The Influence Between the Length of Radiographer Working Time and The Reduction of Salivary Ph

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Submission date: 04-Aug-2020 08:06AM (UTC-0400)
Submission ID: 1358042945
File name: f_Radiographer_Working_Time_and_The_Reduction_of_Salivary_Ph.doc (1.62M)
Word count: 2191
Character count: 14948

DENTINO
JURNAL KEDOKTERAN GIGI
Vol III. No 1. September 2018

THE INFLUENCE BETWEEN THE LENGTH OF RADIOGRAPHER WORKING TIME AND THE REDUCTION OF SALIVAR pH

(Research on Radiographers at RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin in 2017)

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ABSTRACT

Background: *Radiographer is a radiation worker in a field of investigations that uses x-ray radiation sources for health services. X-ray radiation can cause radiation effects for radiographers, patients, the environment and surrounding communities. Salivary glands are organs which susceptible to x-ray radiation. One of the effects caused by ionizing radiation is the decrease in salivary pH.* ***Purpose:*** *The purpose of this study was to analyze the effect of radiographers' length of working time on salivary pH decrease due to exposure to x-ray radiation received by radiographers while working at RSUD Ulinv Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin.* ***Methods:*** *This research was an observational analytic study using cross-sectional design. The samples used in the study consisted of 18 respondents which were radiographers who did saliva taking with total sampling technique* ***Result:*** *The salivary pH measurement results showed the mean valu of salivary pH on the radiographer with the average of 7 years of working which has a decrease by 0.12 from the normal salivary pH of 6.70. The statistical analysis was done using parametric statistic test of Simple Linear Regression where significant value of p = 0,003.* ***Conclusion:*** *There is an influence between the length of radiographer working time and the reduction of saliva pH resulting from the exposure of x-ray radiation received by the radiographer while working at RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin*

Keywords*: Length Of Radiographer Work, Radiation Effect, Salivary pH*

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INTRODUCTION

The radiographer is a radiation worker assigned to use x-rays in the radiodiagnostic field. As the era developed, the use of x-ray radiation is increasing in the field of health services.[1,2,3] Radiodiagnostic is an investigation that uses x-ray radiation in diagnosing disease on the human body Which is displayed in the form of black and white images.[3] As a result, radiation exposure occurs in the work environment and also to the radiographer, so that while them doing their work, the radiographer should pay attention to work safety.[1,4] Radiation may pose a potential hazard if its use is not in accordance with the functions and benefits. It is important to warn the radiation user to use radiation intensity as low as possible and not to ignore the radiation effects.[5]

Radiation is a beam of light that can penetrate the human body in the form of light waves.[5] At irradiation time, radiation can penetrate the tissue because the body can not be protected completely. Radiation can not be detected by the body and it has been human nature to not aware of any danger if it does not

show the consequences directly.[4,5] Some of the radiation exposure will be absorbed inside the body so it can cause biological effects on body cells health. This radiation effect occurs several seconds after exposure. The effects of radiation fall into two categories, which are deterministic effect and stochastic effect.[5]

The impacts may results in cell death or cell changes. They are depend on radiation exposure, and how long the radiographer works in the radiation field. Radiation will cause ions decomposition process in the tissue that will lead to the chemical compounds process, called free radicals.[6] Free radicals cause cell apoptosis in the body which can be a physiological and pathological cell death.[7]

Excessive exposure may have clinical effects on oral cavity. They will change salivary glands, taste bud, and caries.[8] The salivary glands are one of the radiosensitive organs to radiation exposure. Salivary gland will produce saliva to maintain oral cavity to stay healthy. A person who is often exposed to the radiation, their salivary glands especially the parotid gland will consequently have a decrease in salivary flow rate and the saliva also has a pH below normal pH (around 6,7).[8] There are two cells which can be found in the salivary gland, namely acinus cells and mucus cells.[9,10]Acinus cells are cells which contain water, higher than mucus cells. Therefore, these cells have radiosensistive properties. Radiation exposure will affects the cells by decreasing salivary pH.[9,10]

Based on studies from Susanti et al (2016), they mentioned that there was salivary pH reduction by 0.6 from normal salivary pH after radiographic irradiation. On the study from Banah Syah (2015), it is also mentioned that there was some reduction in the number of cells after a single exposure and repeated exposure by 14 times x-ray radiation caused by biological effects on cells. According to the theory that has been explained, saliva is a factor that can affect the process of caries. Salivary flow is oral cavity defense system and can decrease the accumulation of plaque on the tooth surface.[11] This study aims to analyze the effect of radiographers' length of working time on salivary pH reduction caused by x-ray radiation exposure that radiographers had received while working at RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin.

MATERIALS AND METHODS

This research began by making research permit and ethical clearance issued by Faculty of Dentistry, Universitas Lambung Mangkurat Banjarmasin No.026 / KEPKG-FKGULM / EC / VIII / 2017.This research was an observational analytic research with cross sectional design. Sampling on the research was using total sampling technique. Total sampling is a thorough sampling from previous population. The population in this study amounted to 18 respondents from radiographers who worked at Ulin Banjarmasin Hospital and RSGM Gusti Hasan Aman Banjarmasin. This research was conducted at RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin Installation from September to November 2017.

The materials used in this study were spitton, handscoon, mask, stationery, pH meter digital, sterile aquadest, calibration powder and saliva. This research started from collecting data from working period using respondent data sheet and the radiographer filled informed consent approval sheet which means that they were agree to become subject of this research. Then radiographer was instructed not eat and drink about 60 minutes to control saliva pH before measuring salivary pH. Saliva pH measurements were obtained from measurements with a digital pH meter device so the salivary pH data can be obtained from the respondents who worked as radiographers.

RESULT

The result for salivary pH that affected from the length of working time on RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin radiographers was decrease. It can be seen in table 1 - 3.

Table 1.The length of radiographers working time on salivary pH reduction

Length of working time	Saliva pH reduction
3 years	0,11
4 years	0,1
5 years	0,09
7 years	0,1
10 years	0,14
13 years	0,4
15 years	0,4
17 years	0,08
19 years	0,47
Total	0,12

Based on table 1, the length of working time from respondents that affect the occurrence of pH reduction was found on those who have worked for 19 years which resulted in saliva pH decrease as much as 0.47. Respondents who worked for 10 years also had a decrease in salivary pH as much as 0.14. Respondents who worked for 3 years had a decrease of 0.11 and respondents who worked for 5 years was resulting in salivary pH reduction around 0.09, while those who worked for 17 years had a decrease of 0.08.

Table 2. Mean Value of Salivary pH Measurement, Saliva pH Reduction

Salivary pH	Reduction Mean Value
Salivary pH measurement	6,50
Salivary pH reduction	0,12

From the calculation result in table 2, it is shown that the average value of saliva acidity is 6,50 and deviation saliva acidity reduction is 0,12. Based on these results, it means that there has been a decrease in salivary pH from normal salivary pH of 6.70 among the radiographers. The data were followed by normality test using the One-Sample Kolmogorov-Smirnov test to determine data distribution.

The One-Sample Kolmogorov-Smirnov test result showed significant values in the normality test with $p = 0,549$ ($p > 0,05$). It means that the dependent variable and the independent variable have normal distribution. After that, heteroscedasticity test for parametric statistic test was performed. From the results of heteroscedasticity test, it was obtained a significant value of 0.071 where the value was greater than 0.05. It can be concluded that there are no symptoms of heteroscedasticity. Furthermore, an analysis was conducted to determine the effect between independent variable and dependent variable using simple linear regression test.

Table 3. The result of T regression test on radiographer length of working time to salivary pH reduction

Parameter	Sig
The influence of length of working time on salivary pH reduction	0,003*

Note: (*) There is Influence

Data analysis from T regression test result showed significant value equal to 0,003 ($p < 0,05$). It means that there was influence between radiographer length of working time and saliva pH reduction.

DISCUSSION

A radiographer is a worker who exposed to radiation and it more risk than other jobs.[1] Radiographers need to carry out periodic medical checks at least once a year. In the Regulation of the Minister of Health, states that the recording of radiographer health examination results is kept by hospital management which contains of dose notes and monitoring work environment. Start from the beginning they start to work until they stop working.[1,2] The effect of radiation on human organs can occur in any organ, include the salivary glands that will cause a radiation effect and depend on the amount of dose and

exposure to radiation received. A certain amount of radiation can cause changes in body cells.[1,12,14]

Based on the results of T regression test, it showed the influence of radiographers" length of working time to salivary pH reduction. The reduction of salivary acidity is a negative impact of radiographic exposure to radiographers.

Salivary glands are one of the organs affected by radiation because the saliva has acinus cells where the high number of water molecules is highly reactive to ionization. X-ray radiation exposure releases free electrons in water molecules (H_2O). It happens because human body consists of 80% water. As a result of this interaction, the ionization or excitation atoms process in the cell can lead to the change in chemical structure of DNA molecule and the formation of free radicals.[5,13,14] There are many free radicals in the body. Electrons freed from radiation are more reactive to free radicals superoxide compounds (O_2-). This unstable superoxide tends to bind the H element that has been exposed to electrons from radiation to form hydrogen peroxide. Thus, it is re-forming superoxide compounds that include free radicals in the body. Ionizing radiation that exposed to the tissue or organs will cause radiation effects and cell death of the organ. This will occur in radiation-sensitive cells.[5,16,17]

Ionization reactions can lead to the formation of free radicals. Unstable free radicals in body can cause tissue, organ and cell damage. When free radical activity was increased, the body produce antioxidants to prevent oxidative stress.[12,14] Enzymatic changes will further accelerate the chronic and persistent damage process, especially in the fixed organs. The changing in biochemical processes to catalase enzymes components of body fluid response to radiation. The enzyme catalase is an endogenous antioxidant that works by catalyzing hydrogen peroxide (H_2O_2). The higher formation of hydrogen peroxide, the heavier the catalase enzyme works to suppress the activity of hydrogen peroxide.[7,8,13]

The higher hydrogen peroxide formation can cause cell damage and cell apoptosis. The damage of salivary glands acinus cell due to free radicals cause salivary flow rate reduction, that resulting in salivary pH changes. Salivary changes result in the reduction of salivary volume quantitatively, and also qualitatively. Salivary viscosity become more viscous.[10]

Based on those description, we can learn that radiographers has damaged the acinus cells, so the production of saliva become more viscous and resulting saliva flow reduction. This reduction also results in the reduction of bicarbonate ions in saliva. The reduction of bicarbonate ions and proteins that contained in the saliva cause the acidity level in the saliva to decrease lower than normal salivary pH. Apart from the radiation dose, another factor that affecting salivary secretion is the age of the respondents. Age may affect the production and composition of saliva produce. As the age increase, it will cause atrophy in the salivary glands resulting in lower salivary flow and other factors such as dehydration, gender, nighttime rhythms, medication and level dose.[8,9,18,19]

Based on this research, it can be concluded that there is an influence between the length of working radiographers time and the reduction of salivary pH due to the exposure of x-ray radiation received by the radiographer while working at RSUD Ulin Banjarmasin and RSGM Gusti Hasan Aman Banjarmasin.

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