Student's Corner

Byssinosis: As seen in cotton spinning mill workers of Karachi

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Abstract

Objective: To identify Byssinosis in cotton spinning mill workers, probable associations of disease with factors such as different work areas, safety gadget usage and overtime and to ascertain proportions of byssinosis to accidental injuries.

Methods: This study was conducted in a spinning mill of Karachi in June 2006. Mill workers who had worked for a period of minimum 5 years were selected. A sample size of 83 conveniently selected workers participated in the research study. Data collection was done via questionnaire, and pulmonary function tests.

Results: The mean age of the sample was 30 ± 6.9 years. Of all the workers 72% used safety gadgets (masks) while working and 50% availed overtime. Smokers amounted to 31% of the total subjects.

Around 35% workers complained of having respiratory ailments of which 19% (16 workers) closely matched byssinotic symptoms. Pulmonary Function Tests (PFTs) confirmed 13 of 16 workers to be byssinotics, with the remaining being labeled as Probables. The overall proportion of Byssinotics in the mill was 19.28% (95% C.I. 11-27) and that of accidental injuries was 22.9%.

The association of byssinosis with respect to work areas was significantly high in Ring area (O.R. = 2.04) followed by carding (O.R. = 1.3). The association of byssinosis was also high in workers who did not use safety gadgets, e.g. dust masks (O.R = 4.89) and in people who worked overtime (O.R. = 1.82). Associations with respect to duration of employment and smoking could not yield significant results.

Conclusion: Results indicate a very high probability of association of disease to non-usage of safety gadgets and overtime working. Studies comprising of a greater sample size would show precisely the overall prevalence of the disease (JPMA 58:95;2008).

Introduction

Byssinosis, also referred to as "Brown lung disease" and "cotton worker's lung", is a chronic occupational lung disease. Byssinosis causes narrowing of the airways due to the inhalation of cotton, flax, hemp, or jute fibers/dusts. Cotton dust is dust present in the air during the handling or processing of cotton.

Byssinosis symptoms may appear as quickly as a couple of hours after exposure, and diminish when leaving the manufacturing environment. Long-term exposure to cotton, flax, hemp, or jute fibers/dusts may cause permanent scarring of the lungs and airways leading to debilitating lung diseases. Persons with byssinosis generally experience the following symptoms throughout the workweek, during exposure to such fibers/dusts: wheezing, shortness of breath, tightness of chest and coughing.[1] They occur due to smooth muscle contraction after histamine release induced by the dust, which most likely contains bacterial endotoxins. People who smoke suffer the most severe impairment from byssinosis since the combination of dust/fibers and smoke both aggravate the lungs and airways. Individuals with asthma are also particularly badly affected by exposure to cotton dust. There are no changes on x-rays.[2]

An overview of the processes taking place in the different rooms of the mill is as follows[3]:

1. Opening - cotton fibres are separated from sacks, opened and cleaned in the Blow room.
2. Arrangement - fibers are separated by processes like Carding and Drawing.
3. Preliminary Spinning and Spinning - slivered fibers are transformed into rovings and yarn is produced in the Ring area.
4. Winding - yarn is wound on bobbins in the Autocon area.

Schilling recommended clinical grades of byssinosis based on worker histories and symptoms. These grades suggested that there was progression of reversible "asthma-like reaction" to dust in the cotton mills on the first day of the working week (Grade 1) to one of irreversible airway obstruction (Grade 2 and Grade 3) (Schilling's criteria).[4] Schilling's proposal was adopted in 1962 Byssinosis Conference in England. Recently Byssinosis has been divided into two forms - acute and chronic. Acute occurs in those who return to work after a weekend and is characterized by the symptoms mentioned above. Chronic B Byssinosis occurs in workers who have had years of

exposure to cotton dust and is marked by permanent dyspnea and irreversible airflow obstruction.[5]

According to National Institute for occupational safety and health (NIOSH), from 1979 to 1990, the number of deaths in US residents in which the underlying cause was Byssinosis were 124 and the number of deaths in which byssinosis was the Contributing cause were 126. During 1990 - 1999 there has been a decline in the trend with a total of 125 deaths, in which 52.8% died of Byssinosis as the underlying cause.[6] According to Turkish studies, the prevalence of Byssinosis was 14.2% in cotton-processing workers. Among these cases, 28.6% had symptoms on the 1st day of the week, and 71.4% had symptoms on all days of the week.[7] According to Manchester studies in lung function in Lancashire, a cross sectional study of respiratory symptoms and lung function was made in 1057 textile spinning operatives of white caucasian extraction. 3.5% of all operatives had Byssinosis.[8]

The recognition of a specific response to cotton dust, which defines Byssinosis, depends on tightness in the chest and shortness of breath occurring within a few hours after an exposure following isolation from cotton dust for at least 38 hours or occurring on initial exposure. The second dependable criterion is the demonstration of a reduction in ventilatory capacity of FEV1 after a similar absence from exposure.[9]

Byssinosis is a well-established disease occurring in cotton mill workers. Although causes and factors aggravating it are known to some extent, but not enough insight is available as far as our country is concerned. By this study we shall have a snapshot status of the disease in the cotton industry setup of Karachi. It will also be our aim to create awareness among the workers so as to encourage usage of appropriate protective measures and their implementation in cotton industries.

The objectives of this study were to calculate the frequency of Byssinosis in cotton spinning mill workers, to compare disease frequency with that of accidental injuries and to ascertain probable associations of disease with factors such as different work areas, overtime, smoking and safety gadget usage.

Methodology

It was a descriptive cross-sectional study conducted in cotton spinning mill of Landhi, Karachi. Ninety five workers were approached through convenient sampling, to participate in this research programme from which 83 were selected based on inclusion criteria which was having worked in the mill for a minimum of 5 years. This study was done in the month of May- June 2006.

Data Collection Procedures was by interviewing workers through questionnaire and performing pulmonary function test (PFT).

A pre-tested questionnaire comprising of total 52 questions (28 close ended and 24 open ended) was made in English language but for the convenience of the workers it was translated in Urdu and administered and filled by the authors themselves as per details told by the workers. History of asthma and smoking was taken to exclude confounders. Family history included allergic rhinitis and eczema to determine any atopy that the worker might have acquired. Information regarding working overtime and safety gadget usage, was also enquired.

Pulmonary Function Test is a sensitive indicator of lung disease.[4] We used Schiller PFT machine (made in Switzerland) - Type SP-1 for the purpose. Data regarding the participant (e.g. age, height) was fed into the machine. The machine had built-in formulas to calculate the normal values of FEV1 & FVC as per details entered according to the Asian race. The participant was taught how to perform the test and then asked to perform it thrice. The mean of the three tests was used to obtain the final evaluation of the participant's lung function. After calculation, the machine in the form of printed graphs- Normal, Obstructive, Restrictive, and Combined, provided any of 4 patterns. Physical examination was also done using portable sphygmomanometer to record blood pressure; weight and height were recorded and clubbing, cyanosis and crackling also assessed.

Computer software SPSS ver.11 was used to obtain statistical results for the acquired data. Workers having clinical symptoms such as cough, tightness of chest or shortness of breath with elevation of these symptoms on first day of work / return to work after leave and PFT results of restrictive or combined type were labeled as byssinotic.

The mill management was briefed about this research exercise so as to acquire approval and clear any administrative reservations. Consent was taken from all the subjects. All ethical consideration and confidential protection of the individuals was specially observed.

Results

In this study, 95 people were asked to answer the questionnaire and undergo pulmonary function tests. Of these, 83 fulfilled the criteria of having worked for more than 5 years in a spinning mill setup. The mean age of the participants was 30 $\pm$ 6.9 years, (range 18 - 50 years). All the subjects were males. Thirty two participants (39%) were matriculates with 9 (11%) being uneducated. Seven (8.5%) were hypertensives, 1 had a history of heart attack and 3 (3.5%) had a history of tuberculosis. Fifty three (64%) participants had a family history of either asthma,

hypertension, diabetes, tuberculosis, allergic rhinitis or eczema. Thirteen (16%) had addictions other than smoking (e.g. naswar, tobacco chewing). Sixty six (80%) participants worked in Productions [Ring = 20 (24%), Autocon = 18 (22%), Carding = 12 (14.5%)], 10 (12%) in Laboratory and 7 (8.5%) in Engineering. Sixty five (78%) participants had work experience of 5 - 14 years, remainder with 15 years / above.

Table 1. Medical Profile (n = 83).

Variable	Options	Frequency	Percentage
Asthma	Yes	5	6
	No	78	94
Accidental injuries	Yes	19	23
	No	64	77
Smoker	Yes	26	31.3
	No	57	68.7
		29	35
Respiratory problems in last 6 months	Yes	7	
		5	8.5
* Cough, chest tightness, breathlessness	Cough productive	6	6.0
	Cough non productive	11	7.2
	Any 2 symptoms		13.3
	All 3 symptoms		
		54	65
	No symptoms		
		44	53
Taken leave in last 6 months	Yes		
		5	11.36
* Due to medical problem	Yes	39	88.64
	No		
		2	40
* Medical problem respiratory in nature	Yes	3	60
	No		
	No Leave	39	47
Pulmonary function test result	Normal	54	65.1
	Obstructive	15	18.1
	Restrictive	12	14.5
	Combined	2	2.4

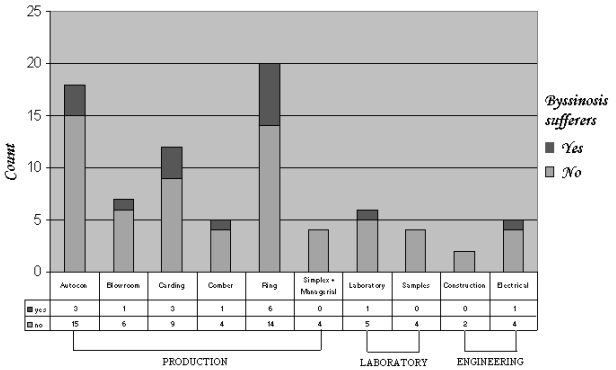

Figure 1. Frequency of Byssinosis in different work areas (Odds ratios; Ring = 2.04, Carding 1.3)

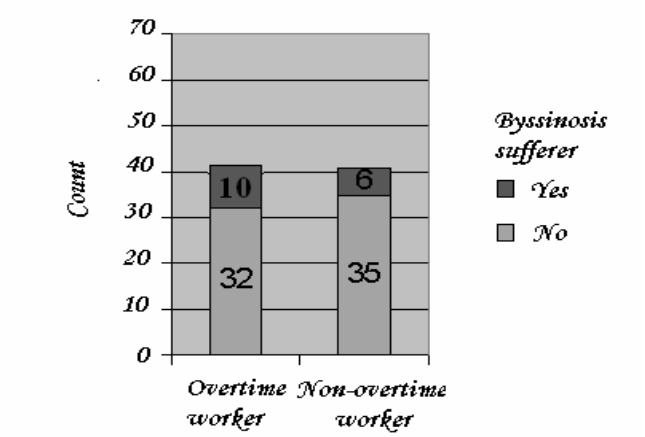

Figure 2. Frequency of byssinosis in Saftey Gadget users and non-users (Odds ratio; safety gadget non-user = 4.89).

Of the 29 people (35%) who complained of having respiratory ailments in the past 6 months (Table), 16 (19.3%) gave a history suggesting an inclination towards Byssinosis. On PFTs 11 (13.3%) gave a restrictive pattern, 2 (2.4%) gave a combined pattern, 2 (2.4%) obstructive and 1 (1.2%) normal. On grounds of a suggestive history and a restrictive or combined PFT pattern, 13 (15.7%) patients were labeled as sufferers of Byssinosis. Remaining 3 (3.6%) people were labeled as probable sufferers of Byssinosis on grounds of history alone and for all calculation purposes were considered as Byssinotics. The overall proportion of Byssinotics in the mill was 19.28% (95% C.I. 11-27) and that of accidental injuries was 23% (Table).

The association of byssinosis with respect to work areas was significantly high in Ring area (O.R.= 2.04) followed by carding (O.R. = 1.3) (Figure 1). The association of byssinosis was also high in workers who did not use safety gadgets, e.g. dust masks (O.R = 4.89) (Figure 2) and in people who worked overtime (O.R. = 1.82). Associations with respect to duration of employment and smoking could not yield significant results.

Discussion

Reported cases of Byssinosis are quite less as compared to other different lung related occupational diseases. Certainly, the disease is on a decline as modernization and mechanization of spinning mills with modern health friendly machines is taking place.

In this study, 19% of the sample complained of Byssinotic symptoms. This is a little above the findings seen

in a study done in Kohat[10], but comes well in concert to findings of two other studies[11,12] conducted in Karachi which showed prevalence rates of between 8 - 21%. A high occurrence of byssinosis was seen in Ring followed by Carding, Comber, Autocon and Blow room (Figure 1). This is contradictory to Sabina[4], who stated in her study that Byssinosis was more frequent amongst opening room operatives and card room workers (Strippers and grinders) followed by draw frame tenters and least common amongst ring spinners. Reduction in blow rooms could be attributed to installation of well-piped machineries in the blow room with minimal dust release. Of significance is also the well-maintained air-conditioning ventilating system in use at the mill. The number of air changes varied from 20 in the blow room to 48 in Ring and carding areas.

Ring and Carding are two areas that are exposed to high temperatures. Temperature regulation alongside humidity maintenance is essential for spinning mills. If the temperature rises, humidity is raised to counterbalance it. Many workers who were suffering from Byssinosis reported a rise in temperature before they experienced respiratory symptoms. This could mean that there is a delay in the regulation of temperature via counterbalancing of humidity. An increased temperature might promote the suspension of cotton dust particles and small fibers in air. Humidity on the other hand might make these dust particles heavy and cause them to settle and thus hinder their entry into the worker's airways.

Users of Safety gadgets (masks) had a proportion of approximately 75% (Figure 2), which was more than double seen in the study done in Kohat.[4] The reasons attributed to this are firstly the literacy rate observed in this study was approximately 90%, which could mean better awareness of cotton dust being a hazard and secondly the mill management placed a fine of Rupees 100/= on whoever would not put the safety masks on while working.

Around 75% of the examined working population had duration of employment between 5-14 years and the remaining above 14 years. Previous studies have demonstrated that prevalence of Byssinotic symptoms increase with years of exposure in the industry.[10] But Pickering states that byssinosis is rare within the first 5 years of exposure and usually requires a period of dust exposure between 20-25 years.[13] However this argument is debatable.[4]

A larger study sample would be required for stronger associations to be established regarding byssinosis in cotton spinning mill workers. But what can be observed through the results is a probability of association with safety mask usage and overtime.

The study had limitations. During a small time period of our research training in which this study was to be completed, the sampling frame used here was a weaker one. Also to note is the lack of comparative study as workers from only one mill were approached resulting in a small sample.

Conclusion

The frequency of byssinosis was seen to differ in separate working areas of a cotton-spinning mill with highest in Ring department followed by Carding department. It is also very likely that byssinosis occurrence might be associated to non-usage of safety gadgets and overtime working as both groups showed high frequencies of the disease.

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