

Duration of Contact and Frequency of Contact Increased The Risk of Irritant Contact Dermatitis among Workers in Premix Division

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Abstract: Irritant contact dermatitis is inflammation of the skin due to direct contact with a substance on the surface of the skin. It is usually caused by substances such as solvents or other chemicals that can irritate the skin. Exposure can cause red spots and itching on the affected skin area. Irritant contact dermatitis occurs in 80% of all sufferers of contact dermatitis while allergic contact dermatitis only occurs about 10-20%. This study aims to determine the effect of duration of contact and frequency of contact on the incidence of irritant contact dermatitis among workers in premix division. This was an observational study with a cross sectional approach. The populations of this study were all workers in premix division with a total of 65 people who were taken with total sampling technique. Data collection method used here was interview and physical examination by doctor. It was found that there was a relationship between duration of contact ($p = 0.009$) and frequency of contact ($p = 0.000$) and the incidence of irritant contact dermatitis. The results of multivariate analysis showed that the most influential variables on the incidence of irritant contact dermatitis were: duration of contact ($p = 0.008$), OR (Exp B) 8.257 and frequency of contact ($p = 0.000$), OR (Exp B) 56.519. The frequency of contact factor was the most dominant predictor. The provision of personal protective equipment in accordance with the potential hazards of chemicals such as neoprene gloves was intended to reduce direct contact with chemicals.

1. Background

The use of chemicals has a positive impact on the progress of the industrial world and it also has a negative impact especially on the health of workers, one of which is dermatitis. Since 1982, dermatitis has become one of the top ten occupational diseases based on the potential incidence, severity and ability to be prevented [1].

There are numerous and varied types of chemical industry. Grouping can be made according to substances or chemicals used as raw materials, namely as intermediate products in a series of production processes, and as the final product of a chemical industry. Thus, the potential hazards and risks of poisoning, accidents, fires, blasting, occupational diseases, and the effects and adverse effects caused by substances or chemicals are relatively high [2].

WHO research on workers' occupational diseases in 5 continents in 1999 showed that skeletal muscle disorders (Musculo Skeletal Disease) ranked first of 48%, then mental disorders of 10-30%,



chronic obstructive pulmonary disease of 11%, occupational disease skin (Dermatitis) of 10%, hearing loss of 9%, pesticide poisoning of 3%, the followed by injury and others [3].

The International Labor Organization (ILO) in 2002 reported that every year 2 (two) million people died and there were 160 million cases of occupational diseases (PAK) or occupational relationship diseases (PAHK) and there were 270 million cases of occupational accidents. This incident caused the world to suffer losses equivalent to 1, 25 trillion dollars or 4% of the gross national product (GNP) of the world. Of the 27 countries monitored by the ILO (2001), in Indonesia is at 26th position regarding data on worker deaths [3].

Occupational Skin Disease (PKAK) is popularly known because it has a direct impact on workers who are still economically productive. The term occupational disease can be interpreted as a skin disorder that is proven to be aggravated by the type of work, or skin diseases that are more easily occur due to the work done [4].

Occupational skin disease (PKAK) as one of the occupational diseases, is the second most frequent occupational disease after musculo-skeletal disease, accounting for around 22 percent of all occupational diseases.⁴ Data in the UK shows that 1.29 cases per 1000 workers constitute occupational dermatitis. In terms of occupational dermatitis, more than 95 percent are contact dermatitis, while others are other skin diseases such as acne, contact urticaria, and skin tumors [5].

Based on the types of organs that can experience abnormalities due to work, the skin is the most frequently affected organ, which is 50% of the total number of sufferers of Occupational Disease (PAK). From an epidemiological study abroad, PAK could have an impact on the loss of working days by 25% of the total working days. In general, it seems that up to now PAK data is still one of the challenges, because PAK is frequently not observed or not well identified due to many factors that must be examined in ascertaining this type of disease.⁴ Data about the incidence and prevalence of occupational skin diseases is difficult to obtain, including from developed countries, as well as in Indonesia. In general, incomplete reporting is due to undiagnosed or underreported disease. Another thing that causes large variations between countries is different reporting system adopted. Effendi (1997) reported the incidence of occupational contact dermatitis as many as 50 cases per year or 11.9 percent of all cases of contact dermatitis diagnosed in the Skin and Gynecology Clinic of FKUI-RSUPN Dr. Cipto Mangunkusumo Jakarta. More than 90% of occupational disease was eczema, while the remaining 10% was in the form of non-eczematous occupational disease. Type of disease included in eczematous occupational disease are Irritant Contact Dermatitis (ICD), Allergic Contact Dermatitis, and Urticaria. Among these three types, generally ICD was more common [4].

2. Methods

This was an observational research with a Cross Sectional approach. The populations in this study were all workers in the premix division as many as 65 people. Determination of sample size used the sample size formula, which is the determination of the number of samples for a limited population. However to make a perfect study result then all populations were taken as research samples (total sampling) because if the closer number of samples to the population, the better the study.

Data collection methods used in this study were interviews with respondents and clinical examinations conducted by doctors. Bivariate data analysis used chi-square test and multivariate analysis using multiple logistic regression analysis to determine the independent variables that were significantly related to the dependent variable using the ENTER method [6].

3. Results

Table 1. Frequency distribution of respondents by duration of contact among workers in premix division

No.	Duration of contact	Frequency (f)	Percentage(%)
1.	Long	41	63.1
2.	Short	24	36.9
	Total	65	100.0

Based on table 1 it can be seen that 63.1% workers in premix division had duration of daily contact to chemicals of more than 2 hours.

Table 2. Frequency distribution of respondents by frequency of contact among workers in premix division

No.	Frequency of contact	Frequency (f)	Percentage (%)
1.	Frequent (≥ 8 times)	41	63.1
2.	Rare (< 8 times)	24	36.9
	Total	65	100.0

Based on table 2 it can be seen that workers in premix division had a frequency of daily contact to chemicals of more than 8 times.

Table 3. Frequency distribution of respondents by irritant contact dermatitis among workers in premix division

No.	Irritant contact dermatitis	Frequency (f)	Percentage (%)
1.	Yes	34	52.3
2.	No	31	47.7
	Total	65	100.0

Based on table 3 it can be seen that as many as 52.3% of workers were positively diagnosed by irritant contact dermatitis.

Table 4. Relationship between duration of contact and the incidence of irritant contact dermatitis among workers in premix division

No	Duration of contact	Irritant contact dermatitis				Total	P value
		Yes		No			
		F	%	f	%	n	%
1	Long	27	65.9	14	34.1	41	100.0
2	Short	7	29.2	17	70.8	24	100.0
	Total	34	52.3	31	47.7	65	100.0

Based on table 4 it can be seen that the proportion of workers who suffered from irritant contact dermatitis who had a long duration of contact for chemicals was 65.9%, while workers who had a short duration of contact for chemicals was 29.2%. Furthermore, the proportion of workers who did not suffer from irritant contact dermatitis who had a long duration of contact with chemicals was 34.1% compared to workers who had a short duration of contact with chemicals of 70.8%. Based on the Chi Square calculation with $\alpha = 0.05$, a p value of 0.009 was obtained, meaning that statistically there was a relationship between duration of contact and the incidence of irritant contact dermatitis. This illustrates that workers who had a long duration of contact with chemicals had an increased risk of irritant contact dermatitis.

Table 5. Relationship between frequency of contact and the incidence of irritant contact dermatitis among workers in premix division

Irritant contact dermatitis among workers in primary division								
No	Frequency of contact	Irritant contact dermatitis				Total	p-value	
		Yes		No				
		f	%	f	%	n	%	
1	Frequent(≥ 8 times)	32	78.0	9	22.0	41	100.0	0.000
2	Rare (< 8 times)	2	8.3	22	91.7	24	100.0	
Total		34	52.3	31	47.7	65	100.0	

Based on table 5 it can be seen that the proportion of workers who suffered from irritant contact dermatitis who had a frequent frequency of contact with chemicals was 8.0%, while the workers who had a rare frequency of contact with chemicals was 8.3%. Furthermore, the proportion of workers who did not suffer from irritant contact dermatitis who had frequent frequency of contact with chemicals was 22.0% compared to workers who had rare frequency of contact with chemicals of 91.7%. Based on Chi Square calculation, 1 cell had an expected count of less than 5 (more than 20%) so that the chi square test could not be used. The p value used here was the p value in the Fisher Exact test with a p value=0.000 meaning that there was a statistical relationship between the frequency of contact and the incidence of irritant contact dermatitis. This illustrated that workers with frequent frequency of contact with chemicals had an increased risk of irritant contact dermatitis.

Table 6. The most influential factors on the incidence of irritant contact dermatitis among workers in premix division

Variable	B	S.E.	Wald	df	Sig.	Exp (B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Duration of contact	2.111	0.791	7.116	1	0.008	8.257	1.751	38.944
Frequency of contact	4.035	0.933	18.707	1	0.000	56.519	9.082	351.731
Constant	-8.346	1.948	18.351	1	0.000	0.000		

Based on table 6, after multivariate analysis of multiple logistic regression, the results showed that the relationship between frequency of contact variable and the incidence of irritant contact dermatitis obtained $p=0.000$ and OR: 56.519. Then frequency of contact was the most dominant predictor of the incidence of irritant contact dermatitis. This meant that workers in the premix division with frequent frequency of contact were 56 times more likely to be at risk of irritant contact dermatitis than workers who have rare frequency of contact. The relationship between duration of contact and the incidence of irritant contact dermatitis obtained $p=0.008$ OR (Exp B)=8.257 which meant that the workers in premix division with a long contact period were 8 times more likely to be at risk of irritant contact dermatitis.

4. Discussion

Based on the results of this study, it was shown that workers who experienced irritant contact dermatitis were mostly had a long contact time with irritant materials (63.1%) and there was a relationship between duration of contact and the incidence of irritant contact dermatitis with OR (Exp B)=8.257 can be interpreted that workers with long duration of contact with irritants had an opportunity/risk of 8.257 times greater for the incidence of irritant contact dermatitis compared to workers who had short duration of contact with irritants. Duration of contact is the number of working hours of workers in contact with chemicals in a day. In this study, 41 workers had a duration of

contact of ≥ 2 hours and 24 workers had a duration of contact of < 2 hours. Contact with chemicals is the primary cause of occupational contact dermatitis [7]. The length of time the chemical is exposed in a day is one of the risk factors for contact dermatitis [8].

Chemicals have different abilities to cause irritant reactions. Some of them will cause damage even with low concentration. Strong irritants will cause dermatitis in almost all individuals if adequate contact occurs.[9] In theory, duration and intensity of substance exposure to humans are factors that cause irritant contact dermatitis in addition to the type and amount/concentration of the substance.[10] Duration of contact affects the incidence of occupational contact dermatitis. The duration of contact is the period of time workers come into contact with chemicals in a matter of hours/day. Workers who have longer contact with chemicals cause damage to the outer layer of skin cells, the more frequent contact the more damage on the deeper layer of skin cells and make it easier for dermatitis [11].

As it is known that the premix materials used have an average pH of 5 and at this degree of acidity will easily cause irritation to the skin. According to the theory, when premix materials (irritants) have first contact to the workers' skin, the skin directly has a mechanism of homeostasis, so the skin is able to adapt to the premix materials. The materials do not damage the horny layer and penetrate the cell membrane so that the skin is protected from the effects of the premix materials. However, when the contact of the premix material repeats, the skin cannot maintain its homeostatic mechanism, so that the premix materials can damage the horny layer and penetrate the cell membrane (lipid membrane) of keratinocytes, hyperplasia can also occur which eventually compresses the dermis layer until erythema arises, etc.[12] Based on the results of the study it was shown that 63.1% workers had frequent frequency of contact and there was a relationship between the frequency of contact and the incidence of irritant contact dermatitis with $OR (Exp B) = 56.519$. It can be interpreted that workers who have frequent frequency of contact with irritant material had an opportunity/risk of 56.5 times greater for the incidence of irritant contact dermatitis compared to workers who had a rare frequency of contact with irritants.

Repeated and continuous contact with chemicals will cause contact dermatitis. Even a small amount of chemical will cause excess dermatitis that is disproportionately broad and severe.⁷ Weak irritant substances will cause skin disorders after repeated contact, starting with damage to the stratum corneum due to delipidation which causes desiccation and loss of barrier function, thereby facilitating irritation of the underlying cells by irritants [13]. Thus, an attempt to prevent the incidence of occupational contact dermatitis is by reducing the frequency of contact to chemicals [14].

Educating patients about how to avoid irritants in the home and work place is very important. Reducing contact with irritants such as soap, solvents, oils, alkalis, acids or abrasive materials decreases the incidence of ICD. However, when avoidance of the irritant is not possible, protective skin products are the next alternative [15].

5. Conclusions

There was a relationship between duration of contact and frequency of contact and the incidence of irritant contact dermatitis among workers in premix division. Workers with long duration of contact with irritants had an opportunity/risk of 8.257 times greater for the incidence of irritant contact dermatitis compared to workers who had short duration of contact with irritants. Workers with frequent contact with irritants had an opportunity/risk of 56.5 times greater for the incidence of irritant contact dermatitis compared to workers who had a rare frequency of contact with irritants.

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