Indicações de radioterapia após quimioterapia neoadjuvante enquanto se aguarda os resultados dos ensaios clínicos

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Março 2019

HOSPITAL SÃO LUCAS DA PUCRS

Grupo ONCOCLÍNICAS

ASTRO'S 60TH ANNUAL MEETING

Translating Discovery to Cure

Management of the Axilla and Neoadjuvant Systemic Therapy: Radiation Oncology

Julia White MD, FASTRO
Professor, Department of Radiation Oncology
The Ohio State University Comprehensive Cancer Center

ASTRO'S 60TH ANNUAL MEETING
Translating Discovery to Cure

Management of the Axilla and Neoadjuvant Systemic Therapy

Quality of Life Considerations

Simona F. Shaitelman, MD, EdM
Associate Professor
The University of Texas MD Anderson Cancer Center

Sunday, October 21st, 2018

Indications for Radiation Treatments After Neoadjuvant Chemotherapy While Awaiting the Results of Clinical Trials

Thomas A. Buchholz, MD
Medical Director, Scripps MD Anderson Cancer Center
Emeritus Professor, The University of Texas MD Anderson Cancer Center

Exciting Times in 2018

Overview of Presentation

- radiation of lymph nodes and postmastectomy radiation can:
  - reduce local recurrences
  - decrease distant metastases
  - improve overall survival
- neoadjuvant chemotherapy can:
  - shape decisions of local-regional treatments
  - decrease morbidity or local-regional treatments

2014 PMRT Oxford Overview

22 randomized trials

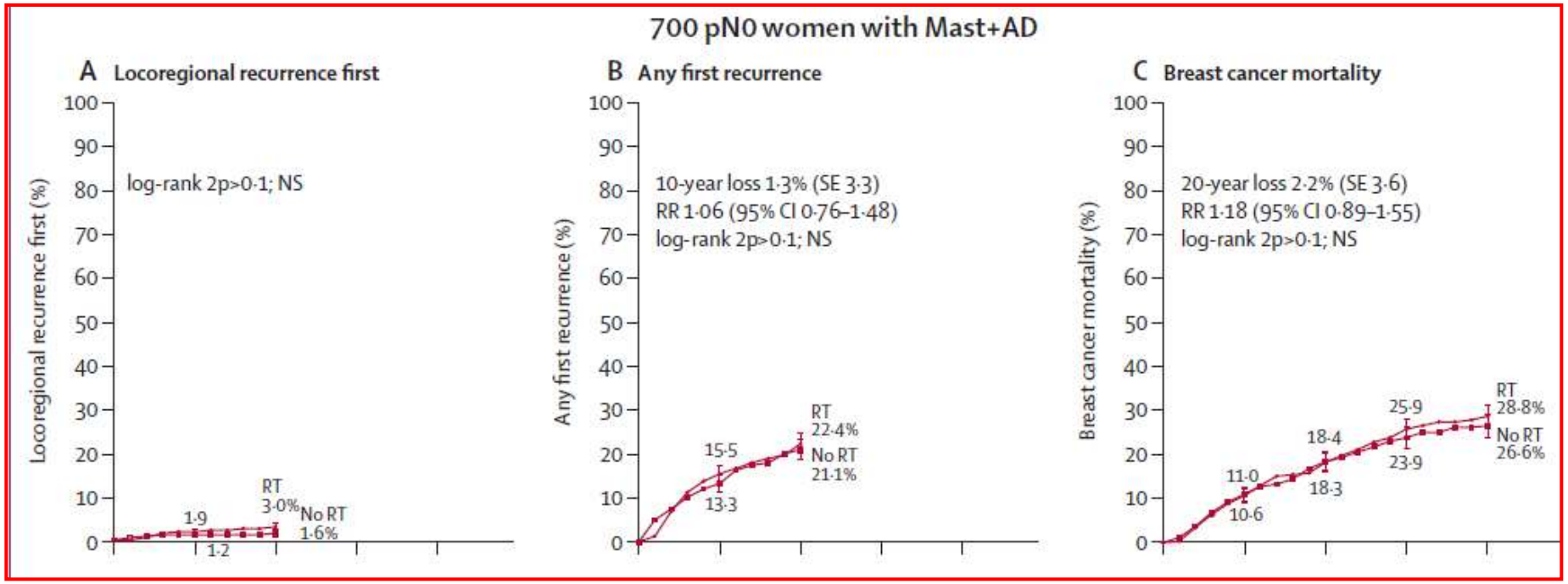
2014 meta-analysis of all randomized trials

- years of the trials: 1964 to 1986
- none of these trials included neoadjuvant chemo
- focused on the 8,135 patients with ALND
  - 700 patients with LN- disease
  - 1,314 patients had 1-3 +LN
  - 1,772 patients had 4+ LN

EBCTCG Lancet 2014,vol 383, 9935: 2127-35

PMRT for LN-Negative Disease

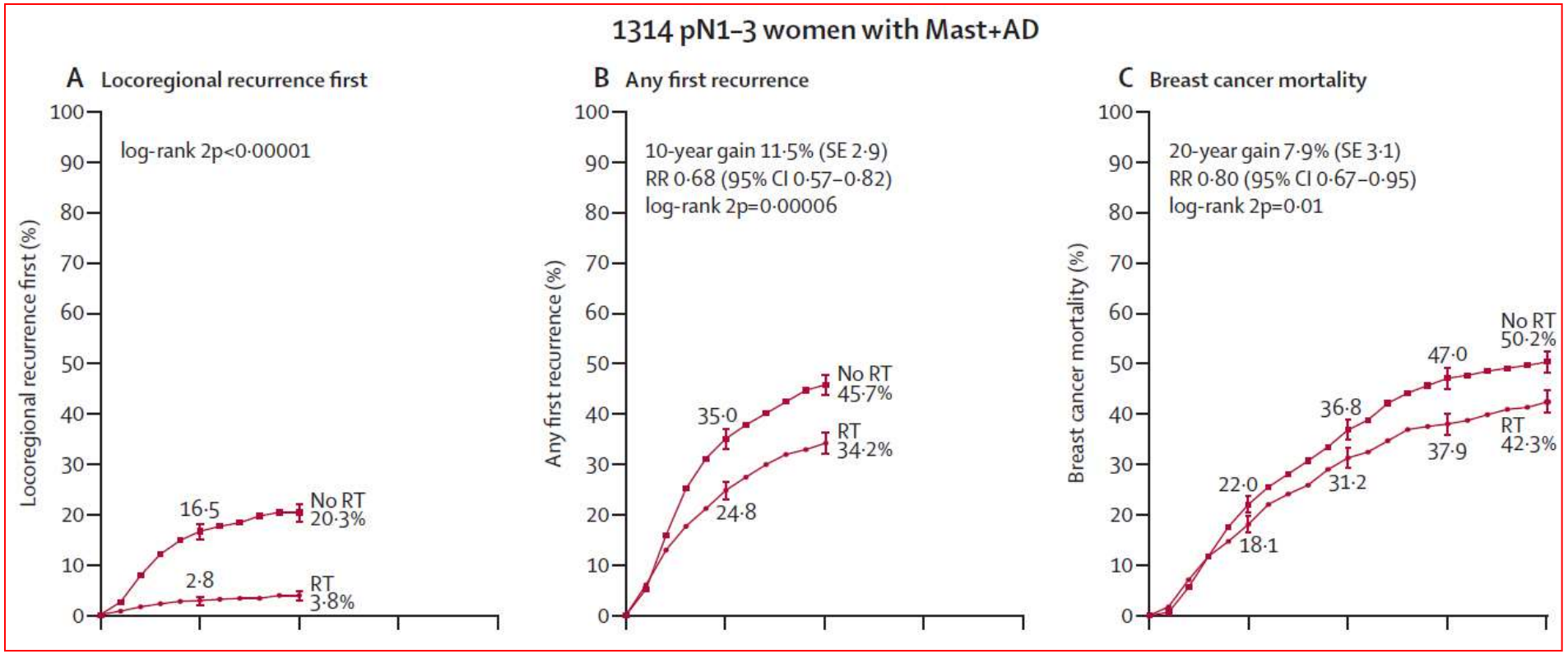
Lancet, 383:2127-2135, 2014



No Indication of LRR, DM, or OS Benefit

Results for Patients with 1-3 +LN

Lancet, 383:2127-2135, 2014



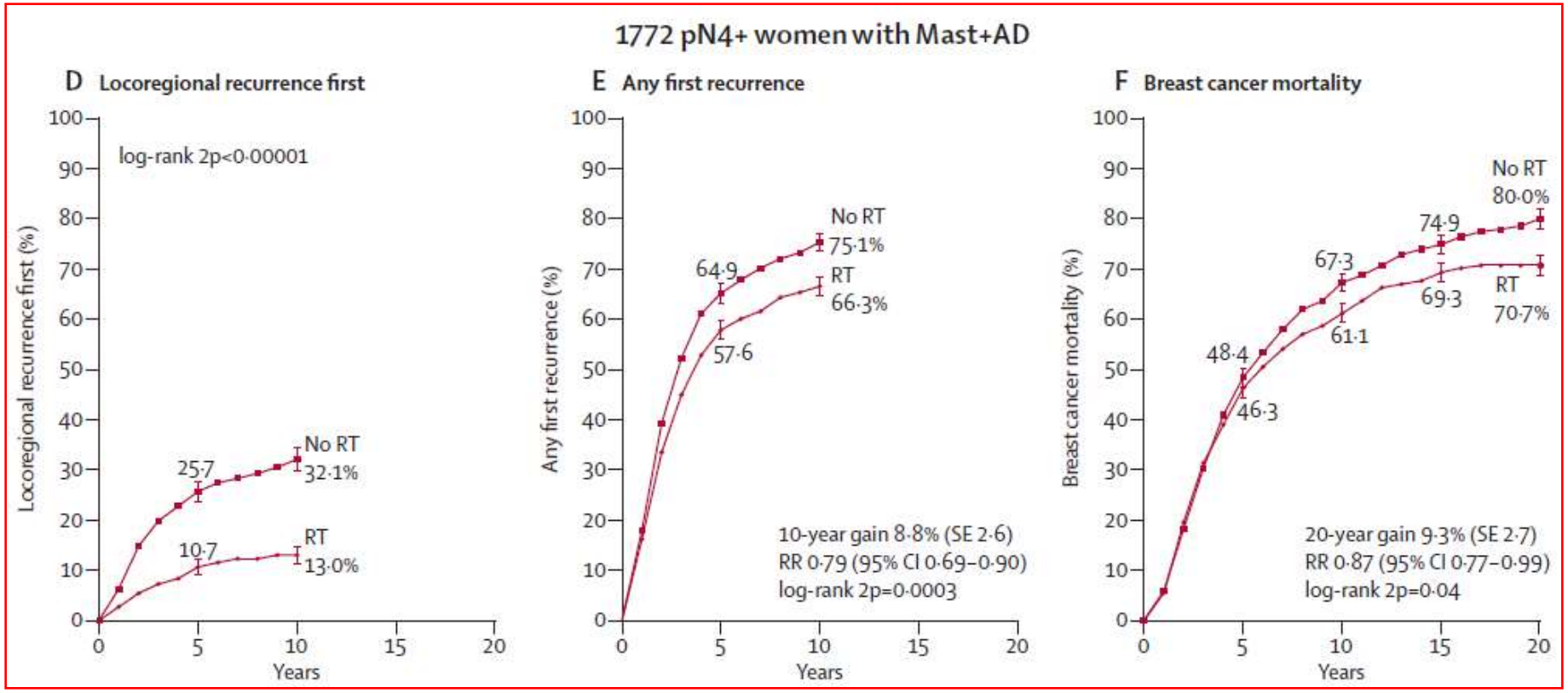
16% Overall
LRR Benefit

(ratio of 2:1)

8% Overall
Mortality Benefit

Results for Patients with 4 or more +LN

Lancet, 383:2127-2135, 2014



19% Overall
LRR Benefit

(ratio of 2:1)

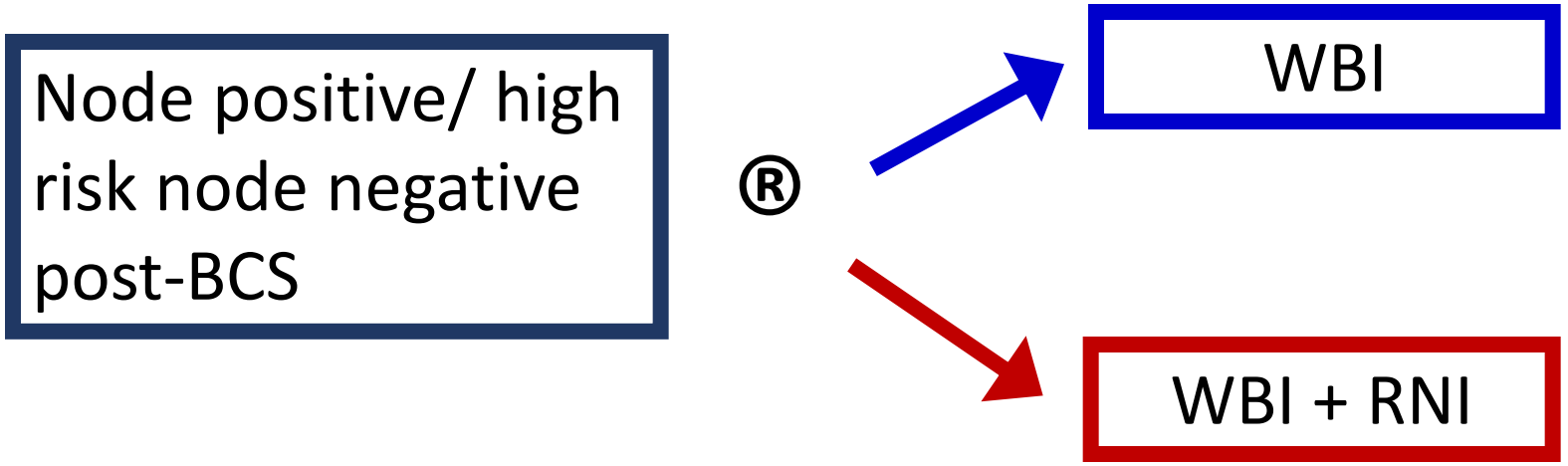
10% Overall
Mortality Benefit

Regional LN Radiation

2 Recently Published Randomized trials

- MA20 (breast conservation) and EORTC
- neither trial included neoadjuvant chemo
- both focused on the benefits of LN radiation
  - most of LN+ pts had 1-3 +LN

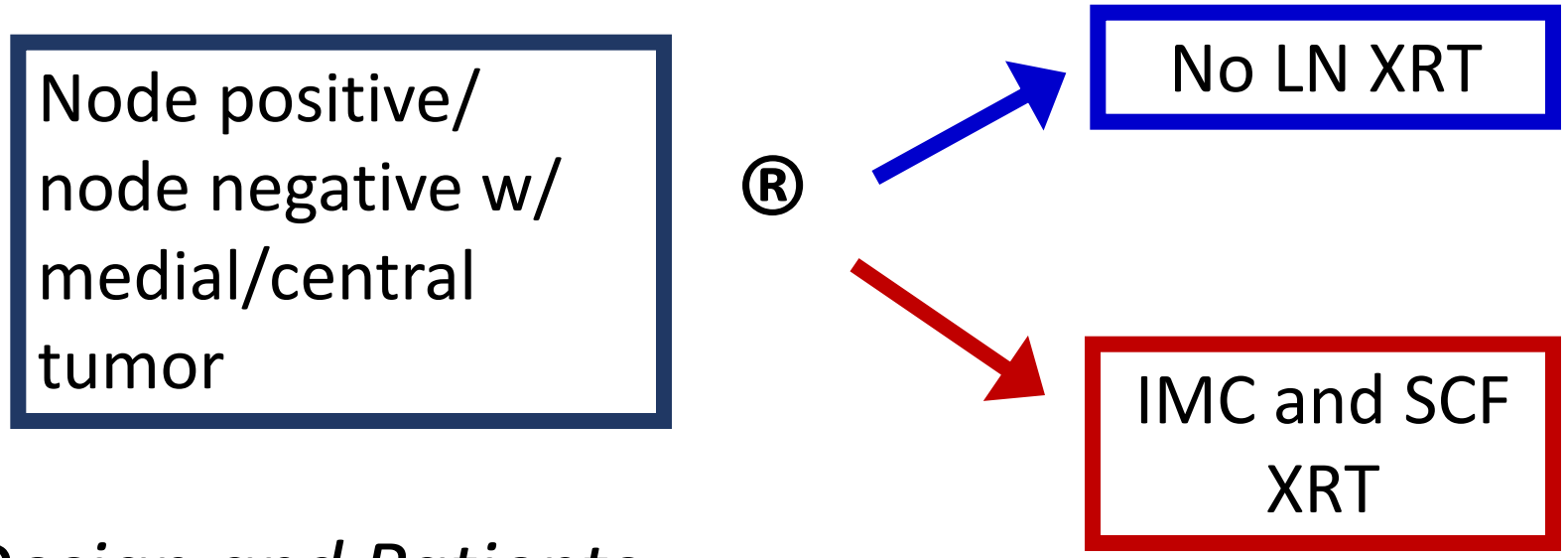
MA 20: Study Design



Design and Patients

- 1800 pts, most over 50
- Median # of resected LN was 12, 48% had T1 disease
- 85% had 1-3 +LN
- 43% had G3 disease, 25% had ER- disease

Radiation Of LN: EORTC Trial

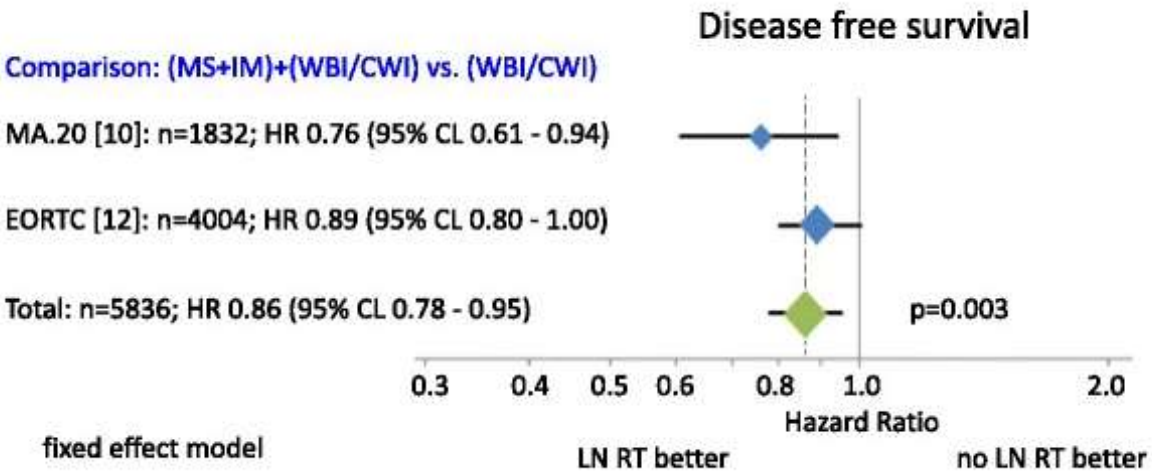


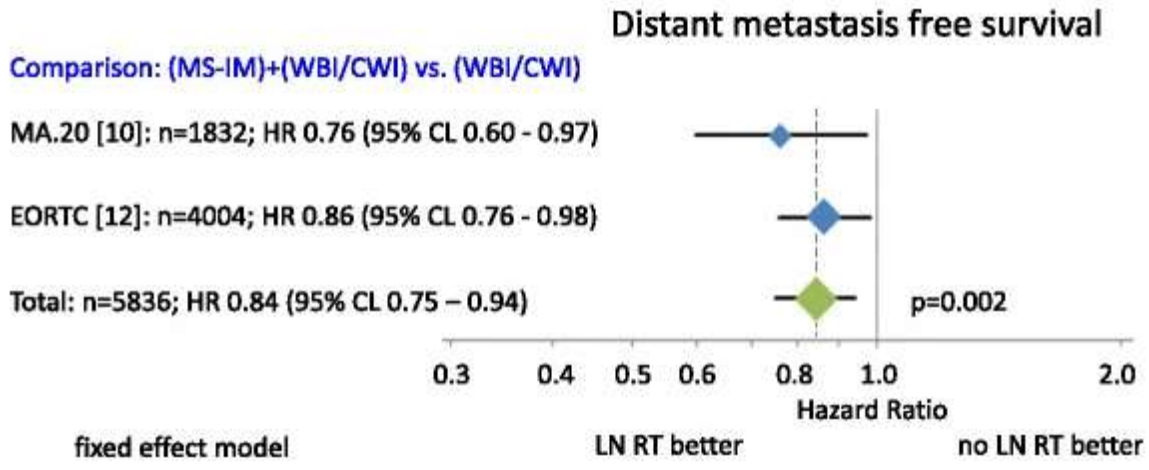
Design and Patients

- 4000+ patients randomized
- 59% were postmenopausal
- 60% had T1 disease
- 44% had LN negative disease, 44% had 1-3 +LN

Meta-analysis of the 2 Trials

DFS and Distant-Met Free Surv

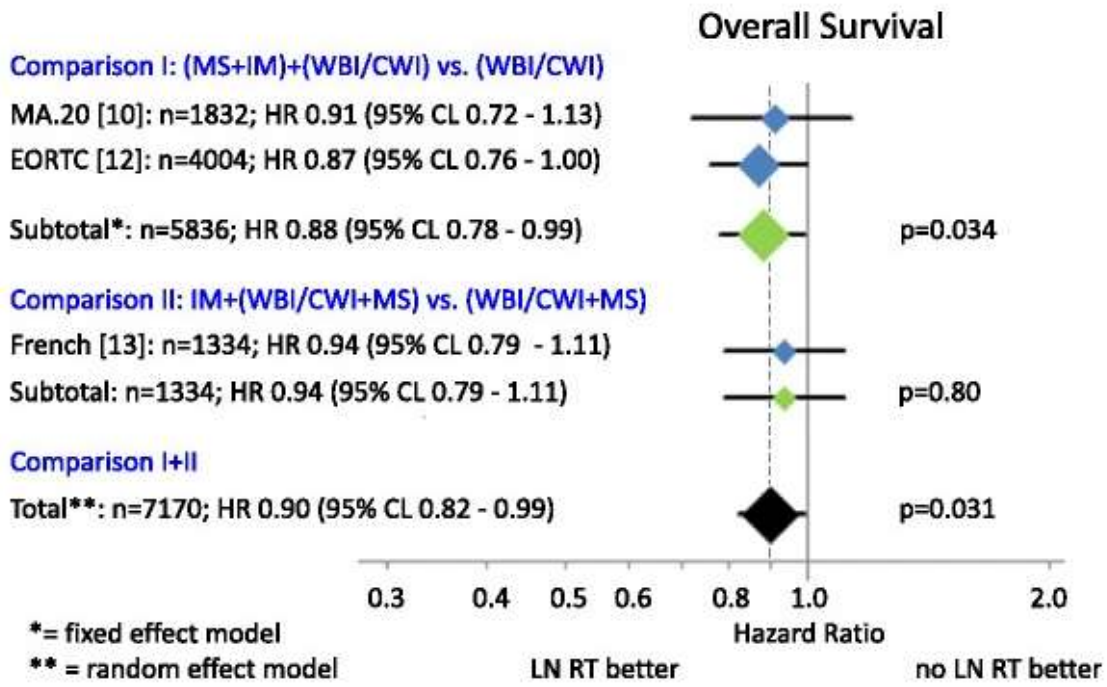




Radiat Oncol 2015;10:258

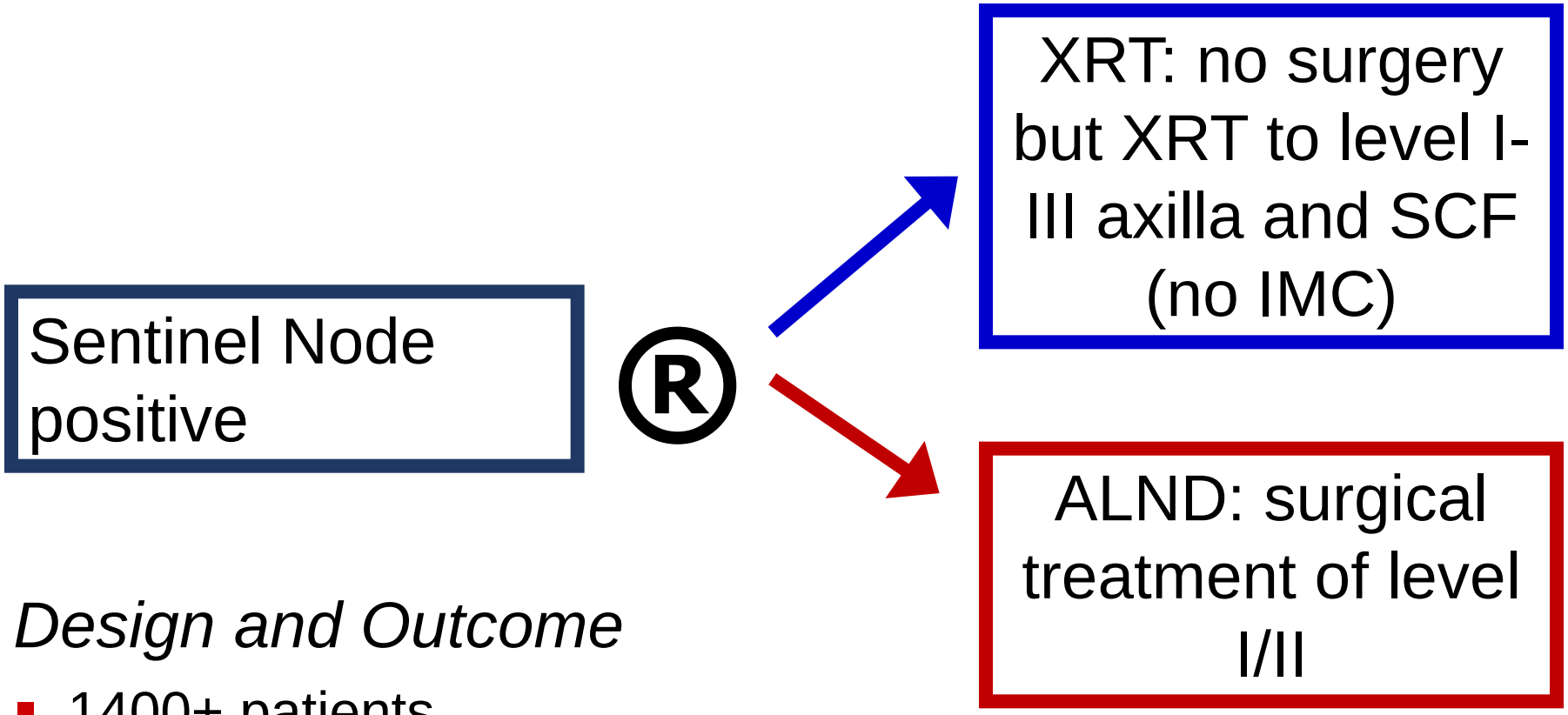
Meta-analysis of the 2 Trials

Overall Survival



Radiat Oncol. 2015;10:258

Radiation Of LN: AMAROS Trial



Design and Outcome

- 1400+ patients
- No statistical difference in DFS/OS
- Axillary recurrence less than 1.5%

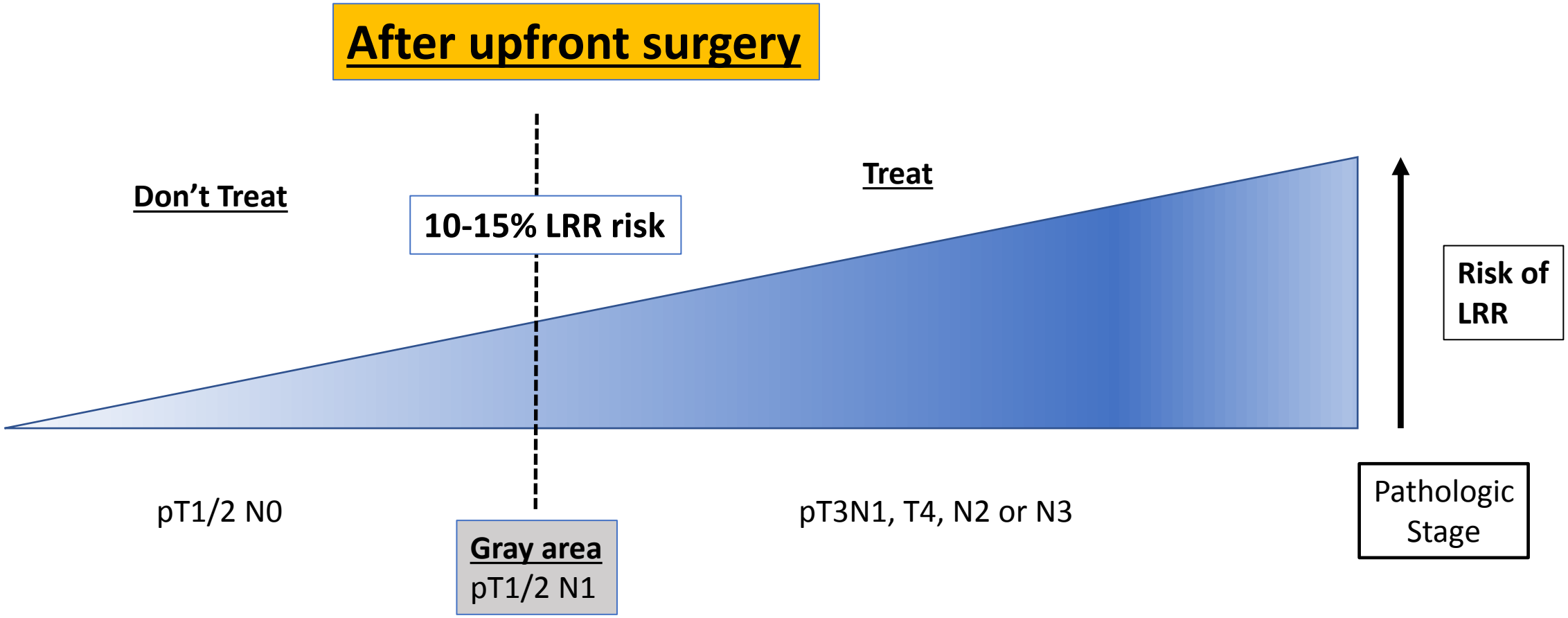
Conclusion of AMAROS Trial

Patients with Clinically Occult LN Disease

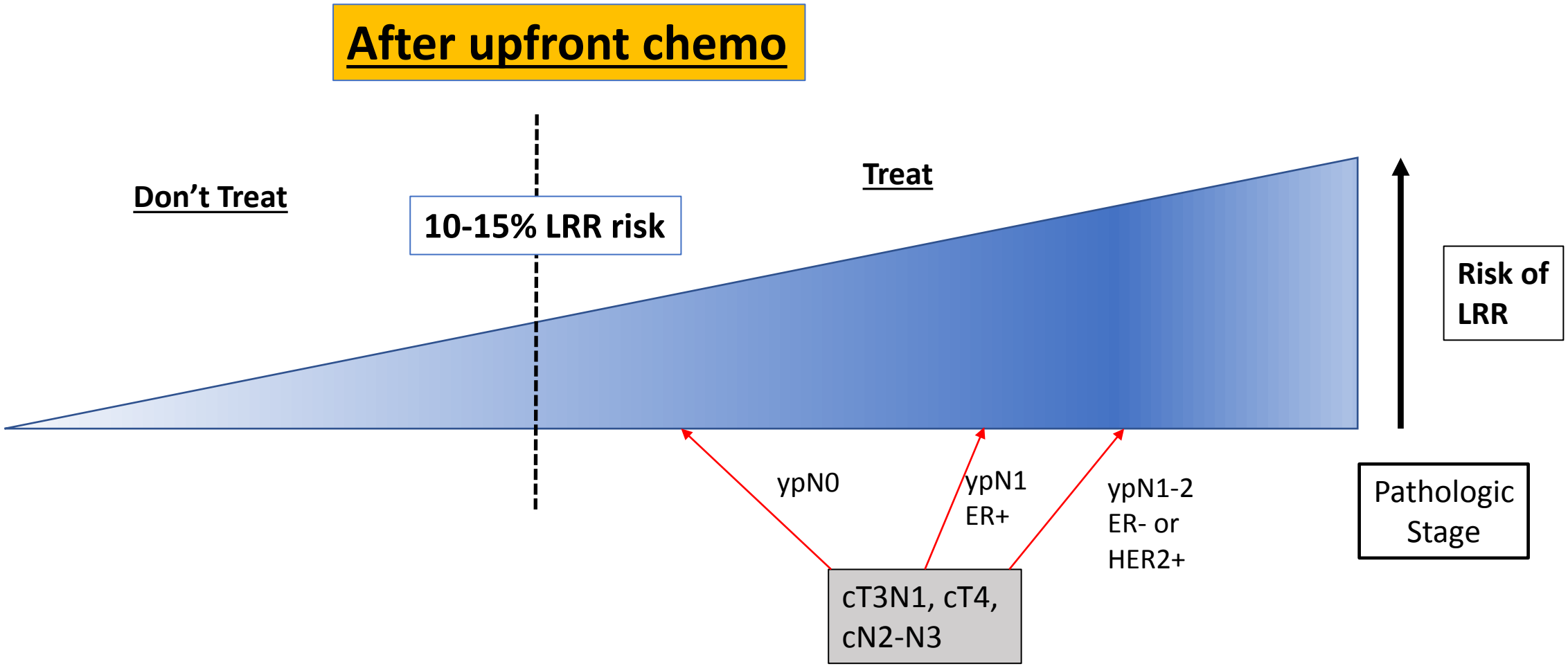
- Radiation likely as effective as surgical removal
- Morbidity of radiation alone is less than ALND + radiation

Can Use of Neoadjuvant Chemotherapy Shape Local-Regional Radiation Decisions And Decrease Morbidity of Treatment?

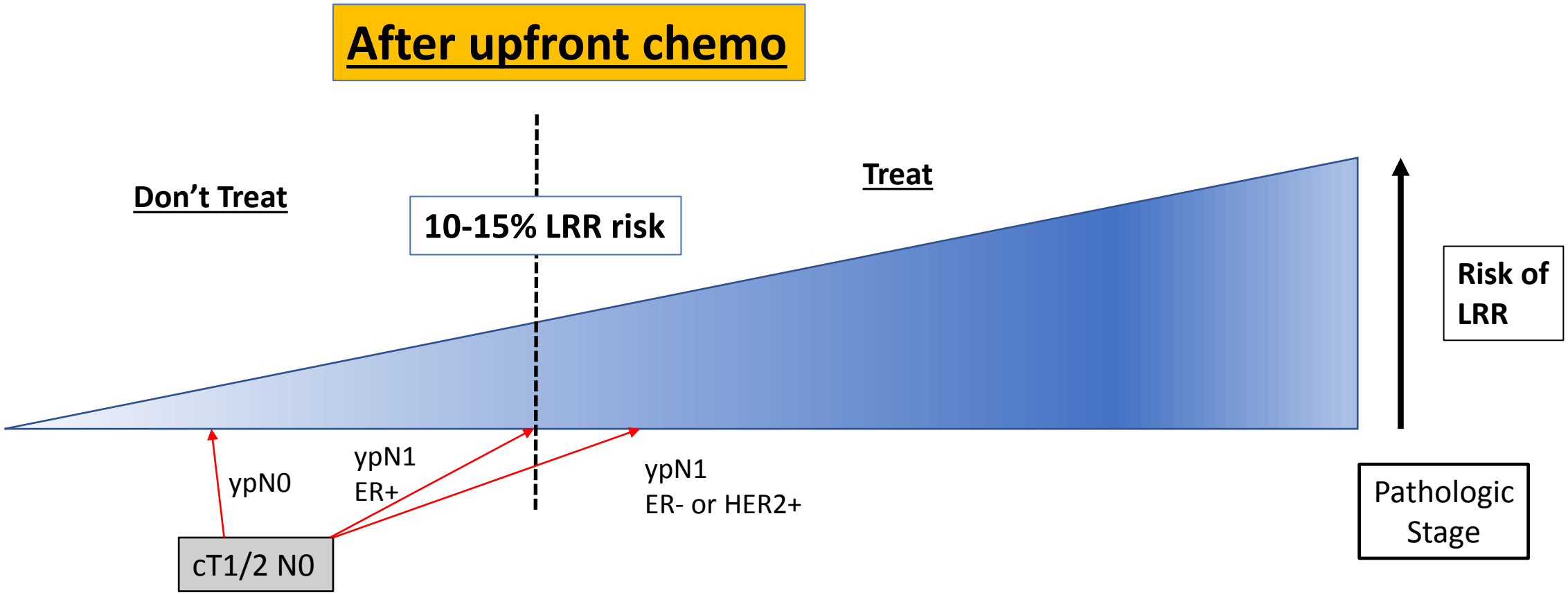
Indications for PMRT/RNI after initial surgery



Indications for PMRT/RNI after Neoadjuvant chemotherapy



Indications for PMRT/RNI after Neoadjuvant chemotherapy



Clinical Evidence Indicates That Response and Biologic Subtype are Both Important in Changing the Local-Regional Recurrence Risk

ACOSOG Z1071: Response and LRR risk

Study design

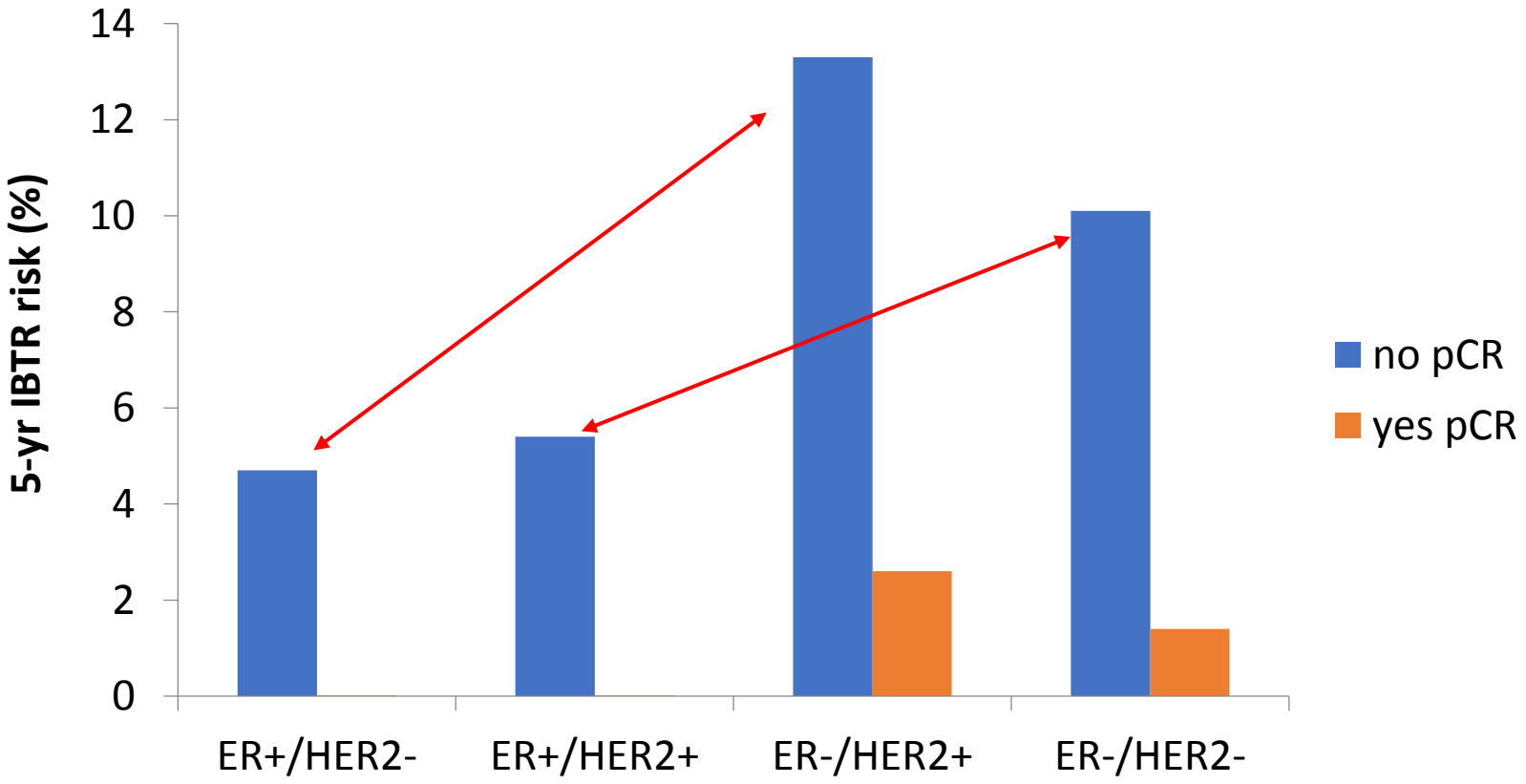
- N=701, cT1-3, N1-2 breast cancer (LN biopsy positive)
- Neoadjuv chemo -> Surgery
- Radiation after BCS, at discretion after mastectomy

Residual Cancer Burden strongly correlated with LRR risk

- RCB 0 - HR: 1 (referent)
- RCB 1 - HR: 1.38 (0.15-12.4)
- RCB 2 - HR: 2.25 (0.66-7.7)
- RCB 3 - HR: 4.65 (1.53-14.1)

Haffty et al, PROC ASTRO 2016

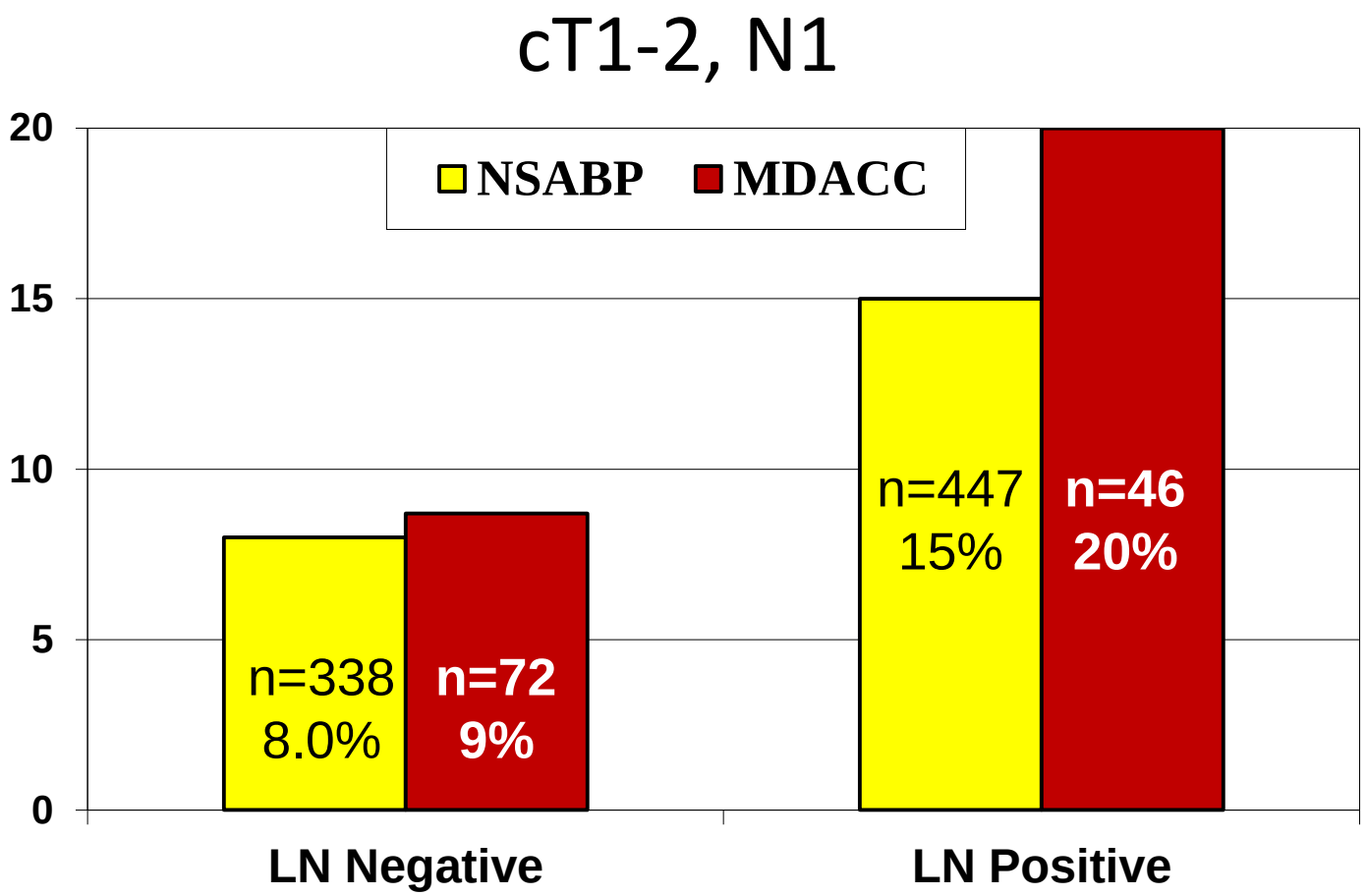
Subtype Affects How the LRR Risk Interacts and the Response to Chemo



N=751
- MD Anderson cohort
- NCT + BCT
- 2005-2013
- Trastuzumab era

Swisher et al, Ann Surg Oncol 23:749-56, 2016

Risk of LRR after Neoadjuvant Chemo and Mastectomy For Patients with Stage II Disease

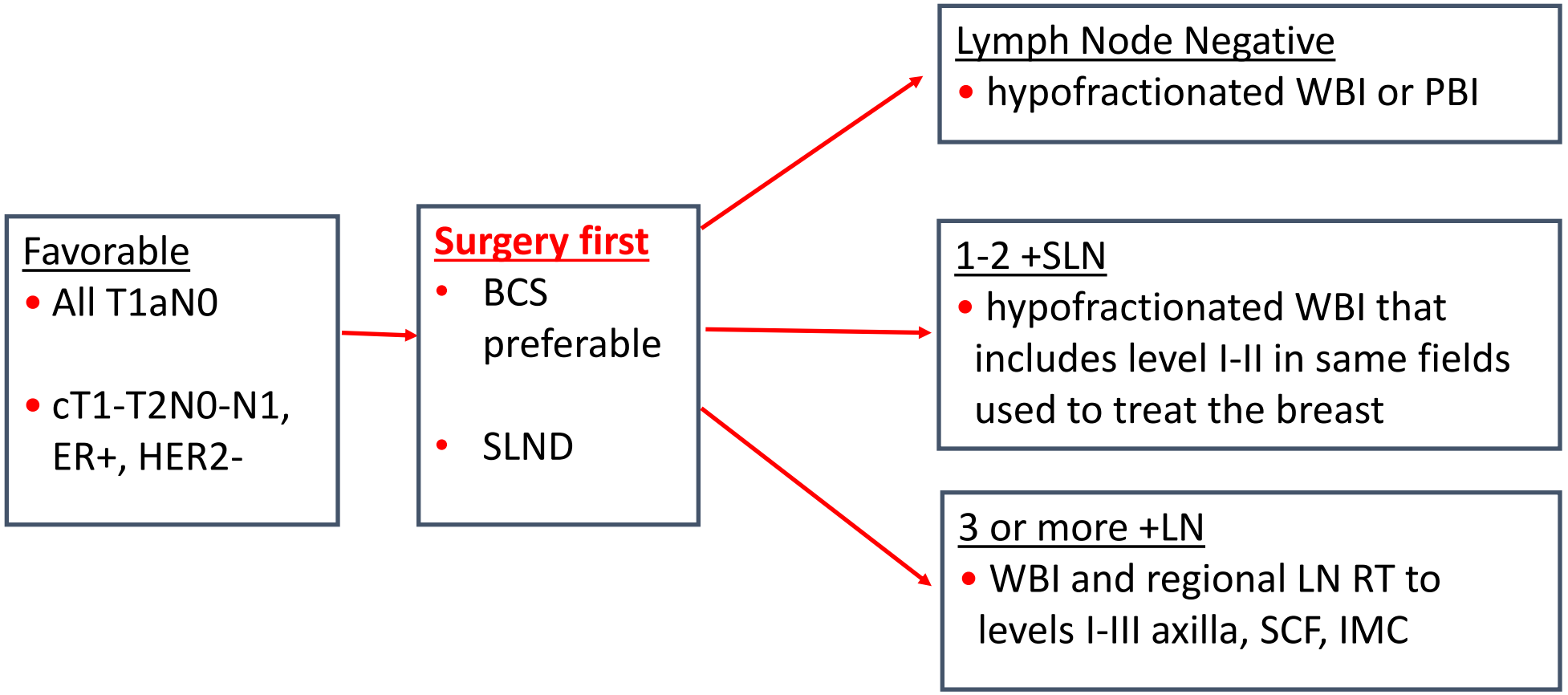


Mamounas et al, J Clin Oncol 30:3960-66, 2012

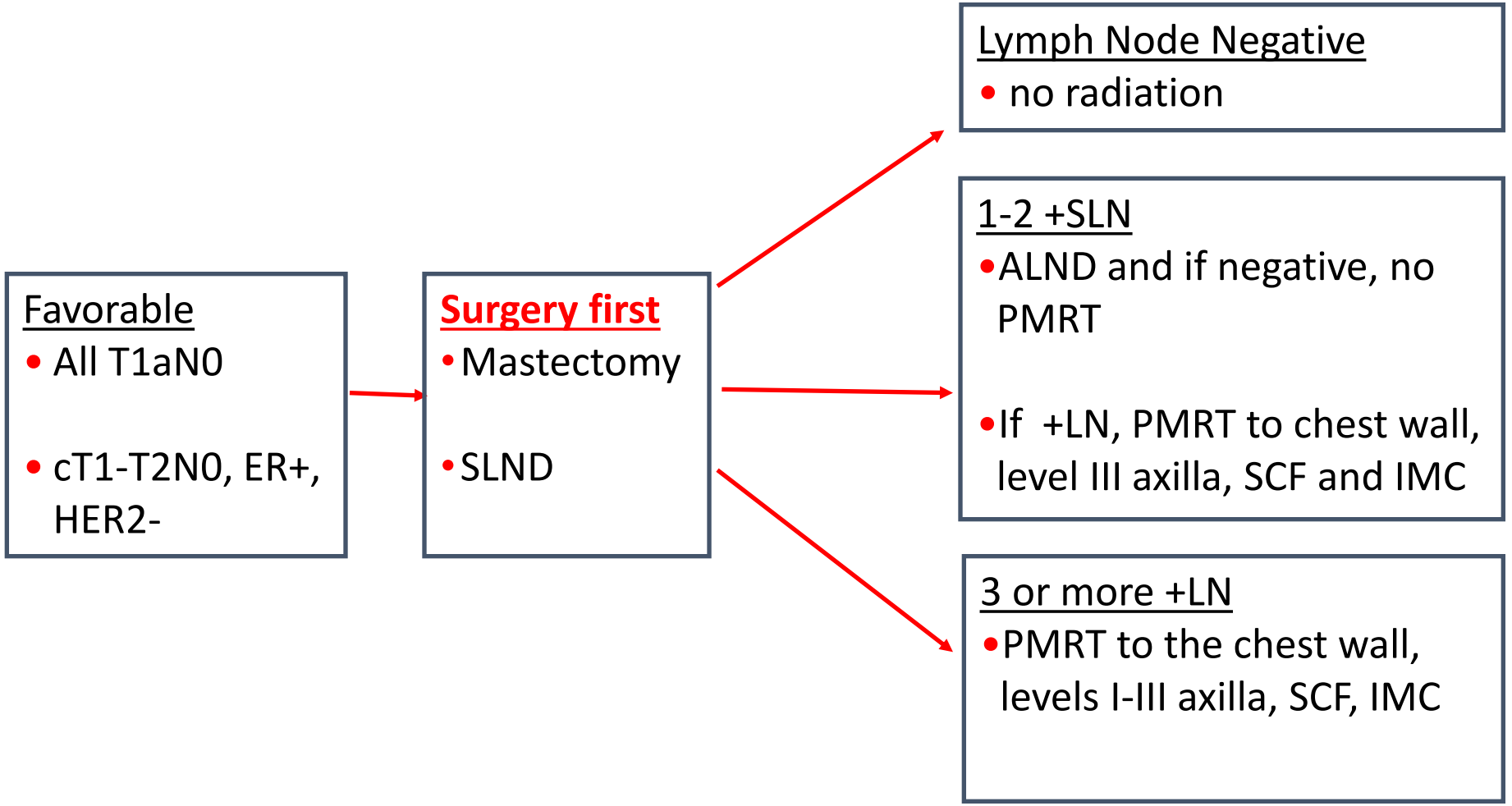
(Garg, 2006)

How to Put This All Together in Clinical Practice

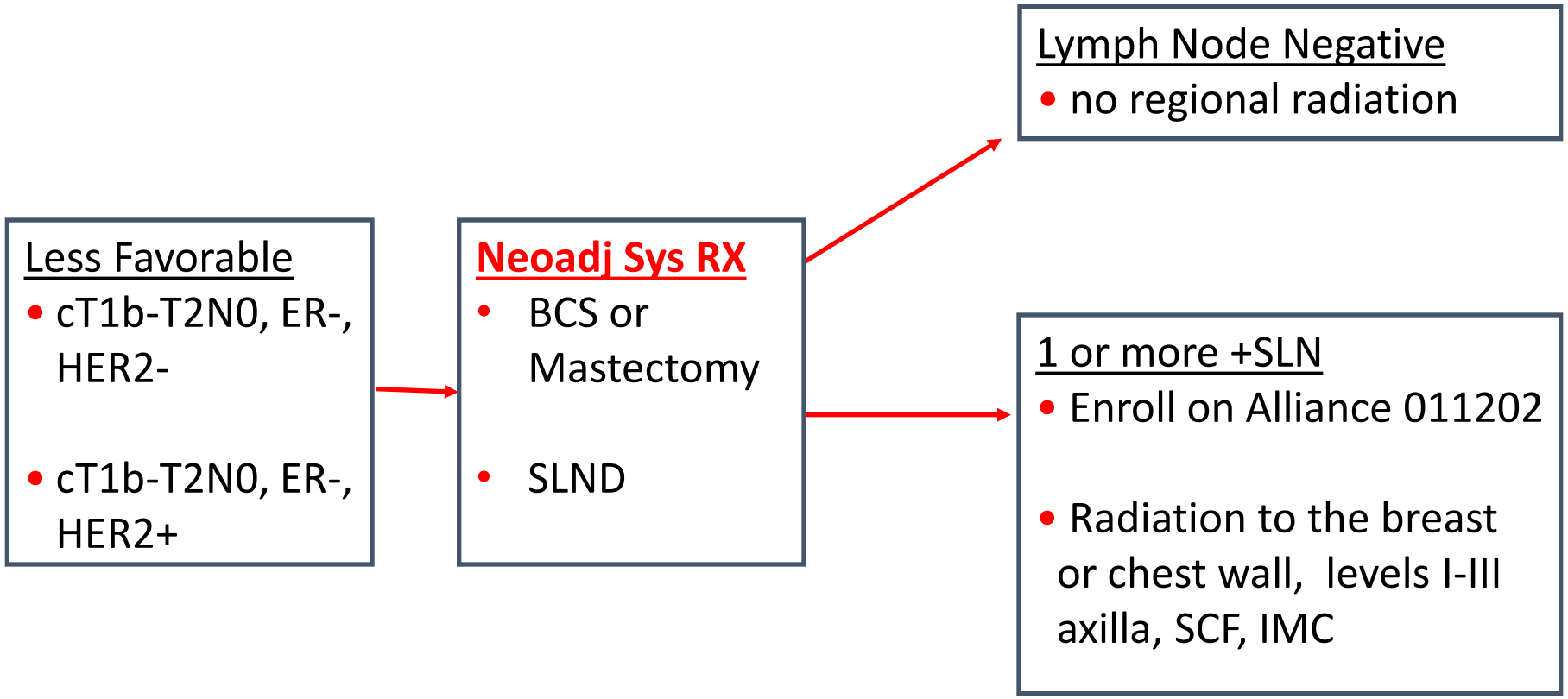
Favorable Clinical Stage and Biology



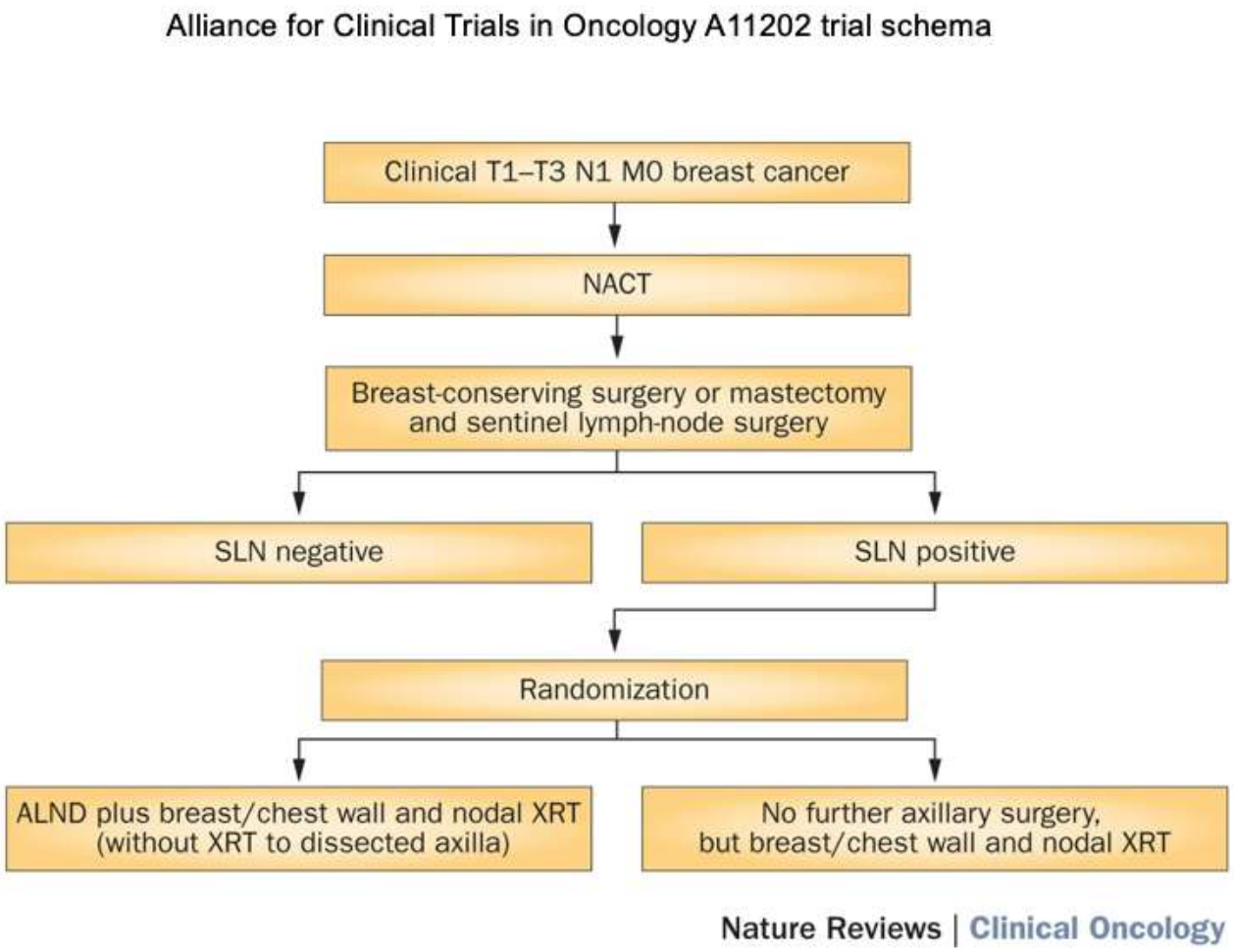
Why Breast Conservation is Better Than Mastectomy for These Patients!!



Favorable Clinical Stage, Unfavorable Biology

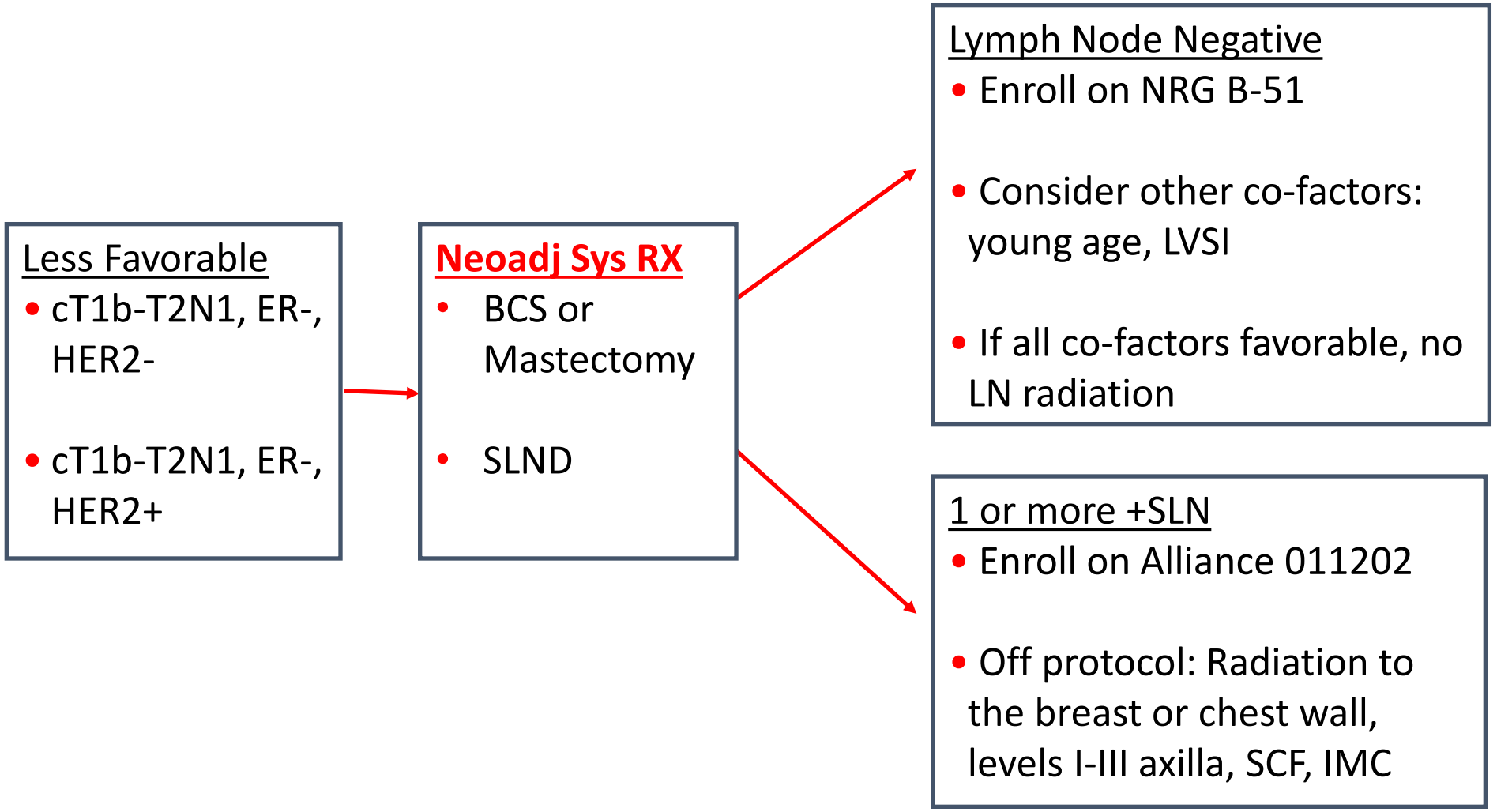


Alliance A11202

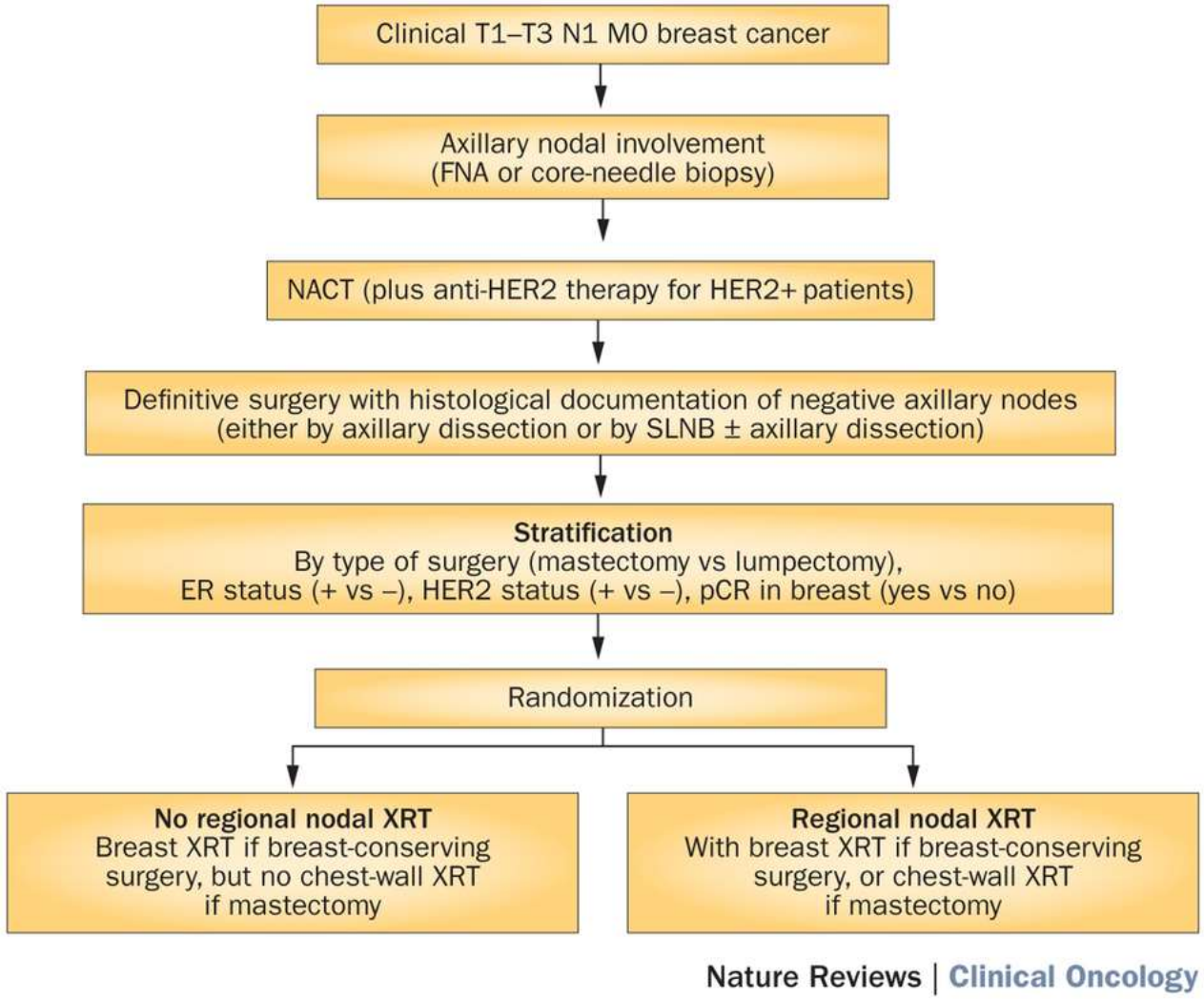


King, T. A. & Morrow, M. (2015) Surgical issues in patients with breast cancer receiving neoadjuvant chemotherapy *Nat. Rev. Clin. Oncol.* doi:10.1038/nrclinonc.2015.63

Clinical Stage II, Unfavorable Biology



NRG/NSABP B-51



King and Morrow, Nat Rev 12:335-343, 2015

NSABP B-51/RTOG 1304 Trial Phase III

- Clinical T1-3N1M0 breast cancer
- Pathology positive axillary node (**FNA/Core**)
- Neoadjuvant CT ± anti HER2

ypN0 at definitive Breast Surgery + AND or SNB

Randomization

Arm 1

No Regional Nodal XRT

A. Lumpectomy: Breast XRT.
B. Mastectomy: Observation

Arm 2

Regional Nodal XRT

A. Lump.: Breast/Nodal XRT
B. Mast: Chestwall/ Nodal XRT

Targeted accrual = 1636

Stratification: Type of Surgery (Mast v. Lump) , ER-Status (+ v. –), HER2 Status (+ v. –), pCR in Breast (yes v. no)

NSABP B-51/RTOG 1304 Trial Phase III

Eligibility (select):

- clinical T1-3, N1
- Path confirmation of Axillary nodes Pre NAC
- Pathologically negative axillary nodes post NAC
- ER/PR/HER2 done pre NAC
- Minimum of 8 weeks of standard NAC

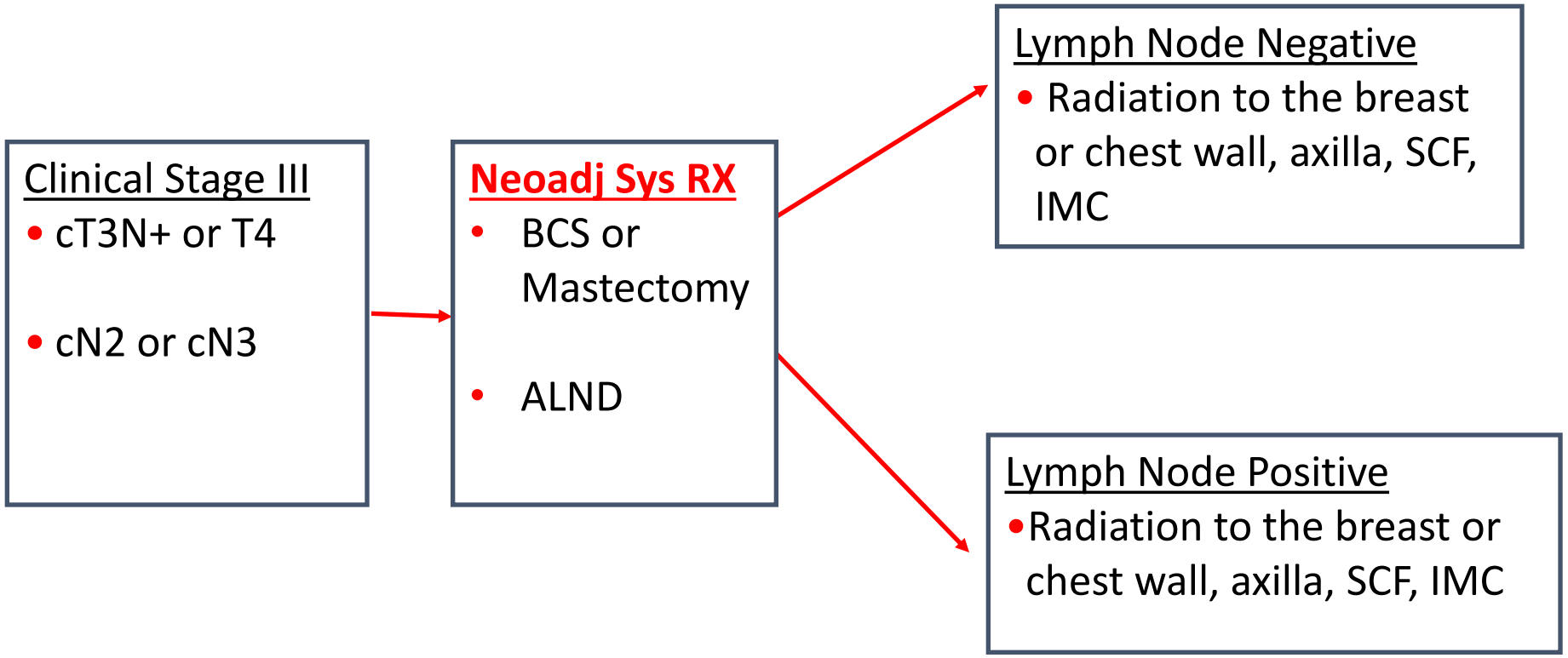
Ineligibility (select):

- Metastatic disease
- c T4
- c N2 or N3
- SNB pre NAC

NSABP B51/ RTOG 1304
Patient Characteristics (9/2018)

Characteristic		%
Receptor Status	TN	22.3
	HR+,HER2-	21.2
	HER2+	**56.5**
pCR Breast	yes	76.8
	No	23.2
Surgery	Mastectomy	41.4
	Lumpectomy	58.6

Clinical Stage III



If Treating Regional LN: Include the IMC

MA20 and EORTC found a decrease in DM with regional XRT, which included the IMC

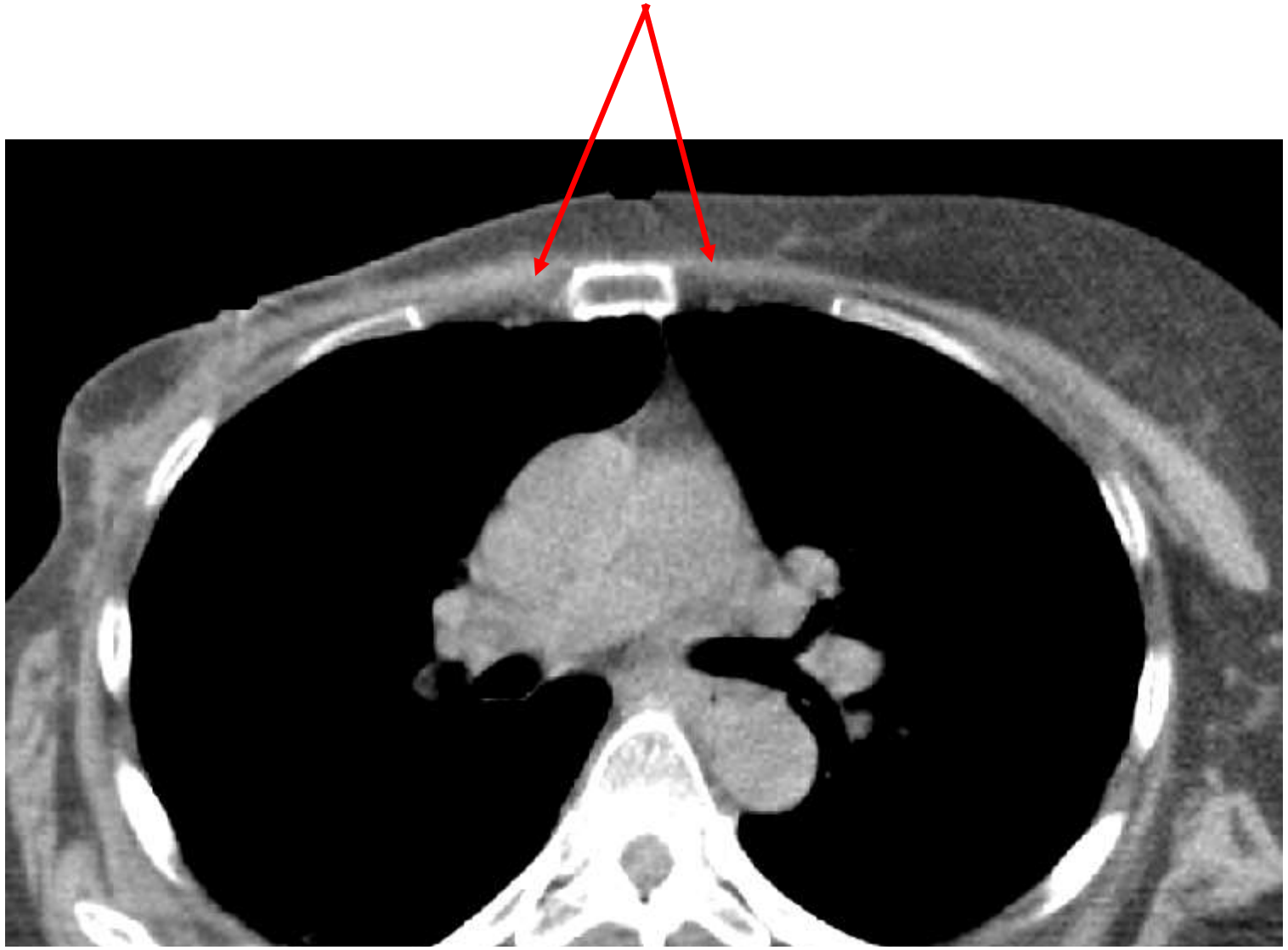
AMAROS found no DM benefit with regional XRT, which included only the axilla/SCF (only 10% had IMC)

High rates of IMC Positivity

4 or more positive axillary nodes	
• 4 – 6 lymph nodes	28.1%
• 7 or more	41.5%
Medial tumors and positive axillary nodes	
• 1 – 3 lymph nodes	23.6%
• 4 – 6 lymph nodes	47.5%
T3 tumors in patients 35 and younger	25.4%
T2 tumors and positive axillary nodes	
• 1 – 3 lymph nodes	20.3%
• 4 – 6 lymph nodes	31.5%
• 7 or more	42.0%
T2 tumors in a medial location	20.6%

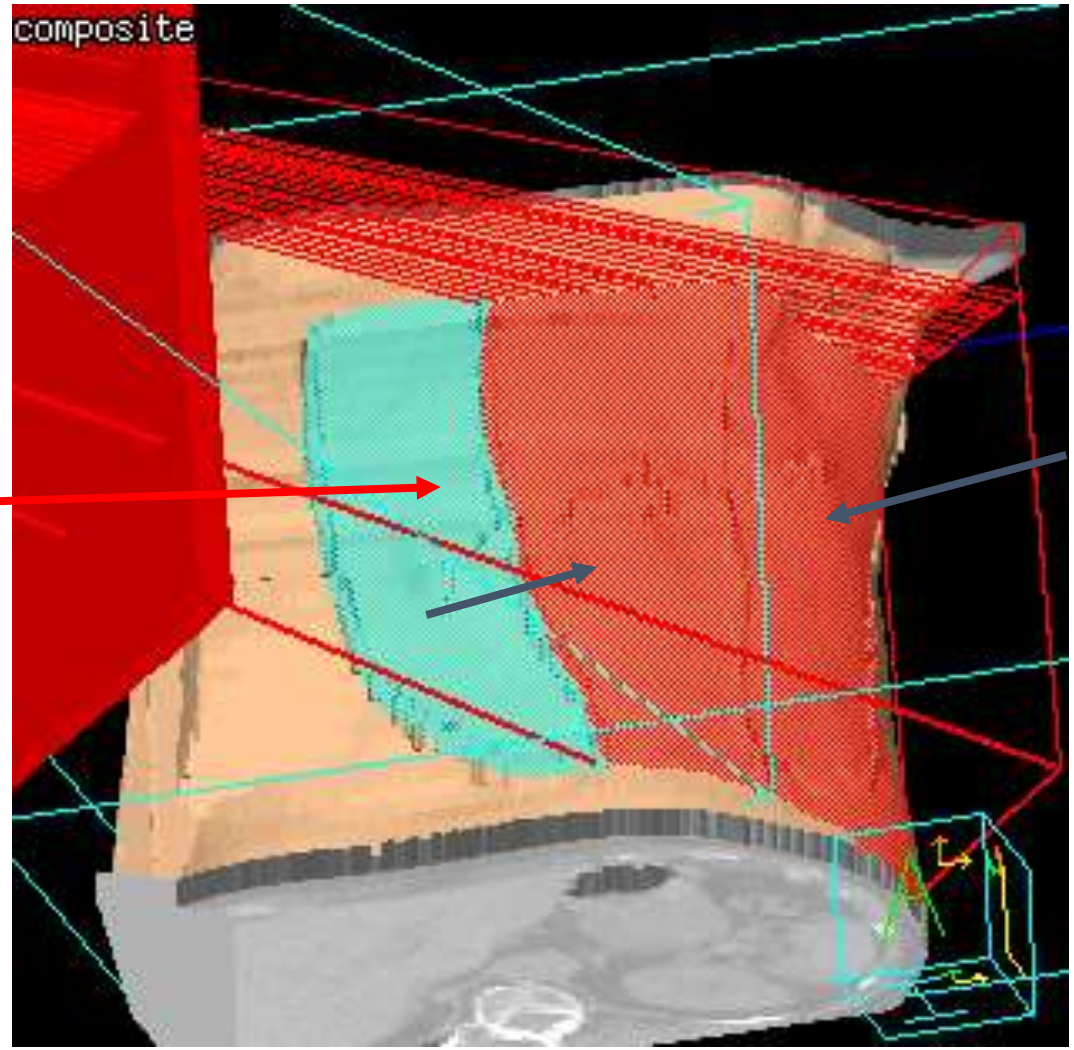
From Huang et al. Breast Cancer Res Treat 107 (3): 379-87 (2008)

Contouring the IMC



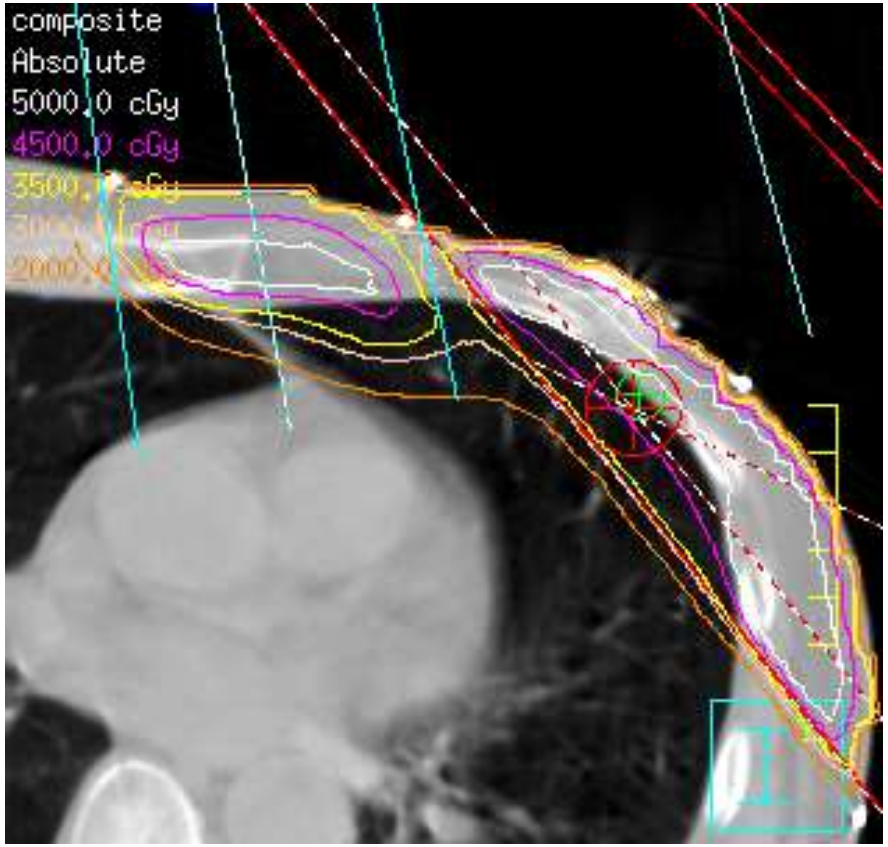
Heart-Sparing Postmastectomy Radiation Technique

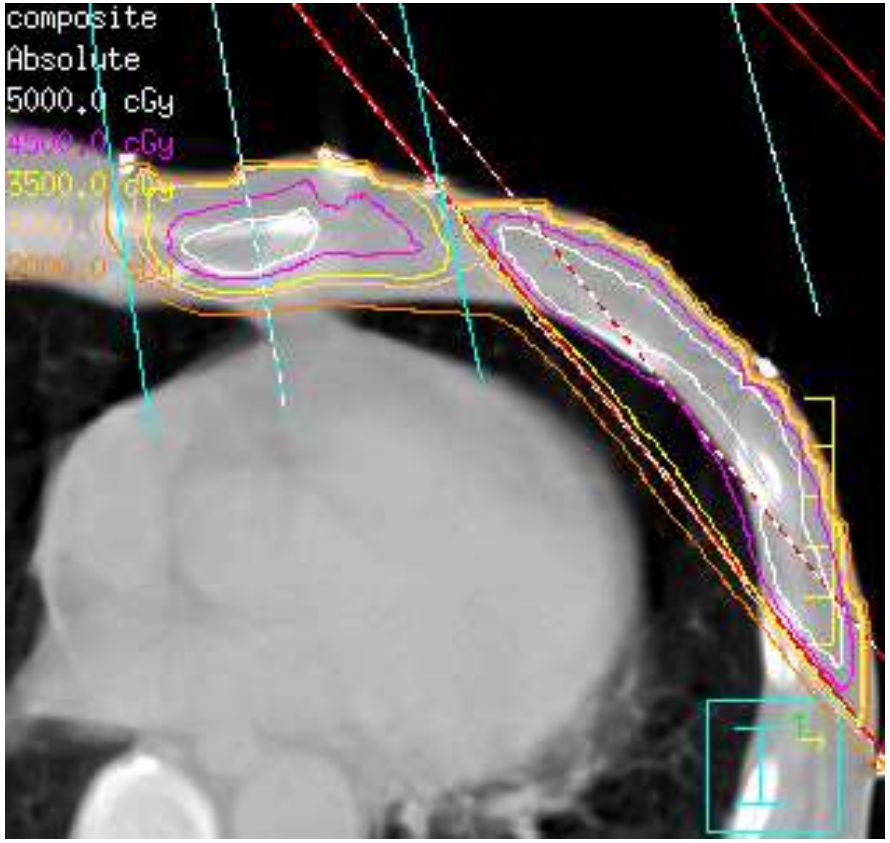
Superficially-penetrating electron beam radiation



Opposed-tangential photon radiation

Modern Post-Mastectomy Technique

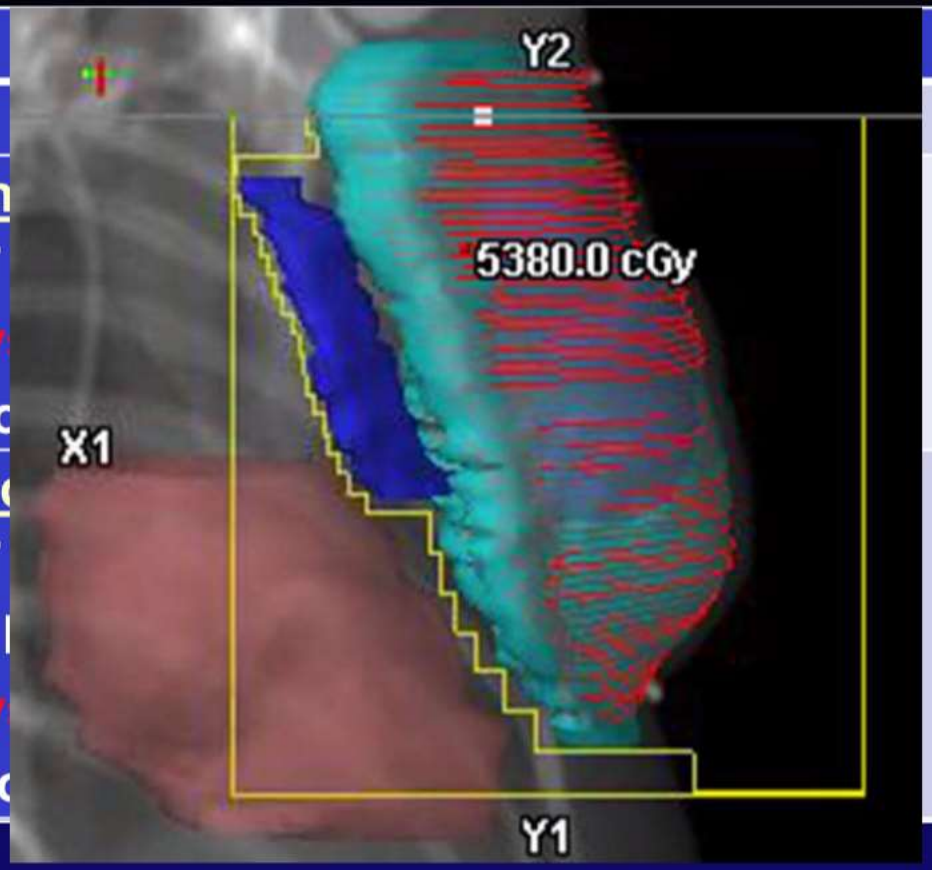




Modern RT Treatment Planning Allows Safe Inclusion of IMN

- 202 Women Treated with RNI: 33 BCT, 169 PMRT
- 3DCRT 80%, IMRT 20%, DIBH 40% Left sided

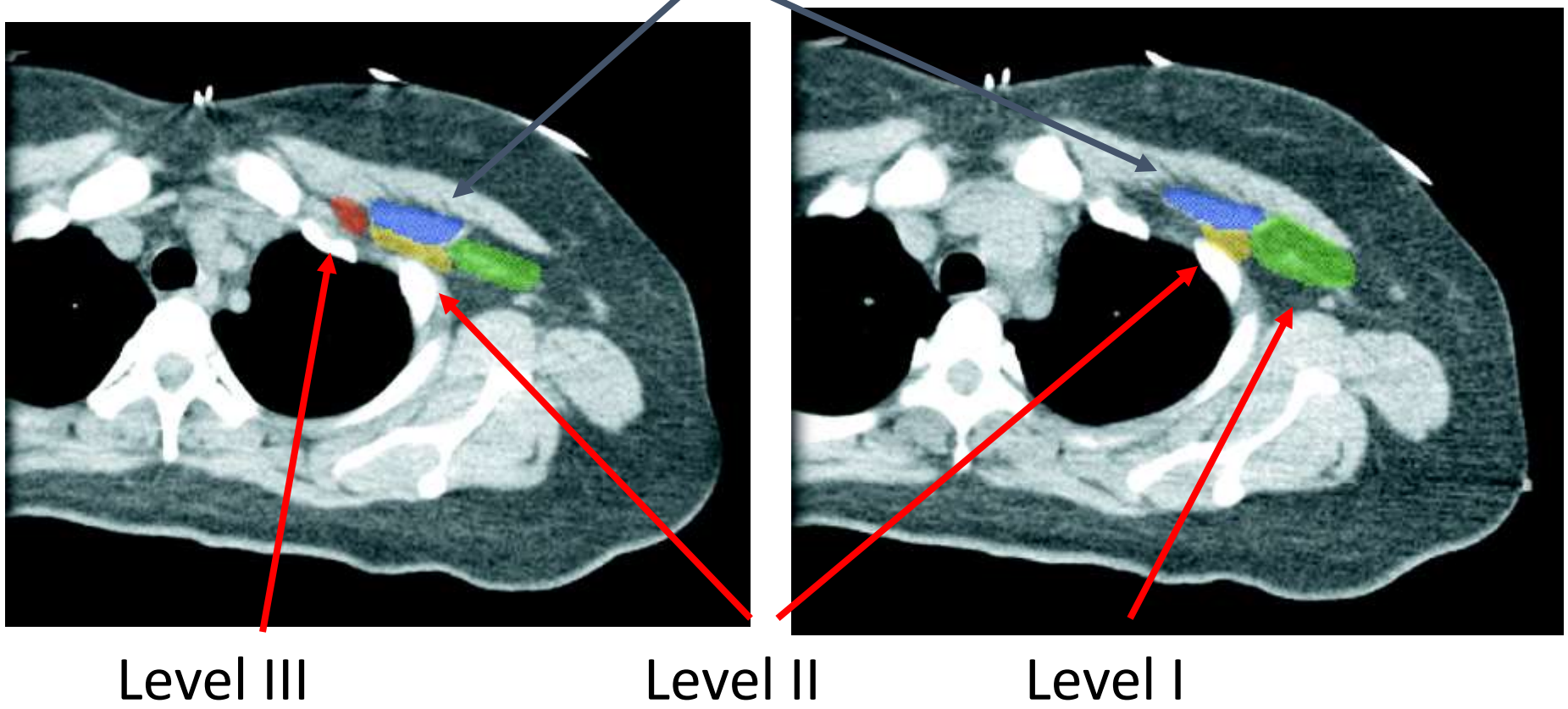
Va		p-value	
IM	Model #1: All patien		0001
IM	IMRT vs. 3DCRT	p<0.001	3
Le	IMN irradiation v	p=0.350	90
Int	Use of nodal boo	p=0.037	66
Us	Model #2: Left-sided		5
No	IMRT vs. 3DCRT	p<0.001	
Pri	Use of DIBH vs.	p=0.512	76
No	IMN irradiation v	p=0.998	001
Re	Use of Nodal boo	p=0.559	31
Ma			27



Bazan et al, PRO, 2017

Contouring the Axilla

Practical Essentials Of IMRT, 2004



Conclusion

Neoadjuvant Chemotherapy Can Help

- Better define who benefits from radiation
- Better define who can avoid radiation
- Help minimize the morbidity of local-regional treatment
- Still much work to do to fully clarify these issues
- If you are going to treat, use optimal techniques!

Summary: Radiation Management of the Axilla after NAC

- Clinical cN0/ yp N0: observation
- Clinical cN+ / ypN+: regional nodal irradiation
- Clinical cN2-3/ ypN0: regional nodal irradiation
- Clinical cN1/ ypN0:
  - Regional nodal irradiation in many
  - Observation – Clinical small volume, ypT0, ypT1Luminal, older age

16th St. Gallen

International Consensus Guidelines

Breast Cancer Conference

Primary Therapy of Early Breast Cancer

March 23th ,2019

RT en áreas ganglionares regionales post TSP

cN+ → TSP → GC negativo. RT es el tratamiento:

1.	estándar	43,8 %
2.	no estándar	16,7 %
3.	si FR negativos (ΦT, IVL+, # GG sospechoso preTSP)	22,9 %
4.	si ypT+	6,2 %
5.	Abstención	10,4 %

RTPM post TSP

T3N0 TRN. ypT0 ypN0 (GC-). Indicaría:

1.	RTPM basada en estadio pre TSP	66,0 %
2.	No RTPM en pts con excelente respuesta	21,3 %
3.	Abstención	12,8 %

Indicações de radioterapia após quimioterapia neoadjuvante enquanto se aguarda os resultados dos ensaios clínicos

fernandomobst@gmail.com

Março 2019

HOSPITAL SÃO LUCAS DA PUCRS

Grupo ONCOCLÍNICAS

Lymphedema in the Setting of Neoadjuvant Systemic Therapy: Z1071 Lymphedema Substudy

- cT0-4N1-2M0 treated with neoadjuvant chemotherapy & ALND
- Lymphedema measures: limb volume, circumferences, symptoms
- Dx Lymphedema: ≥ 10% volume increase OR circumference increase ≥ 2cm
- Timepoints: preoperative, 1-2weeks postop, semiannually thru 36mo

Armer, Supportive Care in Cancer, 2018

Z1071 Cumulative Incidence of Lymphedema

	Baseline	1-2wks	6mo	12mo	18mo	24mo	36mo
≥ 10% limb volume increase		20%	5%	31%	45%	54%	60%
≥ 2cm circumference increase		33%	8%	45%	58%	70%	75%
Arm heaviness	7%	25%	2%	12%	20%	23%	26%
Arm swelling	3%	24%	2%	14%	23%	28%	31%

Cumulative incidence not including measures 1-2 weeks postoperatively

Armer, Supportive Care in Cancer, 2018

How Does This Compare to Prior Reports

	6 month			12 month		
	Z1071			Z1071		
≥ 10% limb volume increase	5%			31%		
≥ 2cm circumference increase	8%			45%		
Arm heaviness	2%			12%		
Arm swelling	2%			14%		

How Does This Compare to Prior Reports?

	6 month			12 month		
	Z1071	mixed cohort*	Z11**	Z1071	mixed cohort*	Z11**
≥ 10% limb volume increase	5%	8%	-	31%	21%	-
≥ 2cm circumference increase	8%	46%	6%	45%	70%	11%
Arm heaviness	2%	19%	8%	12%	40%	13%
Arm swelling	2%			14%		

*Mixed cohort of stage I-IV breast cancer patients:

- 41% ALND
- 60% chemotherapy
- 39% lumpectomy
- 51% radiation

**ALND arm of trial

- cT1-2N0
- 1-2 SLN+
- 58% chemotherapy

Armer, Supportive Care in Cancer, 2018; Armer, Lymphatic Research and Biology, 2005; Lucci, JCO 2007

How much does XRT contribute to lymphedema?

Radiation and Surgical Targets	Incidence of Lymphedema
Sentinel Lymph Node Biopsy/Axillary Sampling	
Breast/Chestwall Radiation	4.1% (2.5%-5.8%)
Breast/Chestwall + Node Radiation	5.7% (3.3%-8.1%)
Axillary Lymph Node Dissection	
Breast/Chestwall Radiation	9.4% (5.8%-13.7%)
Breast/Chestwall + Node Radiation	18.2% (12.4%-23.9%)
All Patients	10.9% (7.1%-15.4%)

Estimated # Breast Cancer Survivors in the U.S.	
2016	3.6 million
2026	4.6 million

Shaitelman, BCRT, 2017; American Cancer Society, Cancer Treatment & Survivorship Facts & Figures 2016-2017

Radiation dose fractionation may impact deconditioning

Predictors of Patient-Reported Outcomes at 6 Month Follow-Up								
	Lack of Energy				Trouble Meeting Family Needs			
	N	OR	95% CI	p-value	N	OR	95% CI	p-value
Randomization Arm								
CF-WBI	140	1			139	1		
HF-WBI	128	0.39	0.24-0.63	<.001	128	0.34	0.16-0.75	0.007
Chemotherapy								
None	185	1			184	1		
Neoadjuvant	27	1.21	0.50-2.89	0.68	27	1.34	0.41-4.30	0.63
Adjuvant	56	1.87	0.99-3.54	0.055	56	2.78	1.26-6.15	0.01

The interplay with this and neoadjuvant chemotherapy remains to be studied

Shaitelman, JAMA Oncology, 2015

Clinical Stage III Disease

cT3N1, ypT0-3,N0

Without radiation

- NSABP B-18/27 10% LRR risk

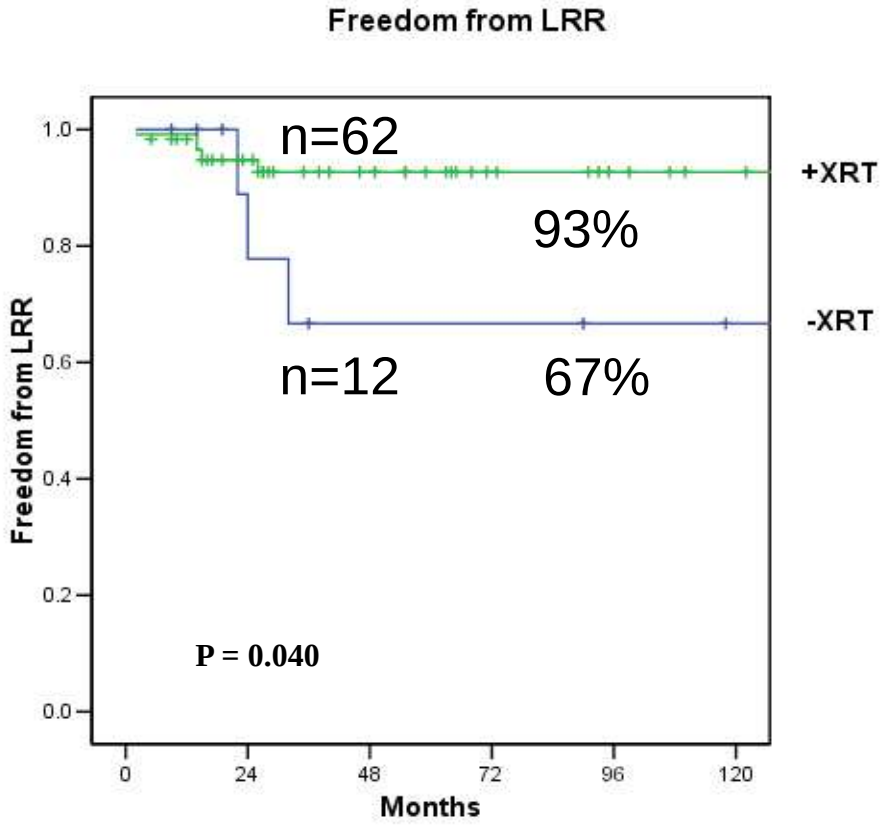
cT3N1ypT0-3,N1

Without radiation

- NSABP B-18/27 >20% LRR risk

Mamounas et al, J Clin Oncol 30:3960-66, 2012

Clinical Stage III Disease w/ pCR



(McGuire, 2007)

Early Stage (T1/2), Clinical Node-Negative

Path stage = ypT0-2 N0

- NSABP B-18/27

Without radiation

6% LRR risk at 10-years

Path stage = ypT0-2 N1

- NSABP B-18/27

Without radiation

10% LRR risk at 10-years

Mamounas et al, J Clin Oncol 30:3960-66, 2012

Whelan et al. *NEJM* 2015;373(19):1878-1879

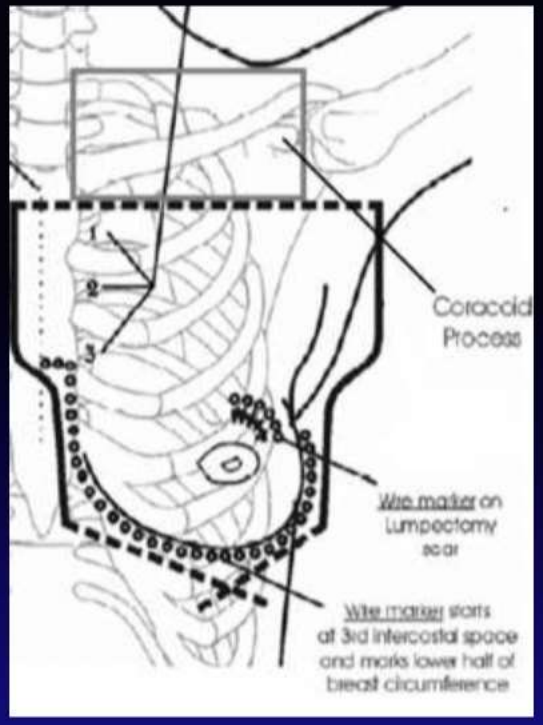
NCIC MA.20:

Node positive **Post lumpectomy**

R

WBI	WBI + RNI

- Accrued 2000-2007
- N =1832
- Median follow up: 10 years



Poortmans et al, NEJM 373: (4):317-327 *2015*

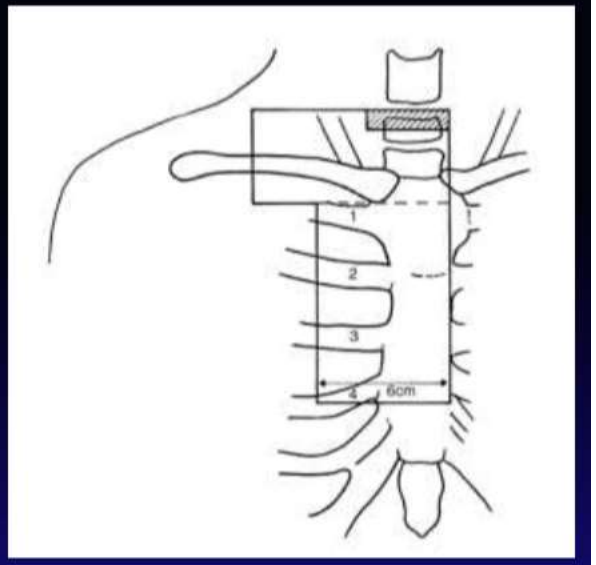
EORTC trial 2922/10925

- pN+ axillary nodes or
- pN- central or medial tumor

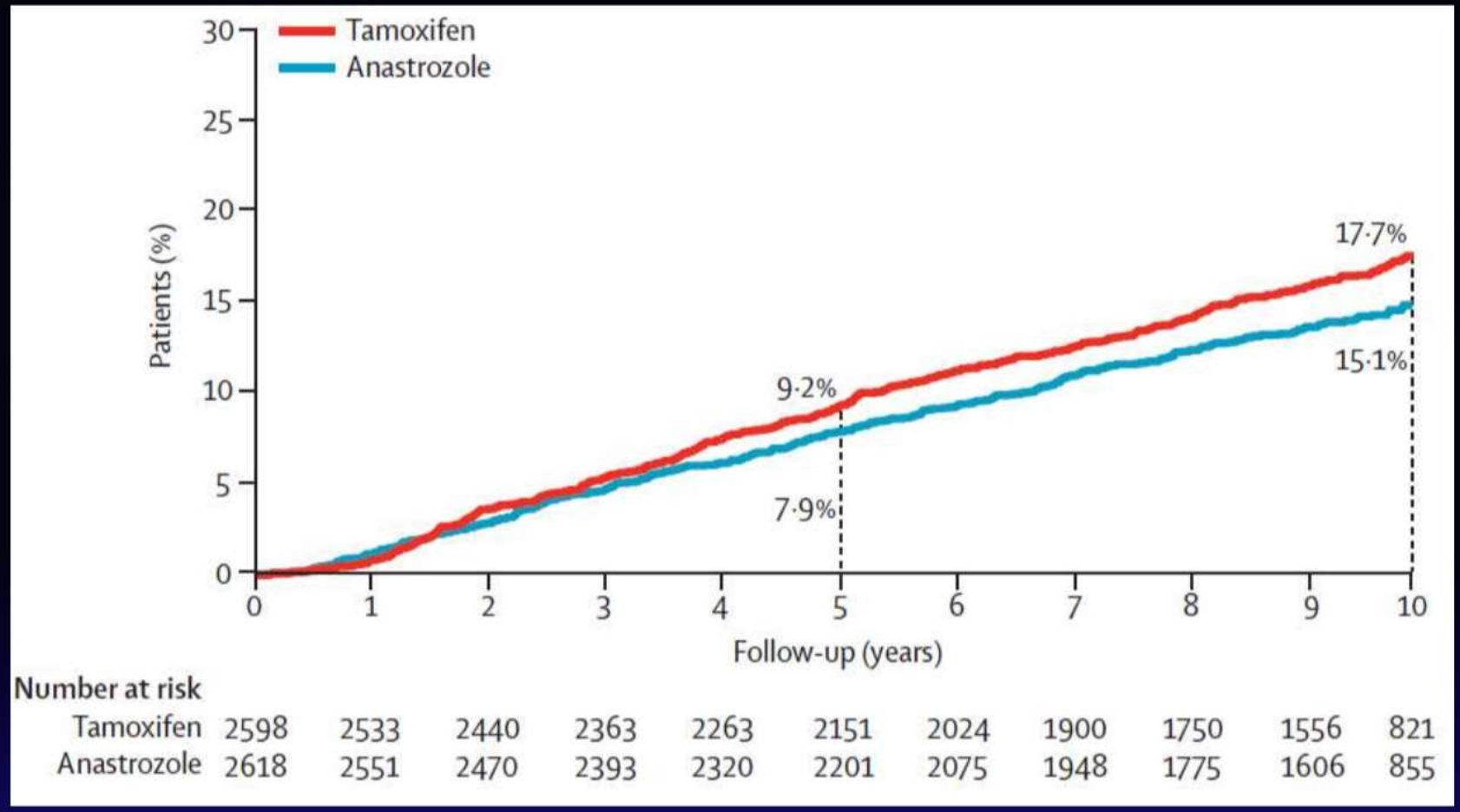
R

No IM-MS XRT	IM-MS XRT

- Accrued 1996-2004
- N= 4004
- 76% BCT; 24% Mast.
- Median Follow up: 10.9 years



ATAC Trial 10 Year Outcome: Improvement in Time to Distant Recurrence is 2.6%



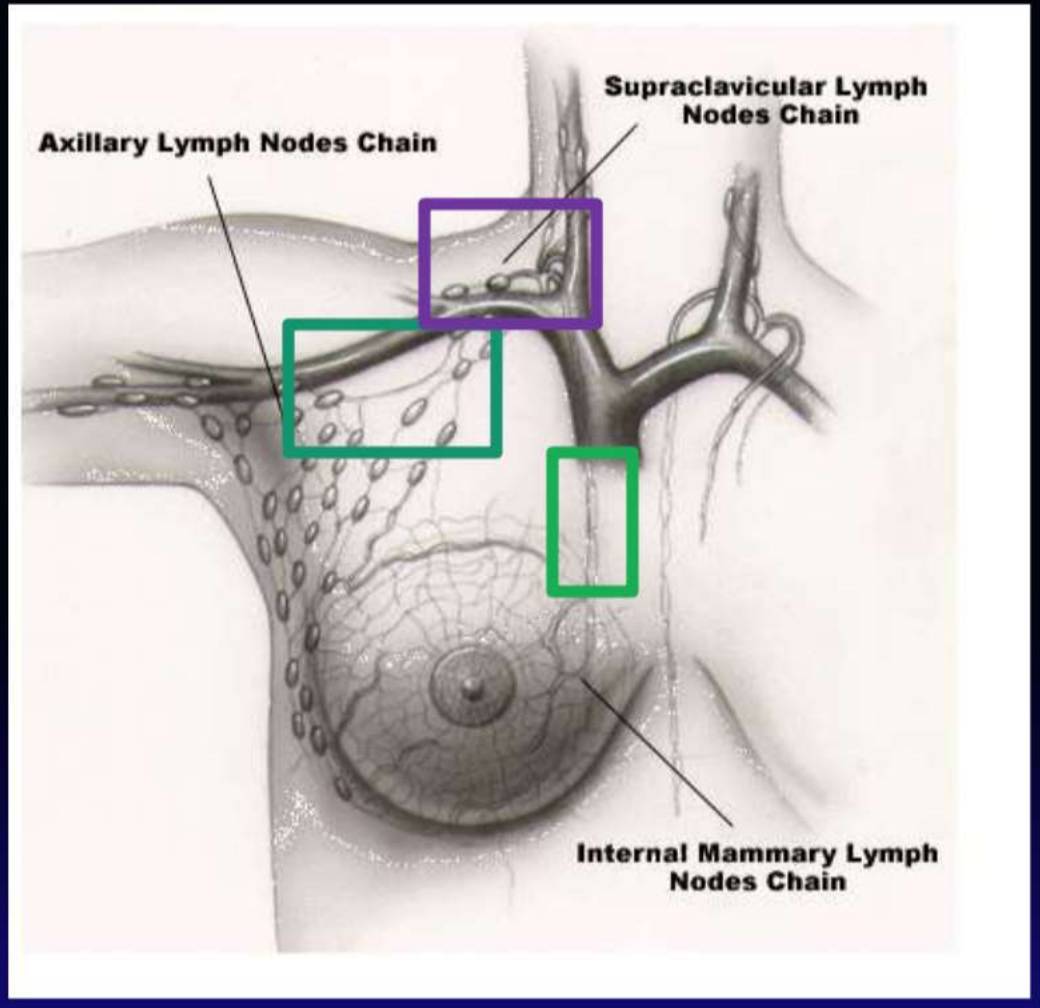
Time to distant recurrence in hormone-receptor-positive patients

Cuzick, et al. Lancet Oncol 2010

All Trials Demonstrating Benefit of Regional Nodal Irradiation Target Axilla, SCL and IMN

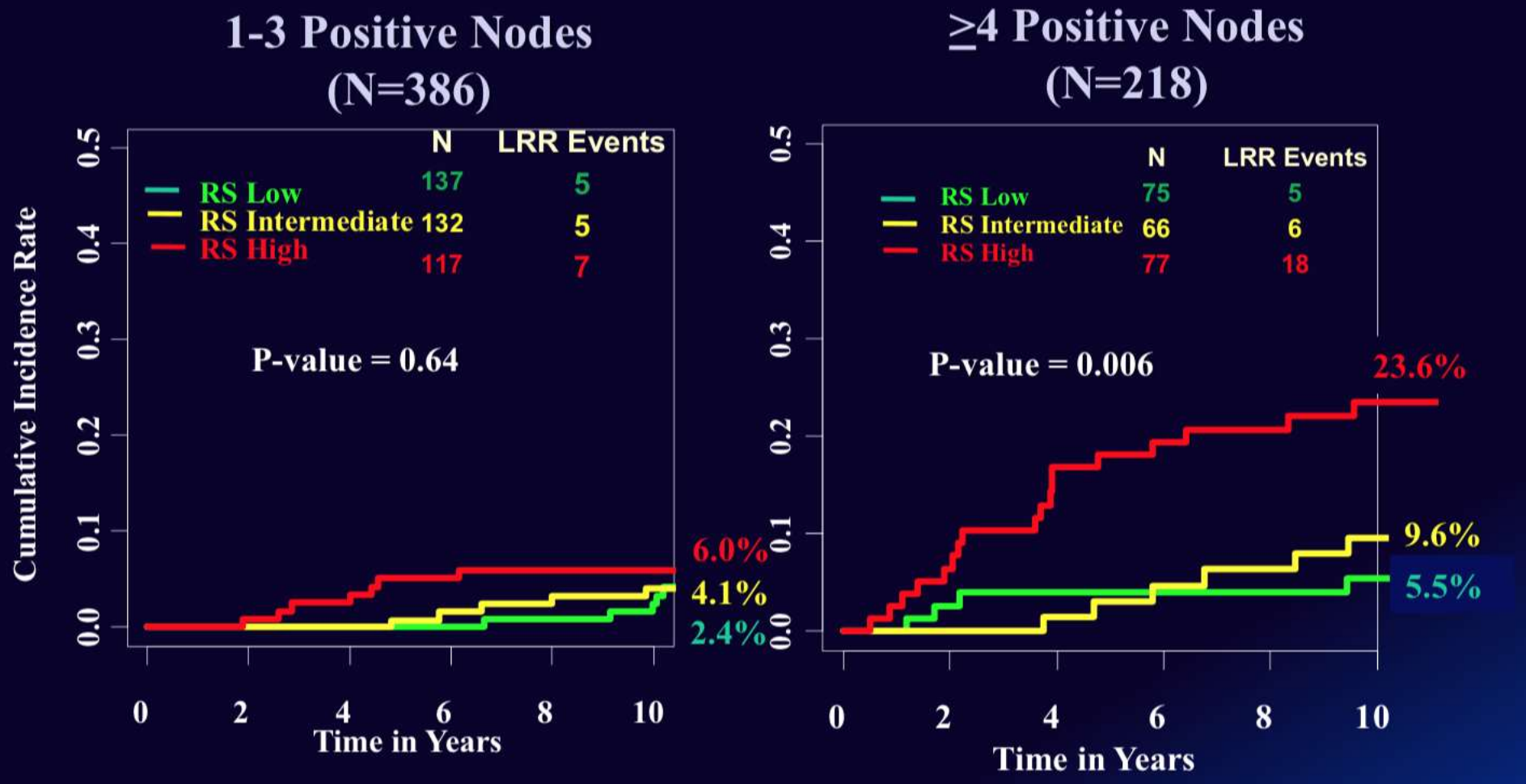
Regional nodes:

- Axilla: what did not get removed with SN biopsy or dissection,"undissected or retained axilla")
- Supraclavicular
- Internal mammary: first three intercostal spaces



Oncotype RS Multigene Assay Predicts LRR Post Mastectomy for ER/PR+ Breast Cancer

NSABP B28: ER+, Node positive



Mamounas EP, et al. *JNCI 2017*

CCTG MA39 "Tailor RT" Phase III Trial

Women > 50 with 1-3 + axillary metastases
ER+ and/or PR+, HER2-Negative,
Luminal A by IHC, ROR , 40, Oncotype-DX RS ≤ 18,

STRATIFICATION

- SNB vs Axillary dissection
- Surgery – mastectomy vs BCT
- Adjuvant chemo – yes/ no
- Oncotype RS (0-10, 11-17)

RANDOMIZATION

Arm 1

Regional nodal radiation therapy +

Endocrine therapy

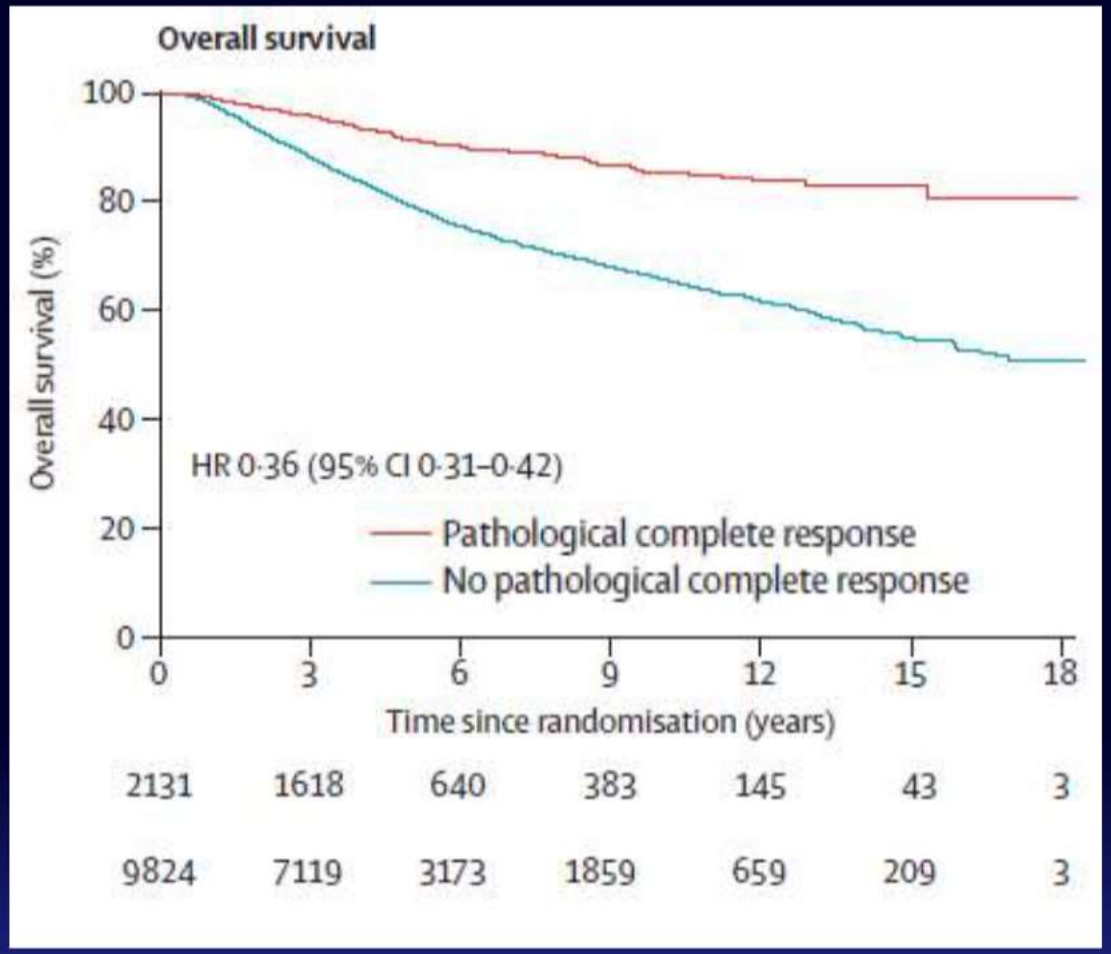
Arm 2

Endocrine therapy

Targeted Accrual: 2140

PI: Dr. Tim Whelan

Complete Pathologic Response to Neoadjuvant Chemotherapy Prognostic for Improved Overall Survival



Cortazar et al, ***Lancet*** **2014**

Combined Analysis of NSABP B18 and B27: Examined LRR post NAC without RNI

- NSABP B18: AC x4 pre v. post op
  - n=742, 1988-93, median follow up 15.4 years
- NSABP B27: AC +/- Taxol pre v. post op
  - n = 2,041, 1995-2000, median follow up 10.7 years.
- Operable breast cancer (70% cN0, ~73%c T1-2 ≤ 10% c Stage III)
- Combined- 2961 Patients -with 318 LRR as First Events
- Breast radiation allowed after lumpectomy but **not** to regional nodes.
- Post mastectomy radiation **not** allowed.

Mamounas et al, JCO 2012

Combined Analysis of NSABP B18 and B27: Examined LRR post NAC without RNI: 10-year Cumulative Incidence of LRR

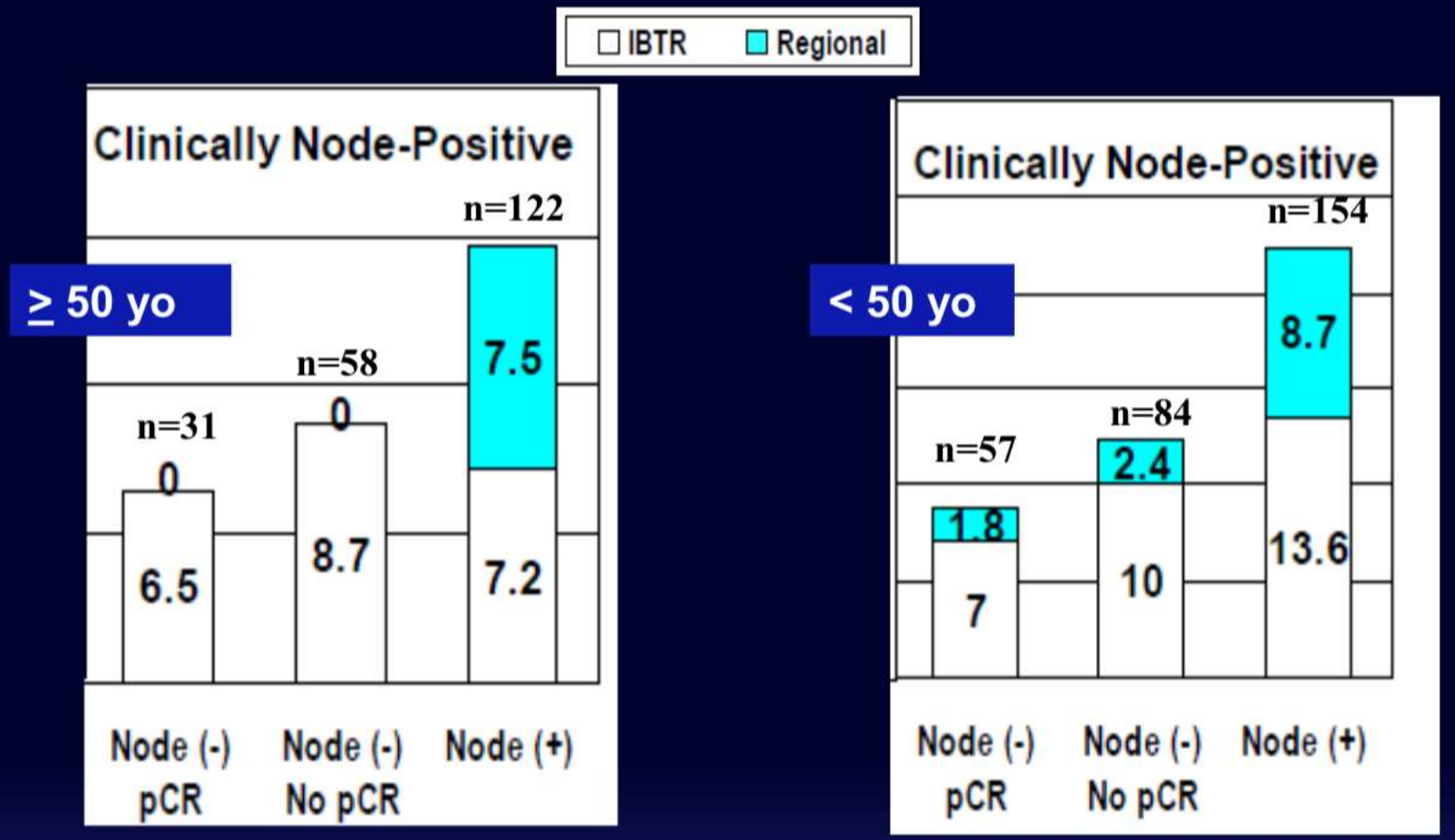
- Entire cohort (n=3,088): 11.1% (8.4% local; 2.7% regional).
- Mastectomy (n= 1947): 12.6 % (9.0% local; 3.6% regional)
- BCT (n= 1,100): 10.3% (8.1% local; 2.2% regional).
- Multivariate analysis factors associated with LRR after NAC:

Variable	HR	95% CI	p
Age (≥ 50 yrs *v.* < 50 yrs)	0.78	0.63-0.98	0.03
Clinical T-Size (> 5 cm *v* ≤ 5 cm)	1.51	1.19-1.91	0.001
Clinical N+ *v.* Clinical N-negative	1.61	1.28-2.02	0.001
ypN0/ no breast pCR *v. ypN0/ breast pCR*	1.55	1.01- 2.39	0.001
ypN+ *v.* ypN0 /breast pCR	2.71	1.79- 4.09	0.001

Median follow up: 11.8 years

Mamounas et al, JCO 2012

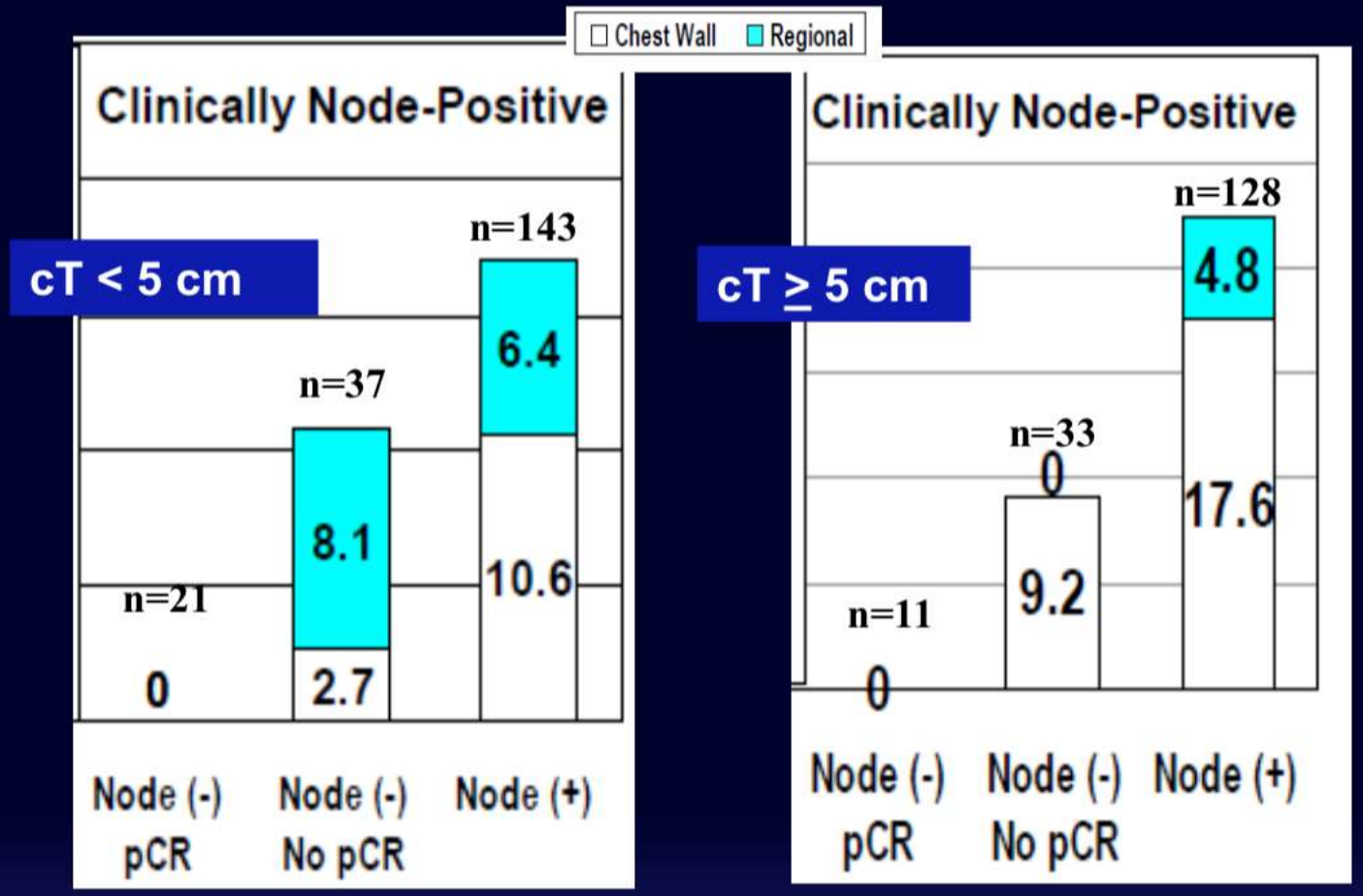
Combined Analysis of NSABP B18 and B27- BCT
Reduced LRR with Complete Response in the Axillary Nodes



Median follow up: 15.4 years B18 and 10.7 years B27

Adapted from Mamounas et al, JCO 2012

Combined Analysis of NSABP B18 and B27- Mastectomy Reduced LRR with Complete Response in the Axillary Nodes



Median follow up: 15.4 years B18 and 10.7 years B27

Adapted from Mamounas et al, JCO 2012

LRR on the Phase III EORTC 10994/ BIG 1-00

- 2001-2007: 1856 randomized FEC or Taxane based CT- all NAC
- Clinical stage II-III, 45% cN0 and 55% cN+
- Subtype: LumA/B ~ 42%, HER2+ 23% (Traz 7%), TN 14%, Unk 21%
- Radiation:
  - BCS: Breast/ CW RT 50 Gy/ 25 Fractions (F), boost 16 Gy/ 8 F
  - Mast: CW, Supraclav/ Infraclav. , IMN optional 50 Gy/ 25
- Response: pCR (ypT0-TIS, ypN0): 19%
- Median follow up: 4.4 years
- LRR at 5 years 4.9%
- LRR as first site of failure 1%

Gillon et al, Eur J Ca 2017

EORTC 10994/ BIG 1-00: Multivariate Analysis LRR Following Neoadjuvant Systemic Therapy:

Variable	n	LRR n (%)	HR (CI)	p
Breast cancer subtype/trastuzumab				
Luminal A	491 (32.6)	8 (10.8)	1.00	< 0.0001
Luminal B (HER2−)	143 (9.5)	5 (6.8)	2.29 (0.76−6.97)	
HER2+ Trastu−	245 (16.3)	25 (33.8)	6.26 (2.81−13.93)	
HER2+ Trastu+	105 (7.0)	5 (6.8)	3.37 (1.10−10.34)	
Triple negative	219 (14.6)	20 (27.0)	6.44 (2.83−14.69)	
Unknown	302 (20.1)	11 (14.9)	2.28 (0.93−5.63)	
Pathological response				
ypT0/is ypN0	278 (18.5)	16 (21.6)	1.00	< 0.0001
ypT + ypN0	420 (27.9)	10 (13.5)	0.58 (0.26−1.28)	
ypT + ypN+ 1−3 nodes	450 (29.9)	14 (18.9)	0.74 (0.36−1.52)	
ypT + ypN+ ≥4 nodes	357 (23.7)	34 (45.9)	2.43 (1.34−4.40)	

median follow-up: 4.4 years

Gillon et al, Eur J Ca 2017

Locally Advanced Breast Cancer Benefits from PMRT after NAC

- MDACC 1974 - 2000
- 6 Prospective Neoadjuvant Chemotherapy Trials
- n = 636 PMRT: 542 No RT: 134

PMRT Improved 10 Year Cause Specific Survival			
Factor	No PMRT %	PMRT %	p
Clinical: > IIIb	22	44	0.002
T4	24	45	< 0.007
N2-3	27	49	<0.024
Pathological ≥ 4 pos nodes (ypN2)	18	44	<0.005

Huang, et al., JCO, 22:2004

Axillary Management in the Adjuvant Setting

- Many (but not all) axillary node positive breast cancer patients benefit from Regional Nodal Irradiation
- Overall modest but consistent reduction of in-field local regional and out of field distant recurrences.
- Clinical Trials demonstrating benefit of Regional nodal irradiation targeted the SCL, Axilla and IMN
- Integration of Advanced Treatment planning allows targeting of regional nodes and avoidance of OAR

Axillary Management

Regional Nodal Irradiation (RNI) for Axillary Node Positive Breast Cancer Established in the ***ADJUVANT*** setting

Historically:

– 4 or more axillary nodes with metastases (N2)

– Tumor > 5 cm in size and 1 or more nodes with metastases (T3,N1)

Axillary Management

Numerous Clinical Trials Now Support the use of Regional Nodal Irradiation (RNI)

Breast Cancer Patients w/1-3 Axillary Nodal Metastases

- Post Mastectomy Improve DFS/ OS

– EBCTCG Meta analysis Lancet 2014

– EORTC 22922/10925 NEJM 2015

- Post Lumpectomy Improve DFS

– NCIC MA.20 NEJM 2015

– EORTC 22922/10925 NEJM 2015

- Positive SNB Replace ALND

– EORTC AMAROS Lancet 2014

Ongoing Dilemma of Radiation Decision in NeoAdjuvant Setting.

- Current evidence for clinical decisions is informed by retrospective data.
- Unknown how to weight which factors should drive indication: clinical disease at presentation versus pathologic disease post NAC.
- Radiation Oncology consultation often occurs after NAC and surgery done.

Radiation Decision Making post NAC Dependent on Work up Pre NAC!

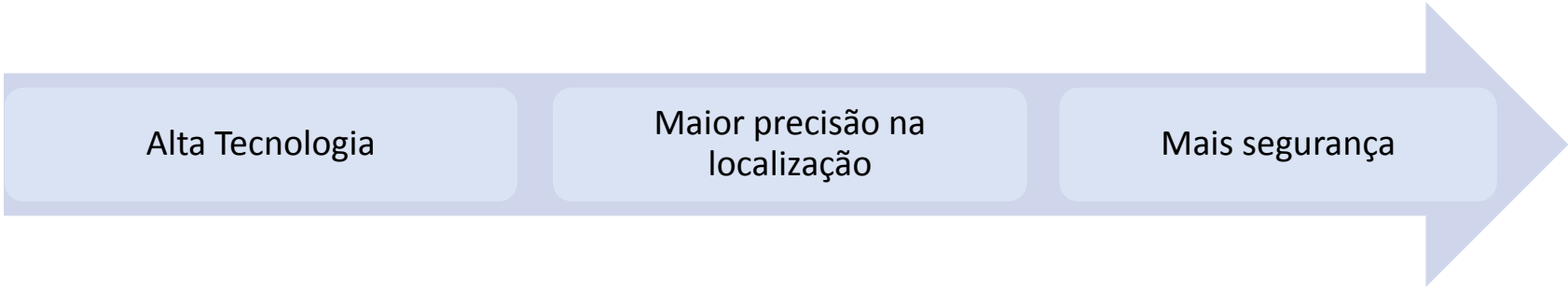
- Evaluation of the Axilla:
  - Ultrasound with FNA/ Core for abnormal nodes
- Evaluation of supraclavicular/ IMN
  - CT thorax

Radioterapia - Fracionamento Convencional

Hipofracionamento

- Uso crescente
- Fracionamento “convencional” 1.8Gy a 2.0Gy/dia
- Doses atuais prescritas 76-81Gy (38-44 frações diárias)
- Hipofracionamento: fracionamento + curto, dose diária >2.0Gy, calculada p/ obter efeito biológico similar.

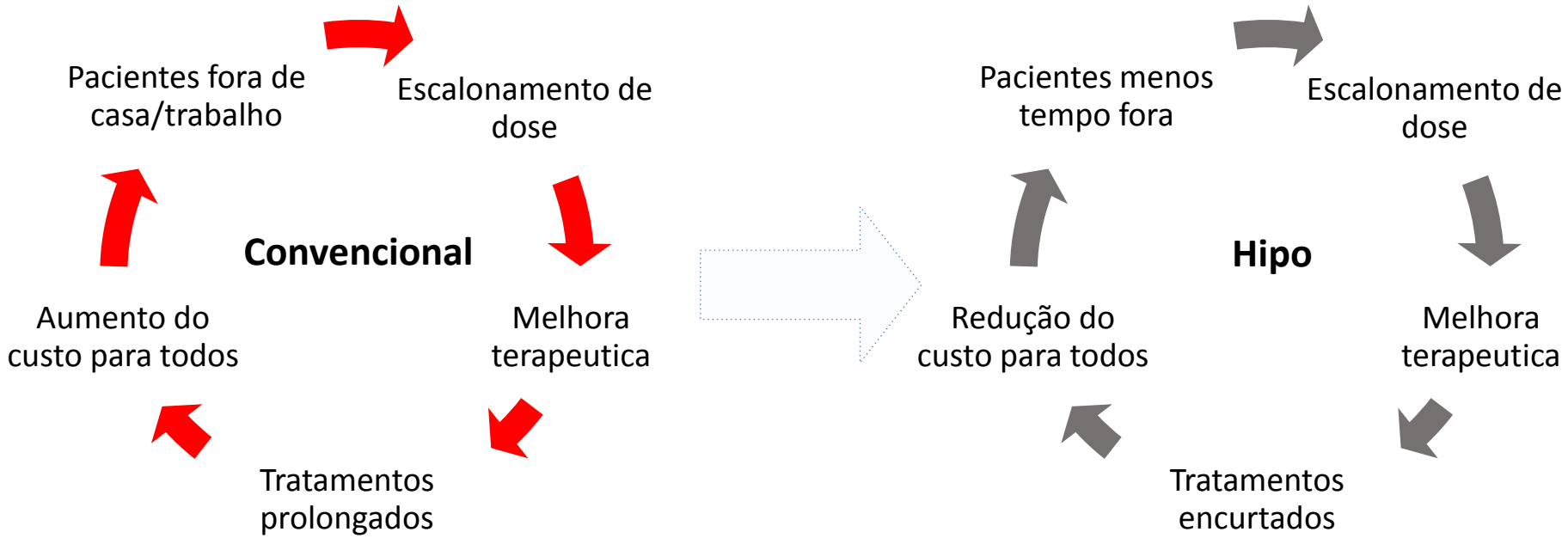
Hipofracionamento em Radioterapia



Hipofracionamento em Radioterapia

- Moderna radioterapia experimenta nova fase.
- Radiação mais dirigida, preservando tecido normal, com maiores doses diárias de radiação, fracionamento + curto.
- Dose diária >2.0Gy, calculada p/ obter efeito biológico similar.
- Série de estudos demonstrando a viabilidade do procedimento.
- Vantagens para o paciente: menos visitas ao serviço, associação com outras terapias (QT, imuno).
- Aplicável nas principais condições clínicas: neoplasias primárias e lesões metastáticas (tumores disseminados).

Hipofracionamento em Radioterapia



IMRT

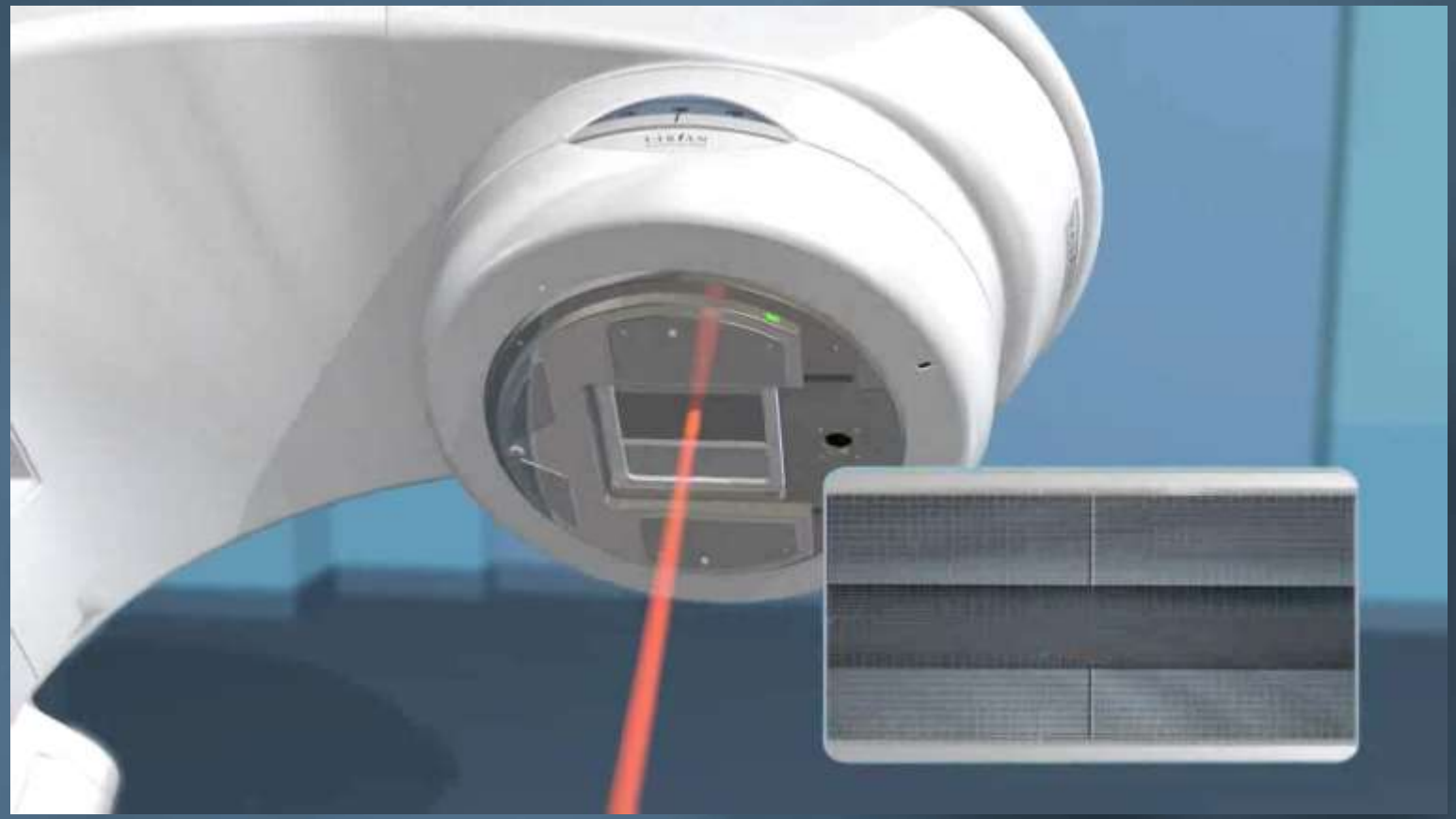
Intensity Modulated Radiation Therapy

DEFINIÇÃO

Tratamento com Intensidade modulada do feixe, isto é, durante cada posição da aplicação, conseguimos dar doses diferentes em locais diferentes do “campo” de Radioterapia

IMRT

"Sliding Window"



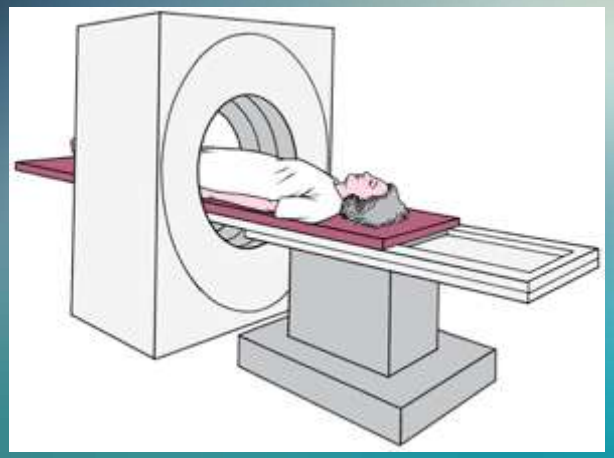
A modulação (movimento das lâminas) acontece durante a irradiação

IMRT

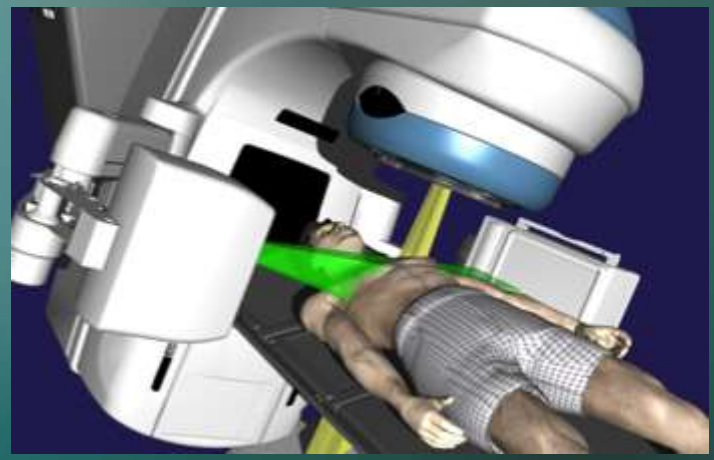
Como de fato funciona? Ex.: Próstata

IGRT

Image Guided Radiation Therapy



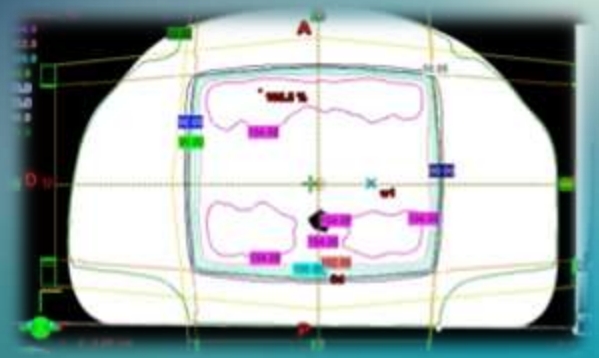
- Planejamento
- Delineamento
- Setup
- Movimentos Internos
- Posicionamento
- Imagem

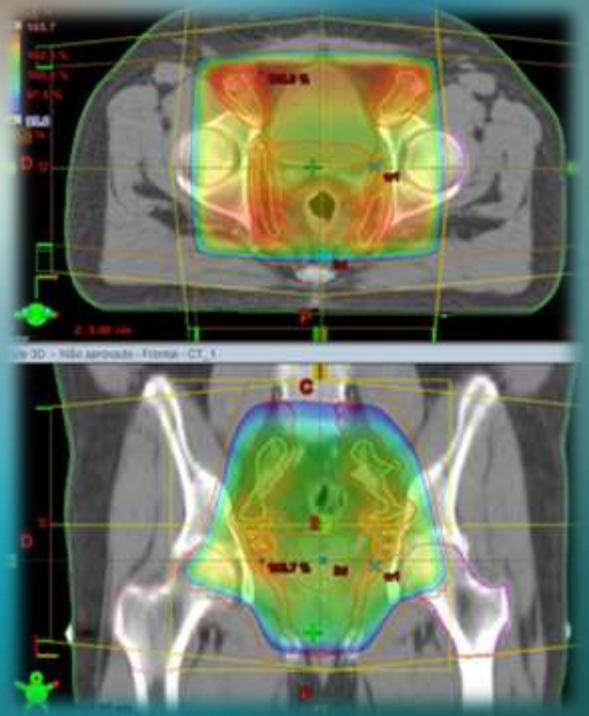


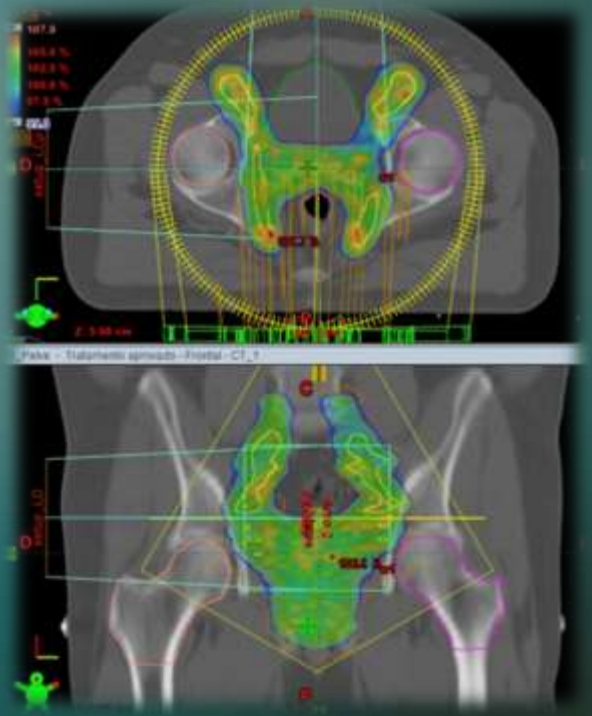
Há erros inerentes ao processo!

IGRT

Sempre seria preciso.







Cálculo Simples 2D

3DCRT

IMRT / VMAT

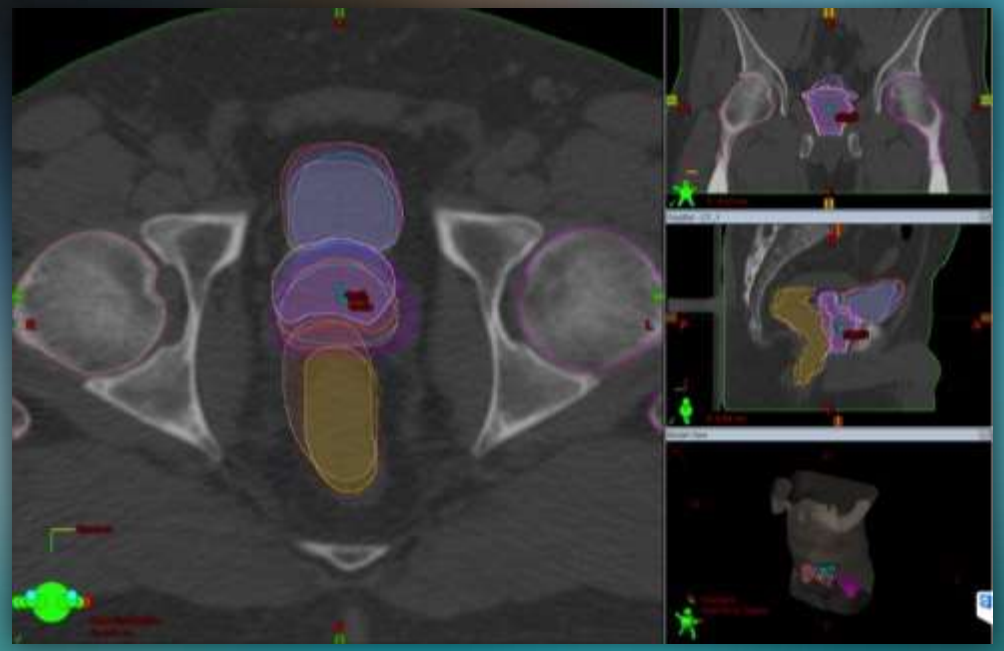
IGRT

IGRT vs. Filmes

Imagem Portal:

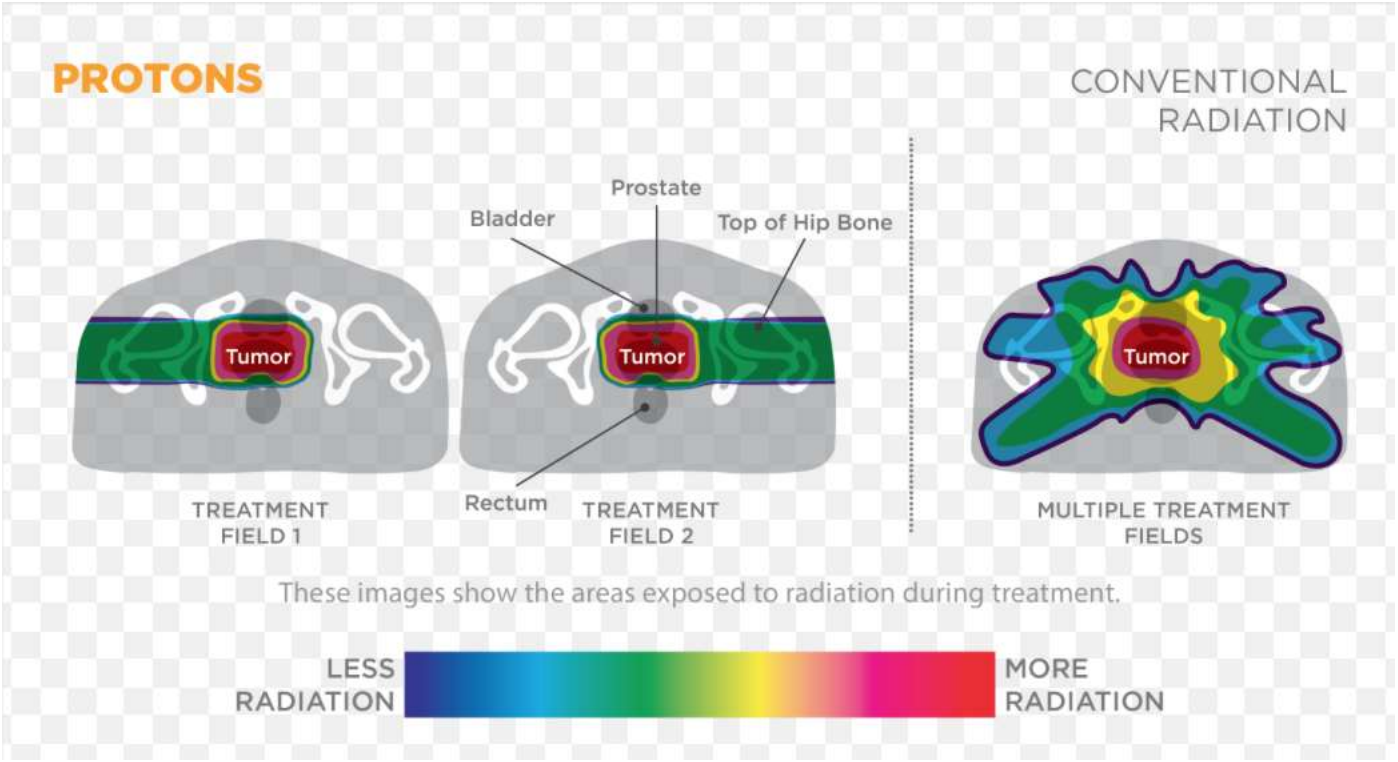
IGRT

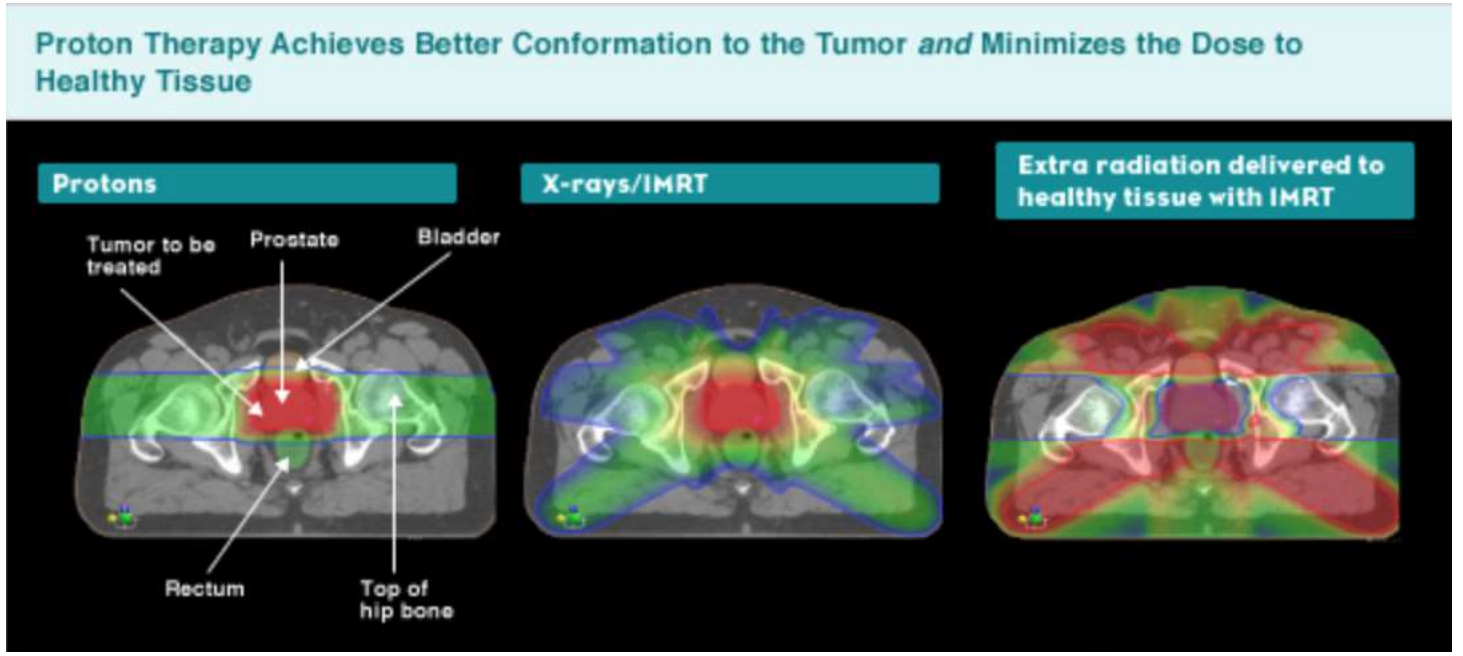
IGRT e Margens



- ✓ Variações diárias de alvos e dos órgãos de risco
- ✓ Variações anatômicas
- ✓ Incerteza de posicionamento

Posicionamento do Paciente → Imagem Planar → Análise e Ajuste **pré tratamento** → Possibilidade de redução de margens → Tratamento mais efetivo e com menor toxicidade


PROTONS
CONVENTIONAL RADIATION
Prostate
Bladder
Top of Hip Bone
Tumor
Tumor
Tumor
Rectum
TREATMENT FIELD 1
TREATMENT FIELD 2
MULTIPLE TREATMENT FIELDS
These images show the areas exposed to radiation during treatment.
LESS RADIATION
MORE RADIATION


Proton Therapy Achieves Better Conformation to the Tumor and Minimizes the Dose to Healthy Tissue
Protons
X-rays/IMRT
Extra radiation delivered to healthy tissue with IMRT
Tumor to be treated
Prostate
Bladder
Rectum
Top of hip bone