Breast Thickness in Routine Mammogram

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Abstract

The purpose of this study was to evaluate the thickness of the compressed breast in mediolateral oblique (MLO) and craniocaudal (cc) mammograms to relate these thickness and breast patterns to mean glandular dose (MAD) in Iraqi women and to evalualat radiology's recommendation for Iraqi women. The study of population consists of 20 paired MLO and CC mammograms obtained on one mammograms unit .The digital read out of compressed breast thickness MGD was calculated by multiplying entrance skin exposure by the exposure-to-absorbed dose conversion factor for the range of breast thickness which was 7.1 ----7.4cm in cc mammograms with a mean breast thickness of 7.2 cm and 7.3 ------7.5 cm in MLO mammograms with a mean breast thickness of 7.52 MGD_s in cc and MLO mammograms were 1.89 mGY and 1.99 mGY   per view respectively.

According to our initial trial, the MGD_S OF IRAQI women are lower than recommended by the American collage and UK of radiology.

Introduetion

X-ray mammography carries a small but significant risk of radiation-induced. , mammographic is the most accurate and reliable means of detecting minimal nonpulpable breast cancer [1]   however, the carcinogenic risk associated with mammography and the absorbed radiation applied to the breast has given rise to concern.

Breast cancer almost always arises in the glandular breast tissue. As a result ,the average radiation dose absorbed by the measure of radiation risk associated with mammography. Carcinogens and the determination of the mean glandular dose represent an important aspect of the quality control of mammographic imaging system. The number of people with breast cancer was increased at a rate of 10% a year. In particular, the incidence in patients aged to forty years has increased in rapidly routen check – ups and early detection . However , this would increase the level of radiation exposure by mammography , which is a major concern considering its relationship with breast cancer [2]

For radiological studies ,the breast can be considered to be well approximated by a homogenous mixture of fibroglanduler and adipose tissues . The fibroglandular tissues comprise the tissues at risk for cancer development ,and the dose to this tissue is the most important in determining the radiation risks associated with mammography examinations . The fundamental compositions of both fibroglanduler and adipose breast tissues are presented in $ICRU_{44}$ [3]

Granularity is variable for individuals, but has been observed to correlate with compressed breast thickness and age. Both galndularity and breast thickness affect patient aloes with general expectations of increased dose with the increase of thickness (granularity help constant) and the variation of dose with thickness is evidenced through the increase of kilovoltage pesk (KVP) and mill ampere seconds (MAS) required to maintain a constant image density when varying the thickness of patient women in the rotini testing of mammography automatic exposure control (AEC) modes. The quantitative variatis with breast thickness and glandularity is not commonly evaluated , althongh it is important than both glandularity and thickness to be accounted for when studying patient doses or optimizing imaging techniques for mammography . [4]

The digital read outs of compressed breast thickness entrance skin dose(ESD_{p4}) was measured by thermolumensces dose meter (TLD) .

The average glandular dose (MGD) cannot be measured directly, but it is calculated by making certain assumptions based on experimentally, determined entrance exposure surface dose (ESD) using so-called conversion factors .These factors were developed as a function of thickness, KVP, and HVL bassed on WUS [1], then MGD was calculated by multiply ESD_{pa} -to-absorbed dose conversion factor (g) ;as follows; $AGD = g\ ESD_{pa}$

The AGD and dose measurements were converted to may using the formula(GY=100rad).

On the other hand ,researcher Geis and palchevsky [5] reported that the width of the glandularity distribution ,increases for compressed thickness between 3cm and 7cm but is narrower above and below this range Helvie et al .[6] reviewed compressed breast thickness is approximetly 44cm based on the 250 patients . Other studies [4] demon strate that compresed thickness and glandularity can be correlated with age, also other studies ,in united state Rothan [7] reported that the mean glandular dose (MGD) may vary between 2and 3 mGY from (50%   adipose and 50% glandularity tissue compressed breast of v4.2 to 5.0cm thickness. On the other hand

Researcher reported similar recent studies as Dewered [8] and Burch et al in United kigdom (UK)

The purpose of this study was to evaluate the thickness of the compressed breast in mediolateral oblique (MLO) and craniocaudal (CC) mammograms, to relate these thickness to the mean glandular dose (MGD) in Iraqi women,and to evaluate the suitability of the American College of Radiology's recommendations(ACR) .

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Methods

The total number of mammograms examend were 20 paired medioateral oblique (MLO) and craniocadul (cc) mammograms from 20 paires, and were oblique on one mammographic unit (ITALIAN Giotto HI_techi) which has control panel makes the use of the unit easy . Mammograms of women with breast implants ,for each view ,a digital read out of compressed breast thickness ,applied compression force ,clear messages of the LCD leave no doubts to the operator ,mill amperes (mAs) and tube voltage was obtained (KVP) in an automatic exposure control mode, with a very short-exposure ,the device can select the KV a among a wide rang of values in order to optimize the exposure to the breast .The rodium fitter allowes the reduction of x-ray dose to the very thick breasts mill amperes (mAs) and tube voltage was obtained ,in an automatic exposure control (AEC) mode.

Entrance skin exposure was measured by using thermolumences dose meter(TLD) units provided by issuing laboratory and it is located on the poteins dress just below the compression device ,using the same conditions as, used for the digital measured of compressed breast thickness . We also measured (mAs) ,tube voltage ,and entrance skin dose . The average glandular dose (MGD) was calculated by using the measured(ESD_{pa}) and appropriate conversion factor (g) ,depends on the HVL the (AGD) for each projection which is derived as follows; AGD=g ESD_{pa} , and using tables ,which were computed using mont carlo simulations of x-ray photon transport in breast tissue ,as described by Wu, et al [1] AGD has been defined as the average absorbed dose in the glandular tissue in the uniformly compressed breast.

Breast paherns were divided into two group[A,B] according to breast thickness the average of these groups were 7.3_7.34 ……7.75 the other from 7……….7.4 .

The relation between MGD and compressed breast thicknesses was investigated on MLO and CC mammograms.

Results and Discussion

It is widely considered that breast cancer can be induced in high dose of ionizing radiation, such as x-rays.The probability of risk of induction is believed to be dependent on dose. The highest dose are likely to be received by women with the thickest breasts ,these women also required more than one film per view, possibly up to four such films. However the number of women in this subgroub is extremely small and difficult to predict.

The study of population consisted of 40 patient's age between 40 to 65 years with an average age of 52.5 years.

Breast patterns were divided into two subgroups and classified as type A and type B.

Table 1.and Fig shows the relation between mean glandular dose and breast thickness(Fig 1).the average breast thickness of Graph A were 7.0 ,7.25,…….and 7.4 cm, respectively the average entrance skin of dose exposures10.52 , 11, 11.179…..and 11.52mGy, and the average MGDs 1.79 ,1.87 ,1.90……..and 1.96mGy these were investigated on CC mammograms.

When the average breast of group B. (table.2) was 7.3, 7.28, 7.43………and 7.75cm, respectively the average MGDs of group B were 1.89, 1.92, 1.95, and 2.31 mGy this was investigated on MLO view mammogram(table 3)shows breast thickness ranged from 7 to 7.4cm in CC mammograms, with an average breast thickness of 7.2cm ,and from 7.3 to 7.75 cm in MLO mammograms with an average thickness of 7.52cm the average MGDs in CC and MLO mammograms was 1.89 and 1.99 mGy per view respectively for 7.2 cm and 7.52cm average breast thickness .The mean glandular radiation dose is greatly affected by changes in breast thickness .Gentry and Dewered [8]measured the compressed breast thickness and entrance skin exposure by using thermo luminescent dosimeters for 4400 women ,They reported an average thickness of 4.5 cm and a mean glandular dose of 1.5 mGy for the CC

view, which is similar to that reported in the UK study by Burch et al. [9,10] and similar finding and relationship were reported by Kruger,et al.[9] .

Our results may be compared with those of similar recent study in the UK [10,11].Burch ,et al. examined data from 4633 women on the United kingdom(UK) .They found a mean breast thickness 5.7 cm and 5.2 cm for MLO and CC views , respectively, which are lower than those of our study .The mean dose per film was 1.93mGy in the MLO view, which is somewhat lower than the 1.99mGy of our study ,and the mean glandular per film was 1.63 mGy for the CC view ,which is somewhat less than 1.89mGy used in the present study. It is interesting to note that in this UK study, the mean glandular dose was 1.63mGy for a mean breast thickness of 5.2 cm, whereas our present study showed 1.89mGy for a mean breast thickness of 7.2cm. This difference can be explained in part by the greater percentage of composed glandular tissue in Iraqi women, and by application of different target \filter combination automatically controlled by AEC mode for larger breast thickness in Iraqi women than in the UK study, and the use of different conversion factors [11].

As mentioned earlier, an upper limit of 3.0mGy per film has been established by the ACR [12] as a mean glandular dose for 4.2cm thick breast with 50% glandular composition. The mean glandular dose used in the present study was well below this limit of 3.0 mGy .

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مجلة إبن الهيثم للعلوم الصرفة و التطبيقية

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Table No. (1) : The relation of Mean Glandular Dose to Breast Thickness in CC View

Thickness (cm)	ESD $_{mGY}$	MGD $_{mGY}$
7.0	10.52	1.79
7.25	11	1.87
7.29	11.179	1.90
7.39	11.352	1.93
7.4	11.52	1.96

Table No. (2): The relation of Mean Glandular Dose to Breast Thicknees in MLOView

Thickness (cm)	ESD $_{mGY}$	MGD $_{mGY}$
7.3	11.27	1.89
7.28	11.29	1.92
7.43	11.72	1.95
7.65	12.58	12.14
7.68	13.582	2.31
7.75	17.70	3.01

Table No. (3): Mean Glandular Dose of Both Mediolateral Oblique and Craniocaudal Views of Mammograms

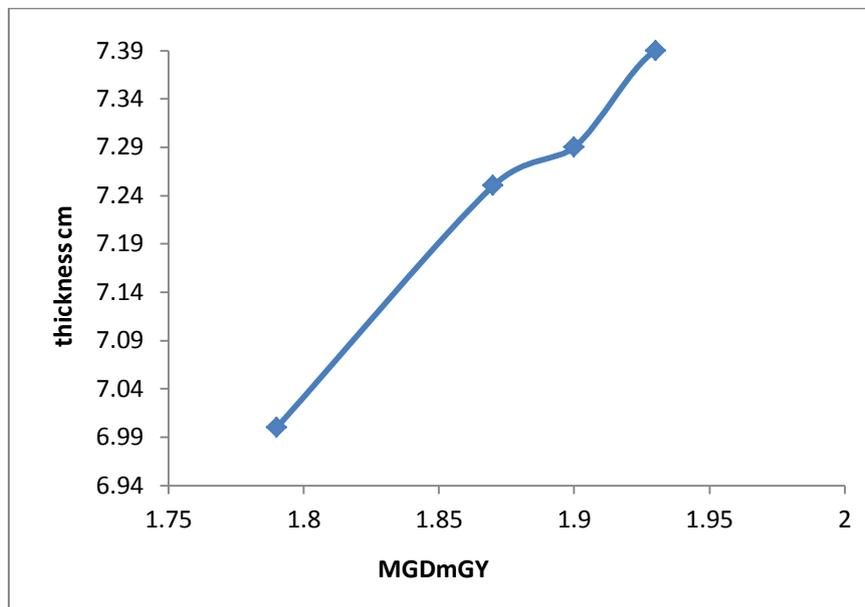|	ESD$_{mGY}$	MCD$_{max}$
MLO	11.78	1.99
CC	11.28	1.89

Figure No. (1) Mean Glandular Dose with Breast Thickness

الفحص الروتيني لسمك الثدي

نجلاء رجب شريف القدسي

قسم الفيزياء/ كلية التربية ابن الهيثم للعلوم الصرفة /جامعة بغداد

الخلاصة

تضمن البحث حساب سمك الثدي المضغوط بوضعية مائلة لـ(MLO) وبوضعية قائمة مباشرة (CC) في جهاز تصوير الثدي وايجاد العلاقة بين هذه القيم ومعدل الجرعة الغدية (MGD) خلال فحص مجموعة من النساء ومقارنة هذه القيم مع النتائج التي حصل عليها الباحثين في المملكة المتحدة .

اجريت الدراسة في مستشفى بغداد التعليمي نوع GIOHO المتطور ، وقد شملت عدد من المرضى بواقع عشرين مريضة وقد استعملت اقراص الوميض الحراري (TLD) في هذه الفحوصات .

قيس سمك الثدي بتطبيق من خلال قوة مناسبة لذلك السمك ومن ثم قياس جرعة الدخول السطحية (ESD$_{Pa}$) ، وحسب معدل الجرعة الغدية AGD بحاصل ضرب (ESD$_{Pa}$) مع مقدار مناسب من عامل التحويل (g) .

تمت الدراسة على مجموعتين من سمك ثدي احداهما من (7.4 cm - 7) في وضعية CC لجهاز فحص الثدي وبمعدل سمك ثدي 7.2 cm ، والاخرى من 7.75 cm – 7.3 بوضعية MLO للجهاز وبمعدل سمك 7.52 cm وقيمة MGD هي 1.89mGY لسمك 7.2 cm و1.99mGY لمعدل سمك 7.52 cm . والجرعة الغدية MGD لكلا المجموعتين تتراوح من (1.96 mGY...... 1.87 – 1.79) على التوالي والمجموعة الثانية من (3 mGY...... 1.92 – 1.89) وعند مقارنة هذه النتائج بالذي حصل عليها بعض الباحثين في المملكة المتحدة وجد ان هذه القيم متقاربة جداً .

الكلمات المفتاحيه: تصوير الثدي،معدل الجرعه الغديه،اقراص الوميض الحراري