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# Effects of X-Ray Radiation Exposure toward Lymphocytes of Radiographers in Abcd Hospital of Mataram Town 2014

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**Abstract**:- *X-ray radiation sources in ABCD Hospitalisused as one of the healthfacilities and the role of management, itis not maximized as well in providing protection against the radiographer. The use of personal protective equipmentisstilla rare thingdone right by the radiologist. This studyaimed to analyze the influence of X-ray radiation to the lymphocytes of radiographer in the ABCD Hospital. This studyis a quantitative studyconductedin 4 Hospitals in Mataram, West NusaTenggara (NTB) in June and October 2014. The populations in thisstudywere all radiographerswhoworking in ABCD Hospital as many as 30 people. The sampling technique usedis simple randomsamplingwhere a sample size of 28 people. Data wasanalyzed by usingregressionanalysis. Theseresultsindicatethat the radiologistcharacteristics affect the lymphocytes wereage (p = 0.028), radiation protection training (p = 0.046), use of APD (p = 0.026) and radiation dose (p = 0.046). Radiation protection efforts at A hospital are still not good and B, C and D hospitals are good*.

**Keywords:-** radiation, X-Ray, radiation dose, radiographer characteristic

## I. INTRODUCTION

X-ray radiation Exposure has a bad effect on human health, especially the effects on human biology aspect. Hematopoietic and lymphatic system damage in Humans is due to exposure to biological effects of ionizing radiation on the human body. ABCD hospital is a hospital located in the town of Mataram. ABCD Hospital is the main choice by the town of Mataram for health checks and health care services. One of the health care services is a health facility that uses X-rays. Based on the results of preliminary studies on the ABCD Hospital Radiology Unit has a considerable number of Patients to be served a year is about 13.500 patients. A large number of Patients led to the radiologist often, operate X-ray technologist and consequently more often exposed to those X-ray. Major factor concern in this study is the amount of radiation absorbed dose when operating the X-ray and what Efforts have been implemented by the Hospital to protect the radiographer from radiation exposure. The degree of Decrease in the number of human peripheral blood cells as a result of X-rays or gamma rays depend on the dose received (Gabriel, 1996). One control that can be done is to take measurements of radiation exposure dose with a blood test, especially in the white blood cells to see its limposit. Hematopoietic Indicators commonly used as an indication of radiation exposure are leukocyte count, absolute lymphocyte count, neuotrofil, platelet, and red blood cells. White blood cells, especially lymphocytes are the most bioindicator response to radiation. Blood cell count, Instant confirmation is used in general because blood cell count has been used routinely and in addition many experts have been trained in handling it intervening quickly. Hematopoietic system disorders due to exposure to radiation resulted in a number of blood cells, decreases with sensitivity and life expectancy, where lymphocytes are first reacted, Followed by granulocytes, platelets and erittrosit at the end (Lusiyanti, 2007). This study is aimed to analyze the influence of X-ray radiation of the lymphocytes of radiographers in ABCD hospital.

## II. MATERIALSANDMETHODS

This study was conducted at Hospital Mataram Town, West Nusa Tenggara (NTB). This research is quantitative with a causal relationship, since the goal of this research is to explain the causal relationships between variables in the form of influence through hypothesis testing. This study used a cross-sectional study design. The populations in this study were all radiographers working in ABCD Hospital, as many as 30 people. Based on the sample size formula if the population of this study were 30 people, the sample sizes of this study were 28 people of radiographers. Data processing was performed by using a computer program through the stages of editing, coding, data entry and processing, then the data was analyzed for the presentation of the data, it is done in the form of a frequency distribution table with the narrative. Analysis of the data used are: (1) univariate analysis for every variable of the research by using a frequency distribution table in the distribution and the resulting percentage of study variables and used as the scale variable category the which aims to

simplify and save the table that will be narrated, (2) logistic regression analysis was conducted to determine the direction of the relationship between the dependent and independent variables. Independent variables associated positively or negatively, and to predict the value of the dependent variable when the independent variable values are Decrease or increase.

## III. RESULT

**Table 1Analysis resultRegresionLogisticEnter Metod**

| Independent Variable | Limfosit | | Conclusion |
|---|---|---|---|
| | Exp (B) | Sig. | |
| Age | 0,413 | 0,028 | Signifikan |
| Useof APD | 0,001 | 0,026 | Signifikan |
| Radiation Dose | 6,815 | 0,046 | Signifikan |
| Gender | 3,466 | 0,425 | notsignifikan |
| Protection training | 0,01 | 0,046 | Signifikan |
| Work Period | 0,003 | 0,094 | notSignifikan |

Based on the analysis of variables of age resulted in a significance of 0.028. 0.028 significance level of less than 0.05 (0.028 <0.05), it can be seen that the hypothesis that age affects the lymphocytes can be accepted. Based on the analysis on the variable use of APD produce a significance of 0.026. 0.026 significance level of less than 0.05 (0.026 <0.5), it can be seen that the hypothesis that the use of APD effect on lymphocyte acceptable. Based on the analysis on the training variable protection radiation, produces a significance of 0.046. 0.046 significance level of less than 0.05 (0.046 <0.05), it can be seen that the hypothesis that radiation protection training effect on lymphocyte acceptable. Based on the analysis on tenure variable produces a significance of 0.086 is greater than 0.05, it can be seen that the hypothesis that tenure effect on lymphocyte unacceptable. Based on the analysis on the gender variable produces a significance of 0.425. 0.425 significance level greater than 0.05 (0.425> 0.05), it can be seen that the hypothesis that gender affects the lymphocytes cannot be accepted. Based on the analysis on the variable radiation dose resulted in a significance of 0.046 level significance less than 0.05 (0.046 <0.05), it can be seen that the hypothesis that the radiation dose effects on lymphocyte is acceptable.

**Tabel 2Analysis result RegresionLogistic *Backward LR Metode***

| Independen Independent | Limfosit | | Conclusion |
|---|---|---|---|
| | Exp (B) | Sig. | |
| Useof APD | 0,002 | 0,026 | Signifikan |
| Radiation Protection Training | 0,01 | 0,043 | Signifikan |
| Age | 0,456 | 0,025 | Signifikan |
| Radiation Dose | 5,472 | 0,037 | Signifikan |

Based on the results of the regression analysis tables can be explained that most of influential variable magnitude 5.15 is the radiation dose, age, training in radiation protection and use of APD.

## IV. DISCUSSION

### 4.1 Age

Based on the analysis conducted that age radiographers have a significant effect on lymphocytes. Age influence as 0.413 times against lymphocyte disorders. That age has a great technologist at 0.413 times the risk compared to other variables against lymphocyte disorders. This is consistent with the function of the human immune system in its formation. The human immune system of infants to mature adult endurance will creating the best form when people age range of 27-30 years and a decrease in the age of 30 years and above, but in small quantities and still within normal limits (Darmojo, 2001 ). Increased with age, which means human being growing old, then the function of the human body is declining, Including the immune system, especially in the

elderly age is above 65 years. Radiographers are the most normal lymphocytes in 23-27 year old of radiologist as many as 13 people (68.4%) and most of age radiographer with normal lymphocytes at the age of 26 and 27 years respectively by 4 people (21.1%) of the 19 people who have normal lymphocytes. The results are consistent with research Hidayati (2012) which has the result of research that radiographer who had leukocyte counts that are not normally found in the age of 28-33 years old of radiologist.

**4.2 Gender**

Based on the results of the analysis conducted found that gender has no effect on lymphocytes. Occurrence of abnormal lymphocyte count does not depend on gender, which means that anyone can be exposed to the effects of radiation exposure. This is in line with the requirement to work as a radiographer that there is no requirement that states radiographer requires a specific gender. In general endurance in a female is better than the endurance of male because females have the X chromosomes more base than males but there is no certainty that the effects of radiation exposure would be an effect to kind of particular sex. Radiographer's abnormal lymphocytes of male sex amounted as 6 people (66.7%) and normal numbered as 13 people (68.4%). For female radiographer totaling 9 people known that abnormal lymphocytes were 3 people (33.3%) and normal as much as 6 people (31.6%). Based on the results above in general between men and women the effect of exposure to X-ray radiation is almost equivalent to the value of the exposure received by men and women.

**4.3 Work Period**

Work period is the length of when first person started working until ongoing now. The longer a person works the more it will deepen and become an expert in the areas of expertise including work as a radiographer. The results of the analysis is based on research that has been conducted found that the period of employment does not have any effect on lymphocytes. This can be caused by radiographers with tenure <5 years more frequently, operate X-rays than the radiographer who >5 years old when the study was conducted. In addition, radiographers of who tenure under 5 years of working with the division of work shifts and radiographers who have worked more than 5 years only works on the morning shift only. It is clear that the effects of radiation exposure to X-rays do not see from one's working life, but based on the magnitude of the dose received when operating of X-rays. In addition, the use of APD can also be used as a reference so that every radiologist can operate it, thereby reducing exposure to X-ray radiation

**4.4 Radiation Protection Training**

Based on the results of the study stated that the radiation protection training has an influence on lymphocytes. This means that the radiation protection training has no effect of 0.01 times compared to the other variables of the lymphocytes in the ABCD hospital's radiographer which means that the effect of radiation protection training by 0.01 times compared to other variables against lymphocyte disorders radiographer. Based on the results of the analysis indicate that the radiographer who most abnormal lymphocytes in the radiographer who are not trained as much as 6 people (66.7%) and radiographers roommates mostly as normal lymphocytes in the training of radiation technologist as many as 13 people (68.4 %). Most of the training radiographers who are not financed by the hospital. Technologist who has trained more radiation protection who are not using APD when working Compared with no training are 7 people (58.3%) had received training 5 people (41.7%) who have not been trained. This is because the radiographer training assignments outside of the hospital and the training is long enough before radiographers linked began working at the hospital so that the radiologist is starting to forget the training materials that have been followed. When viewed from age, radiographers are using APD training and not much going on radiographer who has over 30 years. It is also related to training undertaken by the radiologist should be given training by the hospital, so the knowledge will always remembered.

**4.5 Use of APD**

Based on the survey results revealed that the use of personal protective equipment have amounted to 0.001 times Compared to the influence of other variables on lymphocytes radiographer. Analysis of the effect of the use of APD radiographer against lymphocytes is APD use has the effect of other variables 0.001 times compared to the radiographer lymphocyte disorders. It is claimed that the use of APD will give effect to the human body by protecting the human body from exposure to X-ray radiation. Use of APD in the radiographer especially the apron can protect the radiographer of X-ray radiation exposure. The use of APD is the last attempt to protect workers from hazards in the workplace. The more radiographers who APD use, the more radiographers who have normal lymphocytes. Based on the analysis that has been made known that the radiographer abnormal lymphocytes occurred at the radiographer who is not using APD are 6 people (66.7%). Radiographer is normal lymphocytes in the use of APD at most the radiographer with a value of 75, which means that during the observation radiographers who use APD for 3 times per weeks as many as 10 people

(52.6%). Based on the analysis above table it can be concluded that the radiographer who use APD are more protected from the dangers of exposure to X-radiation and growing of normal lymphocytes.

**4.6 Radiation Dose**

Based on the results, it showed that the dose of radiation has an influence on radiographer lymphocytes. The results of the analysis of the effect of radiation dose to radiographer against lymphocytes are absorbed dose of radiation technologist has the effect of 6.815 times than other variables to disruption of lymphocytes in the radiographer. The radiation dose received by the radiologist is all still in the normal range is under NBD, although the entire radiographers receive radiation exposure under abnormal lymphocytes NBD still radiographer who totaled 9 people (32.1%). Based on the results of the analysis can be concluded that there are factors that affect the results read that the radiation dose can be illustrated by the presence of radiographers who have abnormal lymphocytes. Exposure for more than 1-2 days to ionizing radiation at doses above 1 gray (Gy) will cause acute effects and are characterized by cell damage and death of body tissue exposed to radiation. Doses of 0.05 to 0.25 gray, exposure to ionizing radiation usually does not cause clinical signs and symptoms despite chromosomal damage, it may be detected in cells limsofit. Exposure at a dose of 1 gray Generally do not cause clinical symptoms, but in some individuals description can cause a decrease in the number of white blood cells and platelets. Exposure at a dose of 1-2.5 gray will cause symptoms Reviews such as nausea, vomiting, and fatigue and hematologic changes early, especially a decrease in the number of lymphocytes and an increase in the number of white blood cells that are temporary. After a latent phase, exposure at this dose will cause a depression in the bone marrow and this will cause leucopenia (white blood cell count decreases), thrombocytopenia (platelet count or Decreased blood clotting cells), and anemia (anemia). At doses above 4 gray, acute exposure will lead to Acute Radiation Syndrome great with complications in the digestive tract (WHO, 1986). Deterministic effects on reproductive organs or gonads can interfere with the process of the formation of sperm cells are produced. 0.15 Gy radiation dose can already lead to a decrease in the number of sperm cells (oligospermy). Doses up to 2 Gy can cause temporary sterility during 1-2 years. Permanent sterility threshold dose in 3.5 to 6 Gy (Alatas, 2004). The decline in the number of sperm may affect fertility. One of the factors that can affect fertility is particularly subject of radiation exposure to ionizing radiation in which the x-rays include ionizing radiation (Olayemi, 2010). Therefore, radiation is Often Considered to be scary for some people because radiation can cause sterility (infertile).

The sensitivity of the various organs of the body to ionizing radiation varies greatly. Thus various organs and tissues of the body have a different threshold dose. Skin classified into groups very sensitive organs to radiation. in addition to the testes and ovaries. Radiation exposure on the skin may occur during diagnostic procedures, treatment and during the work related to the radiation source (Tubiana, 1990). Radiation exposure of the skin causing the circuit changes are generally the same as the dose Increased absorption of various types of radiation, or the fraction of time that different doses for divided doses. Stages of change and the time required for type of damage to the skin is consistent (Archhambeau, 1987). skin and hair Damage is a radiation induced deterministic effect that will arise when the absorbed dose received has exceeded the threshold dose. The severity is highly dependent on large doses. The greater of the radiation dose, the more damage would be happen (Tubiana, 1990). When viewed in terms of time occurrence of damage to the skin, the order of the damage that caused by radiation exposure can be grouped into two periods: the period beginning and ending. In the initial period radiation effects occur immediately within 70-120 days after exposure to radiation damage in the form of erythema (skin reddish color), desquamation (peeling skin) dry and moist desquamation. While damage to the end of the period as a delayed effect that Occurs within 4-6 months to Several years in the form of atrophy (hardening of the skin) in the epidermis and dermis, telangiectasia, fibrosis and skin necrosis (death of skin tissue) (Archhambeau, 1987).

**4.7 Radiation Protection Effort**

ABCD Hospital has a radiology service unit of which means hospitals employ radiographers that have a source of radiation in the workplace. Based on BATAN (2011) that the radiology room has a standard room that is used. Under the regulation ABCD hospital has run various efforts to provide the safety and health of the radiographer. Efforts made by the hospital in this case using the knowledge of Health and Safety (K3) is a Hazard Control hierarchy consisting of elimination, substitution, engineering, administrative controls and personal protective equipment (APD). Under the control of the hospital hierarchy cannot do because of the Efforts of elimination and substitution of materials (radiation source) cannot be removed and replaced because it is one of the tools of health facilities. Based on the results Obtained, the radiologist at the ABCD Hospital is not provided by the hospital for medical examination. Radiographers shall be given a medical examination by the hospital facility, this is in accordance to the Decree of the Head of Nuclear Energy Supervisory Agency Number: 01 / Ka-Bapeten / V-99 on Provisions against Radiation Safety stating that the responsibility of the

installation employers must conduct medical examinations for apprentices and radiation workers and health services for radiation workers. Accordingly, hospitals should provide and organize health checks to employees. ABCD Hospital has run various efforts to provide the safety and health of the radiographer. Efforts made by the hospital in this case science approach, Occupational Health and Safety (K3) is a Hazard Control hierarchy consisting of elimination, substitution, engineering, administrative controls and personal protective equipment (APD). The Efforts made by the ABCD Hospital as the table below.

**Tabel 3Description radiation protection effort in hospital ABCD**

| No | Hospital | Radiation protection efforthospital | | | Total |
|---|---|---|---|---|---|
| | | tehnique (10 Observation) | Administartif (8 Observation) | APD (7 Observation) | (25Observation) |
| **1** | A | 60.00 | 78.12 | 42.85 | 61.00 |
| **2** | B | 87.50 | 81.25 | 46.42 | 74.00 |
| **3** | C | 90.00 | 84.37 | 89.28 | 88.00 |
| **4** | D | 85.00 | 84.37 | 82.14 | 84.00 |
| **Total Score** | | 40.00 | 32.00 | 28.00 | 100 |

Assessment of radiation protection Efforts that have been made by the hospital is done by giving the value of scoring at any observations made on 25 criteria for observation. 25 of this observation criteria consisted of 10 observations engineering, administrative controls and 8 observations, 7 observations APD. Based on the table above it is known that radiation protection safeguards that have been performed by hospital that has the highest value is the C hospital with a total value of 88 and the and lowest is a hospital with a total value of 61. When Compared based on assessment criteria home ill of C hospital still has the highest score of the criteria and the lowest is also still in A hospital.

## V. CONCLUSION

Radiographer who works in the ABCD Hospital more males, the average service life of 5-6 years with the last education of D3, more radiographers who follow training in radiation protection and use of APD. Abnormal lymphocytes in the radiographer of ABCD hospital numbered as 9 and 19 normal lymphocytes. Radiographers' characteristics that Affect lymphocytes were age, radiation protection training and use of APD. The radiation dose received by the radiologist of ABCD hospital is the effect on lymphocytes. Radiation protection Efforts that have been made by the A hospital is still not good and B, C and D hospital Efforts radiation protection has been done and has been good. Effects of exposure to X-ray radiation in the ABCD Hospital has an influence on the lymphocytes roommates are valued at radiation doses, Age radiographer, radiation protection training and use of APD. The division of labor hours must be tailored to the age radiographer radiographers in the case to determine the maximum dose that can be received by the radiographers within normal limits by using the formula of MPD = 5 (N - 18) rem.

## VI. SUGGESTION

Based on the research that has been made known that the radiation dose, radiation protection training, the use of APD and Age radiographer are influenced on lymphocytes. The results of observations of radiation protection Efforts that have been done in a hospital of A, B, C and D is known that the A hospital radiation protection is still not good. Based on the advice that can be given is the ABCD Hospital must create a firm and consistent rules for problem use of APD that radiographers will always use APD when working. There must be people who supervision it carefully about the use of APD is particularly important because the use of the TLD is used to determine the absorbed dose received. The hospital must provide radiation protection training to more radiographer. radiographers order to know how to reduce radiation exposure to X-rays properly. The hospital must provide APD to complete in accordance with the type of tests done and APD that has been held to be admitted to the condition that the function intact who radiographer growing to PAK (abnormal lymphocytes) must be followed so that the radiologist can work well linked or given treatment so that Reviews of their condition improved as well.

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