 did not present cavities in the chest radiography, she was smear and culture positive so the risk of transmission could not be excluded. Therefore, all family and school contacts were screened. This activity did not prove to be fruitful as all children tested negative, only one adult was found to have LTBI (probably not connected with this situation) and it did not lead to the identification of the source case. At this point in time, we were reconsidering our strategy when another case appeared in the same geographic area. Further inquiries revealed a seemingly improbable contact between the adult and the child in an unusual place for a child to be – a coffee shop. Genotyping of the M. tuberculosis isolates from both cases however, confirmed the connection.

Figure 2

IS6110 restriction fragment-length polymorphism (IS6110-RFLP) typing fingerprints, tuberculosis cases Portugal, 2007



The delay of the diagnosis of TB in case 2, by two months and a prolonged infectious period were the causes of the high rate of TB transmission, resulting in three cases of pulmonary TB (two family members and case 1) and 18 LTBI among contacts which can most probably be attributed to the event.

Transmission of TB in bars has been described before and may pose a risk to public health [10,11]. This case report is intended as a reminder to health professionals that all TB transmission scenarios are possible and need to be considered in an investigation around a case, even the less likely. Moreover, a delay in the diagnosis of the infectious case results in transmission of the disease. Finally, the link between the child and the adult would not have been proved without the use of the *M. tuberculosis* fingerprinting techniques.

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