

Sudan University of Science and Technology

**College of Graduated Studies**



**Evaluation of Breast Prone Position Irradiation Dose**

**تقويم العلاج الاشعاعي لسرطان الثدي في الوضع البطني**

*Submitted for partial Fulfillment of Academic Requirements for the Degree  
of Master in Radiation Therapy Technology*

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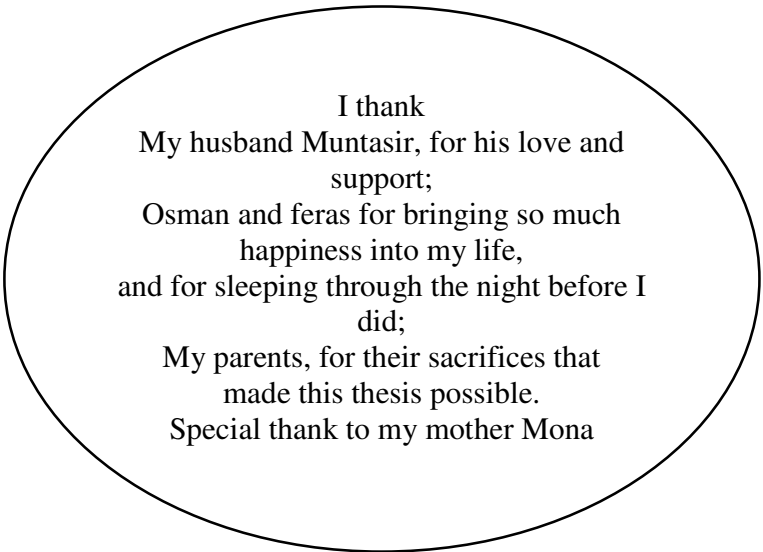
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صدق الله العظيم  
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# Dedication

*(This thesis is dedicated to my parents Mather and Father)*



I thank  
My husband Muntasir, for his love and  
support;  
Osman and feras for bringing so much  
happiness into my life,  
and for sleeping through the night before I  
did;  
My parents, for their sacrifices that  
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I am greatly indebted to my thesis advisors for their guidance and encouragement.  
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## **Abstract**

The prone position can be used for the planning of adjuvant radiotherapy after conservative breast surgery in order to deliver less irradiation to lung and cardiac tissue. In the present study, we compared the results of three-dimensional conformal radiotherapy planning for 15 patients irradiated in the supine and prone position used compared. Tumor stage was T2N0M0 in group of patients and T2N1M0 in other. All patients had been previously submitted to conservative breast surgery. Breast size was large in 15 patients and moderate in 10 and small in 5. Planning in the prone position was performed using an immobilization foam pad with a hole cut into it to accommodate the breast so that it would hang down away from the chest wall. Dose-volume histograms showed that mean irradiation doses reaching the ipsilateral lung were  $(8.3 \pm 3.6)$  Gy with the patient in the supine position and  $(1.4 \pm 1.0)$  Gy with the patient in the prone position. The values for the contra lateral lung were  $(1.3 \pm 0.7)$  Gy in supine and  $(0.3 \pm 0.1)$  Gy in prone and the values for cardiac tissue were  $(4.6 \pm 1.6)$  in supine and  $(3.0 \pm 1.7)$  Gy in prone, respectively. Thus, the dose-volume histograms demonstrated that lung tissue irradiation was lower with the patient in the prone position than in the supine position. Large-breasted women appeared to benefit most from irradiation in the prone position. Prone position breast irradiation appears to be a simple and effective alternative to the conventional supine position for patients with large breasts, since they are subjected to lower pulmonary doses which may cause less pulmonary side effects in the future.

## الخلاصة:

الوضع البطني يُمكنُ أَنْ يُستعملَ لتخطيط علاج بالأشعة بعد جراحة الثدي الجزئية لكي نعطي أقل جرعه إلى الرئة والنسيج القلبي. أجريت الدراسة في المركز القومي للعلاج بالأشعة والطب النووي في الفترة ما بين يوليو الي سبتمبر 2009 تمت مقارنه نتائج العلاج بالأشعة الثلاثي الأبعاد بتخطيط خمسة عشر مريض خطط وعولج افتراضيا في الموقع المنبطح والوضع البطني. مرحلة الورم كانت T2N0MO في مجموعة المرضى وT2N1M0 في آخرين كل المرضى كانوا قد أجروا جراحة صدر جزئية سابقاً. حجم صدر كان كبير في 8 مريض ومعتدل في 5 وصغير في 2. التخطيط في الوضع البطني بواسطة استعمال ملحق خاص به فتحة قطعت فيه لإسكان الصدر لكي يتدلى بعيداً عن حائط الصدر. مدرج حجم جرعة الإحصائي يظهر ان جرعة الاشعه المتوسطة التي تصل للرئة المجاوره للثدي المصاب مع المريض في الموقع المنبطح  $= 3.6 \pm 8.3$  وحدة بينما تساوي  $= 1.0 \pm 1.4$  وحدة مع المريض في الوضع البطني, القيم الخاصه بالرئة المقابله للثدي المصاب  $= 0.7 \pm 1.3$  وحدة في الوضع المنبطح بينما  $0.1 \pm 0.3$  وحدة في الوضع البطني, القيم الخاصه بالنسيج القلبي  $= 1.6 \pm 4.6$  وحدة في الوضع المنبطح و  $1.7 \pm 3.0$  وحدة في الوضع البطني على التوالي, هكذا بين مدرج حجم الجرعه الاحصائي بان الجرعه الممتصه في النسيج الرئوي المجاور كانت اقل بكثير في الوضع البطني منه في الوضع المنبطح, بالاخص في المريضات ذوات الصدور الممتله والكبيرة نسبيا حيث اظهرت الدراسة انه من الافضل علاجهم في الوضع البطني لما في ذلك من تقليل للجرعة الواصلة للرئة مما يقلل الآثار الرئوية الجانبية في المستقبل .

## List of Abbreviations

<b>AP</b>	Anterior-Posterior direction
<b>BCSS</b>	Breast cancer-specific survival
<b>Ca</b>	Cancer; carcinoma
<b>CT</b>	Chemotherapy
<b>CTV</b>	Clinical target volume
<b>CTV</b>	Clinical Tumor Volume
<b>CLD</b>	Central Lung distance
<b>DVH</b>	Dose Volume Histogram
<b>DWH</b>	Dose Wall Histogram
<b>FS</b>	Field Size
<b>GTV</b>	Gross target volume
<b>Gy</b>	Grays (units of radiation)
<b>HDT</b>	High-dose therapy
<b>ITV</b>	Internal target volume
<b>IMRT</b>	Intensity Modulated Radiation Therapy
<b>IPTV</b>	Internal Planning Target Volume
<b>ICRU</b>	International Commission on Radiation Units
<b>IBV</b>	Ipsilateral breast volume
<b>IM</b>	Internal Margin
<b>LN</b>	Lymph Node
<b>Lx</b>	Lumpectomy
<b>M</b>	Metastases
<b>MTD</b>	Maximum tolerated dose

<b>MHD</b>	maximum heart distance
<b>N</b>	Regional lymph nodes
<b>PTV</b>	Planning Target Volume
<b>RTOG</b>	Radiation Therapy Oncology Group grading system
<b>SM</b>	Setup Margin
<b>T</b>	Primary tumor
<b>TPS</b>	Treatment Planning System
<b>TV</b>	Target volume
<b>TBI</b>	Total body irradiation



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# Symbols

D mean	Mean treatment dose
MLD	Maximum lung dose
T	Total time of treatment (days)
$\Delta\lambda$	photon wavelength
$\lambda_c$	Compton wavelength of the electron
$E_K$	kinetic energy
LET	Linear energy transfer
N <sub>j</sub>	Number of portal images
N <sub>pat</sub>	Number of patients in a particular study
N <sub>z</sub>	Number of slices in CT image set
3DCRT	Three dimensional conformal radiotherapy
Z	Atomic number
q	Scattering angle
H <sub>2</sub> O <sup>+</sup>	water ion