

***Indicazioni e limiti della radioterapia in  
posizione prona***

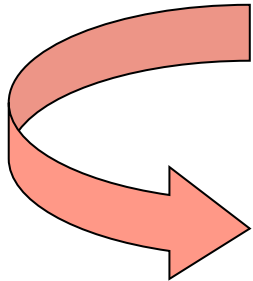


## POSIZIONE SUPINA

Risultati consolidati nel tempo

Problematiche legate a mammelle voluminose e pendule:

- Dislocazione laterale e inferiore
- Accentuazione piega cutanea
- Eccessivo volume polmonare e cardiaco in alcuni casi
- Profilo esteso oltre le dimensioni della TC



Int. J. Radiation Oncology Biol. Phys., Vol. 30, No. 1, pp. 197-203, 1994

### PRONE POSITION BREAST IRRADIATION

THOMAS E. MERCHANT, D.O., PH.D. AND BERYL MCCORMICK, M.D.

Department of Radiation Oncology, Memorial Sloan-Kettering Cancer Center, 1275 York Ave., New York, NY 10021

1994

Int. J. Radiation Oncology Biol. Phys., Vol. 40, No. 5, pp. 1137-1140, 1998

#### ● *Clinical Investigation*

### USE OF THE PRONE POSITION IN RADIATION TREATMENT FOR WOMEN WITH EARLY STAGE BREAST CANCER

ÖZER ALGAN, M.D., BARBARA FOWBLE, M.D., SHAWN MCNEELEY, B.S. AND DOUGLAS FEIN, M.D.

Department of Radiation Oncology, Fox Chase Cancer Center, Philadelphia, PA

1998

## POSIZIONE PRONA

Adatta per mammelle voluminose e pendule:

- Riduzione piega cutanea
- Minimizza il solco fra le mammelle
- Sproietta la mammella dalla parete
- Potenziale riduzione dose polmone e cuore (patologie cardio-polmonari)
- Minimizza movimenti respiratori
- Adatta in pz che non riescono a mantenere la posizione supina

## Esperienze dei singoli centri

PROs

CONs

**LONG-TERM CLINICAL OUTCOMES OF WHOLE-BREAST IRRADIATION  
DELIVERED IN THE PRONE POSITION**

LAUREN D. STEGMAN, M.D., Ph.D.,\* KATHERINE P. BEAL, M.D.,\* MARGIE A. HUNT, M.S.,†  
MONICA N. FORNIER, M.D.,‡ AND BERYL McCORMICK, M.D.\*

\*Departments of Radiation Oncology, †Medical Physics, and ‡Breast Cancer Medicine Service, Department of Medicine, Memorial Sloan-Kettering Cancer Center, New York, NY

- **1992 - 2004: 245 pz**
- **3D-CRT**

Mediana FU: 4.9 anni

- Recidive mammella 5.5%
- Recidive regionali linf 1.2%
- Tossicità acuta > G2 2.0%
- Tossicità cronica > G2 1.6%

**Conclusions: Prone position breast radiation results in similar long-term disease control with a favorable toxicity profile compared with standard supine tangents. The anatomic advantages of prone positioning may contribute to improving the therapeutic ratio of post-lumpectomy radiation by improving dose homogeneity and minimizing incidental cardiac and lung dose. © 2007 Elsevier Inc.**

JCO, 2007

## Phase I-II Trial of Prone Accelerated Intensity Modulated Radiation Therapy to the Breast to Optimally Spare Normal Tissue

Silvia C. Formenti, Daniela Gidea-Addeo, Judith D. Goldberg, Daniel F. Roses, Amber Guth, Barry S. Rosenstein, and Keith J. DeWyngaert

- 91 pz
- WBI :40.5 Gy (2.7 Gy)+Boost Integrato: 48 Gy (3.2 Gy)/15 fraz
- < 5% cuore dose > 18 Gy
- < 10% polmone dose > 20 Gy
- Mediana FU: 1 anno
- Recidiva mammella 1%
- Tossicità acuta > G2 0.9%
- Tossicità cronica > G2 0%

### Conclusion

Accelerated whole breast intensity modulated radiotherapy in the prone position is feasible and it permits a drastic reduction in the volume of lung and heart tissue exposed to significant radiation.

IJROBP, 2009

### CLINICAL INVESTIGATION

#### INDIVIDUAL POSITIONING: A COMPARATIVE STUDY OF ADJUVANT BREAST RADIOTHERAPY IN THE PRONE VERSUS SUPINE POSITION

ZOLTÁN VARGA, KATALIN HIDEGHÉTY, M.D., PH.D., TAMÁS MEZŐ, ALÉZ NIKOLÉNYI, M.D., LÁSZLÓ THURZÓ, M.D., PH.D., AND ZSUZSANNA KAHÁN, M.D., PH.D.

Department of Oncotherapy, University of Szeged, Szeged, Hungary

- 61 pz
- 3D-CRT
- MLD e  $V_{20Gy}$  (polmone) significativamente inferiori in posizione prona ( $p<0.0001$ )



**Prone Whole-Breast Irradiation Using Three-Dimensional Conformal Radiotherapy in Women Undergoing Breast Conservation for Early Disease Yields High Rates of Excellent to Good Cosmetic Outcomes in Patients with Large and/or Pendulous Breasts**

Carmen Bergom, M.D., Ph.D.,\* Tracy Kelly, M.D.,\* Natalya Morrow, Ph.D.,\*  
J. Frank Wilson, M.D.,\* Alonzo Walker, M.D.,<sup>†</sup> Qun Xiang, M.S.,<sup>‡</sup>  
Kwang Woo Ahn, Ph.D.,<sup>‡</sup> and Julia White, M.D.\*

Departments of \*Radiation Oncology and <sup>†</sup>Surgery and <sup>‡</sup>Division of Biostatistics, Medical College of Wisconsin, Milwaukee, WI

- 1996 - 2008: 110 pazienti
- BMI 33.6
- Volume medio mammelle 1396 cc
- 3D-CRT

- Tossicità acuta: G1-G2 nel 98% dei casi  
G3 nel 3% delle pz
- Tossicità tardiva: G1-G2 nell'11% dei casi  
G3 nel 2% delle pz
- Cosmesi giudicata buona nell'89% delle pz

Conclusioni: profilo di tossicità acuta e tardiva buona in una popolazione “a rischio”. Non significativa la correlazione fra BMI e tossicità → la posizione prona azzera il fattore BMI e volume mammella

## Pilot study of feasibility and dosimetric comparison of prone versus supine breast radiotherapy

E. Fernández-Lizarbe · A. Montero ·  
A. Polo · R. Hernanz · R. Morís · S. Formenti ·  
A. Ramos

- 10 pz (volume mammelle > 750 cc)
- Cfr dosimetrico supina vs prona 3D-CRT

**Table 4** Comparative analysis (Wilcoxon test) of dose homogeneity parameters for PTV, dose at OAR and number of radiation segments and MU (mean values  $\pm$  SD)

| Breast             |                     | Ipsilateral lung  |                    | Heart           |                   | Extramammary tissue | RT segments/<br>MU            |
|--------------------|---------------------|-------------------|--------------------|-----------------|-------------------|---------------------|-------------------------------|
| $D_{max}$          | $V_{95-107} \%$     | $V_{20Gy}$        | $D_{med\_lung}$    | $V_{35Gy}$      | $D_{med\_heart}$  | $V_{105} \%\_{est}$ |                               |
| Supine             |                     |                   |                    |                 |                   |                     |                               |
| $54.822 \pm 0.889$ | $88.174 \pm 10.217$ | $26.5 \pm 11.167$ | $13.588 \pm 5.130$ | $3.4 \pm 3.864$ | $4.688 \pm 3.132$ | $34.245 \pm 31.778$ | $5.3 \pm 2.05/296.5 \pm 92.3$ |
| Prone              |                     |                   |                    |                 |                   |                     |                               |
| $53.287 \pm 1.203$ | $90.923 \pm 7.185$  | $2.9 \pm 2.998$   | $3.070 \pm 2.525$  | $1.2 \pm 2.573$ | $2.783 \pm 1.810$ | $0.1 \pm 0.316$     | $4.1 \pm 1.5/268.8 \pm 99$    |
| $p = 0.017$        | $p = 0.114$         | $p = 0.005$       | $p = 0.005$        | $p = 0.066$     | $p = 0.047$       | $p = 0.012$         | $p = 0.042/p = 0.24$          |

•In qs setting di pazienti vantaggio dosimetrico su OAR, con copertura PTV analoga a trattamenti tradizionali

**Prone Hypofractionated Whole-Breast Radiotherapy Without a Boost to the Tumor Bed: Comparable Toxicity of IMRT Versus a 3D Conformal Technique**

Matthew E. Hardee, M.D., Ph.D.,\* Shahzad Raza, M.D.,\* Stewart J. Becker, Ph.D.,\* Gabor Jozsef, Ph.D.,\* Stella C. Lymberis, M.D.,\* Tsvia Hochman, M.Sc.,<sup>†</sup> Judith D. Goldberg, Ph.D.,<sup>†</sup> Keith J. DeWyngaert, Ph.D.,\* and Silvia C. Formenti, M.D.\*

\*Department of Radiation Oncology and <sup>†</sup>Division of Biostatistics, New York University School of Medicine, New York, NY

- 40 pz 3D-CRT (2.66 Gy/fr)
  - 57 pz IMRT (2.66 Gy/fr)
- Cfr dosimetrico e profilo tossicità**

**Table 3** Dosimetric analysis by breast size and treatment planning group

| Variable                                 | Large (≥1,500 cm <sup>3</sup> )<br>[median (range)] |                           | Medium (750–1,499 cm <sup>3</sup> )<br>[median (range)] |                           | Small (<750 cm <sup>3</sup> )<br>[median (range)] |                           |
|--|---|---------------------------|---|---------------------------|---|---------------------------|
|  | 3D-CRT<br>(n = 11)                                  | IMRT<br>(n = 16)          | 3D-CRT<br>(n = 15)                                      | IMRT<br>(n = 22)          | 3D-CRT<br>(n = 14)                                | IMRT<br>(n = 19)          |
| % Dmax                                   | 110.6 (106.8–113.9)                                 | 108.2 (104.6–114.9)       | 109.6 (108.2–112.7)                                     | 107.2 (105.5–110.3)       | 110.0 (106.1–111.1)                               | 107.2 (105.1–109.9)       |
| Breast dose                              |   |                           |   |                           |   |                           |
| Dmax (cGy)                               | 4,313.1 (3,997.0–4,888.8)                           | 4,342.2 (4,030.2–4,888.8) | 4,064.7 (3,720.6–4,130.8)                               | 4,386.3 (3,904.6–4,426.0) | 4,010.8 (3,633.8–4,112.4)                         | 4,385.1 (3,698.5–4,425.0) |
| Mean dose (cGy)                          | 4,122.3 (3,997.0–4,191.6)                           | 4,342.2 (4,030.2–4,395.6) | 4,064.7 (3,720.6–4,130.8)                               | 4,386.3 (3,904.6–4,426.0) | 4,010.8 (3,633.8–4,112.4)                         | 4,385.1 (3,698.5–4,425.0) |
| Homogeneity index                        | 1.14 (1.11–1.18)                                    | 1.06 (1.03–1.19)          | 1.15 (1.13–1.27)  | 1.04 (1.02–1.19)          | 1.17 (1.13–1.30)                                  | 1.05 (1.02–1.21)          |
| Heart dose                               |   |                           |   |                           |   |                           |
| In-field heart volume (cm <sup>3</sup> ) | 0 (0–0.18)  | 0 (0–2.54)                | 0 (0–1.92)  | 0 (0–2.49)                | 0 (0–3.12)  | 0.01 (0–1.67)             |
| V5 (cm <sup>3</sup> )                    | 0 (0–0.18)  | 0 (0–2.54)                | 0 (0–1.92)  | 0 (0–2.49)                | 0 (0–3.12)  | 0.01 (0–1.67)             |
| Dmax (cGy)                               | 237.1 (135.0–2,060.0)                               | 237.1 (135.0–2,060.0)     | 255.0 (135.0–2,060.0)                                   | 237.1 (135.0–2,060.0)     | 315.5 (143.5–4,182.7)                             | 1,198.0 (0–3,899.9)       |
| Lung dose                                |   |                           |   |                           |   |                           |
| In-field lung volume (cm <sup>3</sup> )  | 0 (0–0.66)  | 0 (0–1.63)                | 0 (0–23.5)  | 0 (0–23.9)                | 6.30 (0–47.2)                                     | 8.11 (0–64.7)             |
| V5 (cm <sup>3</sup> )                    | 0 (0–0.45)  | 0.02 (0–1.01)             | 0 (0–4.46)  | 0.24 (0–4.19)             | 0.40 (0–5.42)                                     | 1.51 (0–5.97)             |
| Dmax (cGy)                               | 507.0 (255.4–2,949.0)                               | 828.2 (155.0–3,960.6)     | 560.0 (111.8–4,258.3)                                   | 2,283.6 (212.0–4,295.0)   | 3,390.1 (167.0–4,461.0)                           | 4,224.0 (110.0–4,403.2)   |

**Vantaggio dosimetrico (↓ dose max cuore) se volume > 1500 cc**  
**Profili di tossicità analoghi**

Abbreviations: 3D-CRT = three-dimensional conformal radiotherapy; IMRT = intensity-modulated radiotherapy.



## Prone Breast Intensity Modulated Radiation Therapy: 5-Year Results

Etin-Osa O. Osa, MD,\* Keith DeWyngaert, PhD,\* Daniel Roses, MD,<sup>†</sup> James Speyer, MD,<sup>‡</sup> Amber Guth, MD,<sup>‡</sup> Deborah Axelrod, MD,<sup>‡</sup> Maria Fenton Kerimian, NP,\* Judith D. Goldberg, ScD,<sup>§</sup> and Silvia C. Formenti, MD\*

Departments of \*Radiation Oncology, <sup>†</sup>Surgery, <sup>‡</sup>Medical Oncology, and <sup>§</sup>Population Health, New York University School of Medicine, New York, New York

- 2003-2006: 404 pazienti
- IMRT e valutazione ipofrazionamento (2,66 Gy/fr)
- Solo 32 pz trattate supine (DVH sfavorevoli)

**Table 2** Volumes of heart and lung for patients treated prone

| Breast volume (cm <sup>3</sup> ) | Right breast |  | Left breast |  |   |
|----------------------------------|--------------|--|-------------|--|---|
|                                  | n            | In-field lung volume (cm <sup>3</sup> ), mean (95% CI) | n           | In-field lung volume (cm <sup>3</sup> ), mean (95% CI) | In-field heart volume (cm <sup>3</sup> ), mean (95% CI) |
| <750                             | 81           | 26.19 (19.78-30.35)                                    | 68          | 16.62 (9.18-24.07)                                     | 3.00 (1.74-4.26)  |
| 750-1500                         | 85           | 18.68 (12.52-24.84)                                    | 72          | 2.92 (1.48-4.35)                                       | 1.29 (0.40-2.17)  |
| >1500                            | 29           | 8.24 (1.63-14.86)                                      | 38          | 2.27 (-0.98 to 5.52)                                   | 0.57 (-0.20 to 1.34)                                    |
| Total                            | 195          | 20.25 (16.25-24.25)                                    | 178         | 8.01 (4.87-11.16)                                      | 1.79 (1.15-2.43)  |

Abbreviation: CI = confidence interval.

Conclusioni: IMRT ipofrazionata è fattibile nel trattamento della mammella prona con eccellente LC e ottimo risparmio OAR (aggiornamento lavoro del 2007).

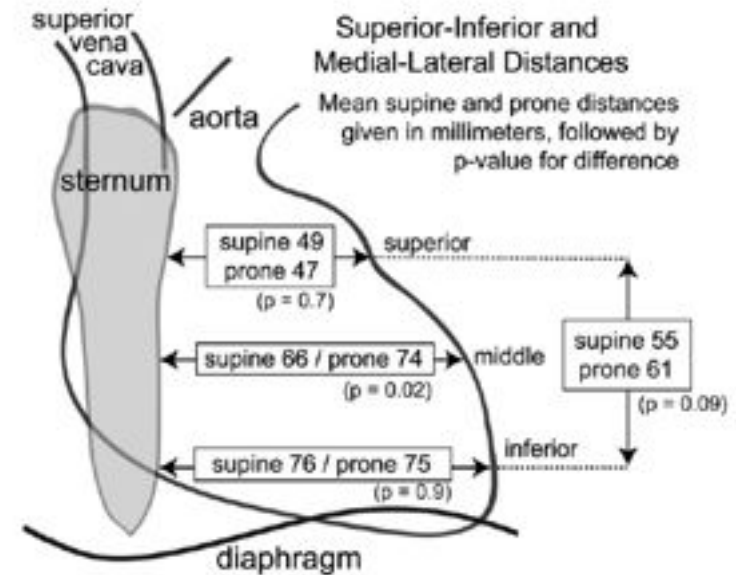
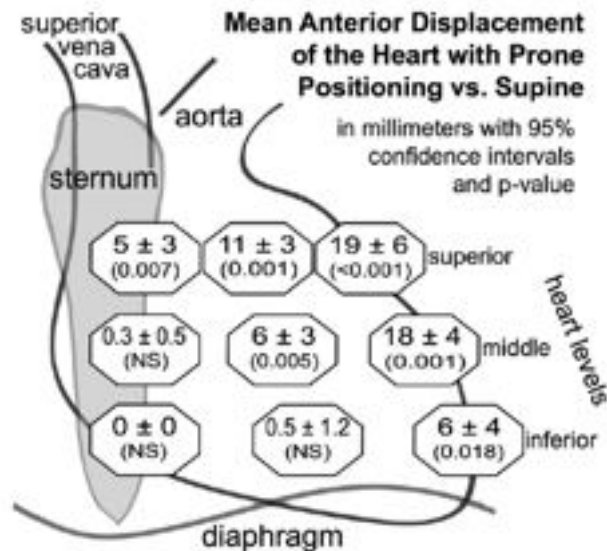
No valutazioni dosimetriche

**PRONE POSITIONING CAUSES THE HEART TO BE DISPLACED ANTERIORLY WITHIN THE THORAX: IMPLICATIONS FOR BREAST CANCER TREATMENT**

Int. J. Radiation Oncology Biol. Phys., Vol. 70, No. 3, pp. 916–920, 2008

JUNZO P. CHINO, M.D., AND LAWRENCE B. MARKS, M.D.

Department of Radiation Oncology, Duke University Medical Center, Durham, NC

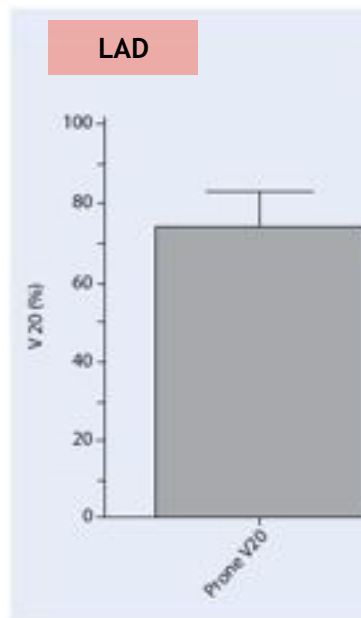


Le porzioni superiori e laterali del cuore tendono a spostarsi maggiormente in posizione prona. Riduzione del vantaggio dosimetrico per npl localizzate in profondità o qualora dobbiamo irradiare parete toracica

## Incidental dose to coronary arteries is high supine whole breast

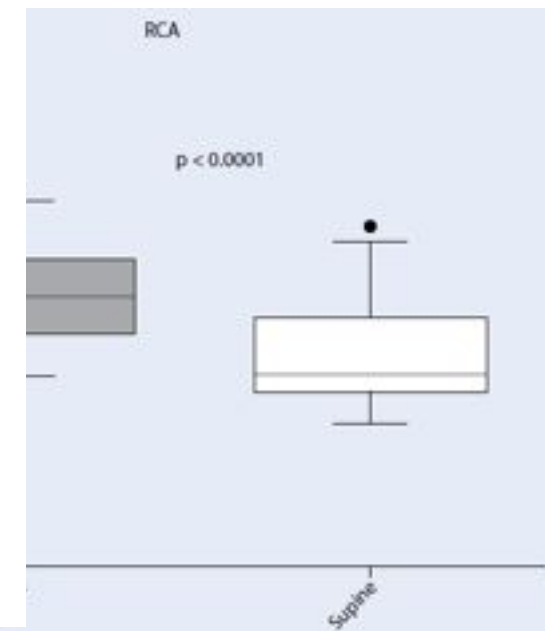
### Conclusion

The incidental dose to the coronary arteries especially the LAD can be significantly higher in prone compared to supine whole breast irradiation. This is discussed controversially in the literature as other groups found lower LAD and heart doses in prone WBI. The differences could be due to different contouring and treatment techniques necessitating evaluation of alternatives, e.g., IMRT and/or deep breath hold techniques. We recommend contouring of the coronary arteries (LAD) for plan evaluation of prone WBI.



- analisi retrospettiva

• analisi retrospettiva  
• pendule  
• medio mammelle 1804 cc  
• posizione prona e supina



# Prone left-sided whole-breast irradiation: Significant heart dose reduction using end-inspiratory versus end-expiratory gating

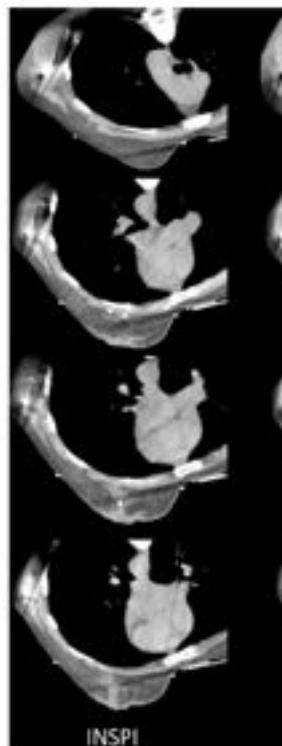
T. Mulliez<sup>a,\*,b,1</sup>, B. Speleers<sup>a,1</sup>, K. Mahjoubi<sup>b</sup>, V. Remouchamps<sup>b</sup>, M. Gilsoul<sup>b</sup>, L. Veldeman<sup>a</sup>, R. Van den Broecke<sup>c</sup>, W. De Neve<sup>a</sup>

<sup>a</sup> Department of radiotherapy, Ghent university hospital, 9000 Ghent, Belgium

<sup>b</sup> Department of radiotherapy, Clinique et maternité Sainte-Élisabeth, Namur, Belgium

<sup>c</sup> Department of gynaecology, Ghent university hospital, Ghent, Belgium

- 20 pz irradiate per neoplasia della mammella in posizione prona
- TC di simulazione
  - End-inspiratory phase
  - End-expiratory phase



|   | P <sub>T<sub>EX</sub></sub> | P <sub>T<sub>IN</sub></sub> | P value |
|---|-----------------------------|-----------------------------|---------|
| <i>PTV<sub>optim</sub></i>                      |                             |                             |         |
| Homogeneity                                     | 0.90 ± 0.02                 | 0.89 ± 0.02                 | 0.2     |
| D <sub>max</sub> (Gy)                           | 42.0 ± 0.5                  | 42.2 ± 0.5                  | 0.5     |
| <i>Heart</i>                                    |                             |                             |         |
| D <sub>mean</sub> (Gy)                          | 2.5 ± 0.8                   | 1.3 ± 0.4                   | <0.001  |
| D <sub>max</sub> (Gy)                           | 21.4 ± 9.8                  | 6.2 ± 4.7                   | <0.001  |
| V <sub>5</sub> (%)                              | 8.0 ± 3.7                   | 2.1 ± 1.9                   | <0.001  |
| V <sub>10</sub> (%)                             | 5.2 ± 3.0                   | 1.0 ± 1.1                   | <0.001  |
| <i>Left anterior descending coronary artery</i> |                             |                             |         |
| D <sub>mean</sub> (Gy)                          | 10.2 ± 4.4                  | 3.9 ± 2.5                   | <0.001  |
| D <sub>max</sub> (Gy)                           | 31.5 ± 6.3                  | 14.0 ± 11.1                 | <0.001  |
| <i>Ipsilateral lung</i>                         |                             |                             |         |
| D <sub>mean</sub> (Gy)                          | 1.0 ± 0.4                   | 0.9 ± 0.4                   | 0.3     |
| D <sub>max</sub> (Gy)                           | 8.2 ± 5.9                   | 7.5 ± 5.4                   | 0.5     |
| V <sub>5</sub> (%)                              | 2.7 ± 1.9                   | 2.7 ± 1.9                   | 0.7     |
| V <sub>10</sub> (%)                             | 1.5 ± 1.3                   | 1.4 ± 1.2                   | 0.9     |





# Radiation dose to the nodal regions during prone versus supine breast irradiation

- 100 pz trattate con 3D-CRT
- Ricontornate retrospettivamente le stazioni lfn

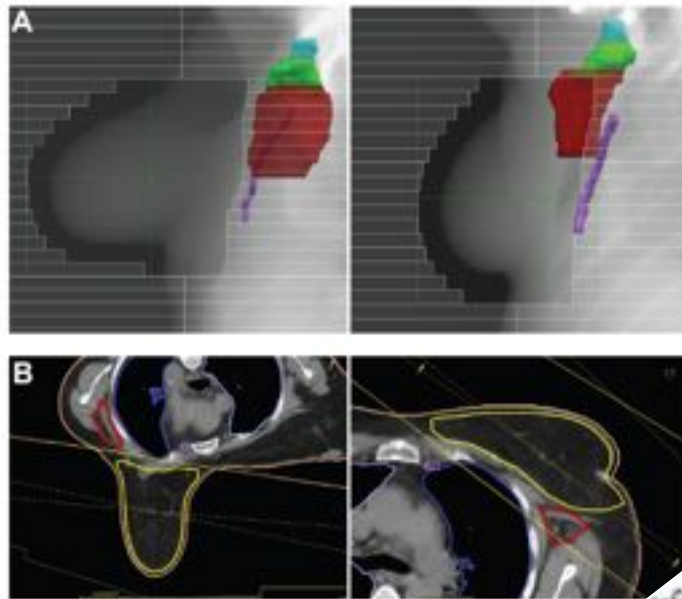


Figure 1 (A and B) Left-sided whole-breast irradiation. (A) Beam's eye view of the right anterior oblique field, with 3-D reconstruction of axillary and internal mammary lymph-node regions in the prone and supine field arrangements and their relation to the node regions

Table 1 Volumes of the irradiated breast (PTV) and lymph-node regions in the prone and supine positions

| Volumes   | Prone (mean ± SE, mm <sup>3</sup> ) | Supine (mean ± SE, mm <sup>3</sup> ) |
|-----------|-------------------------------------|--------------------------------------|
| PTV       | 971.6±44.0                          | 967.1±44.0                           |
| Level I   | 61.6±2.0                            | 61.6±2.0                             |
| Level II  | 14.2±0.4                            | 14.2±0.4                             |
| Level III | 6.0±0.2                             | 6.0±0.2                              |
| IM        | 4.7±0.1                             | 4.7±0.1                              |

Table 2 Mean radiation dose to the axillary and IM lymph nodes during breast radiotherapy in the prone and supine positions

| Volume    | Prone (mean ± SE) (range) | Supine (mean ± SE) (range) | P (paired t-test) |
|-----------|---------------------------|----------------------------|-------------------|
| PTV       | 37.7±0.7 (18.6–50.5)      | 37.7±0.7 (18.6–50.5)       | <0.001            |
| Level I   | 13.8±0.1 (0.7–45.8)       | 13.8±0.1 (0.7–45.8)        | <0.001            |
| Level II  | 1.6±0.2 (0.3–12.6)        | 1.6±0.2 (0.3–12.6)         | <0.001            |
| Level III | 15.3±6.2 (2.6–38.7)       | 15.3±6.2 (2.6–38.7)        | <0.001            |
| IM        | 10.6 (1.4–48.9)           | 10.6 (1.4–48.9)            | <0.001            |

**Conclusion:** The radiation dose to the axillary and IM lymph nodes during breast radiotherapy is therapeutically insufficient in most cases, and is significantly lower in the prone position than in the supine position.

Attention should be paid to the specific targeting of lymph-node areas if this is clinically necessary.

# La nostra esperienza

Krengli et al. Radiation Oncology 2013, 8:232  
<http://www.ro-journal.com/content/8/1/232>



RESEARCH

Open Access

## Prone versus supine position for adjuvant breast radiotherapy: a prospective study in patients with pendulous breasts

Marco Krengli<sup>1,3\*</sup>, Laura Masini<sup>1</sup>, Tina Caltavuturo<sup>1</sup>, Carla Pisani<sup>1</sup>, Giuseppina Apicella<sup>1</sup>, Eleonora Negri<sup>2</sup>,  
Letizia Deantonio<sup>1,3</sup>, Marco Brambilla<sup>2</sup> and Giuseppina Gambaro<sup>1</sup>

Valutazione per RT in posizione prona

55 donne con mammelle voluminose e pendule

Criteri di inclusione:

- Presenza solco infra-mammario in posizione supina
- Fattibilità TC

La paziente sarà in grado di mantenere la posizione prona?

BMI

Compliance

41 pazienti inserite nello studio

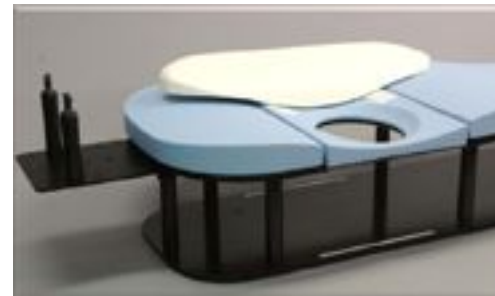
**Tutte le pazienti hanno eseguito simulazione TC in posizione prona e supina**

**Sistema posizione supina: breast board  
CIVCO, Kalona, USA**



**Durata: 20'**

**Sistema posizione prona: Clear Vue  
Orbital Therapy, Bedford, USA**



**Durata: 40'**

**Scansione TC all'isocentro per valutare simmetria prima di TC simulazione**

**TC con scansioni contigue a 5 mm comprendente tutto il volume mammario e il volume polmonare con ampio margine**



| Characteristics              | Parameters                                      | Values     |
|------------------------------|---|------------|
| Age                          | Mean  | 54.9       |
|                              | Median  | 55         |
|                              | Range   | 30-74      |
| Karnofsky Performance Status | Median  | 90         |
|                              | Range   | 80-100     |
| Body Mass Index              | Mean  | 24.3       |
|                              | Median  | 24         |
|                              | Range   | 20-32      |
| Breast Side                  | Right   | 24 (58.5%) |
|                              | Left  | 17 (41.5%) |
| Pathological Tumor Stage     | Tis   | 2 (4.9%)   |
|                              | T1  | 29 (70.7%) |
|                              | T2  | 10 (24.4%) |
| Pathological Nodal Stage     | N0  | 28 (68.3%) |
|                              | N1  | 13 (31.7%) |
| Surgery                      | Conservative surgery + biopsy of sentinel node  | 28 (68.3%) |
|                              | Conservative surgery + axillary node dissection | 13 (31.7%) |
| Histology                    | Ductal infiltrating carcinoma                   | 31 (75.6%) |
|                              | Lobular infiltrating carcinoma                  | 5 (12.2%)  |
|                              | Mixed carcinoma                                 | 3 (7.3%)   |
|                              | In-situ ductal carcinoma                        | 2 (4.9%)   |

|                  |        |            |
|------------------|--------|------------|
| Optimal Position | Prone  | 29 (70.7%) |
|                  | Supine | 12 (29.3%) |

**Caratteristiche delle  
pazienti**



## Contornamento e piano di cura in posizione prona e supina:

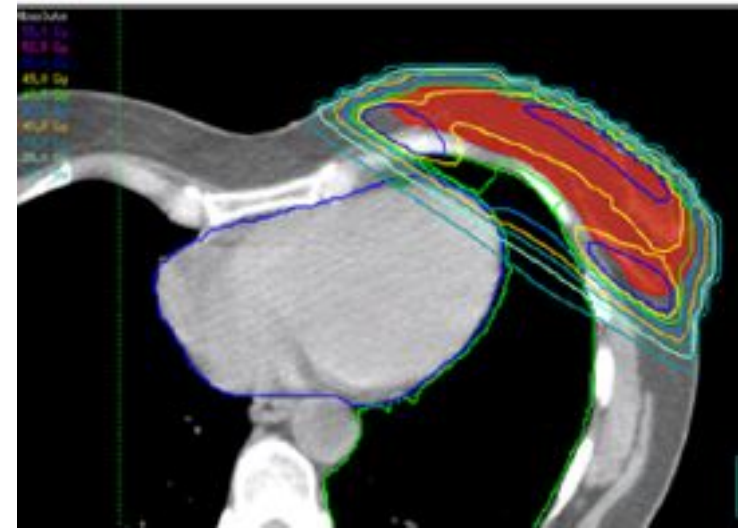
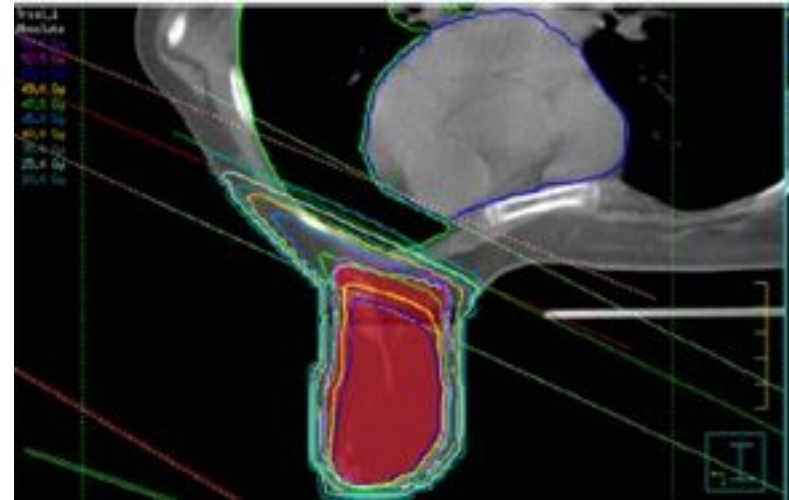
**CTV** : margine superficiale a 5 mm dalla cute, profondo fino al muscolo pettorale e laterale e mediale a comprendere tutta la ghiandola mammaria

**PTV** : espansione del CTV di 5 mm dal margine profondo, 1cm in cranio-caudale

**OAR** : polmone, cuore, LAD per mammella sinistra

## Trattamento:

2 campi tangenziali isocentrici con raggi X 6 MV, dose totale 50 Gy, 2 Gy/frazione + boost con e<sup>-</sup> 9MeV in posizione supina



# Verifica set-up

**Sistema IGRT con AlignRT (VisionRT, London, UK):**

**sistema 3D a infrarossi che rileva la superficie corporea**

**Il sistema permette un'accuratezza inferiore al mm, una statistica di ricostruzione di 20.000 punti.**

**matching con superficie della TC di simulazione ricostruita**



- 2 sistemi posizionati in sala trattamenti
- Work Station
- Plate di calibrazione

**Tempo set-up posizione supina: 3'**  
**Tempo set-up posizione prona: 6'**

# Risultati: AlignRT - EPID

| media (mm) | st dev   |
|------------|----------|
| VRT -0,03  | 0,153217 |
| LGT -0,04  | 0,232514 |
| LAT -0,29  | 0,22298  |

La riproducibilità interfrazione del setup è risultata di :

1.5 mm in VRT

2.3 mm in LGT

2.2 mm in LAT

e inferiore ai margini assegnati al PTV



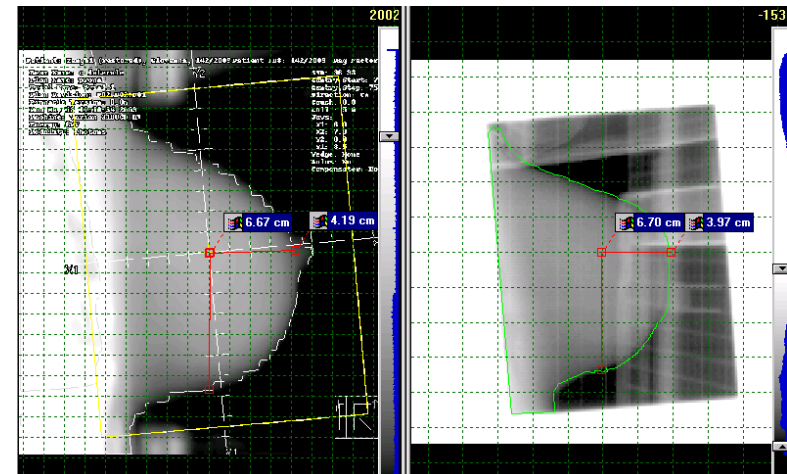
Il volume mammella è sempre risultato contenuto con margine adeguato entro i limiti del campo. Il valore medio della variazione non ha mai superato i 5 mm

**Errore di set-up asse verticale:**

**Range 2.9 - 4.8 mm Media 3.6 mm**

**Errore di set-up asse longitudinale:**

**Range 1.2 - 5.0 mm Media 3.4 mm**



**Table 2 Comparison of dosimetric parameters from treatment plans obtained in the two setup positions for the whole patients series (41 patients)**

|            | Prone setup    | Supine setup   | p-value           |
|------------|----------------|----------------|-------------------|
| PTV (cc)   | 534.9 ± 229.4  | 515.3 ± 174.2  | 0.32              |
| V95 (%)    | 96.5 ± 3.5     | 98.0 ± 1.6     | 0.04              |
| V105 (%)   | 1.4 ± 1.1      | 2.0 ± 2.5      | 0.14              |
| V107 (%)   | 0.1 ± 0.2      | 0.2 ± 0.5      | 0.16              |
| Dmin (Gy)  | 35.8 ± 11.3    | 35.8 ± 10.2    | 0.97              |
| Dmax (Gy)  | 53.7 ± 0.6     | 53.7 ± 0.6     | 0.80              |
| Dmean (Gy) | 50.1 ± 0.4     | 50.1 ± 0.3     | 0.42              |
| CTV (cc)   | 468.1 ± 216.6  | 432.0 ± 159.0  | 0.02              |
| V95 (%)    | 98.4 ± 2.3     | 99.3 ± 1.0     | 0.02              |
| V105 (%)   | 1.3 ± 1.1      | 1.8 ± 2.4      | 0.25              |
| V107 (%)   | 0.1 ± 0.2      | 0.1 ± 0.4      | 0.45              |
| Dmin (Gy)  | 42.4 ± 7.4     | 44.4 ± 4.4     | 0.15              |
| Dmax (Gy)  | 53.6 ± 0.6     | 53.5 ± 0.6     | 0.42              |
| Dmean (Gy) | 50.2 ± 0.4     | 50.2 ± 0.3     | 0.92              |
| Lung (cc)  | 1335.0 ± 331.0 | 1201.0 ± 264.0 | <10 <sup>-6</sup> |
| V20 (%)    | 1.5 ± 1.8      | 9.0 ± 3.4      | <10 <sup>-6</sup> |
| V10 (%)    | 2.6 ± 2.4      | 12.7 ± 4.3     | <10 <sup>-6</sup> |
| V5 (%)     | 4.0 ± 3.2      | 18.4 ± 5.3     | <10 <sup>-6</sup> |
| Dmean (Gy) | 1.4 ± 0.9      | 5.2 ± 1.5      | <10 <sup>-6</sup> |
| Dmax (Gy)  | 39.7 ± 12.4    | 49.5 ± 1.7     | <10 <sup>-5</sup> |

**Table 3 Comparison of heart and left anterior descending coronary artery (LAD) dosimetric parameters in the two setup positions for the 17/41 patients with left breast cancer**

|                | Prone setup  | Supine setup | p-value |
|----------------|--------------|--------------|---------|
| Heart (cc)     | 438.3 ± 79.5 | 465.3 ± 90.3 | 0.09    |
| V20 (%)        | 1.5 ± 2.2    | 1.5 ± 1.5    | 0.90    |
| V10 (%)        | 2.3 ± 2.8    | 2.6 ± 2.4    | 0.64    |
| V5 (%)         | 4.0 ± 4.1    | 4.6 ± 3.9    | 0.59    |
| Dmean (Gy)     | 1.9 ± 1.3    | 2.0 ± 1.0    | 0.95    |
| Dmax (Gy)      | 36.8 ± 12.5  | 41.9 ± 9.8   | 0.06    |
| Dmean LAD (Gy) | 11.8 ± 9.8   | 12.0 ± 9.1   | 0.95    |
| Dmax LAD (Gy)  | 27.8 ± 16.0  | 33.0 ± 13.2  | 0.14    |

**V5, V10 e V20 polmone** significativamente inferiori in posizione prona che supina

**Cuore: V5, V10 e V20 + dose massima e media LAD** inferiori in posizione prona ma non in maniera statisticamente significativa



## PROs

- Risparmio dose al polmone
- Trend favorevole per dosi al cuore
- Trend favorevole per dosi LAD

## CONs

- Compliance pazienti
- CTV ns casistica < CTV letteratura
- Addestramento del personale tecnico
- Training contouring

## VARIABILITA' INTER-OSSERVATORE NEL CONTORNAMENTO DEL CTV E DEGLI ORGANI A RISCHIO NEL TRATTAMENTO DELLA MAMMELLA IN POSIZIONE PRONA.

C. Pisani\*, G. Gambaro\*, S. Berretta\*, L. Deantonio\*, L. Masini\*, E. Negri\*\*, G. Loi\*\*, I. Manfreda\*, M. Krengli\*,\*\*\*

\*S.C. di Radioterapia, AOU Maggiore della Carità, Novara; \*\* Fisica Medica, AOU Maggiore della Carità, Novara ; \*\*\* Dipartimento di medicina Traslazionale, Università del Piemonte Orientale, Novara

### SCOPO

Valutare la variabilità nel contouring del CTV, del cuore e dell'arteria discendente anteriore (LAD) nel trattamento radiante della mammella in posizione prona fra operatori di uno stesso centro.

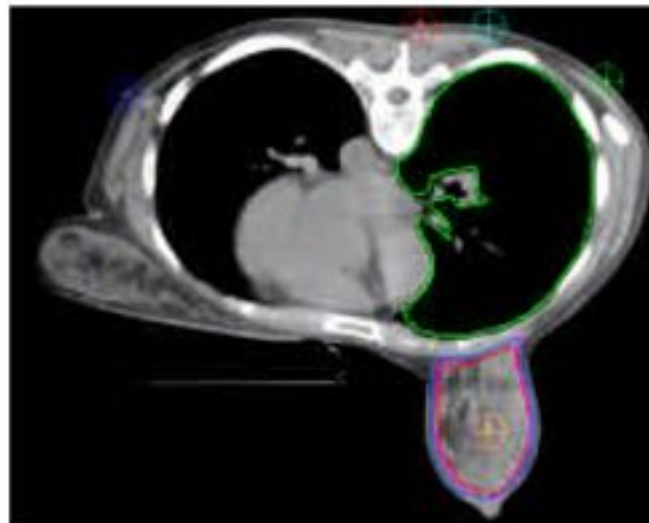
### MATERIALI E METODI

Cinque operatori (4 specialisti in radioterapia, di cui 2 con esperienza superiore a 10 anni, e uno specializzando) hanno contornato in cieco il target, la LAD e il cuore sulla TC di simulazione senza mdc in 41 pazienti affette da carcinoma della mammella, di cui 17 sinistre, operate di quadrantectomia (pTis-2;N0-1), selezionate per eseguire il trattamento in posizione prona.

Sono state quindi valutate le differenze nel contouring del CTV, del cuore e della LAD.

Dai dati preliminari emerge come non vi siano differenze significative fra gli operatori in termini di CTV (**CTV medio specialisti senior: 331.68 cc, CTV medio specialisti junior + specializzandi: 364.20 cc  $p>0.10$** ).

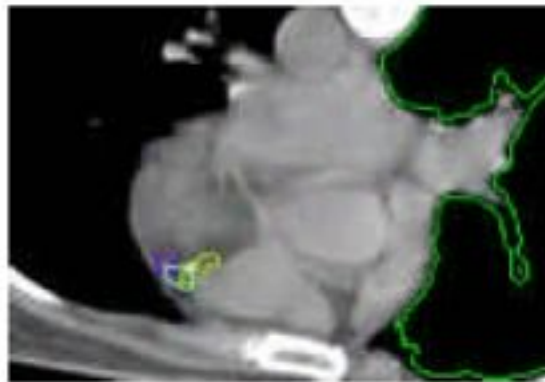
**L'indice di concordanza fra i CTV è del 94.6%.** Sul contouring emerge come il  **margine superiore del CTV** sia stato da tutti posizionato al limite inferiore dell'inserzione della clavicola sullo sterno; **il limite inferiore** al termine del tessuto mammario visualizzato; **l'anteriore** a 5 mm dalla cute; **il posteriore** a esclusione del muscolo pettorale e della parete toracica. **Lievi differenze fra operatori con diverso livello di esperienza sono emerse a livello del margine profondo. Il limite mediale** è stato posizionato non oltre la giunzione costo-sternale (variabilità fra gli operatori di 0.2–0.5 cm) mentre il laterale non oltre la linea ascellare media (variabilità di 0.5-1.5 cm).



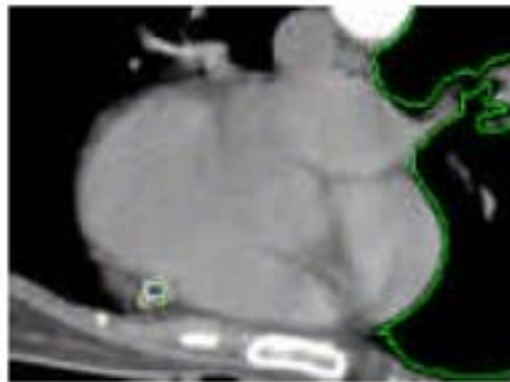
Contorni CTV

## Variabilità nel contouring del cuore e della LAD.

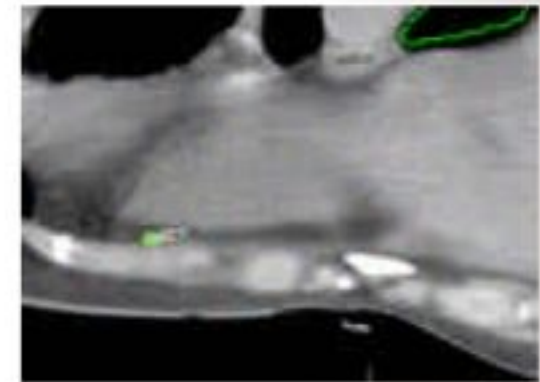
Il volume cardiaco risulta in media di 434.0 cc +/- 79.5 cc senza variazioni significative fra i diversi operatori. Tutti gli operatori hanno considerato come punto di repere per la LAD il solco fra i due ventricoli. L'indice di concordanza dei contorni della LAD a livello dell'origine aortica e nel tratto terminale è del 73.8%; concordanza del 89.3% si è evidenziata invece nei contorni a livello del tratto di LAD che decorre nel solco interventricolare (distanza massima fra i contorni 0.42 cm; distanza minima 0.03 cm).



Tratto LAD all'emergenza coronarica



Tratto LAD nel solco interventricolare



Tratto LAD distale