

2 Dimensional Versus 3 Dimensional Radiation Therapy in the Management of Operable Left Breast Cancer

A Thesis Submitted in the Partial Fulfillment of M. D. Degree in
Radiotherapy and Clinical Oncology

By

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Under supervision of

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الملخص العربي

هذه دراسة استقصائية عشوائية إكلينيكية تم إجراؤها في مركز قصر العيني لعلاج الأورام والطب النووي (نمروك) في الفترة من نوفمبر 2004 حتى فبراير 2008 على ستين مريضة بسرطان الثدي الأيسر. تم متابعة المرض فترة تتراوح من 3-39 شهراً مع فترة الوسط 29.5 شهرو متوسط 26.30 ± 12.777 شهر. تم تخطيط كل مريضة في هذه الدراسة بخطة علاج إشعاعي ثنائي وثلاثي الأبعاد وقبل بدء الجلسات تم تطبيق أحدهما على المريضة بصورة عشوائية إلى:

المجموعة (أ) عولجت حسب خطة الإشعاع ثنائية الأبعاد.

والمجموعة (ب) عولجت حسب خطة الإشعاع ثلاثية الأبعاد.

في الدراسة التخطيطية قمنا بمقارنة 60 خطة علاج قائمة على مقطع واحد للأشعة المقطعية (ثنائية الأبعاد) مع 60 خطة علاج ثلاثية الأبعاد من حيث معلومات الجرعة / الحجم .

في الدراسة الإكلينيكية قارنا بين نتائج الثلاثين مريضة بالمجموعة (أ) بالثلاثين مريضة بالمجموعة (ب) من حيث الارتجاع الموضعي والليمفاوي، حياة المرضى، السمية الناتجة عن الإشعاع تبين لنا أن المجموعتين كانتا متساويتين في معظم المتغيرات الباثولوجية والإكلينيكية وكذلك مقاييس الجسم ووظائف الأعضاء في البداية.

أكدت الدراسة التخطيطية عدم وجود فرق واضح إحصائياً بين التقنيتين من حيث تجانس الجرعة وتغطية الثدي الأيسر (بعد العمليات التحفظية) أو جدار الصدر (بعد العمليات الاستئصالية) أو في الغدد فوق الترقوة.

توجد أفضلية لتقنية العلاج الإشعاعي ثلاثي الأبعاد في تجانس الجرعة وتغطية الغدد اللبنية الداخلية وكان أهم نتائج الدراسة التخطيطية أفضلية تقنية العلاج الإشعاعي ثلاثي الأبعاد في حماية الرئة اليسرى من تلقي جرعة 20 جراي أو أكثر (ح 20 جراي).

لم نجد فرقاً في الدراسة التخطيطية بين التقنيتين بالنسبة للمجموعة الداخلية التي تلقت علاج إشعاعي للغدد فوق الترقوة أو الغدد اللبنية الداخلية .

أما عن نتائج الدراسة الإكلينيكية فقد أكدت عدم وجود فرق في الارتجاع الموضعي والليمفاوي وكذلك حياة المرضى، كذلك لم نجد فرقاً في السمية الناتجة عن العلاج الإشعاعي بين المجموعتين حسب قياس مجموعة العلاج الإشعاعي وعلم علاج الأورام ولكن وجدنا فرقاً طفيفاً ولكنه واضح إحصائياً في درجة انخفاض نسبة ضخ القلب عندما تم قياسه بالنظائر المشعة لصالح العلاج الإشعاعي ثلاثي الأبعاد.

لم نجد فرقاً في الشكل الجمالي بين المجموعتين.

كذلك مثل ما حدث في الدراسة التخطيطية فلم نجد فرقاً في الدراسة الإكلينيكية للمجموعات الداخلية التي تلقت علاجاً إشعاعياً على الغدد فوق الترقوة والغدد اللبنية الداخلية.

مقارنة العلاج الأشعاعى ثنائى الأبعاد و ثلاثى الأبعاد فى العلاج الأشعاعى للأورام الخبيثه للثدى الأيسر

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ABSTRACT

INTRODUCTION:- Postoperative radiotherapy in the management of breast cancer has been proven effective in reducing local and distant recurrence but survival advantage may be limited by increased non- cancer related mortality which may be attributed to radiation doses received by risk structures. 3D-Conformal Radiotherapy (3D-CRT) may reduce these unwanted irradiation & consequently may improve quality of life &/or survival.

AIM OF WORK:- to compare between 2D & 3D-Conformal Radiotherapy(3D-CRT) in the postoperative management of left breast cancer following mastectomy or breast conservative surgery considering homogeneity of the dose distribution inside the target volume(s)& doses received by surrounding risk structures specially the heart& the left lung. Also to compare clinical outcome considering tumor control, survival & toxicity for both techniques.

PATIENS & METODS:- 60 Patients with left sided breast cancer have been planned with both 2D & 3D-Conformal Radiotherapy(3D-CRT). In the planning study both planes have been compared considering V45Gy, V40Gy, Dmax.,Dmin.,D90%&TCP for Planning Target Volumes(PTVs) &different doses received by Risk Organs (RO)e.g V20Gy for left lung & V40Gy heart have been compared between both plans in addition to the calculated Normal Tissue Complication Probability according to *Burman* model & Tumor Control Probability (TCP) according to *Nahum &Tait* model. In the clinical study, group A treated based on the 2D plans was compared to group B treated based on the 3D-CRT plans considering local control, survival & toxicity according to RTOG toxicity criteria. We estimated the excess relative risk of right breast cancer incidence (EERRRBCI) for both techniques from the curve by *Hall, 2006*.

Subgroups analyses for patients received supraclavicular& internal mammary nodes(SCLN&IMN) have been carried out.

RESULTS: - In the planning study, the significant differences observed between 2D &3D-CRT were better V20Gy D50% & NTCP for left lung in the 3D-CRT (20.18±5.67% for 2D vs 18.22±5.289%-p=0.031, 189±106 for 2D vs 149±78cGy-p=0.03 & 0.747±0.5169% for 2D vs0.5893±1.58203%-p=0.014), better IMN coverage in the 3D-CRT (V45Gy=76.47±20.195% for 2D vs 89±8.856%-p=0.036, V40Gy=84.47±21.28% for 2D vs98.13±1.727%-p=0.005, D90%=3948±1178cGy for 2D vs 4665±365 cGy-p=0.019, Dmin.= 3259±1874cGy for 2D vs 4499±416cGy-p=0.036& TCP = 59.85 ± 4.9 % for 2D v s 75.9± 1.9% for 3DCRT, p=0.003) & better D50% for the heart(119±50 cGy for 2D vs 102±41 cGy-p=0.033) EERRRBCI was estimated to be better in the 3DCRT(1.68 ± 0.815 %) than in the 2D, but the difference was of no ststetical significant difference(p= 0.599)

In the clinical study, in a median follow-up of 29.5 months, no significant difference were detected in local recurrence (3.3% for both arms- $p=1.0$), disease free, overall survival or toxicity according to RTOG toxicity criteria. Only small but significant less reduction of cardiac Ejection Fraction (EF) as measured by isotopic scanning ($5.127\pm 4.8839\%$ for 2D vs $2.363\pm 4.7562\%$ - $p=0.013$).

No positive data resulted from the subgroup analyses in the clinical or planning studies apart from the previously mentioned better IMN coverage in the 3D-CRT .

CONCLUSION:- 3D-CRT provided better sparing of the left lung in the pot-operative radiotherapy of left breast cancer following mastectomy or breast conservative surgery from receiving higher radiation dose with only small but significant less reduction of cardiac Ejection Fraction (EF) as measured by isotopic scanning in favor of 3D-CRT during this short follow-up period. Patients with Internal Mammary Nodes (IMN) irradiation have a much benefit from 3D-CRT in coverage of the IMN but this did not improve toxic dose to lung & heart which is a difficult planning problem and may necessities further investigation by newer techniques like IMRT. We recommend using 3D-CRT whenever possible in pot-operative radiotherapy of left breast cancer following mastectomy or breast conservative surgery specially when IMN irradiation is needed.

KEY WORDS:-conformal radiotherapy, left breast.

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Mohammed Abdelrahman Hassan

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