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# Radiation therapy after breast reconstruction

I have no conflicts of interest

# Effect of radiotherapy after mastectomy and axillary surgery on 10-year recurrence and 20-year breast cancer mortality: meta-analysis of individual patient data for 8135 women in 22 randomised trials

*EBCTCG (Early Breast Cancer Trialists' Collaborative Group)**

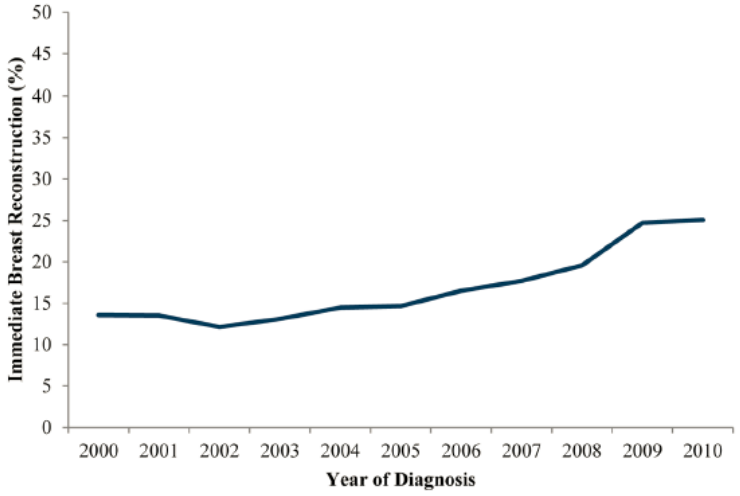
Any breast cancer recurrence
Breast cancer mortality

EBCTCG, Lancet 2014

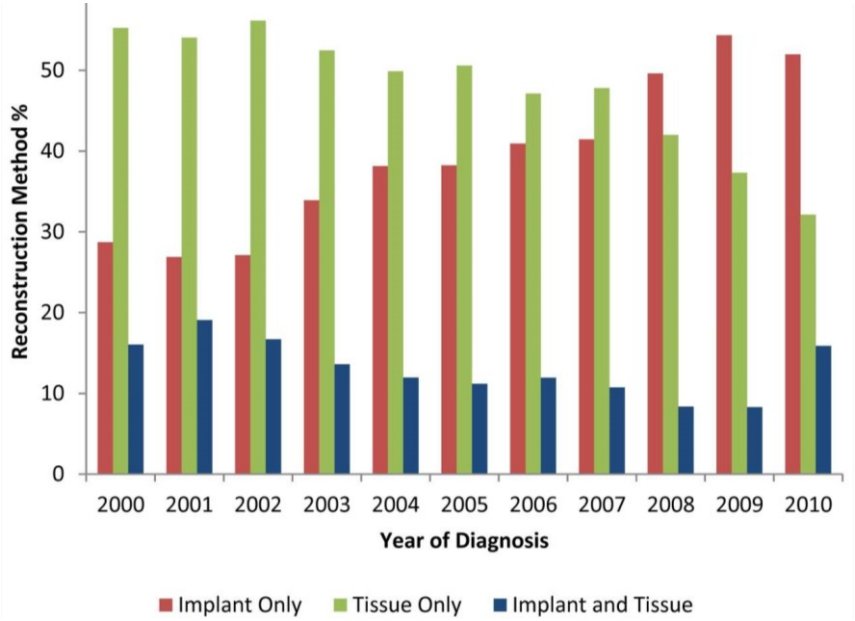
# Background

**SEER 2000-2010:**

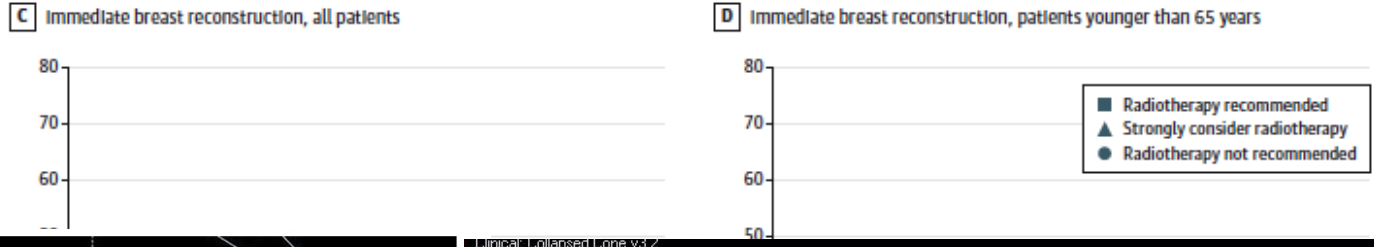
- The **immediate breast reconstruction** rate among pts **requiring RT increased** from **13.6** to **25.1%**
- **IR with implant-only increased** from **27** to **52%** (p<0.001) with a decrease in **IR tissue-only** from **56 to 32%** (p<0.001).

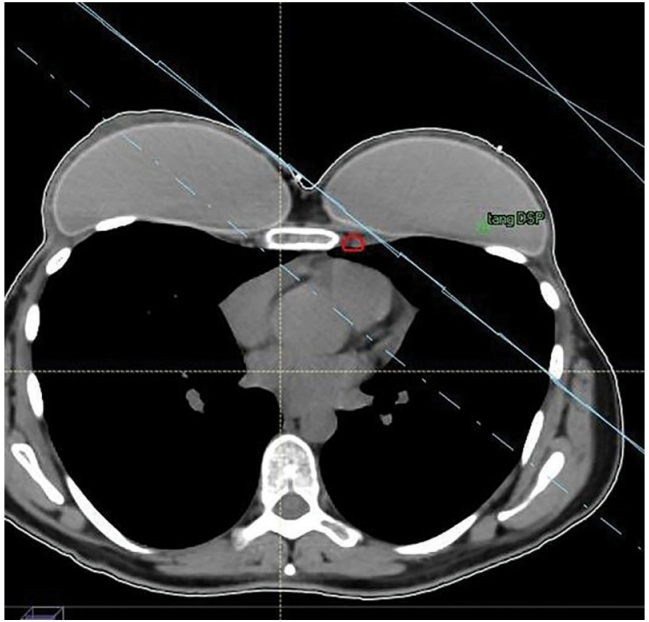


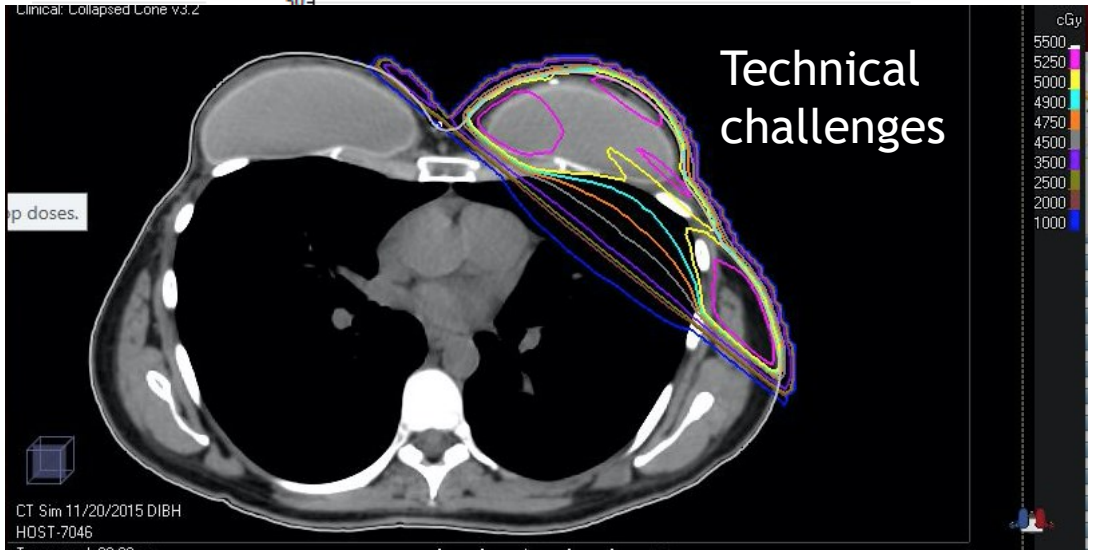

Agarwal Ann Surg Oncol 2015



# Background






Kaidar-Person et al, Plast Reconstr Surg Glob, 2017

Fraiser et al, JAMA Oncology 2016

# Background

## Complication rates – timing of implant reconstruction and PMRT

| Complication | RT -> Reconstruction Pooled rate (95% CI) | Reconstruction-> RT Pooled rate (95% CI) |
|---|---|---|
| | | Immediate reconstruction |
| Severe Capsular contracture | 25% (0-45) | 32% (20-46) |
| Minor complications | 49% (25-72) | 39% (24-55) |
| Successful implant reconstruction | 83% (68-94) | 80% (68-90) |

Momoh et al, Ann Surg Onc 2014

# Best approach for combing RT and Immediate breast reconstruction

- Advise breast conserving therapy (if possible)
  - Too many ‘unnecessary’ mastectomies
  - Mastectomy leads to reconstruction
  - Symmetry leads to bilateral mastectomy and implant recon
  - Avoid mastectomy if possible:

    Primary systemic therapy to support risk adapted BCS

    Use oncoplastic conservation to support more BCS

# The Assisi Think Tank Meeting and Survey of post MAstectomy Radiation Therapy after breast reconstruction: The ATTM-SMART report

Cynthia Aristei [a, *], Orit Kaidar-Person [b], Luca Tagliaferri [c], Meritxell Arenas [d], Charlotte E. Coles [e], Birgitte V. Offersen [f], Giovanni Frezza [g], Maria Cristina Leonardi [h], Vincenzo Valentini [c], Céline Bourgier [i], Philip M.P. Poortmans [j]

Main results from a survey in 19 countries regarding:

1) Clinical decision on recon-type for PMRT

2) RT technique and dosimetry

3) Fractionation

European Journal of Surgical Oncology, 2018

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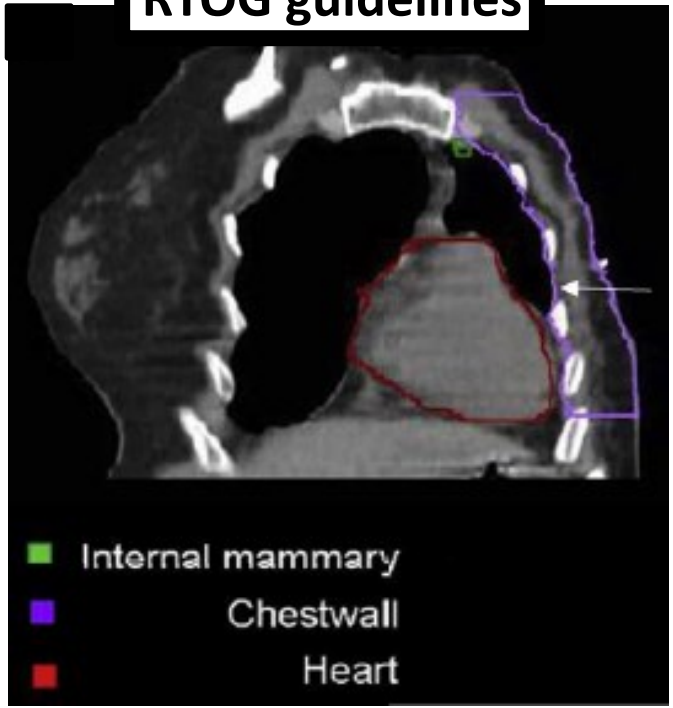
Main results from a survey in 19 countries regarding:

1) Clinical decision on recon-type for PMRT – the final decision was made by the surgeon, most rad oncs recommend mastectomy with immediate (expander) implant – RT – final reconstruction
2) RT technique and dosimetry – most 3D-CRT, few inverse IMRT, 48% recommend only boost if close/involved margins, 18% recommend boost also at other risk factors, 60% use bolus only if skin involvement,
3) Fractionation – majority use 50Gy/25 fr

European Journal of Surgical Oncology, 2018

# Guidelines for PMRT- CTVp_chest wall

## RTOG guidelines




## ESTRO guidelines

**Skin** - CTVp_thoracic wall extended up to the level of the skin.

**CW-** Unless invasion (T4a and T4c), there is *no* reason for routinely including the major pectoral muscle and the ribs.

Vargo et al., IJROBP 2015

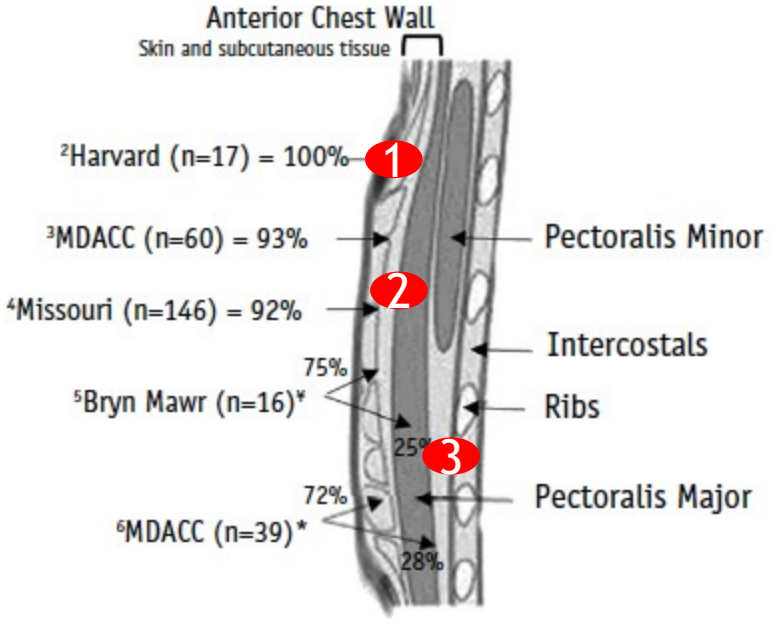
Offersen BV et al., Radiother Oncol 2015

# Sites of recurrence

1. 72-100% “chest wall” recurrences are within the skin and subcutaneous tissue anterior to the pectoralis

2. #2nd most common site is within the pectoralis major

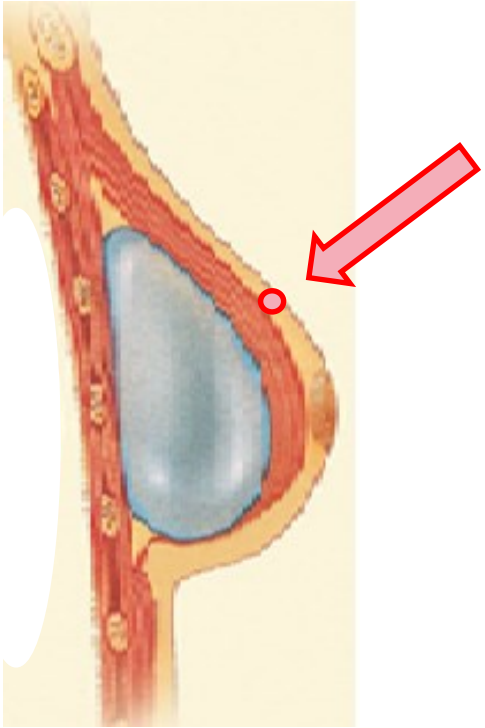
3. No reports of isolated rib or intercostal metastasis
   A few Isolated rib and intercostal muscles (reported by Chang et al., Radiother & Oncol, 2017)




Vargo et al., IJROBP 2015

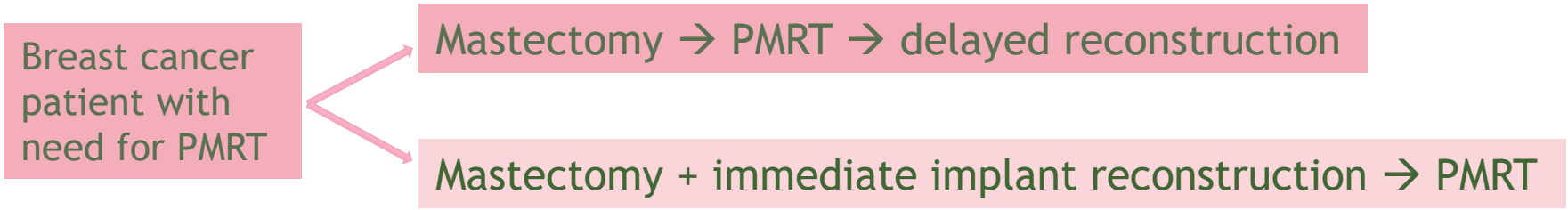
# Sites of recurrence

Post-pectoralis implant



# The DBCG RT Recon Trial:
# Immediate versus delayed breast reconstruction in early breast cancer patients treated with mastectomy and adjuvant loco-regional radiation therapy.

## A multicenter randomized clinical trial



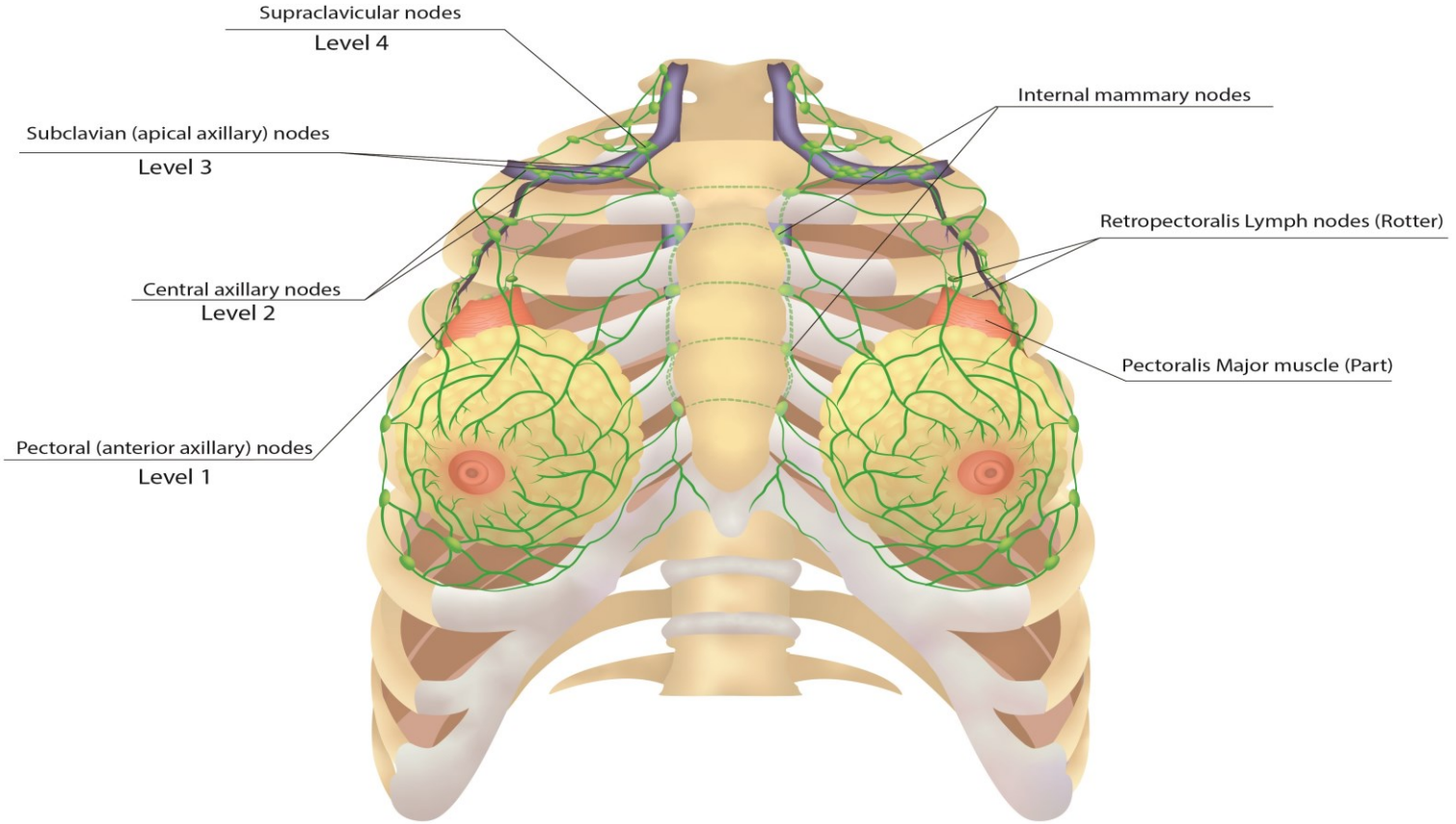

Primary endpoint: complication treated with knife within 12 months

**ESTRO ACROP consensus guideline for target volume delineation in the setting of postmastectomy radiation therapy after implant-based immediate reconstruction for early stage breast cancer**

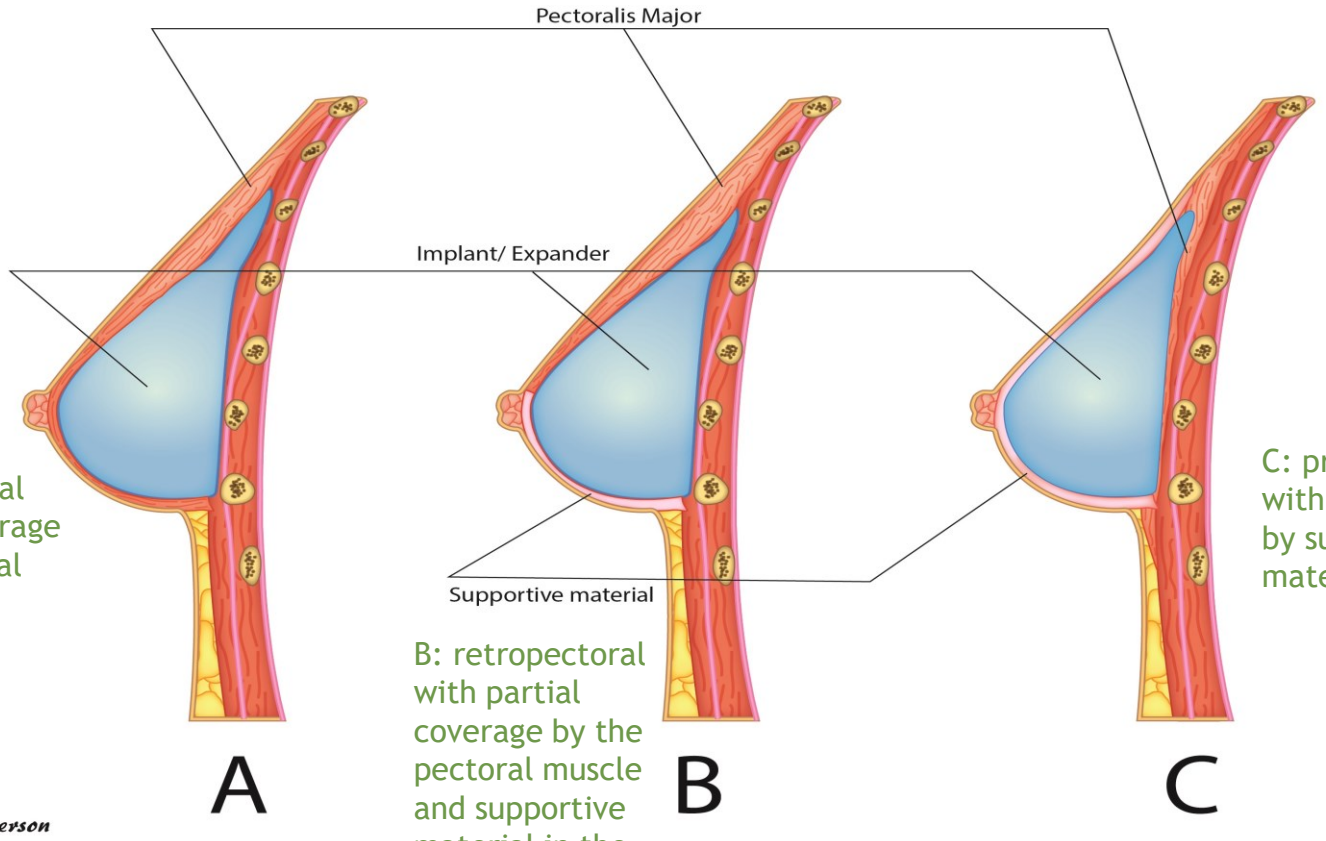
Orit Kaidar-Person*, Birgitte Vrou Offersen*, Sandra Hol, Meritxell Arenas, Cynthia Aristei, Celine Bourgier, Maria Joao Cardoso, Boon Chua, Charlotte Coles, Tine Engberg Damsgaard, Dorota Gabrys, Reshma Jagsi, Rachel Jimenez, Anna M. Kirby, Carine Kirkove, Youlia Kirova, Vassilis Kouloulias, Tanja Marinko, Icro Meattini, Ingvil Mjaaland, Gustavo Nader Marta, Petra Witt Nystroem, Elzbieta Senkus, Tanja Skyttä, Tove F Tvedskov, Karolien Verhoeven, Philip Poortmans.

Radiotherapy & Oncology 2019

# Lymphatic draining pattern from the mammary region via the dermal plexus located within the subcutaneous tissues




Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019




A:retropectoral with full coverage by the pectoral muscle

B: retropectoral with partial coverage by the pectoral muscle and supportive material in the lower part

C: prepectoral with full coverage by supportive material

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

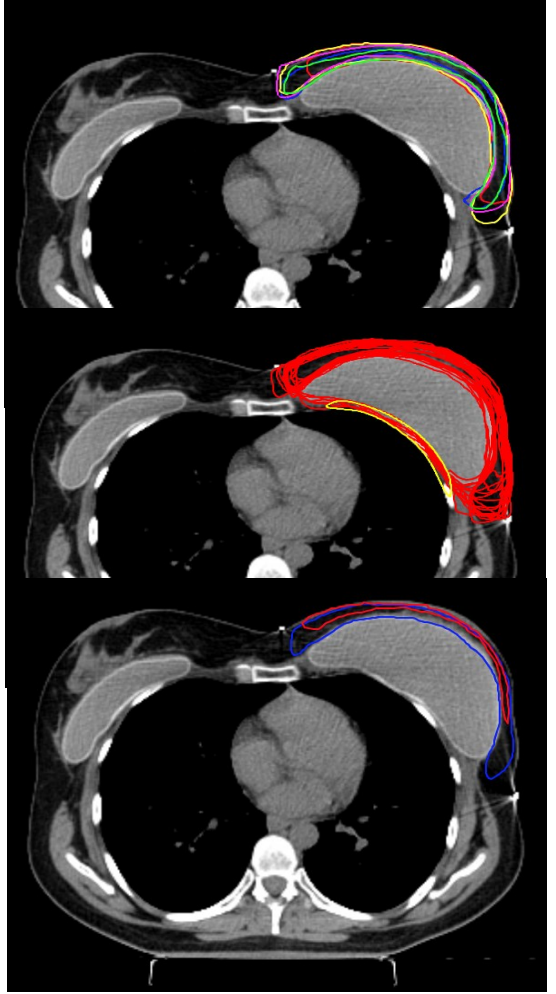
# ESTRO consensus for target volume delineation in implant based reconstruction

International core consensus group representing all involved professions

Radiation oncology group 1 =
involved in the preparation of the guidelines used for the DBCG trial: CC, LB, PP, OKP, BVO

Radiation oncology group 2 =
not involved in the preparation of the guidelines used for the DBCG trial, n=18

Other specialties: surgeons, n=2



Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

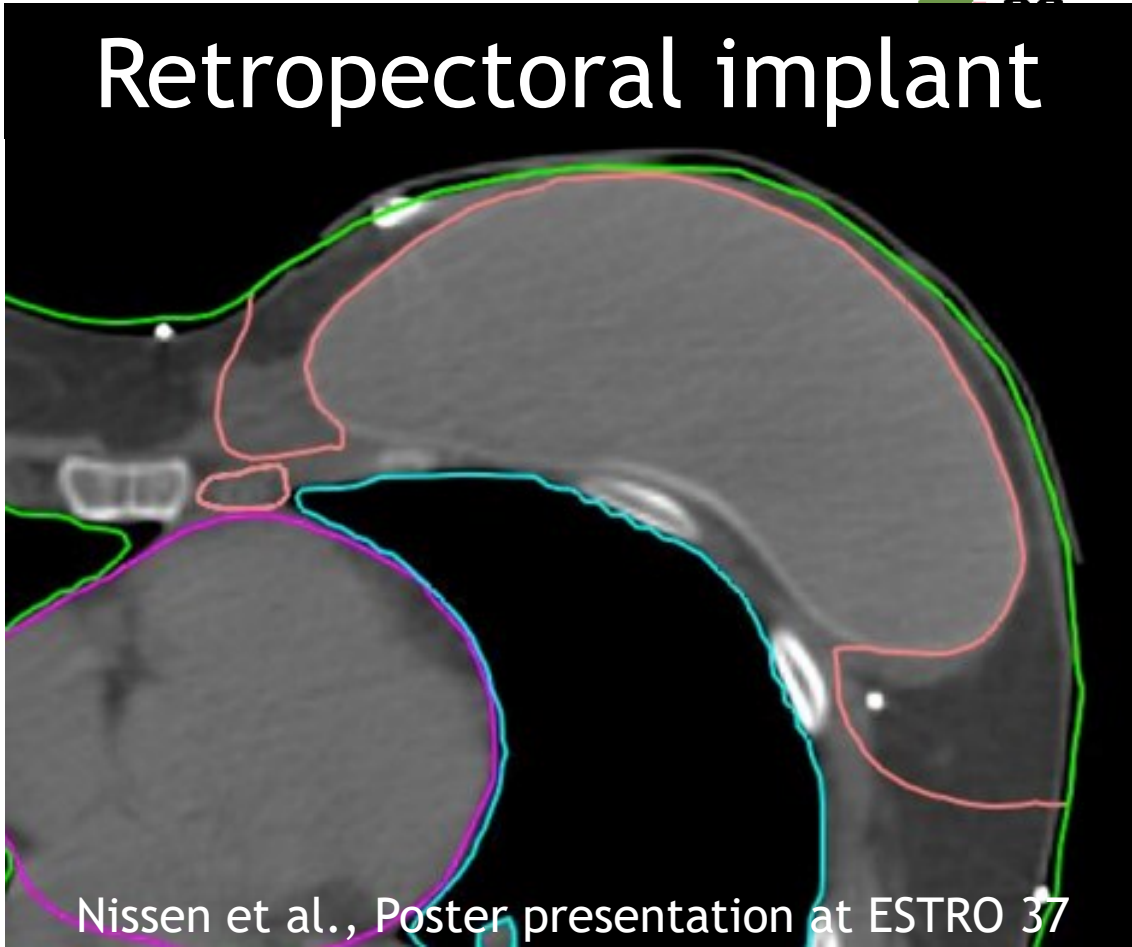
# Agreement

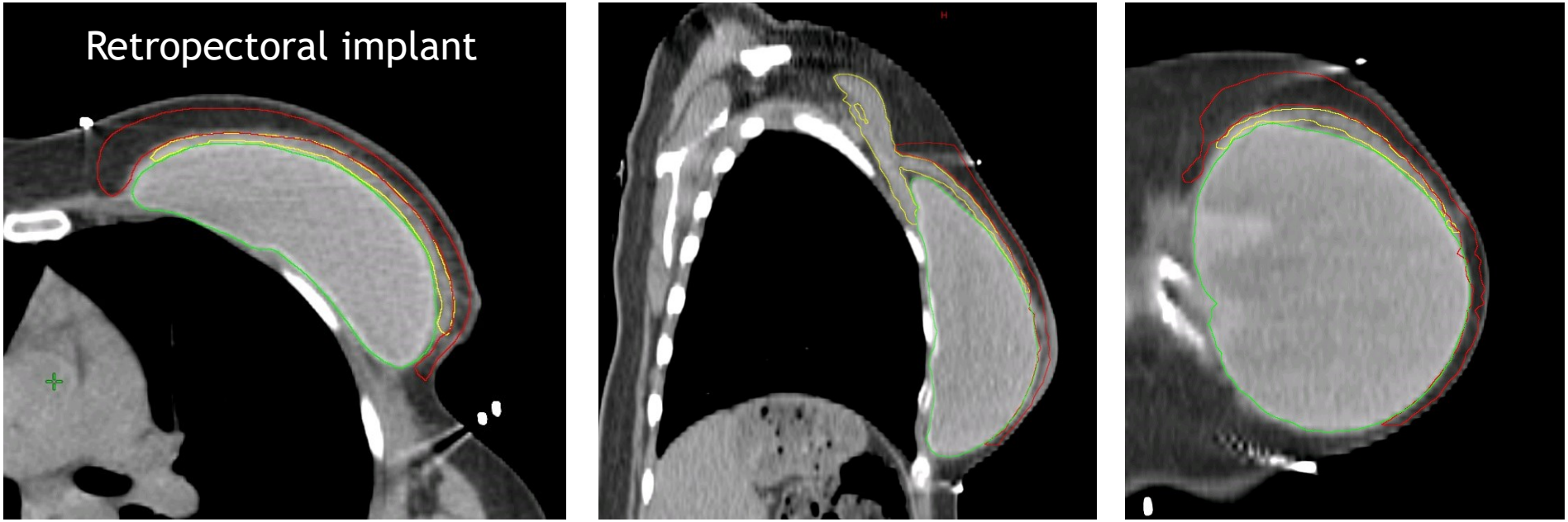
Most patients:

➔ CTVp_chestwall is ventral to the implant

Selected patients (e.g. if locally advanced breast cancer):

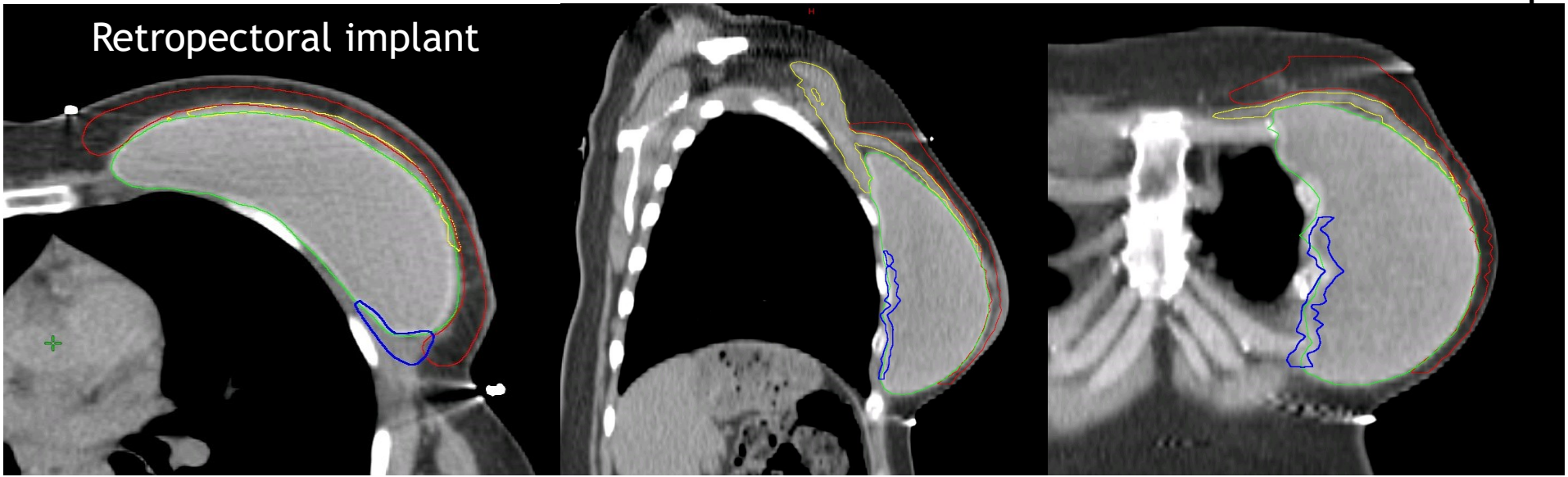
➔ CTVp_chestwall includes ventral & dorsal to implant to include both the subcutaneous lymphatics and the prepectoral lymphatics





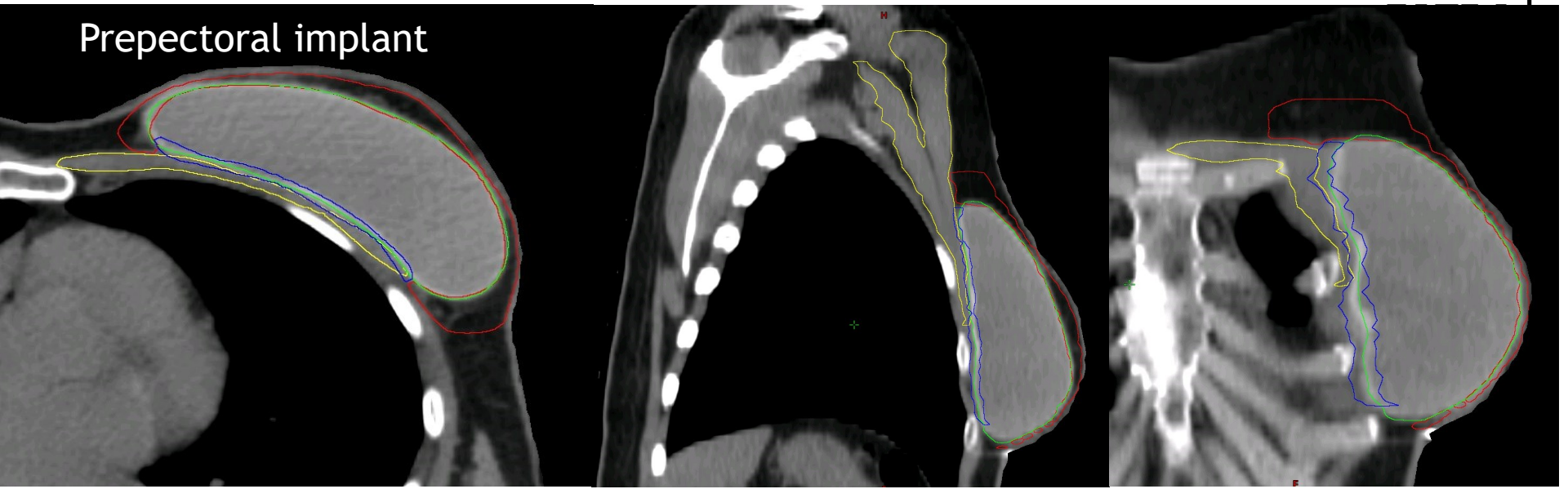

CTVp_chestwall with only a ventral part (red) in cases for whom only the subcutaneous lymphatic plexus should be irradiated. Pectoral muscles (yellow) and implant (green)

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019




CTVp_chestwall with a ventral (red) and dorsal (blue) part in cases for whom the subcutaneous lymphatic plexus should be irradiated as well as the part of the chest wall that was initially not covered by the pectoral muscles (yellow). Retropectoral implant (green)

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

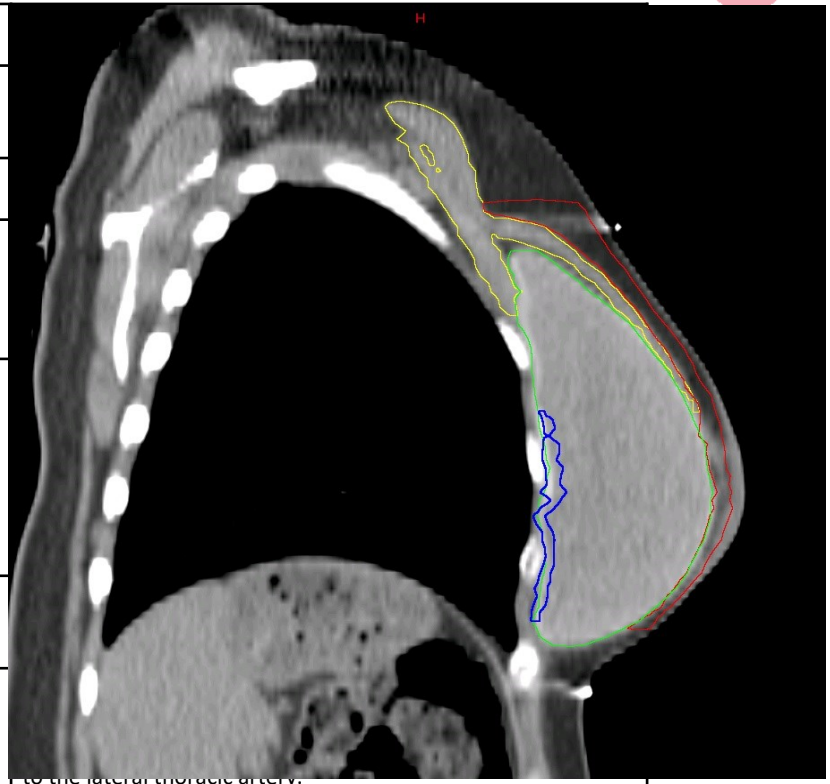



CTVp_chestwall with a ventral (red) and dorsal (blue) part in cases with a prepectoral implant (green). Pectoral muscles (yellow)

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

# ESTRO consensus on target volume determination in early breast cancer operated with mastectomy and immediate implant reconstruction

| Border per region | CTV Retro-pectoral implant: |
|---|---|
| Cranial | Guided by palpable/visible signs, planning CT; if appropriate guided by the contralateral breast; maximally up to the caudal edge of the sterno-clavicular joint |
| Caudal | Guided by palpable/visible signs; if appropriate guided by the contralateral breast |
| Ventral | 1. Ventral part: if possible, up to 3-5 mm under the skin surface;<br>2. Dorsal part caudal from original insertion of pectoral muscle: the dorsal side of the implant. |
| Dorsal | 1. Ventral part: major pectoral muscle or implant where no muscle;<br>2. Dorsal part caudal from original insertion of pectoral muscle: ribs and intercostal muscles.<br>** consider including the superficial part of the pectoral muscle if it is thin or in case of local invasion. |
| Medial | Guided by palpable/visible signs; if appropriate guided by the contralateral breast. Lateral to the medial perforating mammary vessels. |
| Lateral | Guided by palpable/visible signs; if appropriate guided by the contralateral breast. Usually ventral to the mid-axillary line (important, location of most residual glandular tissue). Ventral to the lateral thoracic artery. |



Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

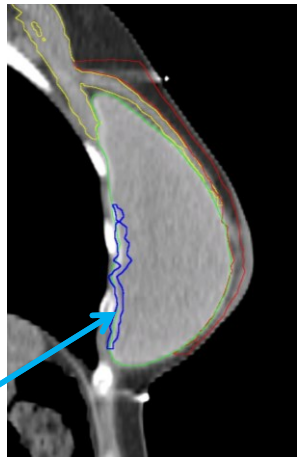
# ESTRO consensus on target volume determination in early breast cancer operated with mastectomy and immediate implant reconstruction

| **CTV Pre-pectoral implant** |
|---|
| Guided by palpable/visible signs, planning CT; if appropriate guided by the contralateral breast; maximally up to the caudal edge of the sterno-clavicular joint |
| Guided by palpable/visible signs; if appropriate guided by the contralateral breast |
| 1) Ventral part: if possible up to 3-5 mm under the skin surface;<br>2) Dorsal part: the dorsal side of the implant. |
| 1) Ventral part: ventral side of the implant.<br>2) Dorsal part: ventral side of the pectoral muscles or ribs and intercostal muscles where no muscle is present.<br>** consider including the superficial part of the pectoral muscle in case of local invasion |
| Guided by palpable/visible signs; if appropriate guided by the contralateral breast. Lateral to the medial perforating mammary vessels. |
| Guided by palpable/visible signs; if appropriate guided by the contralateral breast. Usually ventral to the mid-axillary line (important, location of most residual glandular tissue). Ventral to the lateral thoracic artery. |

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019

**Indications for including a volume dorsal to the implant in the CTVp_chestwall:**

- Partial inclusion in post-pectoral implant positioning: in case of the presence of adverse factors and/or if the tumour was localised in areas within the breast close to the dorsal fascia that was not covered by the initial position of the major pectoral muscle: separate volume (blue volume)

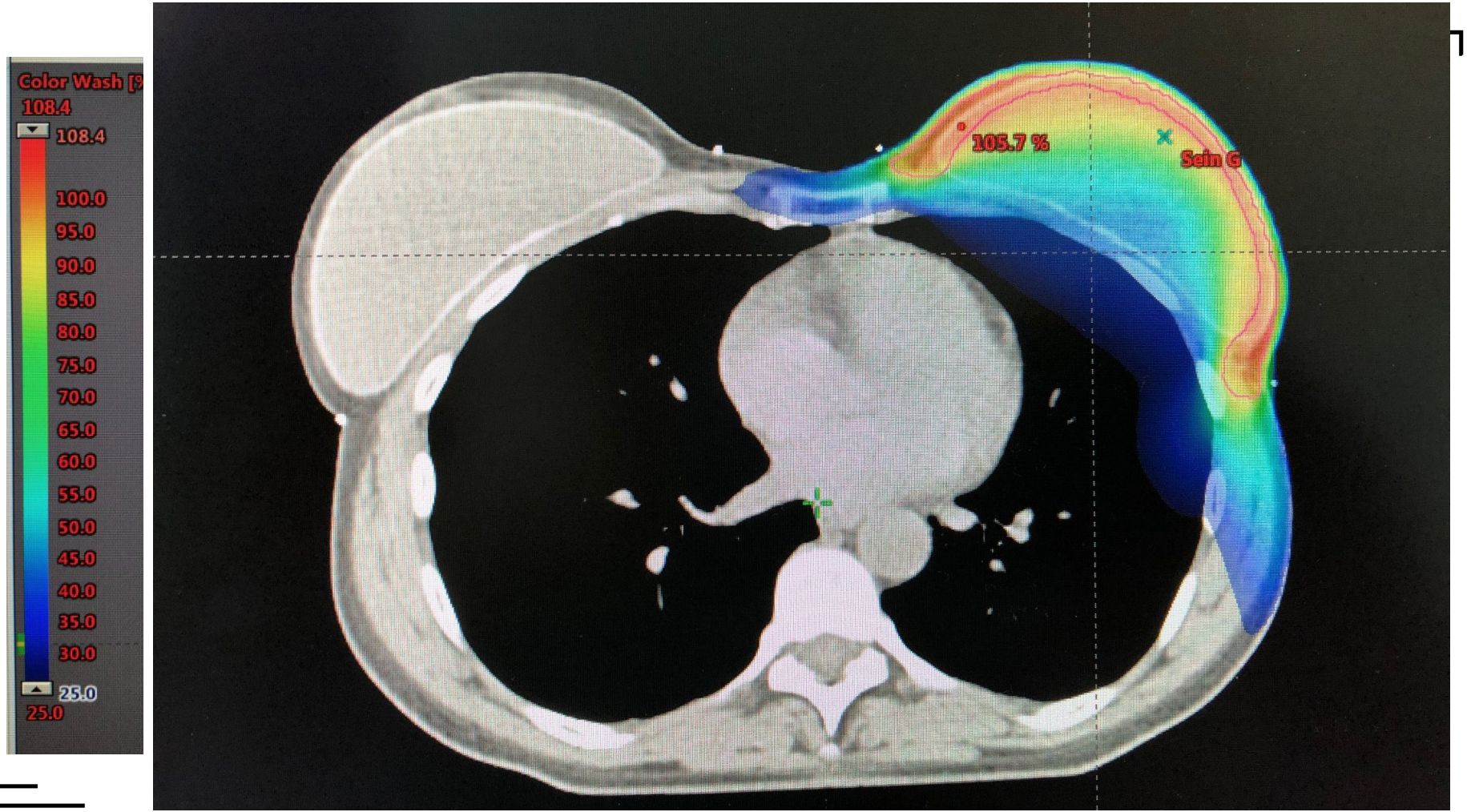


- Complete inclusion in pre-pectoral implant positioning: in case of the presence of adverse factors and/or if the tumour was localised in areas within the breast close to the dorsal fascia (blue volume)

- **Adverse prognostic tumour characteristics** include:

- Large primary breast cancer (pT3) treated by mastectomy and IBR-i
- Locally advanced breast cancer (LABC) with non-pathological complete response to primary systemic therapy
- Invasion of the major pectoral muscle and/or the chest wall

Kaidar-Persen & Offersen et al, Radiother & Oncol, 2019



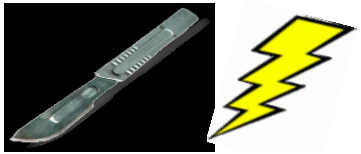

Courtesy Philip Poortmans, Institute Curie, Paris

# Guidelines for RT & Reconstruction

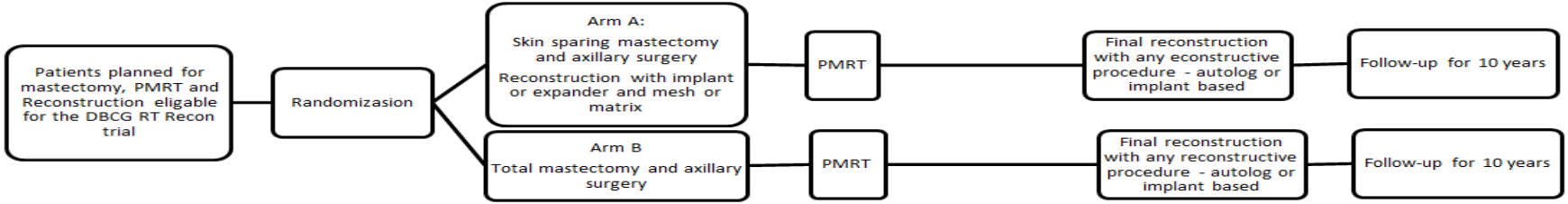
Consensus guidelines for autologous reconstruction are pending

# The DBCG RT Recon trial

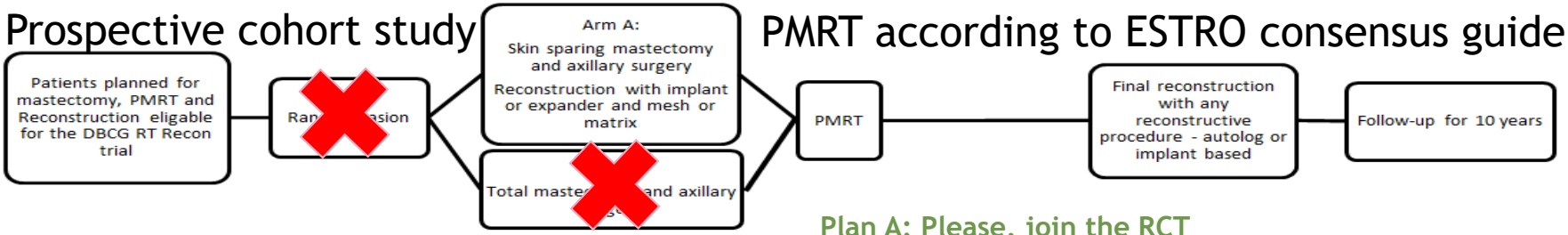
Principal Investigator: Tove Tvedskov, breast surgeon, Copenhagen University Hospital



Day 0 — 6 months — 12 months




## Prospective cohort study




## PMRT according to ESTRO consensus guidelines

Plan A: Please, join the RCT

Plan B: Please, join the single arm prospective cohort study

## Thank you for your attention

# Special thanks to

Orit Kaidar-Person, Philip Poortmans, The DBCG RT Committee & all co-authors on the ESTRO ACROP consensus

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