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Occupational Irritan Contact Dermatitis Among Shipyard Workers in Samarinda, Indonesia

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Abstract

Occupational irritant contact dermatitis (OICD) is still a occupational health problem. Shipyard workers are susceptible to OICD. A cross sectional study was conducted on 32 samples of shipyard workers in Samarinda to analyze the prevalence of OICD and related factors. The dependent variable is OICD, while independent variable consists of age, length of service, length of contact, history of skin diseases, personal hygene and personal protective equipment. Data collection through interview and direct observation, data analysis using Phi test and multiple logistic regression. All respondents had OICD and significantly correlated with working period (p = 0.001), history of skin disease (p = 0.004), personal hygene (p = 0.003) and use of PPE (p = 0.05). History of skin disease (B = 1.116) and use of PPE (B = 1.053) are most dominant variables. Personal hygiene improvements, tightening monitoring of use of PPE and improving occupational health efforts have been suggested.

Introduction

Work related disease is still an occupational health issue that needs attention of various stakeholders. Occupational disease is a disease caused by work or work environment, one of its kinds is occupational dermatitis. In Asia, Occupational dermatoses contribute to a significant portion of work-related diseases, where a major portion of the workforce is in the unorganized sector (Bathia, 2017). while in the United States, the National Institute for Occupational Safety and Health has classified skin diseases as one of the most significant problems faced by workers in the USA. Since 1982 skin diseases have been recognized as one of the top 10 diseases related to work based on the incidence and severity of the disease (Zorba et al., 2013).

Occupational skin diseases are mostly contact dermatitis (92.5%), about 5.4% due to skin infection and 2.1% for other reasons. Worldwide, over the past two decades the incidence of OCD ranges from 1.3 to 8.1 per 10,000 workforce per year (Behroozy & Keegel, 2014). OCD is responsive inflammation of the skin that occurs immediately after contact with a substance, such as chemical or biological compounds. Contact dermatitis can be caused by either direct irritation from a substance or aggravating factor such as wet work, soap, solvent and heat that triggers the release of implamatory mediators, which is known as irritant contact dermatitis (ICD), or contact with an unfavorable sensitizer, which is known

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as allergic contact dermatitis (ACD) (Al-otaibi, 2016).

Occupational contact dermatitis (OCD) is the most common occupational skin disease in labor populations, with prevalence of 70-90% (Smeldey, 2010). OCD is dermatitis or inflammation caused by exposure of the skin to irritant outer substances or allergens, and in this case exposure comes from the work environment. Clinical features and the course of occupational dermatitis due to work vary greatly depending on various internal and external factors (Kurpiewska et al, 2015). Epidemilogically, the incidence rate of OCD is still high, and adversely affects both the individual workforce and the company in the form of residual symptoms that can not be cured and the total length of return to work time after experiencing OCD (Holness, 2011). In Europe, allergy incidence and prevalence about 20% of the general population suffer from contact allergy. Most common are allergies to nickel, fragrances and preservatives. Allergic reactions to chromate and *p*-phenylenediamine (PPD) are generally less common but occur frequently in occupationally exposed subgroups of the population (Peiser et al, 2011). In Australia reported incidence of contact dermatitis is 2.15 per 10,000 labor per year (Lau et al, 2011). Meanwhile, in Indonesia occupational skin diseases are often experienced by workers is contact dermatitis, ie dermatitis caused by substances or substances that attach to the skin (Djuanda, 2017).

Occupational contact dermatitis is a multifactorial skin disease that is influenced by exogenous factors: chemical characteristics, exposure characteristics (eg exposure frequency with agent, duration of work, contact type, and exposure to more than one type of chemicals), and environmental factors (eg : temperature, humidity, pressure, and friction); and endogenous factors (such as genetic factors, sex, age, race, location of skin, history of atopy, and other factors may include individual behavior, personal hygiene, hobbies and odd jobs, and use of personal protective equipment while working). Contact dermatitis, an inflammatory eczematous reaction to the skin caused by direct contact with a particular substance, may be a low molecular weight compound or protein. Contact dermatitis is initially preceded by itching, followed by erythematous lesions, vesicles, exudation, due to scratching, and when it is chronic, skin thickening will occur (likenification). This condition is classified as acute or chronic depending on the type of dominant lesion. There are two types of contact dermatitis namely irritant and allergic (Cekti et al, 2014).

One type of industry that many developed in Samarinda is shipyard industry; with the main service is shipbuilding and ship repair. Everyday the workers in this industry is exposed to fiberglass dust, aluminum dust, paint, epoxy resin, pigment paint and others so susceptible to contact dermatitis. According to Sripaiboonkij et al., (2009), fiberglass is carcinogenic, and irritants to the respiratory tract and skin due to penetration of small fragments in the skin cornified layer. This study aims to determine the prevalence of OICD in shipyard workers in Samarinda, to analyze the related factors and to analyze the factors that cause the most influence.

Methods

This is a cross-sectional study on 32 samples of workers at the shipyard companies in Samarinda. Research was conducted in February until April 2017. The dependent variable in this study was occupational irritant contact dermatosis (Y), while the independent variables were age (χ^1), duration of contact with irritant material (χ^2), working period (χ^3), history of skin disease (χ^4), personal higene (χ^5), and use of personal protective equipment (χ^6).

Clinical complaints and symptoms of OICD, duration of contact with irritant, age of worker, working period, history of skin disease and personal hygiene was measured using a Guttman scale questionnaire prepared by the researchers themselves. The questionnaire has been tested and has proven to be valid (coefficient correlation = 0.444) and reliable (cronbach alpha = 0.766). Clinical complaint and symptoms of OICD in this study is a perceived complaint in workers due to inflammation of the skin due to exposure to chemicals in the workplace or other factors during the work, the symptoms can be skin itch, skin burn, swelling, blisters on the skin and will remove fluid when exfoliated, skin peeling, dry skin, scaly skin,

thickening of the skin, and skin feels sore. Use of personal protective equipment in this study was studied by interviews and direct observation by check list observation tool.

To determine the distribution of data is done by Shapiro Wilk normality test, and obtained data not normally distributed so that hypothesis test using non parametric statistic (Phi Test). To analyze the most influential variable multiple logistic regression test was used, a p value <0.05 was considered statistically significant.

Result and Discussion

Table 1 shows that all respondents suffer from OICD, which consists of 50% light OICD and 50% severe OICD. Most of the respondents were over 30 years old (65.5%), had contact with irritant material more than 8 hours and had more than 2 years working period (81.2%). Most respondents never had history of skin disease (56.2%), personal hygene respondents mostly bad (56.2%) and the use of personal protective equipment is largely incomplete (90.6%).The incidence of OICD was significantly associated with the duration of contact with irritant substances (p = 0.001), history of skin disease (p = 0.004), personal hygene (p = 0.003) and use of personal protective equipment (p = 0.053) (see table 1). Meanwhile, complaints of irritant contact dermatitis symptoms experienced by workers were mostly itchy (81.2%), skin redness (62.5%), burning skin (56.2%), dry skin (56.2%), cracked skin (43.8%), and skin peeling (43.8%) (see table 2).

Based on table 3 can be seen that Negelkerke R Square = 0.365, means that the ability of independent variables explain the dependent variable of 0.365 or 36.5%, there are 63.5% other factors outside the model that explains the dependent variable. Lemeshow Goodness of fit test (GoF) = 0.873 (p> 0.05), it means that the model that is formed is correct because there is no significant difference between the model with the observation value. Overall percentage = 0.84, meaning the accuracy of this research model is 84%. Wald

Table 1. Characteristics of Shipyard workers (n=32) and Association between its Variables and Occupational Irritant Contact Dermatitis (OICD) prevalence

Variables	Number	(%)	Correlation
Age (years)			0.264
< 30	11	34.3	
> 30	21	65.6	
Length of Contact (hours/day)			0.001
< 8	11	34.4	
≥ 8	21	65.5	
Working Period(years)			1.000
< 2	6	18.8	
≥ 2	26	81.2	
History of Skin Disease			0.004
No	18	56.2	
Yes	14	43.8	
Personal Hygiene			0.033
Good	14	43.8	
Poor	18	56.2	
Use of PPE			0.05
Complete	3	9.4	
Not complete	29	90.6	
Occupational Irritant Contact Dermatitis			
Acute	16	50	
Chronic	16	50	

Tabel 2. OICD Symptoms Experienced by Shipyard Worker

No	Symptoms	n	%
1	Itchy	26	81,2
2	Skin burns	18	56,2
3	Redness of the skin	20	62,5
4	Swelling on the skin	3	9,4
5	Small blisters on the skin and remove fluid when peeled off	3	9,4
6	Skin peeling	14	43,8
7	Dry skin	18	56,2
8	Scaly skin	8	25,0
9	Thickening of the skin	11	34,4
10	Pain	12	37,5
11	Cracked skin	14	43,8

Table 3. The Results of Multiple Logistic Regression Analysis

Variable	B	Wald	Sig	Exp (B)	95% CI for Exp (B)	
					Min	Max
Length of contact	-0.343	0.055	0.000	0.710	0.040	2.436
History of skin disease	-1.164	1.614	0.004	2.866	0.015	2.436
Personal hygiene	1.053	0.388	0.003	0.838	0.203	40.517
PPE	0.177	0.015	0.005	0.416	0.061	11.536
Constant	1.686	11.998	0.001	0.185		
Negelkerke R Square = 0.365						
Lemeshow Goodness of fit test = 0.873						
Overall percentage = 0.84						

significance value of all <0.05 means partially each dependent variable has a significant influence on independent variables. The amount of contribution of each dependent variable to the dependent variable can be seen from the value of B. Variable contact length accounted for 0.343, previous skin disease history 1,164, personal hygene 1.05 and use of PPE 0.177. It can be concluded that the largest variable contribution to the incidence of contact irritant dermatosis is history of previous disease and personal hygene. From the value of B can be made model of regression equation as follows :

$$\mathbf{Y = a+b_1.X_1+b_2.X_2+b_3.X_3+b_4.X_4+e}$$

Occurrence of OICD = 1.686+0.343*length of contact + 1.1164*history of skin disease + 1.053*personal hygene + 0.177*PPE

The results showed that all respondents in this study had OICD (50% light OICD and 50% severe OICD), and the most frequent symptoms were itchy skin, skin redness, burning skin, dry skin, split and peeling skin. These results complement the conclusion that the prevalence of contact dermatitis in workers increases with increasing use of allergen and irritant substances in various industries. Clinical features of acute contact dermatitis may include redness, swelling, blisters and fluid. Chronic contact dermatitis may occur with scaly, thickened, fissure and pigment changes (Harrianto, 2015).

As previously cited that occupational skin diseases affect workers of all ages in a wide variety of work settings. Industries in which workers are at highest risk include manufacturing, food production, construction, machine tool operation, printing, metal plating, leather work, engine service, and forestry. History of illness and occupational history may reveal a close association between a skin condition and a specific work exposure known to produce skin effects (Zorba et al., 2013).

We found the age of the worker is not

related to OICD. The results of this study support the previously study which concludes the age of the worker is not related to contact dermatitis in the varnish, cement, nickel salt and oil paint industries in Pane (Rahman et al, 2014). However, the results of this study are inconsistent with Sarma (2009) studies that concluded age associated with occupational allergic contact dermatitis among construction workers in india. The absence of a consistent relationship between the age of the worker and the OICD is understandable because according to Brasch et al., (2014), contact dermatitis can affect various age groups, meaning that age is not a major risk factor for exposure to substances that cause contact dermatitis.

We found length of contact with irritant substances significantly related to OICD. The results of this study are consistent with the conclusion of Nuraga, Lestari, & Kurniawidjaja (2008) which concludes the length of contact with irritant materials related to OICDs in automotive industry workers in Cibitung West Java; study of Lestari & Utomo (2007), that concluded contact time with irritant substances is related to OICDs at PT Inti Pantja Press; study of Behroozy & Keegel, 92014) that conclude wet work (immerse hand in liquid) for > 2 hours per shift as a main risk factor for irritan contact dermatitis of the hand. Workers with more than 8 hours of work per day indicate longer contact with irritant substances longer than workers who work less than 8 hours per day, especially based on other variables observations found that most respondents do not use personal protective equipment such as the right gloves so that the skin of hands are not protected from exposure to irritant substances with exposure time of more than 8 hours per day; and study of Eberting (2014) that conclude physical and chemical irritants that contact the skin damage epidermal cells and remove epidermal lipids from the epidermis. To prevent and treat irritant contact dermatitis, contact time should be minimized / restricted and irritants should be inhibited from coming in contact with the skin.

We found the respondent's working period unrelated to OICD. The results of this study is inconsistent with previous studies by Lestari & Utomo (2007) which concluded there was a relationship between the working period with the incidence of contact dermatitis; Cahyawati & Budiono (2011) which conclude working period was corelated with dermatitis among fishermen; and Chen, et al (2017) which conclude there was association between working experience with incidence of contact dermatitis. According to Sarah & Katherine (2014), the longer a person is at work, the more he is exposed to the dangers of his work environment, but in this study is not proven. No relationship between working period and the incidence of OICD in this study may be due to the majority of the respondent's working period (81.2%) over 2 years, where the workers have enough experience, mastering the work procedures so as to minimize contact with irritant materials.

Workers with a working period of less than 2 years indicate that the worker has not had sufficient experience and is likely to make mistakes in the chemical use procedure, potentially increasing the incidence of contact dermatitis. Workers with a working period of more than 2 years are more experienced, more careful in applying chemicals that contain less chemicals

We found a history of skin disease related to OICD. This result is consistent with the study of Chen et al (2015) which concludes a history of skin disease associated with the incidence of contact dermatitis in clothing manufacturing employees in Beijing. History of skin diseases is an inflammation of the skin with subjective symptoms of itching, burning, redness, swelling, small blister formation of the skin, skin peeling, dry skin, scaly skin, and thickening of the skin or other skin disorders that had previously or is suffered by workers. Workers who are suffering or have experienced non-occupational dermatosis tend to get OICD more easily. Workers who have a previous history of skin disease when working in a hot environment or exposed to chemical dust, will recur in more severe stages (Ganong, 2008). As disclosed Djuanda (2017) that workers who were previously suffering from skin diseases or have a history of allergy will be easier to get contact dermatitis, because the function of skin protection is reduced as a result of previous skin disease.

We found a significant relationship between personal hygene of workers and OICD. The results of this study support the results of previous research by Al-otaibi (2016) which concluded that poor personal hygene is one of the risk factors of OICD occurrence, so to decrease the incidence of OICD is suggested to improve personal hygene of workers; and Cahyawati & Budiono (2011) which conclude that personal hygene was correlated with dermatitis among fishermen. As previously mentioned by Callahan et al (2014), hand washing frequency (≥ 10 times a day) were associated with irritan hand dermatitis. Cloth cleanliness is also one of the efforts to prevent the occurrence of contact dermatitis; it is recommended that work clothes that have been contaminated with chemicals are not reused before washing. In addition, it is necessary to improve the way of washing clothes by not mixing / soaking the work clothes with clothes worn everyday (Lestari & Utomo, 2007).

Washing hands with a mellow cleanser and water can successfully remove allergens and irritants from the skin. However, overuse or abuse of skin cleansing products can elicit or exacerbate contact dermatitis. Industrial solvents should not be used to clean skin. Eating, drinking, and smoking at work should be restricted to an assigned area in order to maintain a strategic distance between workers and allergens or irritants. Individual cleanliness should also incorporate general washing and cleaning of protective attire in light of the dangers of skin contact with allergens or irritants, particularly for soiled apparel (Smeldey, 2010; Al-otaibi & Alqahtani, 2015)

The results showed that the use of personal protective equipment (PPE) was significantly related to the incidence of OICD. The results of this study are in accordance with previous results by (Sasaki & Kanda, 2006) which concluded the wrong use of PPE that (glove type) increases the risk of OICD; the use of PPE was significantly associated with contact dermatitis in automotive workers in Cibitung West Java (Nuraga et al., 2008); the use of personal protective equipment related to the incidence of OICD in workers in Greece (Zorba et al., 2013); and Macfarlane et al (2013) which concludes the use of PPE is associated with OICD in agricultural workers using pesticides. Working without adequate PPE will increase the risk of OICD, because it makes the skin is not protected from exposure to various irritants and allergens in the workplace (Lestari & Utomo, 2007).

Personal protective equipment, including gloves, boots, and worker clothing, should be chosen taking into account the physical properties of chemicals used in industry and the adaptability of the workforce. Ordinary gloves can not prevent the absorption of chemicals by the skin. Accordingly, appropriate gloves should be selected for specific job tasks. Clothes should be reviewed and discarded if they are already damaged. Disposable clothing is required to ensure reduced contact with allergens and irritants. On the other hand, protective clothing can cause contact dermatitis through nonspecific friction from sweat and rub clothes against the skin. Protective clothing should not be the primary method of prevention unless prior control (elimination, substitution, engineering control and administrative control) is perceived to be less than optimal. The clinical utility of barrier creams is debated and is not supported by clinical trials. Manufacturers' guidelines should be followed when this barrier cream is used. Many inhibiting creams remove sticky oils and fats, thus reducing the need to wash with water and irritating soaps. The barrier cream should only be used on normal skin and not itch because it can aggravate dermatitis when used on inflamed skin (Al-otaibi, 2016).

Almost all work using hands and the use of latex gloves is very effective to protect the skin of the hand from exposure to chemicals in the workplace. As a result of the research of Ningtiyas, et al, (2013) which concluded that latex gloves can be used as an effort to prevent contact dermatitis at worker stripping at one food industry in Wonosobo.

Multivariate analysis showed that the history of skin diseases and personal hygene were the two largest variables contributing to the incidence of OICD. The results of this study differ from the conclusion Nuraga et al (2008) which concluded the main factor causing contact dermatitis in automotive industry workers in Cibitung West Java is the inappropiate use of PPE; and the completeness

use of PPE is a factor that greatly affects the disease OCD on composter workers Jambangan Surabaya.

Conclusion

Our findings showed all respondents suffered occupational irritant contact dermatitis (50% acute and 50% chronic). The most common ICD symptoms were itching (81.2%), redness (62.5%), skin burn (56.2%) and dry skin (56.2%). The incidence of OICD was related to the duration of contact with irritant substances (p = 0.001), previous history of skin disease (p = 0.004), personal hygene (p = 0.003) and use of PPE (p = 0.05). The most dominant variables affecting the incidence of OICD are history of skin disease (B = 1.116) and use of PPE (B = 1.053). Workers are advised to improve personal hygene and OSH managers are advised to tighten supervision of use of PPE, improve health efforts such as routine medical check up and treatment of each worker.

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