Asbestos-Related Malignant Mesothelioma in The South of Iran: A Cross-Sectional Study

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Abstract

Objective: Malignant Mesothelioma (MM) is a rare malignancy of the serosa membranes with a high mortality rate and long latent period. The relationship between a group of mineral fibers known as asbestos and mesothelioma is now well accepted in which people can be exposed to these fibers by various means during their lifetime.

Method: In this study, we analyzed the demographic features and occupations of confirmed cases of MM in Shiraz, southern Iran along with the follow-up of the patients' disease from 2008 to 2018.

Results: Among the 35 confirmed cases of MM with an average of 61 years, 9 (25.7%) were female and 26 (74.3%) were male. At the time 12 patients have already died with a mean of 11.26 months after diagnosis. Our results showed a higher prevalence of MM among housekeepers and oil company employees. Compared to the control group, we concluded that employees of the oil company are at a high risk of MM in Iran. Also, individuals living near refinery locations had higher MM rates.

Conclusion: Exposure with asbestos, either through occupation or proximate living location to a source, had a significant correlation with MM occurrence. MM can be prevented if asbestos exposure is reduced.

1. Introduction

Malignant Mesothelioma (MM) is a rare and lethal malignancy which involves the serosa membranes such as the pleura, peritoneum, pericardium, and tunica vaginalis. Malignant pleural mesothelioma (MPM) is the most common form of MM with a median survival rate of 1 year and higher incidence in men than women, which is believed to be due to the occupational exposure of men to potential risk factors [1, 2]. Asbestos, a natural mineral fiber that is mined and used in different industries, is now well-known for its carcinogenicity and is proven to be responsible for the majority of MM cases [3, 4]. Other risk factors for MM, although still controversial, include infection with simian virus 40 (SV40), exposure to other mineral fibers such as erionite and some extent, genetic factors like BAP1 (BRCA1 Associated Protein 1) gene mutations [5] and radiation to chest and abdomen [1, 6]. Unlike lung cancer, there's no evidence of a correlation between cigarette smoking and MPM [7].

Despite the extensive researches done worldwide, the molecular pathogenesis process of MM has not been completely understood, yet chronic inflammation caused by asbestos which eventually results in gene mutations in mesothelial cells has been believed to play a part in the pathogenesis of the disease [8]. Many epidemiologic studies have been conducted in the past decades in different countries to predict the incidence of MM in each region. The expected incidence varied depending on the countries past and present history of asbestos usage alongside the production, supervised protection, safety methods of the workers, and the working environment [9]. Also, occupations that are directly related to asbestos, such as asbestos factories, mine workers, and many other professions, are at higher risk of exposure due to extensive usage of this material in building and construction [10, 11]. Other occupations which are at risk include shipyards [11], electrical industry,[12] pulp and paper industry [13], sugar refineries [14], oil

refineries [15], cigarette filter [16], jewelry industry [17], and many others resulting in a higher prevalence of MM in these environments [18]. In Iran, the first asbestos cement factory was established in 1908, and also the mining company started to work in 1974 in the East part of the country which was then shut down in 2003; since then, asbestos has continued to be used in industries through the importation of materials from other countries instead [19].

The current study aimed to find out the clinicoepidemiological features of 35 MM cases in the south of Iran.

2. Materials And Methods

This retrospective study was conducted in Namazi Hospital, affiliated with Shiraz University of Medical Sciences from 2008 to 2018 in Shiraz, in Fars Province, Southern Iran. Hospitals records were carefully searched for all the cases that were diagnosed with MM and confirmed with Immunohistochemistry (IHC), as the preferred method of diagnosis in patients suspected of MM [12]. The files of 47 patients with MM diagnosis were found in the hospital records. The individuals were contacted for their demographic data and environmental exposures. Of these, 12 were excluded from the study because no contact information was found in their file or we did not receive a response after the call. Also, in cases in which the patient had died, information was gathered from the closes relative. Variables such as sex, age, previous occupation, living area geographies, the time which MM was diagnosed, history of smoking, and familial history of MM was obtained. Align with this, 105 patients admitted to other hospitals with a similar distribution between age and gender was selected as a control group for comparison.

Statistical analysis

Statistical analyses were performed by the statistical package for social sciences (SPSS Inc., Chicago, Illinois, USA) version 26.0 using the Chi-square test for comparison of the relationship between descriptive variables and MM. Data were presented as mean ± SD and proportions as suitable. P.value of less than 0.05 was considered significant.

3. Results

Among the 35 MM cases, 9 (25.7%) were female and 26 (74.3%) were male. The mean age of the patients was 61.05 (SD = 15.33) years with the youngest case being a 27-year-old woman and the oldest being an 86-year-old man. At the time of the study, 34% of cases (12 patients) had died and 66% (23 patients) were still alive. Among those who died, the minimum time interval between the MM diagnosis and death was one month and the maximum was 48 months (mean = 11.26 months) (Fig. 1).

The highest frequency of the disease (31.4%) was in the age group of 61 to 70 years of age and the lowest (8.6%) frequency was among the 41 to 50 years age group. The familial history of MM was negative in all of the patients in our study.

Among the patients in our study. 16 (46%) were either active or passive smokers, while 19 (56%) were a non-smoker. Statistical analysis showed no significant correlation between smoking and the prevalence of MM (P = 0.433)

Our results demonstrated that there was a significant correlation between the prevalence of MM with the patients' occupation (P. = 0.004). (Table 1)

Table 1 Distribution of malignant mesothelioma among various occupations in southern Iran.

Variable	Malignant Mesothelioma (%) *n=35*	Control Group (%) *n=135*
Oil company	6 (85.7)	1 (14.3)
Construction	4 (25)	12 (75)
Farmer	3 (15)	17 (85)
Fisherman/woman	2 (66.7)	1 (33.3)
Carpet-weaver	2 (50)	2 (50)
Housekeeper	8 (29.6)	19 (70.4)
Driver	1 (12.5)	7 (87.5)
Teacher	1 (9.1)	10 (90.9)
Others*	8 (18.2)	36 (81.8)

* Other occupations included physician, sales manager, electronic industries employee, university student, a food company employee, water laboratory technician, retired army member, photographer, and mattress manufacturing factory employee.

Occupations and living location of the participants were categorized based on related to a refinery of a living location near a refinery and were compared among the case and controlled group as demonstrated in table 2.

Table 2 Comparison of the relationship between exposure and contact with asbestos (yes compared to no) through either occupation or geographical living location with the prevalence of malignant mesothelioma in southern Iran.

Variable	Total (%)	Case (%)	Control (%)	OR	P.value
Refinery related occupations (Yes/No)	7 (5)	6 (85.7)	1 (14.3)	21.51	0.001
Living location near refinery (Yes/No)	27 (19.3)	13 (48.1)	14 (51.9)	3.841	0.005

Among the case group, 6 (17.1%) were employees of oil companies whereas, in the control group, oil company employees were 1 (1%). There was also a significant correlation between the occupation of oil company employees and MM (P. =0.001).

After evaluating our data based on multiple regression analysis, only refinery related occupations had a significant correlation with MM (P.= 0.024; OR: 36.63).

4. Discussion

Asbestos has been discovered and mined by mankind for thousands of years [20]. The modern asbestos industry started in the 1800s and the production and use have raised ever since [21]. The link between occupational exposure to asbestos and mesothelioma was first proposed in 1935 [22]. The popularity comes from the unusual and practical properties of these fibers such as heat resistance, flexibility, and high tensile strength, thermal, electrical, and sound insulation [4, 23].

Followed by the extensive use of asbestos in the industry, the annular mortality due to MM increased dramatically in the 1900s [24]. That was a wake-up call for many countries to start banning and limiting the use of these hazardous fibers in industry. Laws on asbestos ban started with Denmark in 1972 with the ban of thermal and noise insulation and waterproofing use of asbestos and soon after, other countries came up with new legislation limiting the use of asbestosis too; Iceland was the first country to completely ban asbestos use in 1983 [25]. The effect of the new legislation can be seen from 1980 when worldwide asbestosis usage started to decline. By 2010, 52 countries banned all forms of asbestos use; but Iran was still one of the 8 countries (Brazil, China, India, Iran, Kazakhstan, Russia, Thailand, and Ukraine) with the highest usage in 2003 [21, 26]. With the estimated median latent period of 32 years after the first occupational exposure, it is obvious that MM is still going to be of a concern in the following decades and it can be expected that the peak has not yet reached in Iran like other countries such as Italy which banned asbestos in 1992 [24, 27, 28].

Numerous studies have been conducted worldwide to raise awareness around asbestos carcinogenicity which led to this strict legislation we have today. Regarding our study, the mean age of the patients was 61 years, and male to female ratio was 3 to 1 which is corresponding with many articles such as Haining Yang et al. that demonstrated most of the patients are between 50 and 70 years of age and that men are more at risk due to occupational exposure than women [1]. Furthermore, their study, similar to ours, stated that there is no evidence showing an association between MM and smoking. Contrary to our study, Abdel-Hamid MA et al. regarding the environmental and occupational risk factors among malignant pleural mesothelioma, reported that smoking was considered as a risk factor for MM of pleura [29].

In our study oil company workers were the second group, after housekeepers, who were diagnosed with MM. a study on occupational exposure in 2002 on 1445 confirmed cases of mesothelioma in the USA showed that shipbuilding, US navy, and construction industry were the top three industries with the most cases of MM while oil and chemical industry was in the 5th place [30]. Taking into account that the oil

and gas industry is the main industry in the south of Iran, it is safe to say that our results are comparable to the results of the mentioned study. Another study on employees of refinery and petrochemical in Lambton County, Ontario also confirmed that employment as a maintenance worker in the refinery and petrochemical sector was associated with increased risk of asbestos-related MM [15].

Also, other forms of occupational exposures [30], such as non-occupational and environmental exposures should also be taken into account; although lower compared to occupational exposure, many people are at risk by various means during their lifetime especially women [31, 32]. In 2011 Alessandro Marinaccio and his colleagues studied on Pleural malignant mesothelioma epidemic which demonstrates occupational asbestos exposure was in 69.3% of pleural MM cases (N = 4,577 cases), while 4.4% was due to cohabitation with someone (generally, the husband) who was occupationally exposed, 4.7% by environmental exposure from living near a contamination source and 1.6% during leisure activity [33]. Excluding the 6 oil company employees, 7 of our patients lived near the oil company which could be a potentially contaminated source which our study showed that increases developing MM by threefold. In a similar study on 272 cases of MM in Iran from 2006 to 2010, which was reported by the ministry of health of Iran, high-risk occupations included construction workers with 20% of cases followed by oil company workers with 13.3% [34]. In our study no significant difference was seen between our case and control group regarding the construction workers; however, this could be because in this study some of the cases were excluded because they could not be contacted and the sample size was small, but oil company employees are proven to be a high-risk occupation in Iran regarding MM.

Almost all articles reviewed concurred that due to the tumor's aggressive nature and limited efficacy of current therapies, the median survival of patients with MM from the time of diagnosis is about 12 months. This result is consistent with our findings demonstrating an average of 11 months [4, 31].

5. Conclusion

Our study demonstrated that exposure with asbestos, either through occupation or proximate living location to a source, had a significant correlation with MM occurrence. MM can be prevented if asbestos exposure is reduced. For this to happen, it is necessary to ban asbestos use and replace it with safer material. Considering the long latent period of MM, even if all forms of asbestos use would be banned now, we will not see a considerable decline in MM incidence until years after. Meanwhile, we should improve the safety protocols in the identified high-risk occupations, to minimize the exposure until asbestos is eliminated from the industry.

Abbreviations

MM: Malignant Mesothelioma; MPM: Malignant Pleural Mesothelioma

Declarations

Available data and materials all materials

SPSS data of the patients can be requested from authors. Please write to the corresponding author if you are interested in such data.

Competing interests

The authors declare that they have no competing interests.

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Disclosure

Ethical approval

The present study was approved by the Medical Ethics Committee of Shiraz University of Medical Sciences (Code: IR.sums.med.rec.1398.113) and conducted in compliance with local regulatory requirements and the Declaration of Helsinki and approved by the ethics committee of the institution. The purpose of this research was completely explained to the participants and they were assured that their information will be kept confidential by the researcher.

Informed consent

Verbal informed consent from the participants or next of kin was acquired and they agreed to share related data in the study.

Conflict of Interest.

None

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Figures

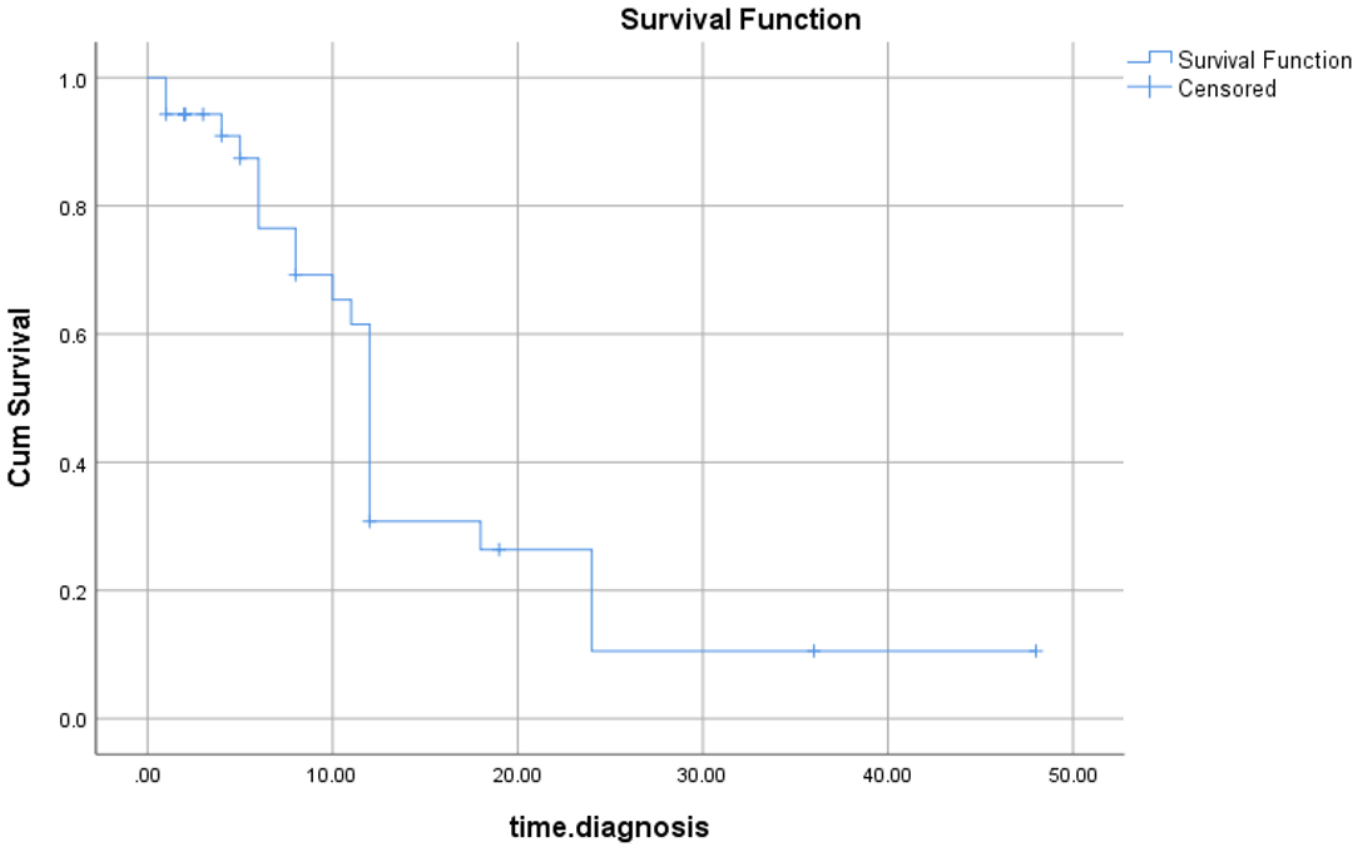

Figure 1

The Kaplan-Meier curve among patients diagnosed with Malignant Mesothelioma, indicating a decrease in the chance of survival over the years.