**ASSESSMENT OF CANCER RISK FROM FLUORSCOPIC BILE DUCT EXAMINATIONS AT SANJIWANI HOSPITAL, GIANYAR**

# ABSTRACT

**Aim:** Study on the Assessment Of Cancer Risk From Fluoroscopic Bile Duct Examinations At Sanjiwani Hospital, Gianyar the aim is to determine the magnitude of the effective dose received by bile duct patients during fluoroscopic, to determine whether there is a difference between male and female patients in terms of the effective dose, and to determine the risk of cancer in bile duct examinations using fluoroscopic.

**Study Design:** This study uses a quantitative analysis design using secondary data. This study was conducted at the Radiology Unit of Sanjiwani Gianyar Hospital from December 2024 to Febuary 2025.

**Methodology:** This study involved 30 biliary tract patients. Data were analyzed using IBM SPSS and Excel software and for statistical tests using normality test, homogeneity test, one-way t-test, and one WAY ANOVA test to determine the risk of cancer in biliary tract examination with fluoroscopic.

**Results:** After carrying out t-test for the absorbed dose, effective dose and cancer risk which were compared with the BAPETEN and ICRP values, the following result were obtained namely where the absorbed dose value was found to be below the safe threshold set by BAPETEN, which is 50 mGy. And where the effective dose value was found to be below the safe threshold set by BAPETEN, which is 10 mSv. And for the cancer risk value, it was found to be below the safe threshold set by ICRP, which is 0.08%.

**Conclusion:** It is know that the values for the absorbed dose, effective dose, and risk of cancer received by patients at Sanjiwani Gianyar Regional Hospital are still below the values set by BAPETEN and ICRP so that they do not endanger patients undergoing bile duct cancer treatment at the Sanjiwani Gianyar Radiology Installation.

*Keyword: Fluoroscopy, Bile Duct , cancer,* effective dose, radiation.

# INTRODUCTION

Radiation is the emission of energy through matter or space in the form of heat, particles, and electromagnetic waves or light (photons). Radiation in the form of electromagnetic waves of photons is a type of radiation that has no mass and no electric charge, such as gamma rays and X-rays. Several imaging modalities that use X-rays are X-rays, mammography, dental,,CT Scan and fluoroscopy (Akhadi, 2000)



**Figure 1.** Fluoroscopy

Fluoroscopy is a tool used for visual (direct) study of the fall of a latent image from a fluoroscopy screen into a image in a film of film spot. In medical applications fluoroscopy is used to visualize the movement of internal structures. A radiographer or radiology doctor can observer images of organ structures dynamically or (real time imaging) following the desired imaging needs, and using a very long time (Silverman, dkk 2018).

The bile duct is a system of small tubes that connect the liver to the small intestine. The bile duct is responsible for transporting bile, a fluid produced by the liver to the small intestine to aid in the digestion of fats (Kusnandi, 2013). Cancer is a type non-communicable disease whose increase every year. Bile duct cancer or cholangiocarcinoma is a disease that occurs due to the presence of malignant cells in the epithelium, bile or can occur in the liver parenchyma (Khan, 2019).

One common method used to diagnose problems in the bile ducts is fluoroscopy. Fluoroscopy allows doctors to view the bile ducts in real time, providing important information about anatomical abnormalities and function of the ducts. However, the use of fluoroscopy of the ducts. However, the use of fluoroscopy also carries risk, especially radiation exposure that can increase the change of cancer. Radiation exposure from fluoroscopy can have long-term effect, including an increased risk of cancer. Several studies have shown that radiation exposure, especially in high doses and over a long period of time, can cause DNA damage that can potentially lead to cancer. Therefore, it is risk in patients undergoing bile duct examination. Factors that influence the risk of cancer due to radiation exposure must be well understood. The duration of exposure, the radiation dose received, and the patient’s health condition before the examination all contribute to the potential risk. This study aims to identify and analyze these factors in the context of bile duct examination using fluoroscopic (Patel, T, 2002).

Understanding cancer risk is also important for the development of safer screening protocols. By evaluating the risk, medical personnel can take the necessary steps to protect patients. This includes the use of alternative imaging techniques that may have lower radiation risks. In the context of gastrointestinal cancer care, early detection is essential. With the right tools and techniques, cancer can be detected earlier, so that medical intervention can be better done. This study will contribute to the development of more effective early detection strategies that take radiation risks into account. And according to BAPETEN Regulation of the Nuclear Supervisory Agency Number 4 of 2013, the absorbed dose value is 50 mGy, the effective dose is 10 mSv, and according ICRP 2007 the value of cancer risk is 0.8%.

This topic is of great value for patient safety and radiation protection practice, where the findings can help balance the risk-benefit ratio, ensuring that procedures are justified and optimized according to the ALARA (As Low As Reasonably Achievable) principle. It can also guide clinical decision support among clinicians regarding the need and frequency of procedures. Such studies can also contribute to dosimetry data for “unreported” procedures such as biliary tract imaging. Technically: correlation of risk with technical factors such as kV, mAs and DAP can help optimize protocols, raise operator awareness and encourage the use of protective measures, as well as highlight the need for training programs to address any issues.

This study provides data on the absorbed dose, effective dose, and cancer risk of fluoroscopic procedures at the hospital, comparing these values with established national (BAPETEN) and international (ICRP) safety limits. The findings, which indicate that radiation dose and cancer risk remain within acceptable limits, provide reassurance regarding the safety of current practices at Sanjiwani Hospital and contribute to the body of evidence supporting the judicious use of fluoroscopic for biliary tract examination. This study may help guide safer imaging protocols.

This manuscript offers valuable insight into the cancer risk associated with biliary tract fluoroscopic examination, an area of major radiology. By measuring the absorbed and effective radiation doses and comparing them with international safety standards (BAPETEN and ICRP), this study provides strong evidence that current practices at Sanjiwani Hospital Gianyar are within safe exposure limits. These findings are important because they contribute to the global discourse on radiation safety, especially in vulnerable populations undergoing repeated imaging. This study also supports the development of evidence-based protocols optimized to minimize cancer risk, thereby improving patient safety and public health outcomes.

# MATERIALS AND METHODS

## Materials

## 2.1.1 Study area

## The research was conducted at the Radiology Installation of the Sanjiwani Gianyar Hospital (RSUD) located at Jl. Ciung Wanara-Gianyar No.2, Gianyar, Gianyar District, Gianyar Regency, Bali.

### 2.1.2 Study tools and materials

The tools and materials used in this research include a fluoroscopy machine with the Siemens brand No. 802071751, and a radiographer’s computer to search for bile duct patient data using a fluoroscopy examination tool.

### 2.1.3 Study design

This study used a direct field observation design to determine whether there was a risk of cancer when examining the bile ducts with fluoroscopy.

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1. **Methods**

### Sampling techniques

Data collection was conducted using the following steps:

1. Data Capture Phase : open the data set application to search for bile duct patient data on the radiographer’s computer. Search the data based on month and year for the data needed, namely 30 bile duct patients.

### Study instruments

### The research procedure consisted of the following stages:

### Search for data such as tube voltage (kV), time current (mAs), and absorbed dose (Gy).

### Open the data collection application to search for bile duct patient data, search for the data based on month and year.

### Record and photograph as needed.

### Next, the equivalent dose (Sv), effective dose (mSv), and cancer risk (%) are carried out.

### After that, continue with the Normality Test and Homogeneity Test for absorbed dose (Gy), effective dose (mSv), and cancer risk (%).

### Next, a t-test is carried out on the absorbed dose (Gy), effective dose (mSv), and cancer risk (%) and then compared with the BAPETEN and ICRP values.

### Next, a One Way ANOVA Test is carried out to answer the existing problems formulation. 2

### Data collection method

### The following is a flow diagram of research related to determining the risk of bile duct cancer using fluoroscopic at Sanjiwani Hospital, Gianyar:

### 

### Figure 2. Research flow diagram

### 2.2.4 Data Management

### Normality Test: the normality test aims to find out whether the data distribution is normally distributed or not. Normally distributed data is a mandatory requirement that must be met before carrying out the One-Way t-test and the One Way ANOVA test. The data normality test method used was Kolmogrov-Smirnov and Shapiro with significance level of 95% (= 0.05) to determine the data distribution. Guidelines for making decisions on data normality tests are:

### If the significant value (P value) is > 0.05 then the data is normally distributed.

### If the significant value (P value) < 0.05 then the data is not normally distributed.

### Homogeneity Test, homogeneity test is a statistical method used to test whether the variants of two more groups of data are homogeneous or not. Guidelines for decision making in the homogeneity test are as follows:

### If the significant value (P value) is > 0.05 then it can be concluded that the data variance is homogeneous (homogeneity test is fulfilled).

### If the significant value (P value) < 0.05 then it can be concluded that the data variance is not homogeneity test is not met).

### One-Way t-Test, aims to determine whether the null hypothesis should be rejected, with the existing sample data. From this test, it is expected to meet a confidence level of 95% with a significance of 0.05. the statistical hypothesis proposed is as follows:

### HO = The value of the absorbed dose, effective dose, and cancer risk obtained does not exceed the limits set by BAPETEN dan ICRP.

### HI = The value of the absorbed dose, effective dose, and cancer risk exceeds the limits set by BAPETEN and ICRP from the results of the statistical test.

### One Way ANOVA Test, after the normality teat, homogeneity test, one-way t-test with the following hypothesis:

### ANOVA test for comparison of each classification of male and female patients

### HO = (Initial Hypothesis): There is no difference in the average effective dose value of the classification of male and female patients.

### HI = (Alternative Hypothesis): There is a difference in the average effective dose value of the classification of male and female patient

### The guidelines for decision making in the One Way Test are as follows:

### If the significant value (P value) < 0.05 concludes that there is a significant difference (HI Accepted, HO rejected)

### If the significant value (P value) > 0.05 concludes that there is no significant difference (HI rejected, HO accepted) (Guanawan, A.A.N, 2023).

# 3.RESULTS AND DISCUSSION

# In this study, data was collected from 30 patients (13 women and 17 men) the data taken were tube voltage kV, time current mAs, and absorbed dose mGy . These data will be used to calculate the equivalent dose mSv, effective mSv, and cancer risk % received by bile duct patients. This research uses statistical test, namely normality test homogeneity test t-t test, One Way ANOVA test. The following is a table of observations from bile duct patients:

# 

# Table 1 : Observations from bile duct patients

# 3.1 Comparision Of Absorbed Dose, Effective Dose, And Cancer Risk Values At Sanjiwani Gianyar Hospital With The Values Recommended By BAPETEN And ICRP

# The absorbed dose value received by patients at Sanjiwani Hospital, Gianyar, is the value obtained below the safe threshold set by BAPETEN, which is 50 mGy. The effective dose value for patients at Sanjiwani Hospital, Gianyar, is the value obtained below the safe threshold set by BAPETEN, which is 10 mSv. The cancer risk value for patients at Sanjiwani Hospital, Gianyar, is value found below the safe threshold set by ICRP, which is 0.08%.

# Statistical Test Result

**Table 2: Normality Test results of absorbed dose**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tests of Normality** | | | | | | |
| Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
| Statistic | df | Sig. | Statistic | df | Sig. |
| .137 | 30 | .155 | .971 | 30 | .554 |

# To determine whether the data is normally distributed or not, it is done by comparing the significance value of 5% or 0.05. if the significance value of the normality test is greater than 0.05, then the data is considered normally distributed. Conversely, if the value is less than 0.05, then the data is considered not normally distributed.

**Table 3: Homogeneity Test results of absorbed dose**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test of Homogeneity of Variances** | | | | | |
|  | | Levene Statistic | df1 | df2 | Sig. |
| Dosis Serap | Based on Mean | .068 | 1 | 28 | .796 |
| Based on Median | .055 | 1 | 28 | .816 |
| Based on Median and with adjusted df | .055 | 1 | 27.356 | .816 |
| Based on trimmed mean | .029 | 1 | 28 | .865 |

# Above, normality and homogeneity test are carried out according to the provisions if the sig value > 0.05 then the data is normally distributed, so that data is can be continued with a t-test (One Sample t-test) to determine whether the absorbed dose value that has been obtained does not exceed the established standard out for the absorbed dose value.

**Table 4: T-Test results of absorbed dose**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **One-Sample Test** | | | | | | |
|  | Test Value = 50 | | | | | |
| t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Dosis Serap | -18.262 | 29 | .000 | -15.43333 | -17.1618 | -13.7049 |

# Because the table < t count (-18.262 < 1.699), HO is accepted, so the absorbed dose is given according to that determined by BAPETEN.

# Table 5: Normality Test results of effective dose

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Tests of Normality** | | | | | | | |  | Kolmogorov-Smirnova | | | Shapiro-Wilk | | | | Statistic | df | Sig. | Statistic | df | Sig. | | Dosis Efektif | .170 | 30 | .028 | .939 | 30 | .088 | | a. Lilliefors Significance Correction | | | | | | | |   To determine whether rhe data is normally distributed or not, it is done by comparing the significance value of 5% or 0.05. if the significance value of the normality test is greater than 0.05, then the data is considered to be normally distributed. Conversely, if the value 0.05 then the data is considered not normally distributed. Based on the normality test that was carried out in this research, significance value was obtained that was greater than 0.05. the next result is a homogeneity test to ensure whether the data from each group to be analyzed comes from the same population or not. |

**Table 6: Homogeneity Test result of effective dose**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test of Homogeneity of Variances** | | | | | |
|  | | Levene Statistic | df1 | df2 | Sig. |
| Dosis Efektif | Based on Mean | .263 | 1 | 28 | .612 |
| Based on Median | .369 | 1 | 28 | .549 |
| Based on Median and with adjusted df | .369 | 1 | 26.495 | .549 |
| Based on trimmed mean | .278 | 1 | 28 | .602 |

above, a normality test and homogeneity test were carried out in accordance with the provisions, if the sig value is > 0.05 then the data is normally distributed, so it can be continued with a t-test (One Sample t- test) to determine whether the absorbed does not exceed the predetermined standard or not. Next, a t-test will be carried out for the effective dose value.

**Table 7: T-Test results of effective dose**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **One-Sample Test** | | | | | | |
|  | Test Value = 10 | | | | | |
| t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Dosis Efektif | -58.883 | 29 | .000 | -5.98400 | -6.1918 | -5.7762 |

Because the table < t count (-58,833 < 1,699), then H0 is accepted, so the effective dose is given as determined by BAPETEN.

**Table 8: Normality Test results of cancer risk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tests of Normality** | | | | | | |
|  | Kolmogorov-Smirnova | | | Shapiro-Wilk | | |
| Statistic | df | Sig. | Statistic | df | Sig. |
| Risiko Kanker | .183 | 30 | .012 | .941 | 30 | .096 |
| a. Lilliefors Significance Correction | | | | | | |

To determine whether the data is normally distributed or not, it is done by comparing the significance value of 5% or 0.05. If the significance value of the normality test is greater than 0.05, then the data is considered to be normally distributed. Conversely, if the value is led than 0.05 then the data is considered not normally distributed. Based on the normality test that was carried out in this research, significance value was obtained that was greater than 0.05. the next result is a homogeneity test to ensure whether the data from each group to be analyzed comes from the same population or not.

**Table 9: Homogeneity Test results of cancer risk**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Test of Homogeneity of Variances** | | | | | |
|  | | Levene Statistic | df1 | df2 | Sig. |
| Risiko Kanker | Based on Mean | .232 | 1 | 28 | .634 |
| Based on Median | .295 | 1 | 28 | .591 |
| Based on Median and with adjusted df | .295 | 1 | 26.272 | .592 |
| Based on trimmed mean | .244 | 1 | 28 | .625 |

Above, a normality test and homogeneity test were carried out in accordance with the provisions, if the sig value is > 0.05 then the data is normally distributed, so it can be continued with a t-test (One Sample t-test) to determine whether the absorbed dose value that has been obtained does not exceed the predetermined standard or not. Next, a t-test was carried out to determine the cancer risk value.

**Table 10: T-Test results of cancer risk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **One-Sample Test** | | | | | | |
|  | Test Value = 0.08 | | | | | |
| t | df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| Lower | Upper |
| Risiko Kanker | -68.028 | 29 | .000 | -.05117 | -.0527 | -.0496 |

Because the table < t count (-68.028 < 1.699), the Ho is accepted, so the cancer risk value is as determined by the ICRP.

**Table 11: Anova Test results of cancer risk**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ANOVA** | | | | | |
| Risiko Kanker | | | | | |
|  | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | .000 | 1 | .000 | .135 | .716 |
| Within Groups | .000 | 28 | .000 |  |  |
| Total | .000 | 29 |  |  |  |

The results of the One Way ANOVA statistical test showed that F count > F table (420 > 135), so HO was accepted and HI was rejected. After carrying out the normality test, homogeneity test and t-test, the One Way ANOVA test is now carried out to answer the second problem formulation. The One Way ANOVA test for cancer risk is carried out, showing that there is no significant difference between each cancer risk. These results can be demonstrated through hypothesis testing where the results of F count > F table or P (sig) > 0.05, which means HO is no difference in the average cancer risk value for each patient.

**4.⁠ ⁠CONCLUSION**

This study shows that the effective dose value received by bile duct patients from the smallest value of 3.00 mSv, to the largest value of 5.52 mSv. After the One Way ANOVA test was carried out, the results showed that there was a significant difference between each cancer risk. These results can be shown through hypothesis testing where the F count result > F table or P (sig) < 0.05 with an F count value of 420 and F table value of 135. Where HO is rejected and HI is accepted, which means that there is no difference in the average value in male patients and female patients. There is no cancer risk for this examination because the results of the cancer risk at the Sanjiwani Gianyar Hospital do not exceed the limits set by BAPETEN and ICRP.

# RECOMMENDATIONS

It is further recommended that this research expand the data sample for bile duct cancer, to provide broader insight regarding cancer risk.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models and text-to-image generators have been used during writing or editing of this manuscript.

# CONSENT

All authors declare that a ‘written informed consent was obtained from all the patient;

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