

L'attuale utilizzo della IORT nella rete

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IORT

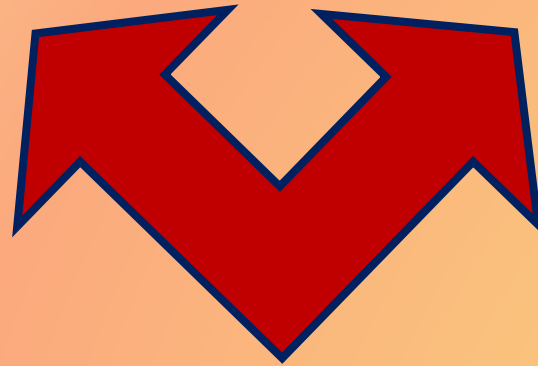
Irradiazione con dose singola ed elevata in corso di intervento chirurgico, a campo operatorio aperto, che consente di far convergere il fascio di radiazioni sul letto tumorale, sede di malattia microscopica o di residuo macroscopico nel caso di resezione non radicale

IORT

Azione sul letto operatorio

Alto gradiente di dose
tessuto neoplastico/sano

Effetto radiobiologico
della dose singola



Potenziamento del lavoro
del chirurgo e del radioterapista

IORT

Visualizzazione diretta



↑ **Dose tumore**

Risparmio dei tessuti sani



↓ **Dose organi a rischio**

> Indice Terapeutico

IORT

Acceleratore mobile dedicato



Novac 7 NRT

(New Radiant Technology, multienergia da 3 a 9 MeV)



COMPAGNIA
di San Paolo

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di San Paolo

IORT TEAM

- ☐ **Personale di sala operatoria**
- ☐ **Chirurgo**
- ☐ **Fisico**
- ☐ **Radiologo**
- ☐ **Radioterapista**
- ☐ **Anatomo-patologo**



Normale sala operatoria idonea dal punto di vista radioprotezionistico



IORT e EBM

- ☐ Neoplasie rettali localmente avanzati e recidivanti
- ☐ Neoplasie pancreatiche resecabili
- ☐ Sarcomi retroperitoneali dei tessuti molli



**Miglioramento dell'overall survival
e del controllo locale di malattia**



IORT MAMMELLA

VANTAGGI

- dose unica più efficace dal pdv radiobiologico
 - visualizzazione del letto operatorio
 - ottimizzazione dell'approccio integrato
-
- ✓ Studi clinici
 - ✓ I risultati a lungo termine sono ancora da valutare e così pure gli effetti collaterali a media e lunga scadenza



I Mobilizzazione



II Protezione dei tessuti sani



III Ricostruzione



IV Protezione cute (cosmesi)

CONSENSUS STATEMENT

ACCELERATED PARTIAL BREAST IRRADIATION CONSENSUS STATEMENT FROM THE AMERICAN SOCIETY FOR RADIATION ONCOLOGY (ASTRO)

Table 7. Comparison of clinical studies by APBI treatment technique

Treatment technique	Total patients	Total follow-up (patient-years)	Average follow-up (y)
Interstitial	1,321	7,133	5.4
MammoSite	1,787	4,110	2.3
Intraoperative	681	1,430	2.1
External beam			
3D-CRT/IMRT	319	335	1.0
Protons	40	20	0.5



GEC-ESTRO Recommendations

Patient selection for accelerated partial-breast irradiation (APBI) after breast-conserving surgery: Recommendations of the Groupe Européen de Curiethérapie-European Society for Therapeutic Radiology and Oncology (GEC-ESTRO) breast cancer working group based on clinical evidence (2009)

Table 8

GEC-ESTRO recommendations on patient selection for accelerated partial-breast irradiation.

Characteristic	A/low-risk group – good candidates for APBI	B/intermediate-risk group – possible candidates for APBI	C/high-risk group – contraindication for APBI
Patient age	>50 years	>40–50 years	≤40 years
Histology	IDC, mucinous, tubular, medullary, and colloid cc.	IDC, ILC, mucinous, tubular, medullary, and colloid cc.	–
ILC	Not allowed	Allowed	–
Associated LCIS	Allowed	Allowed	–
DCIS	Not allowed	Allowed	–
HG	Any	Any	–
Tumour size	pT1–2 (<30 mm)	pT1–2 (<30 mm)	pT2 (>30 mm), pT3, pT4
Surgical margins	Negative (>2 mm)	Negative, but close (<2 mm)	Positive
Multicentricity	Unicentric	Unicentric	Multicentric
Multifocality	Unifocal	Multifocal (limited within 2 cm of the index lesion)	Multifocal (>2 cm from the index lesion)
EIC	Not allowed	Not allowed	Present
LVI	Not allowed	Not allowed	Present
ER, PR status	Any	Any	–
Nodal status	pN0 (by SLNB or ALND*)	pN1mi, pN1a (by ALND*)	pNx; >pN2a (4 or more positive nodes)
Neoadjuvant chemotherapy	Not allowed	Not allowed	If used

Comparability among the studies is low

Prospective randomized phase III trials of accelerated partial breast irradiation

Institution/trial	Trial design	N	Control arm	Experimental arm	Status
NSABP B-39/RT0G-0413 [114]	Equivalence	4300 patients Lumpectomy Stage 0, I or II T < 3.0 cm pN1 neg margins any age	WBI 50–50.4 Gy, 1.8–2.0 Gy per fraction to whole breast followed by optional boost to 60–66 Gy	34 Gy in 3.4 Gy fractions using multi-catheter brachytherapy or MammoSite balloon catheter or 38.5 Gy in 3.85 Gy fractions using 3D CRT #	Start March 2005, since March 2007 closed to low-risk patients
RAPID/Ontario Clinical Oncology Group ^a	Equivalence	2128 patients Lumpectomy >40 years, DCIS, pT < 3 cm, pN0, non-lobular, No BRCA 1 or 2	WBI 42.5 Gy/16 f/22 days (small breasts), 50 Gy/25 f/35 days (large breasts), Optional boost of 10 Gy/4–5 f	3D CRT 38.5 Gy/10 f/5–8 days Minimum daily fraction separation 6–8 h	Start January 2006
GEC-ESTRO [115]	Non-inferiority, non-irrelevant, 3% difference	1170 patients, Lumpectomy >40 years, T < 3 cm, <1 micrometastasis in axilla, neg margins >2 mm (>5 mm for lobular or pure DCIS)	WBI, 50–50.4 Gy, 1.8–2.0 Gy per fraction to whole breast followed by optional boost to 60 Gy	Interstitial brachytherapy # 32 Gy/8 fractions HDR 30.3 Gy/7 fractions HDR, 50 Gy PDR	Start May 2004
IMPORT-LOW, UK	Non-inferiority	1935 patients Lumpectomy >50 years, pT < 2 cm, pN0 (isolated tumor cells <0.2 mm allowed) non-lobular, grade I or II, neg margins >2 mm	WBI 40 Gy/15 f/3 weeks	ARM 1: 36 Gy/15 f (2.4 Gy/f) to low risk areas and 40 Gy/15 f (2.67 Gy/f) to region of primary tumor ARM 2: 40 Gy/15 f to region of primary tumor Based on IMRT and apical position	Start September 2006
ELIOT, Milan [116]	Equivalence	824 patients Quadrantectomy Age >48 years, any invasive cancer <2.5 cm, pN0	WBI 50 Gy/ 25 fractions followed by optional boost 10 Gy	Intraoperative 21 Gy single fraction, Electrons up to 9 MeV	Start December 2000
TARGET [111] multicentric trial	Equivalence	1600 patients "Pragmatic trial" where the treating institution judges the patient to be suitable, Non-lobular and no EIC (if EIC or ILC on final pathological report, WBI is added)	WBI according to institutional guidelines at the participating center	20 Gy low-energy X-rays 50 kV intraoperative single fraction	Start March 2000

ELIOT randomized trial

$T \leq 2.5$ cm Age ≥ 48 years

Quadrantectomy, SN biopsy/axillary dissection



EXTERNAL RADIOTHERAPY
50 Gy whole breast, 10 Gy
boost

ELIOT 21 Gy
(90% isodose)

CLINICAL TRIAL

Intraoperative radiotherapy during breast conserving surgery: a study on 1,822 cases treated with electrons

Umberto Veronesi · Roberto Orecchia · Alberto Luini · Viviana Galimberti · Stefano Zurrada · Mattia Intra · Paolo Veronesi · Paolo Arnone · Maria Cristina Leonardi · Mario Ciocca · Roberta Lazzari · Pietro Caldarella · Nicole Rotmensz · Claudia Sangalli · Daniele Sances · Patrick Maisonneuve

Table 2 Side effects among 1,822 patients

Side effects	N	%
Mild fibrosis	32	1.8
Severe fibrosis	2	0.1
Lyponecrosis	78	4.2
Haematoma	101	5.5
Oedema	24	1.3
Pain	13	0.7
Wound infection	24	1.3
Sieroma	235	12.9
No side effect	1434	78.7
1 Side effect	292	16.0
2 Side effects	76	4.2
3 Side effects	16	0.9
4 Side effects	3	0.2
5 Side effects	1	<0.1

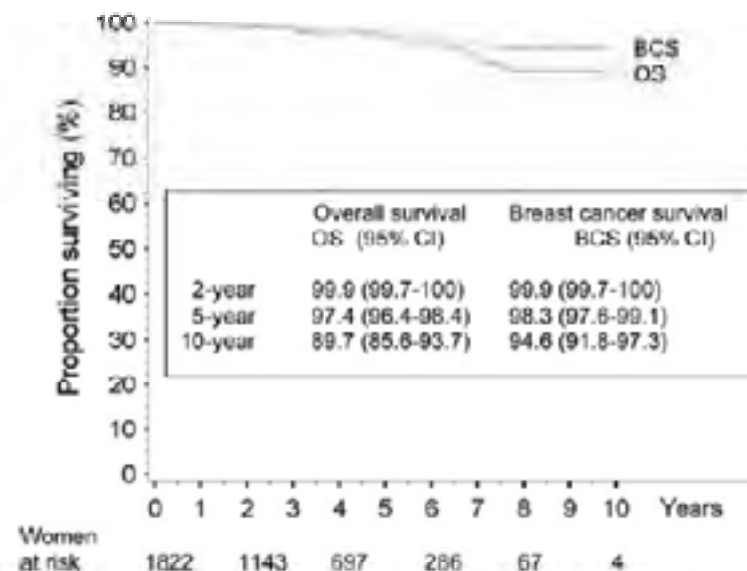
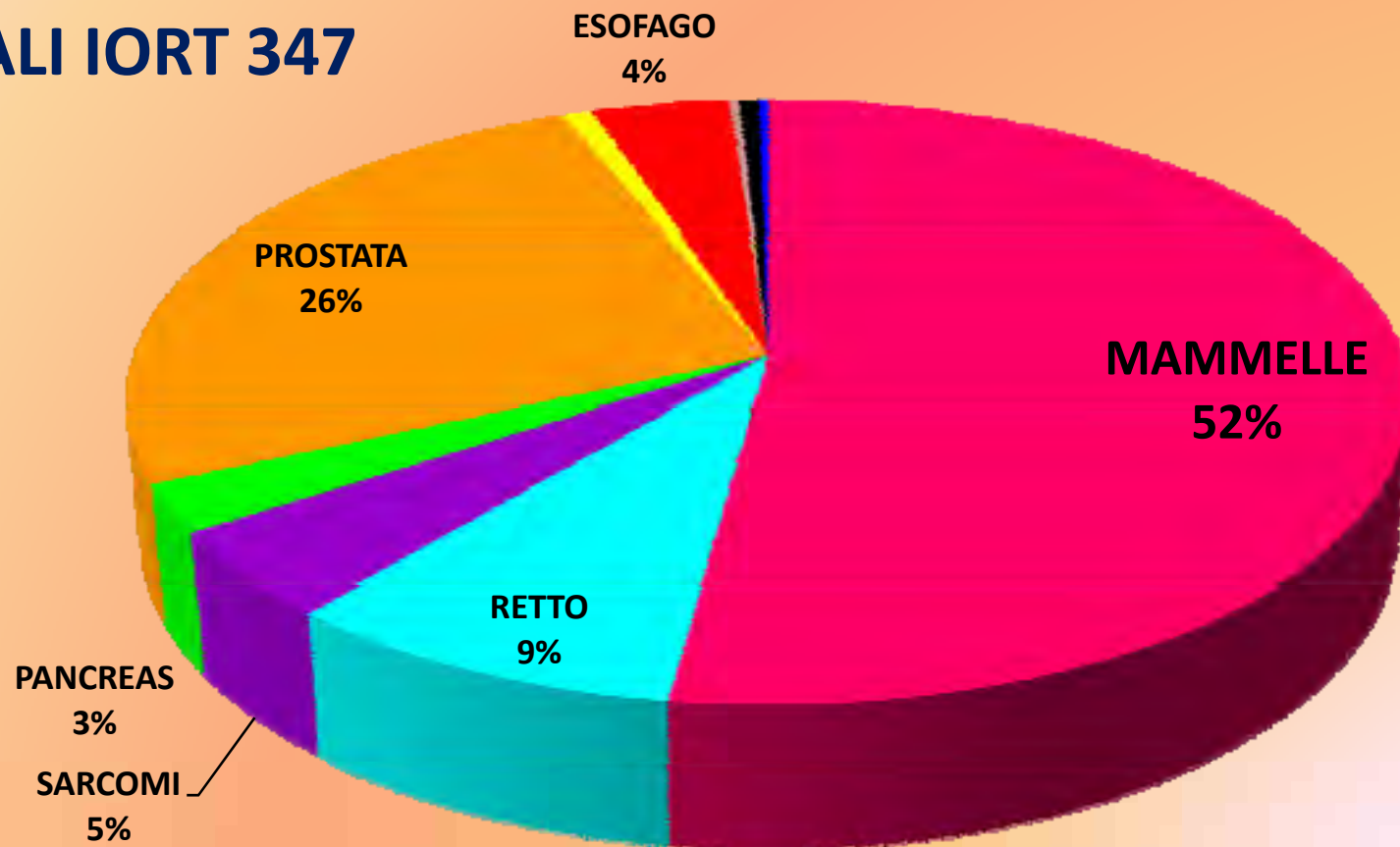


Fig. 3 Overall survival and breast cancer survival of women with breast cancer treated with ELIOT

IORT IN PIEMONTE

TOTALI IORT 347



Novara dal 2005

Molinette dal 2007

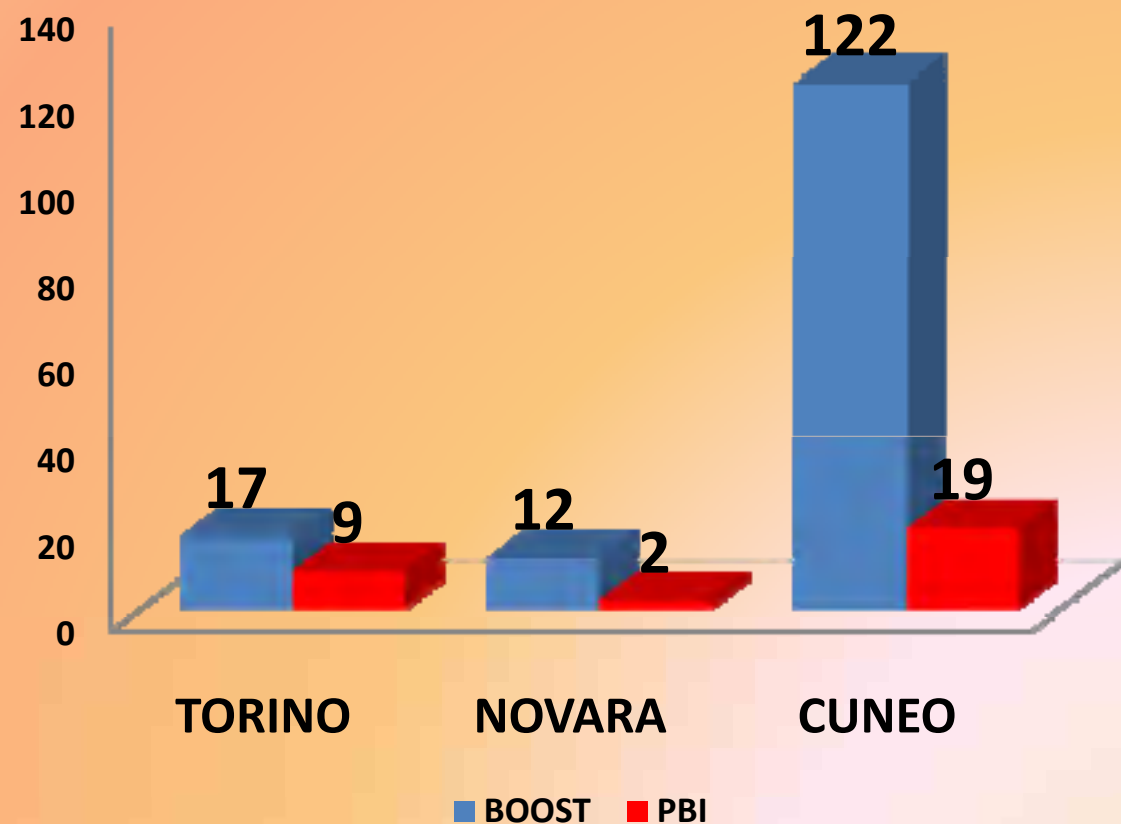
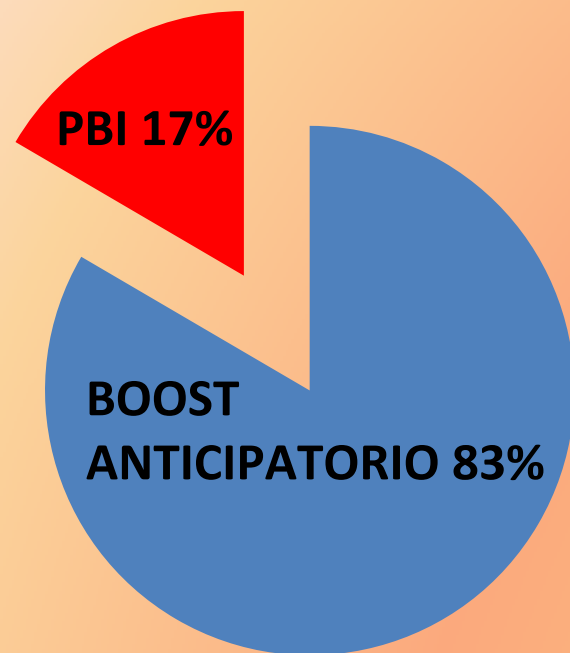
Cuneo dal 2008

IORT IN PIEMONTE

- ❑ Boost (9/10 Gy) e successiva radioterapia a fasci esterni
- ❑ IORT come singola seduta radioterapica (21 Gy)



IORT MAMMELLA IN PIEMONTE



**STUDIO PROSPETTICO E RANDOMIZZATO DI CONFRONTO
TRA QUADRANTECTOMIA SEGUITA DA RADIOTERAPIA
ESTERNA COMPLEMENTARE E QUADRANTECTOMIA
ASSOCIATA A RADIOTERAPIA INTRAOPERATORIA O A
IRRADIAZIONE PARZIALE DELLA MAMMELLA DALL'ESTERNO
IN UN'UNICA FRAZIONE IN PAZIENTI AFFETTE DA
CARCINOMA MAMMARIO DI PICCOLE DIMENSIONI E DI ETÀ
SUPERIORE \geq A 48 ANNI IN POSTMENOPAUSA**

Centro coordinatore dello studio:

Istituto Regina Elena - I.F.O. –

Via Elio Chianesi, 53 – 00144 ROMA

S.C. Radioterapia – *Dott.ssa Paola Pinnarò*

OBIETTIVI DELLO STUDIO

Obiettivi principali

Recidive locali

Secondi tumori omolaterali

Intervallo libero da recidiva locale

Obiettivi secondari

Sopravvivenza globale nei due gruppi di pazienti

Tasso d'incidenza annuo delle recidive locali

Risultato cosmetico della IORT rispetto a EBRT

NUMEROSITÀ DEL CAMPIONE

938 pazienti

(attualmente arruolate circa 800 pazienti)

CRITERI DI INCLUSIONE

- Età tra 48 e 75 anni
- Postmenopausa
- Diagnosi di focolaio unicentrico con diametro ecografico non superiore a 2,5cm (si raccomanda RM)
- Nessuna precedente terapia compresa la biopsia escissionale
- Centratura preoperatoria in caso di lesioni clinicamente non palpabili
- Nessun secondo tumore ad eccezione dei tumori ano e basocellulari della cute ed il carcinoma della cervice uterina adeguatamente trattati

CENTRO PARTECIPANTE: _____

RESPONSABILE: _____

SCHEDA N°1 – REGISTRAZIONE/RANDOMIZZAZIONE

INIZIALI PAZIENTE _____

CODICE PAZIENTE _____

N. CARTELLA CLINICA _____

DATA DI NASCITA ____/____/____

MENOPAUSA: SI ☐ NO ☐

VALUTAZIONE PREOPERATORIA

SEDE LESIONE: QSI ☐ QSE ☐ QII ☐

QIE ☐ QC ☐

DATA MAMMOGRAFIA ____/____/____

Dimensione massima della lesione: mm. _____

QUADRANTE

SI

CALCIFICAZIONI:

EXTRAQUADRANTE

NO

DATA ECOGRAFIA ____/____/____

Dimensione massima della lesione: mm. _____

DIMENSIONI CLINICHE DELLA LESIONE _____x_____

DATA RX TORACE ____/____/____

METASTASI POLMONARI: SI ☐

NO ☐

DATA ECOGRAFIA EPATICA ____/____/____

METASTASI EPATICHE: SI ☐

NO ☐

DATA SCINTIGRAFIA OSSEA ____/____/____

METASTASI OSSEE: SI ☐

NO ☐

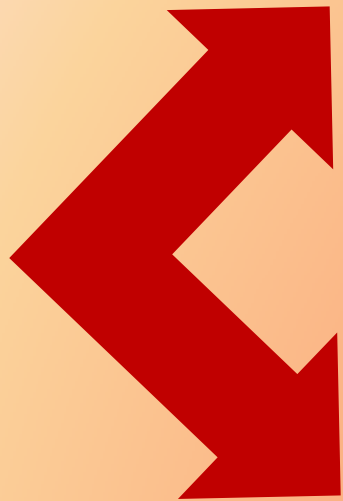
DATA RANDOMIZZAZIONE ____/____/____

IORT ☐

RTESTERNA ☐

(da compilare e rinviare a cura del Centro di Coordinamento dei Dati)

**RT esterna complementare
sulla mammella operata
(50 Gy + boost 10 Gy)**



**IORT
(21 Gy all'isodose del 90%)**

RISULTATO COSMETICO A 3 MESI





LANDESKRANKENHAUS SALZBURG
UNIVERSITÄTSKLINIKUM
DER PARACELSDUS MEDIZINISCHEN PRIVATUNIVERSITÄT



**Hypofractionated Whole-Breast Irradiation preceded by
Intra-Operative Radiotherapy with Electrons as anticipated Boost**

HIOB

A new Option in Breast-Conserving Treatment for Operated Breast Cancer Stages I and II

Prospective one-armed multi-center-trial
ISIORT 01

IORT 10 Gy + EBRT 40,5 Gy (2,7 X 15 fr / 3 settimane)

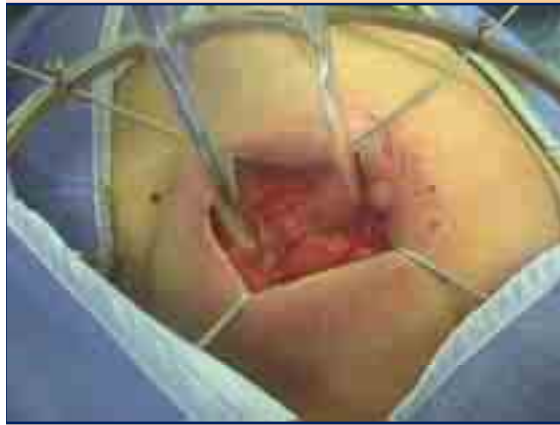
VS

EBRT 50 Gy (2 x 25 fr + Boost 10-16 Gy)



GRAZIE PER L'ATTENZIONE!

FOLLOW-UP E RADIOTERAPIA



IORT

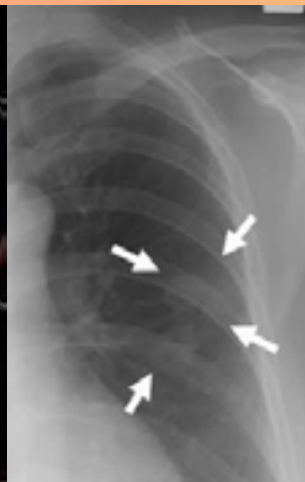
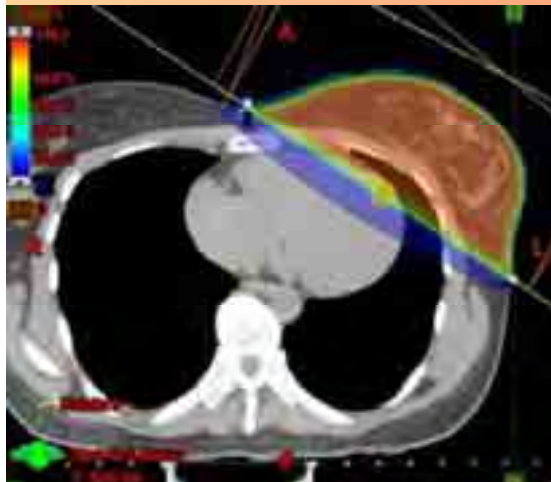
EBRT



TOSSICITA' TARDIVA

CARDIACA

CUTANEA



POLMONARE

