

A Short Report

Radiotherapy Treats a Greater Volume than Surgery Using an Axillary Sentinel Node Model

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Abstract: Radiotherapy and surgery are local treatments and can be compared in randomized trials. Recent examples have compared axillary radiotherapy to completion lymphadenectomy surgery for sentinel lymph node positive breast cancer and have shown radiotherapy was non-inferior in terms of regional control, but was also significantly less morbid. A superficial reading of these studies may miss an important consideration, the volume of the axilla actually being treated by the different modalities. We conducted this study to compare the difference in planned axillary treatment volumes undergoing axillary lymph node dissection as compared to axillary radiotherapy.

Keywords: Breast neoplasm, General surgery, Radiotherapy, Sentinel lymph node biopsy, Axilla, Local control, Regional control.

Introduction

Radiotherapy (RT) and surgery (Sx) are local treatments and can be compared in randomized trials. With drastic improvements in RT such as the emergence of Volumetric Modulated Arc Therapy (VMAT), RT offers a safe alternative to Sx due to its conformity and reduced dosage [5]. Recent studies have compared axillary RT to completion lymphadenectomy Sx for sentinel lymph node positive (SLN+) breast cancer. Sentinel lymph node biopsy (SLNB) allows pathological staging of the clinically negative axilla. The Z0011 randomized controlled trial (RCT) in 891 patients with T1-T2 breast cancer with 1 to 2 sentinel lymph node positive (SLN+) compared completion axillary lymphadenectomy (ALND) with observation [3]. All patients underwent lumpectomy and tangential whole-breast RT. The trial showed that observation was not inferior to further ALND. Discussion afterwards suggested that the RT tangents may have incidentally sterilized any remaining regional disease.

Should the SLN+ axilla be specifically treated? The AMAROS trial was designed to answer this question. This RCT compared axillary RT to ALND in 1425 T1-2 primary breast cancer patients with SLN+ axillas. With a median follow-up of 6.1 years, the trial showed that RT was non-inferior in terms of regional control, but was significantly less morbid [1].

A superficial reading of these studies may miss an important consideration, the volume of the axilla actually being treated by the different modalities. We conducted this study in order to see whether there was a difference in treatment volumes.

Materials and methods

Ten consecutive post-operative patients with T1-2 breast cancer who required RT planning were simulated on a GE Light Speed CT Scanner for RT in the usual treatment position, with arms above the head on a breast board (CIVCO; Iowa, USA). Acquired scans were loaded into Eclipse planning system version 8.6 (Varian; Palo Alto, USA) for volume contouring. A breast surgeon (BS) (AW), and a radiation oncologist (RO) (RSA) with a subspecialty in breast RT, then contoured the Sx and RT volumes, without knowledge of each other's contours, using the contouring tools of free brush, pencil and the paintbrush. The contoured volumes for Sx and RT are shown in Fig. 1.

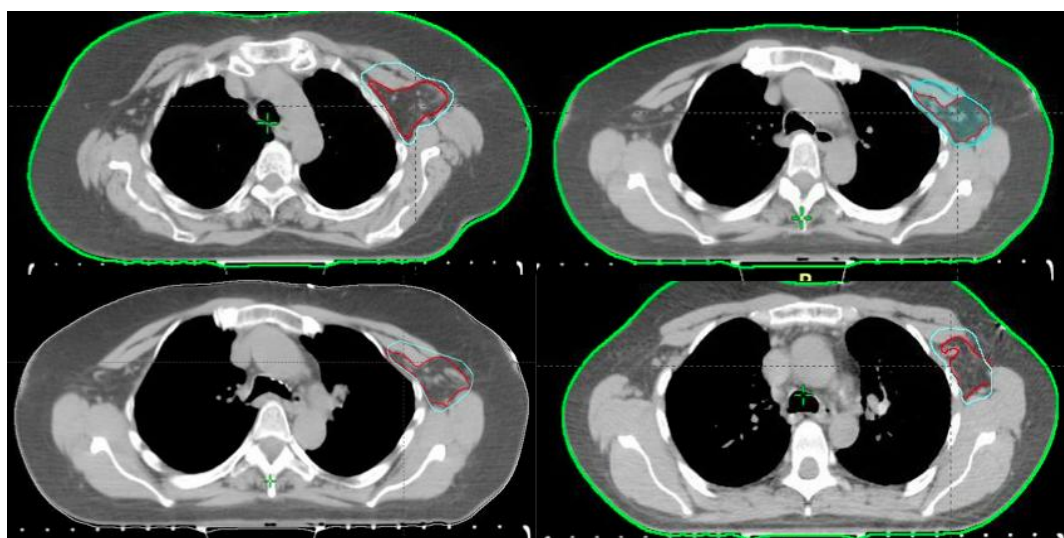


Fig. 1 Axial planning computer image demonstrating the contouring of the axilla by a radiation oncologist (green) and a breast surgeon (red). Note the difference in the treatment volume.

BS contoured according to her interpretation of the volumes detailed in McMinn (2003) [4]. The RO contoured according to Radiation Therapy Oncology group (RTOG) breast cancer atlas for radiation therapy planning [6] and axillary volumes published for other cancers [2]. The RO and BS axillary volumes were calculated in cubic centimetres (cc) using the volume tools of the software, and compared using the Wilcoxon Signed Rank Test. A p -value less than 0.05 was considered statistically significant.

Results and discussion

The planned median surgical volume was 44.5 cc (range 24-94) and median radiotherapy volume was 78.5 cc (range 47-167) (Table 1). The planned RO treatment volumes were significantly greater than the BS volumes ($z = -2.8, p = 0.005$).

Table 1. Comparison between planned surgical and radiotherapy volumes of the Axilla in ten patients

Patient number	Surgical volume, (cc)	Radiotherapy volume, (cc)
1	49	78
2	29.7	67.3
3	40	79
4	39.7	74.3
5	24	47
6	56	99
7	75	94
8	72	167
9	24	51
10	94	143
Median volume	44.5	78.5

Our study showed a significant difference in the planned treatment volumes between RT and Sx in ten consecutive post-operative patients with T1-2 breast cancer. The BS would treat a median volume of 44.5 cc, the RO a median volume of 78.5 cc ($p = 0.005$).

RT treats a significantly greater volume, yet the results of Donker et al. [1] shows that, despite this bigger volume, the side effects, especially lymphedema, are less with RT alone than with Sx alone. The studies showed that RT was non – inferior to Sx with oncological outcomes. Given the volume treated was almost doubled, the scene is set to study whether RT is superior.

Conclusion

This short report confirmed that there is a significant difference in the axillary volumes planned to be treated by a BS as compared to a RO in ten consecutive post-operative patients with T1-2 breast cancer. The median Sx volume was defined at 44.5 cc (range 24-94). The median RT volume was 78.5 cc (range 47-167) ($p = 0.005$). The RT volume is more than 1.75 times than the Sx volume. This fact may need to be taken into account in any future studies.

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Competing interests

There are no significant competing personal, professional or financial interests.

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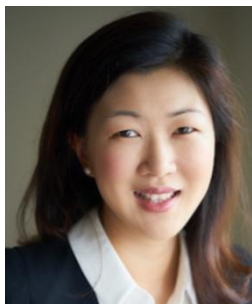
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