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Educational Case Report: When you look for one thing and find another

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Abstract

Aims and scope: The purpose of this article is to present a case study to conclude education in Occupational Health. We intend to examine the possibility of TBc transmission in the workplace following an incident.

Methods: After verifying the information, all employees in contact with hospitalized patient were checked with tuberculin test and chest X-ray to ensure about possible transmission of Tbc. We surveyed the scientific literature on TB screening programmes in workplaces and the occupational characteristics of workers exposed to asbestos, particularly marine carpenters, for potential respiratory health risks due to daily exposure to fine particles and wood dust. Thus, the literature specifically on mesothelioma and other health problems in marine carpenters was investigated.

Findings: 27/95 employees were found Mantoux positive but no TBc transmission was verified. Instead, a carpenter was found with pulmonary fibrosis. Special tests (BAL) found asbestos fibers. An accurate study of the worker's occupational history showed previous exposure while working in the shipyard.

Discussion: The laboratory plays an essential role, since the surveillance of bacteriologically confirmed cases allows the most reliable comparisons, and because of the importance of the identification of drug resistance. The incidental finding of a case of mesothelioma in a carpenter

was investigated in detail. Unfortunately, mesothelioma patients have a very aggressive cancer and often do not survive long enough for their personal injury lawsuits to become final.

Conclusion: For Public Health practice control for transmission of a known infection [TBc] maybe lead us to other findings. Then occupational exposure history can establish the correct diagnosis. In investigating the causes of workers' diseases, Ramazzini's teaching remain relevant.

Keywords: Tuberculosis, transmission, asbestos, carpenter, occupational history

Introduction

We have been informed that "*the barista at the cafeteria of Municipality's green service is hospitalized with tuberculosis*". What do we do?

The serious question raised on how to prevent the transmission of TBc infection to the other workers, and what to do about possible transmission.

Controlling the existence of an increased risk of tuberculosis among people working in certain industries or occupations, while controlling alcohol use and cohabitation with a sufferer, is a focus of Occupational Safety and Health (Rosenman, 1996).

The relationship of TBc and occupation can be broadly classified into three categories (Tam, & Leung, 2006):

1. Occupations that involve workers at higher risk of contracting tuberculosis. Such as workers with less favorable socioeconomic conditions especially unskilled workers and low-wage workers.
2. Occupations that increase susceptibility to mycobacteria: workers predisposed to TBc (e.g. mining, quarries, foundries and pottery).
3. Occupations that increase the likelihood of exposure to infection in environments conducive to transmission: healthcare workers, mycobacteriology laboratories and autopsy rooms.

In a case study, Hutchroff L.W. (1911), occupational tuberculosis was found in carpenters. A historical study showed that the carpenter industry had a higher ratio of deaths from tuberculosis in the age period from 20 to 29 years compared to other industries (Hutchcroft, 1911).

Following the medical guidelines for investigating the transmission of TBc infection we were faced with another finding related to occupational health. The special lung tests established the diagnosis while completion of a thorough occupational history showed the cause. Unfortunately, this was done after the worker's death, the lawsuit and the court's decision.

The legal procedure for compensation for occupational disease requires for identifying the mechanisms of occupational exposure on workers health. The retrospective study of such cases can serve to deepen our knowledge to appropriately implement effective prevention measures.

In these cases where an unexpected finding always arises, a return to the teachings of Occupational Medicine is required. The ethical contribution of Ramazzini 's comments, suggestions and legacy can still be useful.

Methods

For confidentiality and data protection, we officially confirmed the information with the clinic's medical director. Hospitalization cure as well as the possibility of prophylactic treatment for his family members concerned the clinicians. But his 'contact' with the other workers of Municipality's green service concerned occupational physician role. It was decided to examine by TST [TB-Mantoux reaction] all exposed employees.

We research scientific literature for screening programs for TBc in workplaces and occupational characterization of workers exposed to asbestos, especially naval carpenters, for potential risks of their respiratory health due to daily exposure to fine particles and wood dust.

A bottle of tuberculin was procured from the Public Health Department of the Region and all employees of Municipality's green service were notified by the Occupational Health and Safety Committee, with the substantial assistance of the chairperson of the Committee. After 48 hours, reading accuracy was calculated using two cut-off points - 5 and 10mm – and 27/95 (28%) workers were found TST positive (or false positive) and sent for a chest x-ray (Rothel & Andersen, 2005). Thus the literature specifically on mesothelioma and other health problems in shipbuilding carpenters was investigated.

Discussion

TBc is an infectious disease caused by mycobacterium and transmitted through the air by those who are infected (i.e., coughing). To characterize the risk of transmission we need an extended review of the literature on occupational infections occurring in workplaces, especially TBc. Direct contamination by aerosolization is the main mode of transmission reported, although indirect contamination was described too. Because of probably significant under-declaration we need sufficient information to link to occupational exposure in workers. Generally, there is no alarm, thanks to effective preventive measures.

TBc is one of the oldest diseases in the world. TBc was a major global public health threat, affecting millions of people annually. In 2010, TBc rates per 100,000 people in different regions of the world were: 178

globally, 332 in Africa, 36 in the Americas, 173 in the Eastern Mediterranean, 63 in Europe, 278 in South-East Asia and 139 in the Western Pacific (WHO, 2011).

After Koch's discovery of the tubercle bacillus [Mycobacterium tuberculosis], repeated tuberculin surveys were implemented to monitor infection. Despite efforts for workers' protection against TBc the number of cases remains high. Surveillance of tuberculosis started more than two centuries ago and case notification of active disease was progressively established during the 20th century with a specific focus on low income countries as the disease is associated with poverty, poor sanitation or hygiene practices and being easily transmissible from person to person (ECD, 2022 ; WHO, 2021).

Tbc may be transmitted especially in healthcare workers during bronchoscopy, laryngoscopy, tracheal intubation, aspiration, and mechanical ventilation. There should be very little contact with patients with Tbc. Epidemiology of nosocomial TBc among nurses is in a context of low endemicity. If necessary, a tuberculin test should be performed, and chemoprophylaxis should be applied. Using appropriate protective clothing and personal respirators, limiting the number of personnel in contact with the patient, and delaying surgery until the patient is non-infectious are strategies to prevent disease transmission (Nicholau D, & Arnold, 2010).

Treatment of tuberculosis disease is the key intervention to stop transmission, monitoring of treatment outcome and more recently of drug resistance became integral parts of tuberculosis surveillance. Since 1997, the WHO has been publishing an annual global TBc report. There are multiple guidelines published about TBc. Tuberculosis transmission has long been recognized as an important occupational hazard mainly for HCWs. Ooccupational health specialists must review and critically appraise the evidence-based guidelines regarding interventions for the identification of TBc.

While global estimates are useful to raise public health awareness, reports present data notified by each country as well as based on case notification adjusted by various correction factors. Incidence rates are compared by time, place and patient characteristics to identify high-risk groups. The laboratory plays an essential role, since the surveillance of bacteriologically confirmed cases allows the most reliable comparisons, and because of the importance of the identification of drug resistance (Valérie Schwoebel, 2020; Kendra Brett, Camille Dulong, Melissa Severn, Ottawa 2020).

Asbestos, as a mineral fiber abundant in nature, classified as a carcinogen since 1987. An integrative literature review indicates the occupations and activities developed by sick workers and which categories

would be affected with asbestos-related diseases. Through a literature review performed 23 studies published from 2015 to 2020 were evaluated. The occupations that showed greater illness due to asbestos exposure were general asbestos workers (40%), miners (22%), and textile workers (9%), followed by **naval,** automotive, **carpentry**, doll-making, construction, and upholstery workers, as well as workers involved in the rescue, recovery, cleaning, and restoration of the World Trade Center (4%). Malignant mesothelioma (43%) is the most described disease associated with exposure to asbestos (Kauane Vicari, Inaye Mayr Ribeiro, Bianca Fontana Aguiar et al., 2022).

Non-occupational, environmental or ecological exposure to asbestos has also been reported to cause mainly pulmonary diseases and mesothelioma (Sxiza et al, 2024).

Table 1: Health and safety hazards of carpenters

Biological	molds, fungi and bacteria
Injury	various machinery and tools, working in awkward positions, performing repetitive tasks, and lifting and falling from heights
eye injury	flying particles
Toxic	chemicals, solvents
Stress	shift work and extended workdays
Exposure to	extreme temperatures, working outdoors, heat stress and frostbite risks, flammable or combustible materials, wood dust
Cancer	solvents, formaldehyde, wood dust

Research has shown that carpenters, especially those who have worked in industries like construction, shipbuilding, or woodworking, may face various health problems due to their occupation. These health issues can include:

- Musculoskeletal Disorders Carpenters often perform physically demanding tasks such as lifting heavy materials, operating power tools, and working in awkward positions, which can lead to musculoskeletal disorders such as back pain, tendonitis, and carpal tunnel syndrome.
- Respiratory health Exposure to wood dust, chemicals, and other airborne particles in the workplace can contribute to respiratory issues such as asthma, bronchitis, and COPD.
- Injuries Carpenters are at risk of injuries from falls, cuts, and accidents involving power tools and machinery. These injuries can range from minor cuts and bruises to more severe injuries such as fractures and amputations.
- Hearing Loss Prolonged exposure to loud noise from power tools and machinery can result in hearing loss over time if proper hearing protection is not used.

- Occupational Dermatitis Contact with various chemicals, solvents, and construction materials can cause skin irritation, allergic reactions, and occupational dermatitis among carpenters.
- Psychological Stress The demanding nature of the job, deadlines, and job insecurity can contribute to stress, anxiety, and other mental health issues among carpenters.

Research and occupational health organizations often provide guidelines (OHSA, 2021) and recommendations to mitigate these health risks, including the use of personal protective equipment, proper training, ergonomic work practices, and regular health screenings (International Registries, 2021). Ship carpenters were historically exposed to asbestos because asbestos was commonly used in shipbuilding materials due to its fire-resistant properties and durability (Class NK, 2023).

Carpenters were exposed to asbestos through virtually every material they handled from the early 1900s until approximately 1980. Even today, carpenters risk being exposed to significant levels of asbestos during demolitions and repairs of older structures. Carpenters with mesothelioma were likely exposed on the job. Ship carpenters are involved in nearly all aspects of shipbuilding, including the internal support structure and external trim carpentry, such as cabinetry and the hull. Asbestos is effective for waterproofing, lightweight, and non-corrosive, so it is useful throughout the ship. This makes shipbuilding **one of the riskiest occupations for asbestos exposure (Mesothelioma, 2023).**

Asbestos exposure can lead to serious health issues such as mesothelioma, lung cancer, and asbestosis. Regulations and safety measures have been implemented to reduce asbestos exposure in shipbuilding and other industries, but the legacy of past exposure still affects many workers today. Ship hulls were lined with asbestos. Asbestos was also used in adhesives, joint compound, sealants, insulation, and cement. Carpenters would have handled these materials directly. Airborne asbestos from the ship's internal machinery, plumbing, and electrical wiring may also have been present. Asbestos was also widely used in cement pipes, flanges, valves, gaskets, and boilers. Asbestos was used liberally in these components until 1980, but many of these ships are still in use today. The same materials were also used by military vessels.

The asbestos problem on board seagoing vessels is far from being solved. Mesothelioma is an aggressive form of cancer that is caused by long-term exposure to asbestos and unfortunately can take 20 to 50 years to develop.

In EU if one worker have been diagnosed with an asbestos-related illness after working for these companies, or if worked with products

manufactured or supplied by these companies, may be eligible to pursue significant damages through a mesothelioma lawsuit and an asbestos exposure workers' compensation claim. In USA workers exposed to asbestos while serving as carpenters in the military, may be eligible to file a claim and a lawsuit against the companies that provided asbestos products to the military.

Mesothelioma is an aggressive cancer and patients often do not survive long enough for their personal injury lawsuits to resolve. If someone suffers from mesothelioma, they usually do not have time to bring a claim and receive compensation.

Most mesothelioma lawsuits settle without going to trial, and the average settlement can be in the millions. Wrongful death lawsuits are filed by the immediate family members or an estate representative after someone has died from mesothelioma. If a wrongful death case is successful, the family may be able to recover compensation for funeral costs, pain and suffering of the deceased, loss of companionship, lost income, and other financial and emotional losses.

Results

After tuberculin testing and chest X-rays, no one was found with TB findings but...one with pulmonary fibrosis. Further lung examinations revealed fibers of asbestos in the bronchoalveolar lavage [BAL]. The worker [Ts] has followed various diagnostic and medical treatments. Unfortunately, he died a few years later. His relatives brought a lawsuit against the employer [Municipality of K]. After several years the court found Municipality K guilty and awarded compensation [÷200.000 €].

Reviewing the case for educational purposes we found that the worker [Ts] was a carpenter. Seeking transmission of tuberculosis to other workers showed no result. In addition, there was no occupational exposure to asbestos. However, the carpentry shop's roof had an 'elenit' leaf, which an occupational physician -acting as a safety technician- had recommended for its removal. Employers must be informed of these recommendations and must take appropriate action. This negligence (omission) was relied upon by the court.

Figure 1: Asbestos asbestos sheet used as a roof or shed, with a corrugated shape imitating a tiled roof (Elenit)

From the employee's remote occupational history i.e. before taking up employment with the Municipality of K, it was found that he had worked for many years in ship repairing, where asbestos-containing materials were known to be used.

The amount of fibers in the lungs is considered to reflect the cumulative intensity of past asbestos exposure, as bronchoalveolar lavage (BAL) is a good indicator of the presence and quantity of asbestos particles in the lungs (Negar SabzeAli et al, 2022).

Assessment of exposure to asbestos is crucial and requires accurate medical and occupational histories. Quantitative analysis of asbestos body burden is better performed in digested lung tissues by counting asbestos bodies by light microscopy and/or uncoated fibers by transmission electron microscopy. The benefits of screenings for asbestos-related malignancies are equivocal. The attribution of lung cancer to asbestos exposure is difficult in a clinical setting since the need of assessing asbestos body burden and the fact that virtually all these patients are also tobacco smokers or former smokers. Given the premise that asbestosis is necessary to causally link lung cancer to asbestos, the assessment of both lung fibrosis and asbestos body burden is necessary.

EU law focused on the health protection of employees and the responsibilities of employers, as well as on environmental protection. The legislation in the EU, including Greece, emphasizes on the legal protection of workers' lives against asbestos assuring the health and safety of workers still exposed and those formerly employed to asbestos.

Conclusions

Systematic reviews confirm the current knowledge regarding asbestosis and silicosis, indicating a higher risk of lung cancer in exposed individuals compared to exposed workers without fibrosis (Krabbe J, Steffens KM, Drießen S, Kraus T. Lung, 2024).

As we know from available data many measurements did not exceed historical OSHA exposure limits [TWA 8-h] for PEL of 0.1 fibers/cc], average fiber concentrations generally in place at the time, except perhaps during specific activities onboard ships. Beyond specific short-term tasks, workers sometimes wore respiratory protective equipment. Data were not sufficient to determine whether the airborne asbestos fiber concentrations represented a potential health hazard (Williams PR et al, 2007).

Father of Occupational Medicine Bernardino Ramazzini's method focuses on analyzing episodes that stimulated the composition of his main work and highlighting some observations on which current epidemiological and toxicological studies are based. Some reviews in his work show systematic descriptions of work-related illnesses, occupational lung diseases, breast cancer, and environmental disorders; and remarked on his main observations in the fields of risk prevention and health promotion.

Although current practice is based on ethical contribution of Ramazzini, goes far beyond his noble and heartfelt words, demonstrating his intellectual and moral depth. In fact, alongside comments and suggestions, quotations and proposals, information and warnings, Ramazzini offers a framework for his beliefs on the attitude that the physician should adopt (Giuliano Franco, 2014; Giuliano Franco, 2013).

Moral: let us not be prejudiced. In searching for communicable diseases, we may find other causal links between work and diseases. We must not forget Ramazzini's legacy: ***Quam artem exerceat ?*** (George Dounias, 2001).

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