Dysphagia reduction with optimized photon and proton intensity-modulated radiotherapy for head and neck cancer

11th Biennial ESTRO, 9 May 2011, London

Hans Paul van der Laan, PhD

Department of Radiation Oncology
University Medical Center Groningen / University of Groningen
Groningen The Netherlands

On behalf of the ROCOCO group

Why reduce swallowing dysfunction?

- Big problem
  - ~ 2/3 patients have swallowing related problems
  - ~ 1/3 patients Grade 2 or higher late swallowing dysfunction
- Big impact on quality of life
- Bigger impact than xerostomia

Langendijk *et al.* JCO 2008

Study swallowing dysfunction

- Identify related factors

  Patient / Treatment / Dose in swallowing structures

- Identify Swallowing Organs at Risk

  Atlas → Define variety of potential SWOARs

  DVHs → Dose data SWOARs >350 patients

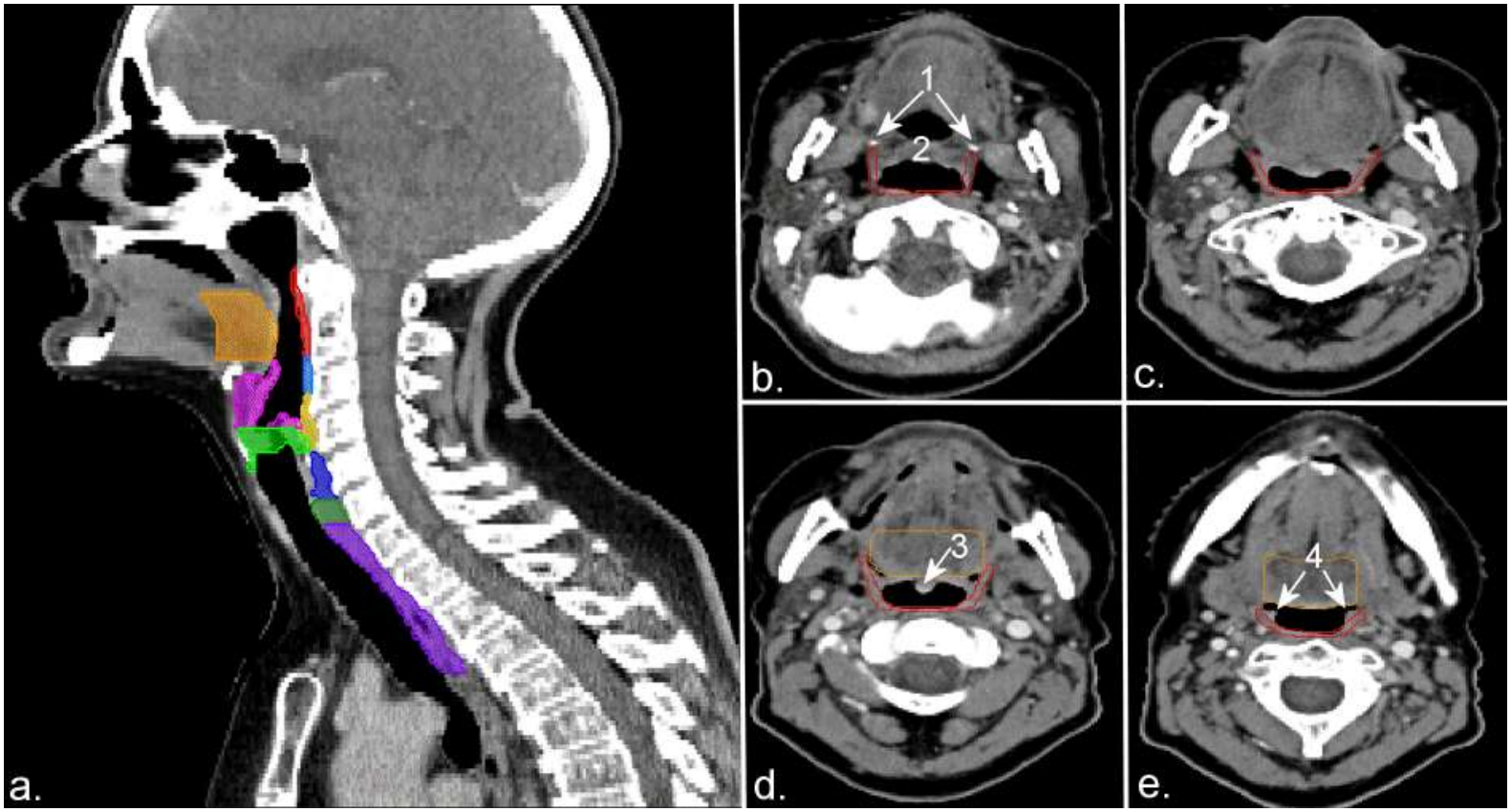
  Toxicity → physician and patient rated at 6 months

- Build predictive model

  Advanced statistical methods

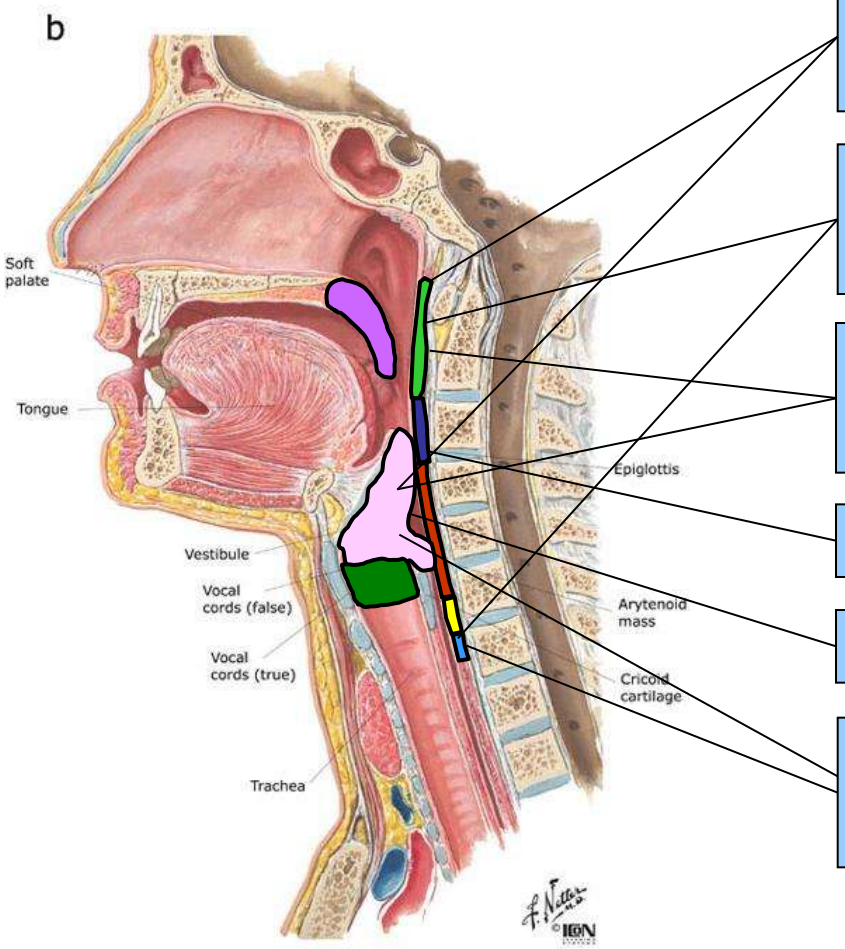
Christianen *et al.* work in progress 2011

Potential SWOARs



Christianen *et al.* submitted 2011

Identified SWOARs

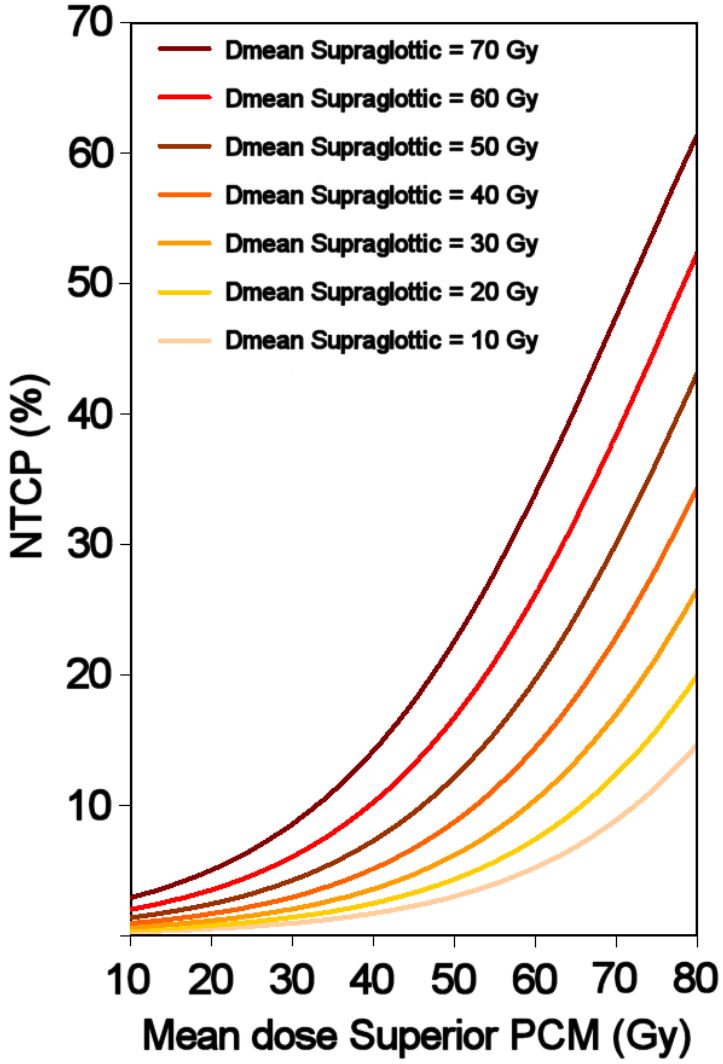


RTOG Grade 2-4	PCM superior MD Supraglottic MD
Tube feeding	PCM superior MD EIM V60
SOLID FOOD	PCM superior MD Supraglottic MD
SOFT FOOD	PCM medial MD
LIQUIDS	Supraglottic MD
ASPIRATION	Supraglottic MD EIM V60

Christianen *et al.* submitted 2011

NTCP model

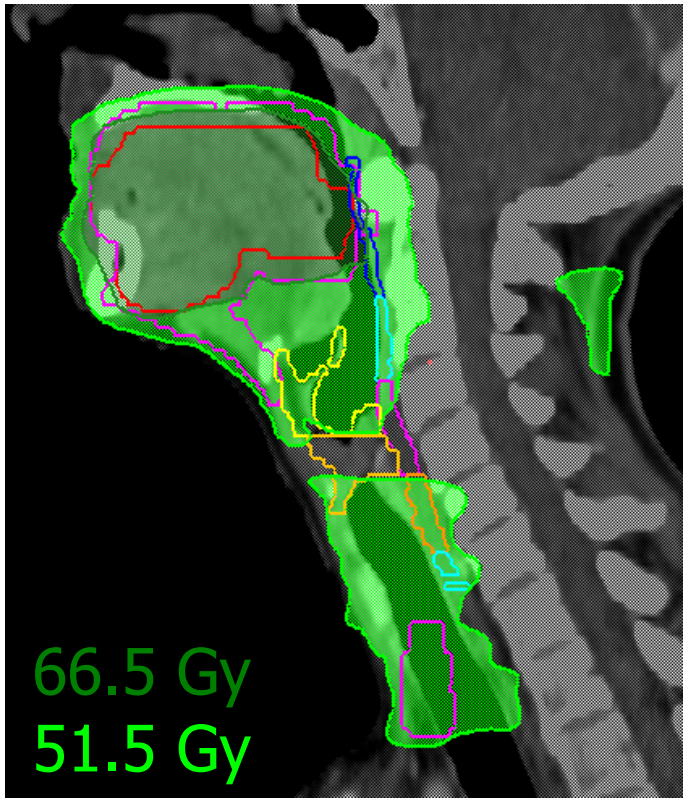
RTOG G2-4 swallowing dysfunction



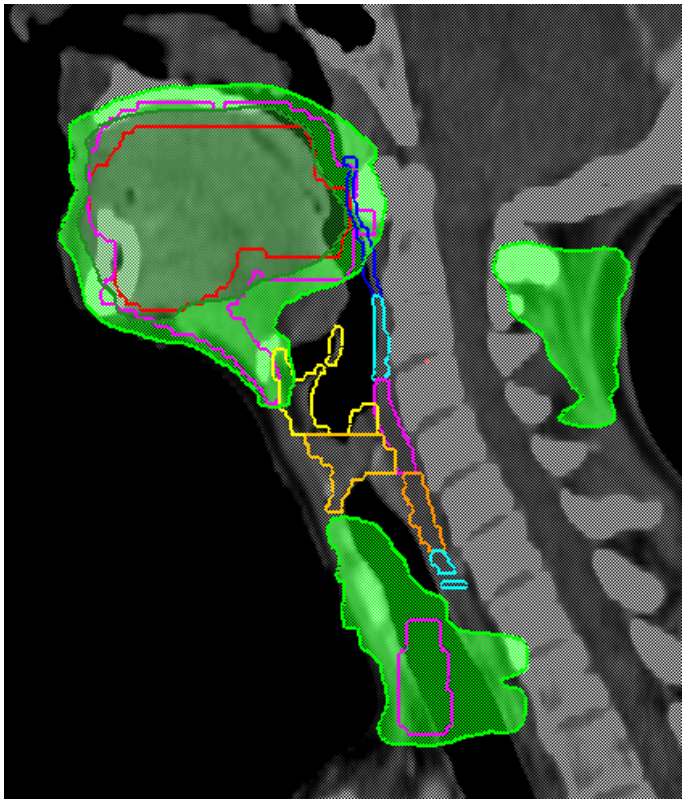
Christianen *et al.* submitted 2011

Swallowing sparing IMRT

Simultaneous boost, PTV 54 Gy and PTV 70 Gy



ST-IMRT

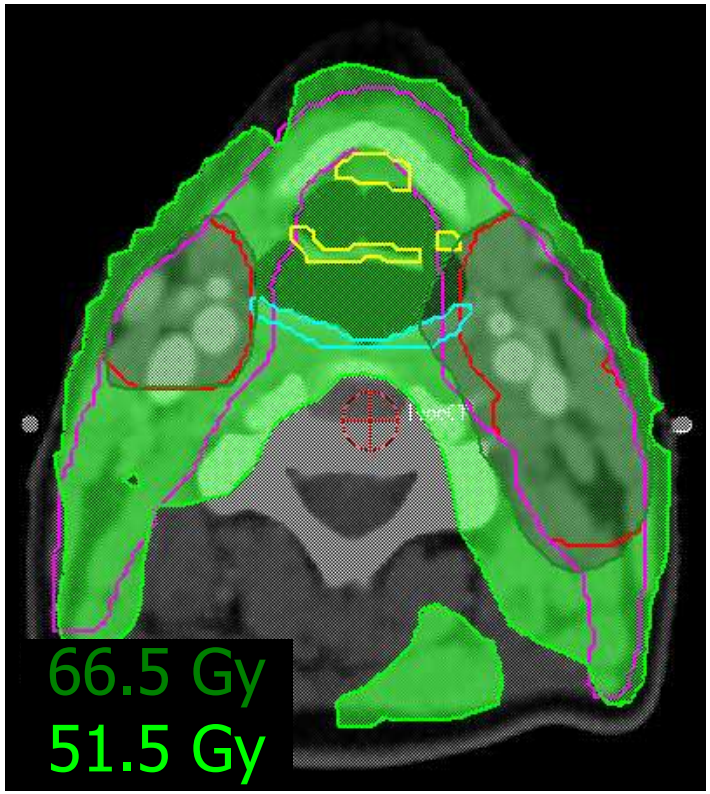


SW-IMRT

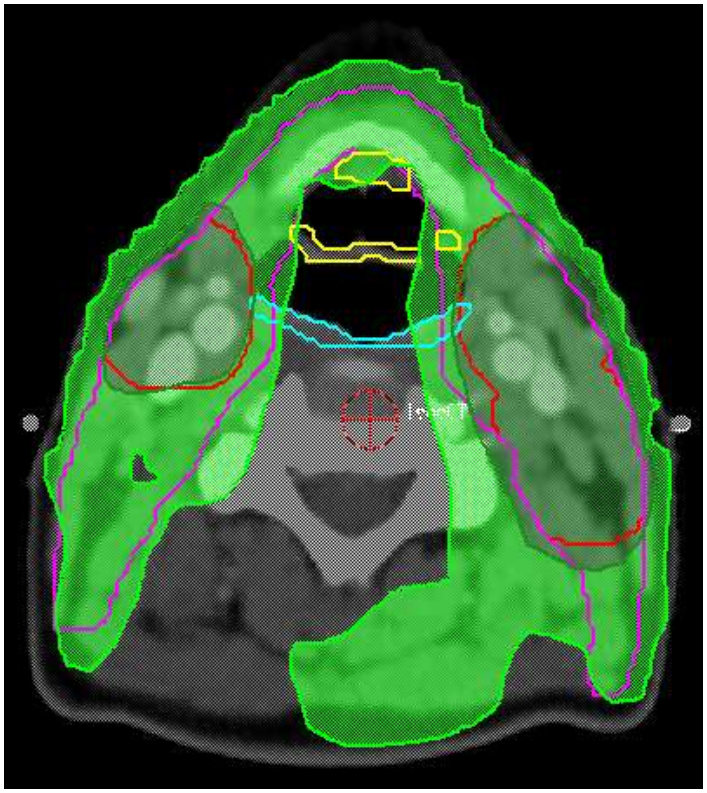
van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

Simultaneous boost, PTV 54 Gy and PTV 70 Gy



ST-IMRT



SW-IMRT

van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

Simultaneous boost, PTV 54 Gy and PTV 70 Gy

Objectives
ST-IMRT

1. PTV 98%volume / 95%dose
   Critical structures < limits
2. Max plan dose 76.5 Gy
3. 1 parotid gland minimized
4. 2 parotid glands minimized
5. Conformal dose distribution

Copy treatment plan

Objectives
SW-IMRT

1. PTV 98%volume / 95%dose
   Critical structures < limits
2. Max plan dose 76.5 Gy

4. Maintain parotid glands MD

5. PCM superior MD minimized
6. Supraglottic MD minimized
7. PCM medial MD minimized
8. PCM inferior MD minimized
9. EIM V60 minimised

10. Conformal dose distribution

van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

30 patients, various sites, bilateral neck

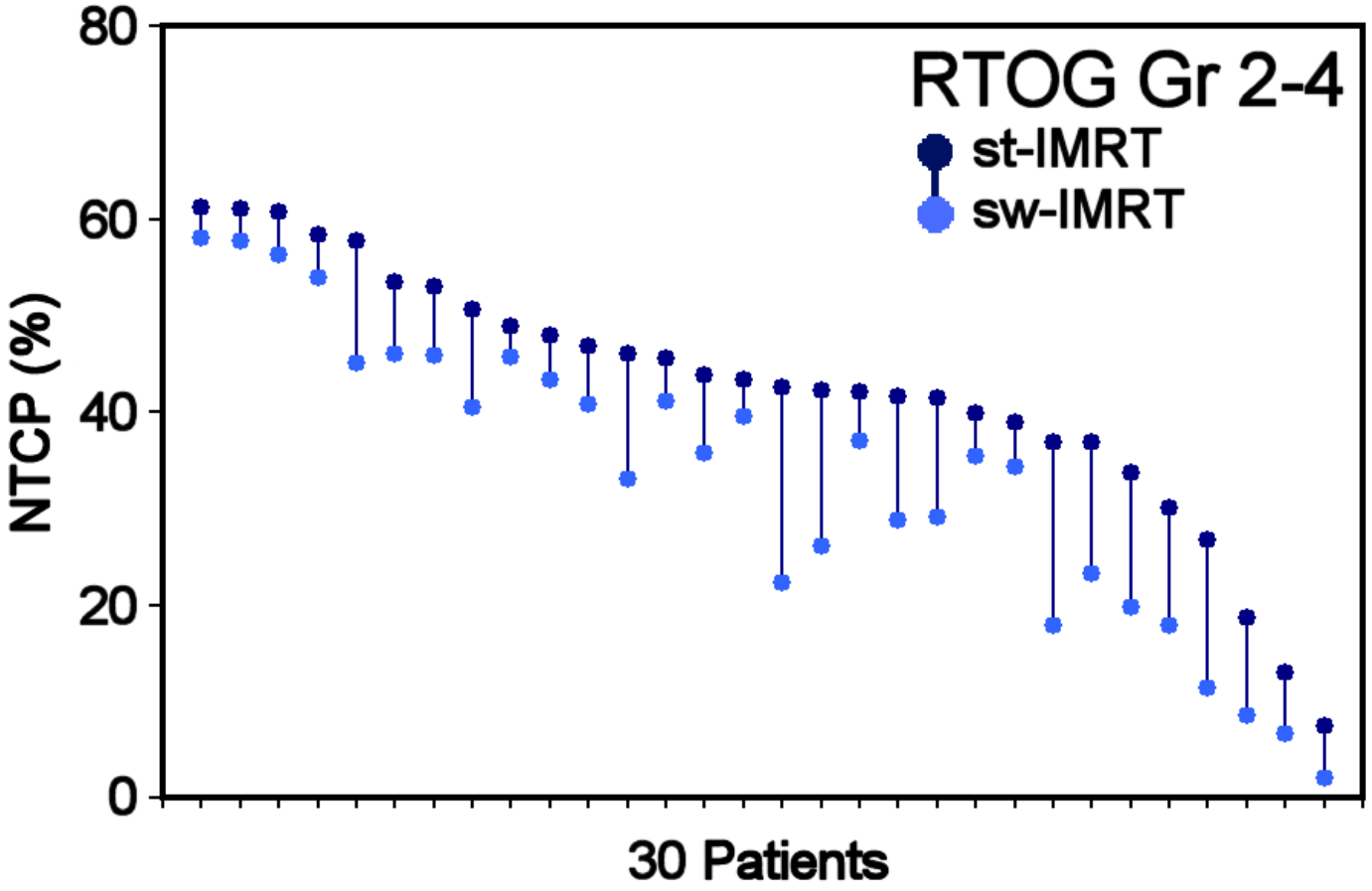
		ST-IMRT	SW-IMRT
SWOARS dose / volume			
PCM-sup mean dose	(Gy)	**61** (26-72)	**56** (9 -71)
PCM-med mean dose	(Gy)	**62** (49-72)	**58** (31-70)
Supraglottic area mean dose	(Gy)	**61** (46-71)	**56** (26-70)

Mean values, ranges in parenthesis

van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

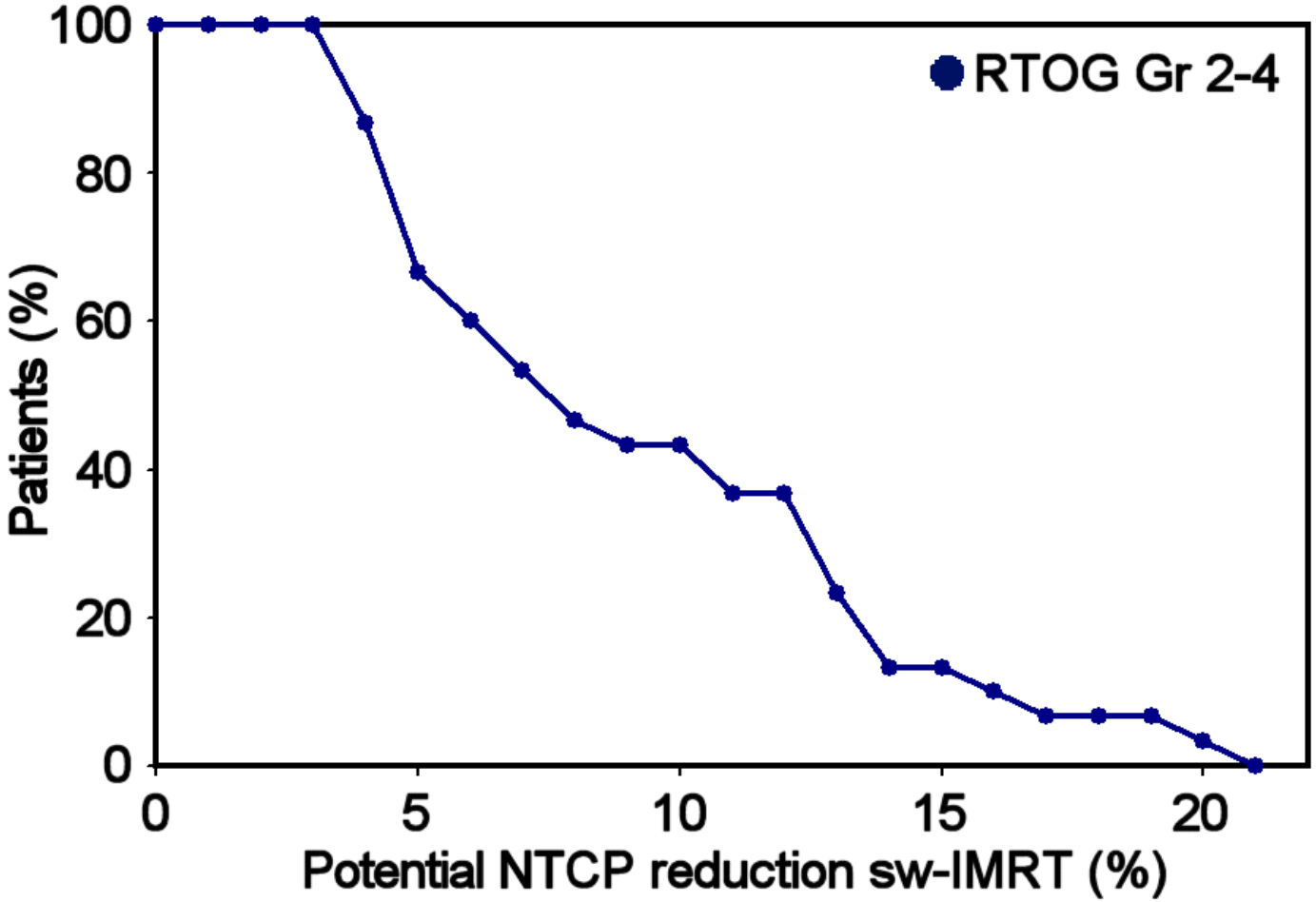
30 patients, various sites, bilateral neck



van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

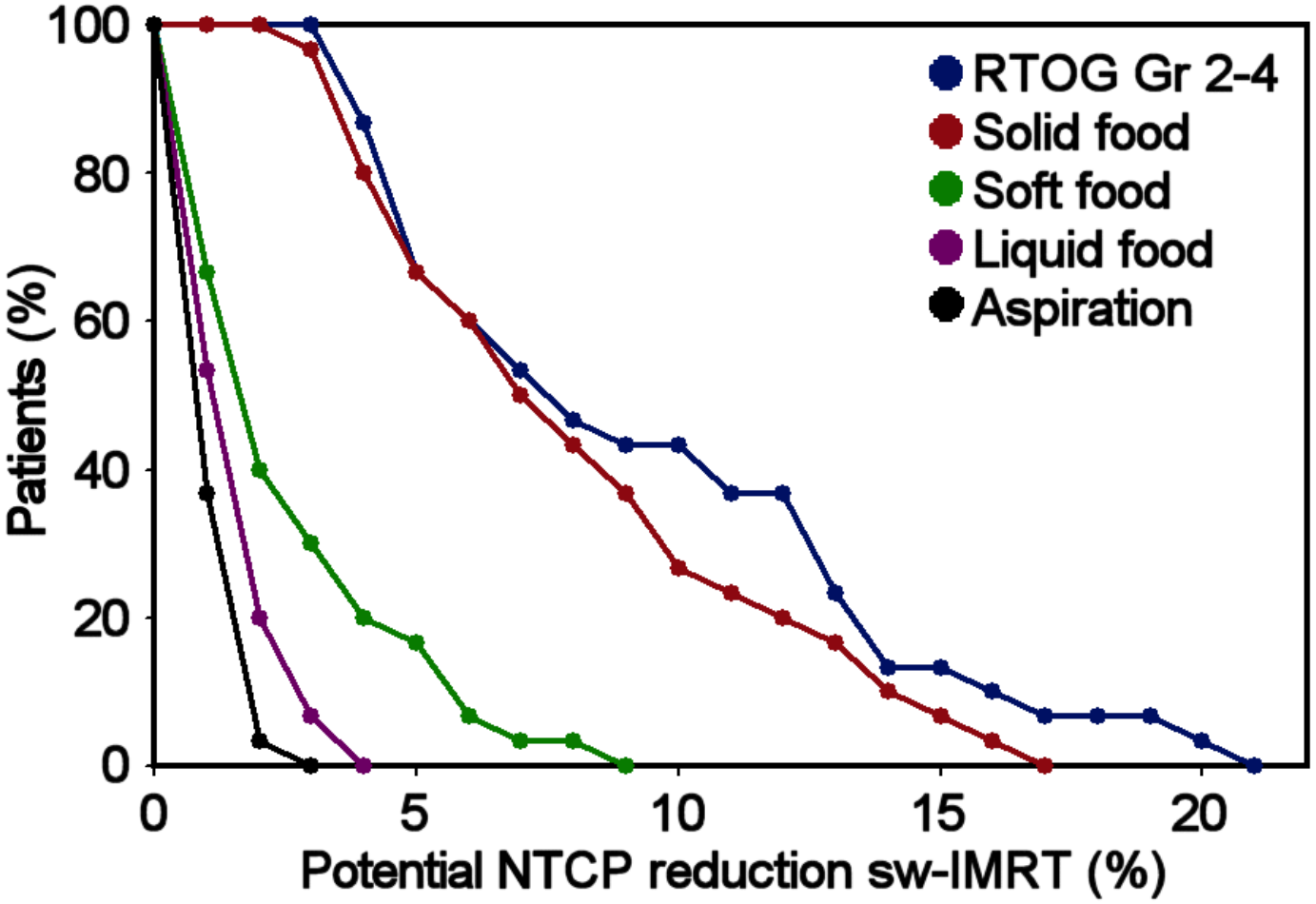
30 patients, various sites, bilateral neck



van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

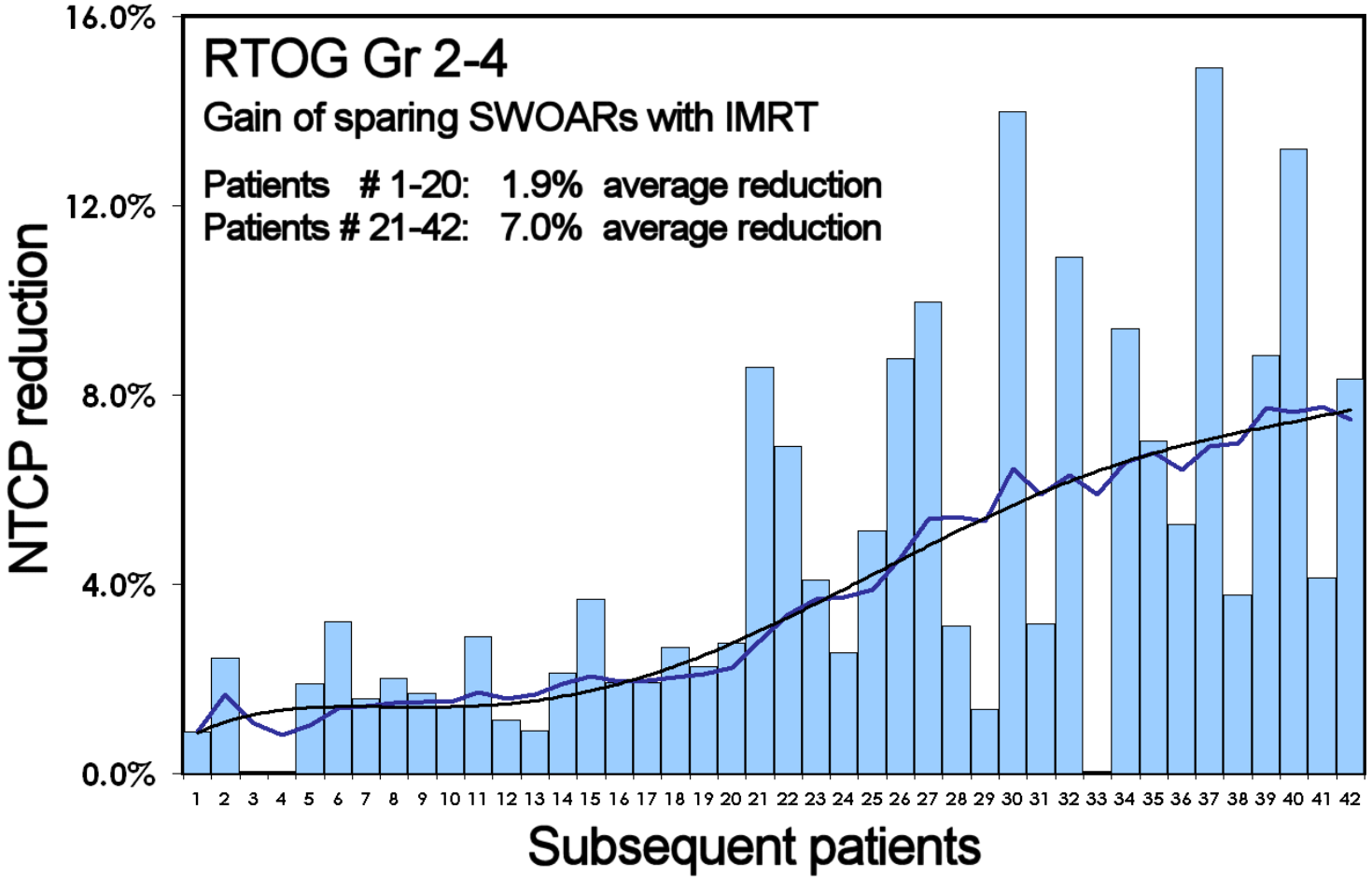
30 patients, various sites, bilateral neck



van der Laan *et al.* work in progress 2011

Swallowing sparing IMRT

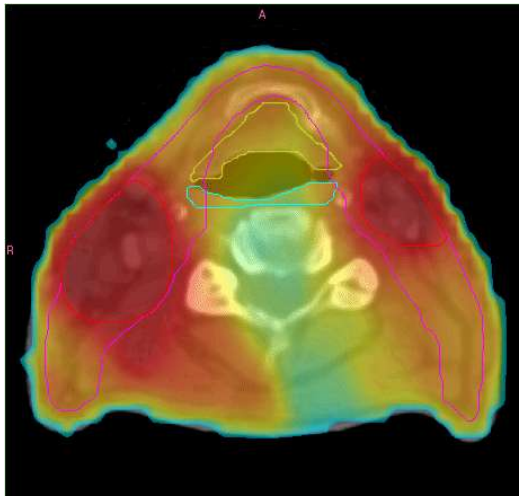
Learning curve after clinical implementation



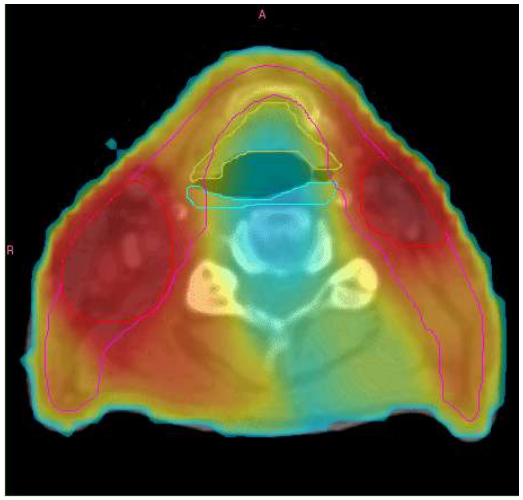
van der Laan *et al.* work in progress 2011

Swallowing sparing IMPT

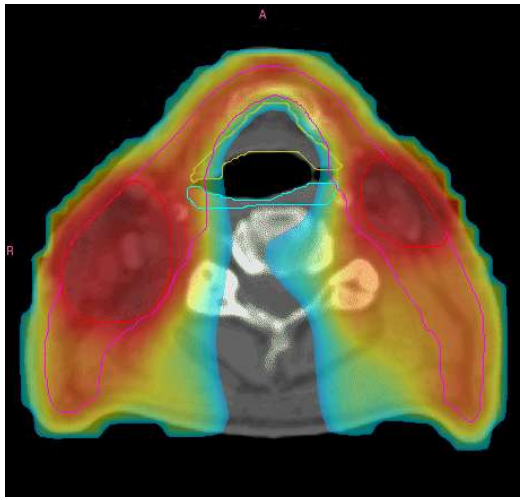
IMRT



SW-IMRT



SW-IMPT



van der Laan *et al.* work in progress 2011

Swallowing sparing IMPT

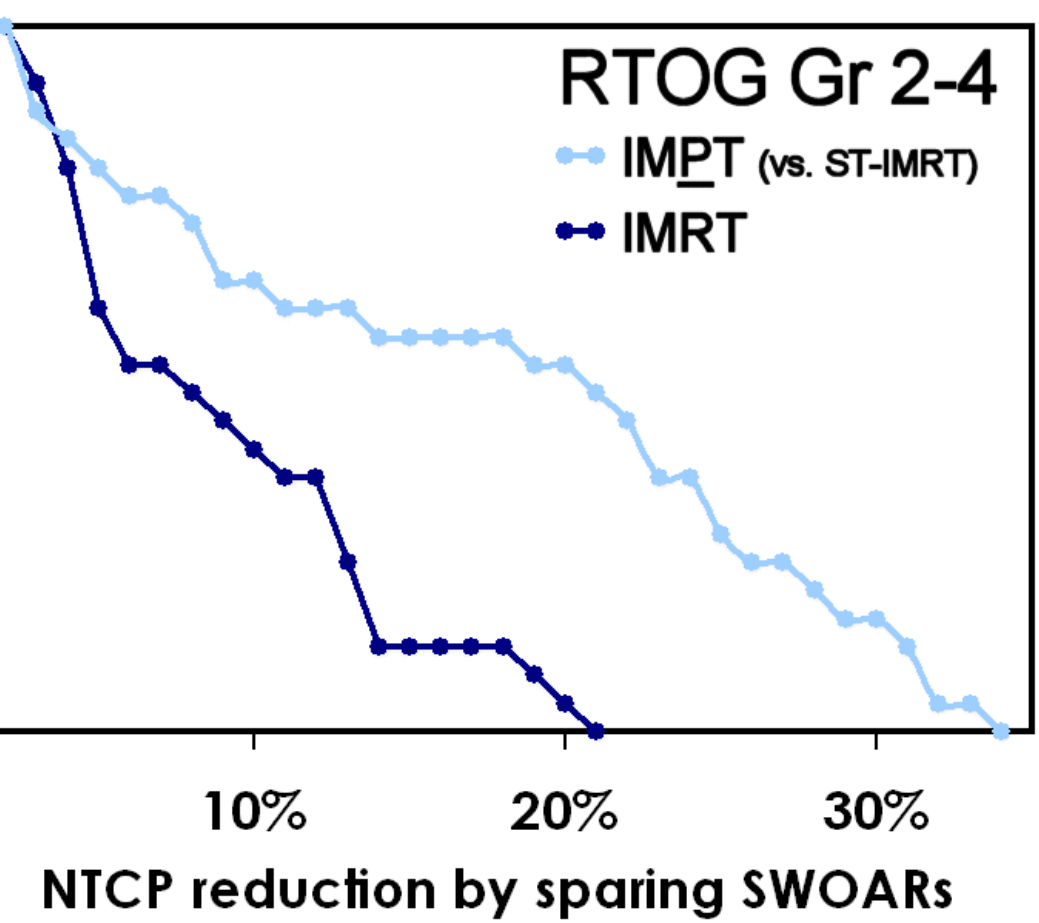
25 patients, oropharynx, bilateral neck

		ST-IMRT	SW-IMRT	SW-IMPT
Parotid glands dose / volume				
Ipsilateral mean dose	(Gy)	**45** (26-63)	**45** (26-65)	**28** (15-49)
Contralateral mean dose	(Gy)	**35** (24-49)	**35** (24-48)	**21** (7-31)
SWOARS dose / volume				
PCM-sup mean dose	(Gy)	**65** (55-72)	**63** (50-71)	**62** (45-70)
PCM-med mean dose	(Gy)	**63** (49-72)	**59** (30-70)	**57** (27-70)
Supraglottic area mean dose	(Gy)	**60** (48-71)	**53** (25-70)	**40** (10-70)

Mean values, ranges in parenthesis

van der Laan *et al.* work in progress 2011

Swallowing sparing IMPT



van der Laan *et al.* work in progress 2011

Conclusions

- Dose in SWOARs can be reduced with IMRT and even more with IMPT
- SWOAR dose reductions translate into potential reductions swallowing dysfunction
- Reductions vary between patients
- There is an institution wide learning curve
- Predictive model needs clinical validation

van der Laan *et al.* work in progress 2011

Acknowledgements

ROCOCO cooperative group

M.E.M.C. Christianen

T.A. van de Water

H.E. van Herpt

H.P. Bijl

C. Schilstra

I. Beetz

O. Chouvalova

R.J.H.M Steenbakkers

P. Doornaert

C.R. Leemans

B.J. Slotman

I.M. Verdonck-de Leeuw

J.A. Langendijk

And many others

Questions / Discussion

rijksuniversiteit
groningen