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# AVERAGE GLANDULAR DOSE (AGD) AND BREAST DENSITY MAMMOGRAM GUIDELINES

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**ABSTRACT**

Introduction/background: The aim of mammography examination is to detect, determine and evaluate breast cancer and other breast pathologies. Mammography had been proven to be most effective method to detect breast carcinoma. GE Senographe FFDM system operates with three automatic optimization parameters (AOP), namely: contrast (CNT), standard (STD) and dose (DOSE). Higher breast density has been strongly associated with increase breast cancer. Thus, measurements of breast density are important for risk assessment and prevention strategies, Knowledge of the ranges of breast density in patient is important when planning for breast screening. Objective: to develop a reference table for mammographers according to breast density of patient. Method: A mammographic breast phantom (012A) set were used for this research are 40 mm thickness with 30%, 50% and 70% breast density composition were exposed using Mammography machine GE Senographe FFDM. The exposure was performed using three settings, exposure was selected by default with setting, AOP; (STD, CNT and DOSE) were switched ON. AGD and mAs were recorded. Result: 70% breast density type recorded highest AGD compare with other breast type and DOSE setting produce lowest mAs among others. Conclusion: A reference table was developed for mammographers in determine which setting is suitable for patient.

**Keywords:** mammography, breast density, average glandular dose

## 1. INTRODUCTION

Breast cancer is among the most common cancers among women in Malaysia according to Malaysian National Cancer Registry (MNCR) [1]. Mammography is the standard imaging technique to detect and evaluate breast cancer and other breast pathologies in symptomatic patients. Due to limited contrast between tumor and adjacent tissue, a digital mammography was implemented to separate and optimize the images which allow greater visualization [2]. GE Senographe FFDM system operates with three automatic optimization parameters (AOP), namely, contrast (CNT), standard (STD) and dose (DOSE). Based on previous study, 98% of the cases were acquired using the STD Op Mode whilst CNT and DOSE modes were unfamiliar, and their characteristics were not well known [3]. According to [4], women with dense breast is four to six times higher risk of breast cancer. Breast density is measured by determining the ratio of radiodense epithelium and stroma to radiolucent fatty tissue [5]. Thus, measurements of breast density are important for risk assessment and prevention strategies. However, the relationship between breast glandular composition which referred as density and dose among the three AOP modes is not well-defined.

## 2. MATERIAL AND METHOD

A 40 mm thickness mammography breast phantom (012A) with 30%, 50% and 70% breast density were used to mimic a compressed breast. The 30% breast glandular was compressed at 4dN and exposed with three different AOP settings: standard (STD), contrast (CNT) and DOSE. These steps repeated for 50% and 70%. Auto-filter, kv peak (kvp) and milliampere per second (mas) and all anode/filter combination were used as in routine practice. Average glandular dose (AGD) and mAs which automatically appeared on screen after exposure were recorded.

## 3. RESULT

The data was analyzed using SPSS version 26. Highest AGD mean (SD) is 70% breast density, where mean (SD) for AGD was 1.56 (0.3) for STD, followed by 4.49 (0.042) for CNT and 0.93 (0.039) for dose. DOSE recorded lowest mAs produce with 34.82(0.649) for 30%, 36.52(0.389) for 50 and 38.14(0.589) for 70%. A one-way ANOVA was used to compare three groups of independent samples. The difference in AGD scores between setting where DOSE, $f$ (2,12) = 321.69, CNT $f$ (2,12) = 2504.91 and STD f (2,12) = 661.14 were statistically significant, (*p-value* <0.05). while DOSE setting recorded lowest mAs produce for all glandular 34.82 (.649) for 30%, 36.52 (.389) for 50% and 38.14 (.589) for 70%. P-value for each mAs statistically significant from each other (*p-value* <0.05).

## 4. RELATIONSHIP BETWEEN BREAST DENSITY, AGD AND mAs

70% of breast density received greater AGD followed by 50% and 30% breast density. Each of density percentage was representing average patient ages, where it increases risk of having cancer. Supported by research done by [6], where ages between 40 and 49 years had high density breast tissue with additional 17% of them had very high-density breast, had very high-density breast, followed by 50% which ages average between 50 and 60, and 30% with age average above 60%. Thus, high density breast is sensitive and easily penetrated compared with others. Breast density should be an important consideration in designing an individualized mammography protocol, particularly for women with other risk factors for breast cancer [6]. According to American Cancer Society, women age between 44 to 54 should get mammography examination every year compared to women age 55 and older. STD mode was the most common mode used for patient examinations. Study on variations dose done by [7] stated that 577 out of 702 patients used STD mode to lower radiation dose but they didn't count DOSE as a method for lowering dose. CNT setting only used for a case including confirmation of breast disease which for enhancement to increase image quality to detect any abnormalities. While DOSE mode is the among lowest exposure factor in mammography procedure. Table 1 is the suggested reference for mammographers before performing a mammography procedure. This table will help mammographers to reduce radiation dose to patient especially between 40 to 50 years.

Table 1. Reference Table for Mammographers

| Patient age | Setting |
|---|---|
| 40 – 50 years | Dose |
| 51 – 60 years | Standard |
| 61 and older | Standard |

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Sekian, terima kasih.

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