Nosocomial exposure to tuberculosis – experience in an Internal Medicine ward and review of the recommendations for risk-control

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Abstract

Context: Tuberculosis (Tb) is the 2nd cause of death from infectious disease in the world. Portugal is a high incidence country. In the majority of Hospitals in Portugal, Tb patients are initially admitted to Internal Medicine wards. In the absence of isolation rooms with negative pressure, there are recommendations for other attitudes that minimize the risk of Tb nosocomial transmission.

Objectives: To evaluate the risk-control attitudes that were taken facing hospitalized Tb patients in an Internal Medicine ward of a general Hospital; to quantify the time of permanence of potentially infectious patients in the ward.

Patients and Methods: Retrospective analysis of the hospitalized patients with Tb at an Internal Medicine ward with 33 beds, during the period of 3 years. Inclusion criteria: previous Tb diagnosis with less than 4 weeks of treatment; diagnosis during the hospitalization, with treatment decision; microbiological diagnosis after withdrawal from the ward. Evaluated attitudes: "separation" (curtains, increasing bed intervals); use of mask; high efficiency particle vacuum cleaner; transference to other institution.

Results: In a total of 2810 admissions, 39 cases of Tb were included (1.4%), 25 of them with pulmonary forms of disease. Sixteen of these were high risk transmitters, with positive direct or cultural microbiological identification in respiratory secretions. The hospitalizations of these patients completed 303 days (162 until the diagnosis and 141 after the diagnosis), most of them (169 days) without risk-control action. Among the 141 days after the diagnosis, only in 7 no risk-control action was taken. Risk-control action was taken in 14 patients, all of them with pulmonary Tb. The 2 remaining patients only had culture diagnosis, after withdrawal from the ward.

Discussion and conclusions: In 14 of the 16 infectious patients, the recommended risk-control action was taken, after the diagnosis. Despite this acceptable accomplishment, there were 169 hospitalization days with risk of transmission, which we can relate to late suspicion and/or diagnosis. It is necessary to reduce the threshold for suspicion and risk-control action. The authors present some proposals that might reduce the nosocomial exposure to Mycobacterium tuberculosis.

Key words: tuberculosis; nosocomial; isolation; infection control.

Context

Tuberculosis in the world – the last few decades

In 2001, it was estimated that over 1/3 of the world population would be infected by *Mycobacterium tuberculosis* (Mt), with a global incidence of tuberculosis (Tb) of 8 millions of new cases/year and a mortality of 2 millions/year, being the second cause of death by infection[1,2] (in 1998, it was the 1st cause,[3] in the meantime overtaken by HIV/AIDS). In the 80ties and 90ties, in the USA, it was seen an increase in the number of Tuberculosis cases. It was estimated that, in the 90ties, 67 thousand cases could have been avoided through the implementation of strategies to control infections.[1] Such situation took a particular relevance in New York, where the highest incidences in the history of the country were reached, with additional costs estimated in 2 billion dollars.[1] Studies of *DNA fingerprinting* have shown that half of these new cases correspond to aggregates of direct transmission, and not to reactivating ones.[4] At the same time, some hospital transmission outbreaks were seen. In New York, in 1993, health professionals made up 3.2% of cases.[2] From 1985 to 1995, there were 12 outbreaks in American hospitals, with 18 to 35% tuberculin conversions among health professionals.[5] The Center for Disease Control (CDC) has identified, as main factors of hospital transmission, the delay on diagnosis (and consequent isolation) and the existence of

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bad clinical procedures in isolation.[6,7] Reflecting on such period, two authors considered the nosocomial outbreaks of the 80ties and 90ties were due, partially to the difficulty of recognizing atypical patterns of Tb in patients with HIV infection that in 10 to 20% shown normal chest x-rays.[2]

Transmissibility, infection and disease

It is estimated that the arrival of 1 to 5 bacilli to the deep lung it is enough to cause infection, forming 1 granuloma and tuberculin conversion;[5] it is known that about 10% of infected subjects develop the disease throughout their lives (10% per year if infected by HIV).[1,6,7] Mt is never a colonizer, i.e., its arrival in the tissues always causes infection.[8] It is therefore a consensus that any level of exposure to Mt must be considered unacceptable.

Mt transmissibility is 20 to 60 fold higher than *Neisseria meningitidis*.[8] In closed spaces, the probability of transmission before exposure to a patient with respiratory Tb goes from 1/50 (schools, places of work) to 1/3 (co-habitation).[8] A close contact with a patient with a direct test of positive sputum for Alcohol-Acid Resistant Bacilli (BAAR) can limit transmission in 20 to 50% of cases; even with a negative direct test, such risk is high (10 to 15% with a positive Mt culture; and 5 to 10% with a negative Mt culture).[8]

For health professionals, the risk of Mt nosocomial transmission is high. The following factors of higher risk have been mentioned:[5,6,7] high incidence in the community attended; hospitals with a high number of cases/year or a low ratio workers/no of cases; forms of pulmonary disease (pulmonary, larynx); a high concentration of BAAR in the sputum; cavitation lesions; exposure for a long time; delay on the diagnosis and isolation; bad procedures on infection control.

Before such reality, CDC has issued recommendations to prevent Mt transmission in health facilities.[6,7]

The situation in Oporto and HGSA

In Portugal, Tb incidence is around the 50 cases /100.000 inhabitants/year, which is higher than most western countries, that in 1998 had an incidence lower than 20 /100,000.[9] Oporto is one of the districts with a highest incidence (60 to 70 /100,000 /year in 1998.[9]). In Greater Oporto, there are scarce resources to isolate bacilli infected patients. Namely the General Hospital of Santo Antonio (HGSA), where around 600 patients with HIV infection are followed up, does neither have an isolation room nor negative pressure areas. HGSA has about 3000 health professionals. From 1993 to 1996, 101 patients with respiratory tuberculosis were admitted in the HGSA Medicine Service, accounting for a 56.7% increase on the number of cases from 1980 to 1983 (non published data). Such data enables one to say that HGSA is an average risk hospital for nosocomial transmission (from 10 to 100 workers/case/year), where it is recommended the existence of negative pressure rooms or with ultraviolet radiation (UVR).[5]

CDC recommends that in hospitals without isolation rooms, written protocols should be set considering the early identification and transfer of Tb patients to facilities with appropriate conditions.[6,7] In 2003, the Commission of Infection Control and the HGSA Microbiology Service issued local recommendations to Tb screening procedures and to "separating" patients under suspicion.[10]

Objectives

Before such reality, authors have decided to study the situation at HGSA, in a way it would clarify the following points:

a) To quantify the staying of potentially contagious Mt patients in an Internal Medicine ward;

b) To evaluate the risk control steps taken in Tb patients in such ward.

Patients and methods

A retrospective study was made for a three years period (1st January 2001 to 31st December 2003), identifying all Tb cases in an Internal Medicine Service with 33 beds. Patients were identified through research in all tuberculosis ICD 9 codes, added of Mt identifications recorded in the Microbiology Service database. Data gathering was made through a clinical files consultation.

The inclusion criteria were as follows:

a) Microbiology diagnosis during admission (direct examination – DE – and/or culture – Ct);

b) Microbiology diagnosis after admission (DE and/or Ct):

c) Decision to start treatment (strong suspicion);

d) Previous diagnosis with less than 4 weeks treatment.

The risk control steps (RCS) were only considered

as performed when recorded in the clinical file. The following were researched:
a) Separating (curtains, empty beds interposition);
b) Placement of a high efficiency dust vacuum cleaner;
c) Use of a mask;
d) Transfer.

Outcome

Quantification of patients staying

In the defined period, 2810 admissions were verified in the studied ward. 39 Tb cases were included (13/year, 1.4% of admissions). From these, 25 were pulmonary Tb cases, including 16 with a microbiology diagnosis (14 with positive DE, 2 with negative DE but positive Ct), to whom we will call bacilliferous.

39 patients were admitted for a total of 819 patients. The 16 bacilliferous patients completed 329 admission days, that excluding overlapping days correspond to 303 absolute days, i.e., 101 days/year in average. In such patients, the average delay up to the diagnosis was 10.9 days and their staying at the Service after diagnosis was extended for a further 9.6 days. In summary, these patients took 162 absolute days until the diagnosis and 141 absolute days after diagnosis.

Applying Risk Control Steps (RCS)

RCS were applied in 17 patients, all with pulmonary Tb. RCS were applied in 14 bacilliferous patients out of 16. The remaining 2 had a culture diagnosis after being discharged. In absolute, there were 169 days (in average 56 days / year) of bacilliferous patients admitted without RCS. Among these, only 7 correspond to days after a known diagnosis.

DISCUSSION

Results

From the data findings, it can be stated that the RCS recommended by the Commission of Infection Control were complied with in 14 out of the 16 patients in higher risk, and the remaining 2 patients only had their diagnosis after being discharged. In addition, there were only 7 days with a known diagnosis and without a record of steps taken, which seems acceptable to us, mainly considering that we based ourselves in the record, which can not translate all steps. Therefore, all RCS were complied with after the diagnosis.

On the other hand, it is obvious that the average delay until the diagnosis was high (around 11 days in higher risk patients). Confronting this data with the fact that RCS were implemented only at the time of the diagnosis, it can be understood the reason why it was verified in absolute, 56 days per year with an exposure to bacilliferous patients, what makes a very high level of Mt exposure.

The immediate conclusion is that RCS must be started previous to the diagnosis, i.e., before the clinical suspicion.

The recommendations

A cost-efficacy study has estimated that the implementation of the generalized use of masks with high efficacy protection filters would cost from 1.3 to 18.5 million dollars to prevent 1 case of Mt nosocomial transmission in 41 years. This study authors consider that most cases of nosocomial Mt transmission are related with a low clinical suspicion and not with the patients isolation, and not as much as the quality of protection masks used.[11,12]

CDC recommends that casuistic reviews are made to act as a guide to make or to review the protocols of infection risk control.[6,7] According to the recommendations of such organization, any patient under Tb suspicion must be isolated, with respiratory protections and actively investigated. The suspicion must emerge before: persistent cough (> 3 weeks); worsening of the general condition; night hyperhidrosis; hemoptoic sputum; patient from communities with a high Tb prevalence.[6] The research must include: history and physical examination; thorax X ray and Mantoux test; direct test of respiratory secretions with available result in 24 h; and HIV serology.[6] The isolation should consider: a) isolation room (negative pressure; closed door; over 12 air cycles per hour; exhaustion to the outside or recirculation through a high efficacy filter; UVR, if possible; 1 isolation room for each service of acute condition patients); and b) use of respiratory protection masks (patients, professionals and visitors).[6,7] According to the CDC, portable high efficacy filters are not studied for Tb.[6]

CDC, as well the WHO recommends that even in facilities without isolation rooms, protocols are drafted to an early detection and transfer to appropriate places. With this purpose, both the Commission for

Infection Control and the HGSA Microbiology service have issued local recommendations, which include:
a) Case Identification
• Direct examination (available in 24 h) in all suspected patients.
• Direct examination (available in 24h) in all cases under treatment;
b) Confirmed case with admission criteria – transfer.
c) Risk control steps (until a direct exam is got or in a confirmed case impossible to transfer)
• To place an empty bed in between and to draw curtains;
• High efficacy dust vacuum cleaner (portable) near the patient;
• Patient with a respiratory isolating mask ("surgical");
• Workers and visitors with particle breather (mask P1SL, EN 149:2001);
• Limit visitors.

Conclusion

We take the view that our results show a reality similar all over the country: on one hand the scarcity of resources to isolate risk patients; on the other hand, a low rate of clinical suspicion, disproportionate to the community high incidence. Therefore, it seems the right moment to make some proposals to help mitigate the current lacks.

Proposals

Our proposals refer to the crucial points of the problem in Portugal: the scarcity of isolation rooms; the scarcity of recommendations; low rate of clinical suspicion. Thus we list 3 steps we think should be adopted in all health facilities.

a) An effort must be made to implement isolation rooms with negative pressure and/or ultraviolet radiation, with independent ventilation, or air recirculation through high efficacy filters.

b) Specific recommendations must be defined and made public locally, to the Mt transmission risk control, that include, in hospitals without isolation rooms, "separating" steps similar to those previously described.

c) risk control steps must be taken at the time of admission and until getting a direct exam of respiratory secretions negative for BAAR, in patients with:
• Pulmonary Tb diagnosis under treatment for less than 4 weeks;
• Respiratory infection with clinic or suggestive image (condition affecting the general state, hemoptoic sputum, apical infiltrate, cavitations);
• Respiratory infection in HIV infected patients
• Respiratory infection in patients with a recent contact with Tb.

In 1994, M. Hamburg, from the New York City Department, and R. Frieden, from CDC, said "We must acknowledge that many of the current tuberculosis derides from recent failures on the treatment and on the public health approach".13 Over the 10 following years, political steps and public health policies were adopted enabling a reduction in the incidence of tuberculosis in New York for the lowest values of its history.2 It was proven that applying CDC recommendations decreased significantly the tuberculin conversion in health workers.2 We can contribute with this work, so that a similar reality can happen in Portugal. ■

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